

ANCIENT INFRASTRUCTURE

Remarkable Roads, Mines, Walls,
Mounds, Stone Circles

Compiled by:

William R. Corliss



A CATALOG OF ARCHEOLOGICAL ANOMALIES

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*A CATALOG OF
ARCHEOLOGICAL ANOMALIES*

Published and Distributed by:

The Sourcebook Project

P.O. Box 107

Glen Arm, MD 21057

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 Tornados, Dark Days, Anomalous Precipitation (category GW)
 Earthquakes, Tides, Unidentified Sounds (categories GH, GQ, GS)
 Rare Halos, Mirages, Anomalous Rainbows (category GE)
- The Moon and the Planets (categories AE, AH, AJ, AL, AM, AN, AP, AR, AU, AV)
 The Sun and Solar System Debris (categories AA, AB, AC, AE, AS, AX, AY, AZ)
 Stars, Galaxies, Cosmos (categories AO, AQ, AT, AW)
- Carolina Bays, Mima Mounds, Submarine Canyons (category ET)
 Anomalies in Geology (category ES, in part)
 Neglected Geological Anomalies (category ES, in part)
 Inner Earth: A Search for Anomalies (categories EC, EQ, ES in part, EZ)
- Biological Anomalies: Humans I (category BH, in part)
 Biological Anomalies: Humans II (category BH, in part)
 Biological Anomalies: Humans III (category BH, in part)
 Biological Anomalies: Mammals I (category BM, in part)
 Biological Anomalies: Mammals II (category BM, in part)
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- Ancient Infrastructure (category MS in part)
- HANDBOOKS:** Handbook of Unusual Natural Phenomena
 Ancient Man: A Handbook of Puzzling Artifacts
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 Incredible Life: A Handbook of Biological Mysteries
 The Unfathomed Mind: A Handbook of Unusual Mental Phenomena
- SOURCEBOOKS:** Strange Phenomena (vols. G1 and G2)
 Strange Artifacts (vols. M1 and M2)
 Strange Universe (vols. A1 and A2)
 Strange Planet (vols. E1 and E2)
 Strange Life (vol. B1)
 Strange Minds (vol. P1)
- NEWSLETTER:** Science Frontiers (bimonthly anomaly reports)
- COMPILATION:** Science Frontiers: Some Anomalies and Curiosities of Nature (first 86 newsletters organized and indexed)

For availability, prices, and ordering procedures write:

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PREFACE

After more than twenty-nine years of scouring the scientific and semiscientific literature for anomalies, my major observation is that the search has been most fruitful. In fact, I have wondered why the scientific community itself has not been systematically compiling such information. It is surprising that a Catalog of Anomalies does not already exist to guide scientific thinking and research. It is at least as important to recognize what is anomalous as it is to realize what is well-explained in terms of prevailing paradigms. With this outlook and philosophy, here is the eighteenth volume of such a Catalog. It is largely the product of one person's library research. The work has been carried forward entirely through the sale of these Catalog volumes and associated publications.

Under the aegis of the Sourcebook Project, I have already published 34 volumes, totalling roughly 14,000 pages of source material on scientific anomalies. (See page iv for a list of titles.) As of this date, these 34 volumes represent only about 40% of my data base. New material is being added at the rate of about 1,200 new items per year, about 700 of which come from the current scientific literature. This acquisition rate could easily be multiplied several-fold just by spending more time in libraries. Even after twenty-nine years, only a handful of English-language journals have received my serious attention. The journals in other languages, government reports, conference papers, publications of research facilities, proceedings of state academies of science, and an immense reservoir of pertinent books remain almost untapped. Every library foray uncovers new anomalies; the world's libraries are bulging with them.

Given this rough assessment of the extent of the anomaly literature, one can understand why the Catalog of Anomalies will require at least 30 volumes, many of them larger than the one you now hold. I visualize a shelf of these 30 volumes, or an equivalent CD, accompanied by master indexes, to be the logical initial step in providing scientists with access to what, in my opinion, is not well-explained. The underlining of "my" is significant because anomalousness is often in the eye of the beholder. It depends upon how well one is satisfied with those explanations based on currently accepted paradigms. In the Catalog of Anomalies, the data rule; all theories and hypotheses are considered tentative. The history of science, from the luminiferous ether to the static continents, demonstrates that this is a wise policy.

Will the Catalog of Anomalies impact science significantly? Probably not---at least not right away. Quite often the initial reaction to the volumes already published has been disbelief and even disdain. The data must be in error; the data are too often anecdotal; the data are too old; the purported anomaly was really explained long ago. Germs of truth reside in such complaints. Some science and some observations reported in the Catalog are certainly bad; but this is minimized by a heavy reliance upon respected journals. In addition, the baseline of well-established theories---against which anomalousness in measured---is always shifting. And for every anomaly that can be explained away, a trip to a library will quickly replace it with ten more from impeccable sources. Nature is very anomalous or, equivalently, Nature is not yet well-understood. Much remains to be done in both anomaly research and in the resulting scientific research that will ultimately dispose of these anomalies.

William R. Corliss

"ROUND ABOUT THE ACCREDITED AND ORDERLY FACTS OF EVERY SCIENCE THERE EVER FLOATS A SORT OF DUST-CLOUD OF EXCEPTIONAL OBSERVATIONS, OF OCCURRENCES MINUTE AND IRREGULAR AND SELDOM MET WITH, WHICH IT ALWAYS PROVES MORE EASY TO IGNORE THAN TO ATTEND TO . . . ANYONE WILL RENOVATE HIS SCIENCE WHO WILL STEADILY LOOK AFTER THE IRREGULAR PHENOMENA. AND WHEN THE SCIENCE IS RENEWED, ITS NEW FORMULAS OFTEN HAVE MORE OF THE VOICE OF THE EXCEPTIONS IN THEM THAN OF WHAT WERE SUPPOSED TO BE THE RULES."

William James

Illustrations initialed JCH are the work of John C. Holden

HOW THE CATALOG IS ORGANIZED

PURPOSE OF THE CATALOG

The Catalog of Anomalies is designed to collect and categorize all phenomena that cannot be explained readily by appealing to prevailing scientific paradigms. Such phenomena are termed "anomalies." Following its definition, each anomaly is rated in terms of: (1) its substantiating data; and (2) the seriousness of the challenge it poses to mainstream paradigms. Next, important examples of the anomaly are recorded, some of the more interesting ones in greater detail. Finally, all the examined references are listed. Thus, the Catalog is a descriptive guide as well as a reservoir of examples of the phenomena along with their supporting references. Science researchers thus have a substantial foundation for beginning further investigations of these intriguing phenomena. In short, the basic purposes of the Catalog are: the collection and organization of the unknown and the poorly explained in order to facilitate future research and explanation.

GENERAL PLAN OF THE CATALOG

It was tempting to organize this Catalog alphabetically, making it an "encyclopedia of anomalies." But many of the phenomena have obscure names or, even worse, no names at all. Under these circumstances, alphabetical access to the data base would be difficult. Therefore, a system of classification was designed based upon readily recognized aspects of nature, such as lightning or mammal morphology. The universe of anomalies is first divided into nine general classes of scientific endeavor, as illustrated in the diagram on the following page. Few people would have difficulty classifying a phenomenon as biological, astronomical, geological, etc. The second, third, and fourth levels of classification are also based upon generally recognized aspects of nature. The similarity of this sort of classification to that employed in natural-history field guides is quite intentional. Like bird identification, phenomenon classification soon becomes second nature. In fact many of the phenomena described in this Catalog are accessible to anyone with normal senses and, particularly in archeology, a little digging.

Most catalogs employ numbering systems, and this one is no exception. Rather than use a purely numerical system, the first three levels of classification are designated by letters. The triplets of letters selected have some mnemonic value. Thus, an MSR anomaly is easily recognized as belonging to the archeology class (M); as involving structures (S); and as concerning water-control (C). The number added to the triplet of letters marks the fourth classification level, so that MSC1 applies to "ancient aqueducts," as indicated in the diagram on the next page. Every type of anomaly has such a unique alphanumeric code. All cross references and indexes are based on this system. Catalog additions and revisions are made easier with this approach.

These codes may seem cumbersome at first, but their mnemonic value to the compiler has been considerable. The codes are simple, yet they are flexible enough to encompass the several thousand types of anomalies in the several diverse scientific disciplines that have so far been investigated.

A glance through this volume will reveal that each entry for an anomaly type bears an X-number, and each reference an R-number. MSC1-X1 therefore specifies the first entry for "ancient aqueducts". MSC1-R1 is the first reference in this section's bibliography.

<u>First-order classification</u>	<u>Second-order classification</u>	<u>Third-order classification</u>	<u>Fourth-order classification</u>
A Astronomy	A Anthropology	B Buildings	1 Ancient Aqueducts
B Biology	G Graphic Artifacts	C Water-control Structures	2 La Cumbre
C Chemistry & Physics	M Non-graphic Artifacts	D Menhirs, Dolmens	3 Tunnel-Well Systems
E Earth Sciences	S Structures	E Excavated Structures	4 Water-Condensers
G Geophysics		H Stone Rows and Circles	⋮
L Logic & Math		M Mounds and Cairns	⋮
M Archeology		O Carved Rocks, Columns	Other MSC Entries
P Psychology		R Roads and Bridges	⋮
X Unclassified		S Cities, complexes	⋮
		W Walls, Ditches	9 Artificial Harbors

Bold-face subjects are covered in this volume.

CATALOG CODING SCHEME

HOW DATA AND ANOMALIES ARE EVALUATED

Each anomaly type is rated twice on four-level scales for data "validity" and "anomalousness", as defined below. These evaluations represent only the opinion of the compiler and must be considered only rough guides.

DATA EVALUATION SCALE

- 1 Many high-quality observations. Almost certainly a real phenomenon.
- 2 Several good observations or one or two high-quality observations. Probably real.
- 3 Only a few observations, some of doubtful quality. Phenomenon questionable.
- 4 Unacceptable, poor-quality data. Such entries are included only for purposes of comparison and amplification.

ANOMALY EVALUATION SCALE

- 1 Anomaly cannot be explained by modifications of present laws. Revolutionary.
- 2 Can probably be explained through relatively minor modifications of present scientific laws.
- 3 Can probably be explained using currently popular theories. Primarily of curiosity value.
- 4 Well-explained. Included only for purposes of comparison and amplification.

Referring to the evaluation scales above, it should be remarked that anomalies that rate "1" on both scales are very rare. Such anomalies, however, are the most important because of their potential for forcing scientific revolutions.

ANOMALY EXAMPLES

Examples of anomaly types and the entries discussing them are designated by the letter X in the body of the Catalog. Except in the cases of extremely common phenomena, such as ball lightning, all of the examples discovered so far are entered. If the example is of the "event" type, time and place are recorded if they are available. Such data are the basis of the Time-of-Event and Place-of-Event Indexes, which could in principle lead to the discovery of obscure cause-and-effect relationships. When library research has unearthed a great many examples of a specific anomaly, only the more interesting and instructive are treated in detail. In the examples and entries, direct quotations from eye-witnesses and scientific experts are often employed to convey accurately the characteristics and significance of the phenomena.

THE REFERENCES AND SOURCES

Each anomaly type and the examples of it are buttressed by all references that have been collected and examined. Since some references deal with several examples, each reference includes the X-numbers of the examples mentioned. When a reference covers more than one type of anomaly, it is repeated in each anomaly bibliography. Actually, there is little repetition of this sort in the Catalog.

Perusal of the Source Index will demonstrate that the great majority of the references employed comes from the scientific literature. Heavily represented in this volume of the Catalog are such journals as: Nature, Science, and Antiquity. Some less-technical publications are also used fairly frequently, such as Science News and the New Scientist. All of the serials just mentioned are generally very reliable, although one must always be wary when dealing with anomalous phenomena. In addition to these often-referenced publications, a wide spectrum of other journals dealing with archeology have been found useful here. In contrast to many of the preceding Catalog volumes, books, both scientific and popular, have played an important role here.

The sources consulted date from the beginning of organized science some 200 years ago. The great bulk of the references, however, comes from the past 80 years. In archeology, especially, the explosive growth of the data base is remarkable. Indeed, advances are being made so rapidly in archeology and anthropology that some things printed in this volume will be outdated before the books leave the bindery.

THE INDEXES

Most Catalog volumes conclude with five separate indexes. At first glance this may seem to be too much of a good thing, but in the context of a science-wide endeavor each index helps tie the whole together. It is quite apparent, though, that most archeological phenomena are not of the "event" type. Therefore, the Time-of-Event and Place-of-Event Indexes are not included in the Series-M volumes.

The Source Index shows immediately the dependence of this Catalog upon the scientific literature rather than newspapers and other popular publications. Its real purpose, though, is the rapid checking of newly acquired references to determine whether they have already been caught in the fishing net of the library-research aspect of the Catalog effort. The Source Index is doubly valuable because many footnotes and bibliographies in the scientific literature omit article titles and, sometimes, even authors! The researcher also comes across vague references to such-and-such an article by so-and-so back in 1950 in Nature. In such cases, the rather ponderous Source and First-Author Indexes can help pin down references lacking in specifics.

The three Indexes use the Catalog codes described above rather than page numbers. The codes are permanent whereas page numbers would change as volumes are revised. The mnemonic value of the Catalog codes is evident here, too, because the approximate nature of each Index entry is readily apparent, while page numbers provide only location.

SUPPORTING PUBLICATIONS OF THE SOURCEBOOK PROJECT

The Catalog volumes currently being published are actually distillations of huge masses of source material. The Sourcebook Project has already published 34 volumes of such material, as detailed on p. iv. Phase I of the Sourcebook Project resulted in ten loose-leaf notebooks called "Sourcebooks." To meet the demands of libraries, Phase II supplanted the Sourcebooks with a series of six "Handbooks," which are casebound, much larger, and more comprehensive than the Sourcebooks. Phase III, now in progress, is the cataloging phase. This consists of systematizing the data base, which now comprises some 40,000+ articles, and the publication of the "Catalogs."

CATALOG ADDENDA AND REVISIONS

Over 1200 new reports of anomalies are collected each year from current and older scientific journals. New anomaly types and additional examples of types already cataloged are accumulating rapidly. When sufficient new material has been assembled, Catalog volumes will be revised and expanded.

The Sourcebook Project welcomes reports of scientific anomalies not already registered in extant Catalog volumes. Reports from scientific journals are preferred, but everything is grist for the anomaly mill! Credit will be given to submitters in new and revised Catalog volumes. If the reports are from current literature, they may be mentioned in Science Frontiers, the Project's newsletter. Send data to: Sourcebook Project, P.O. Box 107, Glen Arm, MD 21057, USA.

MS INTRODUCTION

This volume, the eighteenth in the Catalog of Anomalies, is the first to concern itself with archeology. Its focus is the infrastructure constructed by ancient humans to support their various, diverse cultures. Typical elements of a civilization's infrastructure are: roads, irrigation systems, mines, defensive walls, calendar-reckoning structures, and, last but far from least, those structures designed for ritual and ceremonial purposes. Stone circles, temple mounds, and medicine wheels come under this heading.

Several types of structures are relegated to a second catalog volume---mainly because we have amassed so much fascinating material on those constructions we loosely call "buildings." Included in this forthcoming volume will be stone chambers, forts, astronomical observatories, pyramids, and towers. Cities and extended sites, such as Nan Madol and Mohenjo-daro are also assigned to this second volume.

It is reasonable to ask what might be anomalous in the sundry structures mentioned in the first paragraph. First of all, we assume that many ancient cultures had access to large labor forces so that the length of a canal and the weight of the stones at Stonehenge are not particularly significant, regardless of how impressive they are. The properties of a structure that do claim the attention of an anomalist are such as follows:

- High degrees of innovation;
- Precocious use of technology and science, as in eclipse prediction;
- Apparent lack of purpose; and
- Unknown identity of the builders

Such properties usually warrant only modest anomaly ratings. They do not really directly challenge deeply entrenched dogmas. Anomaly ratings ascend dramatically when structures imply:

- The Vikings ventured well beyond Newfoundland;
- There were extensive pre-Columbian contacts between the Old and New Worlds, read "diffusion"; and
- Vastly superior civilizations preceded our own, read Atlantis and/or the Golden Age.

Archeologists should not feel singled out in all this. The first seventeen volumes treat the disciplines of geophysics, astronomy, geology, and biology in the same doubting, suspicious way. The attitude of the anomalist may seem "bad" to a mainstream scientist, but it is eclectic, value-free, and ever-inquiring.

MSC WATER-CONTROL STRUCTURES

Key to Phenomena

MSC0	Introduction
MSC1	Remarkable Ancient Aqueducts and Water-Delivery Systems
MSC2	La Cumbre: Peru's Intervalley Canal
MSC3	Subterranean Tunnel-Well Systems
MSC4	Water-Condensing Structures
MSC5	Three Notable Ancient Irrigation Systems
MSC6	Curious Old Dams
MSC7	Unusual Water-Containment Structures
MSC8	Notable Ancient Ship Canals
MSC9	Artificial Harbors

MSC0 Introduction

Water-control structures were vital to early civilizations as they still are to ours. They perform a variety of functions:

- Tapping aquifers (wells)
- Extracting water from humid air (condensers)
- Transporting water from sources to fields and consumers (aqueducts, canals)
- Distributing water to crops (irrigation canals)
- Impounding water for future use (dams, tanks)
- Providing waterways for vessels (ship canals)
- Providing sheltered water basins for vessels (harbors)

Ancient cultures constructed water-control structures virtually identical to those built by modern engineers; they were just a bit less sophisticated. Indeed, some old wells, aqueducts, and irrigation systems are still in use today. The scale of some of these ancient structures is incredible; e.g., the qanats of the Middle East and the great canals of Egypt and China.

Precocious hydraulic engineering can be seen in La Cumbre (a 50-mile-long Peruvian aqueduct) and the huge dams and tanks of Sri Lanka. We wonder what the ancient engineers might have accomplished if they had had bulldozers, dump trucks, dynamite, and laser transits!

MSC1 Remarkable Ancient Aqueducts

and Water-Delivery Systems

Description. A small collection of descriptions of ancient aqueducts that are unusual in:

- (1) Their ambitious scale;
- (2) Their use of wood for long conduits;
- (3) Their unusual geographical location;
- (4) Their apparent great age; and/or
- (5) Our ignorance of their builders

Data Evaluation. Popular science magazines rather than refereed science journals are our primary sources here; and most of these are more than a century old.
Rating: 3.

Anomaly Evaluation. While remarkable for the features itemized above, the structures cataloged here possess only curiosity value for the anomalist; that is, they place no paradigms at risk. Rating: 3.

Possible Explanations. None required.

Similar and Related Phenomena. La Cumbre (MSC2); qanats (MSC3); ship canals (MSC8); irrigation systems (MSC5).

Entries

X0. Introduction. The water essential for agriculture and human consumption is not always located where it is needed. New York City depends upon giant aqueducts to bring its water from upstate reservoirs. Many California farmers are utterly dependent upon that state's extensive network of huge, capacious canals.

Ancient cultures faced the same sorts of water-supply problems and solved them in much the same ways. The great Roman aqueducts are familiar from our geography textbooks; but the Romans have always been recognized as consummate engineers, and we can hardly call their works anomalous. Rather, we are concerned here with ancient hydraulic systems that are even more remarkable and puzzling for their times and places than anything the Romans built.

X1. North America

New Mexico. The following quotation is from a usually reliable source. However, it verges on the fantastic, and we have seen no corroborating discussions elsewhere. So, a caveat is necessary.

Discoveries were made recently in the lava beds of New Mexico, some of which are situated eighteen miles west of Santa Fe, which prove that thousands of years ago there existed in New Mexico a system of reservoirs and irrigation viaducts that is unparalleled at this age. Under the lava, which covers hundreds of square miles, are found traces of cemented ditches and reservoirs that are marvels of civil engineering. Irrigation engineers have much to learn from the people, older than the Pueblo race, who inhabited New Mexico when the race from which

Columbus sprang were still barbarians. The ancients provided against seepage by cementing the bottoms of their ditches wherever they are conducted across loose soils. Their ditches wound in and out at the base of mountain ranges, following the sinuities of canyons and rounding points in such a manner as to catch all the storm water before it was absorbed by the loose sands at the mountain's base. Reservoirs at convenient basins stored the water, which was led in cemented ditches across the loose soils to where it was needed for use. Chasms were crossed by viaducts, and wonderful engineering devices were used for the removal of silt that might be used as an aid to the fertility of loose and rocky soils otherwise valueless. Into some of the ditches lava has run, showing their great antiquity. Others are now covered with shifting sands, but enough are still visible in many places in New Mexico to enable the skilled engineer to understand the system which prehistoric New Mexicans rendered so effective. (R5)

X2. Europe

Switzerland. A most unusual system of aqueducts supplied the canton of Valais with water from glaciers and mountain springs. Unlike most ancient water conduits, which were constructed from stones, earth, and masonry, those of ancient Valais were made mostly from wood. The oldest, the Roth Canal, was unquestionably pre-Roman. The Valais system was extensive and, as the following quotation will attest, very impressive.

The chief canals which bring the water down from the mountains vary in length from one thousand to fifty-five thousand metres; or, measured by the time it takes water to run through them, from a quarter of an hour to six hours. The total length of the canals in the canton is one million five hundred thousand metres, or two hundred and fifty hours. The skill with which they have been located and constructed excites an admiration that is increased when it is remembered that they date from a remote antiquity and are the work of a simple country peo-

ple. Beginning often in the immediate neighborhood of the glaciers, crossing treacherous hills and lofty precipices, and spanning deep abysses, passing through tunnels and cuts, led along artificial terraces, that sometimes require additional embankments or walls to support them, these canals are really formidable works.

.....

Among the most remarkable of the main aqueducts are those of the Gradetsch Valley, where water is led down by eleven canals, the highest of which starts from an altitude of 2,300 metres or nearly 7,500 feet above the sea. Some of the canals require wooden conduits three or four thousand metres long, that have at times to be supported by poles for six hundred metres at a stretch. To reach them for repairs the workmen have in some places to be let down the perpendicular rock-walls with ropes. (R2)

As for aqueduct capacities, the Roth Canal, mentioned above, measured 1.3 meters square and delivered 1 cubic meter of water per second.

Since our reference here dates from 1884, it would not be surprising if the inhabitants of Valais have long ago modernized their water-supply system.

Greece. The Greek town of Samos was in antiquity supplied with water by an aqueduct that ran through a mile-long tunnel. Some features of the tunnel are presented in MSE3-X4. Here, we provide more information on the aqueduct itself. Both tunnel and aqueduct were built during the Tenth Century B.C.

The tunnel about 5,000 feet long was intended to secure a supply of fresh water to the old seaport town of Samos, and consisted of three parts. They are the tunnel proper, 5½ feet high and 6 feet wide; a canal about 5 feet deep and nearly 3 feet wide, which runs in the middle or on the side of the base of the tunnel; and the aqueduct running in this canal. The aqueduct consists of earthen pipes, each 2½ feet long, 32-33 inches in circumference, the sides averaging about 1½ inch in thickness. Every joint has a hole, for what purpose has not yet been fully explained. Mr. Stamatiades, a Greek archaeologist, believes that

they were intended to facilitate the cleaning of the pipes, and to make the flow of the water easier. The canal is arched over, but twenty-eight man-holes were provided to admit the workmen who were charged with cleaning and repairing the aqueduct. (R1)

As related in MSE3-X4, the tunnel and aqueduct, almost a mile long, pierce a mountain. Construction began at both ends simultaneously and, remarkable for 3,000 years ago, met almost exactly in the middle of the mountain.

X3. Middle East

Mesopotamia. In 1954, Professor A. Goetz of Yale announced the discovery of a canal system 100 miles long that ran parallel to the Euphrates River in Mesopotamia. In use between 5,000 and 4,000 B.C., the canals supplied water for agriculture and were also used for transportation between towns. (R7)

X4. Africa

Egypt. The Bahr Joussuf or Canal of Joseph---really more of an aqueduct than a canal---was dug about 4,000 years ago.

The canal took its rise from the Nile at Asiut, and ran almost parallel with it for nearly 250 miles, creeping along under the western cliffs of the Nile Valley, with many a bend and winding, until at length it gained an eminence, as compared with the river bed, which enabled it to turn westward through a narrow pass and enter a district which was otherwise shut off from the fertilizing floods on which all vegetation in Egypt depends. The northern end stood seventeen feet above low Nile, while at the southern end it was at an equal elevation with the river. Through this cut ran a perennial stream, which watered the province named the Fayoum, endowing it with a fertility and supporting a large population. In the time of the annual flood a great part of the canal was under water, and then the river's current would rush in a more direct course

into the pass, carrying with it the rich silt which takes the place of manure and keeps the soil in a constant state of productiveness. All this, with the exception of the tradition that Joseph built it, can be verified today, and it is not mere supposition or rumor. (R4)

This foregoing article mentions that, according to ancient accounts, the Fayoum once boasted a lake with a circumference of 450 miles, supporting a fleet of vessels!

Zimbabwe. The Inyanga Estate is located in mountainous country 250 miles north of Great Zimbabwe. Besides being the site of many curious pits (MSE2-X5), it is noted for an interesting system of aqueducts, as vignettted below by R.N. Hall.

One of the extraordinary features of the Inyanga Range is the vast number of old aqueducts, some two miles or more in length, running from artificial dams on the mountain streams, and crossing from hill to hill in a most remarkable manner.

Whoever constructed these aqueducts must have been a people thoroughly conversant with engineering, for their levels are beautifully and exactly carried out in spite of all natural obstacles, and not an inch of fall is wasted throughout the length of their courses. These are a marvel to all modern engineers who inspect them. Evidently they were used for purposes of irrigation. The hardest material pierced in their construction appears to have been shale or clay stone.

They are all about 16 to 24 inches wide, and are about 2 feet in depth. They have no paving or built sides. (R6)

Hall wrote this in 1905. Presumably, we now know more about the aqueduct builders.

References

- R1. Anonymous; "An Ancient Tunnel," Knowledge, 6:370, 1884. (X2)
- R2. Luders, M.A.; "A Prehistoric Water-System," Popular Science Monthly,

- 24:539, 1884. (X2)
- R3. Anonymous; "The Canal of Joseph," Scientific American, 61:52, 1889.
- R4. Anonymous; "Joseph's Canal in Egypt," Scientific American, 77:138, 1897. (X4)
- R5. Anonymous; Scientific American Supplement, 48:19742, 1899. (X1)
- R6. Hall, R.N.; "Stone Fort and Pits on the Inyanga Estate, Rhodesia," Anthropological Institute, Journal, 35:92, 1905. (X4)
- R7. Anonymous; "Find Canal System of 5000 B.C. Mesopotamia," Science News Letter, 66:37, 1954. (X3)

MSC2

La Cumbre: Peru's Intervalley Canal

Description. An ambitious, 50-mile-long canal built through difficult terrain circa, 1,050-1,300 A.D., in Peru's Moche Valley. La Cumbre displays a precocious grasp of modern hydraulic engineering.

Data Evaluation. La Cumbre has been carefully surveyed and is described in detail in several popular and scientific publications. Rating: 1.

Anomaly Evaluation. La Cumbre is remarkable in two ways. First, it represents an enormous amount of labor with crude tools. Second and more significant, the hydraulic engineering expertise seen in the canal's features was not matched in the Old World for another 500 years. All this was accomplished without a written language, formal mathematics, and modern engineering tools and instruments. Although La Cumbre cannot be considered highly anomalous, it must be rated as one of the wonders of the ancient New World. Rating: 2.

Possible Explanations. The Chimu culture was surprisingly advanced socially, intellectually, and scientifically.

Similar and Related Phenomena. The Inca road system (MSR1);

Entries

X1. South America

Peru. The Great Pyramid is the only survivor of the Seven Wonders of the Ancient World. In the New World, there is also a surviving ancient wonder. It is 50 miles long and is calculated to have absorbed ten times as many man-hours in its construction as the Great Pyramid. This lengthy survivor is Peru's Inter-

valley Canal, also called the La Cumbre Canal. (La cumbre = The summit.) La Cumbre was built by the Chimu, predecessors of the Inca, to bring water from the Chicama River into the Moche Valley on Peru's Pacific Coast. Ultimately, the forces of nature conspired such that La Cumbre never carried a drop of water to the Moche Valley, but the scale and sophistication of this great Chimu enter-

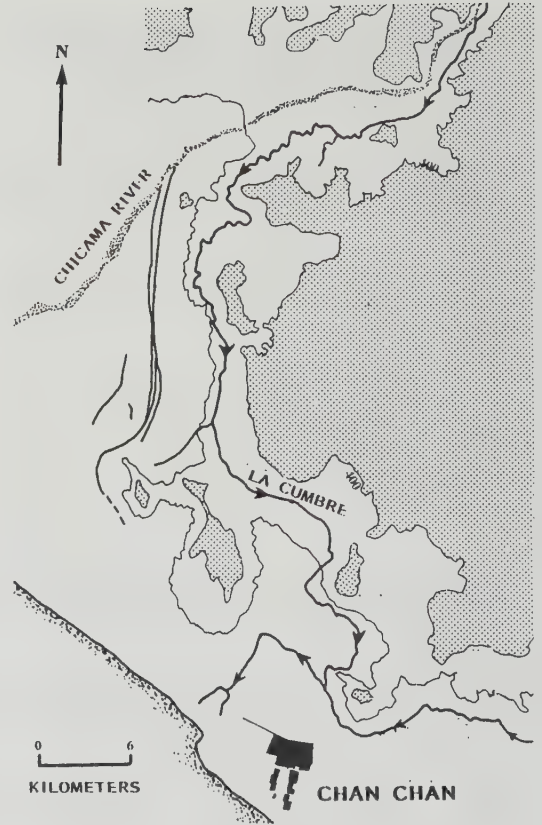
prise requires that we recognize La Cumbre as a marvelous accomplishment.

Prior to their defeat by the Inca circa 1460 A.D., the Chimu controlled a strip-like empire stretching 1,000 miles along the Pacific Coast. Except during El Niño onslaughts, this narrow band of land is one of the driest places on the planet. Nevertheless, it was there that the Chimu constructed their remarkable complex called Chan Chan. To sustain Chan Chan, intensive agriculture was essential, and such agriculture demanded copious water. The Chimu, therefore, developed a complex network of aqueducts and canals to transport water from mountain streams to their irrigated fields. Their most ambitious project was La Cumbre.

The Chimu hydraulic engineers had no bulldozers, trucks, of dynamite at their disposal. Crude stone hoes served for grubbing, wicker baskets for transporting. Instead of dynamiting obstacles, they built fires around offending rocks and reduced them bit by bit. Even so, in a century or so, they had built a 50-mile channel several yards wide. Parts were trenched in rock and soil but many miles of La Cumbre ran between embankments of rocky soil. In some places, La Cumbre towered 70 feet above the surrounding terrain—like the elevated Roman viaducts but without the great arches and masonry.

Before the construction of La Cumbre began (1,050-1,100 A.D.), the long route had to be surveyed precisely, the path laid out, the proper grade determined. Maintaining the proper slope over a distance of 50 miles in mountainous country was no mean civil engineering task. The Chimu probably used plumb bobs, ropes, wooden rods, and possibly, water-filled sighting devices. Remember that all the surveying, planning, and design work had to be done without writing, drafting tables, paper, formal mathematics, and calculators! Canal-building know-how had to be transmitted from generation to generation by memory. In the context of this precocious technology, D.L. Browman wrote:

The Chimu clearly had the ability to build the intervalley canal [La Cumbre] Before intervalley canal construction was begun, they had been successfully designing, building and maintaining canals for 2,000 years. Chimu canals in the Moche Valley that existed at the same time as the intervalley canal were aligned with accuracies of less



Ancient Peru's 50-mile-long Intervalley Canal (La Cumbre) was intended to bring water down into the Moche Valley and Chan Chan from the Chicama River. (Adapted from R6)

than 0.25° over considerable lengths, and construction techniques indicated a level of understanding of the complex relations between wall roughness, bed slope, hydraulic radius, subcriticality and supercriticality of flow rate not known until the late 19th century in Europe and America. (R4)

C.R. Ortloff, an engineer and archaeologist, has studied the Chimu canals on-site and also with laboratory scale models. He has discovered that somehow the Chimu were able to determine the optimum canal cross section to use for maximum hydraulic efficiency. To maintain this hydraulic efficiency under varying conditions, the Chimu changed canal cross sections around curves and, where re-

quired, varied the texture of canal walls to decrease water speed. These features of La Cumbre demonstrate the Chimu's engineering sophistication. (R5, R7)

For all their expertise in hydraulics, La Cumbre never became fully operational. Modern surveys quickly revealed one reason. There are seven sections that run uphill for a kilometer or more. Was this the consequence of sloppy engineering? Such would be inconsistent with the demonstrated sophistication of other features of La Cumbre. Instead, the Chimu were probably thwarted by the tectonic forces so common along the geologically active west coast of South America. These forces repeatedly raised or lowered sections of La Cumbre that had already been built. The Chimu detected these surprisingly rapid changes in the terrain and repeatedly rebuilt sections of the canal to accommodate them. In the end, though, the tectonic activity was too rapid for them. About 1,300 they gave up. La Cumbre never carried water into the Moche Valley, although upper sections may have been operational.

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A rare torrential rain washed away part of this elevated section of La Cumbre, revealing its size and method of construction..

MSC3 Subterranean Tunnel-Well Systems

Description. The presence in many arid regions of the Old World and Peru of a unique technique for tapping aquifers and transporting the water underground to fields and towns. Some of the Peruvian tunnel-well systems seem to be pre-Spanish and, therefore, raise the possibility that earlier diffusion of this technology occurred from the Old World to the New World.

Data Evaluation. The Old World tunnel-well systems ("qanats") are well-researched and thoroughly reported in the science literature. Those of Peru have received less attention. Rating: 2.

Anomaly Evaluation. The qanats of the Middle East (160,000 kilometers of them in Iran alone) are extensive enough to warrant mention here, but it is the appearance of virtually identical tunnel-well technology in Peru before the Spanish Conquest that is potentially highly anomalous. Did the ancient Peruvians originate the qanat concept independently or did they acquire it from pre-Conquest Old World visitors? The latter possibility is highly anomalous. Rating: 1.

Possible Explanations. The Peruvian qanats (the "puquios") were invented separately.

Similar and Related Phenomena. Notable aqueducts (MSC1); La Cumbre (MSC2); remarkable irrigation systems (MSC5). Other examples of early diffusion from the Old World to the New World and vice versa (See Series-M Subject Indexes under: Diffusion.)

Entries

X1. Old-World tunnel-well systems. About 750 B.C. in ancient Armenia, a very important type of water-supply system was invented. The concept was ideally suited to arid regions and spread quickly across the Middle East, west across North Africa to Spain, and east into Central Asia and western China. The English term "tunnel-well system" describes the basic concept accurately, but the Arabic word "qanat," meaning "conduit," is also widely used.

P.W. English outlined the qanat idea as follows:

Qanats are gently sloping tunnels dug nearly horizontally into an alluvial fan until the water table is pierced. Once constructed, ground water filters into the channel, runs down its gentle slope, and emerges at the surface as a stream. In excavating these tunnels, diggers must have air and tunnel spoil must be removed, so the tunnels are connected to the surface with a series of vertical shafts spaced every 50 to 150 meters along its course. The tops of these shafts are rimmed by piles of excavated dirt to form a "chain-of-

wells" on the surface, a distinctive feature of the arid landscapes of qanat-watered regions. (R3)

Qanats are ideally suited to arid regions because the water conduits are covered thereby reducing evaporation. In addition, the water flows under the influence of gravity so that no power sources (pumps) are required.

In mountainous regions, qanats are usually short---only tens of meters long and a few meters below the surface. Elsewhere, however, qanats become giant engineering structures. At Kirman, Iran, water for irrigation and human consumption is supplied by qanats that extend 50 kilometers south to penetrate the water table at the base of mountains. The Kirman Plain is dotted with thousands of vertical shafts marking the courses of this great network of qanats. In all of Iran, the qanats number about 37,500, with an aggregate length that is put at 160,000 kilometers. (R3) Obviously, the Iranian qanats required an immense investment of labor. But in arid lands, they represent an excellent way to tap subterranean water and convey it efficiently

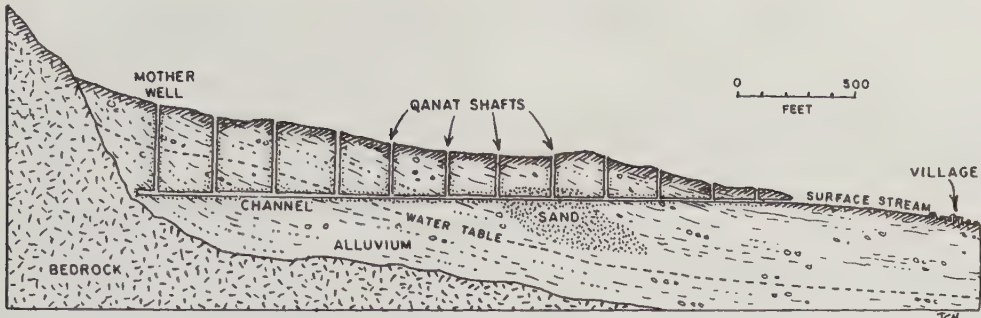


Diagram of a typical qanat or chain well. (Adapted from R3)

to fields and cities and are well worth the expenditure of this labor.

Out on the Libyan Sahara, travellers see the remains of other large qanats or, as they are called there, "foggaras." A first-hand account of some of these Libyan tunnel-well systems has been provided by J. Wellard.

You first become aware of this maze of tunnels as you travel the washboard track that runs along the valley from Sebha to Ghat. Not far from Germa (the Garama of classical history), the car starts to cross a series of ridges giving almost the effect of a switch-back railway. If the traveller will then look out across the plain, he will see that these ridges---there are two hundred of them within twenty miles of Germa---run straight across the valley from the oases in the north to the mountains in the south. There are places where the roof of these foggaras has collapsed. At such openings, the explorer can descend into the tunnels themselves and examine their construction. Some tunnels have become either clogged with sand or silted up; but where they are open, one can estimate that they were horizontal shafts about six feet deep and eight feet wide, with a vaulted roof. They are driven through the rock some ten feet below the present surface of the plain. (R2)

In Libya, there are thousands of miles of these foggaras. They were vital to the pre-Roman people who once lived in this desert region.

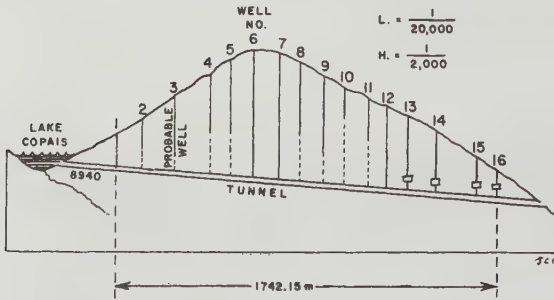
Greece. Usually, qanats are built to tap aquifers and transport their water to fields and communities in arid regions, but they can also operate in reverse; that is, they can drain areas prone to flooding.

A tunnel-well system looking much like a classical qanat was partially completed by ancient Greek engineers at Lake Copais, in northern Boeotia. To prevent disastrous flooding of the area around the lake, a tunnel over $1\frac{1}{4}$ miles long was attempted through the Hill of Kephalaria. As in the typical qanat, access to the tunnel was to be gained through a series of sixteen shafts or wells. These wells would have permitted the workers to advance the tunnel at many locations simultaneously and provide tunnel ventilation as well.

Well #6, at the top of the hill was 66 meters deep and chipped out of hard limestone. (A formidable task!) Wells #13, #14, #15, and #16 are marked by curious horizontal galleries a few meters long. These were never extended until they met and were positioned above the tunnel proper. Perhaps they were false starts in tunnel construction. In fact, the main tunnel was never completed, and all the immense labors were in vain. (R1)

The aborted Copais tunnel-well system has been attributed variously to Greek engineers of the Homeric Age, the Alexandrian Age, and to Crates.

Lake Copais no longer exists. In the Nineteenth Century, it was finally drained and converted to arable land.



This ancient tunnel and access shafts were designed to drain excess water from Lake Copais, Greece. The rectangles at shafts 13, 14, 15, and 16 represent short horizontal galleries, the purpose of which remains mysterious.

X2. New World qanats. In Peru's Nazca Valley, we find tunnel-well systems that closely follow qanat design principles. These qanat-analogs are locally called "puquios" (Spanish for "springs"). There are about 40 puquios in the Nazca Valley. Most of the tunnels are large enough for a person to crawl or walk through. Some are 2-3 miles long. Every 100 yards or so, pits or, in local parlance, "eyes," were dug to permit access to the tunnels. In the dry season, Nazca farmers still climb down into the eyes to remove the accumulated silt and debris. (R5)

The strong similarities between the puquios and qanats raise two questions.

(1) Were the Nazca Valley puquios built before or after the Spanish Conquest?

(2) If they are pre-Conquest structures, were they an independent invention of the Nazca or was the concept introduced by pre-Spanish visitors from the Old World?

E. Hadingham asserts that the Spanish

would have had no incentive to introduce qanats into the relatively poor and obscure Nazca Valley. (R5) Indeed, the early Spanish chronicles do not mention them. (R6) There is no question, however, that the Spanish were responsible for the construction of some puquios in both Mexico and Peru.

Apparently confirming a pre-Conquest origin of the Nazca Valley puquios are dates for the desert varnish that has accumulated on the lintels of two Nazca puquios. The published dates are: 552-644 and 591-698 A.D.--not only pre-Conquest but pre-Inca, too. (R6)

So, if the lintel dates hold up, the Nazca puquios are definitely pre-Conquest. The second question, pertaining to the possible pre-Conquest diffusion of the qanat idea, cannot be answered at the present time. Certainly, most mainstream archeologists would opt today for the independent invention over any very early Asian or European contacts.

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MSC4 Water-Condensing Structures

Description. The construction of stone pyramids by the ancient Greeks for the purpose of condensing water from the atmosphere in arid climes.

Data Evaluation. We have only a single newspaper article to support this phenomenon, but enough details are provided so that it can be checked out. Rating: 3.

Anomaly Evaluation. Surely, all ancient peoples must have observed that moisture (dew) collects on cold surfaces. It is but a short mental step from this recognition to the construction of artificial water-condensers. The piles of stones the Greeks built for this purpose, unusual and inspired though they may be, can only be rated as curiosities. Rating: 3.

Possible Explanations. None required.

Similar and Related Phenomena. The construction of equivalent structures by other mammals, such as mice (BMT12-X5 in Mammals I).

Entries

X0. Introduction. In arid regions and on oceanic islands where fresh water is in short supply, modern engineers have erected large condensers or "dew catchers." These structures cool down at night, mainly through radiation, and condense water vapor from the air. The dew-catcher idea is not new. The ancient Greek engineers built stone structures to serve the same function.

X1. Europe

Greece. It seems that the ancient Greeks also built pyramids, but they were water-catchers, not tombs. These ancient engineers had observed that piles of porous rocks could, in desert climes, capture and condense surprisingly large quantities of water. Take, for example, the 13 pyramids of loose limestone rocks that the Greeks constructed some 2,500 years ago at Theodosia in the Crimea:

The pyramids averaged nearly 40 feet high and were placed on hills around the city. As wind moved air

through the heaps of stone, the day's cycle of rising and falling temperatures caused moisture to condense, run down, and feed a network of clay pipes.

One archaeologist calculated a water flow of 14,400 gallons per pyramid per day, based on the size of the clay pipes leading from each device. (R1)

Weren't the ancient Greeks clever? But perhaps they had observed how some mice in the Sahara pile small heaps of rocks in front of their burrows and lick the condensed moisture off in the morning. In a remarkable instance of parallel invention, some Australian native mice do the same thing. (BMT12-X5 in Mammals I)

References

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MSC5 Three Notable Ancient Irrigation Systems

Description. Three remarkable irrigation systems conceived, designed, and built by ancient cultures:

- (1) Michigan's "garden beds," unique to northern North America;
- (2) Arizona's Hohokam canals, an engineering "wonder" of the New World; and
- (3) Bolivia's platform agriculture, an inspired response to the frosts, floods, and droughts in the vicinity of Lake Titicaca in the high Andes.

Data Evaluation. We were overwhelmed with scientific studies of ancient agriculture. Our References, listed below, are necessarily very selective. Rating: 1.

Anomaly Evaluation. The three irrigation systems presented below demonstrate amazing industry, innovation, and engineering expertise. Since no archeologists deny that ancient cultures possessed these qualities, no anomaly exists here. But we are so impressed with these three irrigation works that we do not hesitate to assign a modest rating here. Rating: 3.

Possible Explanations. None required.

Similar and Related Phenomena. Ancient aqueducts (MSC1); La Cumbre (MSC2).

Entries

X0. Introduction. People in many parts of the world are utterly dependent upon irrigated fields for their survival. From the American Southwest south through Mesoamerica and along the west coast of South America, airline passengers can see canals, wide tracts of irrigated land, ridged fields, and terraced hillsides. The same scenes are duplicated in the Middle East, Southeast Asia, and Oceania. Many of these irrigation works were in place millennia ago and survive today.

It does not seem necessary to dwell upon the multitude of ancient hydraulic-engineering feats that archeologists have discovered. Instead, we have selected three notable irrigation works for special attention based upon their uniqueness, great extent, and/or innovative features.

west, continue to amaze us. Almost totally forgotten, however, are the equally impressive "garden beds" of southern Michigan. These remarkable, highly geometrical works once stretched for miles along the Grand and St. Joseph Rivers and were unique in North American agriculture. Of course, modern activities have now obliterated them completely. Happily, we have a detailed description of these "garden beds" written in 1878 by B. Hubbard. Even in his day, though, many had already been destroyed.

First, we reproduce Hubbard's general description of the "garden beds."

The so-called 'Garden Beds' were found in the valleys of the St. Joseph and Grand Rivers, where they occupied the most fertile of the prairie land and burr-oak plains, principally in the counties of St. Joseph, Cass and Kalamazoo.

They consisted of raised patches of ground, separated by sunken paths, and were generally arranged in plats or blocks of parallel beds. These varied in dimensions, being from five to sixteen feet in width, in

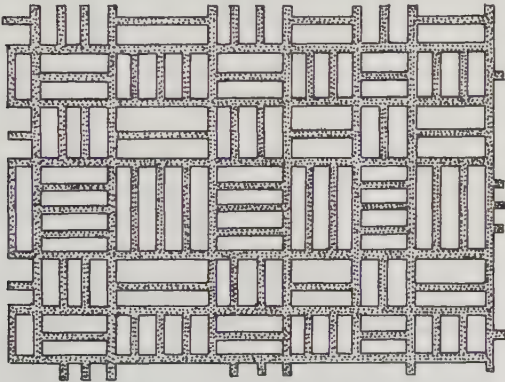
X1. North America

Michigan. The prehistoric ridged fields, canals, aqueducts, and other agricultural engineering feats seen in South and Central America, and even our own South-

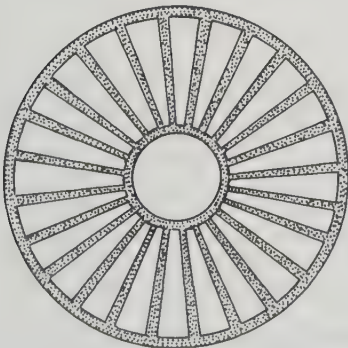
length from twelve to more than one hundred feet, and in height from six to eighteen inches.

The tough sod of the prairie had preserved very sharply all the outlines. According to universal testimony, these beds were laid out and fashioned with skill, order and symmetry which distinguished them from the ordinary operations of agriculture, and were combined with some peculiar features that belong to no recognized system of horticultural art. (R1)

Hubbard recognized eight types of beds. Two of these are shown in the accompanying illustrations. To our knowledge, these curious Michigan garden beds are the only examples of raised-field agriculture in the northern United States.



Rectilinear ancient garden beds, Kalamazoo, Michigan.



An unusual radial ancient garden bed, Kalamazoo, Michigan.

Hubbard gave no figure for the total extent of the beds. Individual plats ran from 20 to 300 acres. Considering that they stretched for miles through three counties, we are certainly talking about thousands of acres. Hubbard stated that the usual pottery, arrowheads, spear points, and related artifacts seemed to be absent from the areas of the beds.

The age of the beds can only be guessed at. When first discovered, large trees grew upon them. One such tree, felled in 1837, was 335 years old, implying that the beds had been abandoned before 1502. (R1)

Arizona. The American Southwest is dry, yet today it blooms around Phoenix, Mesa, and other towns along the Salt River Valley. Of course, modern irrigation projects are responsible for all the greenery and swimming pools. But today's hydraulic engineers were preceded by another band of canal diggers, the Hohokam Indians, who over 2,000 years ago began to grub out canals in the Salt River Valley with the crudest of tools. The Hohokam culture collapsed mysteriously about 1450 A.D. Then, time took its toll on the canal system they had so laboriously constructed. In fact, the first European settlers of the area did not at first recognize the nature and extent of the Hohokam's labors, nor did they always appreciate them. (R10)

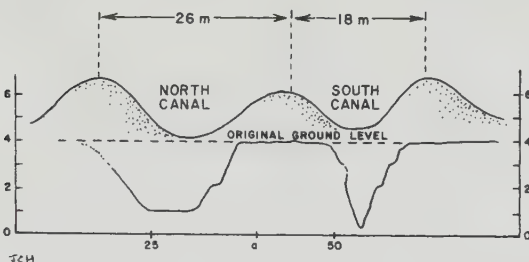
In 1968, F. Midvale wrote:

On first entering the Salt River Valley in 1865, early travelers and pioneer land seekers happened upon a series of causeways. These elevated roadways were most inviting to wagon travel. As they were usually low in the center they were called "sunken roads." During winter rains these westerly directed dikes of earth often were the only means of crossing muddy flats. The mystery of the sunken roads was solved when more ambitious settlers arrived, established homesteads, and began the reclamation of desert lands by irrigation. They were not roads at all, but prehistoric canals built and abandoned by Indians centuries ago! In 1887 prehistoric canals and ruins were so numerous that a downward adjustment was made on the resale price of land to offset the cost of leveling them. (R8)

These primitive irrigators, the Hoho-

kam, prospered along the Salt River from about 300 B.C. to 1,450 A.D. They constructed a network of irrigation canals that is unquestionably one of the Ancient Wonders of the New World. Their canals are mostly erased now, but early investigators recorded more than 500 kilometers of major canals and 1,600 kilometers of smaller ones. One of the main canals was 3 meters deep and 14 kilometers long. As the sketch shows, the canals eventually silted up and had to be raised until they were above ground level.

One of the Hohokam's greatest achievements was the conveyance of water to the top of a long escarpment that is 30-50 feet high and extends for 10 miles. Today, this landmark is known as Lehi Hill or



Two cross sections of two Hohokam canals in Arizona. (Bottom) Cross sections of the canals as originally dug from ground level shown. (Top) Cross sections of the filled-in canals now above original ground level. Dimensions in meters.

the "Great Mesa." The modern city of Mesa takes its name from this geological landmark. (R8)

If we begin to calculate the amount of earth moved, loosened with stones and sticks, and packed out on human backs, the figures become incomprehensibly large. Yet the evidence of superhuman effort is there, clear and unmistakable. For output of labor on a single cultural feature, the Hohokam had no peers among the native Americans north of Mexico. The accomplishment earns for them, hands down, the title of America's Master Farmers. (R4)

E.W. Haury, who wrote the above,

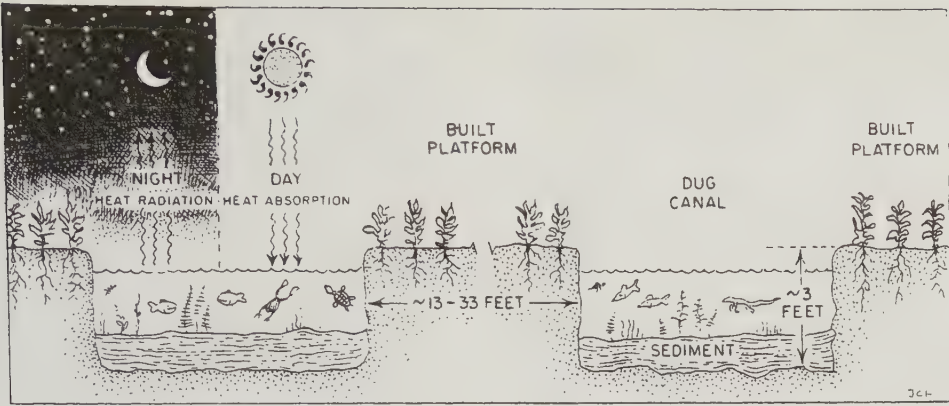
adds that the Hohokam leadership must have been excellent to coordinate the canal digging over such a wide area. In contrast to many of the other ambitious engineering works of antiquity, the Salt River Valley irrigation complex was utilitarian in nature rather than ritual (as at Carnac) or military (the Incan roads).

X2. Latin America. From the soggy wetlands of Guatemala and Belize (1039) to the cold, thin air of the high Andes, the early peoples of Latin America devised a variety of agricultural techniques to suit the radically different environments. Most spectacular are the vast areas of ridged fields and terraced hills found in Columbia, Ecuador, Peru, and Bolivia. (R9) Intensive farming employing irrigation apparently began in the Bolivian Andes about 3,500 years ago. Some of the techniques invented then, such as raised-field agriculture, then have survived to this day. (R15)

As with the Hohokam irrigation canals in Arizona, immense labors were invested in the great swathes of ridged fields and the stepped terraces clinging to the sides of the Andes. We marvel at this industriousness, but it is around the shores of Lake Titicaca at altitudes of 12,000 feet that we find ancient agricultural works requiring our special attention. (Great labor investments by themselves are not considered anomalous.)

Beginning about 3,000 years ago, the inhabitants of this cold land managed to raise bumper crops despite frequent floods and droughts. They pioneered what is termed "platform agriculture," a special type of raised-field agriculture. As shown in the sketch, platform agriculture is characterized by crop-bearing platforms alternating with canals. It is a variation of the ubiquitous ridged fields seen elsewhere in Latin America. In ridged fields, the land's surface is smoothly undulating, in platform agriculture the platforms are flat on top and straight-sided. The latter arrangement maintains fertility and helps ward off frosts during the cold nights so common at 12,000 feet.

Around Lake Titicaca and the ruins of the great city of Tiahuanaco, there were once about 200,000 acres of these alternating platforms and canals---truly a great accomplishment. And the scheme



Platform agriculture was employed in ancient times around Lake Titicaca at altitudes of about 12,000 feet. Water in the canals absorbed the sun's heat during the day and radiated it back at night. This heat reservoir helped protect the crops from frost. Sediments in the canals from algae, plants, and animal remains provided fertilizer for the crops. Platforms were 33-330 feet long. (Adapted from R12)

worked! Although now stark and lonely, this region was once the center of the remarkable Tiahuanacan culture.

All of the great Andean civilizations of antiquity were completely dependent upon the productivity of raised-field agriculture. These fields required no fertilizers, tractors, or plows. The only investment needed was the labor to construct them. Such fields can out-yield conventional, capital-intensive farms, especially in potatoes, a vital crop in the Andes. (R12)

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MSC6 Curious Old Dams

Description. Descriptions of old structures, reputed to be dams, selected for one or more of the following characteristics:

- (1) Unknown purpose;
- (2) Unknown builders;
- (3) Large size (miles in length); and
- (4) Extreme antiquity (over 3,000 years old).

Data Evaluation. This catalog entry is based upon sundry science and popular science publications. The overall impression of these sources is that professional archeologists have shown little interest in old dams. Consequently, our data are rather superficial. Rating: 3.

Anomaly Evaluation. The structures described below are curious and intriguing, but we can hardly call them anomalous, for they threaten no important archeological tenets. Rating: 3.

Possible Explanations. None Required.

Similar and Related Phenomena. Ancient reservoirs (MSC7).

Entries

X1. North America

Maine. Some 33 feet from the seashore near Cutler, Maine, and 130 feet above sea level, beavers now control the outflow from a dam of mysterious provenance. Built of earth and large, round stones, this dam is 4 feet high and 400 feet long. It impounds water in a natural basin creating suggestively named Norse Pond. Obviously, we are not interested in this

dam for its size but rather its unknown builders. Also puzzling is why anyone would build a dam in this location in the first place. Good fresh water is easily available nearby.

There are no records that attribute this dam to settlers in the area. Consequently, imagination has had a free rein. The pond's name was applied over a century ago when it was popular to believe that the Maine coast had been visited by

Vikings from Iceland or Greenland. Some say that the French Acadians from nearby Canada erected the dam. Based upon the supposed existence of ogam inscriptions in the area, Celt-Iberian visitors have also been blamed. Then, some of the symbols that were used by the local Micmac Indians have an Egyptian look to them. (R5)

It's fun to speculate in this manner, but the Norse Pond dam is very real and remains mysterious.

Connecticut. Just as enigmatic as the Norse Pond dam is an enormous stone wall firmly anchored in the east bank of the Connecticut River at South Windsor. It runs all the way across to the west bank and is easily discerned when the river is low.

The whole wall is as straight as an arrow and constructed of the red river shale that is so common in this area. The engineering of such a thing would tax our resources in modern times, let alone centuries ago. (R7)

There are no artifacts or records that hint at the dam's builders--assuming it really was a dam. Nearby Windsor is the oldest town in the state, but the dam is not mentioned in any of its old records.

New York. In the Hudson Valley town of Plattekill, about 30 miles north of the mysterious Ramapo walls (MSW2-X1), lies a structure known as Indian Dam. It is not massive but, like Maine's Norse Pond dam, is catalogable because its purpose and builders remain undetermined. The following description comes from a 1887 book, by P.H. Smith, entitled Legends of the Shawangunk.

The dam in question consists of two stone walls joined at an obtuse angle, and is about one hundred and fifty yards in length, eight or ten feet in height at the highest part, and four feet in width at the top. It is built across a stream at the outlet of a heavily timbered swamp, and would submerge about one hundred acres. As there is scarcely any perceptible fall, the dam could hardly have been built to furnish water power, hence the question as to the purpose of its construction has never been satisfactorily answered. What is stranger still, when the first settlers came into the

vicinity, more than a century ago, the dam was there in the same condition in which it is now found; nor could they ascertain when, by whom, or for what purpose it was built. (as quoted in R4)

Smith went on to doubt that the local Indians could have built the structure since "they were not given to wall building"---a common presumption.

New Mexico. While establishing the international boundary line between the United States and Mexico in 1892, surveyors came across an imposing earthwork they supposed was once a great dam. This structure is in the Animas Valley, 11 miles east of the Arizona line. Given the extensive prehistoric irrigation works known in the river valleys of Arizona, the surmise that the earthwork was an ancient dam was not unreasonable. Here follows part of D.D. Gaillard's account of the discovery:

Measured along the axis of its crest, the dam is 5.5 miles in length, while its crest is from 22 to 24 feet higher than the foot of its eastern slope. At the point where the change of direction in the dam occurs is a breach through which passes the drainage of a watershed of about 25 to 30 square miles. Were this breach repaired and the adjacent portions of the dam brought up to the prevailing height, it would be capable of forming a reservoir with an average length of five miles and a width of one-quarter of a mile. The maximum depth would be about 20 feet and the mean depth about 10 feet. The area would be one and one-quarter square miles only. Practically all of this water could be drawn out at the point where the breach occurs and used to irrigate the portions of the valley to the eastward.

The dam is composed, as judged by surface indications only, of the stiff sedimentary material of the surrounding valley. Its slopes and crest are regular and covered during the rainy season with a luxuriant growth of grass, but are entirely bare of trees or bushes. It has the appearance of great age, and there is now no evidence either of irrigating ditches or of excavations from which material has been obtained. (R1)

In the Mesa Verde area of northern New Mexico, the Anasazi did build modest dams to create reservoirs. (MSC7), but the structure described by Gaillard dwarfs them. No additional information on this imposing structure has been uncovered to date.

X2. Asia

Sri Lanka. This island is well-known for its great waterworks. Since Sri Lanka is subject to floods and droughts, this pre-occupation with water control is quite understandable. In fact, the term "hydraulic civilization" is often applied to ancient Sri Lanka.

In 1981, Sri Lankan engineers began to construct a new dam near Maduru Oya with the intention of creating a lake many miles long. At the same location that modern hydraulic engineers deemed optimum for dam construction, bulldozers quickly discovered that a massive prehistoric dam had already been constructed in exactly the same spot.

Hearing of this discovery, T. Heyerdahl traveled to Maduru Oya to see for himself. He wrote about his visit as follows.

The first objects that caught my eye were the huge blocks lining a twin gallery that ran right through the 10-meter-high (about 33 feet) brick wall that once shut off the valley. The separate openings of these two parallel outlets were formed by three enormous stones set on end and covered by a single monolith of massive dressed granite that weighed over 15 tons. There was more than ample room for a man to crawl comfortably through these square tunnels lined with megalithic blocks. (R6)

Obviously, the prehistoric dam at Maduru Oya was an impressive structure. Unfortunately, Heyerdahl did not indicate the dam's length or its probable age. He did, however, attribute the dam to the Lion people who reached Sri Lanka about 543 B.C.

X3. Africa

Egypt. An anonymous article in a 1918 issue of the Scientific American Supplement was entitled "Engineering Feats of the Ancients." Naturally, the Great Pyramid was featured, but there was also a brief reference to an ancient Egyptian dam across the Nile. This dam was reputed to be 30 feet high and 13 miles long! (R2) We have never seen reference to this formidable dam elsewhere. In fact, we have come across an article that suggests that the ancient Egyptians built only one large dam---not across the Nile ---and that this one was a catastrophic failure.

This contradicting article, from 1955, by G.W. Murray, reviews many ancient Egyptian achievements in hydraulic engineering. Under the heading The Oldest Dam in the World, G.W. Murray wrote as follows:

Seven miles south-east of Helwan, in the Wadi el-Garawi, one may still see the abutments of the Sadd-el-Kafara, the "Dam of the Pagans," the first of its kind in history and one whose failure was so catastrophic that nothing of the sort was attempted again till over 3,000 years had passed.

Its age is not in dispute. From the style of its masonry and the nature of the potsherds lying in the workmen's huts about 200 yards from the site, Professor Schweinfurth who discovered the dam in 1885, Mr. Ernest Mackay who visited it in 1915, and Mr. Guy Brunton who accompanied me to the site in 1935, all agreed in ascribing its erection to the period of the IIIrd or IVth Dynasties, from 2950 to 2750 B.C.

For an initial experiment in dam construction, the size of the structure is surprising. I took the measurements quoted myself in June 1945. It is 348 feet long at the top and about 265 feet at the base; the lintel stood 37 feet above the lowest point in the wadi floor; and, passing through the great breach, one sees that the dam was composite. That is, it was made up of two separate rubble masonry dams, each 78 feet thick at the base, with a space of 120 feet at ground level between them, which was later filled in with over 60,000 tons of shingle from the wadi bed and rubble from the hill-

sides. Beyond that, some 30,000 cubic yards of rubble masonry, say 40,000 tons, were employed in the construction of the upstream and downstream dams---a task that must have occupied the energies of many hundreds of men and animals for a whole season in this desert place, 9 miles from the Nile cultivation. (R3)

The evidence discernible at the dam site suggests that the dam overflowed after a rain, was eroded by the flow of water, and then ruptured catastrophically. People, animals, and buildings downstream were inundated. This failure of "the oldest dam in the world" so discouraged the Egyptians that, according to Murray, they gave up dam building for 3 millennia. This being the case, they could not have built the 13-mile-long dam mentioned earlier.

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MSC7

Unusual Water-Containment Structures

Description. Ancient, very large, frequently highly sophisticated reservoirs, "tanks," and baths designed to store water for human consumption, agriculture, and ritual ablutions.

Data Evaluation. Although most of our sources are recognized science journals and magazines, some are quite old and may not reflect the latest research results. This is particularly true in the case of the great "tanks" found on the Indian Subcontinent, where the so-called "hydraulic civilizations" flourished. Rating: 2.

Anomaly Evaluation. As our custom, we attach scant significance to structure size in our evaluation. Here, the most pertinent characteristics of the water-containment structures are: (1) the level of hydraulic-engineering sophistication; and (2) the close integration of the structures into the overall planning of ancient cities, such as Tikal and Mohenjo-Daro. We see in these two cities foresight not evident in many modern cities. Rating: 2.

Possible Explanations. The ancient hydraulic engineers were more perceptive and expert than generally supposed.

Similar and Related Phenomena. All sections in this chapter (MSC).

Entries

X1. North America

New Mexico. The pre-Columbian inhabitants of the arid American Southwest, particularly the Hohokam, were masters at controlling what little water was available naturally. It is, therefore, hardly surprising to discover that these peoples constructed many rain-catchments and reservoirs to collect and store water for later use. R.H. Wilshusen et al have counted over twenty probable prehistoric water reservoirs in the Mesa Verde area alone. Most of these were rather small, holding only 10,000-25,000 gallons. (R11)

In 1997, a curious topographic feature in Mesa Verde National Park turned out to be a hitherto unrecognized reservoir. This structure epitomizes the efforts the early inhabitants of this area, the Anasazi in this instance, made to husband the scant annual rainfall. A few details about this unusual structure are appropriate here.

In Morefield Canyon, a strange earthen mound, 200 feet wide, rises 15 feet above the canyon's grassy floor. Archeologists have debated the mound's purpose for decades. Being elevated above the floor of a usually dry canyon as it is, the mound certainly does not seem to be a reservoir, but that is what recent research says it is.

The mound is shaped like an inverted frying pan, with a 1500-foot-long handle that leads to a normally dry stream bed higher up in the canyon. The Anasazi were excellent water managers and took advantage of the flash floods that roared down the canyon every few years. To impound some of this valuable water, they initially built a conventional reservoir, but it was soon silted up by the freshets. So, they gradually raised the reservoir walls and constructed a raised canal to the stream bed. It was all very logical once the structure's history was divined.

The engineering of the canal is particularly impressive. The channel is 4-8 feet wide, but only 1-2 feet deep. Its steep, 15-foot-high sides are shored up

with neatly aligned stones that were carried in from somewhere outside the canyon. (R10)

X2. Mesoamerica. Although Mesoamerica occupies tropical latitudes, parts of this region are naturally arid and even the lush areas must endure a 4-month dry season. The prehistoric inhabitants coped with these water shortages by building a wide variety of water-storage structures. Some of these were simple reservoirs and holding ponds like those in Arizona and New Mexico; others were carefully built basins and cistern-like structures. None is particularly mysterious or impressive, so we mention them only briefly.

Mexico. In MSE3-X2, the subterranean structures called "chaltunes" are described. Features of the Yucatan, the chaltunes are believed to have been primarily for water storage.

Guatemala. Like many other Mayan cities, Tikal was not located near any rivers or copious springs. Rain was the only source of water during the entire year. Consequently, extensive water-collection and storage structures were essential to many population centers. According to V.L. Scarborough and G.G. Gallopín, five different types of reservoirs were fed by water catchments at Tikal. These ranged from six "central precinct" reservoirs to 47 "pozás" or small household reservoirs. Based upon an annual rainfall of 150 centimeters, Tikal catchments collected about 900,000 cubic meters of water---the entire year's supply for the population and some of the surrounding farmland.

The above figures pass over the complexity of Tikal's water-supply system. Water from the catchments had to flow by gravity to where it was to be stored or used. A carefully engineered system of canals, dams, and sluices had to ensure that water was available when and where it was needed. Visitors to Tikal are never

shown this remarkable water-control system. It is not the Tikal reservoirs that impress us but rather the integration of the water supply system into the city's overall planning. (R8)

X3. Asia. The ancient inhabitants of Pakistan, India, and Sri Lanka (Ceylon) constructed huge water-storage structures called "tanks" or "baths." Some of these were so large and expertly engineered that brief descriptions are in order. In addition, there is an enormous "tank" at Lothar, India, that is conventionally interpreted to have been a "harbor," although it might have been only a reservoir. It is cataloged as a harbor in MSC9.

Pakistan. The city of Mohenjo-Daro was built on the right bank of the Indus, some 400 kilometers north of Karachi, about 2,450 B.C. Unlike many ancient cities, it was carefully planned from the beginning and possessed a surprisingly sophisticated system of water supply and sewage disposal. Fresh water was obtained from deep, brick-lined wells and efficiently distributed throughout the city.

The structure of interest here is the so-called Great Bath. It is assumed to be a bath rather than a cistern because copious supplies of water were available year round from the wells. Cisterns would not have been necessary. The attention that its builders applied to the Great Bath suggest that bathing there may have been a religious duty, as it is for many Indians today. In other words, it was as much a ritual site as Stonehenge!

Even though the Great Bath was probably not a reservoir, its size and sophisticated engineering make it a candidate for this catalog. In area, it measures 52 x 32.4 meters.

The construction of the actual basin is a technical masterpiece which testifies to the high standard of Harappan engineering. The 1.35m thick innermost shell, forming the basin side walls and floor, was composed of specially manufactured, carefully uniform bricks pointing inwards and laid so precisely in stretcher bond with gypsum mortar that the joints were only a few millimeters wide. Sandwiched between this inner brick shell and an outer one

3cm thick was a 3cm-thick insulation layer of bitumen which the second brick shell prevented from shrinking.

The use of bitumen for sealing water-using structures, familiar in contemporary Mesopotamia, is not testified in the Harappa Culture apart from the Great Bath of Mohenjo-Daro---a unique structure in this and many other respects. (R7)

Indeed, this was precocious hydraulic engineering for 4,500 years ago.

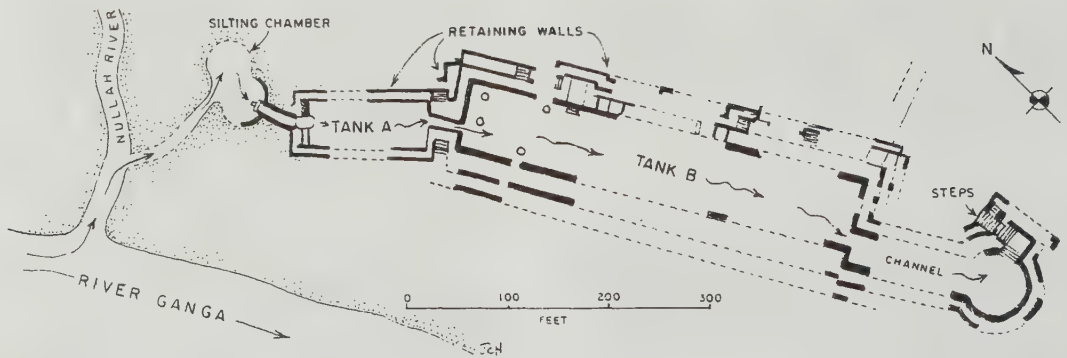
India. The "tank" at Shringaverapura, in Uttar Pradesh, being 250 meters long, is considerably larger than the Great Bath at Mohenjo-Daro, but it was still used as a "bath." It is also about 2,000 years younger. The Shringaverapura tank was fed by water diverted from the Ganga River. Besides being used for ritual bathing, it also served as the town's main water supply.

Actually, the Shringaverapura tank consisted of two separate tanks plus some rather complicated auxiliary structures and supporting wells, as now described.

The hydraulic engineering required to make this tank work is fascinating. The water from the river first entered two successive silting chambers that opened into a curved channel leading to a brick-built siltation tank. From the upper level of this tank, clean water passed through another channel into the main tank. This second tank was provided with staircases at intervals for people to descend and fetch water. In order to ensure that a reasonable supply of water was maintained even during the dry summer months, a series of wells was dug in the bed of the tank through which sub-soil water supplemented the stored water. Finally the water passed into a circular complex which also had an elaborate system of stairs. (R6)

It is easy to see that the Shringaverapura tank was a remarkable feat of hydraulic engineering for 2,000 years ago.

Sri Lanka. In the discussion of the great ancient dam at Maduru Oya (MSC6), the adjective "hydraulic" was applied to the entire ancient civilization of Sri Lanka. This characterization is well-deserved, because the island is dotted with many giant "tanks," the ruins of which are



Plan of the Shringaverapura tank, Uttar Pradesh, India. Partly cleaned water flowed from the silting chambers into Tank A, where further siltation occurred. Access to the clean water in Tank B was provided by steps. (Adapted from R6)

still visible. The Sri Lanka tanks were much larger than the "baths" at Mohenjo Daro and Shringaverapura, being measured in kilometers rather than meters; and they impounded water primarily for agriculture, not for bathing and domestic use. They were, therefore, dedicated reservoirs. In keeping with their size, their construction is unsophisticated. Long, stone-faced, earthen embankments were employed to impound the water rather than brick walls.

Quotations from two old sources give us a feeling for the scale of the Sri Lanka tanks and the long labors that must have been invested in them. First, we have this from Scientific American.

We have held the opinion that the Croton Works [a New York City reservoir] were the most gigantic in the world, and we have heard the assumption made that no works of such magnitude ever existed in the days of old. So far as the latter assertion is concerned, it is not correct. Mr. Tennant, in his recent travels in the Island of Ceylon, described some ancient Water Tanks, beside which our Croton Works are as some small creek compared to the Hudson River. One tank, named Patharicolorn, is seven miles long, three hundred feet broad and 60 feet high. The tank was faced throughout its entire length with layers of square stones. This huge tank is but one of a great many scattered over the coun-

try, and had been erected for irrigation. It is partly in ruins, as the waters flow freely out of a huge breach two hundred feet wide, which appeared to have been made centuries ago. (R1)

Next, we have this from the Journal of the Royal Geographic Society.

The great tanks remain as monuments of the enlightened despotism of various kings, who raised the country in turn to a splendid height of prosperity. Some of them belong to periods long before the Christian era. One, called Kalawewa, was an island sea, thirty miles in circumference, formed by damming up two rivers by means of an immense embankment twelve miles long; another, Padawya, must have occupied a million people for ten or fifteen years in its construction. Its bund, or embankment, is eleven miles in length, 70 feet high, and 160 feet thick at its base. (R2)

X4. Africa

Egypt. When the Greek geographer Strabo visited Abydos in the First Century B.C., he explored a stange underground structure that he called the "well" or "fountain" of Abydos. Some 2,000 years later,

1912-1915, E. Naville directed excavations at Abydos and found what he believed was the same structure that Strabo had written about. However, Naville believed it was a reservoir, as related in the following item from a 1914 issue of Nature.

In the Times of March 17, E. Naville gives a further account of his remarkable discoveries at Abydos. He has found a great rectangular reservoir, which is shown to belong to the period of the Temple of the Sphinx, when building with enormous stones without ornament came into fashion. This he believes to be the oldest stone monument, in the architectural sense, in Egypt. Some of the pyramids may be older, but, except for the inner chambers, they are without architectural plan. [?] This reservoir was used for storage of water in high Nile; and it is a remarkable fact that the beginning of architecture is neither a temple nor a tomb, but a gigantic water-work, showing that even in this early period the people had carefully observed the laws of the rise and fall of the Nile, and of the processes of infiltration. (R4; R5)

Subsequent excavations and studies of Naville's "reservoir," now called the Osireion, have shown that it is much more complex and mysterious than a reservoir. It contains curious naves and cells that would be of no use in a reservoir. There are two small pools, but they were not used for water storage. Carefully shaped, hundred-ton stone blocks were used in the construction of the Osireion, again suggesting that it was something more significant than a reservoir. Whatever its real purpose, the Osireion was a building of extreme importance to the ancient Egyptians. (R9)

Since the Osireion has turned out to be a building rather than a reservoir, we have also cataloged it with other enigmatic buildings. For further details and speculations about this strange structure, see MSB in another volume in this series.

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MSC8 Notable Ancient Ship Canals

Description. Canals constructed primarily for transportation that represent extraordinary investments of labor for the cultures involved. New World canals are generally only a few miles long but located in unexpected places. Most of the Old World canals cataloged here are scores, even hundreds, of miles long and might well be classed with the official Wonders of the Ancient World.

Data Evaluation. Old World canals have been well-researched by scientists and engineers. They are described in the science literature as well as ancient records. Our descriptions of New World canals come mainly from old journals and tend to be superficial. Rating: 2.

Anomaly Evaluation. Since the canals described below utilized no special technologies or inventions; i.e., locks, tools, etc.; they are notable mainly for the immense amount of labor that they required. Large labor investments, even 4,000 years ago, are not considered anomalous. Nevertheless, these canals are interesting for their scope and ambition. Rating: 3.

Possible Explanations. None required.

Similar and Related Phenomena. Ancient aqueducts (MSC1); La Cumbre (MSC2); ambitious irrigation systems (MSC5).

Entries

X0. Introduction. This section focuses on those canals that were probably used as waterways for vessels ranging from canoes requiring only a couple feet of water to the lumbering warships of ancient Egypt and Persia needing 6 feet or more of draft. It is, of course, more than likely that some ship canals also provided irrigation water. Ship canals may be only a mile or so long giving fishermen easy access to the sea or a lake, or they may stretch 100 miles to provide shorter, safer passages from one body of water to another.

The towns [of the Moundbuilders] were surrounded with walls of earth and palisades, and had towers of defense. Entrenchments and ditches were also found in various parts of the country. The most remarkable of the latter was at Pascha, west of the Mississippi. Here a large ditch, "wide enough for two canoes to pass abreast, without the paddles touching," surrounded a walled town. It was cut nine miles long, communicated with the Mississippi, supplied the natives with fish, and afforded them the privileges of navigation. (R2)

X1. North America

Tennessee. The Moundbuilders are renowned for their great pyramidal mounds and long earthen embankments; they were unquestionably accomplished earth-movers. So, perhaps we should not be surprised to discover that they also dug canals when they were deemed useful. The following quotation is from a survey of Tennessee mounds by J. Jones.

Florida. The Indians who piled up the massive shell mounds on the Gulf Coast of Florida (MSM1) were also industrious canal diggers. Accounts of their works frequently mention canals. Most seem to have been constructed to afford easy passage by canoe between the Gulf and lagoons and inland lakes. Generally, they are rather short---a mile or less---but they nevertheless represent considerable excavation. Two of the larger canals merit further description.

The first is located at Horseshoe

Bayou, Choctawhatchee Bay on the Gulf.

The most important and interesting of all the aboriginal remains in this vicinity, however, is a canal leading from the head of Horseshoe Bayou into a large fresh-water lake, about $1\frac{1}{4}$ miles southeast of the bayou. This canal is about 14 feet in width at the top and 6 feet at the bottom. Its original depth was probably from 6 to 18 feet. At present it is not much over half that depth. At ordinary times the canal is dry, but during wet seasons the waters of the lake find an outlet through it to the bay. Excepting a slight angle at one place its course is straight, and the natural advantages of the ground were disregarded in order to reach the desired point by the shortest route. It enters the lake through a marsh, which at a time previous to the cutting of the canal, was probably a part of the lake, and this being drained by the canal, the ancient engineers were forced to continue their work through the marsh until deep water was reached. The lake, which is nearly 7 miles in length, contains immense numbers of fish, and the canal was cut for the purpose of

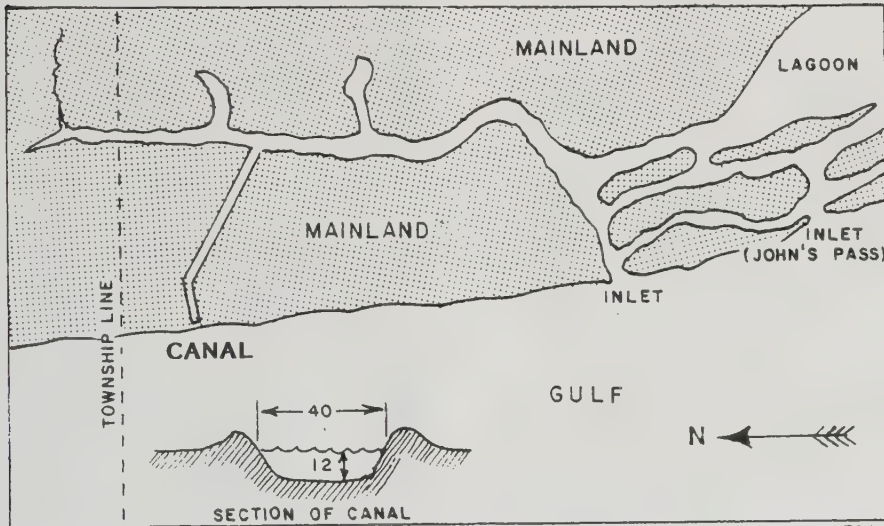
reaching it in canoes, as these must otherwise have been transported over-land at great expense of time and labor. (R4)

The second canal of import was described in great detail by A.E. Douglass. It was by far the most ambitious of the two. This is the account of A.E. Douglass.

While exploring the South-west coast of Florida, I was much interested in two ancient canals which I examined, and whose object seemed quite inexplicable. The first occurs three miles north of Gordon's Pass, an inlet thirty-three miles south of Punta Rasa, and twenty miles north of Cape Romano.

.....

At a distance of three and a half miles from the inlet [one of our party] announced the canal, and we soon joined him and saw the object of our search before us. Where we stood it was buried in the sand embankment, but from that it was plainly visible straight as an arrow, crossing the low intervening morass and penetrating the sandy pine ridge, half a mile, or



This ancient canal on Florida's Gulf Coast allowed easy access to the Gulf. It was about $1\frac{1}{2}$ miles long and had a curious kink in it. Dimensions in feet.

nearly so, away. The bottom was moist and full of tall grass; the sides and summit of the embankment covered with a dense chapparal of oak scrub and scrub palmetto. Its direction from our standpoint was about one point South of East. We could see in the distance, pines growing upon the inner and outer sides of its banks. With infinite labor we worked our way through the dense scrub for a hundred yards or so, and took our measurements. The width of the summit ridge upon each bank was 55 feet, and the depth from that summit level to center of the excavation 12 feet. At the bottom the width was 12 feet, the banks being almost perpendicular for some 5 feet, and then receding on an easier angle to the summit. This summit was about 8 feet above the level of the meadow, through which for nearly half a mile it was excavated, till it reached the higher level of the pine land beyond.

.....

The whole canal is about one mile and a half in length, reaching from the Lagoon to the sea. With the exception of the curve at the Eastern terminus it is perfectly straight. In passing through the pine woods it intersects sand ridges, in which it is excavated to a depth of 40 feet. (R5)

X2. South America

Peru. Before the Spanish Conquest, the natives of South America constructed many aqueducts and irrigation canals (MSC1), including the 50-mile-long La Cumbre (MSC2). The latter canal was built by the Chimu, and it was this same culture that was responsible for the 45-mile-long Taymi Canal that was navigable by balsa rafts for one-way trips to the sea. Return trips had to be made by land. The Taymi Canal began near Tucume in the Lambayeque Valley. It was dug some time during the first millennium B.C. (R14) So far, this is the longest, ancient "ship" canal we have come across in South America.

Bolivia. In extreme northeastern Bolivia, tropical forests prevail in stark contrast to the cold, thin air of Tiahuanaco at 12,000 feet. In these lush environs, near the mouth of the Beni River, lies the

ancient settlement of Tumi Chucua. The inhabitants of Tumi Chucua constructed many earthworks and ditches. The latter served as moats and, in one case, for navigation by canoe to the nearby river about a mile away. This "canal of convenience" is much like the Florida canals. (R12)

X3. Europe

The Crimea. Both Pliny and Strabo wrote about a wide, navigable canal that passed by the town of Perekop, not far from the Greek city of Neapolis. This canal was 9 kilometers long, 5 meters wide at the bottom, and 10 meters deep---large enough for fairly large vessels. Much of the canal is said to have been paved with stones, but these were removed centuries ago for use in buildings elsewhere. As-sande of Bosphorus is thought to have built this waterway in the Seventh Century B.C. (R6) The sort of traffic that used the canal is uncertain.

Greece. Not far from the Crimean canal was the Athos Canal that the Persians hacked through the mountainous, rocky peninsula of Athos in 480 B.C. The Emperor Xerxes ordered that this canal be constructed for his naval invasion of Greece. It shortened the distance and was sheltered from storms. The Athos Canal was only 1½ miles long, but it was wide enough for two oared warships to proceed abreast. (R13)

X4. Middle East

Iraq. See MSC1 for a brief description of a 100-mile long canal system in Sumer (now Iraq). These waterways were used for both irrigation and transportation. (R10)

X5. Asia

China. In their survey of ancient technology, Ancient Inventions, P. James and N. Thorpe remark on three canals built in ancient China.

In China a 260-mile link known as the Canal of the Wild Geese (or Hung Kou) was built between the Yellow River and the Pien and Ssu rivers as early as the Fifth Century B.C. Under the First Emperor, Shih Huang Ti, the digging of the 120-mile-long "Magic Canal" through a mountain range joined together north and south China, creating 1,250 miles of continuous navigable waterway. The "Grand Canal," which was begun in A.D. 70, reached a length of 1,060 miles by A.D. 1327, running for most of the length of eastern China. It was built on a massive scale, ten to thirty feet deep and, at points, one hundred feet wide. (R13)

X6. Africa

Egypt. The urge to connect the Nile with the Red Sea via a canal must have originated about 4,000 years ago. It appears that this feat was first accomplished by the legendary Pharaoh Sesostris, who ruled Egypt in the Second Millennium B.C. It is also written that in 1,470 B.C. Queen Hatsheput was able to send a naval expedition to the Land of Punt via such a canal. This canal was modified and repaired by subsequent pharaohs. However, between 522 and 486, the Persian emperor Darius (father of Xerxes) ruled Egypt, and he had his own canal built to the Red Sea, but it followed much the same route as the earlier Egyptian version. (R13)

Both versions of the Nile-to-Red Sea canal began north of Cairo and used the Pelusiac Branch of the Nile, which was abandoned by the Nile millennia ago, and a wadi leading toward the Bitter Lakes. Obviously, these canals followed an entirely different route than the present-day Suez Canal. There are also traces of a third canal farther to the north. Some pertinent data on these ancient canals follow. See also the accompanying map.

The story of these old canals began when Napoleon occupied Egypt, he had his engineers look at possible canal routes from the Nile to the Red Sea. The survey began in January 1799. The distance was roughly 100 miles and crossed daunting desert terrain. Surprisingly, the French engineers not only found a good route but also evidence that a canal had once been built along the same path they favored. They had found the remnants of

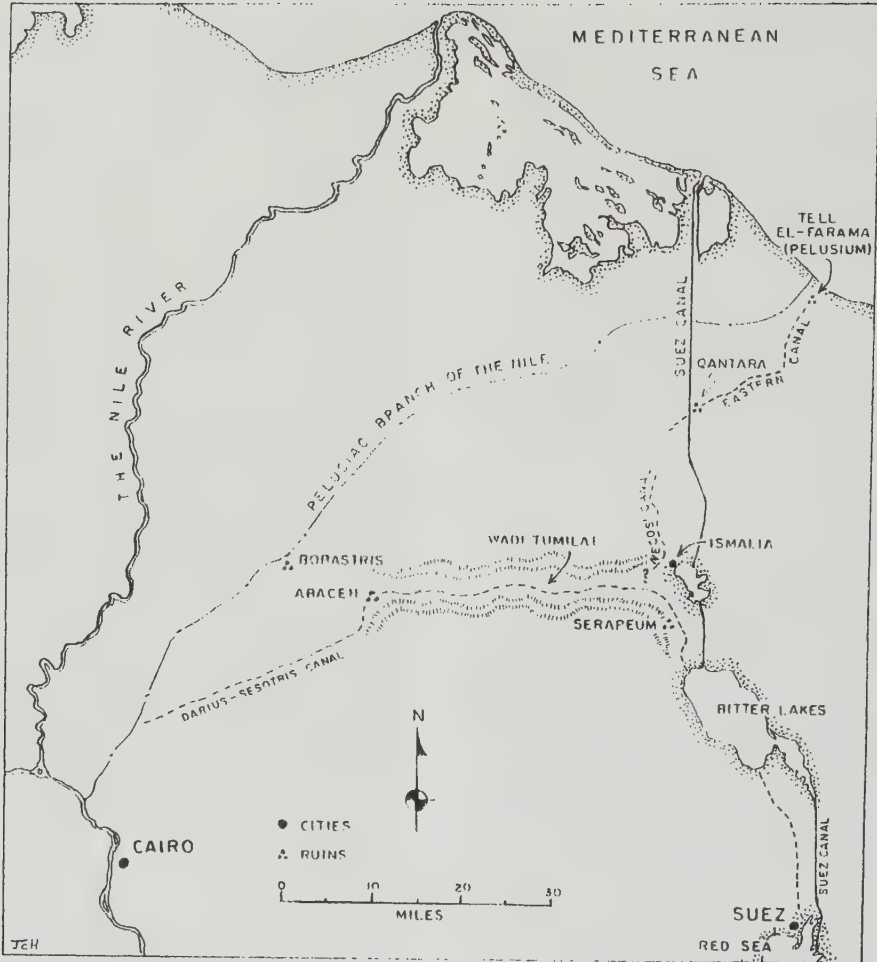
the canals of Sesostris and Darius, which took almost identical routes and which we treat here as a single canal.

Starting from the north end of the Red Sea, the ancient canal consisted of four sections. Starting 1½ miles north of the town of Suez, the first section was about 13 miles long and led to the Bitter Lakes. The French had no trouble following its path for the walls still existed, standing 40-50 yards apart. The canal floor was moist and supported grass and shrubs. Section Two, 27 miles long, led through the Bitter Lakes, which were navigable. Section Three, 30 miles long, utilized the Wadi Tumilat, which connected the Serapeum and Abaceh. This wadi (or "valley") is believed to have been the Land of Goshen mentioned in the Bible. In 1799, the western half of the canal in this section was still clearly visible. The Arabs raised corn on its floor or used it as a reservoir. The fourth and final section of the ancient canal linked Abaceh to Bobastris, 12 miles distant, on the Pelusiac branch of the Nile, which was navigable in ancient times. When the French traversed this last section, it was under cultivation, and some of the irrigation canals then in place were judged to be remains of the old, navigable canal. (R1)

The remains of still another canal were reported by A. Sneh et al in 1975. While making a geological survey of the far northeastern corner of the Nile delta, this party came across two abandoned waterways. One was the Pelusiac branch of the Nile, which had been abandoned by the river. The second was clearly artificial and previously unknown. It was not mentioned in the oldest records examined. The new canal, though largely filled in, was still traceable for long distances. It must have been a formidable undertaking, judging from Sneh et al's report:

The width is an essentially constant 70 meters; the bottom between the banks, discernable in the sandy southern part, is about 20 meters wide. Of course it is hard to tell how broad and deep the water ran when the canal was active, but a depth of 2-3 meters would have served most ancient navigational purposes and would represent no mean technical feat. (R11)

Sneh's field party named their discovery the Eastern Canal. They were able to follow it, with some inferences, from



Long before the Suez Canal was constructed, ancient engineers linked the Red Sea with both the Nile and the Mediterranean by means of several ambitious canals. See text for details.

Qantara, which is located well north of the Bitter Lakes and on the modern Suez Canal, to Tell el-Farama (or Pelusium) on the now-abandoned Pelusiac branch of the Nile. Of course, in ancient times, the Pelusiac branch was navigable and emptied into the Mediterranean. But what about the southern end of the Eastern Canal? It turns out that there are still more earthworks north of Ismalia. These are called Necos' Canal, after Pharaoh Necos (610-594 B.C.). Necos' Canal might

well have extended north to meet the Eastern Canal and also south to Wadi Tumilat, where it might have joined Sections One and Two of the Sesostri/Darius canal. Thus, there could well have been a 3,500-year-old canal connecting the Mediterranean and Red Seas—a predecessor of today's Suez Canal. (R11)

X7. Oceania

New Zealand. Early in the Twentieth Century, C.W. Adams surveyed a series of canals near the mouth of the Wairau River. These canals had been dug by the Maoris to facilitate transportation across the lagoons and mud flats where they caught eels and ducks. The canals were generally 10-12 feet wide and 2-3 feet deep, ample for canoes. The largest of this group is impressive enough to elaborate upon.

The big channel or canal that connected the Upper Lagoon with the Raupo Swamp, probably a lagoon at the time the canal was cut, is a very heavy piece of work...It is over four miles in length, and from ten to twelve feet in width, with an average depth of cut of about eight feet. When it is considered that the whole of the excavation ---sixty thousand cubic yards of soil--- was made with the most primitive of tools, by means of the ancient wooden ko or spade, one begins to notice what an industrious and enterprising people the old-time Maori was. (R9)

The Maori canals closely resemble those along the Gulf Coast of Florida (X1) in size and purpose.

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MSC9 Artificial Harbors

Description. Walled, water-filled enclosures large enough to float ancient vessels. These "inner harbors" provided safety from the elements and convenient docks for loading and unloading ships.

Data Evaluation. All three of our sources are from the science literature, but we have only one reference for each putative harbor. This is unfortunate because controversy exists over the real purpose and extent of some of these structures. Rating: 2.

Anomaly Evaluation. Even if all the structures described below were not employed as harbors, they are all very large, well-executed examples of engineering prowess. However, no special engineering equipment or novel construction techniques seem to have been used, so these structures are cataloged mainly for their curiosity value. Rating: 3.

Possible Explanations None required.

Similar and Related Phenomena. Puma Punku, near Tiahuanaco, Bolivia, is said by some to be an ancient dock (MSB in another volume).

Entries

X0. Introduction. There are many good natural harbors around the planet. Those that are not so good can be artificially improved by dredging channels and installing breakwaters. Even finer and better-protected "inner" harbors are sometimes built within city limits. The ancients also used these engineering stratagems to protect their vessels. We have found three catalogable examples of ancient artificial harbors. There are doubtless more that we have not yet come across.

a pre-existing natural depression into this artificial harbor by dredging and building retaining walls of "ashlar" masonry. The walled basin at Motya is connected to the sea by a channel 5-7 meters wide and about 8 meters deep made from large blocks of limestone. B.S.J. Isserlin terms the basin and its skillfully constructed channel "a splendid piece of marine engineering." (R3)

X1. Europe

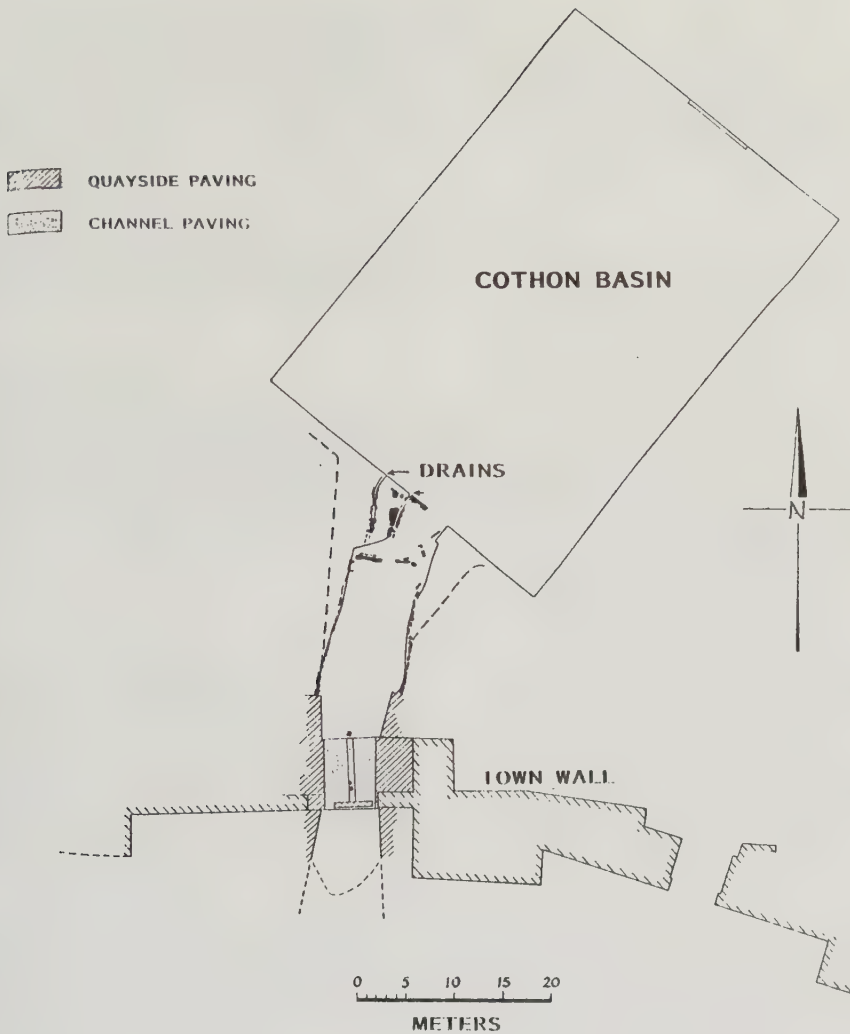
Italy. At the western end of Sicily, just north of Marsala, lies the island of San Pantaleo. Here was the site of the ancient Phoenician city of Motya. The Phoenicians were a great seafaring people that had harbors all around the Mediterranean. On occasion, they constructed inner harbors which they called "cothons." One of these is found at Motya.

Motya's cothon is a rectangular, water-filled basin measuring approximately 37 x 51 meters. Sometime during the Sixth Century B.C., the Phoenicians converted

X2. Asia

Pakistan. Like Mohenjo-Daro, Lothal was a Harappan city in the Indus Valley during the Third Millennium B.C. At Lothal there exists a huge, artificial, rectangular, water-filled basin that is conventionally identified as a harbor or dock. It resembles the Phoenician cothons. (X1) L.S. Leshnik describes this structure thusly:

It is a recessed basin, subrectangular with its long arms running east-west and measuring 710 feet. The southern end is 116 feet long, that at the north, 124 feet. It is revetted on all four sides with a continuous dry masonry



The cothon or inner harbor at Motya, Sicily, provided safety from storms and areas for loading and unloading vessels. (Adapted from R3)

burnt-brick wall, four courses wide, which at its greatest extant depth reaches to fourteen feet. The walls are identical on all sides and there is no access to the basin in the form of steps. Towards the southern end of the eastern embankment there is a broad and relatively shallow gap. This, it has been supposed, was the inlet channel of the dock. Leading off from the southern wall is a narrow, brick water-passage, said to have functioned as a spill channel when fitted with a sluice gate. (R2)

Leshnik disputes the claim that this structure was ever a harbor or dock. Rather, he believes that it is simply another "tank" like those found in India (MSC7-X3) Its real purpose, he asserts, was to store water for drinking and irrigation. Whatever the outcome of this controversy, the Lothal "dock" or "tank" was a major engineering accomplishment for any 4,500-year-old culture.

X3. Africa

Egypt. In a 1919 issue of the Geographical Journal, we found the following review of an archeological study of the ancient harbor at Alexandria---a harbor now submerged beneath of the Mediterranean.

An interesting account, by M. Gaston Jondet, of the remains of building works along the coast of what was once the Island of Pharos, but is now united to the mainland by the strip on which the city of Alexandria has been built, has been published in the Memoires of the Institut Egyptien (t. ix., 1916). The most detailed and complete investigation is devoted to what the author regards as an ancient harbour or dock some 2360 metres long and about 300 metres broad, surrounded by massive quays and breakwaters extending to more than 4 km. in length. Later researches, less complete, led him to extend the harbour works in both a seaward direction and north-eastwards along the coast, till they now cover about $4\frac{1}{2}$ km. in length and about $\frac{3}{4}$ km. in width. Nearly all these old buildings are regarded as the walls and breakwaters of an old port, and all are now submerged to varying depths below sea-level.

The masonry is described as of a singularly massive character, individual stones having dimensions of 2 to 5 and even 7 or 8 metres, and the works are regarded as being of Egyptian origin, probably constructed by the same dynasty as built the great pyramids; the complete absence of any reference to them by classical authors being attributed to their having fallen into ruins and become submerged before the arrival of Alexander the Great. (R1)

The sizes of the building stones are phenomenal. If Jondet's interpretations are correct, Alexandria's ancient harbor ranks with the Giza pyramids as a formidable example of megalithic architecture.

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MSD MENHIRS, DOLMENS, ROCKING STONES

Key to Phenomena

MSDO	Introduction
MSD1	Some Minor Enigmas Concerning Menhirs
MSD2	Menhirs in Unexpected Places
MSD3	Er Grah as a Foresight in an Eclipse Predictor
MSD4	Dolmen-Like Structures Located Outside of Western Europe
MSD5	Rocking Stones

MSDO Introduction

The megalithic era earned its appellation because it was during this period that thousands of standing stones were erected in various configurations all over western Europe. Some stones stood erect and alone; some were arrayed in circles and long lines; still other stones were roofed over to make enclosures called "dolmens." Megalithic structures, however, transcend Europe geographically and, in time, the 5,000-1,000 BC period that is usually allotted to the megalith builders. Megalithic structures are actually found virtually everywhere, and they were still being built in the 20th. Century. Megalithic structures were raised for purposes ranging from grave-marking to tracking lunar motion. Most megaliths are not anomalous.

After dealing with a few minor concerns about how the largest stones were quarried, transported, erected, and recycled, this chapter addresses five important questions:

(1) Do those stone structures called "dolmens" that exist in North America indicate that there were contacts between the Old and New Worlds long before the Vikings and Columbus?

(2) Do the very large European menhirs (standing stones), especially Er Grah, in Brittany, imply a precocious knowledge of the intricacies of lunar motion?

(3) Did the peoples of the Megalithic Age possess the scientific ability, leisure time, and social strength to construct mammoth lunar observatories for the purpose of predicting solar eclipses?

(4) Are all rocking stones natural phenomena, or did ancient peoples emplace them for some unplumbed purpose?

(5) Were some North American rocking stones erected or used by pre-Viking visitors to the New World?

MSD1 Some Minor Enigmas Concerning Menhirs

Description. Minor questions concerning those rude standing stones called "menhirs":

- (1) What were their original purpose(s);
- (2) How were they transported and erected; and
- (3) Why are some of the giant menhirs now prostrate and broken?

Data Evaluation. Most menhirs are easily accessible, and they have been thoroughly studied by professional and amateur archeologists. Consequently, they are featured in hundreds of books and papers. The menhir dossier, however, is incomplete because some standing stones have been toppled---perhaps intentionally---and sometimes broken up for building material. Next, it is impossible to know the exact purpose(s) the megalithic builders had in mind when they erected thousands of menhirs in Europe and elsewhere. For these reasons, there will always be some minor mysteries associated with menhirs. Rating: 2.

Anomaly Evaluation. It is part of human nature to build monuments to commemorate deities, notable individuals, and important events, and to mark territorial boundaries and navigation hazards. That the megalithic peoples did these things cannot be considered anomalous. As noted above, we can really only surmise what the menhir raisers had in mind and must assume that their purposes were as mundane as those we have today when we erect monuments.

As for menhir transportation and erection, these functions could have been carried out very effectively by brute force, given enough men, ropes, and sledges. Despite what is written in sensationalistic books, there is little mystery here.

The broken and dispersed menhirs we see today can be explained in terms of recycling building material.

We conclude that the enigmas addressed in this section are rather trivial and deserve a low anomaly rating. Rating: 3.

These things said, we treat the possible astronomical applications of menhirs as potentially more anomalous and, therefore, worthy of separate treatment. See MSD3.

Possible Explanations. There are several, as alluded to above and detailed in X3.

Similar and Related Phenomena. Menhirs in unexpected places (MSD2); the astronomical significance of menhirs (MSD3); dolmens (MSD4); rocking stones (MSD5); unusual stone spheres (MSO2); arrays of columns (MSO4); alignments of standing stones (MSH2-MSH4); stone circles (MSH7, MSH8).

Entries

X0. Introduction. Menhirs are the simplest of the megaliths. They are merely large, rough, standing stones erected by ancient peoples for purposes we can only speculate about. The name "menhir" is derived from the Breton language: men = stone, hir = large. Most menhirs are crude, undressed, and often stand alone. Sometimes, though, they are paired or arranged in long alignments, which we treat separately because of the astronomical implications. (MSH4) Menhirs are also the basic elements of hundreds of megalithic stone circles, such as Avebury. (MSH3) Here, we confine the discussion to the solitary menhirs that have stood out starkly against the world's horizons for millennia.

A few menhirs are neatly dressed and carved with symbols. They cannot be compared with the famous obelisks of ancient Egypt, but they are still ornate for their age and place. European menhirs are intimately associated geographically and stylistically with dolmens, graves, and other constructions of the megalithic age, circa 5,000-1,000 B.C.

What can be anomalous about large, rather crude stones upended in the earth? The anomalist poses five interesting questions.

(1) Why did megalithic peoples bother to erect menhirs? Many are so large that considerable resources had to be devoted to their transportation and erection. (See X3.)

(2) Why are the two largest menhirs prostrate? (X1) In this connection, some European stone circles are "recumbent"; that is, the stones have either been deliberately toppled, as were some of the huge statues on Easter Island, or they were never erected.

(3) Why are these two large menhirs broken?

(4) When were they toppled and broken, assuming that is what happened?

(5) How were the multi-ton menhirs transported many miles and then set in place?

X1. Four remarkable menhirs.

Er Grah or Le Grand Menhir Brise. Er Grah, the largest of the menhirs, once punctuated the skyline of Brittany about 6 miles east of the town of Carnac, a center of intense megalithic building. Presently, Er Grah lies prostrate and broken ("brise") into four segments. Originally, Er Grah stood about 18.5 meters (over 60 feet) tall, with another 2 meters buried in the soil. Estimated weight: 340 tons. (R5, R9) P. Bahn suggests that Er Grah was probably erected about 3,000 B.C. (R7), but others opt for a 2,000 B.C. date. (R5) The geological source for Er Grah may have been a granite quarry at Finisterre about 50 miles away, but there may have been closer sources when the sea level was much lower in megalithic times. In any case, transporting Er Grah a few tens of miles must have been a daunting task, much more so than the gathering of the smaller bluestones at Stonehenge across the Channel. (R5)

No one really knows when Er Grah toppled, or why, or even if it was ever erected. A sketch made in 1727 shows it in four pieces just as it we see it today. Another record by P. Garcie (Poitiers, 1483 [?]) states that Er Grah was "ruined" at that date. (R9) It may have lain prostrate and broken for millennia.

Why did Er Grah fall over in the first place? After all, it weighs some 340 tons and we suppose it was firmly embedded by those who dragged it for many miles. The theories are several:

(1) A storm blew it over. This is certainly possible if the ground was soft from prolonged rain.

(2) An earthquake toppled it.



Brittany's Er Grah or Le Grand Menhir Brise is now prostrate and broken into four segments. See MSD3-X1 for a sketch showing its original configuration and dimensions.

(3) It was pushed over intentionally by later peoples who considered it a hated symbol of an earlier culture. Such destruction has been seen many times by archeologists, as during the Spanish occupation of Mexico and Central America.

(4) Er Grah was demolished because the stone was needed for other structures and it had served its original purpose, whatever that was.

(5) For some unknown reason, Er Grah was never erected in the first place (R7), perhaps because it was accidentally broken in transit from the quarry.

This leads us to other possible reasons for Er Grah's piecemeal state. (R6, R9) Again, there are five suggestions, some of which overlap those above.

(1) Planes of weakness in Er Grah's granite may have resulted in it breaking up during its transportation and attempted erection.

(2) The menhir was broken up for use in later megalithic monuments. Such recycling of building materials is common; viz., the Great Pyramid's casing stones.

(3) Er Grah was hit by lightning.

(4) The huge stone fractured when it fell over in a storm or quake or was intentionally pushed over.

(5) Er Grah was destroyed for its religious or cultural symbolism.

The most reasonable scenario has Er Grah being toppled and broken up for use in other structures, perhaps even before it was erected. This was evidently the fate of the second largest menhir known, which we now investigate.

Three fragments of an anonymous menhir. The existence of the second largest menhir was unrecognized until some modern archeological detective work. The story goes like this.

During restoration work on a capstone at the tomb of Gavrinis, located on an island just off the Brittany coast, C.-T. Le Roux discovered carvings that had long been concealed. The carvings and the rock itself fit perfectly with the capstone of the Table des Marchands, another famous megalithic monument some 4 kilometers away. Stimulated by this discovery, a third capstone on another monument nearby was found to fit like a jigsaw puzzle piece. The combined result

is a huge menhir 14 meters high, 3.7 meters wide, and 0.8 meter thick. This menhir would have weighed about 100 tons. It is decorated on one side with animals (bovids) and other devices. Apparently, this menhir once stood near the even larger Grand Menhir Brise or Er Grah. Evidently, the period of megalithic tomb building, which probably began about 5,200 BP was preceded by a period when giant, decorated menhirs were erected. Some of these standing stones were apparently pulled down and broken up for use in constructing the tombs. The civilization that raised the menhirs is not well-understood; and one wonders why such impressive monuments were torn down and their engravings concealed. (R7)

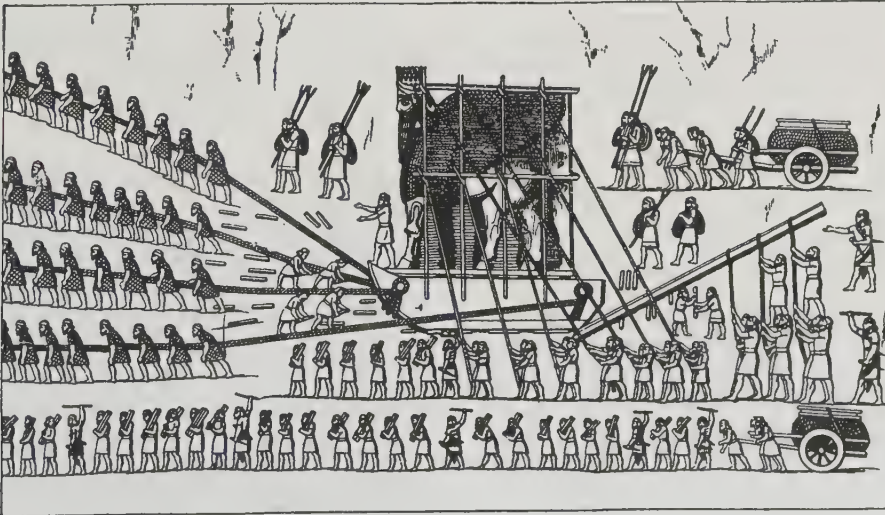
Menhir du Champ Dolent. A large menhir that survived the megalithic recycling phase is located at Dol, near the border of Brittany and Normandy. At 9.5 meters (over 30 feet), it is only half the height of Er Grah. It is beautifully shaped and sharply pointed, suggesting that, like some other large menhirs, it may have had an astronomical purpose. (R5)

The Rudston monolith. Large menhirs are not confined to the European continent.

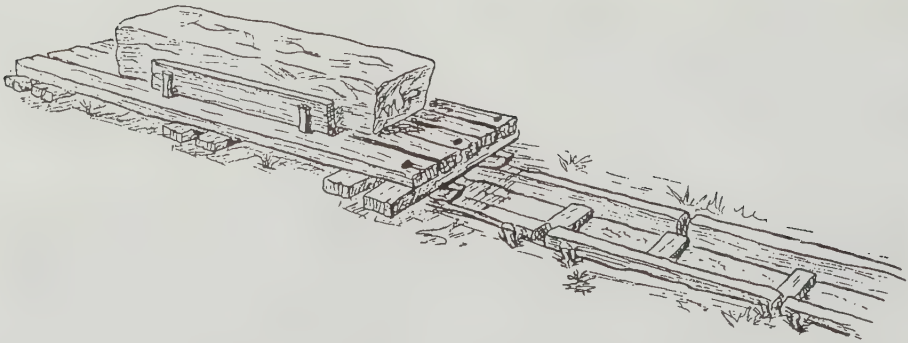
Near Bridlington, in Yorkshire, in the graveyard of a Norman church, stands a 40-ton menhir. With a height of 25½ feet it is the tallest menhir in Britain. Of course, its erection preceded the Norman church by millennia. (R3)

X2. The transportation of very large menhirs. Laymen today look at Er Grah (340 tons), the two colossi of Memnon (1,000 tons each), and even the 217-ton Idolo de Coatlinchan at Teotihuacan, Mexico, and marvel that humans could have moved them without modern cranes and wheeled vehicles. Surely there must be something anomalous here. As a matter of fact, modern equipment could not effectively handle Er Grah; it's too heavy. To illustrate today's inability to transport such heavy objects, when the monuments at Abu Simbel, in Egypt, had to be moved because of the rising of the Nile behind the Aswan Dam, the huge monolithic statues first had to be cut apart, even though they were to be moved only a few hundred yards! (R4)

There is little mystery in how the megalithic builders and ancient Egyptians outperformed modern machinery: they had human power---a lot of it. Old re-



A sculptured limestone panel from the Eighth Century B.C. shows how the Assyrians applied manpower to drag a 30-ton statue. (R2)



T.B. Pawlicki suggests that wooden "skidroads" greased with animal fat could have been applied to the transport of heavy objects. In effect, we have a sledge with runners on a wooden railway of sorts. (R4)

cords and illustrations from Assyria and Egypt almost invariably describe long lines of humans dragging heavy monuments on sledges. (R2) There is no reason to believe that the megalith builders did not move menhirs in the same way.

Actually, sledges would be the choice of many of today's engineers if they were challenged by Er Grah. Human-carried litters would have been totally inadequate. Log rollers, another possibility, would have required a hard surface to be effective, assuming the logs were not first crushed by the weight of their burden. And paved roads were virtually nonexistent in ancient times, although the ancient Egyptians did build at least one stone-surfaced road. (See MSR1-X6) For all these reasons, the ancient monument-movers also liked sledges, as seen in the accompanying Assyrian depiction from the Eighth Century B.C. The progress of the sledge draggers may have been accelerated by wooden planks, perhaps lubricated with animal fat.

Once at the designated site, large menhirs were rather easily raised into position by ropes, A-frames, levers, and similar engineering devices. (R4)

The gist of this discussion is that human power plus a little ingenuity and lots of time could have readily moved large menhirs many miles. Sensational writers on archeology are much too eager to postulate antigravity devices, alien intervention and the like.

X3. Probable purposes of menhirs. All down history, humans have been raising menhirs, obelisks, and shaft-like monuments for a variety of purposes.

- (1) Commemoration of events and famous people. (Washington Monument)
- (2) Expression of pride and cultural accomplishments. (Eiffel Tower)
- (3) Historical recordings (Maya stelae)
- (4) Markers of holy places
- (5) Navigation markers (lighthouses)
- (6) Grave markers
- (7) Astronomical instruments.

The smaller menhirs could well have served purposes (1) through (6). If there is anything mysterious here, it is that we don't really know which of these listed purposes were important to the megalith builders---important enough to drag huge stones for many miles.

Purpose (7), however, seems to require larger menhirs that can be discerned clearly from distances of 10 miles or more. If Er Grah or standing stones of any size were actually used for scientific purposes 5,000 years ago, this might imply levels of intelligence and sophistication that conflict with our assessments of civilizations that old. For this reason, correct or not, we treat the possible archeoastronomical applications of menhirs separately. (MSD3)

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MSD2

Menhirs in Unexpected Places

Description. Prominent standing stones, often solitary, found in locations thousands of miles from recognized centers of megalithic culture in Europe, the Middle East, and North Africa. The most important of these apparently out-of-place menhirs have been reported from northeastern North America.

Data Evaluation. The putative North American menhirs are generally disdained by professional archeologists who consider them to be the works of colonial farmers or outright frauds. By necessity, therefore, the information presented below comes from such publications as the NEARA Journal (NEARA = New England Antiquities Research Association), Kadath (a Belgian journal), and from books by authors working outside the normal professional circle of archeologists. Ordinarily, one would tend to discount such data, but these amateur archeologists have assiduously combed the hills of northern North America and found and photographed many suspicious structures. These unexpected standing stones and associated chambers and dolmen-like structures are highly suggestive of the European megalithic culture. Of course, such leaps of judgment are subjective. Unfortunately, reliable radio-carbon dating of these supposed menhirs, dolmens, etc. is difficult to find. In other words, it is apparently impossible to prove to mainstream archeology that North American standing stones are old enough to be the result of early trans-Atlantic diffusion of European megalithic culture. Nevertheless, many unusual standing stones do exist in northeastern North America, and they need more careful study and thoughtful explanation rather than cursory dismissal by mainstream archeology. Rating: 2.

Anomaly Evaluation. Out-of-place menhirs become anomalous only if it can be convincingly shown that they are not:

- (1) The works of colonial settlers and recent landowners;
- (2) The independent constructions of indigenous peoples; i.e., Native Americans, Africans, Pacific Islanders, etc.;
- (3) Natural geological phenomena;
- (4) The consequence of the diffusion of culture from nearby populations where precocious sea voyages are not required; or
- (5) Fraudulent.

The only standing stones described below that might meet these carefully worded conditions are those found in northeastern North America. If these stones do in fact meet these conditions and a firm connection made to European megalithic culture, we have a first-class anomaly, because a reigning paradigm of archeology insists that the Vikings were the first to make landfall on the Atlantic coast of North America. Rating: 1.

Possible Explanations. Seemingly anomalous standing stones represent the efforts of indigenous peoples, recent settlers, or natural geological forces.

Similar and Related Phenomena. Out-of-place dolmens (MSD4); rocking stones (MSD5); stone alignments (MSH1-4); stone circles (MSH7, MSH8); stone chambers (MSB in another volume).

Entries

X0. Introduction. In his very short chapter on North American "rude-stone monuments," J. Fergusson states boldly:

With this work before us, we feel justified in making the assertion that there are no rude-stone monuments on the continent of North America. (R1)

The "work" Fergusson had before him was Ancient Monuments of the Mississippi Valley, by E.G. Squier and E.H. Davis, published in 1848. Since Fergusson wrote in 1872, he had little else to rely upon regarding North American archeology. In fact, he was aware of little beyond the standing stones of Europe, Northern Africa, and the Middle East. It is now recognized that standing stones, dolmens, and other megalithic structures extend well beyond the purview of Fergusson's classic review. The salient question concerning these far-flung stones is: Are they outliers of Europe's megalithic age, or merely expressions of the natural human urge to raise lithic monuments, or perhaps only

natural geologic phenomena? The most profound anomaly would occur if menhir-like stones could be found in the New World and unequivocally linked to the Old World's megalithic culture. Such would imply trans-Atlantic crossings thousands of years before the Vikings. This discovery would shake American archeology to its foundations.

X1. Menhirs in Africa. Megalithic constructions abound in North Africa and the Mediterranean islands. (R3, MSD4) However, megaliths are very scarce in Subsaharan Africa.

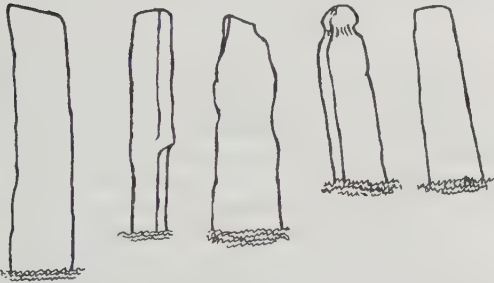
Senegal. In MSH16, we mention some interesting stone circles in the Gambian Valley, Senegal, but there we see no soaring, solitary menhirs like those of Europe, rather there are only groupings of smallish, rounded stones.

Central African Republic. P. Ferryn has mentioned a megalithic assemblage

in Bouar, Central African Republic. (R9) These small standing stones can legitimately be called menhirs. Their purpose and age are unknown. They certainly bear little resemblance to the giant standing stones that we see in such abundance in Brittany and Britain. However, these stones could have had astronomical applications like those at a similar site recently reported in southern Egypt. (MSH16-X5)

Madagascar. From a 1917 paper in the Journal of the Royal Anthropological Institute, we quote A.L. Lewis:

There are, in that part of Madagascar known as the plateau of Emyrne, or Imerina, numerous menhirs, which, however, are of no great antiquity; according to tradition the first of them to be set up were for the commemoration of successes in war; afterwards the practice was extended to signaling the foundation of new villages by the king, then the nobility began to erect stones as thank-offerings to the king for favours conferred by him upon them, and finally the people at large devoted them to the cult of the dead by placing a standing stone at the head of their tombs. (R2)



Madagascar menhirs. The heights from left-to-right are 5.80, 4.75, 4.65, 3.05, and 3.05 meters. These are of relatively recent origin. (R2)

Lewis dates these menhirs as no earlier than the 16th. Century. Obviously, then, there was no diffusion of Europe's megalithic culture to Madagascar,

but a dedicated diffusionist might see a connection to India, where similar standing stones have been raised in recent times. (MSD1-X0)

In any case, we do learn from the Madagascar menhirs several reasons why recent humans might have an urge to erect menhirs.



Recent, nonanomalous menhirs in the Khasi Hills, India. (From MSD4-R2)

X2. Standing stones in Oceania. Many megalithic structures, such as stone alignments, gateways, and low pyramids ('marae'), are sprinkled throughout the Pacific all the way from Australia to Micronesia. (MSH16, MSO12) Large, solitary menhirs are rare, though.

New Guinea. At Male Kula, in midst of the tropical jungle, is a monolith about 12 feet high, as judged from a photograph printed in R10. Origin, age, and purpose are mysteries.

X3. North American menhirs. North America is so distant from Europe that any rock or group of rocks that bears any resemblance to European megalithic structures fires the enthusiasm of a diffusionist; i.e., one who holds that the ancient oceans were crossed repeatedly. But in the eyes of most archeologists and anthropologists, any artifacts implying pre-Viking forays to the New World must be misinterpretations or outright frauds. For the anomalist, hope-

fully more objective than those at either end of the belief spectrum, there is much archeological grist for his or her mill in North America. On this continent, particularly in New England, one finds many putative standing stones, calendar sites, dolmens, and stone chambers. In this section, we commence with the simplest of these possible manifestations of the megalithic culture: the menhirs.

Canada. We begin with a standing stone that is less anomalous than those that imply pre-Viking contacts. The place is the Payne River, Quebec, a stream that flows into Ungava Bay. This area is just west of Newfoundland, where mainstream archeology fully accepts the existence of an old Viking settlement at L'Anse aux Meadows.

T.L. Lee describes the subject stone in his publication, the Anthropological Journal of Canada.

Our survey took us first up the Payne River. Numerous tent ring sites were recorded, and one probable Thule site (Igloo Point), where three large house pits occur. Of special interest---near the mouth of Tom's River is a peculiar stone column, (Thor's Site), some 8 feet high, surmounted by a cross member and a cap-block, making the monument 10 feet high and giving it a startling appearance of the "Hammer of Thor", an ancient and popular Norse god. The weight of the vertical monolith alone runs to about 2,700 pounds. (R4)

This monolith, which easily qualifies as a menhir, is starkly out-of-place. Is it a Viking monument or marker of some kind? Who can be sure? It is close to Newfoundland and also Ungava Strait, which leads into Hudson Bay. One can carry this thinking further and speculate that the Vikings actually sailed into Hudson Bay and explored the lands adjacent. Such unrecognized voyages could explain the controversial Viking artifacts and mooring stones found not too far from the southern shores of Hudson Bay. (MSO1)

New England and New York. Many enigmatic lithic structures litter New England and bordering states and provinces. Professional archeologists adamantly re-



The "Hammer of Thor" near Ungava Bay, Quebec, is almost 10 feet high. The erectors of this strange structure are unknown. (R4)

fuse to accord them any legitimacy. To them, anything that looks like a menhir, stone circle, or dolmen must be either a product of colonial farmers or nature herself.

It is very strange, however, that only in this restricted part of the continent do we find a profusion of rock structures bearing a megalithic cast. Why didn't farmers from New Jersey to Georgia also pile up stones in suggestive ways?

We have space for only a handful of these suspicious menhir-like stones. (See MSD4 and MSB in another for even more-suspicious "dolmens" and "chambers" in this region.)

Poughkeepsie, New York. We quote E.J. Lenik.

At the present time, the standing

stone measures exactly 5 feet 8 inches in height and is composed of limestone. According to Mr. Hilderbrand, the stone was originally about 9 feet in height. However, 3 feet of earth fill was put around its base some eleven years ago in order to level this section of his property...It appears that an additional 6 or more feet of the stone are below ground. (R6)

The Berkshires, western Massachusetts. Amid six standing stones and 14 fallen stones lies a prostrate menhir 17½ feet long. (R5)

In a later report in a 1997 issue of the NEARA Journal (R12), G. Colgate reviewed the research that has been conducted at the Berkshire site in recent years.

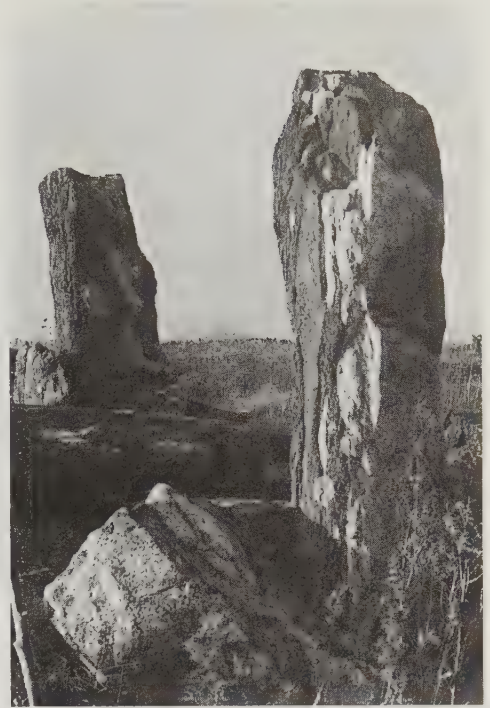
"Burnt Hill," as the site is now called, is perched atop a hill with a panoramic view of the countryside. The standing stones are, or "were," socketed into the bedrock and wedged with small stones. Some have cairns piled around their bases. Separate small cairns are also in the area. One astronomical alignment has been identified and, given the large number of actual and potential standing stones, many other alignments are possible. Burnt Hill might have been a prehistoric calendar site, but this would be difficult to prove.

Historical records mention several "cultural landscapes" that have characterized the Burnt Hill area beginning with Native Americans and ending with a modern blueberry farm. There has obviously been considerable human activity at Burnt Hill down the years, including some modern erection and re-erection of the standing stones. All in all, it is difficult to determine the real archeological significance of Burnt Hill and whether or not any anomalies exist.

South Royalton, Vermont. An element of so-called Calendar Site II is a slim, erect stone about 7 feet high. (R9)

A New Hampshire hilltop. In his book Bronze Age America, B. Fell includes a striking photograph of a group of "phallic menhirs." (R7)

North Carolina. In the Boone/Blowing Rock region of western North Carolina, near Grandfather Mountain (5964 feet high), a group of three very large standing stones points skyward. The



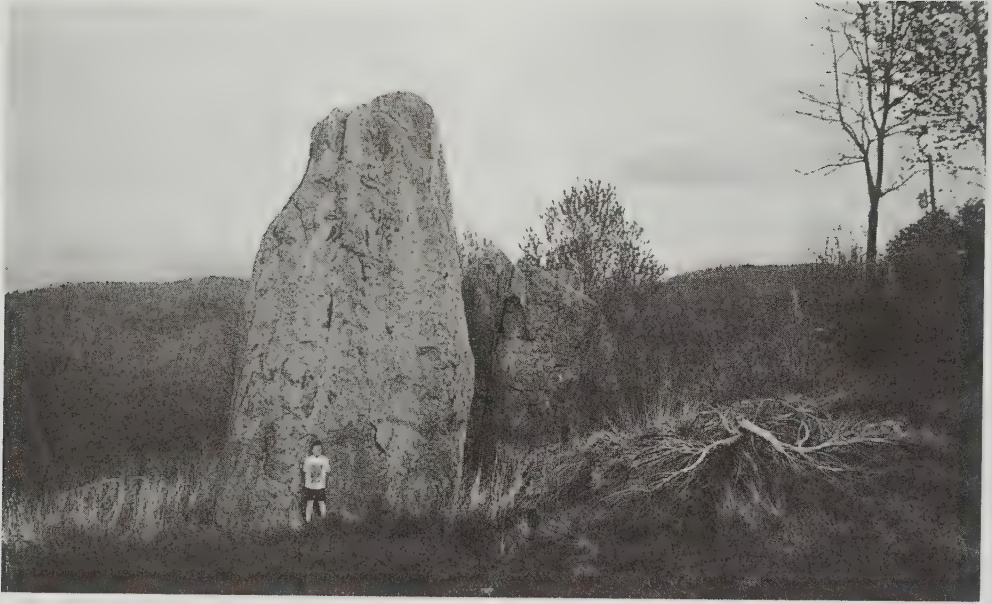
Two of the standing stones at the Burnt Hill site in western Massachusetts. For a general view of this site, see the photograph in MSH16-X5. (R. Calliham)

tallest, as judged from a photograph, is about 15 feet high. (R11)

If seen in Britain or Brittany, an archeologist would immediately think "megalithic." These stones stand in splendid isolation; there seem to be no similar rocks in the neighborhood. But this site is hundreds of miles southwest of New England's ubiquitous standing stones. Did a freakish natural event raise these stones?

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These North Carolina "standing stones" could well have a natural origin, but there are no similar stones in the area. (C. Davant, III)

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MSD3 Er Grah as a Foresight in an Eclipse Predictor

Description. The existence a giant menhir, specifically Er Grah in Brittany, which is much larger than necessary for use as a backsight in astronomical applications. One implication is that it was used as a foresight instead.

Data Evaluation. Er Grah, a 60-foot menhir, is well-described in the literature (MSD1), as are the associated megalithic structures that might have been used as backsights in conjunction with it. A. Thom's theory and his supporting measurements have been published in the professional journals. Rating: 1.

Anomaly Evaluation. The potential anomaly centers on Er Grah and A. Thom's interpretation of this menhir and the megalithic structures surrounding it. Er Grah seems anomalous because it is so much taller than other menhirs employed as backsights. A. Thom's theory is that Er Grah was really a foresight surrounded by as many as eight backsight menhirs located as far as $9\frac{1}{2}$ miles away. The ostensible purpose of this far-flung observatory may have been the acquisition of the more accurate lunar standstill data needed for the prediction of solar eclipses. In the context of Thom's theory Er Grah is anomalous, because it implies that the megalith builders of several thousand years ago could:

(1) Recognize that solar eclipses could be predicted from better lunar standstill data; and

(2) Conceive, plan, organize, and carry out the construction of a giant lunar observatory.

The megalithic people, therefore, seem to have been intelligent, visionary, and capable of mounting vast projects for scientific purposes. If Thom's ideas are correct, megalithic society was more advanced than generally thought. Rating: 2.

Possible Explanations. Er Grah was intended to be just the largest menhir in a row of standing stones, which had more modest astronomical purposes (MSH4). Er Grah was outsized merely to impress people---like the Great Pyramid or Empire State Building!

Similar and Related Phenomena. The theory that Stonehenge was an eclipse predictor (MSH17); the archaeoastronomical applications of stone rows (MSH4); the ancient Greek analog computer (MMT in another volume).

Entries

X0. Background. In both the Old and New Worlds, ancient peoples carefully watched the movements of the sun, moon, and stars and tried to discover some order in their motions across the sky. Solar eclipses in particular were of great concern and were probably woven into their cosmologies and religions, if indeed the two outlooks on life are ever really separate. Given this great interest in the sky, ancient peoples employed both natural and artificial objects to mark and record the motions of heavenly

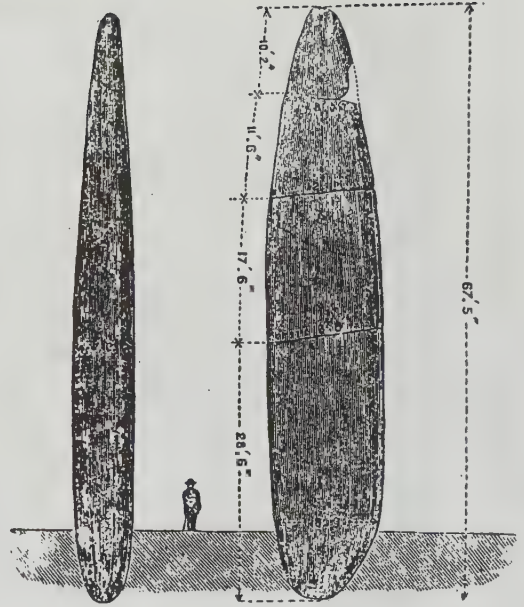
bodies. Thus was born archaeoastronomy.

Menhirs enter into archaeoastronomy because they are sharply defined vertical markers which, when combined with horizon features---hill tops, horizon notches, etc.---can serve as permanent recorders of extreme positions ("standstills") of celestial objects, usually the moon. The menhirs (backsights) were placed so that they lined up visually with certain horizon features (foresights) when the moon reached these standstills. Over hundreds of years,

such crude observations led to the recognition of the $18\frac{1}{2}$ -year lunar cycle. It is believed by some modern archeoastronomers that the megalith builders also discerned the connection between lunar motion and solar eclipses. Such deductions from sightings along rough stones and distant horizon markers implies not only great patience but also high intelligence. (For technical details, consult R1 and R6.)

This Catalog section is not intended to be a primer on the basics of archeoastronomy. Rather, we will examine the theory of A. Thom that that huge menhir, Er Grah, in Brittany, was actually the central element in a giant complex of menhirs aimed at obtaining the precise lunar observations required to forecast solar eclipses.

It is easy to comprehend how the small menhirs, just a few feet high, can serve as backsights roughly marking the positions of lunar standstills. But it is also apparent that these data are probably not sufficient to predict solar eclipses. What is needed is an appreciation of the 173-day cycle in the moon's motion that is imposed by the sun's gravitational field as the earth-moon system circles the sun. This 173-day cycle can be detected by noting lunar standstills that are just a bit "more extreme" than the average standstill. It seems unlikely that these slight nuances in lunar motion could have been discerned using crude menhir backsights and horizon foresights. (R6) The astronomers of the megalithic era would have had to build bigger and better sorts of instruments. Here is where Er Grah comes into the picture. Er Grah is over 60 feet high, much higher than required for backsighting. A. Thom sees a larger purpose in this huge menhir.



An 1872 sketch of Er Grah illustrating how it would have appeared intact and erect. Dimensions in feet and inches. (R7)

Er Grah replaced rather rough natural foresights (hills, etc.) with a sharply defined artificial foresight. With Er Grah in place, more accurate sightings of lunar standstills might have been possible. With greater accuracy, the slight nuances of the 173-day solar cycle might have been detected, leading to the prediction of solar eclipses thousands of years ago. This would indeed have been a remarkable accomplishment for megalithic humans.

If Er Grah was in fact a foresight, where were the backsights? Thom holds that the megalith builders positioned Er Grah so that it could be viewed from as many as eight different backsights, making Er Grah a sort of universal foresight. In this context, Thom wrote:

In Britain we find that the tallest stones are usually lunar backsights, but there seems to be no need to use a stone of this size [Er Grah] as a backsight. If, on the other hand, it was a foresight, the reason for its position and height becomes clear, especially if it was intended as a uni-

X1. Er Grah as a lunar foresight. A. Thom is renowned for his meticulous measurements of megalithic sites in both Britain and Brittany. (R1) He is also gently criticized for claiming that the megalith builders discovered so much about the motion of the moon that they could predict solar eclipses.

Thom began with the observation that Er Grah is much larger than needed to serve as a backsight. He wondered if it might be a foresight instead; that is,

versal foresight to be used from several directions. There are eight main values to consider, corresponding to the rising and setting of the moon at the standstills when the declination was $\pm(e \pm i)$. (R2)

[e = the obliquity of the ecliptic; i = the inclination of the moon's orbit. See the accompanying map for the eight possible sight lines.]

A preliminary examination has been made of all eight lines. It has now been shown that there is at least one site on each of the eight lines which has the necessary room for side movement.

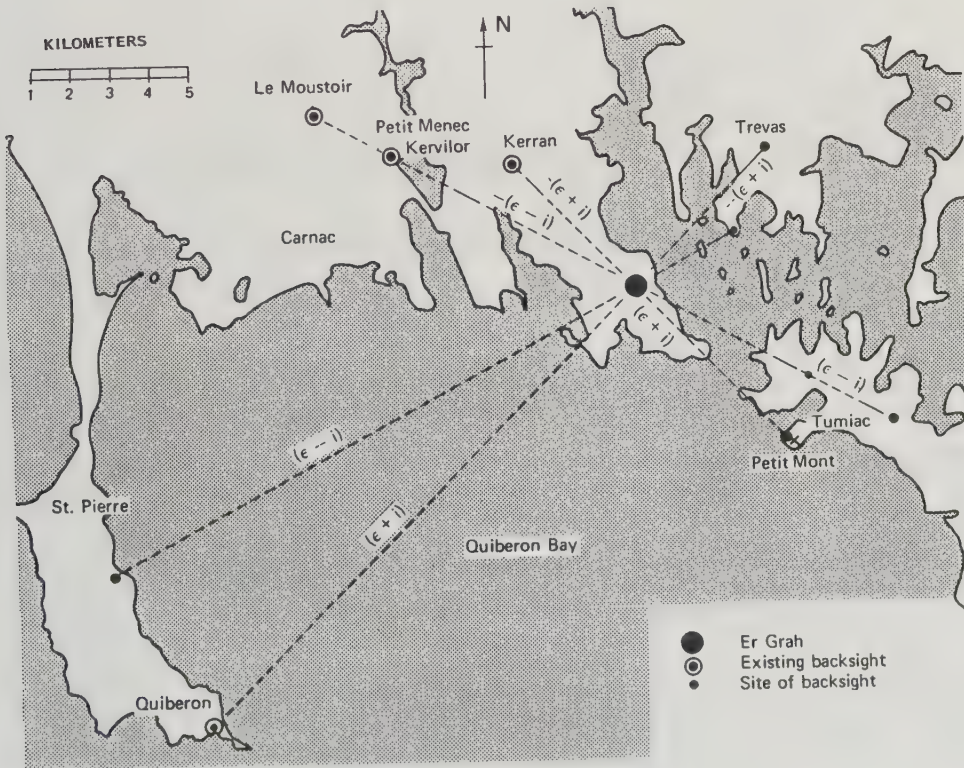
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No one who has seen Er Grah can fail to be impressed, or to ask the reason for its being there. Many explanations have been advanced but

they all fail to account for the sheer size of the stone or indeed for its position. The explanation we have given covers both size and position. (R2)

Many scientists believe that Thom went too far in implying that the megalith builders had the vision to conceive, plan, and build such a huge astronomical "instrument" with sight lines up to 9½ miles long. And for what purpose? How could they have made the connection between lunar standstill nuances and the prediction of solar eclipses? Such insight and analytical abilities challenge our assessment of ancient humans.

Further, in transporting and pinpointing the proper position of Er Grah and searching out and equipping the eight backsights, we see a grand scientific project with little application to solving the needs of everyday life--- something like building the Great Pyra-



Lines of sight in which Er Grah is employed as a universal lunar foresight, as proposed by the Thoms. (R2)

mid or Project Apollo!

No wonder Thom's vision is considered too far out. Yet, there lies Er Grah, now broken in four pieces, but originally too large for any other reasonable megalithic application.

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MSD4

Dolmen-Like Structures Located

Outside of Western Europe

Description. The existence of stone structures resembling dolmens far from the center of megalithic culture. Of particular importance to anomalists are those dolmen-like constructions seen in northeastern North America.

Data Evaluation. That dolmen-like structures are found virtually worldwide is not an issue here. The crucial question is: Are those structures found in locations far from western Europe, the center of megalithic culture circa 5,000-1,000 BC, the consequence of long-distance diffusion of that culture? We are concerned about North America especially because of the claims that dolmen-like structures there were built by pre-Viking explorers.

The North American "dolmens" have been thoroughly investigated by amateurs, but they are dismissed by professional archeologists as being merely "perched rocks"; that is, glacial erratics that happened to be deposited on small supporting stones as the ice sheets melted. Because of this professional disdain for North American dolmens, there is little discussion of them in the mainstream science journals. Our sources for the dolmens most likely to be anomalous are necessarily amateur publications, such as the NEARA Journal. (NEARA = New England Antiquities Research Association.) Such journals are often ignored by mainstream science.

Two additional problems plague research into the North American dolmens: (1) very rarely, if ever, are artifacts definitely associated with these stone struc-

tures; and (2) suitable organic material for radiocarbon dating is generally not available.

In sum, no matter how much North American dolmens "look" like those in western Europe, it is very difficult to prove that humans built them and, if so, who and when. Rating: 3.

Anomaly Evaluation. Since dolmens are simple in design and easy to construct, it is not surprising to find them being built by many cultures down the millennia. As we shall show below, dolmens had, and still have, many nonanomalous purposes. Dolmens become anomalous only when their existence can prove that ancient humans made long voyages considered impossible by prevailing paradigms. The purported North American dolmens, for example, could imply Old World contacts with the New World thousands of years before the Vikings. This would be highly anomalous. Rating: 1.

Possible Explanations. All North American "dolmens" are actually glacially deposited erratics. Or, a few of these North American rock structures were actually built by expeditions to the New World during the megalithic era.

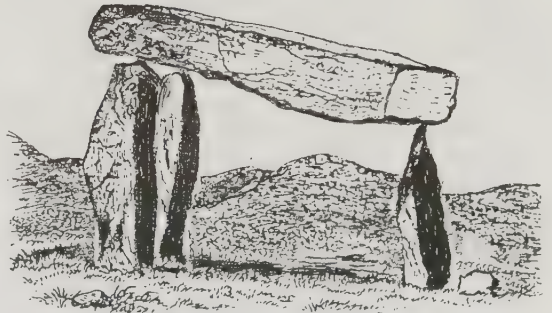
Similar and Related Phenomena. North American menhirs and rocking stones (MSD2 and MSD5, respectively); Old World inscriptions, coins, pottery, and other artifacts found in the New World (MMF, MMM, MGC, etc., in future catalog volumes). Glacial erratics (ESD8 in Neglected Geological Anomalies).

Entries

X0. Background. According to J. Fergusson, the word "dolmen" is derived from the Celtic: daul = table + men = stone. (R1) And all over western Europe, including Britain and Ireland, artificial stone tables are seen by the hundreds. Multi-ton slabs of stone rest upon three or more stone supports, creating these massive stone tables called "dolmens." Some dolmens are more elaborate in that the stone supports form walls, making the dolmen a sort of chamber. Most dolmens in western Europe, however, are open to the elements. Megalithic art decorates some of them.

Originally, many dolmens were completely buried and formed the cores of tumuli. In fact, to build dolmens, the megalithic engineers undoubtedly first buried the supporting stones and dragged the heavy capstones up earthen ramps and over the supports. Today, however, most dolmens have been completely cleared of soil, either by nature or intentionally.

Archeologists hold that dolmens were intended as burial sites, an application consistent with them forming the cores of tumuli. Although human remains have been excavated from some dolmens, others are barren of bones and artifacts. Burials, then, may not have been the only purpose of dolmen construction.



Dolmen at Castle Wellan, Ireland. (R1)

Most were certainly not suitable as shelters from the weather. When in doubt about purpose, one can always postulate a ritual purpose---perhaps some dolmens were shrines of some sort.

In any case, between 1,000 and 5,000 B.C., the inhabitants of western Europe hauled untold tons of large stones many miles for the construction of hundreds of dolmens, not to mention menhirs, and the stone circles and alignments that are often found near the dolmens. Archeologists and anthropologists still puzzle over the imperatives that drove the

megalith builders to such great labors.

Not all dolmens are capped with flat-tish stones. Capstones are sometimes massive, massive boulders. Such dolmens are often called "cromlechs" (Celtic for "arched stones"). It is pertinent to mention this because the most anomalous of the dolmens---those found in North America---are almost always of the cromlech type; that is, the capstones are rounded rather than slab-like.

Yes, there are dolmen-like structures in North America, particularly in the northeast, just where the most menhirs jut skyward. (MSD2) In X2, we will inquire whether the North American "dolmens" are really the work of humans. If they are, they imply either pre-Viking contacts with European megalithic peoples or, perhaps, an independent infection by the megalithic virus! (R17, R18, R21)

The distribution of true dolmens; that is, human-built dolmens---not tall stones playfully erected by nature---does extend well beyond western Europe, especially but to the south and east. Bona fide dolmens decorate the landscapes in parts of North Africa, some Mediterranean islands, the Levant, and the Caucasus. There are also dolmens in Asia and on some Pacific Islands. Many of these "outliers" are much younger than those in western Europe. Like menhir erection, dolmen construction may have been a natural human urge and the result of frequent independent invention.

In X1, we will examine some of these more distant outliers to see how they compare with those of western Europe and those claimed to exist in North America. (X2) First, though, a few interesting examples of dolmens well to the east of the center of classical megalithic activity but still well within range of possible influence via cultural diffusion.

Jordan. Jordan is home to hundreds of dolmens with the typical flat caprocks seen in western Europe, but they are on the small side.

At Damiya, the largest of the fields, there are about two hundred dolmens. They vary little in size: typical side slabs measure 2.5 to 2.7 m. long by 1 m. high; end slabs are usually 0.9 m. wide by 1 m. high; roof slabs

are about 2.8 m. by 3.4 m. Most of the Damiya dolmens were erected on low circular terraces, on which they were placed off center. Small doors were cut into the end slabs of many dolmens; similar doors were carved around the entrances of caves in the northern part of the field. (R10)

Jordan's dolmens are probably grave sites, but no artifacts are clearly associated with them.

Northern Caucasus. Over 1,500 dolmens have been counted in the Caucasus, Many Bronze Age tools, daggers, etc. have been found in these rather sophisticated megalithic structures.

The dolmens are stone cists built of heavy well-squared stone slabs, fitted together with admirable precision. The side walls and capstone project beyond the front, and in the front slab there is generally a hole, like a window, which is fitted with a stone disc, or mushroom-shaped plug. (R5)

No dimensions were given in R5, but these particular dolmens appear to have been shelters or homes for nomadic herders.

India. The many diverse megalithic structures found in India's Khasi Hills (Assam) include dolmen-like stone arrangements. These stones are simply rather recent monuments to the dead, and they were still being raised the Nineteenth Century. (R2)

We mention above the dolmens from Jordan, Russia, and India to demonstrate: (1) that a wide variety of dolmens have been constructed for many purposes; and (2) that they are not all ancient.

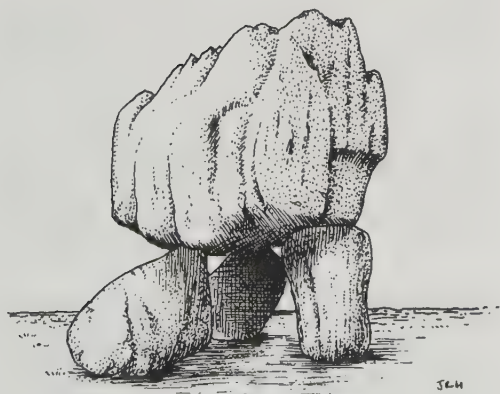
X1. Dolmens in Asia and Oceania. Clearly, the dolmens introduced above cannot be considered anomalous. There are many reasons why humans, both ancient and contemporary, might construct dolmens.

Our purpose in recording dolmens found in the Orient and Oceania is to extend the range of the dolmen-building

urge far beyond what is generally considered to be the classical compass of megalithic activity. No anomaly can be claimed for the existence of Asiatic dolmens, since the concept could have been communicated by land travellers over the millennia. Also, dolmens are such simple structures that independent invention is always a good possibility.

China. From China, we have a report of a very crude "dolmen" that is worth mentioning because it resembles some of the North American rock structures that some claim to be dolmens.

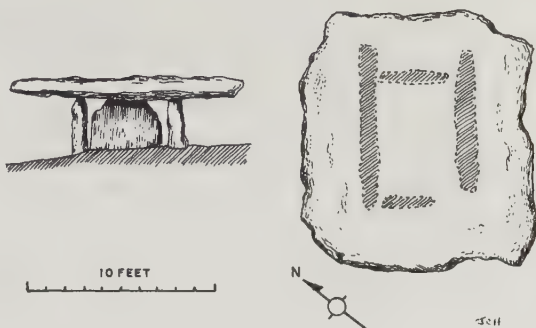
It is situated at Hwang T'ien P'u in the Lingling district, and the approximate coordinates are Lat. $26^{\circ} 15' N.$, Long. $111^{\circ} 40' E.$ In his original letter of 1940, Mr. Harrison quite properly pointed out that the structure might be of natural origin. It consists of a huge block (or capstone), resting on three smaller uprights between 3 feet 3 inches and 3 feet 6 inches high. The capstone is a little over 5 feet thick and about 7 feet square...Locally it is regarded as the work of fairies and of immemorial antiquity. It is not associated with any religious rites or regarded with any reverence. (R8)



This Chinese "dolmen" resembles some of those in North America. It could be a natural phenomenon. (R8)

Korea. More-finely-crafted dolmens exist in Korea. Some of them closely resemble those built in western Europe millennia ago. (R14) In fact, Korea seems to have gone through its own megalithic era. Numerous menhirs and cairns are associated with the dolmens.

Korean dolmens may be divided into two main groups according to geographical location. The "Northern type" has a smoother cover and seems to have been more systematically constructed. The "Southern type" is more often chamber-like. Those with four supporting stones become rectangular chambers, and are of a more refined type. (R7)

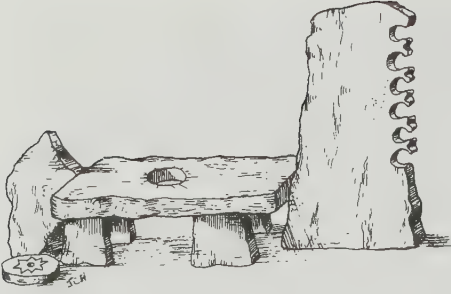


A Korean dolmen. (R7)

Indonesia. Large numbers of recently built menhirs, dolmens, and cromlechs dot the Indonesian islands. In their recency and style, they are a bit like those in India. (R3, R6) See the accompanying sketch.

Oceania. The dolmen-building urge either arose independently or was carried out into the Pacific by the early pioneers to Melanesia but apparently not as far as Polynesia. We hardly to expect to find dolmens amid the palm trees on remote Pacific islands---but there they are!

In spite of very imperfect information, it is clear that dolmens exist throughout Melanesia. One at Unea, French



Dolmen at Waijelo, Sumba, Indonesia.
(R6)

Islands, north of New Britain is figured by Parkinson (*Dreissig Jahre in der Suedsee*, Plate 14). The horizontal slab appears to be about three feet above the ground, and is about five feet long and eight inches thick. In San Cristoval, Fox records that dolmens are numerous...He describes them as tombs, and notes that dogs and bonito are sacrificed on them... Dolmens occur throughout the New Hebrides, and they are reported by J. Macmillan Brown as existing in New Caledonia. (R4)

X2. Purported dolmens in North America. Although separated from bona fide dolmens by the Atlantic and Pacific oceans, the North American continent is not without similar rock structures. These are almost all of the "cromlech" type; that is, the capstones are roundish and huge, and look like run-of-the-mill glacial erratics. Furthermore, these capstones usually reside upon very small supporting stones. The North American so-called dolmens scarcely resemble those of western Europe. They lack the flattish capstones and high supports. In fact, they "look" as natural as much as the European dolmens "look" to be the products of human hands.

A. Rothovius examined the problem of North American dolmens in a 1979 number of the *NEARA Journal*. Mainstream archeologists, he admitted, regard the North American dolmens as merely "perched rocks" or "boulder placements." In other words, the boulder-like capstones were transported from

afar by ice sheets and gently lowered onto smaller stones as the Ice Ages waned. This natural method of dolmen construction is appealing. In addition, North American dolmen distribution is generally consistent with the ice-sheet location. Further, artifacts are rarely, if ever, associated with the purported dolmens.

Can we, therefore, dismiss all North American dolmens as natural? Rothovius thinks not. He asserts that there are just too many of them. (R17) But this is a subjective evaluation. Although we have amassed records of a score or more dolmen-like rock structures in northeastern North America, we have no way of knowing how many there "should" be!

Some of the North American dolmens could be the work of aborigines. It is no great task to lever boulders up and insert smallish supporting stones under them, but there is no indication that this was done. Even if the American Indians did manufacture a few dolmens or shore up some glacial erratics, it would hardly be anomalous. For, as we have seen in the foregoing paragraphs, dolmen-building is widespread and apparently a habit readily acquired.

This said, a few North American dolmens do roughly resemble genuine European megaliths, particularly the cromlechs. If it could be shown that pre-Viking voyagers built just one of these dolmens, we would have a first-class anomaly. But outward appearances and similarities will never do this. Artifacts and/or some datable signs of human association with the dolmens are required, and these are still missing.

Nevertheless, it is worthwhile cataloging some of the more unusual North American "dolmens," not only because some might be legitimate but also to demonstrate some idiosyncracies of the Ice Ages.

North Salem, New York. Here is located one of the more renowned of North America's so-called "dolmens." Balanced neatly upon five erect support or "peg" stones, the roundish capstone weighs about 90 tons. B. Fell has remarked upon the close resemblance to a bona fide dolmen near Dublin, Ireland. From photos, the five supporting stones certainly appear artificially emplaced. Fell argues convincingly that it is very unlikely that a melting ice sheet would have



Sketch of the famous "dolmen" at North Salem, New York. This 90-ton capstone rests neatly upon five much smaller stones. Natural or artificial?

eased the boulder so directly and precisely upon five erect stones. He speculates that this dolmen might have been a memorial to a Celtiberian king. (R13, R18)

Martha's Vineyard, Massachusetts. Also well known is the Quista Dolmen, located on this island just off Cape Cod. J. Whittall, Jr., described this structure as follows:

On the island of Martha's Vineyard, hidden from motorists travelling to Gay Head, there is a small knoll called Quista, on which stands an unusual structure that has given rise to much speculation since its discovery. Four large boulders are arranged in a rough circle with an opening on the down-hill side. These stones are about two feet in height and form a remarkably tight wall. The two on either side of the opening

were evidently selected for their smooth surface and give the doorway a symmetrical appearance. On top of these stones rests a huge quarried capstone, roughly circular in shape and weighing about two tons. A few quoins are placed beneath it to chink up various openings. The chamber thus formed is about two and a half feet in height, and slightly more than three feet wide by about six feet long. The opening faces to the southwest. (R12)

No other dolmen-like structures are located on the island, but 7 miles across the bay, near Westport, is the Has-saneghk Dolmen. (R11) In addition, New England is dotted with crude stone chambers of controversial origin (MSB in another volume); and the Quista dolmen itself might well be classified as a chamber by virtue of its walls and "doorway."

In their thorough survey of New Eng-

land stone structures, J.W. Mavor, Jr., and B.E. Dix cautiously attribute the Quista Dolmen (they spell it "Quitsa") to Native Americans because: "the structure is connected architecturally with stone rows having embrasures, spirit-of-creator stones and other site features which we ascribe to Indians." (R22, R23)

In the Quista Dolmen, we see unequivocally the work of human hands and need not speculate about ice sheets; but which human hands?

Foxboro, Massachusetts. Above, we noted that A. Rothovius had opined that there were too many dolmens in New England for them all to be constructed accidentally by melting ice sheets. In F. Gilbert Hills State Forest, near Foxboro, H.G. Abel has mapped the positions of 14 suspicious "perched stones" in an area 1,600 by 2,200 feet. Some of these elevated stones would qualify as dolmens; others would not. As the figure shows, the distribution of the perched rocks is roughly elliptical. This is very strange, as is this remarkable concentration of "perched stones." Abel adds that such patterns of legitimate megalithic structures are common in northern Europe. (R20)

If further research reveals still more "organized concentrations" of perched stones, one would have to admit human involvement, even if all the structures are not typical of Old World dolmens.

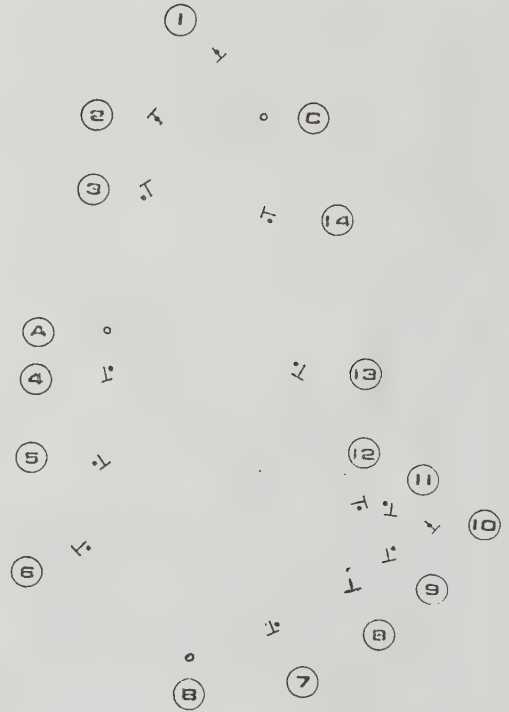
Other striking dolmen-like structures in northeastern North America. There are too many putative dolmens in New England and adjoining states to list, much less describe in any detail. We will flag just three more.

Essex County, Massachusetts. The Prospect Hill Dolmen is very large and of the cromlech variety. Capstone weight estimated at 70 tons. (R15, R23)

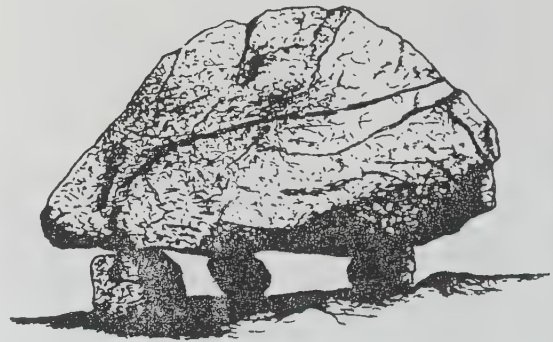
Kennelton, New Jersey. Tripod Rock, as its name implies, is supported by three stones forming a 3-4-5 triangle! The capstone is flattish. (R16, R23)

Lynn, Massachusetts. Another impressive dolmen-like structure. (R21)

Somewhat-less-striking dolmen-like structures outside of northeastern North America. The three structures cataloged below are a bit less impressive but still



The curious disposition of boulders and 14 "perched stones" near Foxboro, Massachusetts. Boulders are indicated by small circles, while the Ts represent perched stones. The distance from perched stone #1 to boulder #B is about 2,200 feet. (R20)



The dolmen at Lynn, Massachusetts. (R21)

belong to the same genus as those in New England. Basically, they are constructed of rounded boulders resting on very small supporting stones. They are found in glaciated regions.

Huron Mountain, Marquette County, Michigan. (R24)

Northern Boundary Waters, Minnesota. (R21, R24)

Melville Peninsula, Northwest Territories, Canada. Here is the most intriguing of the three examples.

One of the unsolved mysteries of the Arctic concerns a scattering of huge boulders which are to be found supported on smaller rocks at the upper end of the Melville Peninsula. Nobody knows why they were thus raised, nor how the primitive people who placed them in position were able to lift such enormous weights. (R9)

The photographs accompanying the above quotation confirm that these Arctic

perched rocks are very similar to those seen in such profusion in New England. Their frequency leads the author of the article, E.H. Mitchell, to assume a human origin.

It does seem improbable that pre-Viking European explorers could have penetrated this far into the Arctic. Yet, the Melville Peninsula is accessible via Hudson Strait and lies just north of Hudson Bay. Perhaps, when the world was much warmer, adventurers sailed these waters! But why elevate all these boulders? Or are the perched stones simply the works of Eskimos? (See MSD2 for the peculiar menhir not far south of the Melville Peninsula.)

Colorado. Far west of New England, at some undisclosed location in the Rocky Mountains, is a flat-topped dolmen bearing an inscription, according to J. Morehouse in one of the Occasional Papers of the Epigraphic Society. The capstone is 4 feet across and rests upon three intentionally placed supporting stones. The uppermost surface of the capstone appears artificially smoothed.



Dolmen-like arrangement of stones on lonely Point Reyes, California. This structure is associated with the unusual stone "wall" described in MSW2-X1. (R. Swanson)

Here are engraved cupules and what is said to be a message in ogam. (Ogam is an alphabet used by the Celtiberian culture centuries before Columbus.) A layer of desert varnish testifies that the dolmen and its inscription are very old. (R19)

Putative ogam inscriptions have been claimed to exist in many parts of North America. Given the revolutionary implications of the reported Colorado dolmen, one would expect that mainstream archeologists would be scrambling to verify this startling find.

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MSD5 Rocking Stones

Description. The existence of multi-ton boulders that are so delicately balanced that they rock back and forth with a gentle shove of the human hand. Most rocking stones are found in regions once covered by Pleistocene ice sheets. Some rocking stones seem to have been artificially erected, particularly in Britain.

Data Evaluation. British and American science journals of the 1700s and 1800s described scores of rocking stones, but these engaging boulders are virtually absent from the professional publications of the 1900s. Consequently, recent discussions of this phenomenon are confined to books and journal articles written by by amateur archeologists.

It is often difficult to determine whether a rocking stone was emplaced by nature or by human effort. Also, artifacts that might help date and elucidate human involvement with rocking stones are usually absent, especially in North America. For this reason, it is very hard to demonstrate any diffusion of megalithic culture from the Old World to the New World. Rating: 3.

Anomaly Evaluation. Huge rocking stones are so fascinating that human involvement with them, even veneration of them, cannot be considered anomalous. If, however, it could be shown that some of the rocking stones in North America were erected by or used in some way by pre-Viking visitors, we would have an important anomaly. Rating: 1.

Possible Explanations. All North American rocking stones are natural, and all human association with them is recent; that is, colonial and later. Possibly, some North American rocking stones were erected and used by Native Americans prior to European colonization.

Similar and Related Phenomena. Putative New World menhirs and dolmens (MSD2 and MSD4, respectively); Old World inscriptions, coins, pottery, and other artifacts found in the New World (MMF, MMM, MG, etc., in future catalog volumes); glacial erratics (ESD8 in Neglected Geological Anomalies).

Entries

X0. Introduction. Rocking stones are large boulders, often weighing many tons, that are so precisely balanced that they can be set to rocking with just a slight shove of the human hand or even the wind. Rocking stones have an understandable fascination for humans, for it is eerie that such ponderous rocks can be moved with the gentle touch of a finger. Were they emplaced by magic, as British legends claim Merlin did? There is ample evidence that some rocking stones were associated with ancient rituals about which we know very little. Given this natural human interest, one must ask if all rocking stones were emplaced by nature or whether human hands dragged some of them into their unstable positions for religious and arcane reasons.

A more serious potential anomaly arises because rocking stones are found in abundance both in western Europe and northeastern North America---the same areas where legitimate and putative menhirs and dolmens are located. (MSD2, MSD4) Are the North American rocking stones additional potential evidence of pre-Viking diffusion of Old World culture?

X1. Possible origins of rocking stones. As they do with menhirs and dolmens, skeptics can and do say that rocking stones are simply accidental products of nature. It is true that the great majority of rocking stones are to be found in



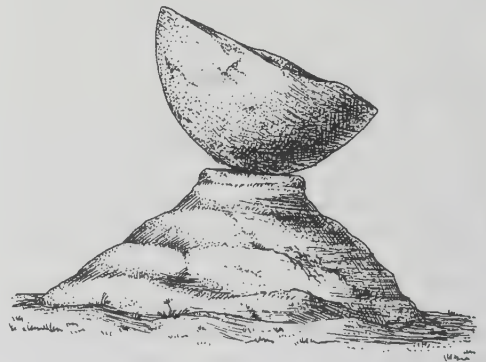
1782 sketch of the rocking stone at Bradley Rocks, England. The rocker was 37 feet in circumference. (R13)

areas once covered by Pleistocene ice sheets. In a skeptic's eyes, rocking stones are glacial erratics that were gently deposited in precarious positions by melting ice. Undoubtedly, this appealing mechanism does explain the disposition of many unstable boulders in glaciated areas. Nevertheless, the possibility exists that glacial boulders were intentionally destabilized by the human removal of smaller stones thus permitting rocking motion. Still other rocking stones may have been intentionally transported to prominent locations for specific purposes. In attempting to answer the question of artificiality, we will introduce below to some of the more remarkable rocking stones that have been described in the literature.

Rocking stones that "appear" artificial. One of the more famous of North America's rocking stones is located near Peekskill, New York. A short description of this oscillating boulder was given in 1824 by J. Finch, who decided that it was probably placed in its unusual position by early Celtic peoples! (Such a conclusion is scientifically unacceptable today.) But in 1824 Finch was free to write:

It is situated near the top of a high hill, near the village of Peekskill, in Putnam County; the moveable stone is thirty-one feet in circumference;

the rock is of granite, but the mica contained in it being schistose, gives it some resemblance to gneiss, and it is supported by a base of the same material. This rocking stone can be moved by hand, although six men with iron bars were unable to throw it off its pedestal. From the drawing which accompanies the description in Silliman's Journal, this rock presents every appearance of an artificial monument, and may perhaps with safety be classed among the Celtic antiquities of North America. (R5)



Old sketch of the famed rocking stone at Peekskill, New York. (R5)

Silliman's Journal is still in publication under the title of the American Journal of Science. We reproduce the drawing Finch mentioned, and one must admit that the Peekskill stone certainly does appear to be artificially emplaced. (R3)

Rocking stones perched on small stones. H. Rooke was a prolific writer on rocking stones in the late 1700s. He made an interesting observation about a rocking stone in Derbyshire, England. The stone was 32 feet in circumference and was easily set to rocking by human hands. It rested not upon bedrock but upon two small stones. To Rooke, this signified artificiality because the Druids, who were then thought to be the erectors of most of Britain's stone monuments, insisted that sacred objects must not be profaned by touching the ground. The Druids, Rooke claimed, considered rocking stones to be lithic deities that must be kept elevated above the bedrock! (R1)

Before laughing, observe that even today we show contempt for objects by throwing them on the ground.

Linear formations of rocking stones. A more convincing "proof" of human erection of rocking stones is seen in The Three Breeders, which are three rocking stones located on an eminence 1,000 feet above sea level on Wharton Crag, in England. (R2) The Three Breeders are equally spaced on a north-south line, an unlikely natural configuration. Clinching the argument for artificiality, just

beyond The Three Breeders is a second line of three rocking stones. These have basins carved in the bedrock at their feet. (R2, R13)

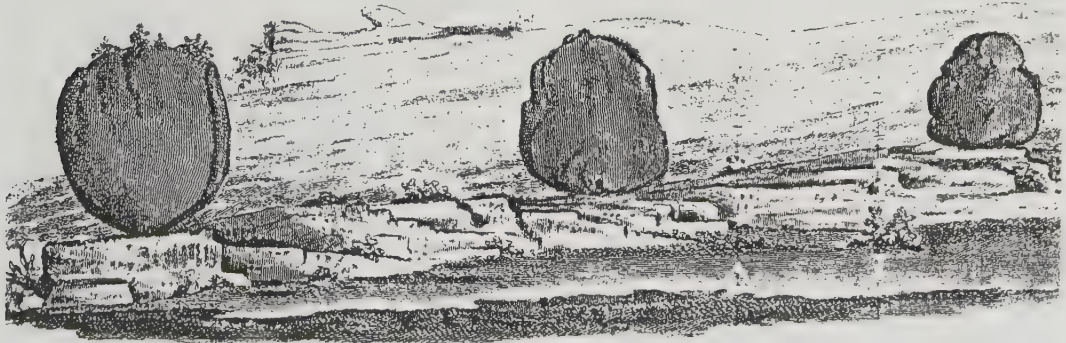
Prominent positioning of rocking stones. The Three Breeders occupied a prominent geographical position. So do many other rocking stones command wide views of the countryside. While we have found no statistical analysis of rocking stone distribution, we can supply another good example of apparently artificial placement.

Rolling Rock, Fall River, Massachusetts, is a 140-ton, egg-shaped mass of conglomerate. The stone is supported on a granite outcrop on two surfaces. Until about 1900, it could be easily rocked by hand.

It is strategically located for visibility on the horizon from some distance to the east and west because it crowns the brow of the southerly spur of the highest hill in Fall River, overlooking North Watuppa Pond. (R14)

Improbability of glacier placement of some rocking stones. Subjective impressions, such as "looking artificial" are unreliable. In the same genre are conclusions based on improbability, because we have no statistics upon which we can base such assessments. Nevertheless, arguments from chance sound convincing, as in the following statement concerning the Peekskill rocking stone.

Granting that the large stone was



The Three Breeders, located at Wharton Crag, England, are three aligned rocking stones. (R13) These certainly appear to be the work of man.

formerly mounted on a pedestal which the story and present indications seem to indicate, it seems rather unusual that the action of a glacier would deposit a huge boulder atop a very small one in a conspicuous position on a hilltop at the same time arranging for such perfect balance that a man could rock its many tons with comparative ease. (R12)

Overview. Probably most rocking stones were lowered into position by melting ice. J. Fergusson, an early aficionado of "rude stone monuments" ventured that 90% of the rocking stones had a natural origin. (R9) This still leaves 10%, among which we would reasonably include The Three Breeders. Being in Britain, this classification would not invoke an anomaly. However, including the Peekskill rocking stone among this 10% would imply a diffusion of Old World megalithic culture to the New World. This is not only anomalous but anathema to mainstream archeology.

X2. Distribution of rocking stones.

Rocking stones have received the most attention by British amateur and professional archeologists. This is understandable because standing stones and stone circles dot much of their countryside. (R13) France also boasts a few rocking stones. (R9) More are found in Asia (R12); but we have no details. The British enthusiasm for rocking stones infected New England, which, like Britain, is strewn with glacial debris. Some of these North American boulders either rock today or have been rockable in the past. The older American scientific journals carry many accounts of these unstable stones. (R3-R8) Today, though, rocking stones are relegated to amateur archeology publications. (R13)

While British rocking stones are widely distributed, those in North America are concentrated in the northeast. Much of Canada, the Rocky Mountains, and the Sierra Nevada were glaciated, but we do not find reports of rocking stones there. The same can be said for most of Northern Europe. We suspect that many rocking stones may be well known locally but have not received attention in the scientific literature we survey.

It is also true that rocking stones

present a challenge to vandals, and numerous unstable stones have been pushed or levered off their bases. In addition, rocking stones have pagan affinities. Oliver Cromwell's armies, for instance, deliberately destroyed rocking stones for their connection to the Druids. (R13) For several reasons, then, the record of rocking stones is incomplete.

Peru. We have found only one account of a rocking stone in South America, this by E.R. Heath in an 1879 number of the Scientific American Supplement.

Near this city [Cuzco] there is an oblong smooth boulder 18 feet in its longer axis, and 12 in its lesser. On one side are large niches cut out, in which a man can stand, and by swaying his body cause the stone to rock. These niches apparently were made solely for this purpose. (R10)

In MSH16, we will see that South America is not without other megalithic structures. Here, however, we must focus on those "niches" in the South American rocking stones because of their similarity to the "seats" or "chairs" associated with some of the British rocking stones. (See below.)

X3. Humans and rocking stones. That the megalith builders were impressed by rocking stones, whether natural or artificial, is highly probable. We are intrigued by them today even though we deem ourselves much more sophisticated! It is sort of magical to be able to move a house-size boulder with the touch of a finger. We can surmise with some confidence that rocking stones and other megaliths were venerated and that religious rites, even sacrifices, were performed in their shadows; but this is really only guesswork on our part. In attempting to discover the human uses for rocking stones, there are two types of artifacts associated with rocking stones. These may have some bearing upon how the rocking stones were used in rituals.

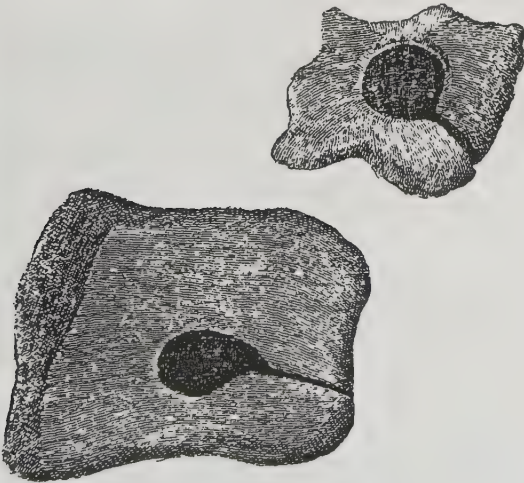
Chairs. Seats hewn out of the solid rock are located close-by some of the British rocking stones. (R13) In addition,

several New England rocking stones have depressions carved in them that can also be used as seats. (R14) The dedicated diffusionist cannot help but see an early Old World/New World connection in this!



Two rock chairs associated with British rocking stones. (R13) Carved chairs are rather common in South America. See MSO9.

Basins. Associated with some British rocking stones are rock basins with peculiar drainage channels. (R13) Perhaps these were used in rites of some sort---sacrifices?



Grooved rock basins associated with British rocking stones. Purpose unknown. (R13) See MSE2 for additional puzzling rock basins.

Rocking stones and earthquakes. On a completely different tack, rocking stones actually have a practical scientific application. Modern seismologists, however, prefer to call them Precariously Balanced Rocks (PBRs).

Precariously balanced rocks (PBRs) are rather common where earthquakes have never occurred. In this sense, balanced rocks are measures of seismic stability. For example, you won't find PBRs within 10 miles of spots where quakes have shaken the ground over the past few thousand years. To illustrate:

Rocks stacked in piles and balanced on their narrow ends on Yucca Mountain near the Nevada border with California...have not moved in at least 10,000 years and perhaps as many as 100,000 years, judging from the depth of "rock varnish," or weathering, on their exposed surfaces. (R15)

These Yucca Mountain rocks are hardly like the rocking stones of New England and were certainly not set up by human hands, but they do demonstrate that unstable rocks occur elsewhere in North America. It also follows that Britain and New England have not been visited by powerful earthquakes recently because of their many still-precariously-balanced rocking stones.

X4. Remarkable rocking stones. Our Fortean proclivities insist that we include the following data.

Very noisy rocking stones. One British rocking stone made such a clatter when it oscillated that it was named: "The Minstrel of the Peaks." (R13)

Another aptly named stone is "The Drum Rock" located near Warwick, Rhode Island. Ten feet long, 6 feet wide, and 2 feet thick, it rests upon another rock at two points. A child of five can set it into motion. When one side descends it impacts at four spots, one after the other, producing a loud drumming sound. On a still evening, it can be heard at a distance of 6 miles. (R6)

The rocking stone of Kephallonia. The locale is the west coast of Greece.

This really remarkable Petra (rock) is situated in a creek at the eastern point of Cape Katoghi, in the district of Pale, in the sea, so near the rocky coast that one can step over from the land to this rock, which is in continued and regular oscillatory motion, alternately touching the land and receding from it, about twenty times per minute---a regular natural pendulum in fact. It is about five paces square, being large enough to admit a small party, who may enjoy the pleasure of being rocked as so many babies. The strangest feature of this phenomenon is that the rock is always oscillating, whether the sea be calm or tempestuous, the waves then breaking over it without changing either the amplitude or the rate of its motion. (R11)

What keeps it in motion when the sea is calm? This is a question for a physicist rather than the archeologist!

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MSE EXCAVATED STRUCTURES

Key to Phenomena

MSE0	Introduction
MSE1	Lines of Pits
MSE2	Puzzling Pits: A Survey
MSE3	Unusual Ancient Shafts and Tunnels: A Survey
MSE4	The Oak Island Shaft and Tunnels
MSE5	Remarkable Ancient Mines and Quarries: A Survey
MSE6	Production-Consumption Discrepancy in Prehistoric Lake Superior Copper Mining
MSE7	Sculpted Hills and Mountains
MSE8	Terrestrial Zodiacs and Star Maps

MSE0 Introduction

Ancient humans were diggers extraordinaire. They mined and quarried extensively for weapons-grade lithic materials and a few metals, such as copper and gold. The 150-mile swath of prehistoric, shallow copper mines in the Lake Superior region poses several important questions to anthropologists; like, "Where did all that copper go? The hundreds of curious "dene holes" that ancient the Britons gouged out of the chalk beds remain enigmatic even after over a century of research. However, the most puzzling shaft of all was dug in more recent times: the tantalizing "Money Pit" of Oak Island.

Even the smallest of the ancient excavated structures---pits just a few feet in size ---raise questions. Why were so many dug in long rows? At the other end of the size scale, the prehistoric Micronesians sculpted entire mountains to suit their purposes.

Some excavated structures have been assigned to other chapters. Canals, harbors, and reservoirs fit in better with other water-control structures (MSC). Earthen hilltop forts, like the Maori "pas," are classified with other forts (MSB in another volume). Lastly, ditches and trenches are closely allied with embankments and other linear structures (MSW).

MSE1 Lines of Pits

Description. Pits excavated in soil or solid rock that are aligned over distances ranging from a few hundred feet to many miles. Hundreds, even thousands, of empty pits constitute this enigmatic phenomenon. Parallel lines and wide bands of pits are also known. Most of the subject pits are 2-6 feet in diameter and usually about the same in depth.

Data Evaluation. Pit alignments, even those of great extent, have been largely neglected by archeology. Most of our information, therefore, comes from popular sources. Fortunately, excellent photographs of several pit alignments have been published and thereby confirm their authenticity. Rating: 2.

Anomaly Evaluation. Several explanations of pit alignments have been put forth (see below), but none is convincing for the grander examples of the phenomenon, such as those in Peru. Pit alignments do not fly in the face of any archeological paradigms because none even addresses the phenomenon. Despite this professional neglect, we must rate pit alignments as being among the most perplexing of the ancient engineering structures. Rating: 2.

Possible Explanations. Blinds for hunters; hut foundations; remnants of unfinished trenches; defensive works; food storage repositories; plundered burial sites; sites that once held large wooden pillars.

Similar and Related Phenomena. Pit clusters (MSE2); deep shafts (MSE3); trenches (MSW1).

Entries

X0. Introduction. The earth that was collected by ancient humans to construct their ubiquitous mounds that are found virtually worldwide had to come from somewhere. So-called "borrow pits" are, therefore, also widespread. However, we are interested here in those pits dug in the earth or laboriously hewn out of the solid rock for more mysterious purposes. Such pits become even more puzzling when they are arranged systematically in lines or arrays.

X1. North America.

Oregon. An item from an 1884 issue of Scientific American Supplement adequately addresses the mysteries of a strange system of pits in Oregon.

A.F. Johnson writes to the Oregonian that eight miles above the mouth of the Sandy River, about twenty-five miles from Portland, may be found what are clearly the works of a race

of men other, if not more ancient, than our present Indians. At the point named, the Sandy sweeps around a ridge, and traversing a distance of probably a mile and a half, describes a figure not unlike an ox bow. At the narrowest point, this peninsula is about forty rods across, and at the highest point is probably two hundred feet above the level of the river. Here, at intervals of fifty feet, are a series of shafts or holes, each of which covers an area of say, 6 x 20, and judging from the embankments formed on the sides (the dust is deposited only on the sides), must have been a dozen feet in depth. These excavations are ranged in a straight line entirely across the peninsula and, what seems remarkable, in every case the longer axes point at right angles to the line of excavations. Just how ancient these works are it is, of course, impossible to determine, but that they existed prior to the great tornado that swept over this valley about two hundred years ago, and has left its footprints

everywhere, is evident. Nor can it be that the labor necessary to the accomplishment of these works was expended by our present labor-despising Indians. But for what purpose this forgotten race toiled for so many weary days, who these ancient workers were, whence they came, when they disappeared and why---these are problems for the antiquarian which time may never solve. (R1)

California. According to A.E. Treganza, there is no archeological evidence that a series of human-excavated depressions in the Coachella Valley of southern California lived up to their popular name, "the fish traps." In 1945, he wrote:

A group of small stone enclosures, supposed by some to be of natural origin and by others to be the work of man, lies on a rocky travertine-encrusted talus slope at the base of the Santa Rosa Mountains on the west side of the Coachella Valley in Riverside County, California. These phenomena are known locally as the "Ancient Fish Traps." They occupy a series of rocky terraces some 90 feet below the maximum high-water shore line of Ancient Lake Cahuilla (called by some Blake Sea), whose basin is now partly occupied by the Salton Sea. The "traps" consist of 85 to 100 bowl-like depressions composed of a travertine-encrusted granite talus debris.

They are arranged in three rows, each of which follows the exact contour of the old recessional terraces of the lake. (R4)

The size of the pits varies, with some being as small as four feet across.

Rather than being fish traps, two other suggestions are on the table:

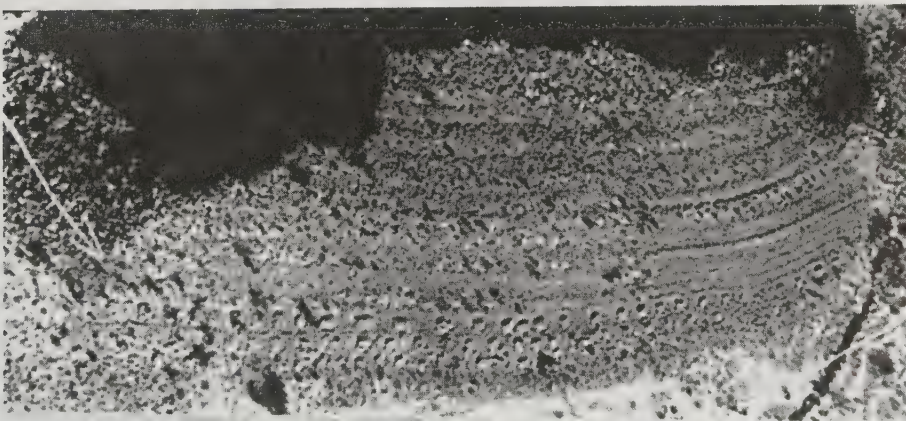
(1) The "fish traps" represent the remains of Indian dwellings. The variable size and location on a talus slope militate against this idea.

(2) The "fish traps" were hiding for places for hunters during antelope drives or, perhaps, when the lake was high, they were blinds for waterbird hunters. Again, the alignment of the "traps" and their size variation cast doubt upon this suggestion.

More recently, however, amateur archeologists A.R. Balch and J.W. Balch have spent many days exploring the environs of this dried-up lake. Contrary to A.E. Treganza, they favor the fish-trap hypothesis that gives the pits their popular name. (R8)

X2. South America.

Peru. Besides discovering the Great Wall



Long rows of bowl-like depressions located in the Coachella Valley, California. Called "fish traps," their real purpose is still being debated. The smallest of the depressions are about 4 feet across. (Photo by Dewey Moore via D.L. Cyr)

of Peru, the Shippee-Johnson aerial surveys of 1931 also snapped photographs of a truly strange, regimented formation of "pockmarks" that stretches for many miles along rocky ridges near the Pisco Valley. Shippee and Johnson did not investigate the pits from the ground, surmising from the aerial photos that they might only be excavated graves. (R3)

The mainstream archeological literature at our disposal does not mention the pockmarks. It was left to E. von Daniken to provide us with some "ground truth." As usual, von Daniken was searching for evidence of past extraterrestrial presence, but this enigmatic army of pits distracted him from his main mission!

Van Daniken wrote that from a distance the band of pits looked like a snake clinging to the far-off hills. Finally, after a laborious climb over rough terrain, he and his academic companion, Professor J. Cabrera, reached the first of the pits.

The hole I stumbled over was one metre deep and one metre in diameter. Next to it there was a second, a third and fourth hole, a veritable

band pierced with holes that unfolded into the distance as far as the eye could see. I looked up, followed the route taken by the holes and saw it disappear far above beyond the mountains. (R6)

As von Daniken and Cabrera walked along the band of pits, which was a constant 24 meters wide, the character of the pits changed. The first of the holes were empty except for some rocky debris. Farther on, some of the pits were partially ringed by little rock walls. Later, on a ridge, all pits were enclosed by walls.

Von Daniken did not believe that the shallow pits would have had any defensive value, nor did he come across any artifacts suggesting that the pits had been used for burials.

So what purpose did the hundreds and thousands of holes fulfil? Clay soil which would have made digging child's play never existed here; the ground was always stony hard and dry. But why had men undertaken such strenuous work? (R6)



This strange band of pits stretches for miles along ridges near the Pisco Valley, Peru. The band is a fairly constant 24 meters wide.

At a place called Cajamarquilla, near Lima, von Daniken came across still more pits, these even more curious than those marching across the ridges near Pisco. Altogether, there were 209 holes, all in a straight line. If we interpret von Daniken's photographs properly, these pits had been cut into solid rock. Measurements of one pit yielded a depth of 5 feet 7 inches and a diameter of 23 inches. (R5)



Some of the 209 holes carved in solid rock at Cajamarquilla, Peru. Arranged in a straight line, their purpose is obscure. (Based on a photograph in R5)

The ages and makers of these two alignments of Peruvian pits are not given in any of our references. In fact, they seem to be ignored by professional archeologists.

X3. Europe

Britain. A short paragraph from Lines on the Landscape, by N. Pennick and P. Devereux, summarizes the salient facts, such as they exist, concerning pit alignments in Britain.

Aerial archaeology has revealed other curious linear features in addition to cursuses. The most bizarre are pit alignments. These are usually single, but sometimes double, triple and even quadruple, rows of pits showing up as crop marks. Although some of these alignments are sinuous, most are straight lines producing clear-cut angles wherever they change direction.

Surviving unbroken lengths up to 3000 feet (900 metres) have been recorded from the air. No one really knows when they date from; periods from the middle Bronze Age to the Romano-British era have been suggested, and there is fragmentary evidence to support all hypotheses. Their purpose is equally unknown. They often occur in river valleys, and are frequently at right angles to the course of a river. Excavation has shown some pits to have been up to eight feet in diameter and over four feet deep. The original idea that these holes held massive timbers has not been supported by archaeological investigation---they seem to have been, simply, pits. (R7)

Some of the pit alignments are associated with the multiple ditches mentioned in MSW1. This fact leads the way to one explanation of at least some of the pits.

Long before aerial surveys demonstrated the full extent of the pit alignments, ground surveys were the only means of finding answers. To this end, J.R. Mortimer visited the lines of pits on Allerston and Ebberston Moors, near Scarborough, in the 1890s. He observed that the distances between the pits varied considerably. In addition, some pits were elongated in the direction of the alignment, even tending to run into each other. These facts left Mortimer with the strong impression that the pit alignments were the initial stage of trench construction. (R2)

Of course, some British pits are merely the surviving evidence of habitations---so-called "hut circles." Huts, though, would never be as small as some of the pits (just 3-4 feet across) or arranged in such long straight lines.

Twenty curious pit alignments have been located in the Welland Valley of eastern England. Judging from a photograph in R9, the alignment at Tallington consists of at least 16 pits, all in a row, each about a meter in diameter. Pottery and an arrowhead excavated from them suggest that the pits were dug by Iron-Age people. Their purpose is unknown. They may have been boundary markers of some sort.

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MSE2 Puzzling Pits: A Survey

Description. Depressions and holes dug in soil or chipped out of solid rock for purposes either indeterminate or highly controverted. Diameters may be as large as 200 feet or as small as 6 inches. Depths are less than 20 feet.

Cross References. Obviously, the distinction between a "pit" and a "shaft" is vague. Our criteria place shafts deeper than 20 feet, and we catalog them at MSE3 and MSE4. The so-called "dene holes" in Britain are also "pits" in a sense, but they terminate in chambers. See MSE3 for more on these interesting ancient subterranean structures. Pits and shafts that are excavated for the extraction of minerals are cataloged in MSE5.

Data Evaluation. Pits are such simple and mundane structures that archeologists find few scientific challenges in them. Who, for instance, would fund a study on "holes in the ground"? Perhaps because of this disdain, we have found no authoritative review articles on pits. Our sources in this section are a mixed bag of scientific and popular sources. Finally, our little survey cannot help but be incomplete for the simple reason that few people write about pits. Rating: 3.

Anomaly Evaluation. There are, of course, no engineering challenges in the digging of shallow pits. The major reason for cataloging pits is that some of them have no obvious application or, often, the suggested applications meet with many objections. Add curiosity value and we have a modest anomaly rating. Rating: 3.

Possible Explanations. Sink holes, gilgai, ceremonial areas (i.e., like kivas), defensive works, water storage.

Similar and Related Phenomena. See Cross References above. Shallow depressions gilgai, glacial kettles, patterned ground, and other natural pit-like structures (ETB in Carolina Bays).

Entries

X1. North America

Florida. Downtown Miami is an unusual place for archeologists to make important new discoveries. Nevertheless, the demolition of an old apartment building in 1998 revealed a 38-foot-diameter circle with a perimeter cut 4 feet deep into the limestone bedrock. The circle itself is a unique structure in North America and manifestly required an enormous amount of chipping away with crude tools. Even more curious are the pits and basins carved into the surface of the circle proper.

There are two types of holes cut into the bedrock: large, amorphous basins, of which there are at least 20, and small circular holes of which there are hundreds. [R.] Carr believes that the circle formed the foundations of a structure, perhaps a temple or council house. What is unusual are the apparent astronomical alignments. The structure's east-west axis seems to align with the rising and setting of the sun on the equinox. One of the holes on the eastern side is cut in the shape of an eye with a stone pupil. Another indication of the site's special nature are the remains of a five-foot-long shark and a sea turtle buried with their heads to the west and tails to the east, as a human body would have been laid out. According to the excavation director John Ricisak, they may have been offerings. (R17)

Archeologists have recovered many artifacts at the site---all characteristic of the Tequesta Indians who lived in the area prior to the Seminoles. Archeologist Carr puts the circle's age at between 500 and 700 years.

It is not the age of the circle that engenders an anomalist's interest but rather the uniqueness of the structure and its uncertain purpose.

Texas. At least six Paleo-Indian village sites in Collins County are marked by

very large pits dug for purposes unknown. One site on the East Fork of the Trinity River was examined by a team of archeologists. Although the pit of this former village has been degraded by erosion and cultivation, it remains rather impressive. Its present diameter, as measured across its raised rim, is 90 feet. The owner of the land stated that when the area was first cultivated, the pit was 10-12 feet deep. (R6) Whatever the purpose of the pit, it was important enough to necessitate the removal of a considerable amount of soil.

A completely different sort of pit is found drilled into the Santa Elena limestone in Boquillas Canyon, Big Bend National Park. The guidebooks call these pits "rock mills," implying that they were used for grinding corn. However, C.R. Froede questions this conclusion on the basis that the geometry of the pits is incompatible with grain-grinding.

Froede examined 19 of the pits and discovered that they all have almost exactly the same diameter, 7.5-8.0 inches. The pit walls are straight, vertical, and smooth; bottoms are flat or slightly concave. Depths range from 12 to 26 inches.

Typical rock mills are concave in shape, flaring out at the top. The nicely cylindrical pits at Boquillas Canyon depart significantly from this shape. They must have had some other, still-yet-undetermined application. (R13)

California. Moving northwest to the Sierras, we discover more mysterious pits scooped out of the solid rock. This time they are much, much larger.

Among the many unsolved riddles that have been handed down by the early inhabitants of this continent to the present occupants is one which, so far as known, is confined to a single county of California, in fact, to a small section of the Sierra Nevada in and adjacent to Sequoia National Park.

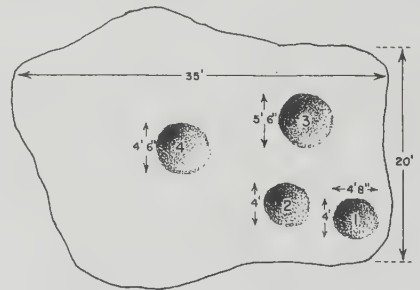
In that region there occur numerous smoothly rounded basins artfully hollowed out of the solid granite, the



Curious pits near the Trinity River, Texas. Carved into the solid rock, many have straight sides and flat bottoms. These would not seem to be useful for grinding grain. (C.R. Froede)

work of a prehistoric race of men of whom the present Indians know nothing. These cavities measure as a rule from four to five feet in diameter and from one to two feet in depth, and are shaped like huge wash bowls with smoothly curving sides and bottoms. To local residents they have been known for many years. But no critical examination of them has been made hitherto. At first they were thought to have been worn by the action of running water, and reports of the occurrence of such basins in locations where streams cannot have existed were given but scant credence. The basins in question are found in groups at altitudes ranging from 4,000 to 9,000 feet above sea level, scattered over an area about 35 miles long from northwest to southeast in that part of the Sierra Nevada in Tulare county which is drained by the Kaweah and Tule Rivers. (R5)

Extreme examples of the basins are found on a ridge near Salt Creek. Here, there are "mortars" that average 3 feet in diameter and 5-7 feet in depth. It is readily apparent that these are not mor-



Jc-v

DEPTH OF BASINS	
N2 1	= 6 INCHES
N2 2	= 14 INCHES
N2 3	= 24 INCHES
N2 4	= 18 INCHES

Ground plan of some basins carved out of solid rock in the Sierra Nevada, California. Some are 5-7 feet deep. (R5)

tars, neither are the smaller ones described in the quotation. They are all too large.

If these basins are not mortars or pot holes, what were the basins used

for? A few suggestions are: tanning hides, baking pottery, storing supplies, roasting seeds or meat, sweat-houses, and grinding gold-bearing quartz. Objections have been raised against all of these possibilities.

X2. South America.

Brazil. Some unique "pits" are found along some of Brazil's tropical rivers. Unlike the other pits covered in this section, these pits are now filled with unusual soil. The question at hand is how were these curious fertile pockets created--they are obviously not natural.

Most of the lush jungles of tropical South America grow on a very thin layer of soil that is continuously regenerated by decaying vegetation. Deforest the jungle and the agricultural potential is about that of a your nearest Interstate highway. But the pits called "terras pretas" ("black earths") are curious exceptions. They are spotted along Brazil's Aripuana River and are small areas consisting of deep, black earth 7 to 17 feet deep. Scientists believe that these fabulously productive "islands" in the sea of otherwise poor soil were developed by native peoples about 10,000 years ago. No one knows how these ancient farmers made the terras pretas. The slash-and-burn farming of the present inhabitants is primitive in comparison. (R15)

Peru. A novel type of broad, circular pit is associated with many ancient Peruvian population centers. One at La Galgada is about 24 meters in diameter. It is lined with masonry and clay mortar. The main concentration of these circular pits is in the Supe Valley, where there are about 30 such sites. (R12)

In his authoritative book Peruvian Prehistory, R.W. Keatinge mentions these pits or sunken plazas briefly but does not suggest their purpose.

Note the similarity to the rock-lined pits in Zimbabwe. (X5)

X3. Europe.

Britain. A report dug out of the science literature of the Eighteenth Century tells

of a cluster of large pits situated $\frac{1}{2}$ mile west of Little Coxwell, in Berkshire. Called Cole's Pits, some 14 acres of ground are honeycombed with 273 pits, 40 feet and more in diameter and from 7-22 feet deep. D. Barrington investigated the area and, as far as he could tell, Cole's Pits were dug in ordinary sand with no worthwhile minerals being in evidence. (R1)

After more than two centuries, Cole's Pits have probably been erased from the landscape, so we will never know why they were dug. Perhaps a clue resides in the apparent absence of spoil heaps; perhaps the diggers were simply after sand!

An entirely different variety of British pit cluster has been described by F.C.J. Spurrell.

For a distance of eight miles along the hills which overlook the sea on the North Coast of Norfolk, from Roughton heath, near Cromer, westward, exists a multitude of shallow pits. The area occupied by them now and formerly cannot have covered less than a thousand acres of ground.

Taken generally they appear much alike, there are however slight differences. The diameters of these pits vary from six to twenty feet with an average of ten feet, and the depth three feet. (R3)

Spurrell spent many hours examining these pits, even excavating some. He concluded that the sandy soil yielded no useful minerals and that the pits were actually the remains of dwellings of some sort.

He next extended his research to other clusters of pits in Britain and Germany. Some of the other clusters were of great extent. "Pen Pits," for example, occupied 700 acres and counted more than 20,000 pits. In fact, clusters of similar pits are rather common in Britain. Spurrell thought that all of the pits he investigated were probably the remnants of ancient dwellings. (R3)

France. Some "singular excavations" pockmark hills on the Portland Plateaux, Haute Marne. In 1877, when the following was penned, these pits were generally thought to be a natural phenomenon. This is certainly the conclusion of M.E. Belgrand, as he reported below:

On the high hills of the town of Poissons near Joinville, the culminating point of which reaches the height of 200 metres above the river Rongeant, these cavities, from their depth and extent acquire unusual importance; certain of these hills are literally riddled with pits (puits) ramifying in all directions, sometimes having a subterranean communication one with another and reaching unascertained depths, sometimes exceeded 30 or 40 metres. The general character of these pits and the polish of their rocky walls suggest that an acid, contained in the waters by which they were eroded, may have contributed to their excavation; but their extent and number suggest some more powerful agent; and what more powerful cause could you invoke than a great quantity of water, acting through a long period, falling into the fissures of the Portland rock, enlarging them, fashioning them, and giving them the capricious forms which we find everywhere in rocks subjected to their action. (R2)

H. Norton, however, saw strong evidence of the work of man in the inter-connecting passages and the regularities of the pits. Norton thought he detected a strong resemblance to the famous ancient flint mines in Britain called Grimes Graves. There are, he noted, flint mines in France similar to Grimes Graves. Why, he asked, had French geologists not made this connection for the pits of Haute Marne? (R2)

Grimes Graves and similar structures are classified as mines and covered in MSE5. We suspect from Belgrand's account that the Haute Marne pits are really a natural formation, but Norton's suggestions of artificiality impel us to give them a bit of catalog space.

Netherlands. Schagen-Muggenburg lies 50 kilometers north of Amsterdam. The Muggenburg part of the town name is only a few years old. Before it was built, archeologists were allowed to explore the meadows making up the construction site. L. Therkorn, an archeologist from the University of Amsterdam, led the exploration team. The digs yielded artifacts going as far back as 300 AD, when this region was sparsely populated by farmers. However, if Therkorn et al had dug up only these old

bones and pottery shards, we would not be cataloging their research.

For anomalists, it was the pits---old pits that had been filled in and that seemed to be arranged in an intricate pattern that mirrored the star constellations making up the classical Greek zodiac. But this revelation didn't come until later. After all, pits are common in archeology. Often they contain just rubbish, sometimes human remains.

But the pits at Muggenburg are different. There are 57 of them, each about a meter wide and deep, extending over about half a hectare [about 1¼ acres] They were certainly not used for storage because the level of the groundwater is too high. Nor were they used as dumps; archaeological evidence shows that they were filled in shortly after they were dug, and some have very little in them.(R14)

It was only when Therkorn mapped the pits did she see that they were not distributed at random. Connecting them as children do with dot-puzzles, she quickly recognized the constellations Taurus (bull), Canis Major (dog), Pegasus (winged horse), and Hercules. The pits were geoglyphs of a new sort, stretching for more than 100 meters, a sort of Nazca figures in Holland. About 500 meters from the 57-pit array, still another Taurus pattern of pits was uncovered.

The mysterious pits didn't contain much, but there were often a few animal bones. The Taurus pits yielded cattle bones; the Pegasus pits, horse bones; etc.; with the bones matching the zodiac animal in each sign. Therkorn surmised that the animal remains represented ritual sacrifices that were probably time-coordinated with specific celestial positions of the real stellar constellations. [What was in the pit for Virgo?]

The pit-zodiac story does not end at Muggenburg. At Velserbreek, over 40 kilometers distant, Taurus and Pegasus pit-patterns have been identified. These are dated at 600 BC---1,000 years earlier than Muggenburg.

The pit-zodiacs show astronomical sophistication unexpected in European farmers 2,600 years ago. And how did these "barbarians" learn about the zodiac of the "civilized" Greeks and Babylonians long before the Roman legions pushed north into Gaul?

Across the Channel in Britain, one finds the equally controversial Glastonbury Zodiac. As seen by some, this is a weakly suggestive arrangement of natural and artificial geographical features resembling a zodiac. (MSE8)

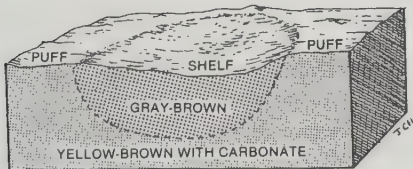
X4. Middle East

Iraq. Some areas of the Middle East (also Australia and Africa) are marked by peculiar circular or rectangular depressions in the soil. Called "gilgai," these natural features often occur in alignments and lattices. (ETB4 in Carolina Bays).

During an aerial survey of gilgai in northern Iraq, S.A. Harris also photographed many large, elongated artificial pits. He wrote:

In the same area occurs a peculiar pattern on the air photographs that closely resembles tank gilgai. This turned out to consist of man-made pits up to 25 m. by 60 m. long and often laid out in a pattern resembling lattice-B gilgai. The spoil was piled around the hollows which were dug by the people who dwelt in the towns and settlements whose remains now stand on the nearby gypsum hills. The present-day inhabitants of the area use them for watering sheep and providing summer grazing for their flocks. (R7)

The age, purpose, and identity of the diggers of these huge pits were not given in the referenced article. Whatever



A cross section of gilgai soil. For the geology of such soils, see ETB4 in Carolina Bays.

their purpose, it took a lot of labor to excavate pits of the size given.

X5. Africa

Tanzania. In 1972, the National Geographic Society announced that M.D. Leakey had discovered some pits in Olduvai Gorge---pits that were about a half million years old! The largest of the pits measured about 3 feet in diameter by 1 foot deep. Some early homonids had scraped out these hollows in the sand for some undetermined purpose ---perhaps to trap small animals. The sand is now hard sandstone, which still bears fingermarks along the sides of the pits. In the bottom of one of the pits, the footprint of a child is clearly impressed. (R8)

Zimbabwe. Many remarkable, stone-lined pits occur in clusters on the Inyanga Estate, Mashonaland.

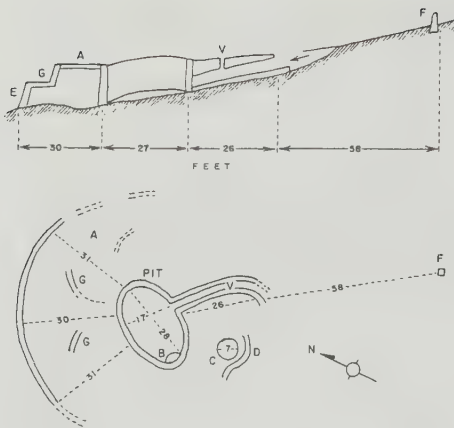
These structures, which are so numerous throughout the whole of the Inyanga Range are proportionately numerous on Mr. Rhodes' estate. For instance, within the small radius of two miles from the farmstead, there can be no less than one hundred of these pits and passages, if not considerably more. This is thought to be a modest estimate, yet it serves to demonstrate the vast number of such pits which are to be found throughout an area of hill country some 60 miles in length by 40 miles in width.

Generally the pits are found in clusters of twos or threes, or singly at 100 yards distance, but sometimes at a distance of 50 yards apart

.....

The original builders have sunk their pits some 9 feet to 12 feet in depth, with diameters varying from 16 to 30 feet. The soil from each pit has been thrown up on the hillside, making a semicircular rampart of some 20 feet to 30 feet in width which increased the depth of the pit on the outer side, making the height of that side of the pit correspond which that of the higher ground on the hillside of the excavation. (R4)

The insides of the pits were lined



Plan and cross section of one of the rock-lined pits on the Inyanga Estate, Zimbabwe. These structures are rather complex. They are too deep to have been for defense. Dimensions in feet. (R4)

with facings of single stones.

Once again we have pits with no obvious purpose. In this case, the pits are extremely large and deep---too deep to be of much use in warfare.

The referenced report was written nearly a century ago. Presumably, today's archeologists know much more about these pits.

X6. Australia

Queensland. In 1986, the Australasian Post carried the following "pit" story.

For more than 10 years, scientists and geologists have been baffled by the discovery of some 30 strange craters between Bundaberg and Gin Gin (Qld.). Made of sandstone, siltstone, and red ochre, and at least 25 million years old, the craters contain unidentifiable markings which could be manmade!

The holes were discovered by a farmer clearing his land and they have now been opened to the public who offer a multitude of theories about their origin, ranging from natural formations---although the craters are not of volcanic origin---

to the work of visitors from outer space. (R11)

While it is true that there are some craters in the area mentioned in the Australasian Post, geologists had already inspected them years earlier, declaring them to be nothing but sinkholes. (R10)

This did not deter the owners of the land from naming these pits "The Mystery Craters" and making them a tourist attraction!

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- R17. Anonymous; "Prehistoric Miami," Archaeology, 52:30, March/April 1999. (X1)
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MSE3

Unusual Ancient Shafts and Tunnels: A Survey

Description. Ancient shafts and tunnels that are remarkable for one or more of the following characteristics:

- (1) Depth or length over 50 feet, especially when cut into solid rock;
- (2) The use of ton-size capstones in the roofs of long tunnels where space is restricted;
- (3) Perplexing configurations of shafts and tunnels that appear to serve no practical purpose;
- (4) Miniature shafts and tunnels (too small to crawl through);
- (5) The use of curious layers of materials to line structures;
- (6) The precision drilling of tunnels from both ends so that they meet in the center;
- (7) Lack of any consensus as to purpose.

Data Evaluation. Most of the information provided below is derived from scientifically acceptable journals and books. However, many of our references are over a century old, and we lack more recent updates. In addition, we review some sensational claims made in the popular literature, particularly in regard to far-flung tunnel systems in South America. Caveats are added where deemed necessary.
Rating: 2.

Anomaly Evaluation. Generally speaking, the structures cataloged are easily within the engineering capabilities of the cultures involved. In some cases, we do not know exactly how some feats were accomplished; e.g., the Samos tunnel and the Mayan miniature tunnels. This ignorance of ancient construction techniques does not undermine any important archeological paradigms. The claims that some North Ameri-

can tunnel-chamber structures resemble Old World structures---thereby suggesting pre-Columbian contacts---are not convincing since no supporting artifacts have been found. The major unknowns here concern the unplumbed purposes of the cataloged structures, their ages, and their builders. Rating: 3.

The only shaft-tunnel complex posing major problems of explanation is the Oak Island "Money Pit." This enduring mystery is treated separately in MSE4.

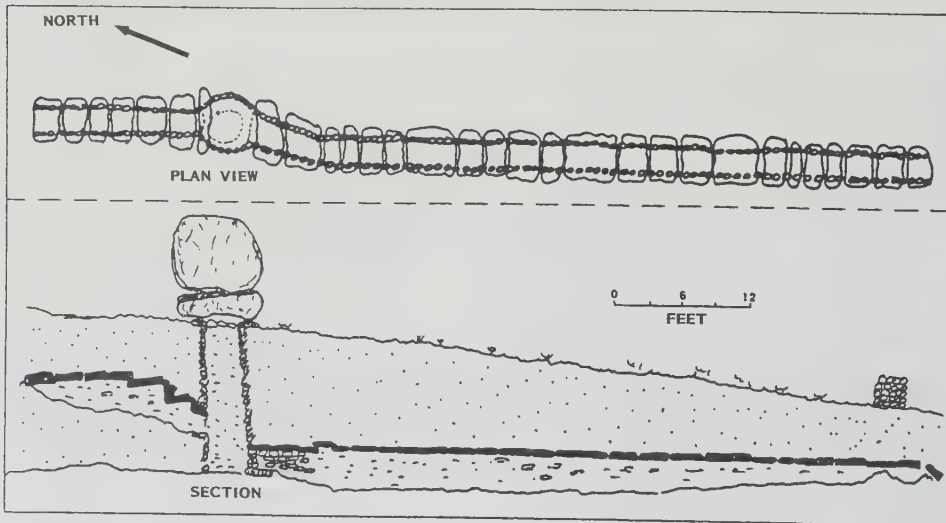
Possible Explanations. Our forefathers and even more distant progenitors were very intelligent and fully capable of remarkable engineering feats. Unhappily, we do not always comprehend their motives.

Similar and Related Phenomena. The Oak Island "Money Pit" (MSE4); New England stone chambers (MSB in another volume); the Iranian qanats (MSC3).

Entries

X1. North America. The hillsides of New England are pierced by a multitude of stone chambers. Some are short and obviously utilitarian, others are too long and elaborate to be simple root cellars. (See MSB in another volume) In this section, we are interested in those stone chambers that are so highly elongated that we are justified in cataloging them as "tunnels." Some, but not all, of these "tunnels" ultimately do open up into true chambers.

Massachusetts. Near Goshen, in central Massachusetts, two such "stretched-out" chambers are combined with a vertical stone-lined shaft to create a unique shaft-tunnel complex. It has been called the "counterfeiter's den," but the sketch shows it ill-suited to that purpose. A dry well? Hardly likely! That would not account for the curious, narrow, offset tunnels. The real origin and purpose of the Goshen complex remain unknown. Whoever built it invested considerable



Plan and cross section of the Goshen, Massachusetts, shaft-tunnel complex. This structure hardly seems to be appropriate for storing vegetables or for living quarters! (R36)

labor picking away at the clay hardpan and lining the structure with stones.

The "well" or shaft part of the structure is 15 feet deep, with a diameter of $3\frac{1}{2}$ feet. The upper tunnel runs north for 16 feet, while the lower one heads south for 68 feet, where it terminates in a collapsed sand pile. Both tunnels are roofed with flat capstones weighing a ton or more. One wonders how these stones were lowered down the shaft and maneuvered into place. (R21, R22, R25)

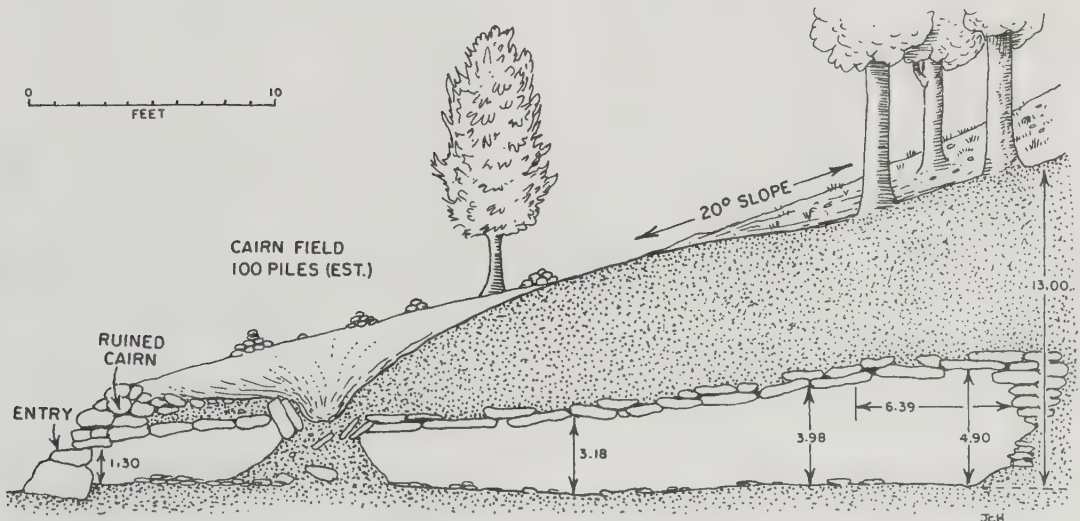
The age of the Goshen shaft-tunnel complex has been difficult to determine. The major clue has been a carefully made stone disk 7 inches in diameter, 1 inch thick, that was recovered when J. Whittall and companions excavated the site in the 1980s. This stone dish is similar to Indian dishes assigned to the late Archaic period---about 5,000 years ago. But New England Indians are not known to have built stone-walled subterranean structures, but who else could have built the structure in that time frame? (R36)

Of course, archeologists scoff at the 5,000-year date for the structure, preferring to attribute the Goshen complex to early European colonists.

Connecticut. Several miles north of New London, a long, stone-lined tunnel penetrates 38 feet into a hillside. This structure was discovered accidentally when the 1938 hurricane uprooted a large oak and exposed a capstone. Amateur archeologists call the tunnel the Montville Souterrain. "Souterrains" are underground tunnel-like structures common in Europe. Naturally, the professionals object to naming the Montville structure after a European megalithic structure. That implies pre-Columbian visitors to the New World---a thought they do not care to entertain! Nevertheless, the Montville "tunnel" does look much like a Bronze-Age Irish souterrain.

Whatever the Montville structure is, it was probably not a colonial root cellar. What colonist would crawl 38 feet through a wet, narrow, spider-haunted tunnel to procure beets for the day's supper? (R35)

Ohio. In 1981, near the town of Greer, workmen erecting an oil-drilling rig were surprised to uncover a long tunnel leading to a subterranean chamber. No one living on the nearby farms knew anything about the long-hidden structure. Together, the tunnel and chamber were



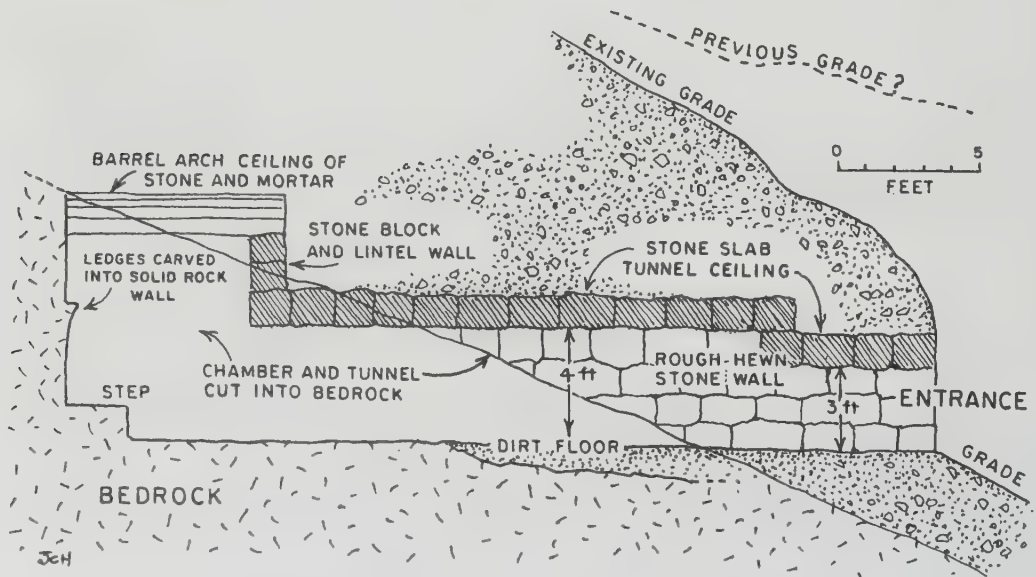
A New England "souterrain"? Located near New London, Connecticut, this tunnel is 38 feet long. Its real purpose is debatable. (R35)

31 feet in length, but it is estimated that perhaps 25 additional feet of tunnel had been destroyed before the workers noticed the structure. The tunnel walls consist of sandstone-block masonry 3 to 4 feet high. The roof was made of heavy stone slabs. The measurements of one slab were 40 inches in length, 22 inches in width, and 14 inches thick. At the tunnel's end, the circular chamber was about 8 feet high, its diameter 50 to 53 inches. No artifacts or inscriptions were found in the tunnel or chamber. There is no way of estimating the age of the structure.

This Ohio tunnel-chamber structure is too damp for storage purposes. In fact, it seems to have little practical purpose. It does resemble the Montville, Connecticut, "souterrain" in its architecture. V. and B. Moseley, who described the Ohio structure for the Epigraphic Society, remarked that they could see a Celtic influence here, just as amateur archeologists do in the case of the New England stone tunnels and chambers. (R27) Of course, Celtic presence anywhere in North America is vigorously denied by mainstream archeology. And reasonably so, because Celtic artifacts have not been found in or near these structures.

Indiana. The shaft and subterranean room described in the following quotation are so unlike the works of the Moundbuilders and other Indians known to have resided in Indiana that we deem them worth including in this volume.

A discovery that cannot fail to interest the speculative mind has just been made in Indiana, United States. Some labourers engaged in digging a cellar came upon a broad flat stone at a distance of about eight feet from the surface of the soil. An attempt being made to raise this stone it suddenly dropped downward. A ladder was procured and lowered into the hole, and the labourers descended with candles. They found themselves within an apartment six feet in depth, 25 feet long, and 18 feet wide. Within this subterranean room were four platforms, upon each of which three skeletons were found. These skeletons were surrounded with stone and copper ax heads and arrowheads, with bracelets and rings of silver, and with tools resembling chisels or "gouges," the latter composed of copper, hardened to a consistency of cast steel. In the



Oil drillers accidentally discovered this tunnel-chamber structure near Greer, Ohio, in 1981. There were no artifacts or other hints as to its age or purpose. (R27)

centre of the room heaps of dust were observed; these are supposed to have been originally piles of furs. Many hundreds of years must have elapsed since this barrow was closed. It is said the the construction of this tomb displays a considerable knowledge of architecture; the walls are neatly and compactly laid and cemented. (R39)

The use of cement by the aborigines of Indiana is particularly interesting.

Mississippi. Back in 1847, in one of the very first issues of Scientific American (old series), the following item appeared.

In the southwestern part of Franklin county, Mississippi, a curious subterranean chamber has been discovered by some persons while exploring the banks of a small stream. It is about 180 feet long and 80 feet wide, and of beautiful mason work, equal to any of modern times. The land above it is cultivated, but thirty years ago, trees of three feet in diameter flourished luxuriantly. It is evidently of remote antiquity---the hands that formed it and the race are unknown, and have long since passed from the earth. The Indians in the neighborhood knew nothing of its existence and had no tradition of the same. There is also a canal connected with it and a long subterranean passage, which have not yet been explored. (R1)

To place things in perspective, the 1847 Scientific American, unlike today's, magazine, relied heavily upon letters and accounts published in frontier newspapers. Since we have read nothing more about this wonderful structure in the professional literature, we must add a caveat.

Missouri Valley. At least 900 years ago, perhaps much more, some of the natives of the Missouri Valley between St. Louis and Sioux City lived in subterranean chambers accessible by shafts about 10 feet deep. The Indians had hollowed out perfectly rectangular rooms averaging 20 by 40 feet. Troglodytes are so rare in North American prehistory that they deserve at least a mention here.

Our information comes from a 1918 number of the Scientific American Supplement, which described the excavators of

these subterranean chambers as belonging to "a mysterious race of unknown origin." Some of the artifacts of this "mysterious race"---such as exquisite heads carved out of soapstone---do imply a rather advanced culture. The features of the carved heads suggested that the sculptors may have come from Mesoamerica. (R13)

California. Table Mountain, in Tuolumne County, is the site of several curious archeological discoveries. There, in a geological deposit called the "auriferous gravels," for their gold content, miners of the Gold Rush days found stone mortars, stone spearheads, and the notorious Calaveras Skull. The problem arising was that these artifacts were found at depths of several hundred feet below the surface and in tunnels driven over 1,000 feet into the gravel. It was easy to assume that the Calaveras Skull and associated artifacts were of the same age as the gravel; i.e., Tertiary age---probably more than 2,000,000 years old! Not unexpectedly, a great controversy erupted over the contents of these auriferous gravels. It continues to this day because creationists use the Calaveras Skull as evidence that the geologists have their dates all wrong. (BHE12 in Humans II)

An alternative to assuming the Calaveras Skull and associated artifacts are the same age as the gravel has prehistoric humans digging in those auriferous gravels only a few thousand years ago rather than millions of years ago. But is there any other evidence that these more recent humans actually dug into the auriferous gravels for gold or, perhaps, just to conduct rituals?

J. Southall examined this possibility back in 1881, when he described the discovery of pre-Gold Rush excavations.

One of these ancient shafts has actually been discovered in this very Table Mountain which figures so largely in these accounts, and where the celebrated Calaveras Skull itself was discovered under such remarkable circumstances.

The discovery in question was made in 1849, long before the discussions about the existence of man in the Tertiary strata had ever been dreamed of. I quote from Schoolcraft's Archaeology, vol. 1, p. 105;---

"It was late in the month of August, in 1849, when the gold-diggers

at one of the mountain diggings called Murphy's were surprised, in examining a high barren district of mountain, to find the abandoned site of an old mine.

"It is evidently,' says a writer, 'the work of ancient times.' The shaft discovered is 210 ft. deep. Its mouth is situated on a high mountain. It was several days before preparations could be completed to descend and explore it. The bones of a human skeleton were found at the bottom. There were also found an altar for worship and other evidences of ancient labour. No evidence has been discovered to denote the era of this ancient work. There has been nothing to determine whether it is to be regarded as the remains of the explorations of the first Spanish adventurers, or of a still earlier period. The occurrence of the remains of an altar looks like the period of Indian worship." (R3)

We have read nothing more on this mysterious shaft.

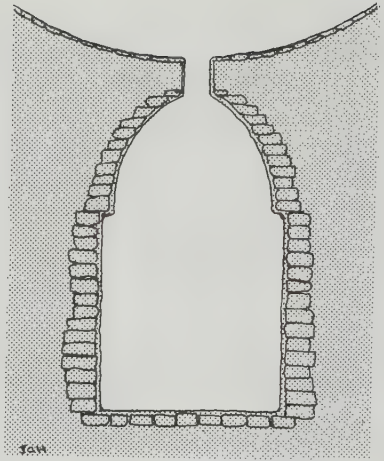
X2. Mesoamerica.

Mexico. An interesting but nonanomalous underground structure found in Mexico and Honduras is the chultune (or chaltune). Chultunes are stone-lined, vault-like, subterranean chambers communicating with the surface through short, narrow shafts. About 15 feet deep, early archeologists had to let themselves down into these bottle-shaped structures, contending all the while with bats, spiders, and snakes in their explorations.

Apparently, the Maya built some of the cruder chultunes for the purpose of extracting a type of white earth they called "zahcab." This was used to make stucco. The more elaborate chultunes, such as that in the illustration, were probably used as cisterns. (R10, R38)

We will not dwell upon the chultunes. They are well within the engineering capabilities of the Maya and have easily recognized purposes.

Mexico/Teotihuacan. One of the strangest subterranean structures in Mesoamerica is a tunnel---half-natural and half man-made---that snakes under the Pyramid of the Sun at Teotihuacan, near Mexico City. A few paragraphs written by D.



Section of a chultune. The Maya apparently constructed these stone-lined chambers to store water; that is, they were probably cisterns. (R10)

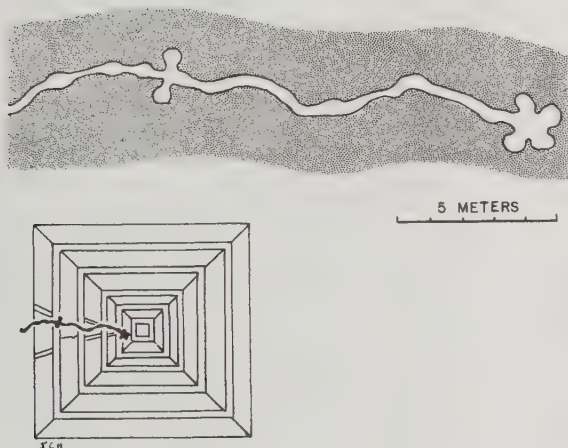
Heyden are appropriate here.

Toward the end of 1971 a depression at the foot of the main stairway of the Pyramid of the Sun in Teotihuacan was examined by Ernesto Taboada, then in charge of the archaeological zone, who found the entrance to a seven-meter deep pit that had been filled in with rocks and rubble many centuries ago. When cleared, it revealed an ancient, semi-destroyed stairway cut out of bedrock, leading down the pit. This man-made stairway led to a natural cave-tunnel penetrating the bedrock underneath the pyramid and ending in a series of chambers in the form of a cloverleaf. Like the main facade of the pyramid, the mouth of the tunnel faces west. Archaeologist Jorge Acosta of the Instituto Nacional de Antropología was in charge and consolidating the find.

Federico Mooser, a geologist of the Mexican National University's Institute of Geology and consultant to the Institute of Anthropology, examined the cave. In his opinion it is a natural formation, the result of a lava flow that occurred more than a million years ago. As it flowed into the Teotihuacan Valley, bubbles were formed, and when new lava flowed over them,

the bubbles remained as subterranean caves and often served as outlets for springs. The tunnel and four end chambers were formed in this way, although the latter show man-made modifications. In addition, two other chambers branch off on either side of the tunnel about midway. Ancient Teotihuacan man also plastered the walls with mud and roofed parts of it with basalt slabs. Some of these slabs are in situ on part of the ceiling.

The existence of this cave must have been known when the Pyramid of the Sun was built, inasmuch as the entrance to the 103-meter long tunnel coincides with the middle of the pyramid's original stairway (discovered recently by Acosta during *Son et Lumiere* installations) and the tunnel itself ends in a series of chambers almost directly under the center of the pyramid. (R23; R24, R31, R33)



The curious tunnel and adjacent chambers under the Pyramid of the Sun at Teotihuacan, near Mexico City. (R23)

The chambers contained basalt discs and clay vessels which had been broken intentionally. Obviously, the tunnels and chambers saw the enactment of many prehistoric, subterranean rituals; but what these were like we do not know.

Mexico/Monte Alban. The miniature tunnels discovered at Monte Alban, Oaxaca, are even more curious than the tunnel-chamber complex at Teotihuacan. These were described in Nature in 1933.

It remains only to describe what is up to the present the most remarkable feature of the site, of which the purpose is at present obscure. This is a series of stone-lined tunnels too small to serve as emergency passages, as was first suggested, and not apparently intended for drainage. The first was discovered at the close of last season's work, but its exploration left until this year. When it was entered on the resumption of work, it was found to be so small---20 in. high by 25 in. wide---that the explorers had to proceed stretched out full length on their backs and work their way along by elbows and toes. At a distance of 195 ft. in the tunnel a skeleton was found, accompanied by an incense burner, funerary urns and ornaments of jade, stone and turquoise as well as a few pearls. Some yards further the tunnel was found to be blocked and had to be entered again by a shaft sunk from the surface 25 ft. above for the purpose. A second skeleton was found 320 ft. from the entrance, just before the tunnel terminated at the side of the north terrace. It was found that a number of even smaller tunnels, not more than foot high, led into the larger tunnel. Of these one had tiny steps leading down to it.

Two further tunnels of similar character to the first were found, but packed with earth or clay. Finally, a complex of miniature tunnels was found to the east of the famous treasure tomb. All are stone-lined and some are less than a foot high. Some but not all, have the inverted V roof. The application of a smoke test revealed a number of unexpected exits. (R14)

A most logical question is: How were such miniature tunnels excavated and lined with stones seeing that they seem to be too small for normal-size humans to enter? One can easily see how stories get started about tiny people living in subterranean abodes!

Guatemala. Mesoamerica and South America have long been rumored to be honey-combed with long, mysterious tunnels. Sensational claims state that some of them run for hundreds of miles! It is understandable how such thoughts arise. Consider what D.H. Childress and a companion experienced when, using the services of a local guide, they explored a tunnel at Utatlan in the central highlands of Guatemala.

With flashlights and a torch, we cautiously entered the tunnel, following our guide. It had a high ceiling, twelve feet or more, and we followed it in for a hundred yards. Side tunnels branched off the main tunnel and our guide told us that they went to the main plaza and pyramid temple. At the end of one tunnel, it was obvious that someone had been burning incense in a prayer or to ask a favor of the ancient gods.

To the right, on one side tunnel, was a deep shaft that dropped down for twenty feet or so. Using my flashlight, I attempted to illuminate the pit. A tunnel seemed to extend from the south side of the pit. I asked our guide what this was.

He explained that it was a tunnel going south which was believed to go for several miles, under a river, and to the nearby fortress town of Paismachi.

I asked him if it might be possible to follow this tunnel all the way to Paismachi, a town eight kilometers or more away. He replied that it was not possible to go the entire way as the tunnel had collapsed at some point. George and I looked at each other with expressions of wonder. This was indeed a strange find, the first of many mysterious tunnel systems in North America I was to come in contact with. (R31)

dreds of miles through the mountains, as far south as Chile, and as far north as Ecuador or Columbia, as far to the east as the Amazon jungles! Rumors of tunnels, treasures, and hidden entrances are so numerous that I ran into them in nearly every country I visited. (R28)

The "researchers" of which Childress speaks are evidently not part of the archeological community. Our mainstream reference books on South American archeology do not mention tunnels of this sort!

Childress, however, does provide specific examples. For example, near the oft-photographed fortress of Sacsayhuaman (MSB in another volume) are strange caverns that are supposedly linked to the Temple of the Sun in Cuzco by a long underground passageway. At Cuzco itself, there are trapezoid-shaped tunnels leading to an underground labyrinth of tunnels that are filled, as in Indiana Jones films, with deadly hazards. Childress reports that the city police dynamited the tunnel entrance to prevent loss of life. (R28)

More recently, the big Lima earthquake of 1972 brought to light a tunnel system beneath that coastal city. During their salvage work, workers found long passages no one had ever known existed. The following systematic examination of Lima's foundations led to the astonishing discovery that large parts of the city were undercut by tunnels, all leading into the mountains. But their terminal points could no longer be ascertained because they had collapsed during the course of centuries. (R28 citing The Chronicle of Akakor, by Karl Brugger)

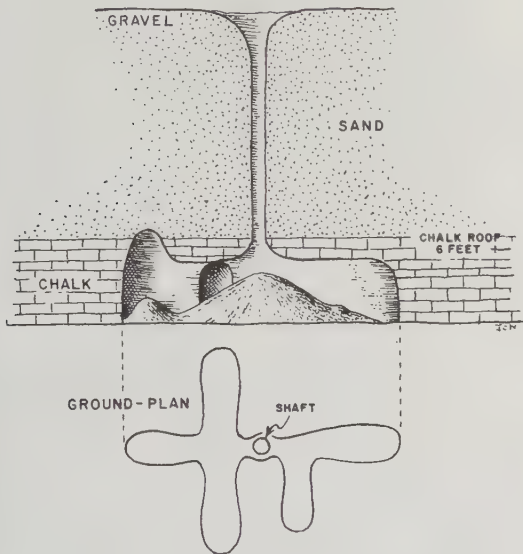
In several of his books, E. von Daniken also claims the existence of great tunnel networks in South America. We have never seen any professional literature confirming the reality of these vast tunnel systems. Certainly there are tunnels and natural caves used by the native peoples of Latin America, but it seems likely that their extent has been greatly exaggerated.

X3. South America. Continuing with the theme of vast subterranean tunnel networks in Latin America, we again quote D.H. Childress.

Stories of these treasures and tunnels abound in Peru and other areas of South America. Many researchers believe that these tunnels run for hun-

X4. Europe

Britain. As if there are not enough archeological enigmas above ground in Britain, the surface soils of Essex, Kent, and Durham are perforated with hundreds of shafts leading to geometrically arranged chambers carved out of solid chalk. These subterranean structures are called "dene holes." Most are 40-50 feet deep, but one pierces the chalk to a depth of 140 feet. Archeologists are still arguing about who built the dene holes and why.



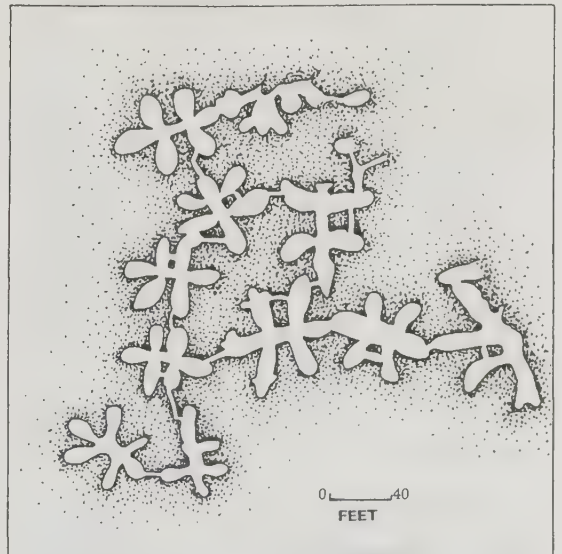
Cross section and plan of a typical British dene hole. (R8)

Dene holes have been the subject of much study; first, by the "natural scientists" over a century ago, and now by modern archeologists. Dene holes intrude upon the public's consciousness when the soil and debris that has been covering them for centuries caves in. Once humans or other animals fall into a dene hole, they cannot climb out. Examinations of some dene holes turn up skeletons of animals that have met this fate. Today, most dene holes are mapped and blocked up. Obviously, they cannot attract tourists like Stonehenge and Avebury, and we read little about them in the archeology books.

A most intriguing complex of dene holes exists not far from the Thames between London and Gravesend. A.L. Lewis described this group as follows:

At a place called Hangman's Wood, near Grays in Essex, on the north bank of the Thames, there were more than fifty of these "dene holes" in six acres; at this place the chalk is covered by a bed of Thanet sand, with a little gravel on the top, and shafts about three feet wide were sunk through these into the chalk below; foot-holes were cut into the sides of the shafts, some of which still remain. When the chalk was reached, oval chambers, usually six in number, each from 20 to 30 feet long, ten feet or so wide, and perhaps 20 feet high were cut in it, radiating from the foot of the shaft. In some cases the ends of the partitions between the chambers have been cut off and left standing. (R11)

In the accompanying plan of the Hangman's Wood complex shows the interconnection of some of the chambers. Usually, these typical "double trefoils" were not interconnected. Some dene holes were



Plan of the dene-hole complex at Hangman's Wood, Essex, England. Note the many subterranean interconnections. (R11)

much deeper; one at Elthan reaching 140 feet. Generally, the shafts were only about 2½ feet wide---a rather narrow fit for bringing up chalk rubble.

Chalk is a very soft rock, so the excavation of the dene holes never presented their diggers with any real challenges in this respect. The dene-hole enigmas have always been connected with "age" and "purpose." A 1955 item in *Nature* revealed the archeological uncertainties associated with these curious underground structures.

The age of the dene holes seems to be pre-Roman, and they are probably of the Iron Age. Many explanations have been given as to why they were made; but none is satisfactory. Underground granaries or stores have been suggested, or pits for obtaining chalk for agriculture; but, if the latter explanation be the correct one, why have they been so carefully made? Drainage sumps, places of worship, underground dwellings and secret refuges, or burial places have all been suggested from time to time. It would seem clear, however, that some connexion must exist between these artificial caves and the earth-houses of northern Scotland. But unfortunately we do not really know why these latter were made, either. (R17)

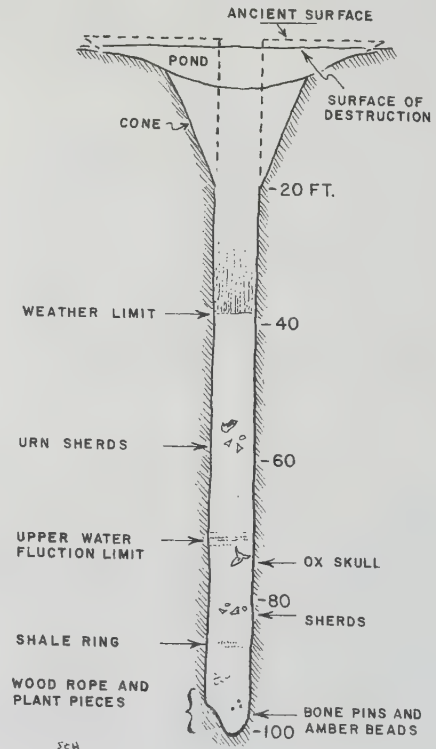
For years the "refuge" theory was applied to the dene holes. They were built, the reasoning went, to protect the populace during the many incursions of invaders from across the Channel. Today, the "chalk-mine" theory holds sway. It is certainly true that chalk improves the fertility of soils; but, when surface chalk deposits are available, as they are in some places, why dig shafts through the overburden and raise the chalk through narrow shafts? And would chalk miners bother to make those geometrically neat, double-trefoil chambers? The last words on the purpose of dene holes have not yet been written.

Britain/Wilsford. In the early 1960s, less than a mile from Stonehenge, archeologists excavated an unusually deep shaft that differed from the typical dene hole. The shaft was larger in diameter, of more sophisticated manufacture, and did not open up into chambers at the bottom. The marks of antler-picks and metal axes suggested that engineers of the Bronze

Age had been at work. (R18, R19)

P. Ashbee provided further details in a 1963 issue of *Antiquity*.

Excavation of the pond barrow at Normanton Gorse, Wilsford, disclosed the weathered top of a circular and vertical shaft which proved to be nearly 100 ft. in depth. Its fill, the result of natural silting processes, contained pottery in the upper part and, at the waterlogged bottom, broken wooden vessels and other objects, besides a mass of rotten wood, seeds, leaves and other organic remains. The dished and funnelled top of the shaft as well as the uneven sides were, for more than a third of their depth, the product of natural weathering. Below here distinctive antler-pick marks and the clear traces of a broad-bladed metal axe showed that the shaft had been dug in short sections, checked by template and plummet. No posi-



Section of the Wilsford Shaft, England. (R18)

tive trace of how the prehistoric engineers moved up and down their sophisticated shaft remained.

.....

The shaft was just under 100 ft. in depth from the estimated ancient surface and was almost 6 ft. in diameter. Some 2826 cu. ft. of chalk had been hewn out by the prehistoric engineers, which means that when broken up some 4945 cu. ft. of chalk rubble had to be brought up to the surface. The would presumably have formed the surrounding bank of the pond barrow. There were no traces at any point of beams or foot-holds. Thus access and egress as well as spoil removal can only have been via some form of winching or hauling gear. (R18)

Although the work of the diggers was halted by flooding, the Wilsford Shaft was probably not a well, for water was much easier to obtain by other means. It may have been intended as a deep grave, but we will never know.

Britain/Ipswich. Three, very deep, filled-in shafts were discovered at Ipswich in an area where brickearth was being mined. These shafts differ in several ways from the design of the dene holes, especially in the fact that they were deliberately filled in. In addition, one is eerily like the Oak Island "Money Pit" (cataloged in MSE4) in its contents and "defenses" against intrusion. Two of the three shafts have been excavated. We focus here upon Shaft Number 2, which is shown in the sketch.

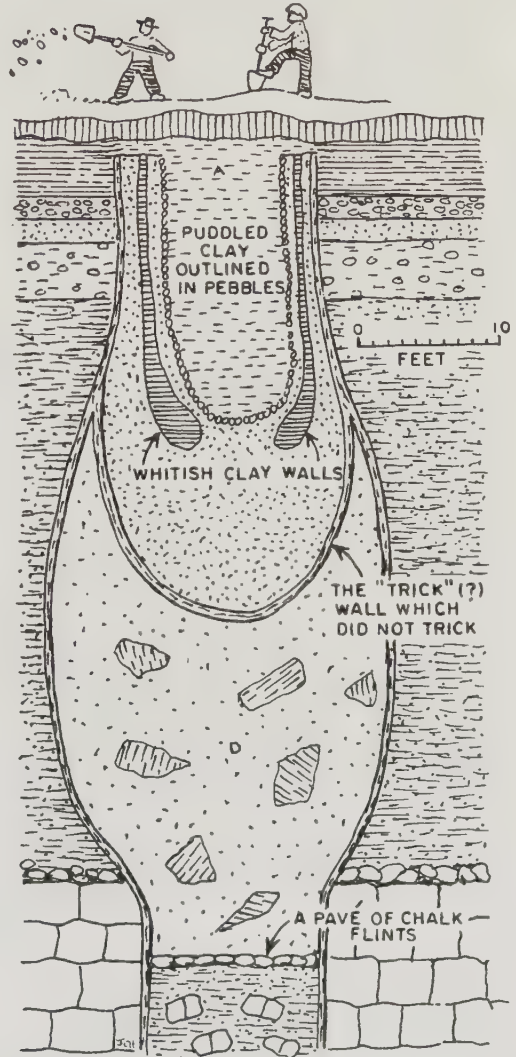
This presented a fundamental difference from Shaft Number 1, being some six feet in diameter, and filled in, as to its uppermost 18 feet, in a careful and elaborate manner. The center of the shaft, marked A, was composed of a pillar of puddled clay. some three feet wide, and with a rounded base, while its periphery was outlined with a layer of black pebbles [as indicated in the sketch], evidently procured from a deposit of these which occurs in the immediate vicinity of the shafts. Between the central pillar of core of clay and the main walls of the shaft, had been built two walls of whitish clay with a globu-

lar base (C).

.....

Below the 18-foot level the infilling was of a haphazard nature.

In both shafts Numbers 1 and 2 a



Cross section of one of three deep shafts discovered near Ipswich, England. The complexity and apparent attempts of the builders to deceive remind one of the Oak Island shaft. (MSE4) One can only guess at the purpose of this structure.

peculiar feature was observed, in that, at some considerable depth from the surface, the clay walls of the shafts coalesced, forming a basin extended over the whole internal area (D). It is difficult to explain this, but it may represent a device to induce any later excavators of the shafts to imagine that they had reached the bottom, and thus abandon their enterprise. In the present case, however, the use of metal probe at once showed that the shafts extended downward below the clay basin and the work of excavation proceeded. (R15)

Upon reaching the level of the chalk, the shaft began to fill with water at the rate of 15,000 gallons per hour---much as at Oak Island (MSE4)---and the work had to be terminated without ever reaching the bottom.

But when the top of the chalk was reached, the excavators came across two pieces of silver sheeting such as that used in the fittings of old treasure chests and caskets. Also, covering the shaft walls at this level was a 3-inch layer of unctuous clay containing hair and considerable organic matter. It was surmised that this strange substance might have come from animal (human?) sacrifices.

Some pieces of brick found deep in the shaft seemed to be of Roman origin. The shafts are also near a Roman graveyard. For these reasons, the Ipswich shafts were compared to some early Roman burial shafts called "puits funeraires" located in France. Some of these French structures penetrate as deeply as 120 feet. (R15)

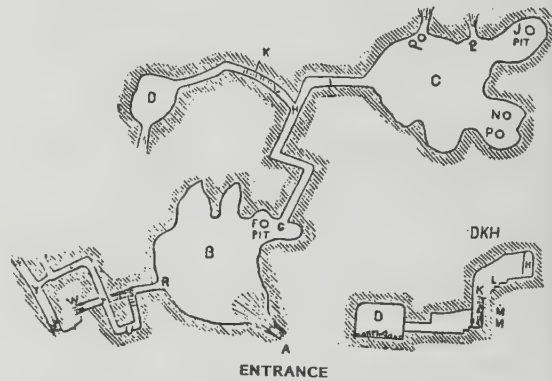
But what was the purpose of all the layers of different materials used in filling the shaft?

France. Besides the "puits funeraires" just mentioned, the countryside of France conceals some impressive subterranean structures. Called "gueriments," these are complexes of tunnels, galleries, and chambers that have been cut out of the solid chalk--like the dene holes but on a grander scale. We quote from a translation from La Nature that appeared in the Popular Science Monthly.

The chalk of Beaumont, stretching south of Chatellerault, resembles a vast ants'-nest, so numerous are the

galleries with which it is honeycombed. The one that I am about to describe is at a place called La Fuye, and it is only a few hundred yards from the old Roman road between Colombiers and Jaulnay. We went down into a hole, A, overgrown with bushes, that looked very much like a fox's hole, and came upon a large hall, B, on which abutted the passages G and R. [See sketch.] The passages are of about the height of a common-sized man, but less than two feet wide. They appear to have once been tightly closed by doors and fortified by beams. After going in about a hundred metres, and making a number of turns, I came to a sudden descent, and fell into the hole K (see the section DKH). (R5)

We omit the the text describing the remainder of the "gueriment" and refer the reader to the sketch.



A French tunnel-chamber complex. These "gueriments" are carved out of the solid chalk. (R5)

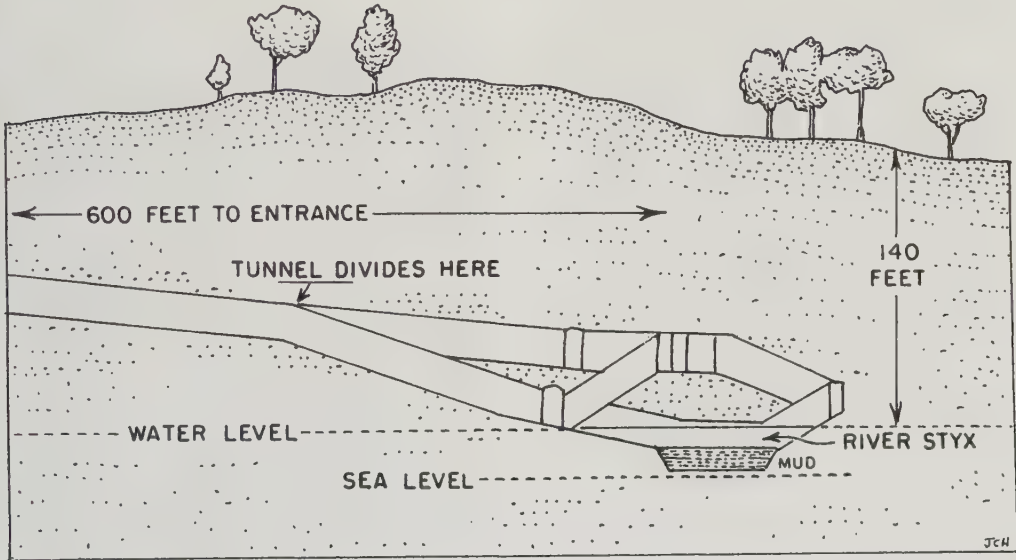
The construction of all the "gueriments" is analogous to that of this one. They are cut in the rock itself, and consist of large chambers connected by narrow galleries, and present a striking similarity of aspect to those dwellings which insects hollow out in the trunks of trees. (R5)

Italy. In his Aeneid, Virgil described the entrance to the underworld and a strange tunnel that led down to the River Styx, where Charon awaited to

ferry souls across. In Italy, there seems to be a reasonable facsimile of this legendary tunnel.

The real-life version of the ancient tale begins under an old temple on the Gulf of Baiae, near the Isle of Capri. In 1962, R. Page and K. Jones found an obscure entrance and had followed the tunnel for 200 yards when they came upon an underground river (the Styx?). They were then 140 feet below the surface. Other tunnels in the complex led to an "Inner Sanctum." All told, some 290 yards of tunnels had been cut out of the solid rock. The passageways were 21 inches wide and 6 feet high. (R32)

What makes the Samos tunnel so remarkable is the fact that Eupalinus began work from both side of the hill and somehow managed to have the separate tunnels join almost precisely in the center. The tunnel is almost 5,000 feet long, with just a slight jog in the middle. Just how Eupalinus managed this feat without modern surveying instruments is not completely understood. (R6, R7, R32)



Under an old temple on the Gulf of Baiae, Italy, researchers discovered this enigmatic tunnel complex hewn out of the solid rock. (Adapted from R32)

Greece. In the late Sixth Century B.C., a Greek "civil engineer," named Eupalinus, oversaw the excavation of a tunnel on the island of Samos for the purpose of transporting fresh spring water to the city of Samos. The tunnel pierced a hill 600 feet high and was carved through solid rock. The ancient Greek historian Herodotus called the Samos tunnel the "greatest building and engineering feat in the Greek world."

X5. Middle East

Israel. A great shaft cut in the solid rock was discovered at Tell Duweir in 1935. It measures 90 feet in depth and 85 by 70 feet in cross section. Because work on it evidently ceased before its completion, its purpose remains a mystery. It probably dates from the Sixth Century B.C. (R16)

Iran. Part of this country is underlain by a truly immense network of ancient, underground, water-carrying tunnels. All the tunnels, called "qanats," taken together measure a fantastic 170,000 miles! (R32) The qanats are described more fully in MSC3.

Just as "fantastic" as the qanats is the "well" now described.

In the neighborhood of Shiraz, on a hill an hour's ride to the northeast, the traveler comes upon some wells which would also seem to date back to the days of the Great King, for the labor involved in their construction certainly points to a dynasty more magnificent in its undertakings for the royal pleasure than either the Parthian, the Sassanian, or the Arab. Near the top of this very precipitous hill, with no trace of masonry to mark the site of fort or palace, there yawns an opening, perfectly rectangular, about eight yards by six, which is the mouth of a well going straight down into the bowels of the mountain. The shaft is cut in the live rock, the sides are as perpendicular as the plumb line could make them, and the depth, as ascertained by the time of a falling stone, something under 400 feet, the bottom at present being dry. Within a distance of 50 yards on the same hill are two other similar wells; and local tradition asserts that there is underground communication among the three. (R40)

X6. Asia

India. In his marvelous and entertaining book Ancient Inventions, P. James provides the only information we have found so far on some unusually elegant, rock-cut tunnels in India.

At Ellora, in western India, six miles of underground tunnels were chiseled out of solid rock between A.D. 200 and 600. Their facades decorated with intricate sculptures, these Indian temples remain the world's most beautiful and elaborate tunnels. Surprisingly the oldest Buddhist examples, dating from the Second Century B.C., are also some of the most sophisticated, something that particularly struck

Peter Brown, an authority on ancient Indian architecture: "Strangely enough there are no evidences of experimental undertakings or trial cuttings, no gradual growth, no progressive stages ...the art emerges in a fully matured state. In fact the earliest examples are the most perfectly aligned, planned and wrought of all these excavated halls, with every line mathematically straight and every angle true." (R32)

Although relatively recent, we can not pass by such beautiful and mathematically perfect examples of subterranean engineering.

X7. Africa

Egypt. The ancient Egyptians carved many tunnels and chambers out of solid rock, particularly in the Valley of the Kings. Amidst all these fine examples of the rock-cutters' art it is difficult to find anything anomalous; that is, anything that challenges our views of the engineering capabilities of the ancient Egyptians. So far, only one large shaft seems worthy of cataloging. This is the so-called Campbell's Well. D.H. Childress described it as follows:

A strange shaft on the Giza plateau between the Pyramid of Chephren and the Sphinx is known as Campbell's Tomb or Campbell's Well. This shaft is now blocked by a grate, but one can still look down it. The shaft is about 15 feet square on each side and about 100 feet deep. On each side of the walls, one can see numerous tunnels, passages and doors cut into the solid rock. These passageways are part of the tunnel system that goes beneath the Giza plateau. It is purposely dangerous to attempt to reach the pyramids or the secret underground rooms that can be found in the tunnels. Their existence, and what lies within them, is a matter of legend and prophesy. (R30)

Someone must have checked out this shaft and associated tunnels before installing the grate, but we have seen nothing else to date.

X8. Oceania

Micronesia. In his many travels, D.H. Childress has personally explored many real tunnels and, in addition, collected tales and rumors of many more. One in the "rumor" category is said to pierce a mountain on the island of Paata, near Truk (or Chuuk). Apparently, this tunnel was built before the Japanese occupation of Micronesia. (R37) no further information available.

Childress also states that the megalithic complex of Nan Madol, Pohnpei, includes a system of tunnels that connects the various islets. According to Childress, tunnel entrances are to be found on many of the islets. (R29)

Easter Island. This isolated corner of Polynesia presents more mysteries than the huge sculptured heads the the Poike Ditch. (MSW1-X7) In his popular book Mysteries of Easter Island, F. Maziere briefly describes some tunnels and galleries that seem worth recording. The location is near the Rano-Raraku quarry and statue "workshop."

At the top of the volcano's lip, standing more than six hundred feet over the sheer drop, there opens a series of holes and communicating galleries. all cut by human hands. These holes are about three feet across and a little less in depth and they follow one another at regular intervals. Another range of holes, rather lower down, has the gap between the holes pierced by an inner gallery that has been very polished by wear. (R20)

Maziere wonders if these holes may have been lookout posts or part of a solar observatory!

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MSE4

The Oak Island Shaft and Tunnels

Description. The presence on Oak Island, Nova Scotia, of a mysterious, very deep shaft protected by long tunnels that flood it with seawater. This shaft-tunnel complex represents an incredible engineering accomplishment, even if it turns out to be only a few hundred years old.

Data Evaluation. The Oak Island "Money Pit" has engendered a host of sensational magazine articles, a long succession of failed attempts to get at the presumed treasure, but no serious scientific study that we know of. Rating: 3.

Anomaly Evaluation. In assessing the anomalousness of the Oak Island shaft-tunnel complex, we first assume that it was constructed within the past 400 years. This being true, it is still a remarkable engineering structure, certainly worthy of the attention of archeologists, but probably still within the capabilities of people living in the assumed time period. Rating: 3.

If, however, the complex is much older, say, dating from medieval times, we have a first-class anomaly on our hands, because the complex would predate

European contact and any indigenous North American cultures likely to dig such large shaft-tunnel systems. The reality of a second set of deeper tunnels in the bedrock would further enhance the mystery. Rating: 1.

Possible Explanation. The "pirate" solution remains the best guess, but these pirates must have been inventive and skilled in engineering---more so than any pirates we know about.

Similar and Related Phenomena. The Great Pyramid, with its concealed entrance and rock-sealed passageway, used similar defensive measures. Similarities also exist in the Ipswich shafts (MSE3-X4).

Entries

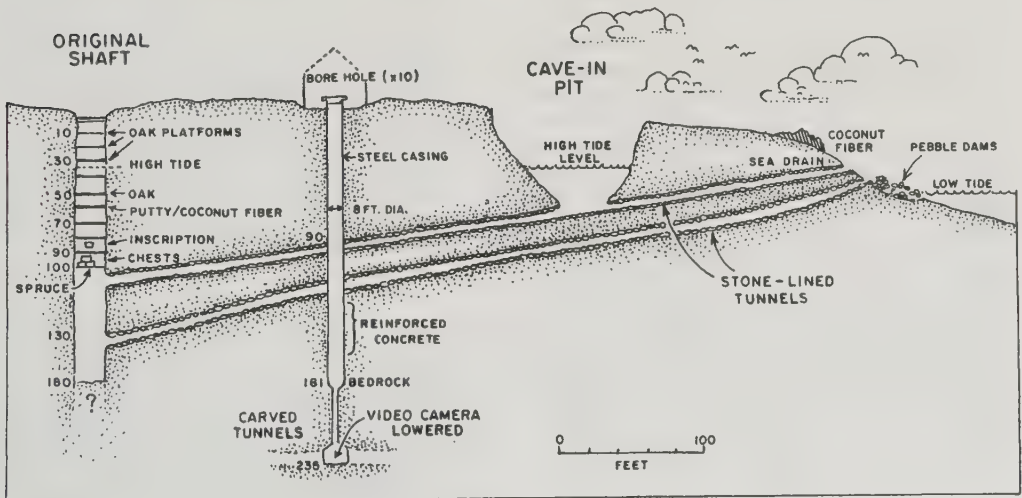
X0. Introduction. We separate the Oak Island Money Pit as its associated tunnels from the general survey for four reasons:

- (1) Its uniqueness and complexity;
- (2) Its potential high anomalousness;
- (3) Its probable recency; and
- (4) Its neglect by the scientific establishment.

In other words, it is in a class by itself and deserving of separate treatment.

X1. General observations. No treatment of mysterious shafts and tunnels can avoid discussing those on Oak Island, just off the coast of Nova Scotia. It is on this peanut-shaped, mile-long island that we find the famous "Money Pit." No one is sure there is any money at the bottom of this curious man-made shaft, but millions of dollars have been spent attempting to find out. An anomalist is not so much interested in the assumed treasure; it is the engineering of the shaft and the associated tunnels that is of scientific importance.

It is difficult to judge the anomalousness of the Oak Island structures because we have no knowledge of who



Sectional view of the famous Oak Island shaft-tunnel complex. Despite the expenditure of millions of dollars, no one has ever found any treasure or purpose for this structure. Whatever its purpose, it is an engineering masterpiece for its time. (Adapted from R1)

dug the shaft and tunnels or when the task was completed. We do know that the structures are at least 200 years old, because it was in 1795 that two boys came across the filled-in shaft. It was all too easy to believe in those days that pirates had buried a fabulous treasure down below. The boys began digging and were soon joined by others and, over two centuries, by many others. Of course, if someone actually had found a chest of gold a few feet below the surface, there would be no anomaly.

The problem is that no treasure has ever been found in the Money Pit, even though many have tried. Instead of doubloons and jewels, every 10 feet or so, excavators found log platforms sealed with coconut fiber and a putty-like substance. (See sketch.) To the diggers, this only raised the ante. Surely, whatever was buried had to be of extraordinary value for the pirates--- pirates are always assumed---to go to all this trouble.

At 90 feet, a large rock slab bearing an undecipherable "inscription" was found. Eventually, digging was hampered when the shaft was flooded with seawater that rushed in through two stone-lined tunnels leading in from the shore.

Now, the anomalousness of the Money Pit begins to take form. Digging a 90-foot shaft is certainly within the capabilities of humans living 200-300 years ago, but building those deep tunnels all the way to the shore betokens an immense investment of labor and considerable engineering expertise. And all that coconut fiber had to be hauled in from at least 1,500 miles away. The Oak Island shaft and tunnels do not seem to be the work of pirates, who are not known for engineering skills.

Carbon-dating of the shaft's upper platforms, which were built of oak, yielded dates from 1550 to 1600 A.D.; dates consistent with the pirate theory. However, deeper spruce platforms, below 100 feet, made of spruce, dated from 860 to 1135. If these earlier dates are accurate, the mystery deepens, to use a pun! Who was digging up Oak Island during medieval times? We can hardly

believe the Vikings would have dug the shaft and, in addition, sailed into tropical waters to gather coconut fiber---or could we? Speculations like these make the Oak Island enigma prime grist for sensational magazines and TV documentaries.

In the 1960s, using modern drilling equipment, another shaft was sunk near the original shaft. Eventually, a depth of 235 feet was attained. Amazingly, a video camera lowered to the bottom of this second water-filled hole sent back apparent images of still more tunnels carved into the solid limestone bedrock. These seemed to be cribbed with wood. A logical question asks if this lower set of tunnels is really artificial. Limestone is easily dissolved and often honey-combed with caves, tunnels, and other solution features. S.M. Trento, our major information source on Oak Island, wonders if this lower set of tunnels might have been carved out 12,000 years ago when sea levels were much lower. Perhaps, he adds, we are dealing with two different mysteries from two different times! In this light, the Money Pit becomes highly anomalous.

If even just half of what is asserted about the Money Pit and its subterranean structures is true, we have a truly profound mystery off the coast of Nova Scotia. But can we really believe all that is asserted about the shaft and tunnels? Unfortunately, we know of no careful scientific study of the Oak Island "problem."

It doesn't help that the Money Pit is now a tourist destination complete with its own museum. It is now difficult to separate fact from advertising hype, not to mention the wild surmises and many sensational articles that magnify the Money Pit's aura of mystery.

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MSE5 Remarkable Ancient Mines and Quarries: A Survey

Description. Ancient mines and quarries of more than usual interest because of:

- (1) The surprising size of some of the works;
- (2) Their extreme ages (over 10,000 years in some cases);
- (3) Unexpected target minerals for the time period (e.g., manganese in ancient Africa);
- (4) The precocious use of sophisticated mining techniques; and
- (5) Implications of an ancient world-wide commerce in metals; i.e., before the Christian Era.

Data Evaluation. Many of our references are over a century old, especially for North America. This may be because many ancient mines have been erased by farming, modern mines, and erosion. Nevertheless, the archeologists of a century ago were diligent and observant, and the age of our references is not a serious consideration here. More significant is the lack of information for ancient mining in Asia, South America, and Australia. Our files are virtually nonexistent here.

Rating: 2.

Anomaly Evaluation. Emphasis in this section is on North American mining before the arrival of Europeans. Almost invariably, these early mines are primitive in nature. We find them "interesting," mainly for their size, but hardly anomalous. The great scope and antiquity of metals-mining in Africa suggests that foreign miners journeyed to Africa for gold, copper, and even diamonds long before the Christian Era. This implied vast, ancient, near-global commerce is not a main-stream view. In this light, the mines and quarries mentioned below are mildly anomalous. Rating: 3.

Possible Explanations. So important to early cultures were flint, quartzite, metals, and other materials that great, prehistoric trading networks existed on both land and sea for their distribution.

Similar and Related Phenomena. Dene holes, shafts, etc. (MSE3); Lake Superior copper mines (MSE6).

Entries

X0. Introduction. The human lineage has been extracting minerals for use in weapons, hammers, cutting tools, etc., for hundreds of thousands of years. Few of these prehistoric mining operations challenge any archeological or anthropological paradigms. Consequently, mining and quarrying anomalies are exceedingly rare.

For this "survey" section, we have winnowed out a handful of ancient mines that are distinctly out-of-the-ordinary because of their size, age, mining techniques, and/or target minerals. At the most, they can be rated as only "curious"

or "interesting." Only in the vast copper mines around Lake Superior, in North America, do we see an important potential anomaly, and this we reserve for MSE6.

X1. North America. Prehistoric mining in North America was decidedly on the primitive side. Mostly, the very early Americans were after lithic materials from which they could fashion weapons and tools.

Their mining efforts were largely confined to surface pits.

Pennsylvania. One of the more impressive prehistoric mining areas of eastern North America is located near Allentown, in eastern Pennsylvania. The material of value there is jasper, an iron-rich, siliceous, cryptocrystalline stone that can be readily turned into spearheads, perforators, knives, arrowheads, and scapers. As H.C. Mercer put it:

This many-colored stone with its smooth, conchoidal fracture stood somewhat in the same relation to the North American Indian that iron stands to us. (R6)

H.C. Mercer was, in fact, the archeologist who first recognized the importance of the prehistoric jasper quarries of eastern Pennsylvania. Even though many of the quarries were already overgrown and filled-in in his day (late 1800s), he was greatly impressed with the magnitude of the labor expended at two of the sites.

But at others, as at Macungie and Vera Cruz, the passer-by would halt in amazement. The appearance is too unusual, the work too vast---one hundred to one hundred and fifty pits, some of them fifteen and twenty feet deep and one hundred to one hundred and fifty feet in diameter, is no everyday sight. Again, the tinted flakes and refuse heaps tell the tale, and the neighboring wheat field glistens with fragments, yellow, blue, purple, red, lavender, and veined in many hues. The forest, too, has set its stamp of age upon the scene, and an old chestnut stump growing on the side of one of the excavations, upon which we counted one hundred and ninety-five rings, proves that the workman must have abandoned his shaft to the growth of the underbrush about the time (1682) that William Penn bought his first tract of land from Indians on the Delaware. (R6)

A century later, research by J.W. Hatch and P.E. Miller at the Vera Cruz jasper quarry showed that jasper had been mined there for about 10,000 years---long before the Moundbuilders---and transported to places as far away as Massachusetts and Virginia. (R26)

Eastern North America. We do not usually think of American Indians as drillers of oil-wells, but there is ample evidence that they did dig deeply into the earth to collect petroleum.

Oil Creek flows near Titusville, in the northwestern corner of Pennsylvania. Oil is near the surface here, and seeps were common in prehistoric times. In fact, the first American oil well was sunk in this area in 1859. But as related by J.W. Newberry, American Indians had been there long before.

When drawn to Titusville by the first successful oil wells, I was struck by the peculiar pitted surface of the soil of the forest which covered the bottom lands of Oil Creek. The pits were ten feet or more in diameter, and two to three feet deep, contiguous, and innumerable. Subsequently I discovered that each of these funnel-shaped depressions marked the site of an ancient well, sunk through the alluvial deposits, but not into the rock. One of these, just opened in an excavation for a new oil well, showed a pit twenty-seven feet deep, cribbed up with timber, and containing a rude ladder like those found in the Lake Superior copper mines. The timber used for the inclosure of the ancient pit had been cut with a blunt-edged instrument, doubtless of stone.

I afterward found similar pits in the oil regions of Kentucky and Tennessee, at Mecca and Grafton, Ohio, and at Enniskillen, in Canada. In the latter locality the oil was obtained by sinking pits to the depth of forty or fifty feet in the Drift clay, the oil issuing from crevices in the underlying rock and accumulating beneath the clay. In the excavation of one of these pits an ancient one of similar character was brought to light. This was filled with rubbish, twigs, leaves, etc., and a pair of antlers was taken from it at a depth of thirty-seven feet. The antiquity of this pit, like those of Oil Creek, was proved by the large trees growing over it. (R5)

Newberry wondered if the Moundbuilders had been after the oil, but it remains uncertain just who sunk the first pits. Dating of a wooden stake from one of the pits yielded dates between 1415 and 1440 A.D.---well before the arrival of Europeans and the Senecas. The Sena-

cas, however, did value the oil for tonics, salves, purges, and as a mosquito repellant. Apparently, these later Indians simply passed feathers through the oily standing water and then wiped the adhering oil into containers. Actually, "Seneca Oil" was a commercial product in colonial days! (R28)

Earlier Indian tribes had evidently dug the deep, cribbed pits---probably for the same purposes as the Senecas. There is no archeological evidence that any American Indians used oil for fuel.

North Carolina. Mica was prized highly by the American Indians, especially the Moundbuilders of the Mississippi Valley. They cut the mica sheets into ornaments and, probably, mirrors. When their mounds were opened up, the contained skeletons were often wholly or partially covered with mica sheets, implying that this strange mineral had some religious significance.

Scores of prehistoric mica mines exist in western North Carolina. These are usually shallow and confined to the softer mineral veins which could be excavated with stone tools. Even so, the primitive miners were very productive. On at least one occasion, a buried cache consisting of several cartloads mica sheets was found near one of the mines. (R1)

The sheer magnitude of prehistoric mica mining in North Carolina is impressive enough, but, in 1875, near Guyer, one pit yielded some surprising artifacts. This particular pit was different from the usual crude surface excavations. Some digging proved that it was a shaft about 50 feet deep. At the 40-foot level, a short adit (horizontal tunnel) was uncovered. It was while clearing this deep shaft that workers discovered several iron implements, including an ax head! Prehistoric American Indians did not use iron.

The inference to be drawn from the discovery of these iron relics, is, that some of the "old diggings" are the work of Europeans, as the use of iron was unknown to the native American races. Is it not possible that there is a basis of truth in the old Cherokee tradition? That a party of Spanish explorers---and perhaps more than one---penetrated Western Carolina in search of gold, silver and other minerals, and, in some instances, finding the old mines of the Moundbuilders, caused



Iron implements found in an old North Carolina mica mine. Although North American Indians prized and quarried mica, they did not employ iron tools like these. (R1)

preliminary investigations of their value, does not seem improbable. In Cherokee county are found "prospect holes" excavated with far greater skill than that of savage or barbaric miners. To what expedition these Europeans belonged is a mystery. (R2)

Actually, De Soto's expedition almost reached North Carolina.

Arkansas. Novaculite is a hard, dense, siliceous rock which, like the jasper mentioned above, was prized for the manufacture of arrowheads, spearheads, and cutting tools. Its popular name is "razor stone." Arkansas, from Little Rock to the western border of the state, abounds in novaculite.

Usually, the Indians worked only those rock masses that had become detached from the outcroppings. They made abundant use of this easily procured mineral.

Everywhere the aborigines found and worked these transported masses, and hundreds of square miles are strewn with flakes, fragments, failures and rejected pieces, and the country around, from the mountains to the Gulf, is dotted with the finished forms that

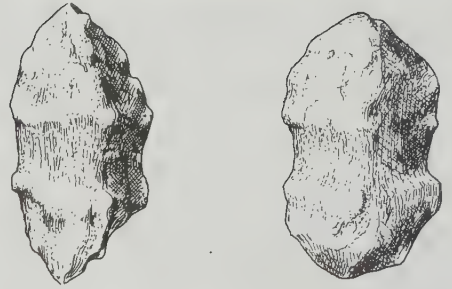
have been used and lost.

The natives did not stop, however, with the utilization of detached and transported masses. Not finding upon the surface material in suitable quantities, they essayed to quarry it from the hills, and the recently discovered evidences of this work are of unusual interest. The quarries surpass in extent any similar achievements of the aborigines in this country, if not in America. (R4)

Novaculite quarries are common on a ridge just east of Hot Springs. One of these excavations is 150 feet in diameter and about 25 feet deep.

The American Indians mined novaculite wherever they could find it, but these mines in Arkansas seem to be the most extensive.

Missouri. In 1903, operations at an iron mine near Leslie, Missouri, uncovered evidence of prehistoric mining of the same deposit. The body of iron ore, which measured about 100 feet wide and 150 feet long, was found to be honeycombed with narrow, sinuous tunnels. In addition, there were crudely shaped masses of hematite and other hard rocks that had obviously been attached to handles for use



Rude, hafted mining tools found in an ancient Missouri hematite mine. (R7)

as sledges.

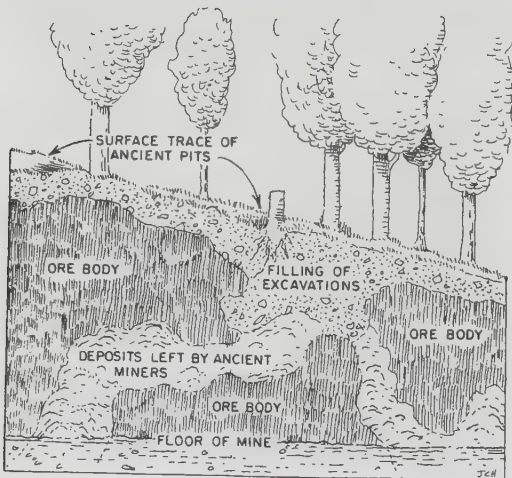
Since iron was not in use by American Indians when Europeans arrived, it was first conjectured that the early miners were after the hematite for use in making implements of some sort. But there was no evidence that the hematite was employed for anything but the sledges. The prehistoric miners were after something else.

It was observed, in approaching the mine, that the exposed surfaces of the ore and the ground about were everywhere a brilliant red. The workmen were red from head to foot, and any one venturing to handle the ore soon found his hands smeared with red oxide, repeated washing being required to remove it. The prevalence of the red color suggested at once the idea that the site had been an aboriginal paint mine and that the red and yellow oxides were mined and carried away to be used as paint---an article of utmost importance in the aboriginal economy. (R7)

As the modern miners broke up the ore body with dynamite, they came across many pockets and seams of red and yellow oxides as well as some purplish iron ore.

Wyoming. The Spanish Diggings of southeastern Wyoming were named in the belief that the hundreds of pits had been dug by Spanish from Mexico looking for gold and silver. However, as far as is known, the Spanish never reached Wyoming. In fact, the Spanish Diggings had been dug by Native Americans beginning as early as 2,000 B.C.

The materials of value at the Spanish Diggings were chert and quartzite, both



Tunnels and borings dug by American Indians near Leslie, Missouri, in their search for the red and yellow oxides accompanying a hematite deposit. In other words, this was a "paint" mine! (R7)



Aerial view of a portion of the "Spanish Diggings," a huge prehistoric chert and flint quarry in Wyoming. (J. Saul)

of great value in primitive cultures. There was plenty of both in southeastern Wyoming. The Spanish Diggings constituted the largest source of these materials of this sort in North America, rivaled only by the Alibates Flint Quarries near Amarillo, Texas.

The Spanish Diggings consisted of many separate quarries spread out over a triangular area of approximately 500 square miles. J.M. Saul has provided a generalized description of them.

Spanish Digging quarries are usually found in groups of two or three up to several hundred in number. Counting the number of pits at a given locality is not a productive task because individual quarries have been merged and have been dug within older pits and in older (rock) refuse piles. Some quarries have been filled in with both quarry debris and soil until they are no longer recognizable. A small quarry area may be only 10 to 20 feet (3 to 6 meters) from east to west and 363 feet (110 meters) from north to south. (R21)

The chert and quartzite of the Spanish Diggings were used by the Clovis people, perhaps 10,000 years ago, but they probably did not actively mine these materials. They easily found enough for their purposes on the surface.

South Dakota. Flint Hill, one of South Dakota's Black Hills, is a smaller version of Wyoming's Spanish Diggings. Its name, however, is misleading, because prehistoric man mined quartzite there, not flint. If there had been flint at Flint Hill, the Indians would have preferred it to the quartzite, which is satisfactory for making larger, sharp-edged tools but not the delicately flaked arrow- and spear-heads.

Even so, the scope of prehistoric work at Flint Hill was impressive.

Flint Hill is a bald isolated ridge which nestles between deeply eroded pine-clad canyons, the steep walls of which form an almost unsurmountable barrier to the quarry. The elevation of the ridge is some 4,200 feet above sea level. However, to the few undaunted individuals who have ventured to scale the steep walls, their efforts have been well rewarded with a most unusual sight. Over the surface of this bald ridge, covering an area of more than one hundred acres, are the remains of countless trenches and pits that have been battered to depths of four to ten feet by the Indians in their search for suitable rock. Thousands of tons of rock have been moved during the course of these operations. Pits and trenches are in evidence everywhere. Some are still open while others are filled or partially filled with

waste rock. To look upon this vast area of pits and heaps of spalls one can hardly help but wonder how it had been accomplished and how long these activities had continued. (R15)

Texas. The Alibates Flint Quarries, 35 miles northeast of Amarillo, were known to the Clovis people some 10,000 years ago. These quarries were worked right up until Europeans appeared with their superior metals. Indians from as far away as Wyoming and New Mexico journeyed to Alibates to procure flint "blanks," which they carried home to be chipped into weapon points, knives, etc.

Unlike most European flint, which occurs as nodules in chalk beds, Alibates flint is found in a vein 50-400 feet wide and almost a mile long. This material was in great demand because it was superior to quartzite, novaculite, and jasper for processing into weapons. (R19)

As at the Spanish Diggings and Flint Hill, the marks of prehistoric mining are seen everywhere at Alibates.

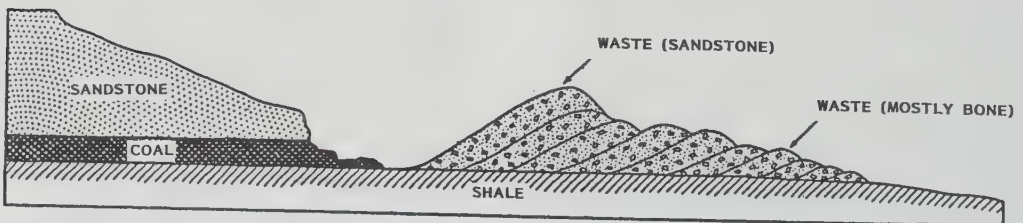
Quarry evidence at the Alibates site is of two kinds. First, there is an enormous concentration of flint chips, flakes, and cores mixed together with occasional large hammerstones, scrapers, knives, and points which litter the ground. In places this deposit is several feet thick. The debris is sporadic in distribution. It occurs mostly on the sides of some of the hills and in more favored locations, although the chips can be found almost anywhere. Second, the sides of many of the hills are pitted with depressions 5 to 20 feet across which are now almost filled with top soil. The depressions which are 1 to 2 feet deep represent the prehistoric quarry sites. In fact some of these hillsides look from a distance as

if they had been peppered with artillery concentrations. (R17)

Arizona. North American Indians only very rarely used coal for fuel. The major exception is the Hopi culture, which strip-mined exposed coal beds in the Jeddito Valley, in northeastern Arizona, between the Thirteenth and Seventeenth Centuries. It is estimated that over 100,000 tons of coal were mined in this period; about 90% for use as fuel in homes, the rest for firing pottery. The Hopi mining methods were elementary.

The simple technique of ancient mining consisted of removing the overburden and excavating the coal. The waste was piled behind the mining face. The result of mining was to leave an area stripped of coal and overlying rock, piled high with heaps of waste material. When the overburden became very thick the mine was abandoned, but in at least one area mining by underground methods was used. (R14)

Utah. Much more mysterious than the Hopi strip mines were two ancient tunnels discovered in a modern coal mine at Wattis, in central Utah. The two tunnels were encountered in a coal seam about 8 feet thick. The long-abandoned tunnels were 5 to 6 feet high and about as wide. That they were very old was obvious because the coal was much oxidized and the tunnels themselves had deteriorated badly. Besides the tunnels, the several miners who dared to venture into the old tunnels said that rooms had been chiseled out of the coal on either side. Assuming that the tunnels ran straight, they would have exited the mountain some 450 feet away. This part of the mountain was searched but no portals were found. This was not surprising because erosion would have



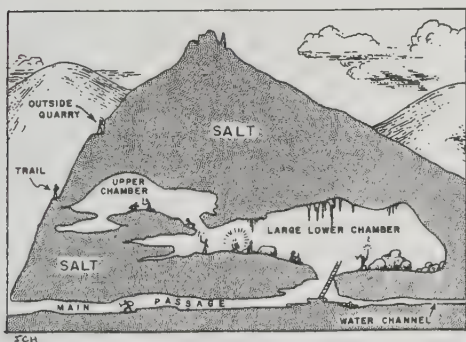
Cross section of a representative strip mine developed by Hopi Indians. (R14)

concealed the entrances in just a few years.

The anonymous author of the source article in Coal Age concluded as follows:

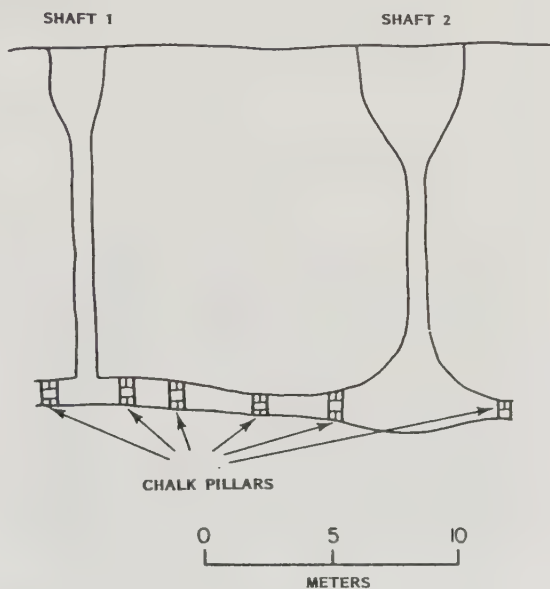
I doubt that these tunnels are the work of any American Indian of whom we have a written or archaeological record. In the first place, such works would have required some immediate and local need for coal. It is not reasonable to suppose that extensive tunnels would have been driven to produce coal for export to distant parts of the state because, before the white man came, transport was by human cargo carriers, or porters, and long-distance movement of heavy loads was impracticable. As for local use, there is no reported extensive burning of coal by aboriginals in the region of the Wattis mine. (R16)

Nevada. In Clark County, Nevada, rises a hill of almost solid rock salt. There are signs that American Indians mined this deposit at least 2,000 years ago, probably even earlier. No serious excavation was required by them. The mining was done in caverns that had already been dissolved out of the salt mass. Entrance to the caverns was through a narrow, tortuous channel that had also been cut by running water. (See sketch.) The prehistoric miners had left behind hundreds of stone picks and hammers with which they had scraped and broken off chunks of salt. (R11)



Prehistoric salt mine south of St. Thomas, Nevada. Running water had carved out most of the tunnels and chambers, so little excavation was required. (R11)

X2. Europe. Europe has been occupied by hominids for hundreds of thousands of years. Apparently, the Neanderthals did not do any serious mining, but the Cro Magnons that followed them began to extract flint nodules from the great chalk deposits of Britain and Western Europe. And as the Neolithic made way for the Bronze and Iron Ages, copper, tin, and iron began to be mined in increasing quantities. Given the recognized intelligence and industry of these later hominids, their mines cannot reasonably be characterized as anomalous. However, for purposes of background and comparison with New World mining activities, a few short paragraphs on early European flint mining are in order.



Shafts and galleries in chalk made by European flint miners at Spiennes, in Belgium. (Adapted from R25)

General observations. Flint has been mined in Europe since Paleolithic times. The massive chalk deposits of Western Europe were quickly recognized as a source of valuable flint nodules. In south-western Britain, at a place called Grimes Graves, the surface is pockmarked by



General plan of Grimes Graves, a famous prehistoric British flint quarry.
(Adapted from R25)

hundreds of pits, where prehistoric men dug down through the overburden to the chalk bed below. In overall appearance, Grimes Graves resembles North America's Spanish Diggings and the Alibates Quarries, where similar crude mining techniques were applied---but thousands of years later, of course.

All across Western Europe, archeologists find scores of flint mines. On the Continent, the Spiennes site in Belgium is the largest and best-known. However, in contrast to the surface pits seen at Grimes Graves, the Continental flint miners usually dug deep shafts through the overburden to reach the chalk. Then, they carved out galleries, bringing up the flint and chalk rubble through the shaft. (See sketch.) (R10, R23, R25)

The British dene holes look very much like the flint mines on the Continent. (MSE3) As far as we know, though, the dene holes were not dug to procure flint.

As indicated earlier, these ancient flint mines are not anomalous, nor are most other prehistoric mining activities in Europe. A possible exception was discovered serendipitously in Northern Ire-

land. The scene is Antrim, Ulster County, the Ballycastle Collieries. We quote from E. Sykes' journal *Atlantis*, in which the following paragraph was reproduced from the *Encyclopaedia Britannica*.

In 1770 the miners accidentally discovered a complete gallery, which had been driven many hundred yards into the bed of coal, branching into thirty-six chambers, dressed quite square and in a workman-like manner. No tradition of the mine having been worked remained in the neighborhood. (*Encyclopaedia Britannica*, 11th. Edition, Vol. II, page 153.) (R18)

We have seen no further reference to this putative ancient coal mine. To place things in perspective, E. Sykes was a dedicated catastrophist (as just about everyone is now) and a firm believer in the existence of Atlantis (which hardly anyone is today). Even so, his *Encyclopaedia Britannica* reference is probably sound.

X3. Asia

Kazakhstan. In 1937, a remarkably ancient gold mine was discovered in Central Asia. Apparently, it was excavated by Bronze Age visitors to the region.

The mines had been worked by a large number of workmen who used some implements of bronze, but for the most part of stone and the bones of animals. There were no traces of iron. Near the shafts were primitive ore-crushing plants, consisting of stone slabs and hammers. Two skeletons of these Bronze Age miners were found, who had met their death by a fall of the roof. On one of the skeletons was a necklace of glass and clay beads and in one hand was a bronze chisel and in the other a stone hammer. They were not Mongolian, as was indicated by their skulls. The mines were 0.75 m. wide and 20-25 m. deep. They were connected by underground passages 100-150 m. long. These passages had natural ventilation, and for illumination it is probable that fat in shallow bowls was employed. Some of these bowls have been found. Stone cross pieces were used as props. (R13)

In Central Asia, the Bronze Age commenced about 3,000 B.C., so these rather sophisticated gold mines could be 5,000 years old!

X4. Africa. Ancient Egypt and the early civilizations of the Middle East apparently acquired much of their gold, silver, tin, copper, and iron from southern Africa. Zimbabwe alone boasts some 1,200 prehistoric gold mines and 150 copper mines. As in the case of Europe, only a few of these ancient mines are interesting enough to mention in this Catalog of Anomalies. These are those of extreme antiquity and those that suggest that an extensive and vigorous maritime commerce existed in south African minerals thousands of years ago.

Swaziland. In 1967, A.K. Boshier completed forty archeological excavations at the Ngwenya Iron Mine in western Swaziland. Over 300,000 artifacts were recovered, including stone mining tools that, according to radiocarbon dating of associ-

ated charcoal were unexpectedly old. Stimulated by these discoveries, R.A. Dart and P. Beaumont penned the following paragraph.

These datings demonstrate that haematite has been mined at Ngwenya, on and off, for at least 28,000 yr. They afford the first dated presumptive evidence that all foreign ores and pigments found in prehistoric deposits all over the world were the result of deliberate mining. Dates of cavern strata containing haematite in Rhodesia and South Africa have ages ranging from 37,000 to 42,000 B.P. Incidentally, the claim made almost 35 yr ago, that "manganese was being deliberately mined in Zambia by a foreign people familiar with its potentialities in Late Stone Age times", and Boshier's expectation that "in this field (of ancient mining) Bomvu Ridge (Ngwenya) is of supreme significance; its thorough investigation might well furnish us with knowledge of the genesis of South African mining", have been fully justified. (R20)

In other words, southern Africa was being mined by "foreign people" who recognized the usefulness of manganese thousands of years ago. Who were they?

Zimbabwe. A Nature article in 1929 by J.W. Gregory promoted this "ancient commerce" theory more vigorously. Gregory's argument was based upon the gold mines of Rhodesia (now Zimbabwe). He did not concur with mainstream opinion that these gold mines were of medieval age. The amount of gold that had been extracted from these mines was immensely greater than that produced in medieval times. In 1929, it was estimated that 100 million tons of gold ore had been removed from Zimbabwe!

Where did all this gold go? There is no evidence of its use in South Africa. The amount exported in medieval times to Arabia must have been relatively small. Which lucky country received it? Ancient Egypt and Chaldea imported large quantities of gold; and the only known early gold workings adequate for their supply are in South Africa (R12)

Gregory underscored his claim by pointing out that Egyptian and Roman

artifacts had been found in Zimbabwe. Going a politically-incorrect step further, he claimed that the efflorescence of Bantu culture, as seen in the Zimbabwe ruins (MSB in another volume), was due to the injection of Semetic influences during the commerce in south African metals. (R12)

South Africa. Not only was gold mined in southern Africa on an organized basis in ancient times, but diamonds were in the cargoes of vessels heading back to Egypt and points in the Middle East. B. Sullivan has put forth two clues suggesting that diamonds were mined aggressively thousands of years ago.

Throughout the length and breadth of the diamond-bearing areas of South Africa, Stone-Age artifacts have been excavated by diamond diggers since the first diggings in 1867. When they found these tools, weathered Old Timers were known to pull up their claim pegs and move to other ground ---muttering, as they did so, that the "Old Ones" had been there already.

It is a fact that where these ancient mining tools occur in the gravel few, if any, diamonds will be recovered. This cannot be passed off as a digger's superstition, as diamonds will be recovered in the "run" of the gravel on either side of the site where the tools are excavated.

.....

In his book The Diamond Fields of South Africa, the mining geologist Dr. Wagner recorded that, while prospecting the Monastery mine, they opened up kimberlite and discovered the existence of ancient workings. Then at a depth of 40 feet below the surface, two human skeletons were found...His report concludes: "and the true nature and object of the workings thus remain a mystery." This evidence of ancient miners is relevant, as it proves that they were able to identify kimberlite, and were actively engaged in prospecting pipes. Today we know that the kimberlite at the Monastery Mine is barren of diamonds, so the ancient miners, who excavated to a depth of at least 40 feet, were most certainly searching for diamonds. All other constituents of kimberlite could be obtained, in unlimited quantities, right on the surface. (R24)

Again, we wonder who these sophisticated ancient miners were.

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MSE6

Production-Consumption Discrepancy in Prehistoric

Lake Superior Copper Mining

Description. The conservative estimate that the prehistoric production of Lake Superior copper was 300 times the amount of copper consumed by North American Indians in their manufacture of artifacts. A "more likely" ratio is 2,000.

Data Evaluation. Over a hundred articles and books have been published about Lake Superior copper mining and its implications. Some are of a sensational nature, but many have been written by archeologists and mining engineers. There are, however, weak areas in the story to be told below. First, there have been no chemical analyses made to determine whether Lake Superior copper was ever used in the manufacture of Old World Bronze. There are few if any artifacts suggesting the identity of the Lake Superior miners, the routes they used to transport their product, and to whom their product was delivered. However, these missing pieces of the puzzle do not detract from the phenomenon at hand: the apparent reality of the copper production-consumption discrepancy. Rating: 2.

Anomaly Evaluation. Even the most conservative production-consumption ratio is so large that it constitutes a major archeological anomaly. Coupled with the almost inescapable conclusion that the "missing" copper is not longer in North America and may have been traded to Old World customers, underscores the anomalousness

of the situation. A transoceanic commerce in New World copper in the 5,000-1,000-B.C. time frame is anathema to mainstream archeologists and anthropologists. Rating: 1.

Possible Explanations. Besides the above-mentioned possibility, we have: (1) the thought that the "missing" copper resides still-unfound in North America; and (2) the mainstream claim that the estimates of prehistoric copper production in the Lake Superior region are grossly in error.

Similar and Related Phenomena. See the Subject Index under: Diffusion. North American "dolmens" (MSD3) and stone circles (MSH16).

Entries

X0. Introduction. The ancient copper mines of Lake Superior are more-than-extensive-enough to qualify for inclusion in our general survey of remarkable prehistoric mines (MSE5). As a matter of fact, they are so huge, stretching for some 150 miles, that they give rise to a really significant potential anomaly: What happened to all the copper that was apparently pried out of the earth and spirited away many centuries before Columbus touched the shores of the New World?

X1. General observations. The copper mines of Michigan's Keweenaw Peninsula and Isle Royale constitute the planet's



The Lake Superior copper deposits are concentrated on Isle Royale and the Keweenaw Peninsula of Michigan, as indicated in black.

largest deposit of "native" (nearly pure) copper. Some of the "nuggets" weigh thousands of pounds. The record seems to be 46 tons, but that was all that remained after the ancient miners hacked off all they could with their crude tools. Lake Superior copper is unique in that it is "contaminated" with small inclusions of native silver.

The Jesuits accompanying French explorers of the Great Lakes learned from the Indians as early as 1636 that native copper existed somewhere around Lake Superior, but the first European miners didn't break ground until 1761. These Europeans were late-comers by almost 7,000 years!

The most obvious evidences of prehistoric copper mining consist of: (1) thousands of pits, probably 2,000 on Isle Royale alone; and (2) hundreds of thousands of hammerstones, with perhaps 200,000 littering Isle Royale. These truly amazing statistics make Wyoming's Spanish Diggings and Texas' Alibates Flint Quarries look puny indeed.

The early copper miners employed the crudest of techniques, they simply dug away and hammered at the veins and outcroppings containing the native copper. Usually, their pits were only a dozen or so feet across and about as deep. One of the largest was measured at 120 feet in diameter, with a depth of 15 feet. Over the millennia, nature filled in many of the smaller pits, especially the so-called "pot holes." (These pot holes are not counted in the pit statistics discussed later.)

Obviously, the technical sophistication of the prehistoric miners is not an issue for anomalists. Rather, it centers on the sheer magnitude of this prehistoric mining enterprise.

By 1863, enough information about the



Typical stone tools found in the copper mines, sometimes in incredible numbers. (R10)

Lake Superior mines had accumulated for C. Whittlesey to author a remarkably thorough scientific report in the Smithsonian's Contributions to Knowledge series. We quote from his summary:

(1) An ancient people extracted copper from the veins of Lake Superior of whom history gives no account.

(2) They did it in a rude way, by means of fire and the use of copper wedges or gads, and by stone mauls.

(3) They had only the simplest mechanical contrivances, and consequently penetrated the earth but a short distance.

(4) They do not appear to have acquired any skill in the art of metallurgy or of cutting masses of copper.

(5) For cutting tools they had chisels, and probably adzes or axes of copper. These tools are of pure copper, and hardened only by condensation or beating when cold.

(6) They sought chiefly for small masses and lumps, and not for large masses.

(7) No sepulchral mounds, defenses, domicils, roads or canals are known to have been made by them. No evidences have been discovered of the cultivation of the soil.

(8) They had weapons of defense or of the chase, such as darts, spears, and daggers of copper.

(9) They must have been numerous, industrious, and persevering, and have occupied the country a long time. (R1)

Additional pertinent information appeared in succinct form in Nature in 1891.

These ancient mines---judging from their extent---must have been worked for centuries. Who the workers were, no one can tell. They seem to have known nothing of the smelting of copper, for there are no traces of molten copper. What they sought were pieces that could be fashioned by cold hammering into useful articles and ornaments. They understood the use of fire in softening the rocks to enable them to break away the rock from the masses of copper. They could not drill, but used the stone hammer freely. More than ten cart-loads of stone hammers were found in the neighborhood of the Minnesota mine. In one place the excavation was about 50 feet deep, and at the bottom were found timbers forming a scaffolding, and a large sheet of copper was found there. In another place, in one of the old pits, was found a mass of copper weighing 46 tons. At another point the excava-



Some prehistoric copper artifacts from Wisconsin. Copper nuggets were beaten into these shapes by American Indians. (R7)

tion was 26 feet deep. In another opening, at the depth of 18 feet, a mass of copper weighing over 6 tons was found, raised about 5 feet from its native bed by the ancients, and secured on oaken props. Every projecting point had been taken off, so that the exposed surface was smooth. Whoever the workers may have been, many centuries must have passed since the mines were abandoned. The trenches and openings have been filled up, or nearly so. Monstrous trees have grown over their work and fallen to decay, other generations of trees springing up. When the mines were rediscovered, decayed trunks of large trees were lying over the works, while a heavy growth of live timber stood on the ground. (R6)

A century ago, when the above was penned, the question on everyone's mind was: Who dug all these shallow pits? Chief among the suspects then was the Moundbuilders. Others supposed that the Aztecs had trekked north from Mexico to hack away at this great metallic hoard. When radiocarbon dating arrived on the archeological scene, it was soon apparent that the primitive miners had been pounding away with their hammerstones many centuries before the Moundbuilders and Aztecs. Charcoal and wood samples produced dates between 5,000 and 1,000 B.C. (R9, R12) The Lake Superior miners were contemporaneous with the European Neolithic and Bronze Age cultures!

In retrospect, it is no wonder that the Indians encountered by the post-Columbus Europeans knew little about the copper mines and nothing at all about the miners themselves.

We still do not know who the miners really were and what enticed them to mine millions of tons of copper. The real anomaly that has emerged, and which was not appreciated in the foregoing quotations, was: Where did all the copper disappear to?

X2. Copper production and consumption estimates. Granted that a strip of territory 150 miles long and 4-7 miles wide is riddled with thousands of pits of various sizes, how much copper was really removed from the Lake Superior region in that 4,000-year period ending about 1,000

B.C.? Of course, this was not the only native copper available in North America. The continental ice sheet had scraped off multitudinous scraps from Isle Royale and the Keweenaw Peninsula and deposited them southward---the so-called "drift" copper. Furthermore, at least 317 minor sources of native copper have been identified in North America. But, just focussing on the Lake Superior mines, the estimates vary wildly: 100-500 million pounds (R8); 1.5 billion pounds. (R10) Are these numbers realistic?

The genesis of such seemingly fantastic estimates is seen in the following quotation from a privately published paper by R.W. Drier (a metallurgist) and O.J. Du Temple (an engineer).

If one assumes that an average pit is 20 feet in diameter and 30 feet deep, then it appears that something like 1000 to 1200 tons of ore were removed per pit. If the ore averaged five percent, or 100 pounds per ton, then approximately 100,000 pounds of copper were removed per pit. If 5000 pits existed, as earlier estimates indicated (and all pits are copper bearing), then 100,000 pounds per pit and 5000 pits means that 500,000,000 pounds of copper were mined in prehistoric times---all of it without anything more than fire, stone hammers, and manpower. If the ore sampled 15%, and if more than 5000 pits existed, then over 1.5 billion pounds of copper were mined. (as quoted in R13)

Such immense figures have led to radical hypotheses because all the Indian copper artifacts found in North American burials and caches do not exceed 10,000 pounds. And much of this copper collected in museums and private collections probably came from pieces of drift copper, which was and is abundant in some places. What happened to all the copper? Did Atlanteans enslave North American aborigines and force them to grub up copper for their island paradise? Or did Bronze-Age Europeans, hungry for copper to add to their tin to produce bronze, organize expeditions to Lake Superior in the 5,000-1,000 B.C. time frame?

With such wild speculations abounding, one can understand why mainstream archeologists seem to ignore the apparent great discrepancy between the Lake Superior copper-production and North American-consumption figures. The ac-

cepted view of world history does not include a great maritime commerce in North American copper well before the Christian era.

The task of explaining this apparent anomaly has been left largely to individuals outside the archeological community. An impressive attempt to resolve the discrepancy has been made by J.L. Guthrie, an industrial engineer. Using the voluminous literature and taking a conservative approach, he reviewed estimates of the number of pits, their volumes, and the richness of the ore. Guthrie produced two figures for the amount of copper extracted by the prehistoric miners: a "most likely" quantity and a "lowest possible" quantity. He concluded:

Combining the lowest values for every component of the calculation gives the result that at least three million pounds of copper is to be accounted for. This is 300 times as much as the ten thousand pounds documented in museum collections. Even if much more is held privately or has been lost, the discrepancy is enormous. Using the most likely result of 20 million pounds, the ratio of mined copper to museum copper is 2,000. (R13)

The production-consumption discrepancy therefore appears both real and very large---too large for mainstream archeologists to shrug off as being due to bad data. Unfortunately, Guthrie's study was not published in a journal read by most archeologists, or even known to them.

Summarizing, Guthrie saw three possible explanations for the discrepancy.

(1) The missing copper still hides undiscovered in North American burials and copper caches. It is unlikely that 99.9% of the (estimated) mined copper has escaped notice in 300 years of archeological research on this continent.

(2) There is no "missing" copper because the thousands of pits were often "blind"; that is, devoid of copper. This suggests that the prehistoric miners were inept to say the least. Their diligence in following the rich veins belies this assessment.

(3) The missing copper was carried off to Europe to make bronze. This could be checked by comparing the chemical "signature" of the minor constituents of Lake Superior copper with that in Old World bronze. No one is doing this.

If we ignore the possibility that extra-terrestrial visitors spirited away all that copper, we have to favor Guthrie's third possibility.

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MSE7 Sculpted Hills and Mountains

Description. Large rock outcroppings, hills and mountains that have been shaped by human hands for utilitarian, artistic, or symbolic purposes.

Data Evaluation. Several South American sculpted structures reported below, such as those on the Marcahuasi Plateau, in Peru, are not recognized or researched by mainstream archeology. Consequently, our information comes from the so-called "fringe literature." Rating: 3.

On the other hand, the sculpted hills of Oceania have received considerable professional attention. Rating: 1.

Anomaly Evaluation. The labor that was required to sculpt the hills of Oceania and South America must have been prodigious but certainly within the capacities of the cultures involved. The purposes of most of these half-natural, half-artificial edifices are usually not at all mysterious, almost always being defensive, architectural, or symbolic in nature. Rating: 3.

The exceptions to the foregoing evaluation are the South American sites of El Fuerte, Kenko, and Marcahuasi, where purpose is obscure. Rating: 2.

Possible Explanations. El Fuerte, Kenko, and Marcahuasi may have been important in rituals in which their weirdness was intentional.

Similar and Related Phenomena. Giant irrigation systems (MSC5); hilltop forts (MSB in another volume); giant carved rocks (MSO11).

Entries

X0. Introduction. Sculpted hills are difficult to distinguish from hills that were terraced for agricultural purposes and from purely natural formations that just happen to look like a human head or perhaps some animal. The latter are often called "simulacra," and with a little imagination one can find them everywhere. To fit in this section, a sculpted hill must incontrovertibly show the hand of man and have purposes other than agriculture. Additionally, sculpted hills must be kept separate from exceptionally large statues carved from the living rock, such as the Sphinx (MGP in another volume) and those familiar images on Mount Rushmore.

Most of the sculpted hills meeting our criteria are defensive in nature, but some have been turned into temples and, perhaps, refuges for people in troubled times. A few, carved out of solid rock, are more mysterious, as in our first few examples.

X1. South America

Bolivia. Samaipata is a small town about 55 miles southwest of Santa Cruz. Nearby, on top of a hill capped by red sandstone, has been carved a perplexing suite of almost whimsical structures collectively called El Fuerte (The Fort). These structures have no military value, their purpose (if any) is obscure. El Fuerte is reminiscent of those strange, intricately carved rocks created by the Inca (MSO11) ---but on a much larger scale.

D.H. Childress made the long climb up to El Fuerte from Samaipata and reported as follows:

On top of this remote jungle mountain was a large, fairly level area of sandstone. Cut into the rock all along the top of the mountain were unmistakable carvings---extremely weathered, yet deep and ancient. There were channels, pools, rooms, stairs, seats, petroglyphs, and many odd grooves, all of which seemed quite out of place.

Toward the east side, cut directly into the rock, was a large pool ringed

with seats, much like a modern whirlpool bath. Some of the seats were triangular, others square. The pool was well worn, but was probably two or three feet deep at one time. Had it been used for ritual bathing?

Like other pools on the rock, it had a drain, about six inches in diameter. The drains led through carved channels to another even stranger square pool, one-and-a-half feet in depth, with two deep parallel grooves running 75 feet to the west. Alongside these parallel grooves were two smaller channels etched in a criss-crossing diamond pattern, apparently for the flow of some liquid. These channels ran into two other pools, which drained off down the hill.

On the south side, the hill formed a crescent shape of solid rock. The ancient builders had carved seats into the slope, reminding me of bleachers at a stadium. In fact, the entire south side had an uncanny resemblance to an amphitheater. (R7)

Square niches resembling rooms had also been carved out of the rock. One had a floor area of about 12 x 50 feet. Petroglyphs and geometrical markings abounded. (R7)

El Fuerte seems to be the rock-cut skeleton of "something." Apparently, little archeological research has been carried out there. El Fuerte must be quite old, because parts of it are covered with as much as 3 feet of hard-packed earth. One wonders what wooden structures might have once adorned this lithic skeleton. Or perhaps, like the Incan carved rocks, El Fuerte is simply an art form or maybe a labyrinthine joke.

Peru. Just a half mile from touristy Sacsayhuaman, with its massive, precision-fit stone walls (MSB in another volume), lies Kenko, which echoes Bolivia's El Fuerte in an eerie way. Again, we rely upon D.H. Childress' eye-witness report.

At Kenko (or Qenqo), large rocks, cliffs, and hills are carved with a most bizarre menagerie of steps, tunnels, seats, niches, windows and other shapes. One begins to imagine an architect doodling with modeling clay, but on an enormous scale. Staircases at odd angles lead nowhere. Other paths, tunnels and staircases are so weather-worn, they give the impression

of being thousands of years old. As we walked around, we even found what looked like an ancient set of parallel cogs cut into the stone, as if it was part of some set of gears or a levering device.

This is one of the strangest ruins I have ever seen. The area is unmistakably ancient, far older than the ruins of Sacsayhuaman and Cuzco behind us. You will not find Kenko in most archaeology books or tourist guides, simply because it cannot be explained! Kenko's appearance gives the impression of a construction that was toppled and destroyed is a great South American earthquake of ages past. Everything appears to be tilted by about 30 degrees, which would have required an earthquake of tremendous magnitude to have done so much damage. Portions remain visible, but the hard stone has been badly weathered over many thousands of years. (R7)

Kenko and El Fuerte are "real," that is, even skeptics can walk around them and verify their artificiality. This may not be the case with the next mysterious Peruvian site: Marcahuasi.

The Marcahuasi Plateau is located near Marcapomacocha, in Peru's Junin Province. On this lonely natural platform, the rocks take on eerie resemblances to humans and other animals as the light changes. As with the shapes of clouds, an observer can see a lot or a little in the scene depending upon his or her mindset. At Marcahuasi, the line dividing the purported human-carved rock formations from simulacra is very tenuous. (R4) Are the reported giant sculpted shapes at Marcahuasi archeological anomalies or are they as mundane as New Hampshire's "Old Man of the Mountain" or, perhaps, that "Face on Mars"?

The giant sculptures on the Marcahuasi Plateau were first discerned or "interpreted" by D. Ruza in 1952, when by chance he had climbed up into this rugged area.

Finally he reached the plateau of the Marcahuasi, to be immediately confronted with a veritable "rock amphitheatre" which was described as a "sacred forest" by French scientist Pierre Legalic. And there he saw for the first time the original sculpture of the "Inca's Head".

For several years, from dawn to dusk, Ruzo examined carefully all the angles and contours of the sculpture. He took hundreds of photographs, studied the shadows projected by the sunlight on the carved ledges and finally perceived the amazing truth:

There were fourteen human heads carved on the rock site, representing men of different races. There were Aryan, Semitic and Negro faces. Some faces, like that of the god Janus, faced North and South.

But the most remarkable thing was how the artist had made use of the changing ranges of light and shadow throughout the day to set off his work. Ruzo's patient dedication finally led him to discover the precise time and place which permitted the clearest perception of each image. And of this he kept perfect records with his camera.

There was no doubt, then, as to the human origin of the monuments, but who had carved the head? The Incas and the Huancas were skillful in working stone but, according to historians, they never even knew of the existence or typology of those other races: the Negro, the Semitic or, even less, the Caucasian, which was supposed to have come only when America was discovered.

.....

When the whole plateau was explored, one amazing shock followed another. Daniel Ruzo built a small hut, and came for weeks at a time to proceed with his studies. It came to him that the whole of the Marcahuasi Plateau was full of human and zoomorphic figures, some of them of gigantic size. But the most extraordinary shock of all was to discover that many of the animals represented had never existed in America. There were lions, horses, frogs, dogs and an ancestor of the turtle: the Amphichelydia, whose hard shell was divided into four mobile parts. This animal was known only through its fossilized remains. (R2)

After reading the above, we must inquire into Ruzo's background, for it may have affected his interpretation of Marcahuasi. Ruzo, it turns out, had theorized that, some 10,000 years ago, South America was inhabited by a white race similar to the Ainu of Japan! This civilization's

legacy consisted of giant heads sculpted from the living rock. (R2) Now, as the saying goes, we know where Ruzo was coming from.

Understandably, Marcahuasi has become a staunch pillar of fringe archeology. It is mentioned frequently in popular books. R. Cote, of R.C. Video, Inc., has even made of TV documentary on Marcahuasi.

So, regardless of how we feel about Ruzo's theory, his sculpted figures are enshrined on film and magnetic tape. But were these figures on the Marcahuasi Plateau really carved by human hands or is Nature once again being mischievous? The Marcahuasi photographs we have seen are not impressive.

In Peru and elsewhere in South America and Mesoamerica, various cultures sometimes reshaped hills and mountains so that they served as architectural structures. A typical example is the Temple of the Sun at Pachamac, on the Pacific Coast, just south of Lima. Here, the Inca terraced a small mountain, built retaining walls, and added other stone structures; thereby converting a natural feature into a useful building. (R8)

X2. Middle East

Jordan. Where Marcahuasi is tenuous, Petra, near Mount Hor, is rock-solid. During the Roman period, the Nabateans carved whole buildings with classical facades out of the solid rock. The tourists flock here, and the archeology books are full of photos of these remarkable works in stone. Petra is not anomalous, since no paradigms are challenged by its existence. However, it must be added here that these same Nabateans also rendered entire mountain tops into buildings---no bricks and mortar, just solid rock. (R9) These works logically fall into this catalog category.

X3. Oceania

Palau. The Micronesian island nation of Palau is famous for its beautiful Rock Islands and abundant marine life. Some of Palau's islands also present remarkable



The sculpted hills of Babeldaob, Palau, in Micronesia. Some of these great terraces were assigned to agriculture. Others are of questionable purpose. (Adapted from R6)

skylines. They are "stepped" by virtue of terraces that stretch for miles. The most remarkable terrace system is on tongue-twisting Babeldaob, as described by W.N. Morgan.

Perhaps the most spectacular monuments of prehistoric architecture in Palau are terraced earthworks sculpted from natural hill formations. The most numerous and impressive of the sculpted hills are found on Babeldaob. As one moves along the island's coasts by boat, sculpted hill complexes appear constantly. It seems in places that, if the intervening areas of forest and jungle were removed, the terraces might be interconnected and extend for miles in a single composition. (R8)

Truncated pyramids, rounded knolls, and depressions cap the terrace systems. One terraced hill, topped by a truncated earthen pyramid, rises 317 feet above sea level.

Terrace construction began in Palau in the Fifth Century A.D. and didn't cease until about 1600 A.D. The primary objective of the lower terraces was agriculture, but, as Morgan observed, the uppermost portions of the sculpted hills probably served other purposes, perhaps as places of refuge. (R8)

New Zealand. On this remote corner of the Polynesian Triangle, the Maoris built terraced forts, called "pas." (R6, MSB in another volume) These are very similar to Palau's terraced hills and, especially,

the unusual defensive structures on Rapa.

Rapa (or Rapa Ita). This lonely speck of Polynesia lies south of Tahiti just outside of the Tropical Zone. To voyagers approaching from the sea, Rapa looks a bit like it belongs in a fairy tale. Conical, castle-like sculpted hills break the skyline. Exploration by T. Heyerdahl and others prove that these structures are sculpted hills augmented by stonework. Like the pas of New Zealand, Rapa's sculpted hills were undoubtedly defensive in purpose. (R1) They are worth mentioning separately because they are considered the most elaborate in Polynesia outside of New Zealand.

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MSE8 Terrestrial Zodiacs and Star Maps

Description. The terrestrial representation of star groups and constellations by means of earthen structures or the intentional sitings of buildings and other artificial structures.

Data Evaluation. Except for the Glastonbury Zodiac, which has received some professional scrutiny, our sources are mainly popular books. In all of the examples of the phenomenon at hand, the connections between the heavens and their purported terrestrial representations are tenuous at best. Often these heavens-and-earth associations have been strongly influenced by belief systems. Rating: 3.

Anomaly Evaluation. The construction of large terrestrial zodiacs, if scientifically verifiable, implies the intense involvement of the various cultures with astronomical phenomena and their possible effect upon their well-being. This human concern is not at all surprising or anomalous, since it persists to this day in astrology columns in the media. While the construction of the purported terrestrial zodiacs represents large investments of human resources, they do not challenge any archeological hypotheses. Rating: 3.

Possible Explanations. Humans will invest great wealth and effort in attempting to communicate with and/or propitiate suspected supernatural or occult entities.

Similar and Related Phenomena. Geofoms and geoglyphs, such as the Nazca lines (MGG in another volume); terrestrial structures devoted to rituals, such as Stonehenge, Avebury, temples, etc. Pit zodiacs (MSE2-X3; mound zodiacs (MSM7-X4).

Entries

X0. Introduction. Zodiacs are pictorial representations of the major constellations lying in a wide band along the ecliptic. The typical zodiac includes a dozen constellations in which the brighter stars outline various animals and objects. The figures vary depending upon the culture involved. We are familiar with the bull (Taurus), the lion (Leo), the scales (Libra), etc.; but virtually anything is possible. The zodiac concept apparently originated in Mesopotamia. The ancient Egyptians liked the idea, and they painted an elaborate one on the ceiling of the Temple of Hathor in Upper Egypt. Called the Dendera Zodiac, it was so impressive that it was spirited away to the Louvre in Paris. (R5)

In this section, we are interested in more ambitious renditions of zodiacs involving either sculptures of the earth itself or arrays of human-built structures that emulate the constellations. We also include simpler versions in which just a few prominent stars are mapped.

Why bother building terrestrial zodiacs that require such great investments of human resources? The urge is doubtless akin to that which induces us to erect huge cathedrals with spires that reach up toward the heavens!

X1. North America

Wisconsin. The earthen effigy mounds of Wisconsin are so large that, like Peru's famous Nazca Lines, they can be properly appreciated only from an airplane. One bird effigy, for example, measures 190 meters wing-tip to wing-tip. These large ground figures were probably piled up by the Hopewell culture that flourished during the first millennium A.D. The purpose of these very large earthen structures has always puzzled modern archeologists. The amorphous impression they convey at ground level seems to eliminate them as props in rituals, so what conceivable use could they have had? Could they represent the heavens in some way?

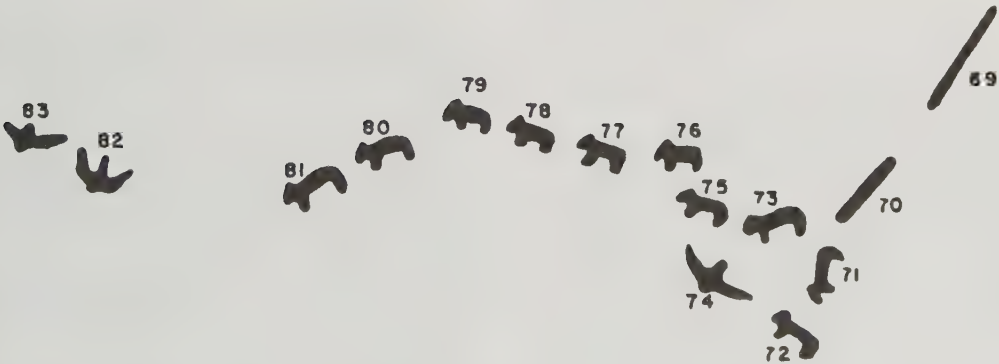
T.M. Cowan has suggested this possibility based upon two facts:

(1) They face skyward and can be best seen from great heights; and

(2) Many are large representations of animals common to many zodiacs, such as bears.

Cowan believes his suggestion is favored by the Marching Bear Effigies. (See sketch.)

Cowan's archeoastronomical analysis of the Marching Bear Effigies indicates:



The Marching Bear Group of earthen effigy mounds in Wisconsin. The nearby Bird Effigy #74 has a wingspan of 50-55 meters. Do the bear effigies mirror the movement of Ursa Major about Polaris? (R4)

(1) The effigies' marching line is oriented in an expected way with the march of Ursa Major around Polaris;

(2) The orientation of each bear is what would be expected from Indian legend;

(3) The path of the bear effigies follows the summer path of Ursa Major;

(4) The direction of the [nearby] Bird Effigies relative to the end of the Bears' march is in keeping with the direction of Cygnus relative to Ursa Major at the end of his arc;

(5) The distance between the bird mounds and the bear mounds representing the bottom of the arc suggests the appearance of Cygnus at the time when Ursa Major reaches its bottom-most point in the sky; and

(6) Finally, what little dating evidence there is coincides with the predicted temporal order of the effigies' construction. (R4)

Obviously, the Marching Bears Effigies, as interpreted by Cowan, describe a dynamic astronomical phenomenon rather than being a static map of a star group or a conventional zodiac. Nevertheless, the Marching Bears fit in well here and illustrate still another way to emulate the heavens with large terrestrial structures.

X2. Europe

Britain. In England, we find the most famous of all terrestrial zodiacs: the Glastonbury Zodiac, sometimes called the Somerset Zodiac. For over 1,000 years, Glastonbury has been a focus of spiritual quests and romantic legend. It was here that tradition states that Joseph of Arimathea founded Britain's first Christian church. Here, too, are centered the Arthurian legends and the Quest for the Holy Grail. Glastonbury is a perfect setting for a terrestrial zodiac and its occult overtones.

The possibility that a terrestrial zodiac might have been established in the environs of Glastonbury was raised by J. Dee during the reign of Elizabeth I. The thought solidified in the 1920s when K.E.

Maltwood, a sculptor, was consulting a map of Somerset County as she was following the history of the Holy Grail. She was startled to notice that the River Cary outlined the underside of a great lion. Further, the contours of the animal's head, tail, and paws were defined by roads and paths. She quickly discovered the outline of a great child with a boat. Eventually, she discerned twelve zodiac signs outlined by ancient roads and water-courses. Nature augmented by human works seemed to collectively constitute a terrestrial zodiac. Maltwood's conclusions meshed nicely with the occult assertion that the earth hosts three great terrestrial zodiacs; one in Britain, one in the Andes (Nazca lines?), and one in the Gobi Desert (as yet unfound). (R1, R2)

Maltwood published her research in her 1929 book A Guide to Glastonbury's Temple of the Stars. Maltwood was well-steeped in ancient myths, the Arthurian legend, and sundry occult concepts. We can sense these predilections in her evaluation of the Glastonbury Zodiac.

The astonishing knowledge and skill displayed in laying out these star figures on the earth, places this solar calendar in a unique position in regard to archaeological survivals, hence the traditional sanctity of the neighbourhood around Glastonbury, 'The Temple of the British Secret Tradition,' for it constituted a laboratory of thought and mystery, recognized by the races of the continent of Europe as unspeakably hallowed and inscrutable. (R1)

Occult innuendoes aside, the Glastonbury Zodiac, if real, would be a remarkable ancient structure---one well worth cataloging.

Anomalists, however, must deal with realities, and the figures in the Glastonbury Zodiac are suspiciously like those questionable sculpted rocks on Peru's Marcahuasi Plateau. (MSE7) Is the Glastonbury Zodiac real; that is, an intentional product of ancient humans? If so, does it match the constellations sprinkled along the ecliptic? Astronomer E.C. Krupp writes:

Although some of the Somerset landscape figures do overlap the appropriate star groups in the combination diagram Mrs. Maltwood provided with her book, it would be difficult to avoid some matches. In any case, actual



Shapes seen in the roads and water-courses in the neighborhood of Glastonbury, England, seem---to some people---to outline the signs of the zodiac. (R7)

stars do not coincide with any special features on the ground---the star markers so to speak. The relative sizes of the terrestrial figures do not match the celestial zodiac either. For example the Glastonbury ram is much too large for Aries. (R5)

Krupp adds that the conventional representations of Cancer and Gemini are missing. Aquarius has been replaced by an eagle or phoenix. Libra becomes a dove and is in the wrong place. There are other "defects," too. However, the greatest obstacle to "believing" in the Glastonbury Zodiac is that discerning the supposed figures requires a lot of imagination, even when blacked in as in the sketch. Of course, the more you believe in such simulacra the easier they are to see!

Britain hosts additional terrestrial zodiacs at Nuthampstead in Cambridgeshire, Kingston-on-Thames in Surrey, and Pumpsaint in Wales. (R5) Worldwide, there are said to be more than 60 terrestrial zodiacs. Just one of the Glastonbury genre is sufficient for our purposes.

Netherlands. Near Muggenburg. a group of 57 pits outlines Taurus, Canis Major, and other constellations. (Details in MSE2-X3) (R9) This is a unique type of zodiac, assuming, as usual, that it is intentional.

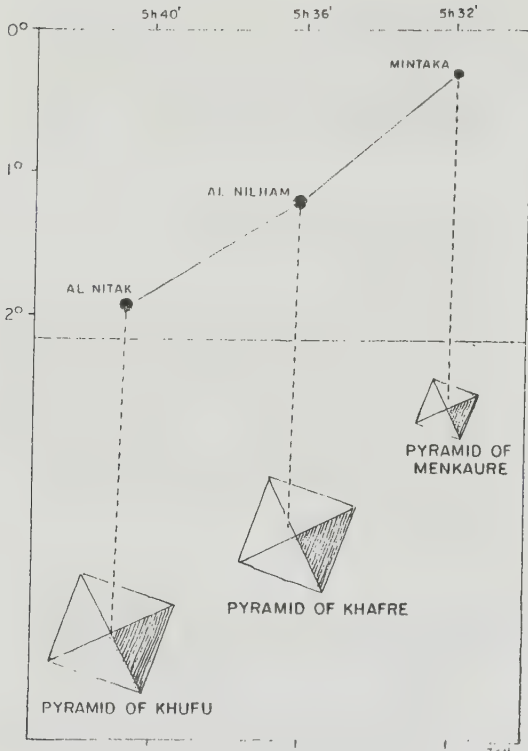
X3. Africa

Egypt. According to the pyramidologists, the Great Pyramid is supposed to model the earth (MSB in another volume). In 1993, R. Bauval published his The Orion Mystery, in which he speculated that the three largest pyramids at Giza were arranged in the same geometrical configuration as the three brightest stars in Orion's Belt.

What Bauval saw was this: as the three belt stars of the Orion constellation crossed the meridian at Giza they lay in a not quite straight line high in the southern heavens. The two lower stars, Al Nitak and Al Nilam, formed a perfect diagonal but the third star, Mintaka, appeared to be offset to the observer's left, that is, towards the east. Curiously enough, this was exactly the site-plan of the three enigmatic pyramids of the Giza plateau. (R8)

The disposition of the three great Giza pyramids thus constitute, according to Bauval, a map of Orion's Belt---a severely abbreviated terrestrial zodiac, so to speak.

In evaluating Bauval's hypothesis, we must first ask whether it is not all coincidence. Only three objects are involved, and there are probably many, many celestial and terrestrial triads that also match the geometrically simple arrangements at Giza and in Orion. Bauval's hypothesis is helped somewhat by the fact that the brightnesses of the three stars roughly correlate with the sizes of the three pyramids. Then, there is the observation that the southern shaft of the King's chamber in the Great Pyramid was aimed directly at Orion's Belt during the Pyramid Age, circa 2,600-2,400 B.C. The point being that Orion is associated with the Giza pyramids in still another way.



The three major pyramids on the Giza Plateau are arranged like the three belt stars in the Orion Constellation. (R8)
Of course, this could well be fortuitous.

The ancient Egyptians were sophisticated astronomers and were familiar with the zodiac concept. They certainly could have tried to map Orion's Belt with the placement of the three large Giza pyramids, but we definitely need more supporting evidence.

In this context, it is interesting to point out that the North American Paviotso Indians were also impressed by the three bright stars in Orion's Belt. They saw them as a line of three sheep! (R4)

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MSH STONE ROWS, CIRCLES, AND OTHER SIMPLE STONE CONFIGURATIONS

Key to Phenomena

MSH0	Introduction
MSH1	Short Stone Rows
MSH2	Long Stone Rows
MSH3	Double Stone Rows and Avenues
MSH4	Multiple Lines of Stones in Western Europe
MSH5	Stone Arrays and Mazes
MSH6	Stone Meanders
MSH7	Stone Circles: General Characteristics
MSH8	Recumbent Stone Circles
MSH9	The Megalithic Yard: A Megalithic Standard of Length?
MSH10	Geometrical Sophistication of Stone Circles
MSH11	Occult Influences on the Design of Stonehenge
MSH12	Physical Phenomena Associated with Stone Circles
MSH13	Psychical Phenomena Concentration at Stone Circles
MSH14	Integration of Stone Circles and the Environment
MSH15	Large-Scale Organization of Stone Circles
MSH16	Stone Circles Outside Britain and Ireland
MSH17	Stone Circles as Eclipse Predictors
MSH18	Stonehenge's Remarkable Rectangle
MSH19	Did the French Build Stonehenge ?
MSH20	Geometrical and Geographical Anomalies of Stone Rectangles
MSH21	Calendar Sites
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MSH23	Woodhenges

MSH0 Introduction

From the megalithic age to the present day, humans have gathered stones and arranged them in rows, circles, and other patterns. This activity seems to be the way some people try to impress and influence other people and, probably more importantly, their god or gods. Most artificial structures built up out of rough stones seem to be designed for rituals, ceremonies, burials, commemoration, vision quests by individuals, shamanism, and astronomy.

The most important and controversial kinds of anomalies associated with stone arrangements are as follows:

- (1) The stone structures suggest mathematical, scientific, and engineering sophistication well beyond that usually assigned to the culture involved. Example: eclipse prediction by the megalith builders.
- (2) The trans-ocean diffusion of Old World culture to the New World long before the Viking contacts.
- (3) The organization of societies and infrastructures beyond the level considered reasonable for the involved cultures. Examples: the great megalithic complexes at Dartmoor, Carnac, and the whole region around Stonehenge.
- (4) Claims of unusual physical phenomena at megalithic sites. Example: magnetic and ultrasound anomalies.
- (5) Claims of unusual psychic phenomena at megalithic sites. Example: the dowsing of "energy" patterns.

Beyond this list, we generalize that we do not really appreciate why the megalithic peoples quarried, transported, and erected all those huge stones. The same can be said for the North American Indians' stone mazes, meanders, medicine wheels, and geoglyphs, all built from multitudes of relatively small stones. But then, modern humans have their great cathedrals, Mount Rushmore, and scores of monuments commemorating George Washington.

MSH1 Short Stone Rows

Description. Straight rows of from two to six, large, upright stones (menhirs) usually aligned north-south or in some culturally significant astronomical direction. Short stone rows are fundamentally different from long stone rows (MSH2).

Data Evaluation. For Western Europe, the information available is overwhelming, with hundreds of short stone rows measured and cataloged. In the rest of the world, we have found only a small handful of stone rows that even remotely resemble those of Europe; and these are not well-researched. Our rating applies only to those short stone rows seen in Western Europe. Rating: 1.

Anomaly Evaluation. The purpose behind the short stone row is obscure; and there is little hope of ever finding a definitive explanation for them. In all probability, they served in rituals that we can only speculate about. Those rows oriented toward solstice points on the horizon could have been associated with seasonal celebrations, but the north-south alignments are more perplexing. What sort of ritual would require a pair of stones oriented north-south? Or even three or four stones? The fewer the stones, the harder the explanations become from our perspective 3,000-4,000 years later. Rating: 2.

Possible Explanations. The short stone rows may have served in rituals involving extended families and small population clusters, being in effect abbreviated versions of the rituals associated with the long stone rows, avenues, and multiple stone rows found near centers of megalithic culture.

Similar and Related Phenomena. Menhirs (MSD1); long stone rows (MSH2); avenues (MSH3); multiple stone rows (MSH4).

Entries

X0. Introduction. In classifying stone rows, we follow the lead of A. Burl. (R3) Short stone rows are straight lines of from 2 to 6 standing stones. Obviously, long stone rows display more than 6 stones, but they also differ from the short rows in that they are seldom straight. While the short stone rows are usually oriented north-south or towards a solstice horizon point, the long stone rows are too crooked to possess any astronomical alignment value. (For a detailed classification of the long stone rows, see MSH2-X0.)

Burl divides short stone rows into pairs, triplets, and rows of 4-6 stones. In this present survey, which is necessarily rather superficial, we find the short-stone-row taxon (2 to 6 stones) adequate.

X1. European short stone rows. Tourists generally ignore Western Europe's hundreds of short stone rows in favor of Stonehenge, Avebury, and the multiple stone rows of Carnac in Brittany. They are overlooking a massive concentration of megalithic structures. In Western Europe, usually on the periphery of the major concentrations of stone circles,

avenues, dolmens, graves, etc., are 333 stone pairs, 202 triplets, and 126 rows of 4-6 stones. Many of these short stone rows are obscure, but one cannot fail to be impressed by the Devil's Arrows, in Yorkshire. Here, three very tall (18, 21, 22½ feet) columns of millstone grit are oriented NNW-SSE in a line 570 feet (174 meters) long. Once, there were five stones in the alignment, but time has taken its toll. In Brittany, the typical short row of four large standing stones at Le Vieux-Moulin, near Carnac, is no less imposing.

Why did the Bronze Age people of 1,800-1,000 BC haul these multi-ton stones for miles and then erect them in astronomically oriented rows? The stones have no defensive value, nor any other obvious practical purpose. These short rows are believed to serve as ritual centers for extended families. What other explanation is there but one involving rituals?

This uncertainty as to purpose is a bit frustrating but hardly paradigm-shattering. More puzzling is how the stones were aligned astronomically. The following quotation from Burl combines both of the minor mysteries in his description of the short row at Le Vieux-Moulin.

At a time when there was no Pole Star to guide them the builders of



*One of the Devil's Arrows, Yorkshire
(Janet & Colin Bord/Fordean Picture Library)*

the row intentionally aligned its stones north-south. How they achieved this is puzzling, why they did it may be beyond explanation. If such an unpromisingly simple site contains evidence of the needs and beliefs of early people it is all the more surprising that stone rows have been ignored for long. (R3)

New Hampshire, that seems to have an astronomical alignment. (R1) No details available. Evidently, the stones are not prominent standing stones like those in Europe but merely artificially arranged glacial debris.

We may hear of other short stone rows, but their paucity is significant. Despite all the claims of North American menhirs, rocking stones, and stone chambers with megalithic overtones, stone rows (of any length)---so very common in Western Europe---did not seem to diffuse well across the Atlantic. It makes one wonder if the other claims of ancient megalithic structures in North America have substance.

X2. North America. Short stone rows are virtually nonexistent in North America from what we have seen in the literature examined so far. These alignments are easily overlooked and so easily erased by farmers clearing their fields that they may have gone the way of the passenger pigeon. On the other hand, perhaps there never was a megalithic influence exerted across the Atlantic from megalith-rich Western Europe!

In fact, we have found only one potential North American short stone row.

L.L. Morrill, Jr., has mentioned a short line of boulders on Mt. Sunapee,

X3. Oceania. Surprisingly, the only megalithic structure we have found that is strikingly similar to the European short stone rows is thousands of miles away in distance and three millennia separated in time. The place is the small atoll of Arorae, in the Gilbert

Islands, in the South Pacific. Archeo-astronomer A.F. Aveni has described the site.

Its northern shore is dotted with half a dozen pairs of parallel rough-cut slabs, each about the size of a man, arranged horizontally and cemented into the ground. One pair points to the neighboring island of Tamana 80 kilometers distant, another to Beru Island 140 km away, and a third to distant Banaba, 700 km over the horizon. Islanders call them "Stone-canoes" or "the Stones for Voyaging." (R2)

The stones not only establish the directions for beginning interisland voyages but also serve in training navigators. Trainees learn to mark the

risings and setting of key stars relative to the vector established by the pairs of stones. When at sea, the navigator's judges from memory the correct heading by observing the rising and setting points of these guide stars. (R2)

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MSH2

Long Stone Rows

Description. Rows numbering seven or more stones. Such rows may extend from 10 feet to over 2 miles. Long stone rows are rarely straight and may curve or wander a bit. Rarely are they aligned toward points of astronomical significance. Their stones may tower 6 feet or more, but many barely rise above the turf that has grown up around them. Ages range from 4,000 years to a century or two.

Data Evaluation. European archeologists have studied and written extensively about their continent's stone rows. We have only sampled this immense lode of information. In North America, long stone rows are scarce as is pertinent literature. Unlike Europe, where A. Burl and others have measured and cataloged all the stone rows they could find, North American archeologists have shown scant interest in them. It is safe to say that many North American stone rows have been overlooked or destroyed by agriculture. Since Western Europe is so well-covered, we concentrate here on North America. Our rating reflects the rudimentary state of the available literature covering this continent. Rating: 3.

Anomaly Evaluation. In North America, a few long stone rows seem to be astronomically oriented. Some others, in Greenland, are associated with native games. All others, in both North America and Western Europe, have more or less automatically been categorized as ritual in purpose, especially in the role of guiding human processions toward shrines or grave sites. None of these applications is

anomalous in itself. Ritual use challenges no archeological theories. In fact, it is nicely compatible with modern scientific thinking. Nevertheless, we catalog long stone rows because they are: (1) curious and interesting; and (2) still a bit mysterious in terms of use. We only suppose that most had ritual applications. Rating: 3.

Possible Explanations. See above discussion.

Similar and Related Phenomena. Short stone rows (MSH1); avenues and double stone rows (MSH3); multiple stone rows (fans) (MSH4); meandering stone rows (MSH5); the East Bay walls (MSW2); boulder trains (ESM4 in Neglected Geological Anomalies).

Entries

X0. Introduction. The transition from short to long stone rows is surprisingly sharply defined in Western Europe according to A. Burl's taxonomy. Rows of seven or more stones, in contrast to those short rows of two-to-six stones, are not straight and are not astronomically oriented. Instead, the long stone rows may drift away from linearity and tend to avoid hills and escarpments. Many long stone rows lead those who walk along them toward stone circles, cairns, and other megalithic structures. Far from being as imposing as the stones of the Devil's Arrows (MSH1), the stones in the long rows may be so small that they are now hidden in the grass. They may increase in size as the row terminates near a cairn or circle. What they lack in height, the long stone rows make up for in length. In Britain, one is over 2 miles long. (R11)

Long stone rows are also necessary components of three more-complex megalithic structures prominent in Burl's megalithic taxonomy:

- Double stone lines
- Stone avenues
- Stone fans or arrays

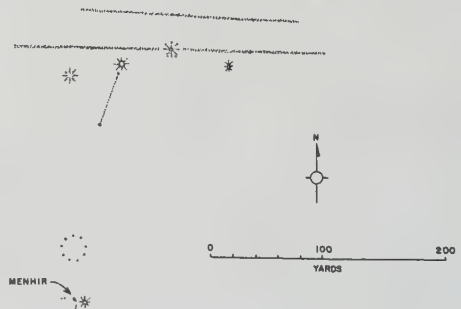
We treat the double lines and avenues together in MSH3; the stone fans, which are certainly the most intriguing of the genre, are dealt with in MSH4.

The only other continent where our literature search has produced anything resembling Europe's long stone rows is North America. On this continent, some of the stone rows seem to be astronomically aligned and may, therefore, have had different purposes than their European look-alikes. Indeed, some North American stone rows are known to have

been used in native games rather than in serious ritual processions!

X1. Western Europe. A. Burl catalogs 171 long stone rows in Britain, Ireland, and Brittany---the same general areas where megalithic dolmens, graves, and other stone structures are concentrated. However, the long stone rows are not evenly distributed, being much more common in southwest England, southwest Wales, and Brittany. On Dartmoor, for example, almost 50 long stone rows mingle with double rows, fans, cairns, and other megalithic structures.

While the stones in the long stone rows are generally rather small, the rows themselves may be very long. On Dartmoor, they average 600 feet in length. The Stall Moor row stretches for over 2 miles. Another interesting feature of the European long rows is



Two long stone rows at Merrivale, on Dartmoor (R4)



*One of the long stone rows, Merrivale, Dartmoor
(Janet & Colin Bord/Fordean Picture Library)*

the frequent increase in stone size as the row approaches a cairn or other structure. However, many rows begin and end nowhere significant!

An obvious question asks why Bronze Age peoples, who were also involved with such large, sophisticated complexes as Stonehenge and Avebury, would drag hundreds of large stones into long rows. And why are so many long rows concentrated in certain regions? As usual, the only convincing explanation invokes a Bronze Age passion for rituals. (R11) Long stone rows may have guided processions toward circles, cairns, and graves where ceremonies took place. Dartmoor, with its plethora of megalithic structures, was probably a vast ceremonial complex, perhaps with different clans or settlements being assigned to specific areas.

As in the case of the short stone rows, we can only surmise about the purpose of the long stone rows. The energetic row-makers left no written

records. We will see next that the long stone rows in North America were not always employed to guide ritual processions.

X2. North America. Although we have searched the literature assiduously, no megalithic complexes resembling those on Dartmoor or at Carnac have been located on the North American continent. To be sure, there is an earthen analog at Cahokia, in Illinois; but, in general, megalithomania did not infect North America. We have come across only four spots in North America where stones have been artificially deposited in long, fairly straight lines for purposes other than sectioning property and clearing fields. Furthermore, the long stone rows at these sites usually bear only a passing resemblance to those of Europe in either design and purpose.

Massachusetts. When tramping across the fields and through the second-growth forests of New England, one sometimes quite unexpectedly comes upon stone walls. Most, of course, are of colonial origin; and most are also truly walls and not stone rows. But a few of these now-abandoned structures are row-like and resist mundane explanations. These exceptions seem to have had ritual and/or astronomical applications and may not have been emplaced by practical New England farmers.

In their book *Manitou*, J.W. Mavor, Jr., and B.E. Dix mention two groups of stone rows that are suspicious enough to warrant cataloging here.

The first site is located at Brewster, Massachusetts, on Cape Cod. The property is believed to have originally belonged to an Indian named Sachemas, who lived during the 16th. Century.

His home is unrecorded but may well have been on the last piece of property he sold, which abuts the ponds

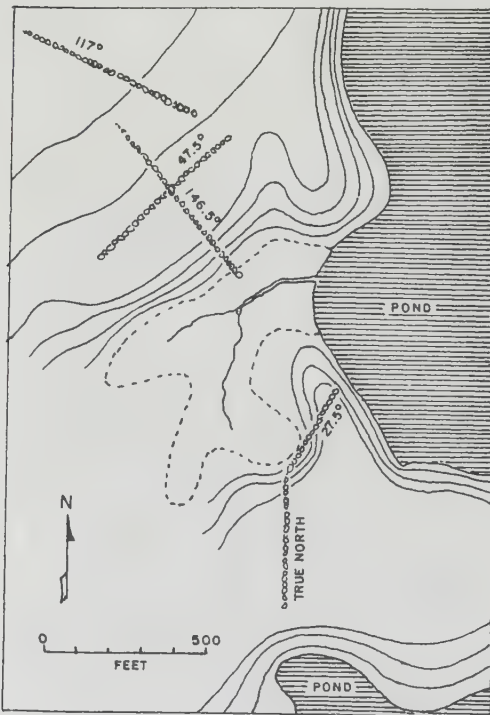
and contains a group of curious, straight, single-course rows of boulders with intermittent groups of standing stones. Some of these have notably avoided becoming land boundaries in centuries succeeding Sachemas' time. In [the figure], we show the rows on this site which connect bodies of water. One ends with a particularly spectacular row of standing stones ending with a large Indian grindstone located precariously on the top of the steep bank of the pond, as if this place, though awkward to use, was important, perhaps for ritual. (R10)

The photograph accompanying the map reveals a straight row of well-separated standing stones, perhaps 3 feet high, that would blend in beautifully with those in a Dartmoor long stone row! (R10)

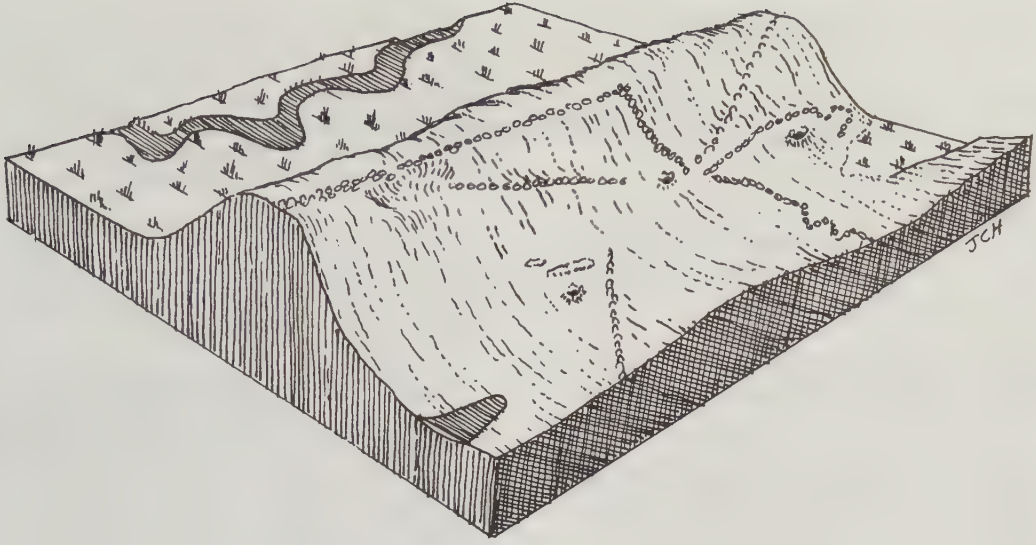
Mavor and Dix found the second suspicious site near Boxborough, in eastern Massachusetts, along the Boxborough esker, a 2½-mile-long ridge, 56 feet high, left behind by the Pleistocene ice sheet. The accompanying map reveals the paths of several of the curious stone rows draped atop and along the esker. Given the precipitous terrain and the swampy land below, these stone rows would have had little practical use. Photographs show the rows to be composed of smallish, rounded boulders. In fact, the rows are sometimes more wallish than rowish. Be that as it may, the most interesting aspect of the stone row along the esker spine is its alignment with the summer solstice. (R10)

Other odd stone structures and artifacts bequeathed by both Indians and colonials are found in the environs of the Boxborough esker. It is difficult to say who built the stone rows, when they were constructed, and why.

Colorado. Three Colorado stone alignments are worthy of note. The first and most renowned was reported by C.A. Deane in an 1869 issue of *Scientific American*. (R1) A much later and more engaging account of these curious stone rows is due to J.C. Moomaw, who was foreman of a trail-building party high in the Rockies. His party was constructing a horse trail from Estes Park across the Continental Divide to Squeaky Bob's Place on the headwaters of the Colorado River. High above the timberline, near what is now called Trail



Sketch of stone rows, Brewster, Massachusetts (Adapted from R10)



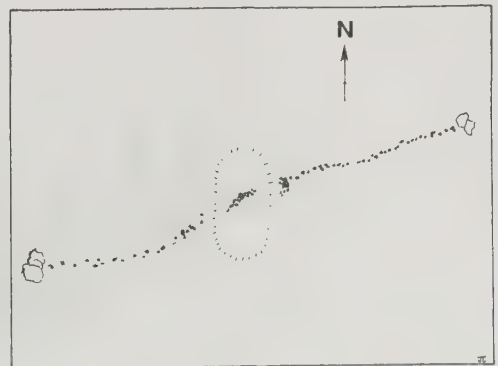
*Curious stone rows draped over an esker, Boxborough
Massachusetts (Adapted from R10)*

Ridge Road, Moomaw spotted a rock alignment similar to that reported earlier by Deane.

While standing on the top of the south hill adjacent to the saddle and trying to picture in my mind the pageant of life that had passed below, I noticed a line of stones running down both sides of the slope at a right angle to the trail. In places it almost resembled a wall. Tipi circles are fairly common in that section but here was something different! The more I looked the plainer it became. It wound this way and that in order to take advantage of large boulders. Without a doubt it was man-made. The stones had not been moved in ages, and many were embedded in the sod and covered with lichens. For several days I pondered over this line of stones and then I noticed another line of them on the north hill running parallel to the path about 150 feet to the north of the trail.

I went over these lines of stones with a compass and tape line and got the following data: The northern line of stones is 240 feet long and runs almost parallel to the trail, southeast to northwest, and is 150 feet north of the saddle. The line of stones to the

south begins at a large boulder south of the saddle and extends for 510 feet. It runs southwest over the top of the south hill and down the slope to another saddle. If the lines of stones were connected and viewed from above, they would look like the letter L. But, the rock "walls" do not quite meet. The opening is located at the bottom of the pass and the trail goes through it. Naturally, the ques-



A rock alignment in Colorado's Front Range. Each "arm" is about 90 feet long. (Adapted from R7)

tion of the purpose of the "walls" arises. (R6)

Moomaw pondered over the purpose of the stone rows, easily eliminating from consideration fortifications and game fences, and finally admitting:

I know that the "out" for archaeologists is often "ceremonial," when they cannot find a plausible use of reason for something. But in this case it may be true. (R6)

Moomaw added that he later found additional examples of these stone lines in the Rockies.

In his 1977 book Native American Astronomy, A.F. Aveni penned a description of two stone rows near Trail Ridge Road, at 11,400 feet altitude. These rows are located in the same general area as those described by Moomaw, but their configuration is different. Two spokes of stones radiate in opposite directions from a central cairn and end in rough piles of stone. The lines are about 100 feet long and meander a bit. With the cairn as a foresight, the longer of the spokes aligns roughly with the rising point of the summer solstice sun. Aveni opines that the two rows may be the spokes of a primitive medicine wheel. (MSH22) But he also wonders why anyone would construct a medicine wheel in such an inhospitable place. (R8)

The medicine-wheel explanation of alignments in the Trail Ridge area seems unlikely to W.M. Hursted. The Moomaw stone rows, he asserts, certainly do not resemble medicine wheels, boulder effigies, or other Indian-built structures common in that area. He also wrote:

Somewhat similar structures found elsewhere in northwestern America are believed to be for ceremonial purposes, and this also may be true of the Colorado examples. (R7)

Indeed there are other examples in Colorado, but our third alignment comes from the southwestern part of the state. All we have on this interesting structure is a sketch from an 1878 report by F.V. Hayden (R2), as reproduced in R12. We have found nothing more on the alignment's exact location, age, builders, or purpose.

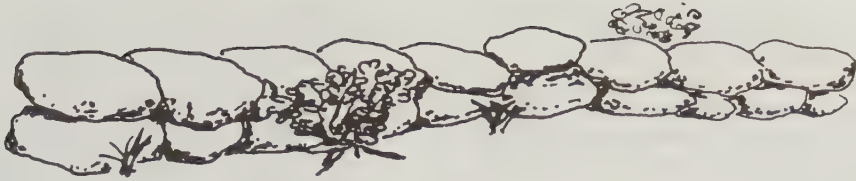
We suspect that further literature research and inquiries to local historical societies would bring to light many more long stone rows in the North American west.

California. Despite the foregoing expectations, we have found only a void between the Colorado stone rows and the next North American example.

Our California rock alignment is located in the northwestern part of the state. Since it is still used for Indian ceremonies, its exact location is not



Standing stones in southwestern Colorado (R2, R12)



A California rock alignment (almost a "wall"). This alignment is associated with Indian prayer seats. (R9)

available due to fear of disturbance. The site is replete with stone rows, cairns, stone circles, and semicircular stone enclosures. It is a modern ceremonial site a bit like a miniature Dartmoor.

The stone rows, however, might well be called low "walls." But they are only 1 to 2 feet high and do not enclose anything. They are short, the longest running for only about 26 feet. Prayer seats and trails that lead to peaks where prayer seats occur are associated with these stone rows or "walls." (R9)

California also boasts many enigmatic stone structures that we classify as true walls. These are located mainly east of San Francisco Bay and on Point Reyes. See MSW2.

The California stone rows stretch Burl's definition of long stone rows a bit, but their application seems to be (present tense) much like that assigned to the legitimate, much longer stone rows in Western Eruope.

Greenland. The stone rows on this huge Arctic island are remarkably like those in Britain but they have a different and unusual purpose: they have been and perhaps still are used in native games that involve hopping from one stone to the next! Probably an Arctic form of hop-skotch! The stone rows are called nanngissats by the natives. M.P. Porsild describes them as follows:

Most frequently the stones are placed in a single straight line. They are usually about as large as could be lifted by a strong man, and their weight alone is sufficient to keep them in place when hopped on. But often for lack of stones of suitable size smaller ones have been used. Their upper surfaces are comparatively smooth. The distance between the stones does not vary much, being ordinarily little more than half a meter. I could easily hop from one stone to another, but I always found



A Greenland stone row ("nanngissat"). Stone rows such as these are used by natives in hopping games!

it wearisome to hop over a large number. I have counted as many as 70 stones in a single row. (R3)

We are not implying that the Bronze Age inhabitants of Europe hopped along their long stone rows, only that long stone rows are not always used in rituals.

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MSH3

Double Stone Rows and Avenues

Description. Two rows of stones, straight or curved, usually separated by a fixed distance. Such double rows are almost always associated with stone circles, cairns, graves, and other megalithic structures.

Data Evaluation. An enormous amount of effort has been expended by professionals and amateurs in measuring, studying, and speculating about the double stone rows and avenues of Western Europe. We have used only a few of the references that are readily available. A near-void exists, however, regarding these structures in the rest of the world. It is probable that double stone rows and avenues are present at megalithic sites in Asia, Africa, and South America. So far, though, we have only read about a few in Indonesia. Rating: 2.

Anomaly Evaluation. Grand though some of them are, we see nothing anomalous in the construction or purpose of double stone rows and avenues. Rating: 4.

Possible Explanations. Parades and processions are part of human nature, and it is only reasonable that we construct these special pathways for them.

Similar and Related Phenomena. Stone circles (MSH7); short stone rows (MSH1); long stone rows (MSH2); stone fans and arrays (MSH4 and MSH5); meandering stone rows (MSH6); stone walls (MSW2); Chaco Canyon "roads" (MSR2).

Entries

X0. Introduction. Double stone rows and avenues both consist of two lines of stones. The lines are usually, but not always, separated from one another by approximately the same distance along their courses. Their courses may be straight or curved. But there is a key distinction between double lines and avenues. Again following A. Burl (R9), avenues are always associated with stone circles. If they lead directly to the stone circles, they are true avenues. The so-called detached avenues and tangential avenues stop short of the circles or approach indirectly, respectively. Double stone rows, in contrast, are never associated with stone circles, although they often lead to grave sites, cairns, etc. Double stone rows and avenues abound in Britain, Ireland, and Brittany. Burl

records 64 double stone rows (most of them on Dartmoor and Exmoor) and 55 avenues (all but 5 in Britain). The only megalithic avenues we have located outside of Western Europe appear to be on Sumatra, in Indonesia.

The configurations and associations of double stone rows and avenues make it virtually certain that their main purpose was channeling the flow of worshippers and celebrants to shrines and other important megalithic sites, such as the Avebury stone circles. A few avenues, such as the straight one attached to the Callanish circle, are astronomically aligned, but astronomy does not seem to have been the main purpose of double stone rows and avenues; they were primarily processional ways.

There is little mystery in processional



W. Stukeley's well-known sketch of Avebury drawn in the early 1700s. Although there are a few minor errors, it records the grandeur of the circles and long avenues.

ways, regardless of their lengths or grandeur. Modern cities and churches often have them. Like pyramids, they seem to come naturally to human builders. With little that is anomalous to attend to, we will now treat some of Europe's most impressive megalithic sites rather cursorily and move on to structures that are more mysterious.

X1. Western Europe. All of Europe's double stone rows and avenues were probably constructed between 2,600 and 1,800 B.C. From the 64 double rows and 55 avenues, we select three as representative. None is anomalous, but that does not mean that they are not impressive.

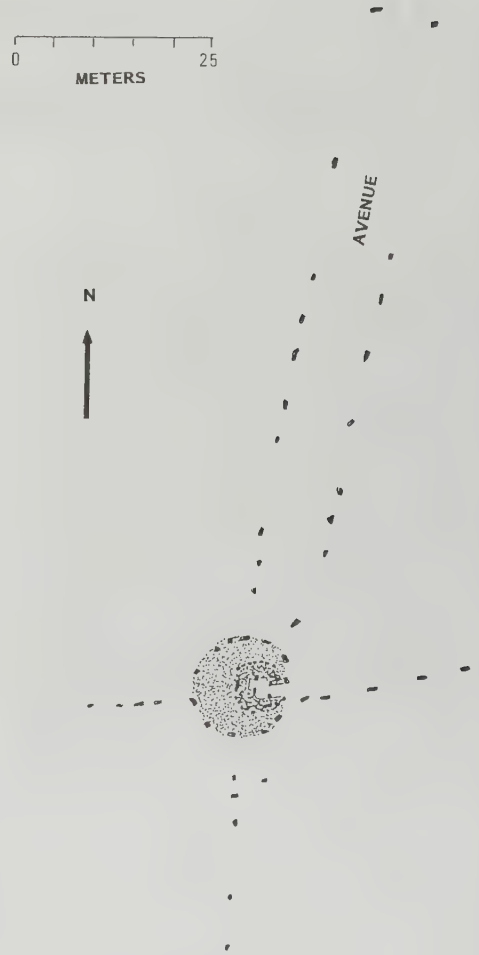
Avebury. Avebury, in Wiltshire, is blessed with two splendid avenues, as shown in W. Stukley's oft-reproduced panorama drawn in the early 1700s. The Beckhampton Avenue sinuously approaches the site's Outer Circle from the west. Kennet Avenue leads southeast from the Outer Circle to Overton Hill (the so-called Sanctuary). Originally, Kennet Avenue boasted about 200 large upright stones, some as tall as 18 feet, and extended for over a mile. (R7, R9, R10)

The curved nature of both Avebury avenues militates against any astronomical alignment. They were undoubtedly processional ways---and what worshipper from the Bronze Age hinterlands could fail to be impressed?.

Callanish. Callanish is a grand megalithic site located, rather incongruously, on the rather bleak island of Lewis, Outer Hebrides, far northern Scotland. One finds it difficult to imagine large crowds of worshippers parading along its avenue towards the central circle so far from the gentler climate and countryside around Avebury.

Callanish's avenue is 273 feet long. It approaches the stone circle from the north-northeast flanked by slim, imposing menhirs as tall as 11 feet, 6 inches. Curiously, the avenue is a bit funnel-like, being 4 feet wider at its beginning.

Early in the 20th. Century, N. Lockyer suggested that Callanish's avenue was built so that it was aligned with the



Plan of the Callanish stone circle and avenue. (Adapted from R9)

rising point of the star Capella. (R2) In 1965, G. Hawkins found another possible alignment. If one stands at the beginning of the avenue, looking south-southwest toward the stone circle, one sees the midsummer moon at its major southern extreme on the slope of Mount Clisham. (R5, R9)

Astronomical alignments notwithstanding, the avenue's main purpose was probably expressed by W.J. Millar back in 1879.

The general impression which one gets from standing amongst the Cal-



*Midsummer sunrise at Callanish, Isle of Lewis
(Gerald Ponting/Fordean Picture Library)*

lanish stones is that the long avenue was intended as an approach from the not far distant shore for a large body of people, who would thus converge towards the central circle. (R1)

Dartmoor. On bleak Dartmoor and nearby Exmoor, the megalith builders erected the great majority of Western Europe's double stone rows. Some are a mere 24 feet long, but others stretch for almost 950 feet. The average width between the rows is 4 feet, 2 inches. Some, however, are very constricting---only 1 foot wide. Any procession along these rows would have to be single file! The upper ends of most double rows end in cairns of barrows. Even though some are very narrow, the double stone rows are almost certainly, like the more imposing avenues, processional ways.

No one has made a convincing case for astronomical alignments for the double stone rows. Actually, with so many double rows, oriented in different

directions, and with so many bright stars, one can rather easily discover alignments. These are probably mostly accidental. (R4, R6, R9)

X2. Southeast Asia. Megalithic structures are found on many of Indonesia's islands: Sumatra, Java, Bali, Sulawesi, and others. Of course, these megaliths are much younger than those of Western Europe. They probably go back no further than the 1st. Century B.C. (R3) The only avenues similar to those seen in Europe that we have found so far are on southern Sumatra. Our only facts come from P. Bellwood's classic Man's Conquest of the Pacific.

Perhaps the finest group of megalithic monuments in Indonesia is situated on the Pasemah Plateau in Southern Sumatra. This group includes

stone blocks with hollowed-out mortars, troughs, groups and avenues of upright stones, terraced 'graves', and slab graves. (R8)

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- R9. Burl, Aubrey; From Carnac to Callanish, New Haven, 1993, pp. 4, 19, 61. (X0, X1)
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MSH4

Multiple Lines of Stones in Western Europe

Description. Standing stones arrayed in three or more rows, as found in western Europe. The rows may be splayed; that is, divergent. Some are short, only a few dozen feet long; others stretch for over a mile. Stone heights range from about 20 feet to just a few inches that are barely visible in the turf. All megalithic-age multiple stone rows are confined to southern England, northern Scotland, and Brittany. Stone arrays erected by other cultures are cataloged in MSH5.

Data Evaluation. The multiple stone rows are so spectacular that they have attracted the attentions of archeologists, both professional and amateur. As a result, the literature is rich. Our references represent only a small fraction of what is available. Rating: 1.

Anomaly Evaluation. The construction of the multiple stone rows presented no major engineering problems in the megalithic age. The stones are modest to small in size and are usually not worked or finished in any way. The real mystery surrounding these magnificent stone arrays is that of purpose. Was astronomy or ritual the force behind their construction? Archeoastronomers have had scant success in proving significant alignments and reasonable astronomical applications, even with the best-preserved of the arrays. In contrast, the characteristics of the multiple stone rows and their associations with other megalithic structures are consistent with their use in ritual processions and celebrations. Still, doubts as to purpose persist. Rating: 3.

Possible Explanations. See above discussion and the last part of X1 below.

Similar and Related Phenomena. Single and double stone rows (MSH1, MSH2, MSH3); stone arrays and mazes (MSH5); stone meanders (MSH6); stone circles (MSH7).

Entries

X0. Introduction. In Western Europe and nowhere else, one is amazed to see hundreds of menhirs arranged in long, multiple lines. Compared to these kilometer-long columns of marching stones of Brittany, the thin single and double lines of stones on Dartmoor seem insignificant. But Dartmoor and Exmoor also have their stone armies, and still others march across northern Scotland.

As is our custom in the matter of stone rows, we follow A. Burl's definition of "multiple rows."

The criteria used here to define a multiple setting are that there should be three or more lines approximately abreast of each other, of about the same length and not at acute angles. (R14)

Multiple stone rows do not form mathematically perfect arrays. One of the most impressive multiple columns, the one at Menec in Brittany, suddenly and curiously changes direction slightly. In addition, almost half of all multiple stone rows are splayed; that is, the rows are farther apart at one end than the other. These characteristics help separate multiple stone rows from the stone arrays, mazes, and patterns cataloged next in MSH5.

X1. General observations. The grandest of the multiple stone rows march across the countryside of Brittany, with those of northern Scotland a close second. More are to be observed on Dartmoor and Exmoor in southwestern Britain. Only in these three geographically separated localities do we find multiple stone rows. This restricted distribution is one of the puzzles associated with this species of megalithic structures. Particularly strange is the close similarity of the multiple stone rows of Brittany and northern Scotland, which are separated by 750 miles (1,200 kilometers). The inhabi-

tants of these two regions must have been in close cultural contact some 5,000-3,500 years ago. (R14)

Multiple stone lines may number as few as three (Yar Tor, Dartmoor) or as many as 23 in Scotland (Mid Clyth). The shortest rows are at Skelpick (Sutherland, Scotland) where they reach only 32 feet (about 10 meters). In Brittany, the Menec lines extend 3,094 feet (943 meters). Kerzerho, also in Brittany, may hold the length record, for there is evidence that these stone lines may have been as long as 6,906 feet (2,105 meters). (R14) The largest menhirs are found at Menec, in Brittany, where they reach heights of 12 feet (3.7 meters) at one end but shrink to only 3 feet (0.9 meter) at the other end. This gradual reduction of height along the rows is a common feature of multiple stone rows. (R13)

Closely associated with many multiple stone rows are cromlechs, cairns, and large rock-defined enclosures, some of which could have corralled hundreds of people. These associations bring us to the question of purpose. Why did megalithic people expend so much energy in gathering and erecting huge boulders? At Kerzerho, 1,200 boulders are marshalled in ten long lines. That represents immense labor. Was the primary purpose of the multiple lines ritual in nature or was astronomy the dominant impetus? Perhaps it was a combination of both?

Obviously, we must ignore here the tales that the multiple rows represent armies of fallen heroes or magically lithified Roman soldiers who were pursuing Cornely, Carnac's native saint and one-time pope. The stone rows were in place a couple thousand years before Caesar.

In assaying the mystery, if any, of the multiple stone rows, we first draw quick sketches of the features seen on Dartmoor, in northern Scotland, and in Brittany to see if any hints as to purpose exist.

Dartmoor and Exmoor. Across the Channel, roughly 200 miles north of Brittany's megalithic center of Carnac, are

the multiple stone rows of Dartmoor and Exmoor. However, the 20 multiple stone rows here cannot compare in grandeur with those in the environs of Carnac. The Dartmoor rows are shorter and seem more primitive.

The Dartmoor and Exmoor rows average only 447 feet (136 meters). Many sites count only three rows of stones and these appear as if they are merely double rows that were later enhanced with an additional row. The stones used are small, even tiny, especially on Exmoor. Like the nearby single and double rows, the multiple stone rows usually terminate near a cairn or stone circle.

Although some of Dartmoor's double stone rows are claimed to have astronomical significance (R7), the multiples seem ill-suited to that purpose. For example, the impressive triple rows at Cosdon tend to wander too much, and the rows at Corringdon Ball converge, as do those at Shovel Down and Chalcacombe. (R14, R15) The Dartmoor and Exmoor rows seem better designed for

use in ritual processions than in the precision observation of the heavens.

Northern Scotland. Five hundred miles north of Dartmoor and 750 miles from Carnac lie the 23 sets of multiple stone rows of Scotland. A. Burl emphasizes that these megalithic rows exist in cultural isolation, much as Callanish does 140 miles to the west. The major concentrations of Scottish multiple stone rows are in Caithness (12 arrays) and Sutherland (9 arrays). The Sutherland arrays each consist of seven short rows about 80 feet (24 meters) long. At Caithness, the rows are longer, averaging 134 feet (41 meters) and usually have more lines of stones---23 rows of them at Mid Clyth. Nearly all of the Scottish multiple stone rows are fans, converging as they climb slopes. (R14)

A. Thom and others see astronomical alignments in some of the Scottish multiple stone rows. (R7) This potential purpose has been well-described by P.L. Brown.



Stone rows on the aptly named Hill o' Many Stanes, Caithness, Scotland (Janet & Colin Bord/Fordean Picture Library)

One of the most remarkable aspects of Thom's megalithic studies at Scottish sites was his interpretation of the curious fan-shaped stone arrays in Caithness. In several of these arrays the slabs are positioned with their long axes laid parallel to the direction of the row. These stone rows had been surveyed in 1871, but their curious layout, with the individual stones seldom more than 45 cm (18 inches) high, had long provided an even bigger puzzle as to their true purpose than had the megalithic circles. However, according to Thom these rows perhaps represent primitive stone computers used by the astronomer-priests to solve complex problems involving extrapolation which arises as a consequence that the moon's maximum declination may be reached when it is not at its rising or setting point... Thom's interpretation of these fan-arrays perhaps represents the greatest degree of sophistication yet claimed for megalithic man, and for good reason they have been referred to as 'megalithic graph paper.' (R9)

Burl dissents in the matter of astronomical significance. He asks why there are multiple stone rows and, second, why they are splayed? These properties are not required for lunar astronomy. Furthermore, Burl adds that the more rows there are in a group, the more fan-like the group. In his eyes, the key to the purpose of all multiple stone rows, wherever they are found, is their convergence on a cairn, cist, mound, or

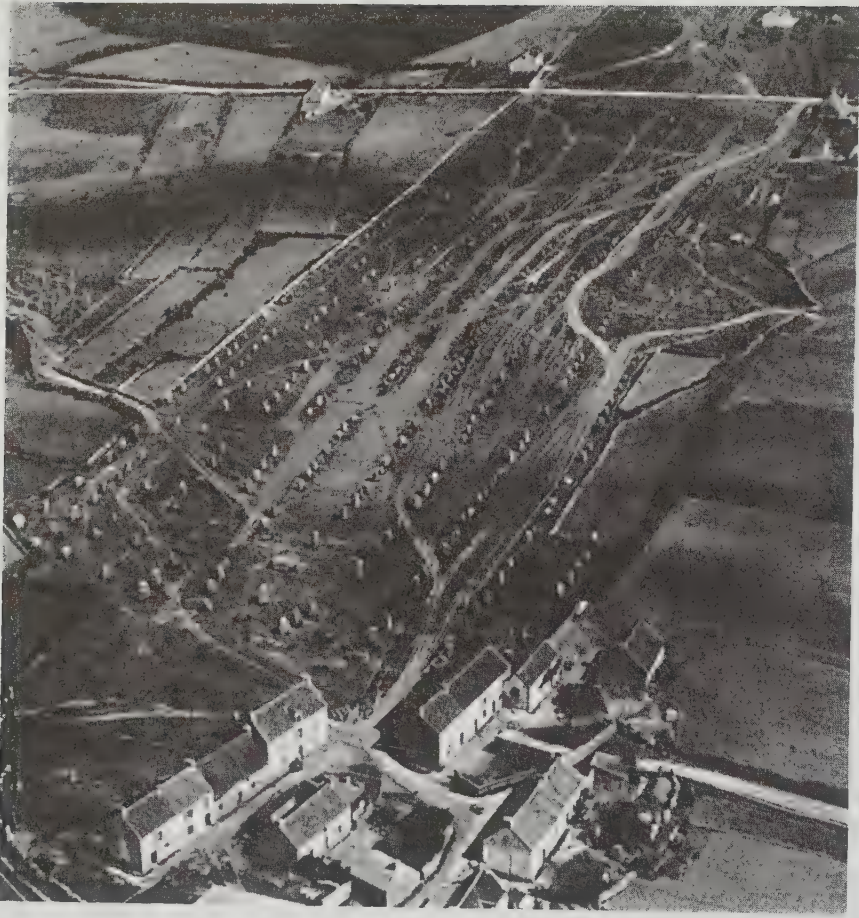
some other megalithic structure. The multiple rows serve to focus attention on and channel the movement of people toward points with ritual significance. (R14)

Brittany. At least 20 magnificent multiple stone rows amaze tourists to Brittany. Eleven of these are within 5 miles (8 kilometers) of Carnac-Ville. In this same area is the greatest concentration of cromlechs. Significantly, the largest and most grand of the multiple stone rows are associated with these cromlechs. The most impressive of Brittany's stone rows are at Menec, Kermario, Kerelescan, and Kerzerho. To convey to the reader the magnificence and mystique of these places, we select E. Hadingham's description of the Menec rows.

The town of Carnac on the southern coast of Brittany is associated with a group of the most surprising and impressive ancient monuments in Europe. A visitor leaves the old town along a minor road to the hamlet of Le Menec, where a cluster of white-washed cottages is encircled by an almost continuous ring of seventy large granite stones, forming an oval enclosure nearly 300 feet across. On the rocky ground to the east of this ring is the starting point for eleven lines of standing stones, and from this position the visitor has a view of 1,099 megaliths sloping away from him almost as far as the eye can see. The first glimpse of these alignments, since restorations were carried out in the late nineteenth century, is now



S.P. Oliver's 1872 sketch of the multiple stone rows at Kermario, Brittany. (R2)



Multiple stone rows at Carnac. (French Government Tourist Office)

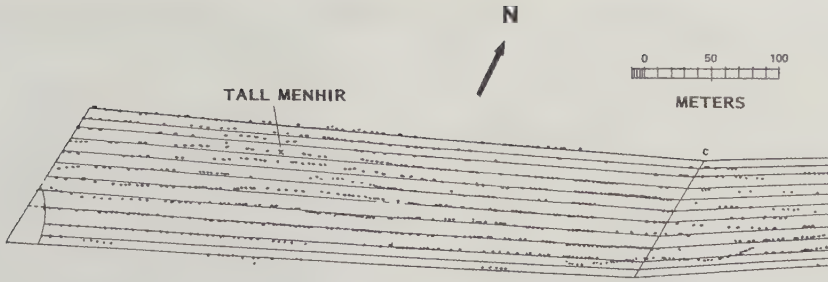
even more striking than it was for an early antiquary, the Chevalier de Freminville, who described it in 1827:

"As I reached the top of the hill, the plain of Karnac suddenly spread itself out below me, and its wild heathland, the horizon fringed with pine woods, and above all the extraordinary view of that regiment of stones, the startling army of shapeless rocks so symmetrically aligned, filled me with astonishment.

"Surely nothing offers a greater, stranger or more singular spectacle than the assembly of these massive and gigantic monuments. Vainly the observer searches for some word to

describe them, and when he has failed, is bound to confess that any idea or picture which he may previously have formed does not bear any relation to what is here before him. The numbers of these stones in their bizarre arrangements, the height reached by their long, grey, mossy outlines rising from the black heather in which they are rooted, and finally the absolute stillness that surrounds them, all astound the imagination and fill the soul with a melancholy veneration for these ancient witnesses of so many centuries." (R8)

Menec is not all geometrical perfection. The eleven stone rows are not perfectly



Plan of the multiple stone rows at Le Menec, Brittany. Note puzzling alignment change. (Adapted from R5)

straight, and there is an enigmatic slight change in their direction about half way between the two stone-girded enclosures that mark the array's beginning and end. One would think these departures from regularity would discourage the archaeoastronomers, but they haven't.

A. Thom held that, like the Caithness fans, the Menec rows were a sort of stone "graph paper" that the builders used to refine their observations of the moon, using Grand Menhir Brise (MSD3) as a foresight. (R4-R6, R10) But, A. Burl, steadfast in his theory that most stone rows have ritual as their main purpose, seriously doubts the astronomical interpretation (R14), as does E. Hadingham in a 1981 paper in *Antiquity* (R12).

More on purpose. Archaeoastronomers have had to struggle to support any theories that multiple stone rows were constructed mainly with lunar observations in mind. A. Thom's "extrapolation" theory is the most interesting. The megalithic people were very concerned with accurately determining the times when the moon reached its extreme positions in the sky. The problem that arises is that this important event in the lunar cycle can occur when the moon cannot be observed on the horizon. Thom believed that the multiple rows at Carnac and Caithness, in particular, were useful in determining the extremes via an extrapolation technique. (R4, R5, R6) This is a highly sophisticated mathematical method for humans to have mastered 5,000 years ago but is not lethal to the theory.

It must also be asked if attaining such astronomical precision was an ef-

ficient use of manpower in view of the immense amount of labor required to set up stone "graph paper" at Caithness and Carnac. Of course, we cannot really answer such a question because we have no idea how much value ancient peoples placed upon either labor or on precise lunar data. We could ask the same sorts of questions about Stonehenge and even the Great Pyramid. The ancients may have had values radically different from ours and built their structures accordingly.

After having made these observations, we must still take Burl's objections to the astronomy hypothesis seriously. Most multiple stone rows are somewhat crooked and/or splayed. Menec, where Thom sees a potential astronomical application, jogs a bits to the north in mid-stream. Menec is also adorned with large enclosures at both ends with no obvious astronomical value. Taking all things into account, Burl's assertion that the multiple stone rows were built for rituals rather than as stone "graph paper" seems more likely.

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- R13. Westwood, Jennifer, ed.; The Atlas of Mysterious Places, New York, 1987, p. 44. (X1)
- R14. Burl, Aubrey; From Carnac to Callanish, New Haven, 1993, pp. 2, 11, 110, 113, 157. (X0, X1)
- R15. Burl, Aubrey; A Guide to the Stone Circles of Britain, Ireland and Brittany, New Haven, 1995, pp. 57, 260. (X1)

MSH5

Stone Arrays and Mazes

Description. Stones arranged in geometrical formations or mazes. The arrays are usually rectilinear or circular. Mazes may be of various designs but are generally easy to classify by their convoluted character. We include here, under the classification of arrays, several multiple stone rows that are temporally and culturally divorced from those of Western Europe. (MSH4) The stones employed in arrays and mazes may be tall menhirs, small and large boulders, or linear heaps of small stones and pebbles.

Data Evaluation. Although our data sources are generally recognized journals and books by respected authors, they are admittedly skimpy. For example, we lack dates, dimensions, and probable engineers in several cases. In comparison to the extensive work on the stone circles and stone rows of Western Europe, arrays and mazes outside of this region have been neglected. Rating: 3.

Anomaly Evaluation. Apparently, most stone arrays were constructed for purposes of ritual, commemoration, or amusement. The purposes of the large stone mazes of the American Southwest are still a bit mysterious; and we are surprised at the extent of megalithic activity in Algeria and India. Nevertheless, there seems to be little here that casts doubt on major archeological hypotheses. Rating: 3.

Possible Explanations. See above discussion.

Similar and Related Phenomena. All other sections in this chapter.

Entries

X0. Introduction. In MSH1-4, we see how ancient peoples employed lines of rude stones for the construction of ritual avenues and astronomical observatories. Some of the stone arrays presented in this section may also have been used for these purposes, but some different applications seem more probable.

First, some stone arrays are obvious mazes that might have been laid out for ritual processions but more likely for games or individual enjoyment---a sort of prehistoric entertainment center! Second, humans have a penchant for geometrical order. This may be seen in many of the arrays of this section. Just as the ancient Greeks favored the regular columns and proportions of the Parthenon, even older cultures seem to have expressed themselves in terms of the orderly arrangements of stones.

This same artistic bent is also seen in the "boulder mosaics" and the effigies outlined in stone, which we cover in another volume (MGG) along with the Nazca lines and other "geoglyphs."

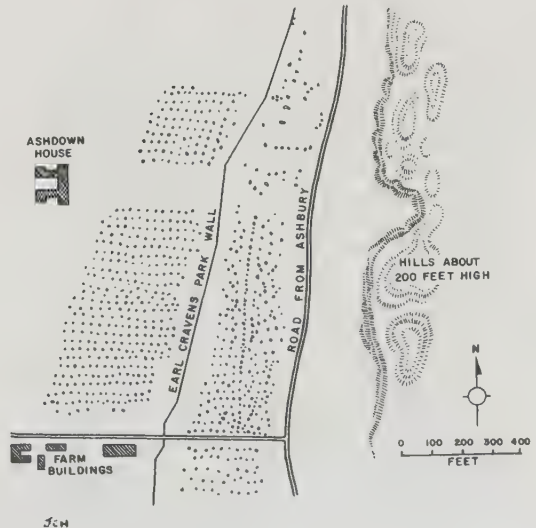
is only the smallest that can be said to be standing. The consequence is, that we cannot feel sure that we know exactly where any of them stood, nor whether they were arranged in lines, like those at Carnac; nor if so, in how many rows, or whether they always had the confused appearance they now present. They are spread over an area of about 1600 feet north and south, and half that distance east and west. The gap in the centre was made purposely to clear the view in front of the house when it was built, and many of the stones it is feared were employed in the erection. They are the same Sarsens as are used at Avebury and Stonehenge, and the largest are about 10 feet long, from 6 to 9 wide, and from 3 to 4 feet high (in their present recumbent position); but there are few so large as this, the majority being from 2 to 4 feet in length and breadth, and from 1 to 3 high. (R2)

Sweden. Scandinavia is home to many stone mazes. We have as yet found no-

X1. Europe

England. It was tempting to classify the stone lines at Ashdown, Berkshire, with the arrays on Dartmoor. However, they are less well ordered and seem to be of a different species. J. Fergusson, that connoisseur of rude stone arrangements, described the Ashdown stone array in conjunction with two other nearby archaeological features: the Uffington "white horse" engraved in the chalk and a cromlech known as "Wayland Smith's Cave."

The third [the Ashdown stone rows] is as remarkable as either, but still wants its poet. The annexed woodcut will give a fair idea of its nature and extent. It does not pretend to be minutely accurate, and this in the present instance is fortunately of no great consequence. All the stones are overthrown: some lie flat on the ground, some on their edges, and it



Stone array at Ashdown, Britain (R2)



Stone maze on St. Agnes, Scilly Isles. The wreck of the Earl of Lonsdale is in the background. (Janet & Colin Bord/Fortean Picture Library)

thing on their ages and original purposes. Presumably, they are much more recent than the megalithic stone rows, dolmens, and cromlechs. Apparently, they are now primarily tourist attractions and, conceivably, may have been built for that very purpose. J. Bord writes the following about the most famous of these stone mazes.

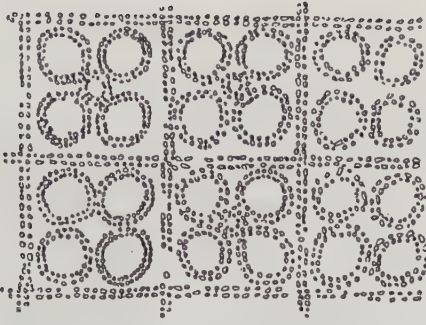
Perhaps Sweden's best-known stone maze is one on the island of Gotland, which is in the Baltic Sea off the east end of the mainland. This maze, known as Trojeborg (Troy Castle), is on flat ground below Gallow's Hill near Visby. One explanation for its presence there is that it was built by a girl in the Middle Ages, in order to obtain a pardon for her rich pirate father. She promised the Council of

Visby that she would promote the area's tourist industry (to use modern terminology) by building a marvelous construction that people would come from far and wide to see. (R11)

Latvia. In addition to the Swedish stone mazes, some unusual geometrical stone arrays exist in nearby Latvia. The accompanying illustration shows one of these arrays at a place called Aschenrade, which is about 50 miles from Riga on the banks of Dwina. Such stone designs are rare in Europe but appear in profusion in Algeria. (See X3.) (R2)

Russia. Everything we know about the Russian "subterranean labyrinths" is contained in the following quotation.

M. Baer, who has recently returned



Curious stone array at Aschenrade, Latvia (R2)

from a journey undertaken, by desire of the Government, into the northern regions of Russia, for the purpose of making a geological survey thereof, has discovered in Lapland, Nova Zembla, and some of the islands lying near the coasts of Finland---particularly in Wiesz, which is all but desert---several subterreanean stone labyrinths. The natives, whom M. Baer interrogated as to the origin or destination of these labyrinths, knew nothing of them, save that they were called Babylons, and held in such veneration that the people were afraid to touch them. M. Baer has brought away drawings, which he is about shortly to publish, for the speculations of the learned and curious. (R1)

X2. North America.

California-Arizona border. Near Blythe, California, where the Colorado River separates California from Arizona, are located two huge ground figures ("geoglyphs"), one of a human, the other an animal. These giant figures were drawn by scraping away darkened surface rocks so as to expose the light-colored soil beneath. Less well known are three impressive stone mazes farther to the north. These, however, were created not by removing stones and pebbles but rather by piling them up in long rows.

The most famous of these mazes is called either the Mohave Maze (after the local Indians) or the Topock Maze (after

a nearby town. (R5, R10, R13) We use here E. Hadingham's description.

The well-known Topock Maze, for example, occupies a location near the Colorado River similar to that of the Blythe figures, about 100 miles farther upstream. Here, eighteen acres of the river terrace are covered with ridges of rocks and gravel shaped into long parallel rows that run in various directions, sometimes straight and sometimes curved. Two huge human figures were originally incorporated in the Topock Maze, but were destroyed by railroad contractors during the 1880s. According to one theory, the site was used by the Mojave Indians for ceremonial running, intended to purge the soul of evil spirits after killing enemies in battle. (R13)

A few miles east of the Topock Maze, covering approximately two miles of the desert, is an even more amazing maze. This one is circular in form but was made in the same way as the Topock Maze. Judging by the desert varnish on the stones, this maze may be several thousand years old. The following account appeared in the Placerville, California, newspaper in 1977.

However, the enormous circular maze (which can be seen from the air several miles east of Needles and south of highway 66 on the Arizona side) is still intact, in an inaccessible area. How prehistoric men could have constructed such a perfect circle of hundreds of circular lines inside each other, by scooping up rocks to form those miles of rows, is almost beyond one's ability to conceive... acres and acres of back-breaking work. The only difference between this maze and the one closer to Needles is that one is circular and the other is angled. How could such engineering have been done by primitive methods...and why? (R12)

New Mexico. The New Mexico stone array is more like those seen in Britain and Brittany. From the description provided below, it sounds so remarkable and incongruous, given its North American location, that we wonder why it has not been mentioned more often in the archeological literature.

After detailing some stone circles found in New Mexico, A.M. Swan wrote:

The second system of upright stones was discovered by Colonel Walter G. Marmon, while running the first correction line of the Navajo Reservation survey. This field is located about thirty miles northwest of Fort Defiance, and two miles east of the point where the correction line crosses Canon de Chelly, in the Navajo Reservation. Colonel Marmon describes this field as consisting of long lines of upright stones in parallel rows. The stones are about three feet high, and from five to ten feet apart. They stand in a dense pine forest, thus not easily attracting attention. (R6)

Arizona

In the March and April American Antiquarian (R6, above), the article on "Prehistoric Stone Circles" has led me to write you of what may be called "Prehistoric Stone Squares."...Occasionally I have found them on the desert, but, of course, always near a hill, for on the desert plain there is but little or no rock. On the mesas near the foot of the mountains, they are a common occurrence. In general appearance, they are perfect squares, and, practically, they are of all sizes, say from 10 to 300 feet. On some mesas there are perhaps, but one, and again, I believe, I have seen as many as a dozen within an area of ten acres. In some cases they are pretty well covered over by the wash from the hills above, and again they stand out bold and plain, as when first put in place. There are several fine specimens of these squares on the southern foot of the Santa Catalinas, about twenty miles east from Tucson. Some of the squares are made of rock quarried from granite by following the seams, and pieces five feet long and six to eight inches square, are not uncommon. These pieces are set firmly in the ground, a few inches apart, of equal elevation and straight sides. In some cases these squares are in the immediate neighborhood of old towns, but not always. They are not the Cliff-Dwellers, of which so much has been said, nor do they appear to have been the people who cultivated the



Sketch of the Tecopa maze of stone piles, Arizona. (R12)

great plains and built reservoirs and canals, but a people who cultivated narrow strips of land along water courses and fortified the hills above. (R5)

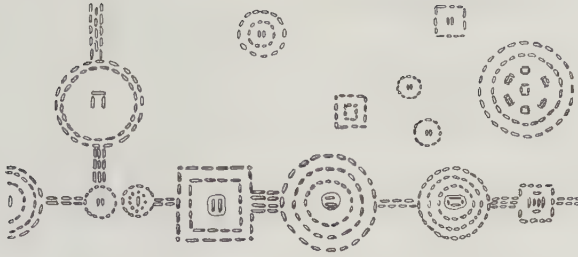
X3. Africa

Algeria. Algeria is remarkable for its thousands of tumuli, dolmens, and stone circles. These megalithic structures are often found linked together by multiple stone rows. (R2) As usual, the purpose of the connecting stone lines is anyone's guess. The same is true for the geometrical stone arrays seen in the accompanying drawing.

Madagascar. Another unexpected location for stone arrays is the island of Madagascar. The menhirs there are apparently all of recent origin. Said to commemorate the deaths of army officers, they are seen aligned on mountain tops. (R8)

X4. Asia.

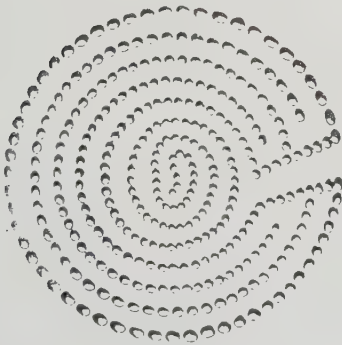
India. Southern Hyderabad is noted for its megaliths. (R3) Some of the menhirs in this region were set up in geometrical arrays and thus belong in this section. Many of the arrays are associated with



A group of megalithic structures in
Algeria. (R2)

graves, just as in Western Europe. From the artifacts unearthed in their vicinity, these standing stones seem to date from from the last century B.C. to the first century A.D. They are, therefore, not evidence of cultural diffusion from the much older megalith builders of Britain and Brittany. F.R. Alchin has provided a good summary description.

The alignments consist of parallel lines of standing stones set out with mathematical precision. The lines are approximately oriented on the cardinal points in all recorded cases. The stones are spaced at carefully regulated intervals which may differ on the north-south and east-west axes. The intervals so far recorded vary between 14 and 40 feet. In one case an alignment is reported to have stones still standing of 14 to 16 feet in height; in another a single fallen stone has been noticed of 25 feet;



Stone labyrinth near Kundani,
India (R11)

but the most common heights for the stones are from three to six feet.

.....

What was the purpose for which these lines of great stones, often weighing several tons, were set up? Within my knowledge, Sanskrit literature supplies no answer, nor does ancient Tamil. There are many references to stone memorial posts, warrior stones, and stones to which offerings are made, but never to alignments of such stones. (R9)

In her Mazes and Labyrinths of the World, J. Bord figures a small stone labyrinth found near the ruined city of Kundani. (R11)

Korea. The megalithic urge to erect multiple stone rows somehow extended across Asia to Korea. This Pacific Rim country boasts at least one European-style array.

Between Chhong-do and Un-chhon (60 miles from Fusan) on a small plain near the base of the craggy slope of a range of hills of basic igneous rock, there are twenty-two large boulders lying in three somewhat regular lines. These lines have a general direction of south-east and north-west, and appear to be about 6 or 7 yards apart, the stones in each line being separated from one another by about the same distance. In the middle line there are seven, and in the outer lines seven and eight respectively. The boulders are all large, one of medium size measuring 12 feet by 9 feet by 5 feet, and are of the same rock as others which

are strewn over the slope of the hill.
(R4)

The Korean megaliths are thought to have been erected in the 16th. century and were obviously not inspired by western Europe.

X5. Oceania

Palau, Micronesia. At Badrulchau, archeologists have counted 52 megalithic standing stones. Twenty-five of these are arrayed in a three-row colonnade 180 feet long, with rows 12.5 feet apart. The stones are about 10 feet long, and it is believed that originally they were all embedded in the ground so that their tops were all level with one another. The tops of all of these stones possess grooves 7-9 inches deep. The popular theory is that these stones were erected to support buildings, after the fashion of the Latte Stones on Guam, Tinian, and associated islands some 700 miles northeast. (MSO5) (R14)

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MSH6 Stone Meanders

Description. Stone lines that curve, wander, and intertwine.

Data Evaluation. We have collected excellent references on stone meanders seen in the North American Southwest and Australia. Surely stone meanders exist elsewhere. If so, we haven't found them, and our files are deficient in this sense. Rating: 2.

Anomaly Evaluation. Despite their disorganized appearance, most stone meanders were probably laid out for the same purposes as mazes; that is, as ritual walks, "spirit paths," and amusement. One Australian example suggests still another purpose: the portrayal of animals and perhaps abstract figures that archeologists do not recognize. Our anomaly rating reflects our residual uncertainty regarding the purpose of stone meanders as well as their curious nature. Rating: 3.

Possible Explanations. See above discussions.

Similar and Related Phenomena. Single and double stone rows (MSH1-3); stone mazes (MSH5); boulder mosaics and ground figures (MGG) in another volume.

Entries

X0. Introduction. Although widely called "alignments," the lines of stones cataloged here are not aligned with anything, not even themselves. Stone meanders wander hither and yon---there is little apparent order to them.

X1. North America.

California. The Mojave Desert from Death Valley south to China Lake is strewn with stone meanders and other rock arrangements. The focal point of these ancient labors was the Panamint Valley, just south of Death Valley. Anthropologist J. von Werlhoff has ventured that the:

Panamint Valley contains the largest number of rock alignments uninterrupted by space or imposing land forms on earth. (R7)

In this valley are found at least 32 separate groups of meandering and interweaving lines of stones. Some of the convoluted arrangements are almost 500 feet across.

Apparently, primitive peoples began constructing the meanders at least 8,000



Some of the many meandering lines of rocks in the Panamint Valley, California. (R7)

years ago and continued this activity for several millennia. E.C. Krupp sees the Panamint Valley meanders as "spirit paths" akin to the ritual mazes of Europe, which people walked along to gain magical power. (R7) However, the European mazes, mostly in Scandinavia (MSH5-X1), are only a few hundred years old, whereas the Panamint Valley meanders predate the Great Pyramid by several thousand years.

In their 1965 survey of "giant ground figures," E.L. Davis and S. Winslow distinguished between "rock alignments," such as the meandering stone lines draped across the Panamint Valley and "gravel effigies," which depict real objects, animals, and geometric figures. The latter are cataloged in MGG in another volume. Here, we append their discussion of the former as seen in the Panamint Valley..

Rock alignments have been constructed by setting out rows of stones in huge, wandering configurations, while gravel effigies were made by a quite different procedure, in which the dark-colored, desert cover-gravels were raked or scraped aside. These gravels were piled up in windrows, outlining an exposed strip of pale subsoil...

Rock alignments are so large that they seem to wander over ridges and flats until they disappear from sight, some being as much as 500 feet in length. They consist of spidery, discontinuous lines made of rows of rocks which are medium (cantaloupe size) to small (child's fist size). Often the ground surface on which they rest has been cleared of large stones and debris, so that the outlining rocks are set in a neat, even pavement... Such pavements are evidently enduring and stable.

The rock outlines form delicate tracteries which are free-form and in very low relief. Sunken portions of the patterns and small rocks are visible only because the surface in which they are embedded has been cleared.

Design elements of these outlines consist of loops, concentric circles, long, wobbly rectangles and serpentine symbols. (R8)

South of the Panamint Valley are many more stone meanders. The accompanying map of one of these bore the following caption.

The strange rock alignments of the ancient people of the Far West have been mapped---but no meaning or purposeful design has emerged.

The top sketch shows the alignments on the ceremonial mesa south of Baker in the Mojave Desert and designated by Malcolm Powers as site M-40.

The area containing the principal alignments is about 168 feet by 155 feet, though there are other cobblestone lines and circles resembling hearths just to the west. The alignments were mapped by Clark Brott of the San Diego Museum of Man. (R4)



Cobble alignments on gravel terraces south of Panamint Valley, California. The longer line in the "Y" at the far right is 40 feet long. (R4)

X2. Australia. We do not ordinarily think of Australia as a continent boasting megalithic structures, but they are there in some profusion. Many have the same appearance as those just described from the North American Southwest; that is, stone meanders and interwoven lines of stones. Again, as in North America, these stone lines intermingle with stone effigies and ground drawings. Of course, it is difficult to claim any cultural diffusion between Australia and North America, but it is odd that aborigines in both locations expressed themselves in the same way.



A serpentine line of stones at an Australian sacred site called Kunturu, in Western Australia. (R5)

Western Australia. Several stone meanders have been reported from this part of Australia. (R2, R3) From these, we select one located at a sacred site called Kunturu on Lake Moore.

The most impressive feature of the site is a perfectly preserved serpentine rock alignment more than 250 feet long situated on the salt crust of the lake bed. This alignment contains 437 upright rock slabs as well as 91 which have fallen over in place. The slabs are small, varying from 6 to 25 inches in length; a few range up to 1 foot in width or thickness, or both. So that they would stand upright if they were shoved 4 to 8 inches directly into the soft lake bed. None of the rocks used in this alignment or in others at the site show any signs of trimming or dressing. All the rocks are local in origin; that is, they are all slabs of hornblende schist identical with the rock occurring naturally on the nearby shore.

Rock alignments are a widespread feature of traditional aboriginal culture throughout the desert regions of Australia. All those we have studied have sacred significance. They are generally regarded as the actual bodies of totemic "dreamtime" heroes who have transformed themselves into lithic form. (R5)

The serpentine character of the Lake Moore stone meander plus interviews with aborigines suggest that this particular alignment represents the totemic Water-Snake "Pimara" that once crawled across

the lake. This meander was apparently not a "spirit path" but rather an effigy rendered in stones.

South Australia. F.W. Jones has written about several Australian sites where stones are laid out in meanders on claypans. These seem to have been used to guide individuals or processions. One of his accounts follows.

Quite recently (May, 1923) I have had the good fortune to visit another claypan, the native name of which is Gungra. The pan lies about 10 miles northwest of McDonall's Peak on the track to Lake Phillipson, about 540 miles in a straight line northwest of



A sinuous line of stones on the Gungra Claypan, South Australia. At the far end there are four rock cairns which are not shown. (R1)

Adelaide... The astonishing thing about this claypan is that of the millions of stones which strew its even surface the vast majority have obviously been placed in their present position by human hands. The complexity of the arrangement is so great that no concrete notion can be had of the general plan; but the main lines of arranged stones, and the cairns are obvious at a glance. The main complexity of the design is toward the southeast side of the pan, and from this centre long lines of stones, in straight or curved lines, radiate right across the claypan and are lost in the sandhills beyond...

As the central portion of the pattern is approached the arrangement of the lines becomes bewildering; some are looped, running from the centre and and then back again; some appear to unite the various rays as do the strands in a spider's web; and some run out to a point and then sharply return. The central portion of the maze-like area has been marked by a series of cairns about 4 feet high and solidly compacted. (R1)

The similarity to the Australian ceremonial sites of the North American Indians, as presented in X1, should not be overlooked.



An alignment of stone slabs, Western Australia. (R2)

Queensland. Jones also mentioned a similar site near Durham Downs, in south-western Queensland. Here, stones are laid out in pathways that radiate from the mouth of a cave to form an intricate pattern. Of special interest to anomalists is the testimony of aborigines living in this area. Their traditions relate that the paths were used by people who lived in the region:

...before the time of their old people. These folk, they say, had blue eyes, and they lived in the cave by day, emerging in the evening to dance among the stones. (R1)

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MSH7

Stone Circles: General Characteristics

Description. Stones arranged in circles, slightly deformed circles, and ellipses. Excluded are such obvious nonanomalous phenomena as tipi rings, council rings, and campfire sites. Megalithic sites fitting this very general description are found worldwide but predominantly in Britain and Ireland. This introductory section provides a baseline of stone-circle information recognized and accepted by mainstream archeology.

Data Evaluation. Thousands of articles and books have been published detailing the stone circles of Britain and Ireland, but data on stone circles elsewhere on the planet are hard to find and generally lacking in detail. Rating: 2.

Anomaly Evaluation. No anomalies are to be found among the baseline data. Rating: 4.

Possible Explanations. None required.

Similar and Related Phenomena. Potential stone-circle anomalies (MSH8-MSH19).

Entries

X0. Introduction. The mention of megalithic circles immediately brings to mind a vision of Stonehenge. Stonehenge, though, despite its fame, is an idiosyncrasy among over 900 stone circles strewn across Britain and Ireland. It is a "special case," which we shall treat in MSH11, 12, 14, and 17-19. In addition, on continental Europe and on all of the other continents, save Antarctica, one finds stone circles. In North America, for example, simple stone circles abound on the high plains, where they are called "tipi rings" and "council circles." (R1) Of course the tipi rings are not built of large standing stones, nor are they of the same ancient vintage as the circles of Britain and Ireland. Nevertheless, the tipi rings and their cousins in Asia, Australia, Africa, and South America are stone circles. The eclectic outlook of the anomalist requires that we discuss them in the same breath as the much older and more mysterious stone circles erected some four millennia ago by the megalithic culture of Western Europe.

This tack will doubtless infuriate the purists who have tramped countless miles over heath and moor in Britain and Ireland, and who look with some disdain on the African stone circles and the even cruder circles of the North American Southwest.

This global panorama of stone circles probably does not imply transoceanic cultural diffusion but rather an innate urge of humans to construct stone circles for various ritual purposes as well as for the more mundane applications of holding down tipis and sitting around campfires. The stone-circle phenomenon is really global and timeless, although most of its mysteries apparently do reside in the circles of the Megalithic Age seen in Western Europe.

X1. A stone-circle baseline. Even though many different cultures have constructed



An engraving of the Rollright stones made circa 1777. (R6)

stone circles for several purposes, the "classic" stone circles will always be those of Britain and Ireland. In addition, it is these stone circles that present the most anomalies to the archeologist, as spelled out in the next section. (X2) By definition, anomalies exist when archeological facts challenge current archeological and anthropological thinking. The stone circles of Britain and Ireland raise many scientific questions. It is therefore necessary to begin our inquiry into stone circles by establishing a baseline of accepted opinion and fact. The best places to build such a baseline are ---obviously---Britain and Ireland, where so much field work and theorizing have been done.

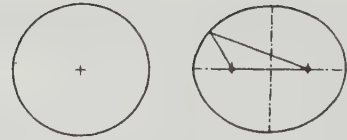
Overview of British and Irish stone circles. A. Burl, a leading expert on the megalithic structures of Britain and Ireland defines his particular universe of stone circles in the following way:

A stone circle may be defined as an approximately circular setting of spaced standing stones which do not act as a kerb and which flourished from the Late Neolithic into the late stages of the Bronze Age, or from the mid-third millennium BC to the end of the second. Integrated with the structure may be banks, ditches, single stones, avenues, or other auxiliary settings which vary from locality to locality. The definition excludes cairn or barrow kerbs even when their height is considerably greater than the adjacent part of the mound they enclose, but it does include settings of detached stones around some chambered tombs like New Grange, Meath, and the Clava cairns, Inverness. (R7)

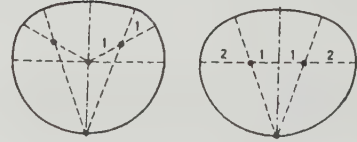
In the time frame stipulated above, the people of Britain and Ireland located, transported, and erected tens of thousands of large stones in over 900 stone circles meeting Burl's definition. Many of these 900+ stone circles have been partially destroyed over the millennia, but enough remains of 963 of them for Burl to provide an interesting geographical breakdown. (R7)

Curiously, across the Channel in Brittany, where other megalithic constructions abound, simple stone circles are practically unknown.

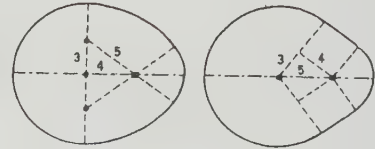
Some 900 of the identifiable stone



CIRCLE AND ELLIPSE



FLATTENED CIRCLES



EGG-SHAPED CIRCLES

The six main classes of stone circles identified by A. Thom. (R2)

England	243
Wales	49
Scotland	407
Ulster	128
Eire	133
Brittany	3

Geographical distribution of European stone circles. (R7)

circles are sufficiently intact to gauge their shapes. About 600 are near-circles, 150 are flattened circles, 100 are ellipses, and 50 are egg-shaped. (R4) The widths vary from a few yards to 370 feet. (R2) Some of the stones barely poke above the turf, while others stand 15-20 feet tall.

Beyond all the statistics lurks the question: Why did the people of the Neolithic and Bronze Ages devote so

much time and labor to all these stone circles? Opinion today strongly favors ritual purposes: funerals, religious rites, seasonal celebrations, etc. Although many stone circles are roughly aligned to specific solar azimuths, such as the solstice points, more sophisticated archaeoastronomy (eclipse prediction and specific stellar azimuths) are generally rejected by mainstream archeology today, but not by all archaeoastronomers! (See MSH17 for more on this matter.) Basically, stone circles are conceived as being "enclosures" for participants in rituals rather than astronomical instruments---churches rather than observatories.

The foregoing statistics and generalizations do not necessarily apply to the stone circles erected outside Britain and Ireland at later times. But, as shown in MSH16, human cultures worldwide have found that stone circles serve well for rituals, spiritual quests, and more mundane functions. Wherever they are found, stone circles are usually nonanomalous.

X2. Potential anomalies presented by stone circles. We have identified 13 potential anomalies presented by the worldwide parorama of stone circles. Not surprisingly, most anomalies involve the megalithic circles of Britain and Ireland, and even more specifically, Stonehenge. Below, we lay out these potential anomalies in the form of 13 questions, each preceded by its section alphanumeric designation.

MSH8. What is the meaning behind the curious "recumbent" stone circles found in Scotland and Ireland?

MSH9. Do any stone circles suggest that their builders knew sophisticated mathematics and geometry, such as the Pythagorean Theorem?

MSH10. Do the dimensions of the stone circles imply that a standard unit of measure was employed---specifically the "megalithic yard"?

MSH11. Do the dimensions and geometries of any stone circles betray mystical relationships; i.e., those associated with numerology?

MSH12. Are any stone circles sources of unexpected luminous, magnetic, electrical, or acoustical phenomena?

MSH13. Do scientifically verifiable psychic phenomena, such as those said to be perceived by dowzers, occur in the neighborhoods of stone circles?

MSH14. Are any stone circles associated with specific geological or geophysical features or phenomena?

MSH15. Are any stone circles physically integrated with other structures; that is, with stone rows, woodhenges, etc.?

MSH15. Are any stone circles intentionally aligned with other stone circles or other structures? In other words, are stone circles ever elements in so-called "leys"?

MSH16. Are the stone circles of Britain and Ireland culturally related to the stone circles seen elsewhere in the world? This question relates to claims of ancient cultural diffusion across the oceans.

MSH17. Do any stone circles have sophisticated astronomical applications, such as eclipse prediction? Stonehenge is the focus here.

MSH17. Do any stone circles have applications other than in rituals and rudimentary astronomy? Tide prediction has been proposed, by way of example.

MSH19. Do the characteristics and any stone circles suggest unrecognized cultural associations? One pertinent recent assertion is that stone circles, particularly Stonehenge, were "invented" by the French!

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Imaginative depiction of a festival of the ancient Britons at Stonehenge, as conceived by S.R. Meyrick and C.H. Smith in the late 1700s. (R9) Of course, we do can only guess how Stonehenge was really used down the millennia.

MSH8 Recumbent Stone Circles

Description. Stone circles characterized by single recumbent (prostrate) stones flanked by two large standing stones. The recumbent stone is nearly always positioned in the southwest part of the circle.

Data Evaluation. Although they are rarely singled out as significantly different in the archeological literature, we have still located considerable reliable information, mainly from the writings of A. Burl, a recognized authority on megalithic structures. Nevertheless, data gaps exist in the matters of radiocarbon dates and artifacts that can define precisely the purpose(s) of this unique type of stone circle. Rating: 2.

Anomaly Evaluation. Archeologists can only guess at the astronomical significance of the usual position of the recumbent stones and the sorts of rituals conducted at the recumbent stone circles. What is known and surmised is hardly anomalous, but the incompleteness of our knowledge of these unique megalithic structures requires a modest anomaly rating. Rating: 3.

Possible Explanations. Several types of rituals have been proposed for the recumbent stone circles, one of which involves child sacrifice and cremation at certain times of the year, as defined by alignments with the recumbent stones. See below for more details.

Similar and Related Phenomena. Stone lines (MSH1-MSH6); other stone circles (MSH9-MSH19); conventional stone circles, such as Arbor Low, where standing stones now lie prostrate due to natural and human causes.

Entries

X1. General observations. Recumbent stone circles (RSCs) represent a unique subclass of stone circles and as such deserve special attention. The defining characteristic of the RSC is a large, flat, altar-like, recumbent stone positioned snugly between two large standing stones called "flankers." This unusual prostrate stone is almost always located in the southwest quadrant of the circle. RSCs average 20.7 meters in diameter and are thus on the small side as stone circles go. Their standing stones, though, are imposing, reaching heights of 12 feet in some circles. The flankers are almost always the tallest. Curiously, most RSCs incorporate either 10 or 11 stones plus the recumbent one. A. Burl wonders if these recurring numbers had some mystical significance associated with rites conducted at the sites. The flankers are frequently decorated with cupmarks---a simple sort of petroglyph found virtually worldwide. Ceramic remains in and about the RSCs indicate that the RSCs were likely constructed

in the early part of the second millennium BC. Over 70 RSCs are concentrated in northeastern Scotland (mainly Aberdeenshire). Additionally, a few similar circles are found in eastern Scotland and Ireland. (R1-R3)

RSCs are manifestly different from the other 900 or so "normal" stone circles strewn about Britain and Ireland. This "difference" probably betokens both a different purpose and different



A recumbent stone circle showing the typical placement of the recumbent stone between two flanking stones. (R2)

cultural values of the builders. In these matters, there are controversy and divergent opinion.

The nature of the recumbent stones and their specific location are probably central to divining the purpose of the RSCs.

The position of the recumbent stone has long puzzled archaeoastronomers. The flat stone is so broad that many significant azimuths are possible from various positions around the circle. It was once thought that the recumbent stone purposely highlighted the mid-winter sunset, but most of the recumbent stones are directed too far to the south. The calendric meaning of the recumbent stone still puzzles, as apparent in the words of A. Burl.

The RSC builders in Scotland may have incorporated traditional lunar and solar alignments in their earliest rings and, in later rings, added variant lines, such as the moon's mid-summer setting or Venus' rising. It is doubtful that such alignments were for the prediction of eclipses. The width of vision across the top of these recumbent stones is too broad for any such delicate observation. Most likely these lines of sight are calendrical to mark the time of ceremonies at the yearly extremes of warmth or cold. (R3)

At best, it seems, the RSCs could have served only as a crude annual clock.

On the matter of purpose, contemporary archeological opinion posits that the RSCs served as ritual centers for rural family groups at certain seasons. The rituals may have involved sacrifice and cremations. The fire-reddened areas and bones of young children at many RSCs are suggestive. Furthermore, the altar-like recumbent stone brings gruesome thoughts to mind.

But perhaps archeologists and anthropologists are surmising too much here. Other, gentler, interpretations of the field data are possible. For the anomalist, the RSCs remain incompletely explained.

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- R2. Burl, Aubrey; The Stone Circles of the British Isles, New Haven, 1976, p. 168. (X1)
- R3. Burl, H. Aubrey W.; "Circles in Time," *Archaeology*, 29:242, 1976. (X1)

Description. The apparent use of a standard unit of length, called the "megalithic yard," by the Neolithic and Bronze Age peoples of Western Europe.

Data Evaluation. In attempting to verify this claim, scientists measure stone circles and other megalithic structures with high precision to see if lengths are quantized; that is, measured lengths consist of integral numbers of a standard length. Some researchers assert they have found such evidence; others do not. Rating: 3.

Anomaly Evaluation. If the Western Europeans of 4,000 years or so ago did use a standard unit of length over a wide region, it suggests that they were more sophisticated technically and socially than generally supposed. But in comparison with the technical capabilities of contemporary Egypt, this phenomenon does not appear particularly profound. Rating: 3.

Possible Explanations. Humans everywhere were pretty smart 4,000 years ago.

Similar and Related Phenomena. Apparent mathematical sophistication of the megalithic culture (MSH10).

Entries

X0. Introduction. Standards of measurement are essential to the efficient functioning of modern society. Everyone today is familiar with the foot, the yard, and (often) the meter. But were such standards really necessary in the Neolithic and Bronze Ages? Indeed, our picture of these "primitive" survivors of the Ice Ages does not envision them laying out stone circles with yardsticks or precisely calibrated measuring tapes. Neither do we see these peoples bowing to a Bureau of Standards that enforced uniformity in weights and measures over all of Western Europe. In this vein J.D. Fernie wrote:

That a prehistoric society, at times thought of as comprising nomadic hunting bands, should have shown such uniformity across such spans of time and place was something to contemplate. On the other hand, those same people had joined in constructing the great monuments of Silbury Hill and Stonehenge, efforts that in terms of the population's resources far exceeded the expenditure of the United States in putting man on the moon. (R6)

Contradicting our modern presumptions concerning our predecessors of 4,000 years ago, some of the stone circles of Britain and Ireland do seem to be quantized in their dimensions. This was noticed as far back as 1743 by W. Stukley, who postulated the existence of a "Druid's Cubit," named after the priests he believed had been behind the construction of Stonehenge and other megalithic monuments. (R7) In the latter 1900s, A. Thom attempted to demonstrate statistically that the makers of the stone circles had in fact used a "megalithic yard" to stake out the ground plans for

their stone circles. Thom believed that he had ample evidence to prove his thesis. He wrote:

From careful statistical analysis of the dimensions of these circles it has definitely been established that the erectors used an accurate unit of length which I propose to call the megalithic yard. This unit was used from one end of the country to the other, so that whether it was determined from the English circles or from the Scottish the value turns out to be the same, namely 2.72 feet. My most recent determinations are 2.722 from the English sites and 2.719 from the Scottish, but from the calculated probable errors (about 0.003) the difference is not significant statistically. It is not possible to say that the actual unit used was not a multiple of this: in fact we find half yards used occasionally and with much less certainty quarter yards. (R1)

The potential cultural ramifications of a widely used megalithic yard are vast. Was there a central authority that sent out to far-flung settlements carrying carefully crafted wooden rods exactly 1 megalithic yard in length? Were inspectors sent out to check construction work and enforce the use of this standard length? Why would people 4,000 years ago even feel the need to standardize anything? Were they obsessed with the precision of their work? Or perhaps they were precocious scientifically and were philosophically impelled to quantize dimensions. If they actually employed the megalithic yard all over Western Europe, perhaps this culture was more sophisticated socially and scientifically than we think.

In actuality, Thom went even further.

He believed he saw a "megalithic rod" emerge from his mass of stone-circle measurements. The rod was equal to 6 megalithic yards or 16.2 modern feet. Suspiciously, the megalithic rod is very close to the still-used English rod of 16 feet! Thom also saw a "megalithic inch" cropping up in his many measurements of the cup-and-ring markings engraved on some megaliths. His megalithic inch equalled 1/40 of a megalithic yard. (R6)

Thom's quantization of megalithic stone circles and petroglyphs created quite a stir among mainstream archeologists who were not used to evaluating statistical arguments. Additionally, if Thom were correct---even partly---the megalithic peoples were much more sophisticated than the prevailing wisdom allowed.

X1. Statistical pros and cons. Proof the megalithic engineers actually employed standard units of length lies buried in the measurements of stone circles and other structures. If stone-circle diameters and other "natural" dimensions were found to be integral multiples of a certain length, Thom's hypothesis would be supported. To this end, Thom and his son, A.S. Thom, meticulously surveyed scores of stone circles. Even those who doubt the existence of the megalithic yard praise the precision of the field work of the father-son team. But do the statistics really support the idea of a megalithic yard (M.Y.)?

Some stone circles certainly seem to have been laid out in standard units.

...several independent surveys have demonstrated that circle-diameters often conform to multiples of the M.Y. At New Grange the circle was calculated to be 103.6 m across, exactly 125 M.Y., like Brodgar and the inner rings at Avebury. At Aultan Broubster, Myatt found the diameter to be 78 M.Y. A field-analysis of thirteen megalithic rings on Dartmoor convinced the surveyors that 'the megalithic yard is a real and valid unit and that it was used to lay out the stone rings...' (R4)

Sometimes students of stone circles find unexpected confirmations of the megalithic yard. In his dossier on the

recumbent stone circle named "Loan-head of Daviot," A. Burl remarked:

It is of mathematical interest that Alexander Thom noted that the diameter of the stone circle was twenty-five of his Megalithic Yards of 2.72 ft (0.83m), and that the ring-cairn measured twenty Megalithic Yards. It is of interest because he was unaware of the central space whose diameter is five Megalithic Yards. It is possible, therefore, that Thom's Megalithic Yard was the local unit of measurement used by the builders of some Scottish recumbent stone circles. (R7)

More curious is the apparent carry-over of the claimed megalithic yard in the planning of some much later English cathedrals, such as those at Canterbury, Winchester, and Gloucester. Often the processional aisles of these old churches are one rod wide. The distance between side chapels is usually an integral number of megalithic yards. (R2)

These supporting observations have not silenced the doubters. In 1970, N. Grossman commented as follows:

...Thom convincingly argues that the builders [of the stone circles] were "obsessed with a concern for perfection---so much so that all their measurements were laid out in integral units." (In fact, Thom's work contains many instances of adjustment of his measurements to preserve commensurability.) Yet we have no record from the megalithic builders of their intents or motives, no blueprints, no record of a single calculation to justify the assumption of any such compelling psychological drive. (R3)

In his book Megalithic Science: Ancient Mathematics and Astronomy in North-West Europe (1981), D.C. Heggie found little statistical evidence for a highly accurate unit of length. (R5)

Based upon a computerized study of stone circles in Cork and Kerry, J. Barber asserted that for these circles, at least, "there is no quantum, no megalithic yard." (R4)

Even in regions where there does seem to be quantization of stone-circle dimensions, the megalithic yard seems a bit flexible. For example, the stone circles of northeastern Scotland seem to

have been built using a megalithic yard that was a bit shorter than elsewhere in Britain.

In this light, the megalithic yard might have only been a rough measure of distance using a convenient gauge, such as the pace of an average male. In some localities, the builders might have never heard of the megalithic yard or, if they did, scorned such regimentation.

References

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- R2. Borst, Lyle B.; "English Henge Cathedrals," Nature, 224:335, 1969. (X1)
- R3. Grossman, Nathaniel; "Megalithic Rings," Science, 169:1228, 1970. (X1)
- R4. Burl, Aubrey; The Stone Circles of the British Isles, New Haven, 1976, p. 71. (X1)
- R5. Ritchie, J.N. Graham; "Prehistoric Geometers," Nature, 296:373, 1982. (X1)
- R6. Fernie, J. Donald; "Alexander Thom and Archaeoastronomy," American Scientist, 78:406, 1990. (X0)
- R7. Burl, Aubrey; A Guide to the Stone Circles of Britain, Ireland and Brittany, New Haven, 1995, p. 101. (X0, X1)

MSH10

Geometrical Sophistication of Stone Circles

Description. The apparent precocious use of sophisticated geometrical relationships, such as 3-4-5 triangles, by the engineers of the British megalithic stone circles.

Data Evaluation. The dimensions of several hundred British stone circles are known with good accuracy, but the precision is not high enough to confirm to everyone's satisfaction the claims made by A. Thom and others regarding the subject phenomenon; i.e., that the stone circles reveal advanced geometrical insights by the megalith builders some 4,000 years ago. At best, the data are suggestive. Rating: 3.

Anomaly Evaluation. No other archeological evidence of any kind supports the subject anomaly, but neither is there any evidence that declares that these people of 4,000 years ago did not recognize some simple geometrical relationships. Certainly, the Egyptians of the same time frame were this intellectually advanced. Nevertheless, mainstream science does not yet recognize such geometrical advances by the Neolithic and Bronze Age peoples of the British Isles. Therefore, the anomaly rating here must be high. Rating: 1.

Possible Explanations. The old adage that one can prove anything with statistical analysis may be applicable here.

Similar and Related Phenomena. The existence of the megalithic yard (MSH9); the numerology of stone circles (MSH11); sophisticated astronomical applications of

the British stone circles (MSH17); sophisticated geophysical applications of the British stone circles (MSH14).

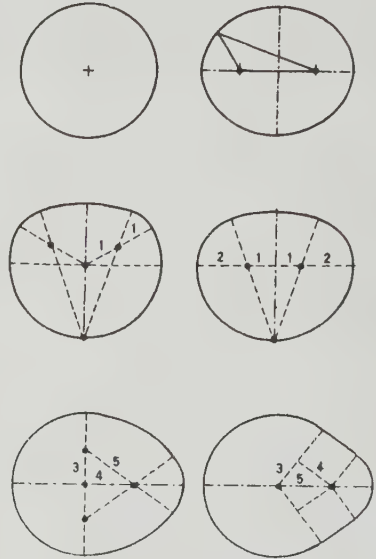
Entries

X1. General observations. The possibility that the builders of the megalithic stone circles employed a standard unit of length---the megalithic yard (MSH9)---was not the only claim suggested to A. Thom by his statistical analyses. He also hypothesized that the stone circles were so precisely laid out and in such configurations that their engineers must have had precocious knowledge of geometry. In particular, Thom claimed that these people of 4,000 years ago (long before Euclid) recognized the following geometrical facts:

- That the ratio of a circle's circumference to its diameter (or pi) is not an integer. This "imperfection" seemed to disturb them!
- That an ellipse can be constructed by using two foci and a long cord.
- That some right triangles have sides and hypotenuses with integral units of length, such as the well-known 3-4-5 right triangle. The recognition of these so-called Pythagorean triangles does not necessarily mean that the stone-circle builders knew of the Pythagorean Theorem; i.e.

$$a^2 + b^2 = c^2$$

Thom's claims derived from his precise measurements of British stone circles and his statistical analyses thereof. If all the stone circles were near-perfect circles, there would not have been much for Thom to analyze. But, it turns out that while about 600 circles are nearly perfect circles, 150 others are flattened in peculiar ways, 100 are actually ellipses, and 50 are egg-shaped. Near-perfect circles and ellipses are easy enough to lay out with a long cord or megalithic yardsticks, but the flattened circles and eggs required special construction techniques. Thom claimed that these aberrant circles were actually laid out using Pythagorean triangles, as shown in the accompanying sketches.



A. Thom's six classes of megalithic rings illustrating the possible application of 3-4-5 triangles and other integral relationships. (R2)

If Thom was correct (he died in 1985), the stone "circle" engineers seemed to be more sophisticated in geometry than one would expect for a culture 4,000 years old. The Pythagorean triangles that Thom found emerging from his statistics were:

$$3^2 + 4^2 = 5^2$$

$$5^2 + 12^2 = 13^2$$

$$12^2 + 35^2 = 37^2 \quad (R2)$$

That the stone-circle builders actually utilized these relationships, especially the third, would be rather impressive and certainly not what mainstream anthropologists would expect for this culture. The Greek geometers were still millennia in the future.

Before discussing the mainstream objections to Thom's theories, we must inquire why the stone-circle builders replaced their aesthetically pleasing (to us, at least) near-perfect circles with rather ugly deformed circles. One interesting potential answer is that they were revulsed by the non-integral character of pi---the perfect circle may have seemed imperfect to them. The flattened circles and egg-shaped circles, on the other hand, could be constructed using the Pythagorean triangles, which had sides measured in integral numbers of megalithic yards. One could view this outlook as a pre-science search for some sort of order in the universe---perhaps something like quantum mechanics on a macroscopic scale!

In some circles, Thom detected a peculiar distortion of the Pythagorean relationship, specifically:

$$8^2 + 9^2 = 12^2 + 1$$

$$11^2 + 13^2 = 17^2 + 1$$

$$38^2 + 49^2 = 62^2 + 1 \quad (R2)$$

This is strange business, and we wonder if even Thom's meticulous measurements could detect the difference between 62^2 and $62^2 + 1$. After all, in 4,000 years, the very soil might creep; i.e., "solifluction." Perhaps Thom went too far in his statistical claims.

The response of mainstream science to these startling claims of anomalously early geometrical insights took three forms.

First, Thom's claims of stone-circle precision were doubted, as seen in the following abstract from a 1986 paper by J. Barnatt and P. Herring.

This paper describes an experiment which investigates the possibility that stone circles were laid out by eye rather than being geometrically planned. Over 100 simulated stone circles were built and hence a data set of known layout method was generated for comparison with stone circles. The results illustrate that no distinction can be made between the hypotheses. Examination of other architectural traits and geographical distribution suggest, however, that simple laying out procedures, as op-

posed to the more complex geometries proposed by Thom, are more appropriate for stone circles in Britain. (R8)

Barnatt and Herring do not address the questions of why some circles were "deformed" and just how one might "eyeball" the neat ellipses, flattened circles, and eggs measured by Thom

Second, as one might well expect, Thom's statistics were questioned. J.D. Fernie expounded on this aspect of Thom's work.

The difficulty seems to lie chiefly with that all-too-often vexatious area, the statistical analyses. Thom was given to using phrases like "Adopting only the most reliable cases..." without making clear what criteria (other than personal judgment) were used to distinguish reliability, which of course could lead to the introduction of unconscious biases. (R9)

Third, N. Grossman asserted that assessing the mathematical capabilities of the megalith builders by measuring their stone circles was akin to trying to decipher an ancient, unknown language from inscriptions. A Rosetta stone is required. Unfortunately, the stone-circle engineers didn't leave that kind of stone behind. Everything we read into the geometries of the British stone circles is only conjecture. (R5) Thom's "translations" could be erroneous.

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- R3. Borst, Lyle B.; "English Henge Cathedrals," Nature, 224:335, 1969.
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- the British Isles, New Haven, 1976, p. 36. (X1)
- R7. Ritchie, J.N. Graham; "Prehistoric Geometers?" Nature, 296:373, 1982. (X1)
- R8. Barnatt, John, and Herring, Peter; "Stone Circles and Megalithic Geometry: An Experiment to Test Alternative Design Practices," Journal of Archaeological Science, 13:431, 1986. (X1)
- R9. Fernie, J. Donald; "Alexander Thom and Archaeoastronomy," American Scientist, 78:406, 1990. (X1)

MSH11 Occult Influences on the Design of Stonehenge

Description. The possible influence of numerology, astrology and other occult concepts upon the geometry and dimensions of Stonehenge.

Data Evaluation. The occult literature is incredibly massive, and we can only touch upon a few pertinent concepts here. Since occult ideas derive from revelation and human-conceived belief systems, such as astrology, they are not part of recognized science. This does not mean, however, that occult ideas do not permeate human architecture. As a matter of fact, occult concepts are so complex, flexible and unconstrained by physical reality that they can be molded to fit virtually any situation, including the design of Stonehenge. For these reasons, occultists have no problem in seeing their ideas and concepts present in ancient architecture. Rating: 1.

Anomaly Evaluation. Humans have always been influenced by religion and occult concepts and this is quite evident in the design of churches, shrines, temples, and other structures. No scientific anomaly exists here. Rating: 4.

Possible Explanations. None required.

Similar and Related Phenomena. The human concept of beauty strongly influences architecture.

Entries

X0. Background. In archeology and anthropology, as in most other sciences, alternative theories and philosophies challenge accepted and vigorously defended methods and paradigms. But, for some individuals it seems that the facts gathered by hard work in the field and the objective hypotheses based upon them are inadequate and philosophically unsa-

tisfying. As a result, subjective, mystical theories are often conceived to replace the cold, hard findings of mainstream science.

One consequence for archeology and anthropology has been a proliferation of several diverse claims that are appropriate to introduce here:

- That a Golden Age existed in the deep past,

●That human existence and works are modulated by divine revelations,

●That the heavens, numbers, and even geometry influence worldly matters.

Thus, in addition to echoes of the supposed Golden Age, we may see the influences of numerology, gematria, astrology, and a striving for the New Jerusalem appearing in ancient structures. To a mainstream scientist today, all this is only a hodgepodge of whacky ideas and New Age thinking.

But 4,000 years ago, when megalithic structures were being planned and constructed, human visions were different; and there remain today many people who place credence in these ancient outlooks on the cosmos. (Astrology is still strong everywhere!) For this reason, we must look further into "alternative" archeology to determine whether stone circles, particularly Stonehenge, were built in accordance with these other visions. In other words can we see in Stonehenge and other ancient structures the influences of astrology, numerology, and other occult and mystical concepts?

It is likely that we will. We know that ancient peoples all over the world observed the motions of the sun, moon, and stars meticulously. We also are well aware that humans are not completely fulfilled by objective science. Who does not have a "lucky" number. Church spires still reach up toward the firmament; so does the Great Pyramid.

So much for justifying our short diversions into areas that are anathema to mainstream science. Our treatments will understandably be brief.

X1. Are earth and the heavens modelled by Stonehenge? It is fashionable today to claim that some major archeological sites reflect stellar configurations. For example, the sizes and placements of the three large Giza pyramids are claimed to model the brightnesses and arrangement of stars in the constellation Orion. MSE8-X3) In an analogous way, M. Saunders asserts that the plan of Stonehenge is a miniature model of the distances between the planets of the solar system. (R3)

Coming back to earth and again referring to Stonehenge:

[J.] Michell has observed that the lintels of the Stonehenge sarsen circle embody in their dimensions 'a synthesis of ancient units of measure, systems of numeration and geodetic standards' in which Stonehenge symbolizes the major dimensions of the earth. (R3)

One of the several observations made by Michell is that the outer radius of Stonehenge's outer sarsen circle, stated to be 52.1362275 feet, turns out to be "exactly" 1/400,000 of the earth's polar radius of 20,854,491 feet! We do not know if the figure 400,000 has any mystical significance, but we do know that no one could ever measure the outer radius of a circle of rough standing stones to nine significant figures; that is, billionths of a foot. Likewise, the earth's polar radius cannot be measured to within a foot!

One undigestible implication of such claims about Stonehenge is that its builders actually knew the earth's shape and dimensions several millennia ago. Of course, one can always say that this superior scientific knowledge survived from the long-past Golden Age, or perhaps introduced by extraterrestrial visitors---or both! You can appreciate why most scientists avoid these subjects.

X2. The solar connection between magic squares and Stonehenge. Magic squares have always fascinated humans, perhaps as long ago as Stonehenge. Who can say that they did not?

The simplest and most familiar magic square is 3 x 3.

4	9	2
3	5	7
8	1	6

As in all well-disciplined magic squares, all columns, rows, and diagonals add up to the same number.

Employing a rationale we have not yet discovered, occult tradition assigns the 3 x 3 magic square to the planet Saturn, while the 4 x 4 magic square belongs to Jupiter, and so on up to the impressive 9 x 9 square associated with

the moon.

It is the 6 x 6 magic square that is of interest here because it belongs to the sun. And it is the sun that links the 6 x 6 square to Stonehenge because Stonehenge is widely assumed to be a solar observatory or temple or both. To the numerologists, this connection is confirmed by the fact that the numbers around the perimeter of this magic square add up to 370, which is exactly the perimeter of Stonehenge's outer earthen embankment in megalithic yards. (R1)

6	32	3	34	35	1
7	11	27	28	8	30
19	14	16	15	23	24
18	20	22	21	17	13
25	29	10	9	26	12
36	5	33	4	2	31

The Square of the Sun, a 6 x 6 magic square. (R1)

J. Michell, in his The View over Atlantis, expands upon the magic square-Stonehenge connection. He first places the first 36 numbers around the perimeter of Stonehenge, beginning with 1 on the axis near the heel stone. Next, these numbers are joined by lines in a curious scheme based upon the way the numbers appear in the magic square. Rectangles, hexagons, and other geometrical figures result, all of which seem to have numerical relationships satisfying to numerologists. Michell is able to write:

In this way the chief numbers from the magic square of the Sun are incorporated within the groundplan of Stonehenge, expressed in terms of the principal units of measurement in the ancient world. (R1)

We cannot resist mentioning another numerological association involving the sun's magic square, Stonehenge, and other important archeological sites. Regard the following facts about the sun's magic square. (R1)

Total number of figures	36
Sum of row, column, or diagonal	111
Sum of the corners and each symmetrical square	74
Sum of numbers on perimeter	370
Total	666

The number 666 can also be coaxed out of the dimensions of the Great Pyramid, Galstonbury Abbey, and a host of other ancient structures. Of course, 666 is better known from the Bible as the "number of the beast" and this connects us to the New Jerusalem, the subject of the next entry. (X3)

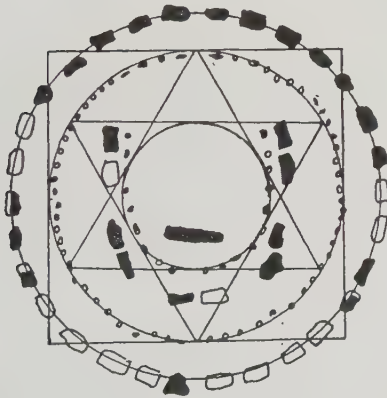
Before attending to Biblical matters, it is reasonable to ask if the numerological relationships reviewed above had any influence on the planners of Stonehenge. Were they guided by numerological considerations and planned Stonehenge accordingly? Or is Stonehenge, with its many rings of stones and Aubrey holes so complex, with so many possible interconnections and relationships, that numerologists (or anyone else so inclined) can prove anything he or she wishes? This sort of question reappears in MSH17 where we inquire into the astronomical significance of Stonehenge.

Of course, we can never be certain what the builders of Stonehenge had in mind when they drew up their plans. (Actually, Stonehenge was built and rebuilt several times.) It is not inconceivable that Stonehenge's engineers were guided by numerology and occult ideas. (Remember that many modern buildings omit the 13th. floor!) If they were so influenced, they were probably limited to only the simplest concepts. That they did have plans is obvious, but were they dictated by the requirements of numerology, astronomy, ritual, or some combination thereof?

X3. Stonehenge and the New Jerusalem. Occultists and the students of myth and legend write at great length about the

Golden Age that once benignly enveloped the world and which is now lost in time. Many hold that, like Christ and King Arthur and Quetzalcoatl, those halcyon days will return and our planet will be reborn. Early Christians were caught up in this idea of rebirth and foresaw a New Jerusalem as it is described in the 21st. chapter of Revelation. There, St. John also provides the dimensions and shape of New Jerusalem. In these statistics, J. Michell sees a similarity to the plan of Stonehenge.

In [the figure] the diagram of the New Jerusalem is superimposed on the Stonehenge plan and the two are seen to be identical. The perimeter of the square New Jerusalem, 48,000 furlongs or 31,680,000 feet, is reduced to 316.8 feet, which is the perimeter of the Stonehenge sarsen circle. Within the square is the cir-



The plan of St. John's New Jerusalem superimposed upon the ground plan of Stonehenge. The square and outer circle have equal perimeters of 316.8 feet. (R2)

cular wall, 144 cubits of 248 feet in circumference and 79.2 feet in diameter, corresponding to the Stonehenge bluestone circle. The diameter of the inner circle of the New Jerusalem diagram is 39.6 feet, the same as that of the bluestone semi-circle. In summary, if the Stonehenge sarsen circle is rearranged as a square of

equal perimeter, the square exactly contains the bluestone circle, and the whole figure is identical in both form and dimensions with the plan of the New Jerusalem in Revelation 21. The New Jerusalem is Stonehenge with the circle squared. (R2)

Since Stonehenge was built long before Revelation was written, the ultimate source for the dimensions of both the New Jerusalem and Stonehenge would have had to exist far back in time--- probably during that fabled Golden Age!

The same kind of thinking can be applied to the Great Pyramid and other "sacred" sites. Atlantis also emerges in many of these discussions. One gets the feeling when perusing the literature of numerology and the occult that one can prove virtually anything by finagling with the numbers and geometries.

X4. Stonehenge and the Sacred Section. Geometrical relationships as well as numerology apparently guided ancient architects. The so-called "sacred section" was used as early as 2,900 BC by the Egyptian and appears in the interior proportions of the Great Pyramid. C.F. Herberger also sees the sacred section in the plan of Stonehenge. (R4)

Basically, the sacred section provides architects with relative lengths that were thought to have some mystical values. These proportions are derived from squares nested within circles. One can even discover that the proportions of the human body also conform to the sacred section! Of course, one has to choose the "proper" lengths to measure.

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 R2. Michell, John; City of Revelation, New York, 1972, pp. 51, 125. (X3)
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 R4. Herberger, Charles F.; The Role of the Sacred Cut in the Geometry

of Stonehenge," NEARA Journal, 29: 57, 1995. French translation available: "Le Rôle de la Section Sacrée dans le Géométrie de Stonehenge," Kadath, no. 84, p. 21, Spring-Summer 1995. (X4)

MSH12 Physical Phenomena Associated with Stone Circles

Description. The unusually high frequency of occurrence of certain luminous, magnetic, acoustic, and other physical phenomena in the vicinities of stone circles.

Data Evaluation. Establishment scientists doubt, usually for good reasons, the concentration of physical phenomena around stone circles. Consequently, there has been little professional interest in the subject phenomena; they have been left to what is called "fringe archeology." The data supporting this anomalous concentration of physical phenomena consists of anecdotes and, more significantly, some exploratory instrumented surveys by a few amateurs and interested scientists. These objective studies, however, have understandably been underfunded. Results have appeared only in unrefereed popular books and one science magazine. Mainstream-science recognition of the phenomena has been turned away by their frequent association with psychics, dowsers, and New Age concepts. Rating: 3.

Anomaly Evaluation. All of the phenomena subsumed here are known to occur in nature under certain conditions and, in themselves, are not anomalous. (See below.) Nevertheless, an anomaly exists because these phenomena seem to be concentrated in the vicinities of stone circles and other ancient sites---for no defensible scientific reason. This apparent focussing effect strengthens the suspect claim that "earth energy" exists and is concentrated at "sacred sites." It is claimed further that ancient peoples sensed these sites and constructed their stone circles and other structures there. Such mystical thinking is completely at odds with the outlook and philosophy of modern scientists. Rating: 1.

Possible Explanations. The presence of unrecognized geologic faults under stone circles could, in principle, account for the luminous and acoustic phenomena, since evidence does exist for earthquake lights and sounds.

Similar and Related Phenomena. Earthquake lights (GLD8 in Lightning, Auroras); rock luminosity (GLD13 in Lightning, Auroras); unusual sounds in nature (GSH in Earthquakes, Tides); magnetic anomalies (EZC and EZF in Inner Earth); radioactivity anomalies (ESC15, ESP13, ESP19 in Anomalies in Geology); psychic phenomena (MSH13 and the Series-P catalogs).

Entries

X0. Background. Just as a visit to the Great Pyramid inspires awe, so does a tour of Stonehenge. Avebury, too, and many other stone circles can fire one's transcendental feelings. After all, these circles of huge stones were designed specifically to impress people. It is hardly surprising that they are today designated as "sacred sites" by the New Agers. Transcendental feelings and psychic phenomena are said to occur at sacred sites as are physical phenomena. We will catalog the former in MSH13. Here, our focus is on several potentially objective phenomena that are alleged to occur in the vicinity of stone circles, namely:

- Luminous phenomena (X1),
- Magnetic phenomena (X2),
- Anomalous radioactivity (X3),
- Acoustic phenomena (X4), and
- Physiological sensations (X5)

Most of these phenomena can, in principle be measured objectively with instruments or recorded on film. Unfortunately, field research of this sort does not attract professional archeologists and physicists. It smacks too much of UFOs and parapsychology. We must rely, therefore, upon anecdotes and a series of more objective observations begun in the late 1970s in Britain under the aegis of the Dragon Project. This Project was founded by a group of British scientists and amateur archeologists who drummed up enough money to acquire several scientific instruments, with which they searched for scientifically acceptable evidence of anomalous physical phenomena occurring in the vicinities of British stone circles. Such research, they anticipated, would support or deny the many anecdotes of strange phenomena reported from these megalithic sites.

X1. Luminous phenomena. New Age thinking asserts that stone circles and other "sacred sites" are foci where "earth energies" manifest themselves. This being so, it is not surprising to learn that UFOs are purported to appear fre-

quently in and around stone circles. P. Devereux recounted a typical sighting of this sort in his book Symbolic Landscapes. The scene is Avebury, near Stonehenge, and the largest stone circle in Britain.

The Avebury complex has produced a number of accounts of strange light phenomena in recent years. In 1987, I collected a report of a life-long inhabitant of Avebury. Several years earlier, she had been walking her dog late in the evening when she saw a light 'like the moon' softly descend within the southwestern arc of the great circle within the henge. It touched the ground and 'went out' without a sound. She checked the place the next morning, and there were no marks or burns on the short grass where the light had extinguished itself. (R1)

This sighting is not unlike thousands of other UFO reports. Such anecdotes have little scientific value. More significant is a different, very curious luminous phenomenon that was recorded several times on film during the Dragon-Project studies at the Rollright Stones, in Oxfordshire. Devereux mentions this in his book Earthlights.

The stones at Rollright have been photographed with infrared film on several occasions; at dawn and at other times. Frames exposed at dawn on three occasions revealed a hazy glow appearance around the monolith near the circle, known as the King Stone. The films have been professionally examined and no mundane explanations have so far been confirmed. (R2)

These aura-like glows are not reliable phenomena, seeming to appear at random times and therefore hard to study scientifically. Interesting but also detrimental to the phenomenon's impact on mainstream science is the fact that dowsers say that they can detect the presence of "fields" near the stones where the glows appear.

Unfortunately, the words "aura" and "dowsers" scare off scientists who might

otherwise investigate such fascinating apparitions. To our knowledge, none of these results---even the infrared photos---has ever been legitimized by publication in science journals. We are invading a scientific Never-Never Land.

X2. Magnetic phenomena. Humans are not consciously sensitive to the geomagnetic fields enveloping them, although there are claims in the literature that some individuals possess a "magnetic sense." Given this sensory deficiency, the only objective way to explore claims of magnetic phenomena said to occur at stone-circle sites would require walking among a circle's standing stones with a recording magnetometer. Unfortunately for its credibility to mainstream scientists, the only stone-circle magnetometer surveys we have found are linked to ley lines (MSH15) and dowsing (MSH13).

In 1982, C. Brooker, a retired BBC engineer, strolled around the Rollright Stones with such a recording magnetometer. He wrote:

The survey showed ley lines---detected by fluctuations in the local magnetic field---converging on the

geometric centre of the stone circle, with a pattern of about half-a-dozen concentric circles of high and low magnetic intensity also showing up inside the stones. The average intensity of the field within the circle was significantly lower than that measured outside, as if the stones acted as a shield.

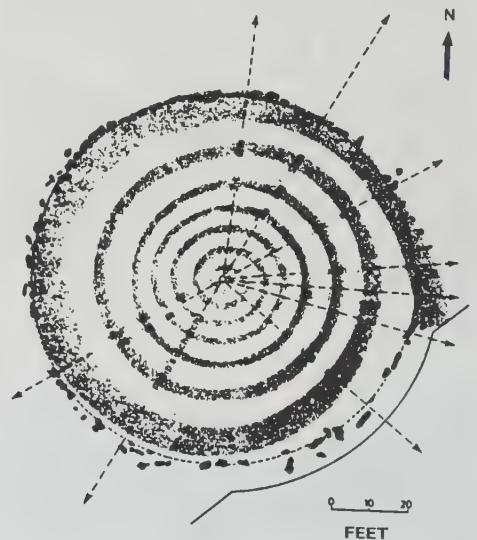
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A more accurate survey was clearly worthwhile. Eventually I found that, as well as the converging ley line proper, the magnetic pattern inside the stone circle forms a seven ring spiral, broadening as it moves outward until it leaves the circle by the "Eastern Gate". What it all means in a mystery, but it is curious that many of the symbols carved on various ancient stones show spirals. (R4)

Although Brooker's results appeared in a respected science magazine, this is definitely "fringe" archeology. Squelching any chance that a more formal scientific investigation might be launched was the fact that Brooker was sometimes accompanied by a dowser. The dowser, according to Brooker, experienced tingling sensations in response to reduc-



The Rollright Stones, Oxfordshire, Great Britain. (Adapted from R6)



The spiral magnetic pattern said to exist around the Rollright Stones. (R4)

tions in the magnetic field strength. (In this connection, see X5.)

Brooker's magnetometer discoveries were no surprise to New Agers, who have long speculated that ancient peoples were more sensitive to the geomagnetic field than modern humans and that they intentionally located their sacred sites at magnetically propitious places.

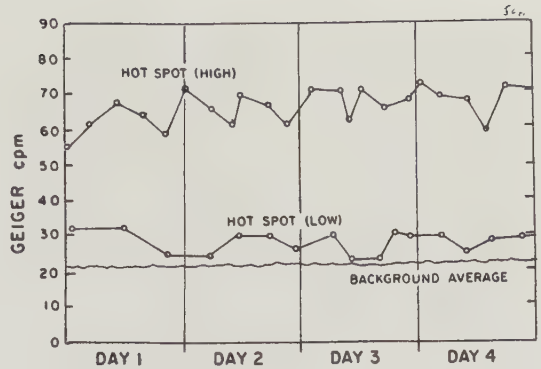
X3. Radioactivity phenomena. Although a few humans may possess a weak "magnetic sense," no evidence at all exists for a human "radioactivity sense." For this reason, one cannot reasonably attribute the presence of anomalous radioactivity at stone circles to the intentional siting or construction of stone circles. The Geiger-counter surveys reported below are, therefore, particularly mystifying.

Under normal circumstances, one could reasonably inquire why anyone would even contemplate making Geiger-counter surveys of standing stones. Why should the radiation environment of stone circles be any different from that of the surrounding countryside? Of course, the standing stones themselves might have been brought in from afar and be more or less radioactive than the environs, especially if granite stones were dragged to the site. (Granite is naturally rather radioactive relatively speaking.) Such radioactive interlopers, however, can be easily identified.

The stimulus that prompted the members of the Dragon Project to procure a Geiger counter was a report from scientists studying the stone circles at Moel ty Uchaf, in Wales. This group had noticed that their Geiger-counter readings increased during the passage of fireballs and other unusual aerial phenomena. (This work in Wales sounds intriguing, but we do not know why these unidentified scientists were operating Geiger counters near stone circles.)

In 1979, the Dragon Project began their work with Geiger counters at the Rollright Stones and nearby control sites. Generally speaking, Geiger-counter readings around the circle were indistinguishable from background measurements, with two exceptions worthy of note.

(1) Sharply delineated hot spots a few square meters in extent were found.

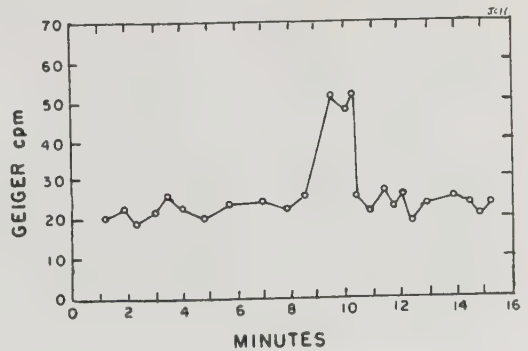


Geiger activity at the Rollright Stones, revealing anomalous hot spots at two places around the circle where readings are consistently above background. cpm = counts per minute. (R4)

Counting rates there were roughly double the background rates.

(2) Geiger-counter "flares" were occasionally noted where the counting rate doubled for 2 to 3 minutes. (R3)

Another curious effect was noted at the Merry Maidens, a stone circle located in Cornwall. In the vicinity of this circle, Geiger-counter readings were substantially below the background levels for the region. (R3)



Geiger activity at the Rollright Stones, indicating "flares" when activity rose sharply above background for a few minutes. cpm = counts per minute. (R4)

In attempting to explain the above anomalies, one can appeal to the fact that the natural radioactivity of soil and rocks does vary considerably geographically. Hot spots near or inside stone circles could be due either to this natural variation or to artificially introduced materials that were buried, perhaps with human remains. As for Geiger-counter flares, cosmic-ray showers come to mind, or perhaps there were unrecognized instrumental artifacts.

Unfortunately, the Dragon Project was always underfunded and could not follow these interesting leads very far. We know of no reports on these results appearing in the mainstream literature, even though one would anticipate that any inquisitive scientist would be most interested in these effects.

X4. Ultrasound phenomena. As with the Geiger-counter anomalies, Dragon Project interest in ultrasound anomalies at stone circles arose serendipitously. A zoologist who was recording the ultrasonic cries of hunting bats was surprised to find strong ultrasound signals emanating from a nearby megalithic site but only as dawn was breaking! To pursue this curious lead, Dragon Project members constructed their own sensitive, wide-band, ultrasound detector. D. Robins recounted his first use of the instrument at the Rollright Stones.

Duly arriving at Rollright before dawn on a foggy, dew-drenched morning in late October, I walked around the site clutching the detector rather self-consciously, fully prepared to pretend it was a transistor radio should I encounter a stray visitor. The detector showed a flickering, minimal background but in the vicinity of the Kingstone I observed a rapid regular pulsing. This ultrasound effect was noticeable for some yards around the Kingstone but was not evident in the vicinity of the circle or the Five Knights. It faded soon after dawn. (R3)

This phenomenon can only be termed "weird." It stimulated the construction of a more sensitive, more sophisticated ultrasound detector. Persistent monitoring of the Rollright Stones proved that

the strange dawn pulsing occurred quite regularly and, even more strangely, peaked at the equinoxes! (R3)

The Dragon Project knew that the Rollright geologic fault was nearby and checked to see if the dawn ultrasound pulses emanated from it, but results were negative, as they also were for nearby potential artificial sources.

The ultrasound phenomenon remains unexplained, but it is eerily reminiscent of the famous "cry of Memnon" that ancient travelers claimed emanated at sunrise from the giant statue of Memnon at Thebes. O. Wilde enshrined this phenomenon in two lines of poetry in his The Sphinx:

Still from his chair of porphyry gaunt
Memnon strains his lidless eyes
Across the empty land, and cries each
yellow morning unto thee. (R6)

Sad to say, the statue of Memnon no longer acoustically awakens at sunrise.

X5. Physiological phenomena. Many humans seem to be afflicted with an innate urge to caress and touch ancient standing stones. Some claim to feel a tingling sensation upon contact with these works of our distant ancestors. In fact, in Gloucestershire, one stone has even earned the name Tingle Stone! Sensations akin to electric shocks have also startled stone stokers. (R2)

We must add that such physiological phenomena often come from individuals claiming psychic powers. Immersion in New Age thinking may predispose individuals to such unusual claims. (See MSH13 for purported psychic phenomena near stone circles.)

References

- R1. Devereux, Paul; Symbolic Landscapes, Glastonbury, 1982, pp. 49, 155. (X1-X3)
- R2. Devereux, Paul; Earthlights, Wellingborough, 1982, p. 141. (X1, X4, X5)
- R3. Robins, Don; "The Dragon Project and the Talking Stones," New Scientist, 96:166, 1982. (X3, X4)
- R4. Brooker, Charles; "Magnetism and

the Standing Stones," New Scientist, 97:105, 1983. (X2)

- R5. Heselton, Philip; Earth Mysteries, Rockport, 1995, p. 47. (X2-X4)
- R6. Gould, Rupert T.; Enigmas, New Hyde Park, 1965, p. 26. (X4)

MSH13 Psychical Phenomena Concentration at Stone Circles

Description. Claims that dowsing detects subterranean lines of "earth energy" that converge beneath some stone circles. The "forces" exerted by these lines resemble those phenomena that dowzers usually associate with water but are more complex and variable. Dowzers also claim that they can detect similar lines and nodes on the standing stones themselves. The convergences of these psychically detected lines at stone circles and other megalithic structures imply (to some people) that the ancient architects also perceived these same confluences and intentionally sited their stone circles over them.

Data Evaluation. Our major sources are popular books and a skeptical magazine. No scientific study of dowsing at stone circles has been found as yet. The reality of the claimed phenomena is undermined by their variability in time and with the identities of the dowzers. Nondowzers do not perceive the phenomena, although they might if trained and given appropriate suggestions. Since science insists upon reproducible results that can be observed by all normal people, the discoveries of dowzers at stone circles are unacceptable. Dowzers live in their own universe of books, journals, and meetings! Rating: 4.

Anomaly Evaluation. Dowsing itself is not on trial here. Rather, the salient anomaly is the convergence of the lines reported by many dowzers at stone circles. Why is there this connection between stone circles and what the dowzers report? It is irrelevant whether dowsing works or not; it is the connection between modern claims and ancient sites. The dowzers actually could be sensing something real, something about the environment that is common to many stone circles but is still unrecognized by archeologists. The surprising successes of some dowzers in finding water is sometimes attributed to their subconscious analysis of geological features. Perhaps, in an analogous way, today's dowzers subconsciously perceive the same environmental features that led the builders of stone circles to site them where they did. The divining rods, the ritual pacing back and forth, and the peculiar maps of earth energies by the dowzers are irrelevant in this view.

If such is the explanation of the phenomenon, there is no anomaly; but we cannot prove that this is the reason for the concentration of dowsing targets in the vicinity of stone circles. The whole business could be illusory, which, of course, is the mainstream view. We prefer to claim that a minor mystery remains. Rating: 3.

Possible Explanations. See the above attempt at a non-ESP explanation and the mainstream rationalizations in X2 below.

Similar and Related Phenomena. Physical phenomena observed in and around stone circles (MSH12); dowsing phenomena (Series-P catalogs).

Entries

X0. Background. The larger stone circles can cast eerie, quasi-religious spells over visitors. Stonehenge is more than just a grouping of big stones, it has transcendental overtones like a great cathedral. Of course, it was designed to accomplish exactly that, and so were many other stone circles and arrays. Such effects were doubtless more pronounced on the culture that raised these edifices. Rituals, processions, chanting, etc. probably enhanced the hold these structures exerted on the Neolithic and Bronze Age societies. It would not be surprising if these peoples did experience transcendental "forces" in the vicinity of stone circles, for such phenomena are common even in today's churches.

So, perhaps we should not be too derisive when we read of people feeling tinglings and electric-like shocks when stroking megaliths. It's in our genes!

Against this background of psychological impressions and claims of gross physiological effects, we now inquire into the more delicate psychic phenomena reported by sensitive individuals who wander around stone circles, perhaps with divining rods or pendulums that are said to enhance those subtle forces that some claim envelop stone circles.

We will never how ancient peoples interpreted these purported psychic forces, assuming that they perceived them in the first place. Possibly they attributed them to earth spirits or gods and goddesses. In today's world, though, psychics hypothesize the existence of "earth energies" that grip the mind as well as divining rods. In the hands of an experienced dowser, all sorts of underground patterns of "something" are perceived; even the standing stones themselves exhibit strange energy "nodes" and lines.

To an establishment scientist the whole idea sounds ridiculous. Yet, dowsing is serious business to many. There are detailed definitions of the various "forces" and types of patterns as well

as handbooks to guide the novice. (R3-R5) There is a rather elaborate belief system operating here, but it lies outside the pale of science.

Nevertheless, dowers do say they experience something, and an anomalist must look into these claims of the psychic phenomena apparently encountered among the standing stones. Just what do dowers claim and might there be scientific explanations for it?

X1. What dowers claim they perceive at stone circles? Dowers are best known for their supposed ability to locate underground water sources. Indeed, governments and other organizations sometimes employ them for this purpose. Dowers also say they can locate minerals, buried treasures, and virtually any hidden thing, including archeological ruins and the strange forces surrounding them.

Dowers noticed back in the 1930s (and probably much earlier) that their divining rods were influenced by powerful forces in the environs of megalithic monuments. These forces resemble those produced by springs, but excavations found no water. These curious spots are termed "blind springs," and they seem to occur under many stone circles. Further psychic scrutiny revealed linear "signals" that could be traced for some distances over hill and dale as if they represented underground rivers. Spiral patterns also appeared. It was obvious that something more than water witching was associated with stone circles.

One of the pioneers in the dowsing of stone circles was G. Underwood, a Wiltshire lawyer. After many years of field work, he concluded that there were three species of invisible lines or tracks detectable by divination in the vicinities of stone circles.

(1) Strong lines due to real under-water streams, which Underwood natural-

ly called "water lines."

(2) "Track lines" that are weaker than the water lines.

(3) "Aquistats" that are paired lines than overrun track lines. (R1, R2)

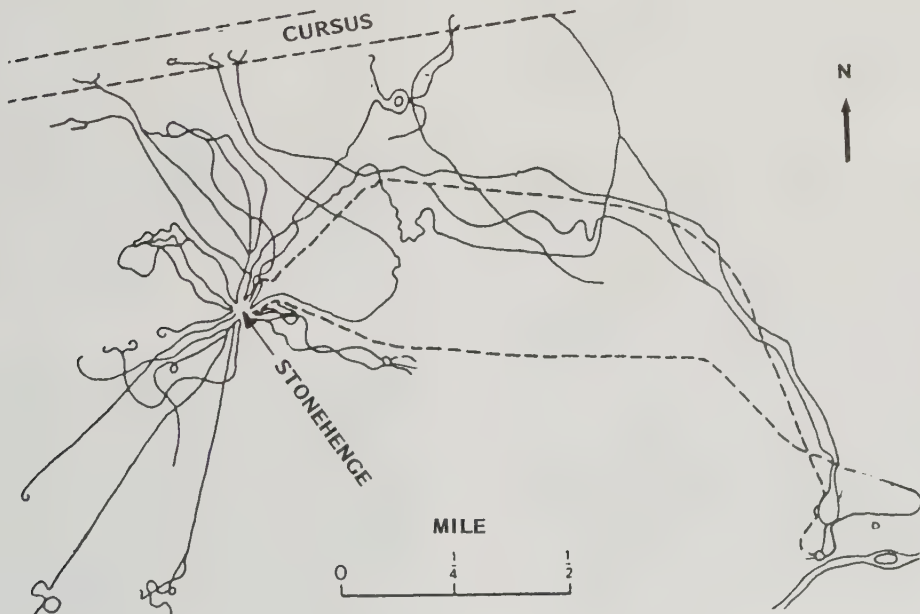


Some dowsers claim that they can detect energy spirals termed "aquastats" near "power centers." (R5)

Most interesting to archeology is the convergence of all three types of lines on stone circles. These points of convergence are the blind springs that perplexed earlier dowsers.

Underwood's map of the lines converging on Stonehenge reveal the complexity of the situation. Other dowsers have found similar but not identical underground "structures" around Stonehenge, as described by C. Chippendale.

Work by several dowsers confirms discoveries made by Guy Underwood and published in his The Patterns of the Past. Stonehenge, like all the barrows, stands over a spring, one running through the ruin under the Altar, Slaughter and Heel Stones and down the Avenue. As befits a site of such importance, there are all sorts of complexities. Reginald Smith found a hidden spring at its precise center dividing into three streams; one runs south, and the other two unite at the north end of the great horseshoe. Underwood tracked more than thirty radiating streams and fissures under Stonehenge. And Californian dowsers who have mapped the earth's acupuncture system have naturally found Stonehenge and Glastonbury to be needle-points. (R6)



The primary underground dowsing lines in the vicinity of Stonehenge, as described by Underwood. Note typical spiralling at the ends of the lines. (R2) Of course, most individuals cannot detect these patterns.

To Underwood, the convergence of these underground lines at stone circles suggested that the builders of these megalithic sites were also able to detect the same underground influences and intentionally chose to build over them. Dowsing would therefore be thousands of years old.

The underground maps drawn by the dowers often differ in the placements of the underground lines. And a few respected dowers feel no tugs at all on their divining rods as they walk around the stone circles. Worse yet, the patterns of lines shift with time, even for the same dowers. This is not the kind of phenomenon that scientists can sink their teeth into.

While many dowers detect patterns much like Underwood's, others have substantially different visions of what exists under the stone circles. For example, S. Lonegren defines his "energy leys" in terms and details guaranteed to engage any conventional scientist.

(1) An ENERGY LEY (or E LEY) is usually a six to eight foot wide "beam" of yang (+) energy. (Sometimes we have noted E LEYS having widths of twenty feet or more; however the norm is six to eight feet.) This width seems to vary according to the time of day, time of year, and perhaps the phase of the moon.

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(4) E LEYS, like rivers have a direction of flow. This can be determined with a pendulum by asking "yes" or "no" questions, or by standing in the center of the E LEY with an L rod in the search position, asking the question, "Which way is downstream?", and turning slowly around in a circle. The L rod will "stick" or point to the downstream position. (R5)

We wouldn't blame the science-trained reader if he or she chucked the whole business of stone-circle dowsing at this point. It is obviously not something that could ever be published in Nature or warrant a grant from the National Science Foundation.

But dowsing has a strong following. Its practitioners are everywhere, and they are always finding something new. This is illustrated by the accompanying sketches of weird underground patterns and improbable "energy nodes" that are

said to occur on above-ground standing stones. Earth energies evidently permeate all components of megalithic sites. Perhaps these energy streams can account for the ultrasound and other physical phenomena mentioned in MSH12!

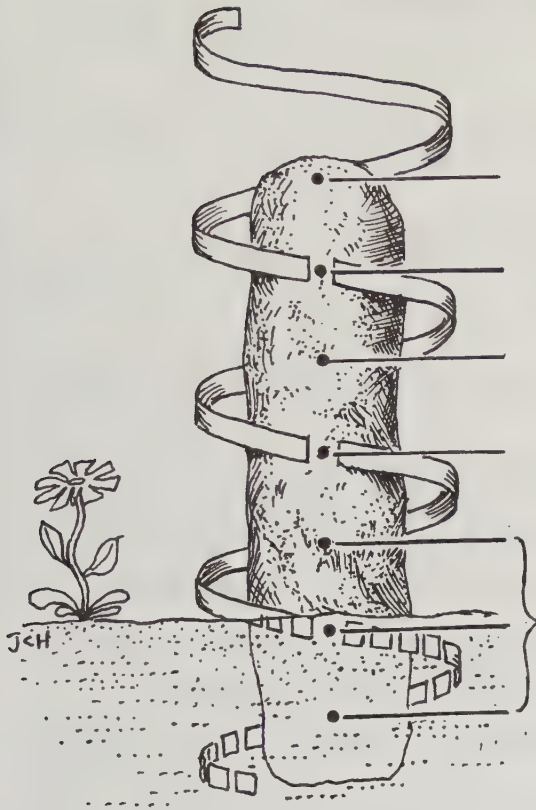
Despite the invisibility of this panoply of these underground lines and above-ground patterns to "normal" people and despite their nonreproducibility among talented dowers, the concept of "earth energies" has fired the imaginations of many. It is a core belief among many New-Agers that Stonehenge, the Great Pyramid, Chaco Canyon, and many other ancient sites were erected at those spots where streams of earth energy converge.

X2. What skeptics say dowers perceive. Actually, skeptics assert that dowers perceive nothing at all. P.A. Hancock, a professor at the University of Minnesota, has elaborated on this.

I suggest that dowsing is one example of a phenomenon I call "self as unrecognized cause." In this range of behaviors, the individual attributes causation to an external agency (e.g., earth energy) when the actual cause is his or her own, albeit unrecognized actions. Among these actions are typically subconscious movements, such as respiration or correcting for postural stability. When such movements are magnified through an external instrument, such as a dowsing rod, it can well appear that some environmental force is being encountered. (R7)

Certainly dowsing seems irrational to any scientist. Yet, dowers have had some successes in finding water. It is conceivable that their occasional success is really due to their subconscious ability to perceive and analyze geological clues. Of course, this capability has little bearing on those strange patterns of different types of "forces" dowers claim they can detect in the neighborhood of stone circles, Stonehenge in particular.

If earth energies flow beneath stone circles, they escape all the sophisticated instruments of modern science.



Point 7. Acts upon the spine muscles.

Point 6. No direct action.

Point 5. Acts upon a dowser's balance.

Point 4. No direct action.

Points 1-3. No direct action but "somehow" connected with Underwood's patterns.

Dowsers claim that energy collection/emission takes a spiral form around standing stones. This spiral is said to reverse during the lunar cycle! Various "points" on a standing stone apparently affect dowsers in different ways. (R4)

References

- R1. Underwood, Guy; The Pattern of the Past, London, 1969. (X1)
- R2. Service, Alastair, and Bradbury, Jean; Megaliths and their Mysteries, New York, 1979, p. 35. (X1)
- R3. Underwood, Peter; The Complete Book of Dowsing and Divining, London, 1980, p. 59. (X0, X1)
- R4. Devereux, Paul; Earth Lights, Wellingborough, 1982, p. 129. (X0, X1)
- R5. Lonegren, Sigfrid; "Dowsing for Earth Energies," NEARA Journal, 18:8, Summer/Fall 1983. (X0, X1)
- R6. Chippendale, Christopher; Stonehenge Complete, Ithaca, 1983. (X1)
- R7. Hancock, P.A.; "Dowsing the Roll-rights," Skeptical Inquirer, 22:32, January/February 1998. (X2)

MSH14 Integration of Stone Circles and the Environment

Description. Claims that the sitings and configurations of stone circles were strongly influenced by one or more of the following environmental criteria:

- (1) The presence of geological faults,
- (2) The presence of springs, including "blind" springs,
- (3) The proximity of sources of appropriate stones,
- (4) Regional topography,
- (5) Low thunderstorm frequency, and
- (6) Solar and lunar haloes.

This is a composite section because it seems most efficient to discuss these criteria together.

Data Evaluation. Factual support for the foregoing six claims varies considerably in the data we have been able to find in the literature. Our evaluations follow.

- (1) We have only assertions in the popular literature; no scientific studies.
- (2) Ditto.
- (3) Geological studies confirm that Stonehenge is located at great distances from its stones' sources.
- (4) Computer analyses suggest that Stonehenge is sited so that it is visible from the many other megalithic sites that surround it.
- (5) Meteorological data confirm that British stone circles avoid areas where thunderstorms are frequent.
- (6) This is a theory proposed in off-mainstream literature. No related scientific studies have been found.

Anomaly Evaluation. For comments on claims (1), (2), (5), and (6), see X1, X2, X5, and X6 below.

Only claims (3) and (4) are weighty enough for separate evaluation here. It is apparent from these that Stonehenge was sited to be the key structure in a regional complex of megalithic ritual sites. Its position in the complex was so important that the distances to sources of suitable stones were not as important as its visibility on Salisbury Plain from other sites on nearby ridges. The regional planning, social organization, and infrastructure necessary for this far-flung complex seem remarkable for Neolithic and Bronze Age peoples but are actually consistent with the sophistication of other ancient cultures. Rating: 3.

Possible Explanations. Neolithic and Bronze Age people were obviously very talented and well-organized socially.

Similar and Related Phenomena. Many ancient structures and complexes of structures are equally impressive; such as the Giza complex, Tiahuanaco, the Carnac region, Cahokia, Chaco Canyon, etc. See the Subject Index.

Entries

X0. Introduction. In MSH13, we explored the claims that stone circles (and other megalithic structures) were sited using dowser-detected confluences of underground lines or "earth energies" as guides. Of course, mainstream scientists give short shrift to such psychic con-

siderations, but they cannot easily slough off stone-circle associations with such recognized scientific entities as geologic faults, regional topography, and atmospheric optics. These are real phenomena that both modern and Neolithic humans can appreciate. It is un-

fortunate that archeologists have paid so little attention to the role of the environment in stone-circle siting and configuration. We have little reliable material to go on here.

X1. Geologic faults and stone-circle siting. Active geologic faults may in principle generate the luminous, acoustic, and magnetic phenomena pointed out in MSH12. In those observations we have circumstantial evidence that some stone circles may be located over active faults. Such siting could just be coincidental. It would be valuable to have a solid scientific study of stone-circle locations relative to faults, but have not found such work in the literature we have reviewed. The best information we have comes from the "off-mainstream" Dragon Project (mentioned in MSH12).

The Dragon Project has confirmed that certain types of sacred sites the world over occur in close proximity to fault lines---fissures or breaks in the Earth's crust (like the San Andreas Fault) which tend to be the scene of tectonic stress, magnetic and gravitic anomalies, and enhanced mineralization (which can cause variable electromagnetic fields). (R5)

Specifics are lacking, but there does seem to be at least a weak connection between stone-circle siting and geologic faults. If this correlation holds up under scientific scrutiny, it probably exists because the stone-circle builders were guided by the luminous and acoustic phenomena that some scientists assure us can be generated by faults. Obviously, the Neolithic and Bronze Age people had no magnetometers and most faults are not obvious from the surface, so they could only rely upon what they could see and hear.

Unquestionably, this linking of stone-circle siting to faults is tenuous at best.

X2. Springs and stone-circle siting. As in the case of geologic faults (X1), the geographical correlation of springs and stone circles has not been a subject

of scientific research. All we can offer is a general statement by J. Michell.

The invariable practice in antiquity of locating sacred buildings immediately above underground springs and watercourses, as at the Temple of Jerusalem, constitutes one of the greatest mysteries of the past, for evidently some principle was involved of which we are now totally aware. It is a fact, however, that the feeling which comes to many sensitive people at ancient ritual sites, that they are standing on ground which is in some way sacred, accords with the experience of dowzers or water diviners, who detect springs beneath every old church and the sites of prehistoric stones. (R1)

We do not know how dependent Michell's assertions are upon actual observations of springs and how much he relies upon their purported detection by dowzers. Again, we have assertions sans hard scientific data.

X3. Noncorrelation of Stonehenge's location and stone sources. Stonehenge, the preeminent stone circle, stands lonely on Salisbury Plain and far from the sources of its bluestones and sarsens. From the standpoint of labor costs, one would expect stone circles to be located close to a ready supply of building material. Not so, with Stonehenge.

It is now a general consensus that Stonehenge's bluestones were transported over 200 kilometers from the Preseli Mountains in Southwest Wales. The geological evidence is heavily against their having been nearby glacial erratics. In addition, the huge sarsens, weighing 25 tons or more, were dragged over 30 kilometers from Marlborough Downs. The social implications of these facts are significant.

So we must accept that the bluestones were transported to Stonehenge by people, and face up to the implications in terms of organization, communications and exchange between communities as far apart as Wessex and South Wales (some 200 km). (R6)

The anomaly addressed here is not the technical difficulty of transporting the heavy stones, nor the social costs, nor the required infrastructure. The real questions are why Stonehenge is located where it is, and why its builders were constrained to use massive, non-local stones of certain types. Apparently Salisbury Plain and the stone types had special meanings of some sort.

X4. Stonehenge's integration with the topography. A partial answer to first question posed in X3 may exist in some new analyses of Stonehenge's topographic environment and the visibility of other megalithic structures from Stonehenge.

They [the studies] reveal that Stonehenge sits at the centre of a number of 'nested bowls', and that visibility considerations influenced the siting of nearby monuments; the Early Bronze Age barrows, for example, were placed in lines along the ridges forming the near horizon so that each could be clearly seen from Stonehenge. (R6)

In other words, Stonehenge was actually sited so that could be integrated into a wide complex of other sites. We can surmise that the megalithic engineers deliberately chose a spot where Stonehenge would be the visible center of a regional system of ritual sites. Evidently the distances of the bluestones and sarsens were of secondary importance to regional planning. We cannot accuse the Bronze Age people of small-scale visions. Were they driven by religious imperatives we do not appreciate? We will probably never know, but we can appreciate the wide geographical reach of their efforts and the social organization needed to satisfy their religious inclinations.

X5. Stone-circle siting and thunderstorm frequency. P. Devereux has remarked upon how virtually all British stone circles are located in areas where thunderstorm activity is low. The map he uses to support this contention is very convincing. (R3) Also derivable from this map is the observation that

almost all stone circles fall in the western half of a bisected Britain!

The stone circle-thunderstorm anticorrelation could just be a coincidence. Thunderstorm frequency is highest in the eastern half of Britain (where circles are scarce), and this might be due to the nearness of the European continent. Western Britain and Ireland are more nearly seagirt, and it is well known that thunderstorms are much, much rarer at sea than over land. As for the skewed stone-circle distribution, we can surmise either that:

(1) Western Britain was more heavily populated than the east and required more stone circles to meet the demand for rituals, or

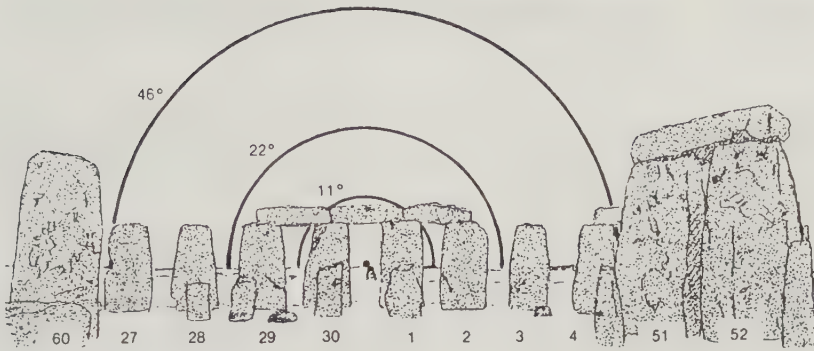
(2) The people of western Britain were culturally different from those of the east and had a different religious infrastructure.

The anticorrelation is interesting but does not challenge any paradigms.

X6. Stonehenge's configuration and haloes. Entries X1-X5 address the question of Stonehenge's siting. It is possible that the environment may also have impacted the design of Stonehenge. D.L. Cyr, who is a champion of I.N. Vail's canopy theory, hypothesizes that solar haloes inspired the stone-circle engineers.

The canopy theory asserts that 4,000 or so years ago, as the Ice Age waned, the earth's atmosphere was charged with ice crystals, which are essential to the formation of solar and lunar haloes. If Vail and Cyr are correct, the Bronze Age people of Britain must have seen spectacular haloes almost constantly. These apparitions could have become part of their world view---something like the Christmas Star is to us---and thereby been woven into the design of Stonehenge.

Cyr has promoted the solar-halo connection to Stonehenge's design for years. The accompanying sketch of Stonehenge at sunrise on June 21, with the trilithons framed by the 11° and 22° solar haloes is striking. But does this sketch prove that Stonehenge's builders were actually guided by the haloes when they sized and positioned the trilithons?



Cyr's so-called "hidden haloes" that would be seen at sunrise on June 21 (under favorable weather conditions). The 11° , 22° and 46° haloes would frame Stonehenge as shown, suggesting that atmospheric phenomena may have affected the design of Stonehenge. (R4)

Archeologists have generally dismissed the halo-influence theory. (R2) In defense of the Vail-Cyr theory, we have to admit that we do not really know how much natural phenomena (lightning, thunder, eclipses, haloes, echoes, etc.) might have influenced ancient human culture. For example, stone-chamber design and rock-art placement have been shown to be related to acoustic effects.

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- R3. Devereux, Paul; Earth Lights, Wellingborough, 1982, pp. 155, 166. (X1, X5)
- R4. Cyr, Donald L.; "Halo Apparitions at Stonehenge," in: Cyr, Donald L., ed., Stonehenge Viewpoint, Santa Barbara, 1985, p. 148. (X6)
- R5. Devereux, Paul; Symbolic Landscapes, Glastonbury, 1992, p. 50. (X1)
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MSH15 Large-Scale Organization of Stone Circles

Description. The incorporation of stone circles into clusters or linear arrangements ("leys") containing cairns, tumuli, henges, and other megalithic sites, including more recent churches constructed over ancient sites.

Data Evaluation. Simple clusters of megalithic sites with stone circles as members are well verified in the literature. Alignments or "leys," however, have been the subject of debate for decades. The science literature uniformly rejects leys as intentional arrangements; they are said to be only chance alignments. Since Britain, Ireland, and Western Europe are densely populated with qualifying ancient sites, this argument is powerful. Nevertheless, a very few, rather short alignments of sites may have been built that way for astronomical purposes. (See X2 below.) On the other hand, the popular literature makes many wild claims concerning leys hundreds of miles long and organized into vast grids. In sum, stone circles are definitely organized into both clusters and linear arrangements. It is the origin of the latter (chance or intent) that is the focus of the controversy. Rating: 1.

Anomaly Evaluation. It is eminently reasonable that the megalithic culture clustered their ritual sites from the standpoint of efficiency alone. Also, there is nothing anomalous about the same people building their sites along straight lines, particularly if astronomy is an objective. Geometrical order is a normal, natural human predilection. In truth, no archeological anomaly exists---even if a few bona-fide leys exist. It is rather the professional archeologists' insistence that there are no leys at all that makes the catalog entry necessary. Rating: 3.

Possible Explanations. None required.

Similar and Related Phenomena. The same sort of controversy prevails when claims are made that Stonehenge and other megalithic structures were built to make sophisticated astronomical observations, such as those required for eclipse predictions (MSH17).

Entries

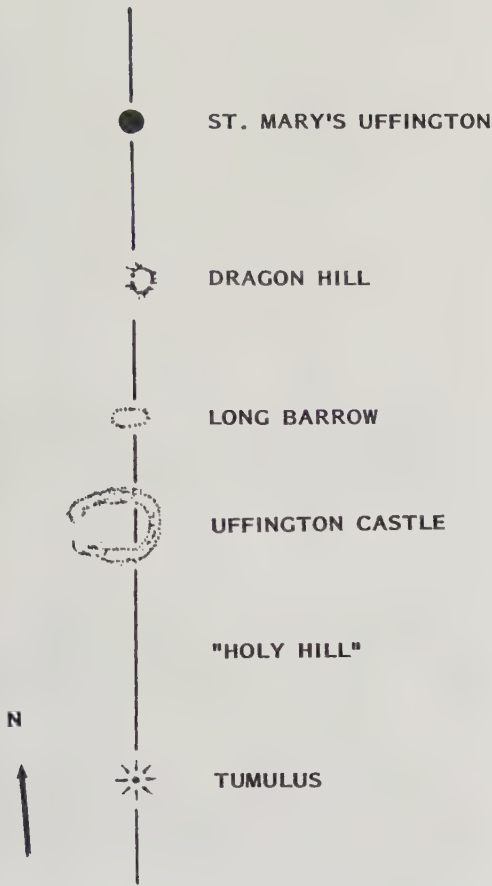
X0. Introduction. One of the more famous British stone circles, Callanish, stands in stark isolation on a remote island in northern Scotland. On the other hand, the most renowned stone circle, Stonehenge, is surrounded by other megalithic sites, some within eye-shot. The questions addressed in this section ask whether some stone circles were deliberately clustered in ritual complexes and, especially, whether they were intentionally arranged in long straight lines along with other ancient sites.

Archeologists do not doubt the existence of megalithic complexes; they are all too obvious. (X1) The controversy really swirls around the so-called "leys" or long, straight lines of structures. The word "ley" was introduced by A. Watkins, who presumed it was derived

from the Saxon word for "cleared strip." Leys may include not only stone circles but also cairns, mounds, dolmens, holy wells, and even churches that were erected more recently on megalithic sites. Actually, most of the best examples of leys do not involve stone circles at all, but enough do so that it is necessary to evaluate the ley concept here.

Britain is peppered with thousands of megalithic sites, and it has been a passion of some amateur archeologists to draw straight lines intersecting as many as possible. Ley discovery, it seems, is almost too easy. The whole of Britain seems to be covered with a network of leys, some of which are hundreds of miles long. At least this is what some ley hunters assert.

The wild claims of the more enthusiastic ley hunters have evoked derision



A typical British ley. Note that no stone circles are involved! (R11)

from the professional archeologists, who tend to see nothing but chance alignments. Their disdain turns to ridicule, when the leys are claimed to be conduits for the flow of "earth energy." Britain is said to be home to a vast "power grid" marked by leys! Such claims have long polarized the amateurs and professionals.

The alignments of some stone circles and other megalithic sites was noticed as far back as 1905 by N. Lockyer, then the editor of Nature and a pioneer archaeoastronomer. (R1) Little came of Lockyer's announcements of site alignments. Modern ley hunting really got its start one summer day in 1921 when A. Watkins, a partner in a firm of flour millers, had what might be called a "revelation." He

termed it "a flood of ancestral memory." When we see the words "revelation" and "ancestral memory," we know that we must be wary.

P. Devereux and I. Thomson summarized Watkin's vision as follows:

Alfred Watkins felt he had caught a glimpse beyond the modern face of the landscape and was tracing the remnants of a system of straight trackways belonging to remote antiquity. He postulated that these tracks were laid out with certain types of markers, some of which may have developed into sacred or important sites in both pagan and Christian times. Some ley markers were therefore original while many others were evolved features, such as ancient churches and castles, standing on sites of former significance. Odd sections of the old straight tracks were still visible, Watkins thought, in some lengths of roadway and old paths aligning on ancient sites. He considered that some of the alignments has astronomical significance. (R14)

For the remainder of his life, Watkins consulted maps and wandered Britain searching for leys, and he found them ---many of them. His major publication on the subject was The Old Straight Track, first published in 1925. (R4) Watkins' leys were largely unappreciated until the 1930s, when ley hunting became popular among amateur archeologists and anathema to the professionals. (R9, R11, R14, R15)

Leys are not a British monopoly. In X3, we'll identify possible leys in Europe, North America, and South America. However, these supposed leys are not all contemporaneous with those of Britain, so no cultural diffusion can be claimed. Instead, ancient peoples may simply have valued straightness!

It is important to recognize at the outset that some, perhaps most, leys are fanciful; that is, just chance alignments. In X4, we'll see why this is so and, at the same time, discuss why professional archeologists disdain leys.

X1. Megalithic complexes. One non-controversial variety of stone-circle

organization is simple clumping together without any internal geometrical structure.

In MSH14, it is seen how Stonehenge is now considered to be the central element of a regional complex of megalithic sites. (R16) Dartmoor is another example of a regional grouping of many stone circles, stone rows, mounds, cairns, etc. (See MSH3) A. Burl characterizes the Dartmoor grouping as a "melange" for it is undeniably a grand mixture of different kinds of structures. It seems to be littered with "experimental" circles and other structures that were tried out and then abandoned.

Burl also sees the Clava cairns area in Scotland as a melange.

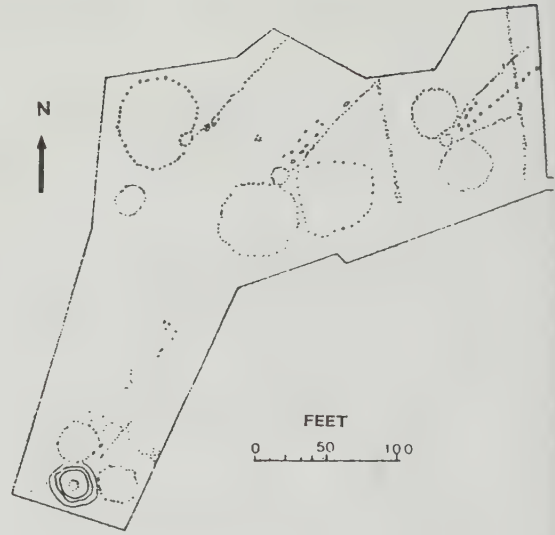
This is most clearly seen in the Clava cairns, Inverness. Thom in Megalithic Sites in Britain summarized his survey of 19 sites in the close-knit group of tombs with stone circles around them. Among the megalithic rings and cairns there were 13 proper circles, 3 ellipses, 2 flattened circles, and 1 egg. The earliest of these passage graves and ring cairns were probably built before all the shapes had evolved if the chronology of Figure 2 [not reproduced] can be trusted. It is thus just possible that plans of the Clava cairns contain a full sequence of designs and are not just an accretion of shapes received from external sources. (R5)

Northern Ireland is home to a remarkable but rarely mentioned stone-circle complex, Beaghmore, which once had been covered by a blanket of peat. Burl elaborated:

Probably the best known of these complexes is Beaghmore, Tyrone. It is also one of the most enigmatic, its interrelated circles, cairns and rows having no obvious pattern. (R6)

Beaghmore is located amid a virtual sea of other stone-circle sites. This site is a puzzle because the circles possess unusual alcoves of unknown purpose. The ring diameters are not measured in megalithic yards. Beaghmore also seems to be a place where new lithic ideas were tried out.

Interesting as these complexes and melanges may be and despite their minor, unplumbed mysteries, they display no



Stone-circle complex at Beaghmore, Northern Ireland. Little geometrical order is obvious here, but the circles possess curious alcoves. A. Burl opines that new ideas may have been tested here. (Adapted from R6)

long-range order. For this reason these groupings have not inspired the fierce controversy that has swirled around our next topic: the British leys.

X2. Some possible British leys. For all the hundreds of British leys that have been traced out on maps by "straight-line" enthusiasts, only a few incorporate stone circles; cairns, cathedrals, mounds, yes; but few stone circles. We have found only four worth mentioning here, and two of these four rather impressive leys run through Stonehenge.

Stonehenge leys. N. Lockyer, back in 1905, was very impressed with the fact that Stonehenge, Grovely Castle, and Old Sarum (a large, circular earthwork) occupied the apices of a neat equilateral triangle. Furthermore, the Grovely Castle-Stonehenge side of the triangle can be extended in both directions to capture other megalithic sites, as shown. What really whetted Lockyer's archaeological appetite was the fact that this line, 21 miles long, was a solstice



Possible leys involving Stonehenge. The huge equilateral triangle is impressive but perhaps just a coincidence. (R1)

line. It pointed directly at the rising sun on the longest day of the year. Lockyer wrote:

The absolute straightness of this line might have been secured by fires at night, but there is more in it than this. Stonehenge, Old Sarum, and Grovely Castle occupy the points of a triangle exactly six miles in the side, and the three sides are continuations of the entrances at Stonehenge and Old Sarum and of a ditch running through the centre at Grovely Castle. (R1)

If there really are deliberately created leys in Britain, this has to be one of them. In addition, the side of the triangle containing Stonehenge and Old Sarum can also be extended to gather in two other sites. In doing so, it passes exactly through the spire of Salisbury Cathedral, which replaced a former bona fide megalithic site.

These "classic" leys are also remarked upon by E.C. Krupp (R7), C. Chippendale (R10), and J.H. Spencer (R2); who are hardly ley aficionados.

The Boscawen-un leys. The rather mysterious stone circle called Boscawen-un is located on the Land's End peninsula in Cornwall. Like many other stone circles in the region, it consists of 19 stones. The significance of this number is not known. Eighteen of these stones are of local granite; the nineteenth is of quartz. It was placed in the WSW part of the circle and may have been a backsight for the May Day sunrise. Also curious is a central pillar 8 feet, 3 inches long that is sharply tilted. Excavation of the base has proved that the tilting is no accident. Why the tilt? It's a mystery. (R18)

Returning to the subject of leys, Boscawen-un seems to be the hub where seven spoke-like leys radiate outward (or inward!). J. Michell sees a grand plan in this.

Before the construction in the middle of the last century of the low stone wall now overgrown with thorns, that encloses the monument, a number of outlying stones were visible on the horizon in several directions. Behind these stand other stones, forming straight alignments that radiate from the circle far into the surrounding country. The circle of Boscawen-un can therefore be regarded as but the nucleus of a greater megalithic structure extending across the whole southern area of the Land's End peninsula. (R18)

N. Lockyer surmised that the seven radial spokes of Boscawen-un had astronomical significance.

To be honest, Boscawen-un is not usually singled out as being on a ley, much less seven of them. This is probably because the radial stone outliers are not other megalithic "sites." But the remarkable radial alignments and possible astronomical implications induce us to stretch definitions a bit.

An Exmoor ley? We use a question mark here because only three stone circles are involved, whereas ley purists insist on at least five elements in a ley to insure statistical significance. Actually, our attention was called to a possible

ley on Exmoor by A. Burl, a ley unbeliever. Here on Exmoor, he wrote were three stone circles on a neat north-south line $6\frac{1}{2}$ miles long. If ley hunters are looking for something for their collections, he remarked, here it is.

The stone circles are named Alms-worthy, Porlock, and Whithypool. To make things more interesting, they are not intervisible. (R6)

X3. Possible leys outside of Britain and Ireland. Ley hunting has been a popular pastime for over 80 years, and many have claimed to have found some. But only a very few of the most convincing British and Irish leys mark stone circles as members---cairns, churches, tumuli, aplenty; but stone circles, just a few. Beyond Britain and Ireland, leys are scarce, perhaps because ley-hunting has never caught on like it has in Britain. Stone circles, too, are relatively rare in the rest of the world. The net result is that there are virtually no convincing leys containing stone circles outside of Britain and Ireland. (Of course, most archeologists assert that there are no leys anywhere, but we'll get to that subject in X4.) However, while on the subject of leys, a brief inquiry into possible leys beyond the English Channel seems worthwhile.

Europe. Like Britain and Ireland, Western Europe is thickly strewn with megalithic sites. It is, therefore, rather easy to connect many sites with straight lines. As early as 1908, following Lockyer's lead, a Captain Devoir drew solstice lines between sites in the Canton of Ploudalmezeau. (R3) In their 1989 book Lines on the Landscape, N. Pennick and P. Devereux identified more astronomical alignments of sites centered on the cathedral at St. Lizier, France. (R11) R. Dehon draws even more in a 1981 issue of the journal Kadath. (R8) To the best of our knowledge, none of these possible leys incorporate stone circles.

Bolivia. Peru is noted for its Nazca lines, but these fascinating geoglyphs are simply made up of straight tracks with few if any circles, cairns, or tumuli along their lengths. In western Bolivia, however, one finds long straight tracks up to 30 kilometers long that are

studded with cairns, shrines, and sometimes Spanish churches that were probably built over old Indian sites. These Bolivian lines seem to be the closest things to the leys envisioned by Watkins outside Britain and Ireland. (R9, R11)

Egypt. N. Pennick and P. Devereux have illustrated an impressive alignment of mosques and tombs in medieval Cairo. The line is about $1\frac{1}{2}$ miles long and, of course, much younger than anything megalithic. (R11)

North America. It is probably just a coincidence, but three important Anasazi sites (Aztec Ruins, Chaco Canyon, Casas Grandes) in New Mexico and Old Mexico are lined up north-south with high precision on longitude $107^{\circ} 57'$. (R17)



A possible Anasazi ley line in the North American southwest. With only three sites involved, coincidence is a strong probability. (R17)

X4. Critiques of the ley concept. For a long time, leys, like UFOs, have been something you either believed in passionately or not at all. It has been another one of those conflicts between amateur



The Boscawen-un stone circle at Land's End, Britain. Note the curious tilted central pillar. Seven spoke-like leys are said to radiate from this circle. (R18)

true believers and the scientific establishment---much like the UFO debate. The situation has eased a bit in recent years but not by much. (R12) Even today, most academics would subscribe to this 1984 opinion expressed by C. Ruggles.

The whole concept of ley lines can be demolished on statistical or archaeological grounds, something which is obvious to anyone with a small degree of scientific or archaeological training who cares to examine the claims of ley-line enthusiasts. (R13)

The statistical argument against leys being intentional alignments is a powerful one, as explained in E.C. Krupp's book In Search of Ancient Astronomies.

One British skeptic, Robert Forrest, in a 1975 article, "Leys, UFOs, and Chance," demonstrated how vulnerable the ley hunter is to the effects of chance. In one experiment he showed that on a typical 1:50,000 Ordnance Survey map (approximately 1½ inches to the mile and depicting an area approximately twenty-five miles square) one can expect to find about 330 antiquities suitable as ley markers. These will generate approximately 1,100 ley lines with a least four markers each. Rarely do the ley hunters find or include these embarrassing riches of evidence. (R7)

The ley controversy has been useful in the sense that today many ley hunters are convinced that leys over 10 miles in length are probably just chance alignments. Still, a hard core remains of enthusiasts who insist that Britain is covered with a grid of leys pulsing with earth energies. (R12)

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- R18. Michell, John; The Old Stones of Land's End, London, 1974, p. 16. (X2)
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MSH16 Stone Circles Outside Britain and Ireland

Description. The presence on all continents, except Antarctica, of stone circles of various sizes, compositions, and ages. These circles often have central standing stones, external marker stones, peripheral windows signifying alignments, or features of unknown purpose. Some of the stone circles selected for this review are included because of their unexpected ages and/or geographical locations. As far as possible, tipi rings, campfire circles, and other mundane stone circles have been eliminated.

Data Evaluation. A wide range of literature sources over the past 200 years was consulted. Most of these have good scientific pedigrees but a few from the "fringe" literature are included, providing they are buttressed by actual photographs and/or confirming data. No claims of completeness are advanced here. We have unquestionably missed many good candidates. Rating: 2.

Anomaly Evaluation. Stone circles are such simple geometric figures that it is not at all surprising that ancient cultures would build them for rituals, calendric use, burials, and other purposes. In other words, stone circles are not inherently anomalous. They could have arisen spontaneously in any culture and at any time in human history without challenging any archeological or anthropological paradigms. Therefore, except for a few stone circles with unfathomed applications, the stone circles collected in this section are easily relegated to the curiosity cabinet. Rating: 3.

Possible Explanations. None needed in most instances; none offered in the remainder.

Similar and Related Phenomena. All other stone-circle entries in this chapter (MSH7-MSH15, MSH17-MSH19).

Entries

X0. Introduction. People of all ages and cultures have had good reasons to place stones in circles, if only to sit around campfires or to hold tent flaps down. While the most sophisticated of the stone circles are located in Britain and Ireland, the rest of the world presents the archeologist with many additional examples of the species, some mundane, others just curious or mildly anomalous.

In some 30 years of literature research, we have amassed a little collection of "other" stone circles of various ages, sizes, and purposes. To sift these out from the thousands of uninteresting circles, we applied six criteria:

(1) They were located in unexpected places; that is, in places where archeologists asserted they should not be;

(2) They were apparently used in unexpected applications, such as astronomical observations incompatible with standard views of the builder's culture;

(3) They seemed to have no obvious purpose;

(4) They were so much like structures on other continents that transoceanic diffusion is suggested;

(5) They are considerably older than the more renowned circles of Britain and Ireland, possibly implying ancient, long-distance diffusion of the practice of building stone circles; or

(6) They are curious enough to intrigue the compiler!

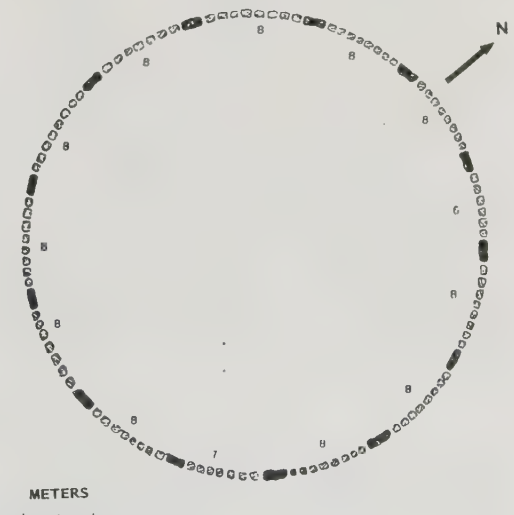
Because our collection is rather large, many of the descriptions will be very brief.

X1. Europe outside of Britain and Ireland. A. Burl, the British authority on stone circles, has understandably con-

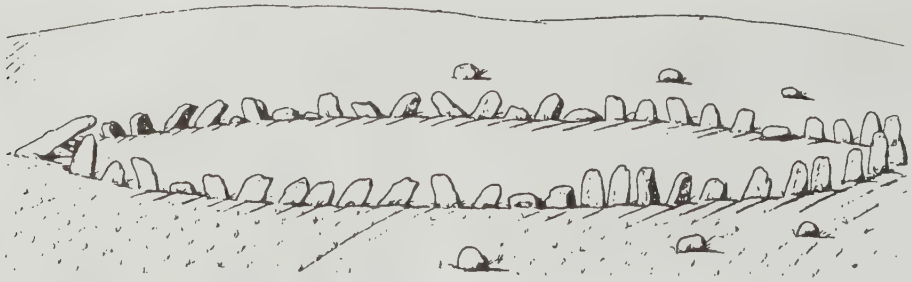
centrated on the 900+ circles in Britain and Ireland. He does, however, mention that stone circles from the Neolithic and Bronze Ages are recognized in Italy, Czechoslovakia, Portugal, Denmark, Sweden, and France. Those in France near the Channel closely resemble those in nearby Britain and were doubtless built by the same culture. (R30)

Italy. J. Fergusson, in his Rude Stone Monuments, recorded a 30-foot-diameter stone circle in Lombardy replete with a tangential avenue 50 feet long. A 20-foot circle was nearby. This assemblage reminded him of the circles on Dartmoor. (R5) Perhaps the British influence did spread this far, or perhaps it moved in the other direction.

Romania. In the Carpathians, stone circles had calendrical applications. See the figure for typical configuration and dimensions. Stones in these circles are small---just a foot or so in height. (R31)



A precision-made stone circle in Romania. Calendric in purpose, the stones are only a foot or so high. (R31)



Ale's Stones overlooking the Baltic from Sweden, as sketched by C.G.G. Hilfeing in 1777. This boat-shaped structure was used as a giant calendar. (R35)

Sweden. Some of Sweden's stone circles are distorted in a way quite different from Britain's ellipses and flattened circles. Ale's Stones, a well-known ship-like megalithic structure in Skane Province, overlooks the Baltic. Used as a giant calendar, this "circle" is officially dated as late Iron Age (400-1,050 AD), but some Swedish scientists now assert that Ale's Stones are much older (3,000-1,500 BC). (R33, R35)

Spain. The Basques of northern Spain are an ancient people with a mysterious language and a curious distribution of blood types. While there are a few stone circles of great antiquity in the Basque region, there are also some unique circles that are only a few centuries old. Very large---sometimes a quarter mile across---they are marked by eight stones, four at the compass points, the other four in between, forming an octagon. In their centers are single stones. The Basques use these "circles" to determine land divisions.

What makes them interesting enough to catalog is that they are laid out using a base-7 system of counting and measuring instead of the common decimal system. (R34, R41)

X2. Asia.

India. Stone circles enclosing interments are common in India. Generally, these circles are small, 24-32 feet in diameter. (R5) However, W.J. Walhouse mentions an interesting exception.

On the Bilgiri hills, on the north declivity of the highest summit, on a spot of exceeding picturesque beauty, where several wooded slopes converge, there is a double circle, 35 feet in diameter, of stones of rather small size, none exceeding three feet above the ground, except two, which form an entrance on the south side. The stones are placed rather close together, and the inner and outer rings are a yard apart. No trace of an interment has been discovered in this circle, the only one of the kind known to me on those hills. (R6)

No application was suggested for this discordant circle.

In northwestern India's Mardan District, is the unusual Stone Circle of Asota. Rather than small, rough, irregular stones, this circle originally contained 32 tall, narrow standing stones in a circle 57 feet in diameter, giving it an appearance more like the British circles. (R20)

See the accompanying sketch of the megalithic circle at Bursahom, Kashmir. Its central stones are 9, 12, and 13 feet high, and capped with a lintel. (R22) It is a little Stonehengish in appearance.

Japan. The Japanese islands of Hokkaido and Honshu feature dozens of stone circles. Two of these, near Oyu in northern Honshu, are spectacular, complex, and double.

The Nonakado and Manza circles are roughly the same size, though the



A megalithic circle at Bursahom, Kashmir. (R22)

irregularity of the remains makes measurements only approximate. The outer circle of the former measures about 135 feet in diameter, the inner circle thirty-five. Manza is a little

larger, the diameter of the outer circle being some 150 feet, of the smaller nearly forty-seven...The Oyu double circles have a feature that is without doubt of considerable significance inasmuch as its relative position is the same in both sets of circles: a sun-dial construction stands apart from the rings, at Nonakado quite isolated, at Manza more nearly within the outlines of the outer ring. Each is located in the northwestern sector of the circle, Nonakado at 302° , Manza at 296° . A difference of six degrees does not alter the apparent calendrical significance of the arrangement. (R24)



Locations of some of the stone circles reported in North Honshu. (R24)

X3. North America. Whenever ancient stone circles are discovered in North America, the salient question is always: Are they the consequence of trans-oceanic cultural diffusion or independent invention? The latter is usually assumed. After all, stone circles are very easy to invent.

New England. L.L. Morrill, Jr., has briefly described two stone-circle sites in New Hampshire and Connecticut, both apparently with astronomical alignments.

The site near Raymond, New Hampshire, actually includes two circles 100 feet apart reminiscent of the megalithic structures of Britain. Each circle con-

tains, in the exact relative position, single stones with identical markings. Some of the stones have holes drilled in them, so we are probably not dealing with an ancient culture. Nevertheless, the circles were deliberately designed for some unperceived purpose by persons unknown. (R28)

As for the Connecticut site, we quote Morrill directly.

The Groton, Conn., site, with a large double circle of boulders as the central sighting point, has at least five good alignments. The boulders in the double circle line up with several flat stones standing on edge, a beehive structure, and the right-angle corners of several nearby stone walls. (R28)

The Groton site seems to be complex, consisting of various stone structures of problematic age---much like the vaunted Mystery Hill site in New Hampshire.

Mystery Hill, now a well-publicized tourist attraction near Salem, New Hampshire, is hyped as the product of pre-Columbian diffusion from Europe. The site contains a stone circle of five

stones and a central observation point. One stone aligned with the meridian and the other four with the sunrise and sunset points at the solstices. (R37)

We must emphasize here that the above claims emanate from the publications of amateur groups and are, in addition, disdained by professional archaeologists. Still, these stone circles do exist and at the very least are curiosities, particularly those that seem to include astronomical alignments that no practical New England farmer would waste time on or have much use for.

One more New England site is worth a mention. In a 1978 issue of the NEARA Journal, an amateur publication, J.B. Jones, Jr., recounts his research at the Burnt Hill site in the Berkshires of western Massachusetts.

Standing atop of the crest of the hill in the midst of a blueberry field is a crude circle of standing stones, plus several fallen ones. To some learned viewers this circle appears similar to those raised in Britain and other parts of Europe, and is comparable to megalithic constructions of unworked rocks. To the area resi-



*Standing stones at the Burnt Hill site
in western Massachusetts. (R. Calliham)*

dents familiar with this scenic spot, these are no more than stones placed there by picnickers or ancestral owners of the acreage. While there is no evidence to support either premise, the owner of the land readily admits that they have always been there. (R32)

Picnickers aside, Jones claims that some of the site's stones are aligned with the sunrise at the autumn equinox.

As always, one must remember that significant astronomical alignments are not too hard to find among a group of several stones, given the many possibilities and the multitude of "significant" astronomical targets.

The Burnt Hill site is also mentioned in MSD2-X3 in connection with menhirs.

New York. From an 1824 issue of the American Journal of Science, we learn of a Celtic "sacred circle" situated on a high hill one mile from Hudson, New York. The stones are supposed to be of "remarkable size." (R1)

We have found nothing more on this site, even in the publications of "fringe" archeology. The lesson to be learned

from this tidbit is that, almost two centuries ago, observers in North America already suspected Celtic influences! This remote, but exciting, possibility has molded the outlook of many amateur archeologists.

Maryland. On the western slope of Polish Mountain, near Flintstone in western Maryland, hikers and hunters stumble across strange rings of jumbled rocks of unknown origin. No one claims a Celtic role in piling up these rings, nor were ancient astronomers involved. Our key reference is an 1988 article in the Washington Post, which said in part:

For more than a decade, 150 to 200 circles of sandstone rock have puzzled area residents and archeologists. Virtually hidden by brush and poison ivy, the gray rocks of various shapes and sizes are neatly arranged in circles. No one knows their purpose, or who put them there. (R39)

The rings average 20 feet in diameter with a 6-foot-wide hole or depression in the center. The rings were built by carefully piling up flat slabs of sand-

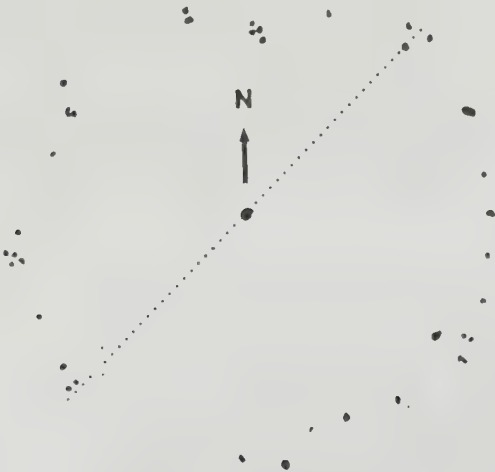


One of the rings of jumbled rocks on Polish Mountain in western Maryland. These rings are about 20 feet in diameter. Age and purpose can only be guessed at. (R44)

stone. (R44) See the sketch.

Michigan. Beaver Island, in Lake Michigan, is home to a large stone circle with possible astronomical alignments. It was discovered in 1985 by T. Bussey while searching for Indian artifacts, which are common on the island, as are petroglyphs and stone structures of various sorts. Here, we attend only to the circle.

This evidence of ancient man's endeavor was found on the west central side of this 53-square-mile island northwest of Charlevoix on the mainland. The circular structure is made up of 39 stones forming a 397-foot circle. Stones vary sizewise from 2 feet to 10 feet in diameter. Experts



Plan of a giant stone circle 397 feet in diameter on Beaver Island in Lake Michigan. (R40)

say the stones are placed horizontally rather than upright. The center rock that occupies the middle position of the boulders contains a hole the size of a basketball, believed to have been chiseled out by humans. Speculation indicates it may once have held a pole, probably serving in the capacity of a sundial. Furthermore, authorities attribute this rock circle to be man-made since there is little evidence of

other boulders of that size range in the immediate area.

.....

Archaeologists maintain the axis of the Beaver Island "circle of stones" is aligned approximately on the point of the midsummer sunrise, and is believed to have been constructed by a cult of ancient sun worshippers or for use as a calendar. (R40)

The author of the above words, B. Soddors, wonders if the Beaver Island circle was used by prehistoric European visitors who were mining the rich copper deposits in the area.

Iowa. Over a century ago, archeologists recorded many stone circles and mounds in northwestern Iowa. Boulders averaging a foot in diameter made up circles 30-50 feet in diameter. Some of the circles were double. The popular explanation of the circles was that they held down tent flaps and were analogous to the tipi rings so common on the Great Plains. But F. Starr, who explored the site, had other thoughts.

However all these lines of stones cannot be "tent anchors." For instance the "ring" around mound three, the lines upon mound four, or a very peculiar instance noticed on a steep hill, where a great granite boulder is surrounded with a ring of lesser boulders and gravel stones, not accurately circular but rudely heart shaped. (R7)

Colorado. Southeastern Colorado is the location of stone circles that were certainly not used to hold down tent flaps. The first scientific investigation of this remote site was made in the early 1930s by E.B. Renaud, who had been enticed by tales of a curious Indian "fort" in the area. A short account of Renaud's research that appeared in Science News Letter is so interesting that we quote liberally from it.

Professor Renaud, who made a long, difficult journey over prairie trails to investigate the local rumor of an Indian fort, found that the "fort" was really a series of circles of gray and brown sandstone slabs set on a high cliff overlooking the Apishapa River and the surrounding country. The



Sketch of a stone "circle" in south-eastern Colorado overlooking the Apishapa River. This structure is as crude as it is enigmatic. Some of the vertical sandstone slabs are 7 feet high! (R42)

circles of stones would have had no usefulness as a defense. Nor are they like the rings marked off for wigwams. The labor involved in carrying the slabs and aligning them according to a pattern can hardly be justified unless the enclosure had some ceremonial function.

The Colorado circles are not constructed on so grand a scale as the prehistoric Britons achieved at Stonehenge, but the Indians had a most impressive setting for their rites.



Another Colorado stone circle. This one has a central standing stone suggesting an astronomical application. (R42)

One group of circles ranges from one pace to nice paces in diameter, and the group is more or less surrounded by a slab fence with an opening at one end. At another site along the Apishapa, Professor Renaud discovered another group of circles made of larger monoliths, and here he found that each circle had an upright stone post in the center. "A solar cult may be suggested by the circular shape and the presence of a central monolith," [Renaud said]. (R17)

W.R. McGlone et al have explored the same area in recent years looking for inscriptions. They have published photographs of the structures mentioned by Renaud. (R42)

New Mexico. An interesting group of stone circles in Socorro County was discovered in the late 1800s by G.H. Pradt while he was making a Federal survey.

He describes the stone circles as "located on a low hill, an extension of the Oscura range." The inner circle was about thirty feet in diameter. The stones stood three or more feet above the ground, and from one to four feet apart. Some of them had fallen down. In the center of this circle were three upright stones, and one that had fallen, forming a square. One broad stone had partly fallen, and without doubt had covered the four stones, forming a table or altar. Around this inner circle was an outer circle, many of the stones still standing. (R10, R11)

As interesting as this New Mexico site appears to be, we have seen no additional discussion of it in the literature we have surveyed so far.

Arizona. Zodiac Ridge is the presumptuous name given to a site northwest of Tucson. Probably constructed by the Hohokam Indians circa 1200-1450 A.D., the site is thought to be calendric in purpose, relying upon horizon-based astronomy. The investigators write as follows:

Intensive investigation and mapping of a circular rock alignment was initiated by the authors [N.E. and W.R. Autrey] during the fall of 1977 under the direction of the Pima Community



General layout of the stones on Zodiac Ridge, Arizona. The ring is approximately 40 meters in diameter. (R36)

College Department of Human Resources. This circular alignment, known as Zodiac Ridge, is located in the lower bajada of the Tortolita Mountains, northwest of Tucson, Arizona. The rock circle is approximately 40 meters in diameter and involves more than 800 stones of a coarse granitic structure. Most of the stones mapped are embedded horizontally in

the soil; however, numerous upright stones are found in the perimeter circle. Near the center of the circle is an alignment of approximately 30 large stones oriented true east-west. It was this alignment that prompted investigation of the site. (R36)

Given the complexity of the site, the authors were easily able to suggest a

wide variety of possible astronomical alignments.

California. So-called "sleeping circles" are present by the thousands in the desert areas of southern California. Most are circular, but ellipses, double-circles, and even rectangles are also on record. The stones used are small---just a few inches in diameter as collected from the surroundings. The circles themselves are 8-12 feet across. Attributed to the San Dieguito culture, the circles could be thousands of years old. (R25) Apparently, the circles were used as sleeping areas by nomadic peoples.

B. Fell, in his provocatively titled book Bronze Age America, provided a photograph and the accompanying sketch of a 15-meter diameter stone circle in the Santa Cruz Mountains. Two stones in the circle are aligned with the meridian. The two southeastern stones mark the direction of sunrise at the winter solstice. (R37)

The age of this site was not given, but the area is now overgrown with forest, including some rather large trees.



A 15-meters-diameter stone circle at Big Basin, Santa Cruz Mountains, California. The two large stones on the lower right mark the direction of sunrise at the winter solstice. (R37)

British Columbia. Crowning the south-eastern end of Vancouver Island are groups of cairns and stone circles of considerable antiquity, according to an 1892 report by J. Dean. These structures range from 3 to 13 feet in diameter. Their total effect reminds one of the megalithic complexes on Dartmoor, in Britain. The local Indians can only say---as usual in such situations---that "they belonged to the old people." Dean supposes that the structures might be the ruins of ancient dwellings. (R8)

Quebec. In the report on his trip to Ungava Bay in 1966, T.L. Lee noted a stone circle in such an intriguing archeological context that we quote a few sentences of background.

Northward along the coast, and almost up to the Eider Islands, we saw many sites, some of them ancient, others merely recent tent rings or burials. There are rectangular or square house foundations, such as those near the outlet of Roberts Lake (the Zachariasi site)---on some sites, so consistent in size (15 by 15 feet) as to give sharp challenge to any notions of Eskimo origin. Remarkable variations in house construction and the forms of burial vaults leave no doubt that many cultures and times are involved. Interestingly, Zachariasi applied the name "Tunit" to only one feature along the coast, a remarkable circle of stone blocks evidently chosen for their roughly uniform size and height, with a larger block in the exact centre. (R26)

Haiti. In 1851, R. Schomburgk reported to the British Association for the Advancement of Science on his researches in what is now Haiti. Of interest here is his description of a very large stone circle. (R2, R3, R16) A later report by E.W. Palm contains more details and we quote from it.

The 'monumental stone,'...is about the centre of the so-called Corral or Cercado de los Indios (Indian circus) at San Juan de la Maguana near the S.W. Haitian border of the Dominican Republic, the country which occupies the Eastern half of the island. The vast stone circus, of a total circumference of about 2,270 feet, consists of two concentric rows of flat river-

polished stones of 30-50 lb. each, which form a kind of continuous ring 20 feet wide. The spot was discovered and first described in 1851 by Sir Robert Schomburgk, British Consul in the then newly founded Dominican Republic, who made the measurements indicated. The 'centre stone,' 5 feet 7 inches high...occupied its present situation already in 1851. The upper part of the slightly inverted stele is decorated by a circular-shaped face; its technique of engraving, often completed by other signs of anthropomorphization of the pillar, recurs in several (unfortunately unpublished) pieces in the island. A kind of road, the width of which in its present state varies between 30 and 58 feet, according to the writer's measurements, and which is paved by the same type of cobbles, leaves the periphery of the circle in a westerly direction, turning sharply to the north and leading to a nearby rivulet. The 'circus' has long been associated with similar monuments on the American continent. As Schomburgk readily recognized, it can hardly be attributed to the Indians found on the island by Columbus. (R23)



Sun circles or "intihuatana" at Sillustani, Peru. (R4)

tor is constructed of simple upright stones, set in the ground; the second one is surrounded by a platform of stones more or less hewn and fitted together. The first circle is about ninety feet in diameter; the second about one hundred and fifty feet, and has a single erect stone standing in the relative position I have indicated. A remarkable feature in the larger circle is a groove cut in the platform around it, deep enough to receive a ship's cable.

I am aware that many of the smaller so-called Sun-circles of the old world are rather grave-circles, or places of sepulture; but that in no way bears on the point I am at present illustrating, namely: the close resemblance if not absolute identity of the primitive monuments of the great Andean plateau, elevated thirteen thousand feet above the sea, and fenced in with high mountains and frigid deserts, with those of the other continent. (R4)

X4. South America.

Peru. Stone circles appear to be rare in South America. The only account of any consequence we have found is that of E.G. Squier, the same archeologist who cataloged the mounds of North America. We now reproduce his original sketch of the Sillustani "sun circles" and add some text from his article in the American Naturalist.

In connection with the group of chulpas at Sillustani, or rather on the promontory on which these occur, are found a number of such Sun-circles, which seem strangely to have escaped the notice of travellers. The tradition of their original purpose is preserved in the Quicha name they still bear of Intihuatana, "where the sun is tied up."

Some of the circles are more elaborate than others, as shown in the engraving, from which it will be seen that while the one nearest the specta-

X5. Africa and the Middle East.

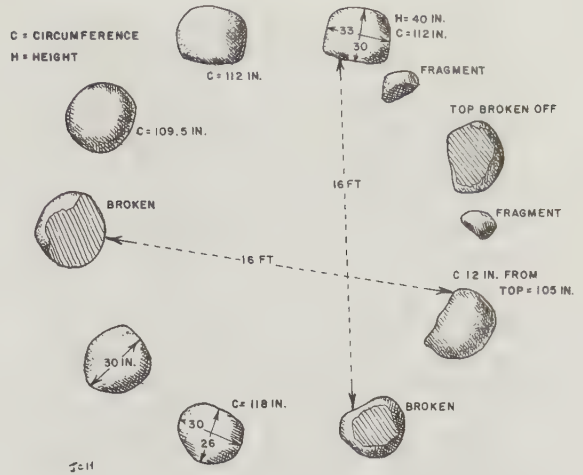
Gambia and Senegal. In West Africa, the tiny nation of Gambia occupies the banks of the Gambia River. It is surrounded on three sides by Senegal and, at the river's mouth, the Atlantic. All along

the river and into adjacent Senegal is a multitude of stone circles and menhirs that have attracted the attentions of many visitors over the years. (R9, R12, R14, R15, R21, R43)

These stone monuments are sometimes termed megalithic. The circles rarely exceed 18 ft. in diameter. The smallest in the Gambia region is 3 ft. in diameter, and the largest about 28 ft. The projection of the stones above the ground is usually 2 to 4 ft. only, with a maximum of from 6 to 8 ft. in some cases, these being usually outer circles. The stones are unusually well-cut cones, truncated and partly rounded at the top, and about 2 to 4 ft. in diameter. Parker counted 1,226 circle stones and 275 outer pillars or menhirs, while those in Senegal are much more numerous. The circles occur sometimes singly, sometimes in groups, but they are usually accompanied by one or more isolated menhirs at a tangent east from the circle. Sometimes the menhirs are found alone. (R21)

Excavations of some of the circles demonstrate that they are burial sites. Local African pottery and some iron objects imply that the circles were likely erected between 900 and 1,000 A.D. (R21)

Although these megaliths seem incongruous in a region where the natives now build mainly with wood, straw, and



A Gambian stone circle complete with dimensions (in inches). (R12)

mud, the megalithic structures of Gambia and Senegal cannot be considered anomalous in the context of Africa a millennium ago, when iron mining and great kingdoms flourished.

Algeria. J. Fergusson guessed that there were as many as 20,000 stone sepulchral monuments in North Africa. In particular, Algeria is home to many tumuli surrounded by stone circles, sometimes several concentric circles. Occasionally, the cir-



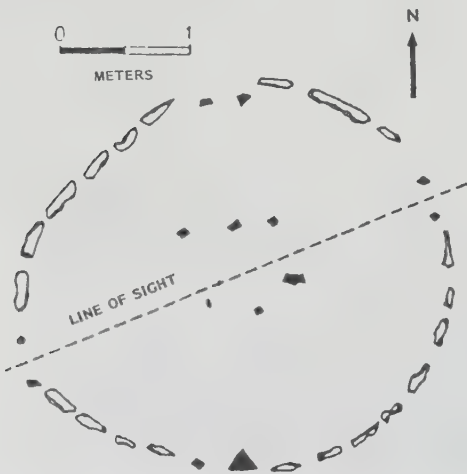
The African country of Gambia is home to many small circles. Usually only 18 feet or less in diameter, they almost always mark burial sites. (R15)

cles are connected by lines of standing stones. (R5) (See illustration in MSH5.)

Libya. While traveling across the Libyan Desert in the early 1930s, R.A. Bagnold came across a stone circle 27 feet in diameter, consisting of sandstone slabs, 18-24 inches high, standing on end in the sand. No artifacts or astronomical alignments were noted. (R18)

Egypt. A stone circle similar to that in the Libyan Desert (above) has recently been found in the Nabta Playa depression in southern Egypt. (R47-R50) This circle is small, only 4 meters across, but there is an interesting astronomical alignment. A line of sight through two "windows" in the circle of stones has a bearing of about 62°. Some 6,000 years ago this would have been close to a solstice line. What makes this megalithic circle particularly significant is seen in the following quotation:

The ceremonial complex could not be more recent than the onset of hyper-aridity in the region around 4,800 years BP, suggesting that the astronomy and ceremonialism of Nabta occurred well before most of the megalithic features of Europe, Great Britain, and Brittany were established. (R50)



This stone circle in southern Egypt is about 4 meters across. It may be older than the megalithic structures in Britain and Brittany. (R50)

Israel. Another very early stone circle apparently exists in Israel.

Israeli archeologist Yehoshua Itzaki believes he has found a Middle East Stonehenge. Halfway between the valley of the Nile and Mesopotamia, at Rujum Al-Hiri, on a flat plain 10 miles east of the Sea of Galilee, are the remains of five giant rings whose marker stones served as a combination calendar, direction finder, eclipse and star calculator.

It has been postulated that Stonehenge was erected by a Bronze Age culture about 2600 to 1600 B.C. This new site is calculated to have been built about 1000 years earlier, well before 3000 B.C. (R29)

Another puzzling five-ringed stone structure, now in Israel-controlled territory, is composed mostly of annular heaps of small boulders. The outer ring, however, contains stones more than 6 feet high, 11 feet thick, weighing up to 20 tons. Here follow more details.

Sitting atop the Israeli-controlled Golan Heights is a monument that, despite its relative obscurity, ranks as one of the remaining wonders of the ancient world. This Stonehenge-like structure is called Gilgal Refaim (the Circle of the Refaim) in Hebrew and Rujum Al-Hiri in Arabic. It consists of five concentric stone rings with a total diameter of about 500 feet. Researchers believe the monument's builders used it for astronomical purposes. (R45)

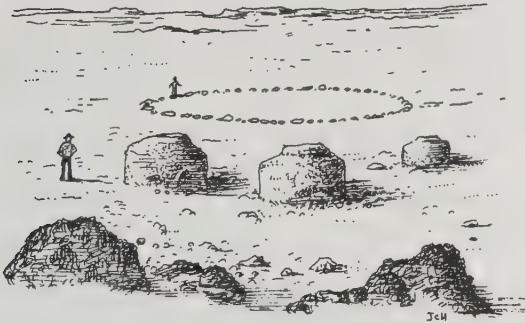
Yemen. In coastal Yemen, E. Keall, of the Royal Ontario Museum, Toronto, has been exploring the ruins of a circular Bronze-Age religious site. This henge is built with granite pillars weighing about 20 tons. (R46) This report, which appeared in Science, does not provide enough information for us to say whether we have here a stone circle of the type covered in this section.

Arabia. Stone pillars similar to those at the Yemen site (above) are said to be scattered across Arabia. (R46) In our literature surveys we have found only one reference to a "gigantic circle with huge upright stones, 15 feet high, and some with long blocks laid across" located in the "unknown wastes of central Arabia." (R6)

X6. Oceania.

Tongareva. Sometimes called Penrhyn Island, this isolated bit of land is found northwest of Samoa among the Cook Islands. There, visitors have reported two circular arrangements of limestone pillars. The pillars are apparently of the same type used in building the rectangular marae common throughout Polynesia. The circles do not appear to be of ancient origin. At the present time, we have no more information on this site. (R19)

Easter Island. Treatments of Easter Island always focus on the giant statues. Writers gloss over or do not even mention the great ditch, the megalithic platforms, and especially the stone circles. The latter consist of small stones and are laid out in front of the statues and their platforms, with the huge heads staring across them. One of the larger circles, the one at Ahu Hanga Tee, has a diameter of about 60 feet, but its stones barely rise above the level of the ground. D. Vrooman, when visiting Ahu Hanga Tee, asked the guide about the circle and was told that it had been used in an unknown ceremony in connection with the statues in charting the sun, moon, and stars. (R38)



An Easter Island stone circle as seen from the platform (Ahu) of Ahu Hanga Tee. Toppled statue crowns in the foreground. (R38)

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MSH17 Stone Circles as Eclipse Predictors

Description. The intentional design of stone circles, particularly Stonehenge, for eclipse prediction by Neolithic cultures.

Data Evaluation. The controversy over the possible astronomical applications of Stonehenge engendered scores of scientific papers, book chapters, and even entire books. Our references are necessarily very selective. There are no shortages of data and opinions. Despite all the literary warfare, some disagreement still survives. Nevertheless, among today's archeologists, consensus tends toward the conclusion that the so-called "alignments" at Stonehenge (and also Callanish), even factoring in the suspicious 56 Aubrey holes, do not support the use stone circles for eclipse prediction. As one might expect, the popular literature still claims Stonehenge was, in effect, a Neolithic computer, perhaps designed by survivors from Atlantis or perhaps even extraterrestrials!

Despite this polarization of opinion, Stonehenge does exhibit significant astronomical alignments. The number 56, as seen in the population of Aubrey Holes, is also meaningful in eclipse prediction. We will never know what the builders of Stonehenge did with their unique structure, but the evidence suggests that, in principle at least, it could have been used to predict eclipses. Rating: 2.

Anomaly Evaluation. If Stonehenge really was constructed to be an eclipse predictor, this betokens intellectual capabilities well beyond those presently associated with Neolithic cultures. Rating: 1.

Possible Explanations. Stonehenge does exhibit some simple solar and lunar alignments but was used primary for rituals, ceremonies, etc. In other words, Stonehenge is just another stone circle, but a bit fancier than most.

Similar and Related Phenomena. Stone rows and arrays as eclipse predictors (MSH4); utility of Er Grah (a menhir in Brittany) in eclipse prediction (MSD3); the unique latitude of Stonehenge (MSH18).

Entries

X0. Background. No one doubts that the Neolithic and later cultures carefully observed the sun and moon and then aligned some of their ceremonial structures according to the solstices and other astronomical phenomena. But when G.S. Hawkins declared in 1963 that the builders of Stonehenge could have predicted lunar and solar eclipses using such alignments, a fascinating and instructive controversy erupted.

In several respects, this conflict resembled another that occurred in the late 1800s between Lord Kelvin (a physicist) and the geologists concerning the age of the sun and, therefore, the age of the earth. It was another case of "hard" science arrogantly invading the turf of "soft" science. The geologists won that one.

In the Stonehenge controversy, Haw-

kins (an astronomer) assured the world that Neolithic people could predict the occurrence of eclipses (R1, R2), even though the archeologists saw no evidence that Stonehenge was ever used for that purpose or that the Neolithic culture had the necessary scientific acumen. (R5, R6) Now, at the turn of the millennium, it appears that the archeologists have shown rather effectively that Stonehenge was probably not a sophisticated astronomical instrument. Nevertheless, Stonehenge is still, in the minds of many, a Neolithic "computer."

Several excellent, detailed histories of this encounter between "hard" and "soft" science are available. (R13, R14, R16, R25) We will not retrace this ground, since our main concern is the possible anomalousness of Stonehenge and other stone circles in the context



A photograph of Stonehenge is a "must" in any section on archeoastronomy.

of Neolithic culture. Nevertheless, a few historical facts are worth pointing out.

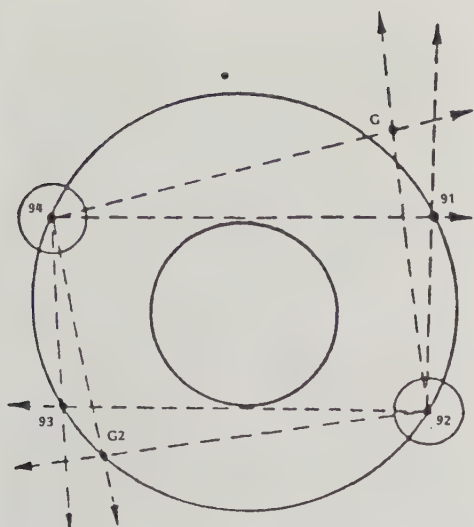
(1) Hawkins was not the first to suggest that Stonehenge could have been used for advanced astronomical purposes. Chief among the predecessors was C.A. Newham, an amateur astronomer. Newham had submitted his findings about astronomical alignments at Stonehenge to the archeological journal *Antiquity* well prior to the appearance of Hawkins' *Nature* article. It was rejected. Fortunately, a popular account of Newham's discoveries were published in the *Yorkshire Post* seven months before Hawkins' *Nature* article. (R14, R16) Admittedly, Hawkins, armed with an IBM 7090 did go well beyond Newham, but he was not the first to see Stonehenge's advanced astronomical potential.

Newham's problem was that he did not belong to the scientific establishment. In contrast, Hawkins was quickly given access to a major journal despite his audacious claims. This amateur-vs.-professional phenomenon crops up frequently in our archeology catalogs.

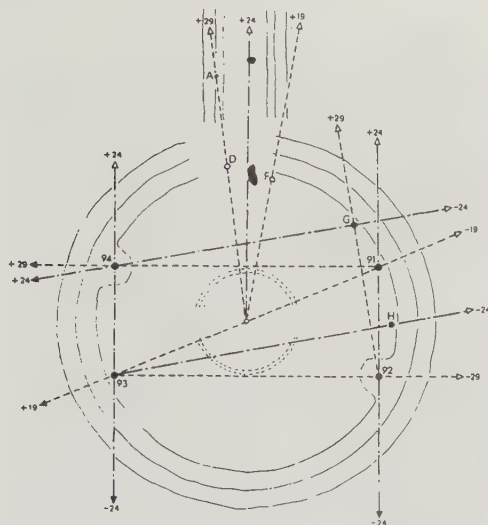
(2) Hawkins deemed Stonehenge's 56 Aubrey Holes to be essential to eclipse prediction, and that eclipse prediction was the only good explanation for the existence of this circle of 56 pits. It is usually not mentioned that a dozen or so other British stone circles are graced by similar pits. One has only five pits; another, 45. None of these other stone circles possessing analogs of the Aubrey Holes seems to have been involved with sophisticated astronomy. (R21) The implication is that Stonehenge's Aubrey Holes and the number 56 may have nothing to do with astronomy.

(3) Stonehenge is such a complex structure with so many stones, mounds, post holes, Aubrey Holes, etc., that other students of this edifice have been able to discern other, different, eclipse predictors using the same basic plan of Stonehenge. (R9, R10) Of these other schemes, F. Hoyle's has been the best publicized. (R7, R15)

If several "Neolithic computers" can be conceived using the same structure, the entire eclipse-predictor idea is weakened. It is hard enough to believe



C.A. Newham's pre-Hawkins model of the Stonehenge "computer." (R14)



- +29 Winter moon high
- +24 Summer sun
- +19 Winter moon low
- 19 Summer moon high
- 24 Winter sun
- 29 Summer moon low



Plan of Stonehenge in the early 1900s. A = fell in 1900; B = fell in 1797. Can archeologists reconstruct Stonehenge accurately enough from this mess to ascertain that it really was an eclipse computer? (Illustration from: *Nature*, 65:55, 1901)

Solar and lunar alignments for Stonehenge Phase I, as envisioned by G.S. Hawkins. (adapted from R1, R14)

that Neolithic people, some 4,000 years ago, could design just one eclipse predictor!

X1. Stonehenge astronomy. Certainly one sees important astronomical alignments in the Stonehenge plan. In fact, both Newham and Hawkins came up with very similar diagrams of these alignments. However, we do not consider solstice alignments anomalous in the context of Neolithic culture. For Stonehenge to be an anomalous structure, one must move beyond solstices and lunar standstills. Hawkins did this; he took a crucial step further.

Employing a computer, Hawkins discovered that lunar and solar eclipses always occurred when the winter full moon nearest the time of the winter solstice rose above the Heel Stone. Even

though not all eclipses could be seen from Stonehenge, this highly specific event could warn the astronomer-priests or whoever "operated" Stonehenge that an eclipse might take place. (R14) Although not essential to recognizing this warning, Hawkins also devised a way to use the Aubrey Holes as an accounting system. He supposed that three black and three white stones were placed in the holes as event markers and moved in a manner such that Stonehenge's "operators" could predict eclipses with great accuracy. The technical details may be found in one of Hawkins' books. (R4)

The technical details we omit are the same ones that perturbed the archeologists. Were the Neolithic people really sufficiently advanced to design Hawkins' computer? For that matter, were they really patient enough to watch the moon through several Metonic cycles of 19 years each to discern the complex nature of solar and lunar eclipses. After all, the life expectancy of the Stonehenge builders was not much longer than 19 years, and they had no written records to draw on.

Yes, theoretically Hawkins' eclipse computer could have worked; so could have Hoyle's, and those of others. The real questions are:

(1) Did Stonehenge really function as a computer from a practical point of view; and

(2) Were the Stonehengers really up to the intellectual task?

We take the second question first.

X2. Neolithic capabilities. Given that Stonehenge could function as an eclipse predictor, could Neolithic society have conceived it, built it, and used it in this way? Actually, we are asking how anomalous Stonehenge is, assuming it really was used as an eclipse computer.

The yawning disconnect between the purported sophistication of Stonehenge and the illiterate culture that built it is seen in the following two quotations from P.L. Brown's book Megaliths, Myths and Men. The first refers to Hoyle's paper in Nature. (R7)

Nature's own editorial emphasized that it was the very cleverness of the ideas which Hoyle attributed to the designers of Stonehenge that was going to be the most difficult part of his theory to accept. The editorial rightly asked whether it was likely that people who had not yet invented enduring houses as domestic abodes could possibly have been clever enough to build an instrument of such intricacy at Stonehenge as implied by astronomers. This was the doubt to be frequently echoed by archaeologists. (R14)

The upshot of it all, Hoyle conjectured, was far-reaching. It not only required Stonehenge to be designed and built to operate as an astronomical device, but the consequences of this idea demanded a level of intellectual attainment for its builders much above that believed standard among a community of primitive farmers. 'A veritable Newton or Einstein must have been at work---but then why not?' wrote Hoyle. (R14)

In reality, it would have taken several generations of Newtons and Einsteins to make all the required astronomical observations, frame the theories, and develop the building plans for Stonehenge.

Hoyle also wondered, as anomalists should, too, about what transpired after the putative eclipse computer was manifest in Stonehenge I. You see, Stonehenge I was modified over the centuries to make what are called Stonehenge II and III. In his From Stonehenge to Modern Cosmology, Hoyle wrote:

The odd and worrying thing is that we have been able to complete the story [of the eclipse computer] without referring at all to the later developments at Stonehenge. We might have hoped to find a culmination of intellectual equality in these later constructions, but in vain. Why, if one should succeed triumphantly in predicting eclipses---no easy matter---one should trouble to haul a great mass of stones all the way from the Prescelly Mountains of Wales. (As quoted in R19)

Did Neolithic society degenerate after Stonehenge I or has more been made

out of Stonehenge I than the facts warrant?

Hoyle's reservations are minor compared to those of the archeologists, who see no hints of precocious intellectual capabilities in their studies of Neolithic Britons.

Conclusion: Stonehenge I, as a Neolithic eclipse-predictor, would stand out starkly as a major anomaly.

X3. Objections to sophisticated Stonehenge astronomy. Both archeologists and astronomers concur that some meaningful solar and lunar alignments do exist at Stonehenge. The question was and still is: Can we reliably ascertain today that the Stonehengers could have predicted eclipses using these rough stones, mounds, pits, and Aubrey Holes---all of which are malleable by the passage of time?

Over the years following the onset of the controversy in 1963, several technical objections have been leveled at the eclipse-prediction hypothesis as initially framed by Hawkins.

(1) On the matter of eclipse cycles, it was pointed out that there is no true commensurability between the 18.61-year nodal cycle and the 19-year Metonic cycle. In addition, "Hawkins had overlooked the fact that the Moon is not directly opposite (180°) to the sun after successive periods of his alleged cycle." (R14)

(2) In his early broadside against Hawkins' theory, R.J.C. Atkinson complained that Hawkins had determined Stonehenge alignments using small-scale plans inadequate for that purpose. In addition:

In claiming to have found thirty-two "significant" alignments, Hawkins has in five cases exceeded his own limits of "significance". Furthermore, he has failed to show that his results are due to anything but chance. Even with the most favourable choice of data, no more than six of his alignments can be shown to be significant in the statistical sense. Before these can be accepted, they need to be measured on the site, and not from plans. (R6)

Such complaints recognize that in 4,000 or more years, stones may have shifted, holes filled, and mounds leveled.

(3) Perhaps most important are the suggested roles of the Aubrey Holes; they are integral to the theories of both Hawkins and Hoyle. A. Burl asserted that these pits are ill-suited to such purposes and were definitely used in other ways.

Explanations for these strange pits have been almost as many as the holes themselves. John Aubrey thought they showed where stones had stood. Then, after Hawley's investigations of the 1920s, which was the first time that the holes were excavated, it was believed that they had been sockets for a great ring of 20-foot-high posts. A more recent interpretation has seen them as ritual pits in which offerings of fertile soil and water were made in rites of sympathetic magic. Now Pitts has revived Aubrey's old idea that some of the holes had held stones while the majority had supported posts. The evidence is so flimsy and equivocal that we may never be sure even of the physical properties of these pits let alone their intended function.

Their rather irregular spacing and the gross latitude allowed in the width and depth of the holes warns us that the people who dug them may not have been much concerned with geometrical precision. If people had somehow calculated that 56 was an astronomically significant number then they may have intentionally laid out just so many pits in order to use them as markers for the prediction of eclipses. (R21)

Hawkins has maintained that 56 is a magic number when it comes to eclipses, and that perceptive observers, even if in a primitive society, would have soon discovered this. (R12)

(4) It was not only archeologists but astronomers, too, who found it difficult to believe that people could predict eclipses 4,000 years ago. Astronomer G. Moir found the whole idea "untenable." (R20) O. Gingerich, a Harvard astronomer doubted that any Neolithic culture was up to the challenge.

Suffice it to say that I remain skeptical. There are certain aspects that stagger the imagination. To get the idea that you could predict eclipses in some cyclical fashion, you would have to have some long record of observations and some kind of motivation for recording them in the first place. Such a record would presumably have to be oral. Today we cannot begin to conceive of the significance of oral records. We have too much cluttered detail to remember, and we are not very good at memorizing things. I am sure that memorization must have played a much more significant role for ancient people than it does for us, because we are so dependent on the written record. Even so, such a route to the prediction of eclipses seems incredible to me. (R18)

All in all, the above criticisms and observations do not seem grave enough to discard an intriguing hypothesis, even if it requires a different view of Neolithic humans. We are continually being surprised by the capabilities of our distant predecessors. That, of course, is the basis for Stonehenge's anomaly.

The undeniable fact is that much astronomy was woven into the plan for Stonehenge I, and it is certainly not impossible that it was used to foresee eclipses.

X4. Hawkins' responses to critics. Hawkins' next book bore the title Beyond Stonehenge, and indeed it went beyond, far beyond Stonehenge. Subjects included the Nazca lines, Tiahuanaco, Kon Tiki, and lost civilizations. (R12) In this book's Appendix, though, we find a primer on archeoastronomy plus a reiteration and defense of his Stonehenge theory.

Addressing the Aubrey Hole issue, Hawkins asserts that his theory is the only practical reason for the existence of 56 (that magic number again) holes. Even the supposed "barbarians" of Neolithic times, he claims, would have easily hit upon 56 by careful observation of the sun, the moon, and their eclipses. (R12)

Hawkins also repeats the speculation mentioned in his earlier book and papers that ancient records actually refer to

Stonehenge and its eclipse-predicting capabilities. The Greek author, Diodorus, for example, referred to the spherical temple of the Hyperboreans (far-northerners) which the god Apollo visits every 19 years. (The 19 refers to the Metonic cycle of eclipses.) Another ancient connection involves Typhon, the demon of eclipses. Typhon, it seems, was associated with a figure of 56 sides! (Once again, that magic number!) (R12)

X5. The present climate. The discipline of archeoastronomy has come a long way since 1963. The books on the subject usually mention the possibility that Stonehenge predicted eclipses 4,000 years ago, but the theories of Hawkins, Hoyle, and others are no longer hotly debated in the journals. The latest word on the subject, in fact, is voiced by an archeologist, C. Ruggles, in updating research at Stonehenge.

Finally, whatever happened to the astronomy? Jacquetta Hawkes, who sadly died the day before the conference began, once famously said that every age has the Stonehenge it deserves, or desires. The idea that Stonehenge was some sort of astronomical observatory or computer, so popular in the 1960s, is now seen as an artefact of its times---one of the most notorious examples known to archaeologists of an age recreating the past in its own image. (R26)

So, it seems that the archeologists won. To them, Stonehenge is undeniably impressive, but it is just another stone circle with no special properties.

Regardless of what Ruggles says, the New Agers and fringe archeologists will continue to speak of survivors from Atlantis or extraterrestrials designing Stonehenge and passing their superior knowledge along to Neolithic humans.

The anomalist sees in Stonehenge the several highly suggestive alignments and those nagging 56 Aubrey Holes. It seems obvious that Stonehenge could have predicted eclipses. It may not have, but we cannot "close the book" on this subject.

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MSH18 Stonehenge's Remarkable Rectangle

Description. The positioning of Stonehenge at a unique latitude where four of its markers (Station Stones and Mounds) not only represent highly significant astronomical alignments but are also located on the corners of a rectangle. This situation is possible at only one latitude the Northern Hemisphere and another in the Southern Hemisphere.

Data Evaluation. The Stonehenge rectangle is a well-recognized feature of this stone circle. Several authors have commented (in some amazement) on this phenomenon. Rating: 1.

Anomaly Evaluation. Only two explanations make any sense:

(1) Pure coincidence; or

(2) The builders of Stonehenge were remarkable astronomers who intentionally placed Stonehenge, their "master observatory" in Britain, very near the only latitude where the phenomenon could occur in the Northern Hemisphere.

Assuming the latter to be the case, the phenomenon is at least as anomalous as Stonehenge's alleged eclipse-predicting capability. Rating: 1.

Possible Explanations. The Neolithic period had its geniuses!

Similar and Related Phenomena. Eclipse prediction at Stonehenge (MSH17) and other megalithic sites (MSD3 and MSH4).

Entries

X1. General observations. Whatever you may think about Stonehenge as a possible predictor of eclipses, you can hardly fail to be impressed at what is either an astounding coincidence or, even more astonishing, a conscious effort of Stonehenge's builders to locate their stone circle at a unique latitude. If the latter was the case, it speaks volumes about the observational capabilities and intellectual stature of Neolithic humans.

Actually, it was not essential that the Stonehengers understood the concept of latitude, but if Stonehenge had been located a few miles north or south of its present position, the phenomenon at hand would be impossible.

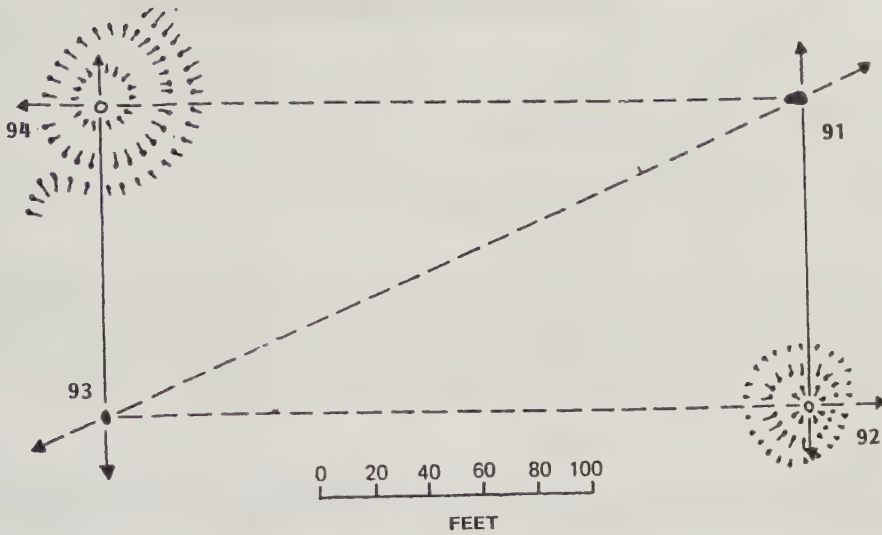
The phenomenon involves Station Stones 91, 92, 93, and 94, which are located at the corners of an-almost-perfect rectangle in the Stonehenge plan view. (See diagram.) The key alignments are:

92 to 91	Summer solstice sunrise
94 to 93	Winter solstice sunset

92 to 93	Northern major standstill moonset
94 to 91	Southern major standstill moonset (R3)

Several students of Stonehenge have remarked on Stonehenge's remarkable rectangle and its implications. G.S. Hawkins put the phenomenon in proper geographical and astronomical perspective in his Stonehenge Decoded.

[C.A.] Newham and [G.] Charriere of France have both commented on the very noteworthy circumstance that the latitude of Stonehenge is practically optimum for sun-moon rectangular alignment. If the site were moved north or south by as little as 30 miles---to Oxford or to Bourne-mouth---the astronomic geometry would be so changed that the station stone figure would change from a rectangle to a parallelogram. And the farther north, or south, the location was moved from Stonehenge's 51°17



The rectangle formed by the four "station stones" of Stonehenge and the resulting astronomical alignments. There is only one latitude in the Northern Hemisphere where this unusual geometrical-astronomical situation prevails. (R2)

latitude, the more "skew" the parallelogram would become, until you reached the equator. After that, as you moved south the parallelogram would lessen its skew until you reached the southern hemisphere counterpart of Stonehenge, latitude south 51°17', the Falkland Islands and the Strait of Magellan. There of course the astronomic geometry would correspond to that of Salisbury Plain. In other words, in the northern hemisphere there is only one latitude for which, at their extreme declinations, the sun and moon azimuths are separated by 90°. Stonehenge is within a few miles of that latitude. (R1)

Naturally, we cannot expect the astronomers and stone-circle engineers of 4,000 years ago to get everything as exact as we could today with our telescopes and satellite-based navigation data. E.C. Krupp noted a few deviations from perfection.

Actually, the two Station Stones [91, 93] and the two Station Mounds [92, 94] do not really appear to form an exact rectangle. Atkinson has shown that more displacement of the Stations from their present locations is needed

to obtain true rectangularity. Furthermore, the exact position of the original marker at Station 94 is unknown, for the mound remains unexcavated. Finally, Atkinson has shown that the true latitude for rectangularity would put Stonehenge in the English Channel. (R3)

These are only minor quibbles in the context of the rather incredible synthesis of: (1) significant astronomical observables; (2) the intellectually appealing, neat rectangle; (3) and the unique geographical location.

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MSH19

Did the French Build Stonehenge ?

Description. Characteristics of Stonehenge that seem to betray a strong cross-Channel influence from Brittany.

Data Evaluation. Our data are merely suggestive, although two high respected British archeologists are prime sources. Rating: 2.

Anomaly Evaluation. The megalithic culture took no heed of the English Channel. There are many similarities between the stone structures in Britain, Ireland, and Brittany. Stone rows are common everywhere, although best-developed in Brittany. The reverse is the case with stone circles. The only reason for declaring an anomaly here is the strong British belief that Stonehenge is uniquely British. The French, of course, are amused by the whole business. Rating: 3.

Possible Explanations. None required.

Similar and Related Phenomena. Most of the megalithic structures mentioned in this chapter can be found on both side of the Channel (MSH).

Entries

X1. General observations. The British regard Stonehenge as a national treasure ---British through and through. What could be more anomalous to them than evidence suggesting that the French inspired Stonehenge or, even worse, built it themselves?

A. Burl's comments. A highly respected British authority on stone circles, A. Burl, has hinted, rather vaguely, that Stonehenge may not be British after all. The source is a newspaper interview.

Like everyone else, I had always assumed that the builders of Stonehenge were Britons. But it has several features alien to Britain which are common in stone circles found in Brittany.

We could be talking about a cross-Channel invasion by sun worshippers ousting a native lunar cult. Or it may have been a peaceful migration. (R1)

Presumably, one of the features Burl was referring to is the strange symbol on Stone 57.

The symbol on Stone 57. C. Scarre began a 1997 article in Antiquity with these words.

Recent studies of Stonehenge, drawing new attention to the box-like symbol carved on stone 57, have proposed an origin in the megalithic art of Brittany. Burl has used this to argue that the final form of Stonehenge 'may well have been the handiwork of intrusive and powerful leaders from Brittany'. (R2)

In his next paragraph, Scarre quotes R.J.C. Atkinson, another British expert on megalithic structures.

The symbol on stone 57 is of particular interest. In so far as its weathered and abraded state allows interpretation, it seems to be a version of a symbol which occurs on many standing stones, and occasionally in chambered tombs, in Brittany. Its appearance at Stonehenge provides one more link between Wessex and the Breton peninsula in the middle of the second millennium B.C. (As quoted in R2)

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*Rubbing of a carved box-like symbol
on Stone #57 at Stonehenge. Similar
symbols are common on megalithic
structures in Brittany. (R2)*

MSH20

Geometrical and Geographical Anomalies of Stone Rectangles

Description. The existence in Europe of stone rectangles exhibiting two of the anomalous features of stone circles, namely:

- (1) The use 3-4-5 right triangles in their geometries; and
- (2) The location of at least one stone rectangle at the unique latitude where certain astronomical alignments are possible.

Data Evaluation. Stone rectangles are rare compared to stone circles, and we know much less about them. In addition, they are relatively small in size, making the exact dimensions and alignments difficult to determine. Finally, little scientific attention has been paid to stone rectangles compared to the hundreds of articles and several books devoted to stone circles. Ratng: 2.

Anomaly Evaluation. Both of the features singled out here have also been claimed for stone circles (MSH10 and MSH18), where they are regarded as highly anomalous. The use of 3-4-5 right triangles implies a precocious knowledge of geometrical

relationships. The discovery of a unique latitude for uniting structure rectangularity with specific astronomical alignments suggests some comprehension of the astronomical relationships of earth, sun, and moon. Rating: 1.

Possible Explanations. The Neolithic period had its geniuses!

Similar and Related Phenomena. Geometrical sophistication of some stone circles (MSH10); the uniqueness of Stonehenge's latitude (MSH18).

Entries

X0. Introduction. The circle was the most popular two-dimensional figure employed by the megalith builders. This was especially so in Britain. In Brittany, though, where circles are rare, horse-shoes, rectangles, and even polygons grace the ancient landscape. The rectangles are particularly interesting because they are sometimes:

- Astronomically oriented,
- Based on 3-4-5 triangles,
- Located at unique latitudes, and
- Geometrically analogous to Stonehenge's four Station Stones (91, 92, 93, and 94) and to the so called "four-posters", which are stone "circles" consisting only of four stones.

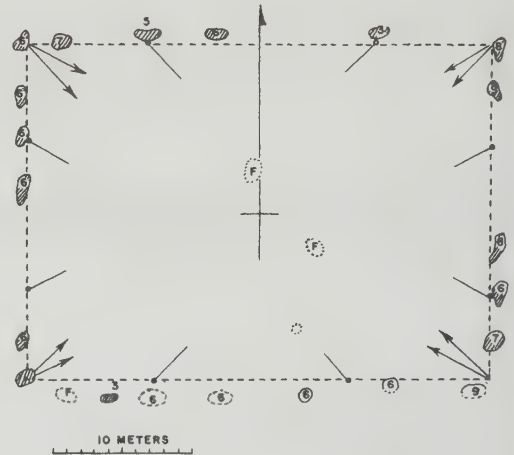
X1. Europe.

Britain. The best rectangle in Britain is found on Bodmin Moor, Cornwall. It goes by the name "King Arthur's Hall."

Measuring 154 ft N-S by 66 ft (47 x 20 m) its thick, heavy earthen bank has a south-west entrance. Its sunken interior is lined with standing stones up to 5 ft (1.5 m) high. Its plan has strong affinities with rectangles such as that at Crucuno in Brittany. (R7)

Brittany. Evidently stone rectangles were favored in Finisterre, but many have been destroyed down the centuries. An especially fine example was located at Lanveoc. It survives only in the accompanying sketch. Another fine representative of the species once existed at Parc ar Varret. (R6)

By far the most renowned surviving stone rectangle is located at Crucuno, Plouharnel. It, too, suffered the ravages

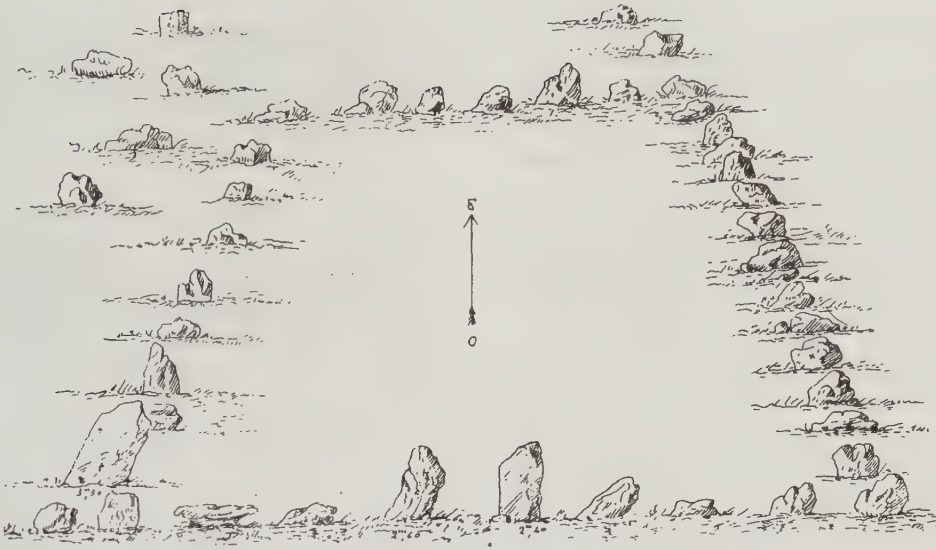


Plan of the stone rectangle at Crucuno, Brittany. The numbers indicate stone heights in feet. F = fallen stone. Arrows and dots represent directions of the rising and setting points of lunar extremes. (R2)

of time, but was reconstructed in 1882 by F. Gaillard. (R7)

The following quotation from E.C. Krupp's *In Search of Ancient Astronomies* outlines its archaeoastronomical and geometrical features.

There are many interesting Megalithic features in the Carnac landscape, and of these the rectangular cromlech at Crucuno is worth mentioning. Its short sides are aligned north-south, and a 30-by-40 MY [Megalithic Yard] rectangle fits the plan. The diagonal of the rectangle is therefore 50 MY, and in this structure we have the familiar 3-4-5 Pythagorean triangle. The diagonals are also astronomically significant. They indicate sunrise and



An Eighteenth Century drawing of the stone rectangle at Lanveoc, Finisterre, Brittany. The rectangle was destroyed long ago. (R6)

sunset on the summer and winter solstices. An arrangement this concise and symmetric is possible only at latitude 47 degrees 37.5 minutes. Cruncuno's latitude is 47 degrees 31 minutes. Its builders were only six or seven miles south of the ideal position. Unfortunately, there are no standing outliers to verify the alignments that are suggested by the short dimensions of the rectangle. Similarly, it may be that stones in the sides of the rectangle indicate some of the lunar standstills' risings and settings, but the small size of the structure prohibits any categorical conclusion. (R3)

Note that the latitude of Stonehenge allows its "rectangle" to exhibit special astronomical features. (MSH18)

Germany. Near Visbek, 50 kilometers west of Bremen, one finds the Visbek Bride aligned enclosure. This structure is close enough to a rectangle to warrant cataloging. The quadrilateral is 80 meters long by 7 meters at its widest end. Toward the northeast it narrows a bit and is, therefore, not a perfect rectangle. Its astronomical features, if any, are obscure. (R4)

X2. South America.

Peru. In his survey of Peruvian antiquities, E.G. Squier mentioned megalithic rectangles. At present, all we know about these structures is found in this short quotation from Squier.

Fig 9 [not shown] is of a singular monument, in the ancient town of Chicuito, once the most important in the Collao. It is in the form of a rectangle, sixty-five feet on each side, and consists of a series of large, roughly worked blocks of stone, sunk in the ground, and projecting fourteen inches outward all around. The entrance is from the east, between two blocks of stone, higher than the rest. This may be taken as a type of advanced class of megalithic monuments by no means uncommon in the highlands of Peru. (R1)

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- R2. Thom, Alexander, et al; "The Astronomical Significance of the Crucuno Stone Rectangle," Current Anthropology, 14:450, 1973. (X1)
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MSH21 Calendar Sites

Description. Groupings of standing stones, cairns, mounds, stone chambers, and horizon features that display culturally significant astronomical alignments. Calendar sites are not geometrically configured like the stone circles, rectangles, medicine wheels, etc. Except for the astronomical alignments, the elements are usually arranged rather haphazardly.

Data Evaluation. Most studies of calendar sites, especially those in northeastern North America, have been carried out by amateur archeologists and duly published in their journals. There is little to be found in the professional literature. In fact, most calendar sites are not recognized at all by mainstream archeologists. There are exceptions, though. The Namoratunga site in Subsaharan Africa has been well-researched and duly reported in the science literature.

A persistent problem with calendar sites is that it is too easy to find significant astronomical alignments---even easier than with the geometrically disciplined stone circles. Horizon features, such as outcroppings and notches in a range of hills, are easy to enlist as elements in astronomical alignments; and, of course, there is never any shortage of "significant" astronomical targets. Rating: 3.

Anomaly Evaluation. Since we do not consider most of the stone circles possessing astronomical alignments to be anomalous, so be it with most of the less-well-organized calendar sites. They are reckoned to be well within the intellectual and cultural capabilities of early human societies. A possible anomaly exists in northeastern North America where many amateur archeologists claim calendar sites to be the work of pre-Columbian visitors from the Old World. In this geographically and historically limited context, calendar sites are highly anomalous. Rating: 1.

Possible Explanations. In general, none are required. In northeastern North

America, conservative archeologists have to declare that the claimed calendar sites are structures built by early settlers and that their alignments are fortuitous.

Similar and Related Phenomena. Stone circles (MSH7 through MSH19; stone rectangles (MSH20); medicine wheels (MSH22).

Entries

X1. North America. Many are the claims of "calendar sites" in North America; that is, spots where natural and artificial objects line up according to solstice horizon points and other astronomically important directions. In the northeast, members of the New England Antiquities Research Association (NEARA) have been very active in searching out sites where cairns, standing stones, and horizon features are aligned with solstice points and other calendric phenomena. Of course, skeptics can and usually do state that the northeast is so hilly and rocky that chance alone can provide a few calendar sites. This said, some spots do seem to show the hand of man and his intentional aligning of stone structures. Also stone walls, stone chambers, enigmatic markings upon stones, and cairns seem to be intimately associated with these alignments. Such sites should not be summarily dismissed because they challenge preconceptions about American history.

It is customary for amateur archeologists to assert that these northeastern calendar sites are "proof" that North America was visited by Europeans and others long before Columbus set foot in the Caribbean. Contacts by Celts, Iberians, and Mediterranean peoples are claimed. These claims naturally upset mainstream archeologists who are quick to point out that the putative calendar sites are generally bereft of those small artifacts, bones, carbon-datable hearths, and other signs needed to properly confirm the claims of early incursions from the Old World. In other words, calendar sites by themselves, no matter how convincing, are not enough to claim early visits to the Americas.

Vermont. Without question, the best-investigated calendar sites in the northeast are Vermont-I and Vermont-II. B.E. Dix and J.W. Mavor, Jr., with the help of NEARA members, have researched these two sites. (R2, R9, R14) Detailed descriptions of these two sites have

also appeared in a professional-level compilation of papers. (R6) We draw upon this reference for our review.

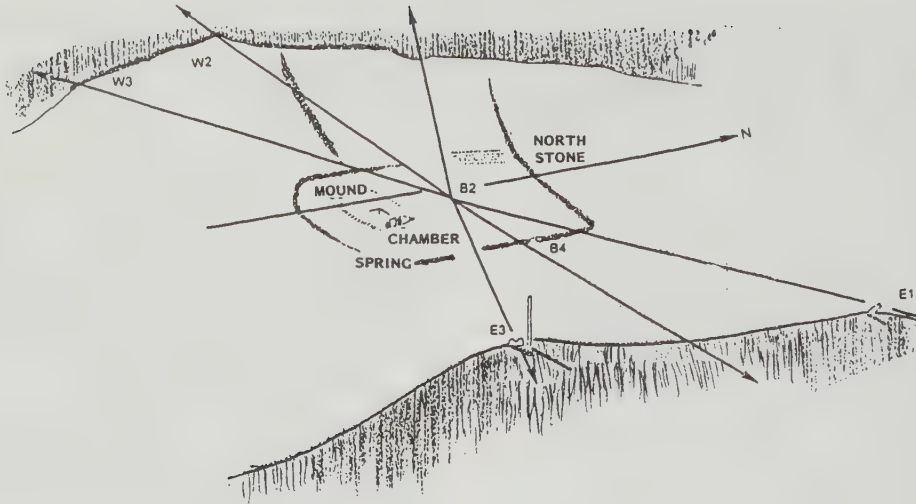
Of all the calendar-site claims for northeastern North America, those for the two Vermont sites are the most convincing. They are embedded in complexes of walls, chambers, standing stones, cairns, and stone markings, the latter suggestive of ancient writing (ogam, in particular). The age and provenance of all of these features of the sites have been hotly debated.

The Vermont-I site is located in central Vermont and encompasses about 20 square kilometers. Seven stone chambers, several walls, a mound, and a spring are found there. Dix and Mavor go into more detail.

The center of Calendar I is a natural bowl. An observer standing within the bowl has a near horizon with distinct features on three sides and a varied distant horizon to the south. The west ridge, as viewed from the bowl, is mostly barren and the horizon is outlined by a stone wall. The east ridge consists of two peaks separated by a valley. The ridge is densely wooded and the ground horizon is obscured in many places, even in winter. A standing stone (E3) is located very near the summit of the south peak. The position of this stone has been precisely determined relative to other significant features of the site. Excavations around the stone revealed that it was positioned vertically on a foundation slab 1 m below present grade. (R6)

The artificial nature of stone-E3's emplacement plus curious grid markings on some other stones suggest that this site may be more than the remains of a derelict farm.

Another standing stone (E1) is located on a peak to the northeast. (See figure.) A wall to the west provides so-called "observation" points W2 and W3. These



Sight lines at the Calendar-I site in central Vermont. W2 and W3 are observation points; E1 and E3 are standing stones; B2 is the "astronomical center" of the calendar site. (Adapted from R6)

and several other features of the site (chambers, small standing stones, surrounding peaks, etc.) combine to provide 14 possible astronomical alignments. Some of these are: the meridian, winter-solstice sunrises and sunsets, summer-solstice sunrises and sunsets, and equinox sunrises and sunsets.

Obviously, Vermont-I is a complex site with a host of possible elements that might determine alignments. There is an embarrassment of riches, so to speak; and this is one of the reasons why too much may be read into such sites. Nevertheless, Vermont-I has enough suspicious characteristics to warrant further investigation.

Vermont-II was discovered near Mount Ascutney in central Vermont. A large stone chamber and platform are surrounded by a complex arrangement of walls. Winter-solstice sunrises can be observed along a line including the long axis of the chamber and a notch on the south-eastern horizon. The impressive chamber is roofed with nine stone slabs, some of which weigh over 3 tons. (R6)

Again, one has to ask whether early Vermont settlers would bother to construct such a complex site using such

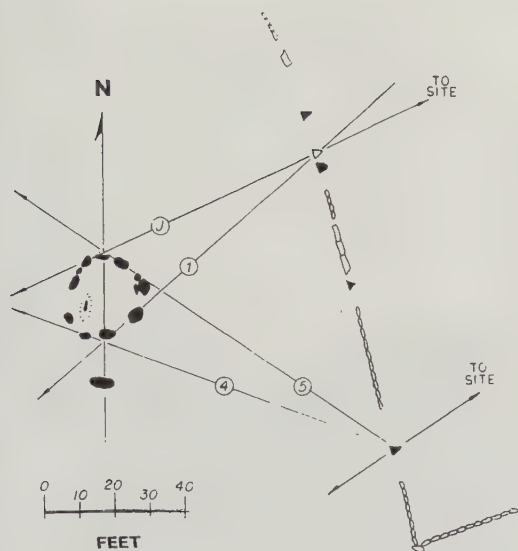
massive stones. But, as is often the case, there do not seem to be any small, utilitarian artifacts suggesting very early Old World contacts---no pottery, beads, etc.

New Hampshire. Many walls and standing stones plus a 21-foot-diameter stone circle characterize a potential calendar site near North Salem. A portion of this complex and some suggested alignments are shown in the figure.

- 1 Major lunar standstills
- J Minor lunar standstills
- 5 Mid-summer sunsets
- 4 Halfway point between spring equinox and summer solstice. (R8)

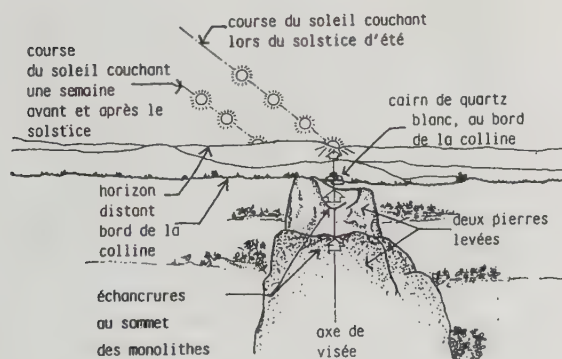
At New Hampshire's famous Mystery Hill there is, besides many other controversial structures, an observation platform from which one can view four horizon features and a standing stone (now fallen). The five claimed alignments are:

- The meridian
- Midsummer sunrises and sunsets
- Midwinter sunrises and sunsets (R1)



Layout of a possible calendar site near North Salem, New Hampshire. See text for meanings of symbols. (R8)

Massachusetts. In 1990, the Belgian journal *Kadath* devoted an entire issue to the megalithic structures scattered across New England. One of the sites featured is at Burnt Hill in the Berkshires, western Massachusetts. There,

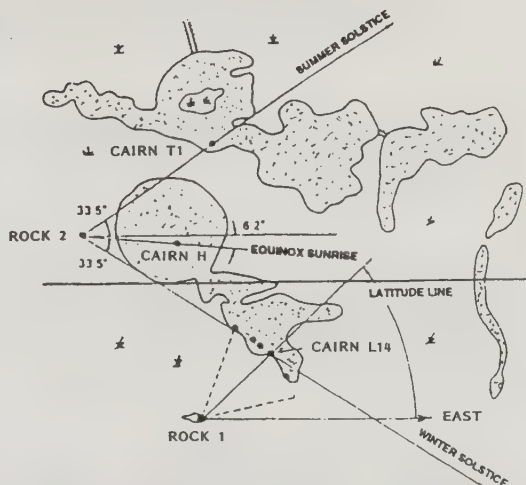


Astronomical alignment at the Burnt Hill site, western Massachusetts. As the sun sets on the summer solstice, it is aligned with the notches in the two standing stones in the foreground, a cairn of white rocks in the background, and the notch in the skyline. (R15)

at the summer solstice, one observes a rather remarkable alignment of the setting sun, a horizon notch, a cairn, and two standing stones. (See figure.) (R15) An alignment of this sort in western Europe would be taken seriously by the professional archeologists.

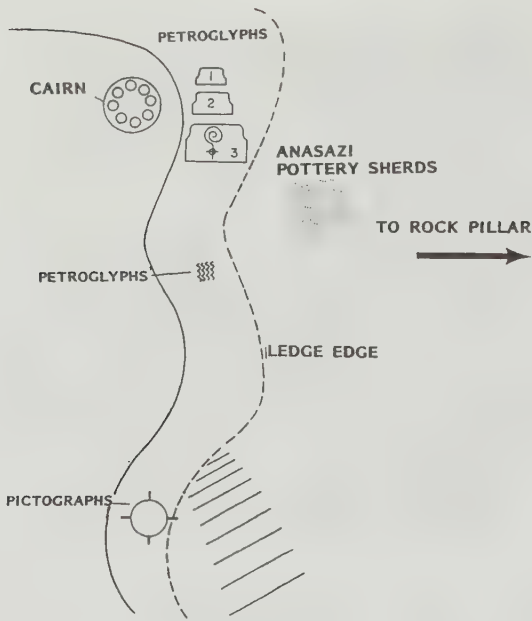
Wisconsin. J. Scherz claims to have discovered an ancient calendar site in a marshy region near Wisconsin Rapids. Strange, seemingly artificial, islands in the bog are capped by prominent rocks and rock cairns. The solstices and equinoxes can be predicted from some of the alignments, as shown in the accompanying map. (R13)

This location is not far from the remarkably large-scale, prehistoric, copper-mining activities around Lake Superior. (MSE6)



Map of the Wisconsin "calendar site," showing some of the rock-cairn alignments. The stippled islands are surrounded by marshes. (Adapted from R13)

New Mexico. On the north side of Chaco Canyon, the Chacoan town of Wiji is the location of what seems to be an Indian calendar site. On a ledge decorated with a Zuni sun symbol, one can view a prominent, natural sandstone pillar about 500 meters away. The winter-



Schematic drawing of features at the Wijiji site, Chaco Canyon, New Mexico. This is a possible calendar site. (Adapted from R10)

solstice sunrises and sunsets are aligned with this standing stone and an observation point on the ledge. (R10)

X2. South and Central America. So far, our literature explorations have located only two South American calendar sites. Surely there are others. However, the Incas, Maya, and other cultures of this region were precocious astronomers and builders. They may have done most of their astronomy from more sophisticated buildings designed just for that purpose; that is, "observatories." Such structures, like the Caracol at Chichen Itza, are cataloged in MSB in another volume.

Honduras. Although the structure described below is termed a "sundial," it does not mark the hours of the day like a conventional sundial. Instead, it really acts as a calendar site, assuming it performs as claimed.

At Copan, one of the oldest cities of the Maya Old Empire which flourished from about 100 B.C. to 500 A.D., two stone stelae or monuments have been discovered. These, according to Dr. H.J. Spinden of Harvard, form a gigantic sundial four and one-half miles across. Here "the sun, as viewed from the eastern stela, sets behind the western stela every year upon a date which the Maya regarded as the beginning of their agricultural year. The most remarkable discovery," continues Dr. [T.] Gann in the Illustrated London News, "was the fact that the base of the eastern stela is on an exact level with the base of the western." (R19)

The foregoing item is from a 1926 publication. Today's archeologists may have a different view of these stelae.

Argentina. The El Mollar site in north-western Argentina is a fine example of megalithic calendar-making. Here, a complex of finely crafted, ornately carved standing stones provide many alignments involving the sun, the moon, and even Venus. (R7)

Unfortunately, we know little about South American sites of this sort. Who built them and when are puzzles. The answers are probably in Spanish-language journals which we have not examined.

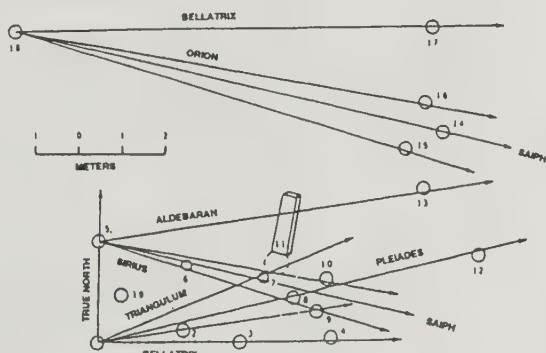
Peru. When the Spanish conquered Peru in the Sixteenth Century, they recorded that the Incas inhabiting Cuzco determined the seasons using pillars outside the city. These particular pillars have been overrun by creeping civilization, but some survive on the Island of the Sun on Lake Titicaca. There, two pillars, now partially destroyed, still frame the setting sun at the summer solstices when viewed from a sacred plaza. (R16)

X3. Africa. Megalithic calendar sites are found everywhere, including Sub-saharan Africa. Although numerous megalithic circles and other stone arrangements are well known in Africa, particularly Algeria and Gambia, astronomy does not seem to have been the primary objective at most of these African sites.



Many significant astronomical alignments exist at this Argentine site. Called El Mollar, the site contains many ornately carved standing stones. (R7; Kadath)

Kenya. In the 1970s, however, a stone alignment in northwestern Kenya called Namoratunga has been found that displays unmistakable astronomical overtones. At Namoratunga, 19 large basalt pillars are arranged in rows forming a suggestive pattern. Since the site is dated at approximately 300 B.C., archeologists have taken sightings on seven prominent stars as they would have appeared during this period. (The azimuths of some of these stars had changed by as much as 12° in 2,200 years.) The stars chosen were those employed by Eastern Cushites, the present inhabitants of the region, in calculating their rather sophisticated calendar. Pairs and frequently triads of these pillars line up very accurately (to less than 1°) with the seven key stars. The people occupying this part of Kenya about 300 B.C., therefore, probably boasted sophisticated astronomers among their number. (R4, R5, R11, R12)



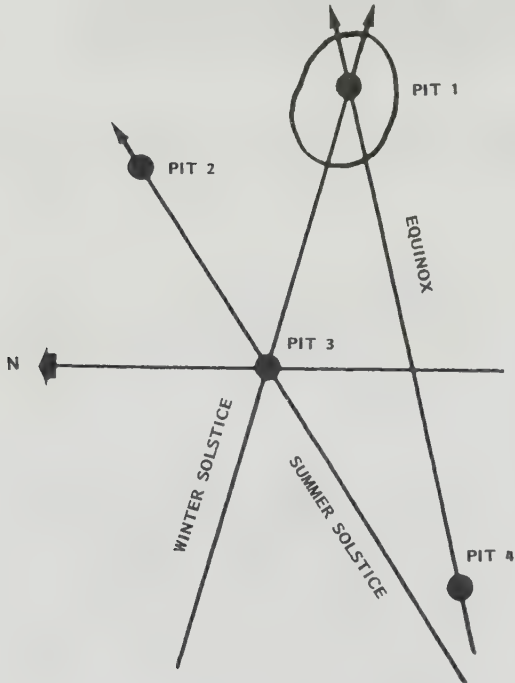
Basalt-pillar alignments at the Namoratunga-II site in Kenya. (R4)

X4. Oceania. In a 1977 number of the Belgian archeological journal Kadath, J. Bianco investigated the influence of astronomy upon Polynesian culture. He reviewed astronomical symbolism, how the heavens were woven into religion, and, of course, the role of astronomy in navigating across the wide expanses

of the Pacific. Bianco also mentioned two probable calendar sites. (R3)

Tonga. The Haamonga trilithon and the surrounding standing stones were apparently employed by the Polynesians as a calendar site. (See MSO12 for more details.)

Easter Island. During his 1955-1956 expedition to Easter Island, T. Heyerdahl discovered a curious array of four holes excavated in the solid rock at the Orongo site. These holes are arranged in such a way that by sighting along poles erected in the holes, the astronomers of Easter Island could predict summer and winter solstices as well as the equinoxes. (See figure.) (R3)



The "rocks of the sun" at the Orongo site on Easter Island are so-named because of the four astronomically aligned pits figured above. Observations were probably made by placing poles in the pits. Pit 1 is 35 centimeters in diameter; pits 2, 3, and 4 are 3-6 centimeters in diameter. (R17) The same pits may be employed in a slightly different way. See MSO8-X1.

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MSH22

Medicine Wheels: An Old World Connection?

Description. In North America, large, wheel-like configurations of stones, some with astronomical alignments and some with suspicious geometrical similarities to Old World stone circles. Estimated ages vary from 150 years to 4,500 years, suggesting that many cultures constructed medicine wheels for various purposes.

Data Evaluation. Medicine wheels have been well researched by United States and Canadian scientists. Dimensions and possible alignments have been widely published in the science and popular literature. However, the similarities to Old World megalithic structures, which are at the core of the claimed anomaly, are rather vague and/or circumstantial. When only these aspects of the medicine wheels are considered, convincing data are weak. Rating: 3.

Anomaly Evaluation. Most features of the North American medicine wheels are non-anomalous. No engineering problems associated with construction are evident. Many reasonable applications exist, especially those associated with shamanism, vision quests, and the determination of solstices and equinoxes. No lunar alignments are apparent, so eclipse prediction and other highly sophisticated astronomical uses are extremely unlikely. None of these applications are deemed anomalous.

The claimed geometrical similarities to Old World stone structures, particularly one in Portugal, do give rise to an anomaly; namely, the possible Precolumbian diffusion of megalithic culture across the Atlantic. This sort of diffusion is vigorously rejected by mainstream science. Rating: 1.

Possible Explanations. Trans-Atlantic contacts occurred long before the Vikings.

Similar and Related Phenomena. Indications of trans-Atlantic diffusion in stone circles (MSH16), rocking stones (MSD5), and menhirs (MSD2). Other claims of anomalous diffusion are claimed in the contexts of epigraphy (MG), language and culture (MA), and artifacts found in the New World (MM). See the Subject Indexes of the other volumes in our archeology series.

Entries

X0. Introduction. Western Europe has its hundreds of megalithic stone circles and long lines of menhirs marching soldier-like into the distance, but the New World is poverty-stricken in these respects. To be sure, there are rather weak claims of astronomically significant stone circles, particularly in north-eastern North America, but there are no American Stonehenges or Carnacs. Americans can take heart, however, for on the northern plains of North America one discovers a possibly unique sort of stone structure called the "medicine wheel." The definitive medicine wheel consists of spoke-like lines of boulders radiating outward from a central hub toward a circular rim. Only a handful of the medicine wheels satisfy this exacting description; most---more than fifty of the species---are scraggly, ill-formed, and incomplete. Who built them, and why, and when?

In this section, we will try to answer these questions, but the questions of real significance to the anomalist are:

(1) Were the medicine wheels used for sophisticated astronomical purposes, such as eclipse prediction?

(2) Are medicine wheels really unique to the New World? In other words, do the New World medicine wheels mirror Old World structures and thereby imply a Precolumbian transfer of the medicine wheel concept?

X1. General observations. The earliest reference we have found to medicine wheels in our literature searching was published in 1903. Surely there are earlier mentions somewhere.

Our reference is an article by S.C. Simms in the American Anthropologist. A few paragraphs from this article will serve as a good introduction to the medicine-wheel phenomenon.

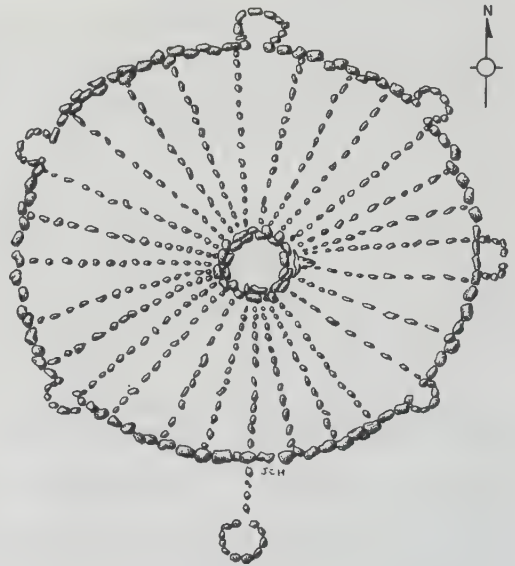
While on a visit, in the interest of the ethnological division of the Field Columbian Museum to the Crow (Ab-sah-ro-kee) Indians of Montana, during June, July, and August of 1902, I was told of the existence of what my informant called a "medicine

wheel" on the summit of a mountain which he called "Medicine mountain," situated just across the Montana-Wyoming boundary line, in the Big Horn range of mountains in the latter state.

Although I made many inquiries of the old men of the Crow tribe regarding the "medicine wheel" and its significance, I found not one who had even visited it. A few of them had heard of it through their fathers, but they could tell me nothing whatever of it excepting that "it was made by people who had no iron."

Simms eventually found a white hunter-pro prospector who knew of the wheel and, after a laborious climb, led him to it.

This peculiar structure consists of a large number of limestone slabs and boulders of various sizes. Directly in the center, of what might be termed the hub, stands a circular structure about three feet high, of the same kind of stone, radiating from which are twenty-seven lines, or spokes, of stone leading to a well-formed perimeter. Around the outer



Simms' 1903 drawing of the Big Horn medicine wheel. It is highly idealized and shows seven "alcoves" on the rim instead of the six recorded by Eddy. (R1)

edge of this circular rim or "felly" of the wheel, at irregular distances, are the remains of seven smaller stone structures, all of which come in contact with the perimeter except the most southerly one which stands several feet away, although it is met by an extension of one of the spokes beyond the rim of the wheel. (R1)

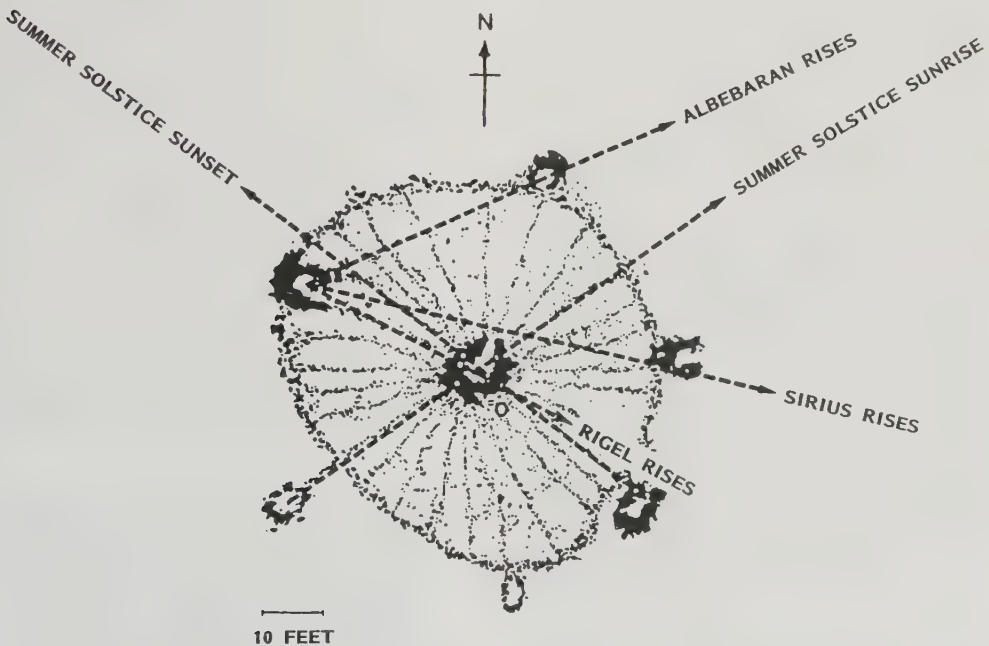
Simms did not speculate on the purpose of this medicine wheel, which because of its location has come to be known as the "Big Horn" medicine wheel.

Despite Simms' intriguing description, medicine wheels remained cloistered within the disciplines of archeology and anthropology until the rise of archaeoastronomy in the 1970s. The major stimulus leading to further research was the publication in *Science* of J.A. Eddy's 1974 paper describing the astronomical alignments of the Big Horn wheel. (R3) A flurry of medicine-wheel reports followed during the next decade. It was soon apparent that scores of medicine wheels, or structures closely related to

them, were scattered all over the northern plains. They were most abundant in the Canadian provinces bordering Montana.

This is a good spot to point out that the North American medicine wheels are found in a region strewn with thousands of tipi rings and other stone structures. The so-called "boulder mosaics," which depict humans, animals, and abstract designs in large-scale arrangements of boulders belong to the same genus as the medicine wheels. This genus, which we call "geoglyphs," also includes the multitude of effigy mounds to the east of medicine-wheel country and also the more-famous Nazca lines of Peru and the hill figures of Britain. Geoglyphs are cataloged in MGG in another volume, but we here illustrate one that displays some features seen on medicine wheels.

True medicine wheels, however, are best treated here because of the astronomical alignments that have been claimed for a small handful of them. It seems probable that some medicine wheels were calendar sites as well as ceremonial



Cairn alignments established by Eddy at the Big Horn medicine wheel, Wyoming. Aldebaran, Rigel, and Sirius are stars of the summer dawn. (R3)



A boulder mosaic near the James River, North Dakota. This aligned structure resembles a medicine wheel in some respects. (Lewis, T.H.; "Boulder Outline Figures in the Dakotas....," *American Anthropologist*, 4:19, 1891.)

structures.

For an overview we quote E.C.Krupp, who places the medicine wheels in their cultural context which, for the great majority of them, is more significant than any astronomical properties they may possess.

Now we usually equate complexity with civilization, but the intricacies of shamanism disclose the complexity of the spiritual life and social life of the early hunters. Ancient people on the Great Plains of the United States and Canada, for example, did not plant crops---or even settle down like the Chumash---yet they, too, built shrines that were aligned with the sky and probably used by their shamans to seek the sacred and experience the cosmic order.

These monuments are known as medicine wheels. The term "medicine" here refers to the supernatural, to sacred lore, and to shamanic power. The wheels themselves are usually circles of small rocks, centered on a large cairn, or pile, of stones of the same sort. They look like wagon wheels, but not all have spokes, and at least one, in Minton, Saskatchewan,

is shaped more like a turtle---complete with head, tail, and four legs---than a wheel. (R17)

Krupp proceeded to detail the Big Horn (Wyoming) and Moose Mountain (Alberta) medicine wheels. He also pointed out that, while some wheels are only a few centuries old, the Majorville Cairn, Alberta, which is really a badly vandalized medicine wheel, is probably 4,500 years old---about the same age as the Great Pyramid. Medicine wheels, therefore, have a long history and were assembled by many different cultures, possibly for different purposes. (R17)

While scoping medicine wheels, it becomes apparent that their geographical distribution may be significant. On this matter, we quote J.A. Eddy.

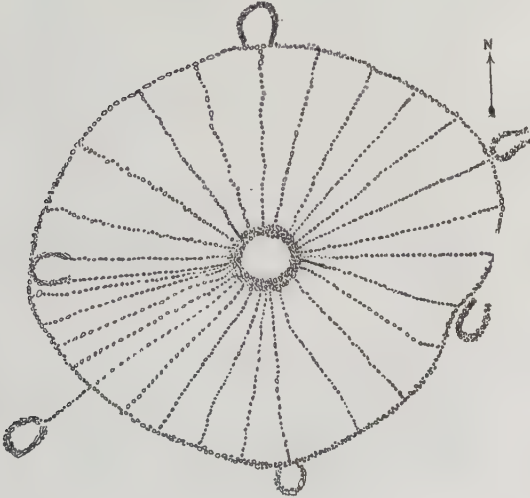
By far the largest number of known medicine wheels are found in the prairie provinces of Canada: at least thirty are known in Alberta and ten in Saskatchewan. Many are not wheels but simply large cairns, some without spokes, rings, or other associated features. The nearest to the Big Horn or Fort Smith [Montana] wheels is a month's walk to the north---a distance (600 or 700 km) almost as great as that which separates the Big Horn site [Wyoming] from the clearly distinct Pueblo culture to the south of it. Although some of the Indians of the short-grass plains surely roamed from Wyoming to Canada, we should be cautious in assuming that the Big Horn and Canadian medicine wheels had common builders, purpose, or eras of use. Nevertheless, an examination of the Canadian cairns and wheels for astronomical association seems obviously necessary in light of the claims made for the Wyoming and Montana sites. (R8)

Eddy collaborated with several Canadian archeologists in a survey of the wheels in Canada. Most are starkly different from Big Horn, being dominated by huge central cairns, some of which contain up to a hundred tons of rocks. The spokes, where present, point in almost all directions. However, about half of the Canadian wheels could have been used to mark the summer-solstice sunrise. Many other sites had no obvious astronomical features. Only one Canadian wheel, the Majorville Cairn, in Alberta,

may have had 28 spokes---the number of days in the lunar month and the number of spokes in the Big Horn wheel. (R8)

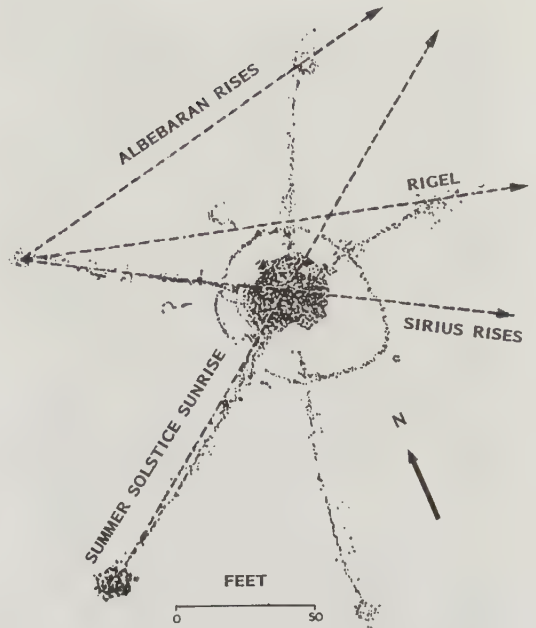
X2. Three important medicine wheels.

Big Horn. Simms' description of this wheel in X1 suffices for our purposes. His drawing is obviously idealized when compared with that of Eddy. The most important difference is that Eddy counted 28 spokes rather than 27. A third drawing of the Big Horn wheel by G.B. Grinnell in 1922 differs from both those of Eddy and Simms. (R19)



A 1922 drawing of the Big Horn medicine wheel by G.B. Grinnell. It differs from both those of Eddy and Simms! (R19)

Moose Mountain. T. Kehoe first noticed the remarkable similarities between this Alberta medicine wheel and that on Big Horn mountain, Wyoming. It is about twice as large as most Canadian wheels and possesses a massive central cairn. The five spokes extend well beyond the ring surrounding the central cairn. The spokes and terminal cairns match the relative positions of the Big Horn cairns. J.A. Eddy surmised that they were built from the same set of plans, even though hundreds of miles apart! (R8)



The Moose Mountain medicine wheel, Alberta. The alignments involve the same stars as at the Big Horn site in Wyoming. (R8)

Fort Smith. This very simple wheel is located about 3 miles north of Fort Smith, Montana. It is of special interest because, according to Crow Indian legend, it was constructed about 1850 by a Crow named Burnt Face. (R15) It is, therefore 3,000 to 4,000 years younger than Big Horn.

Instead of a central cairn, there is a circle of stones 3.2 feet in diameter. Four of the six spokes appear to be intact. The longest is 63 feet long. Four of the spokes extend over the edge of a terrace and continue down-slope, reducing their value to astronomers. (R2) It is doubtful that this recent addition to the medicine-wheel species was ever seriously used for astronomy.

X3. Possible uses of medicine wheels.

Cultural applications. Since the modern Indians do not use the medicine wheels and, indeed, know little about them, anthropologists have been forced to

surmise as best they could from legends and interviews with tribal elders. Obviously, such methods are of little help in determining why those wheels that are believed to be several thousand years old were built. Legends that old are bound to be distorted.

In western Europe, it is easy to propose that megalithic sites were used for rituals and ceremonies. Many North American medicine wheels, however, are laid out on tops of mountains and inaccessible much of the year---certainly not places for mass meetings. The cultural uses, therefore, probably involved only one or a few individuals.

E.C. Krupp ventures that medicine wheels were places for vision quests, fasting, and solstice vigils. (R17) A.B. and T.F. Kehoe suggested that some were the graves or places of death of war chiefs and other important personages. Or, perhaps, the Kehoes added, they were purely symbolic. They may commemorate great chiefs, with the spokes indicating the directions in which they rode off to war! (R10)

Astronomical applications. J.A. Eddy, an astronomer, has visited the Big Horn and Moose Mountain wheels and identified the alignments shown in the accompanying diagrams. (R3, R6) Not only are solstice alignments possible but also the rising azimuth of Aldebaran, a prominent star. Eddy was initially puzzled as to the purpose of the unused sixth cairn, but J.H. Robinson pointed out that to could be aligned with the rising of the star Fomalhaut in ancient times. (R11, R17)

The Big Horn and Moose Mountain wheels, although of crude construction and perhaps disturbed down the centuries, do seem to have been built with astronomy in mind. The wheels' builders could have used them to gauge the time of year and the change of the seasons. Since they were nomads with no crops to plant, calendric knowledge would have been helpful in timing their movements to seasonal hunting grounds and encampments. But, of course, these are only guesses, and they are not applicable to the great majority of medicine wheels that have no obvious astronomical overtones.

None of the cultural and astronomical applications proposed for the medicine wheels seem anomalous in the context of the cultures and time periods involved.

Certainly, they pose no problems in construction, being composed of easily transported local stones.

T.H. Lewis has suggested that the 28 spokes of the Big Horn wheel might, like the 56 Aubrey Holes of Stonehenge, be somehow involved in eclipse prediction. (R4) It seems more likely that, if the number 28 has any special significance at all, it refers to the number of days in the lunar month. Note, though, that no archeoastronomers have identified any lunar alignments for any of the medicine wheels, and that most do not display 28 spokes. In other words, the eclipse-prediction idea is very, very unlikely here.

Not all scientists are comfortable with the widely accepted astronomical interpretations of the Big Horn and Moose Mountain wheels. To illustrate, M.W. Ovenden and D.A. Rodger complain about the cairns used in the alignments.

(1) They are too close together to achieve much accuracy. (The baselines are too short.)

(2) They are too broad (up to 10°) and would have had to support posts to be really useful. And we have no indication where the supposed posts were placed.

Having questioned the astronomical usage of the Big Horn and Moose Mountain medicine wheels, Ovenden and Rodger courageously propose something far more radical. (See X4.)

X4. Similarities between medicine wheels and European stone structures. If the cultural and astronomical applications proposed for medicine wheels are not anomalous, the suggested similarities between New World medicine wheels and Old World stone structures certainly are. It is that nagging diffusion question again! It appears here in two quises.

Geometrical similarities. The Big Horn and Moose Mountain wheels differ starkly from most other medicine wheels in their designs. M.W. Ovenden and D.A. Rodger believe they see in their geometries strong resemblances to two types of European stone "circles" found in A. Thom's classification scheme. Specifically,

the geometry of the Big Horn wheels (less spokes and cairns) is virtually identical to Thom's flattened circle, Type (iii)B. (See figure.) The Moose Mountain wheel, in turn, is related to Thom's egg-shaped circle, Type (iv)II. (R14)

Ovenden and Rodger were not the first heretics in this regard. In the January/February 1978 issue of *Kadath*, P. Ferryn made similar though not identical suggestions.

The implications of their hypothesis were not lost on Ovenden and Rodger, as seen in the following paragraph.

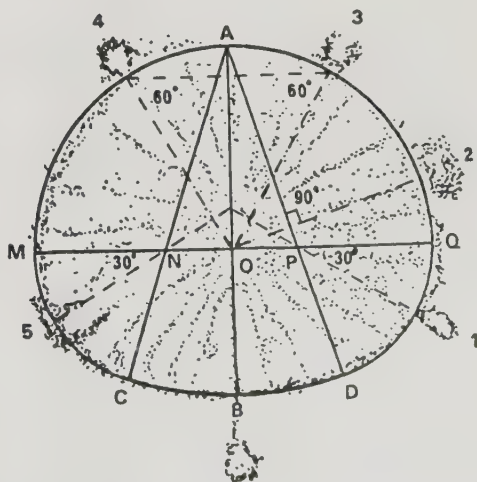
Your judgment [of their hypothesis] will be based on your prejudices, just as our judgment will be based on ours. It is, however, a matter of fact (and not of prejudice) that the ocean currents make the seas faster to "navigate" than the land for people without man-made engines. Before the dawn of history, people must have travelled the oceans of the world, albeit accidentally, as well as the land. The question is simply to what extent they carried with them elements of their culture, and to what extent these elements bore fruit on distant soil. (R14)

Such radical implications did not go unchallenged. A.G. Fries did just that in a 1981 issue of *Archaeoastronomy*. He questioned the statistical analysis employed by Ovenden and Rodger in their studies of Big Horn and Moose Mountain alignments and geometries. (R16)

A European medicine wheel? In a letter to B. Fell, published in the Epigraphic Society's Occasional Publications, W. Stender recounted a visit he had made to southwestern Cabo de S. Vincente, Portugal. There, within the fortress of Sagres, he was shown a wheel of stones 43 meters in diameter. This remarkable wheel possesses 42 spokes, but only 28 (that "lunar" connection again) of them extend to the wheel's circumference. Stender concluded:

I am convinced that, if these wheels appear on both sides of the Atlantic, their origin must have been in the Old World. Nothing would support a probability that the wheel of Sagres can be a copy of the American monuments. (R18)

In his reply, B. Fell added the fact that petroglyphs strongly resembling



(Left) Map of the Big Horn medicine wheel. (Right) The wheel's rim as constructed from four arcs. Ovenden and Rodger assert that this geometry is identical to the British flattened circles (Thom type iiiB). (R14)

medicine wheels have been found in central Australia and in Arizona. (R18)

Such trans-Atlantic connections are intriguing, but they have not swayed mainstream archeologists and anthropologists.

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MSH23 Woodhenges

Description. Roughly circular, concentric arrangements of post holes. Most woodhenges are located in Britain, with one each known in Germany and the United States. Woodhenges are cataloged here because of their resemblance to stone circles and their frequent association with them.

Data Evaluation. Known woodhenges have been thoroughly studied by archeologists. The relevant literature is large. But because post holes thousands of years old are considerably less obvious than above-ground stone structures, the dossier on woodhenges is probably woefully incomplete. Rating: 2.

Anomaly Evaluation. With the exception of the single recognized American woodhenge, astronomy was probably not the main objective of woodhenges; most seem to have been supports for large roofed buildings of some sort. The American woodhenge, at Cahokia, Illinois, was apparently only a simple calendar site and is, therefore, not anomalous. Despite some similarities between the American and British woodhenges, they are separated in time by up to 3 millennia and also in purpose. Therefore, they cannot be considered evidence for early cultural diffusion across the Atlantic.

In short, woodhenges are not anomalous. Although it must be admitted that some of the British woodhenges imply the construction of impressively large wooden structures. Rating 4.

Possible Explanations. None required.

Similar and Related Phenomena. Stone circles (MSH7).

Entries

X0. **Introduction.** The word "henge" immediately brings Stonehenge to mind. Actually, the word "henge" has a special meaning all its own. Henges are roughly circular embankments concentric with an inner ditch. These earthen enclosures are usually marked by one or more entrances. Henges are abundant in Britain, either standing alone by themselves or in their encircling of stone circles or wooden structures ("woodhenges"). Archeologists are unsure of the purposes of the henges, but rituals and ceremonies lead the list.

Stonehenge got its name from its stones and its surrounding circular henge, but Avebury and many other stone circles are likewise encircled by henges and could legitimately be called "stonehenges," too! When evidence of wooden structures is discovered within henges, we often have "woodhenges," the subject of this section. However, in X1, we will introduce an American "woodhenge," which lacks the henge feature of the British woodhenges and

is therefore really misnamed.

Wooden structures quickly rot away, and because of this woodhenges are much harder to find than stone circles. Some woodhenges and other "timber monuments" have been discovered accidentally by construction workers and archeologists trenching ancient sites. Actually, old post holes are hard to obliterate completely. The disturbed soil may enhance the growth of vegetation and thereby reveal a new site, especially to aerial surveyors. In fact, the first woodhenge was serendipitously pinpointed using aerial photographs in 1926. (R1) A more recent and more sophisticated technique uses sensitive magnetometers. These instruments detect the magnetite that was synthesized by the magnetotactic bacteria that originally consumed the posts millennia ago. Hints of a large, unsuspected wooden structure at the Stanton Drew henge were found with a magnetometer in 1997. (R17-R19)

In Britain, woodhenges may be older than stone circles---perhaps they were



Arbor Low in Derbyshire. All stones in this circle are obviously recumbent. The photograph clearly shows the henge surrounding the stone circle; that is, the circular earthen bank and ditch. (Janet & Colin Bord/ Fortean Picture Library)

even their precursors. Woodhenges are probably much more common than suspected. Magnetic surveys may revise British archeology in this respect!

X1. General observations. Over the years, post holes belonging to many ancient timber structures have been located in Britain. Some are associated with henges; others are free-standing and seem to be the wooden versions of stone circles. Archeologists also have come across the remains of wooden forts, palisades, halls, etc. Some of these British wooden structures have been carbon-dated as being about 4,000 years old. (R8)

The only timber structures that interest us in this catalog volume are

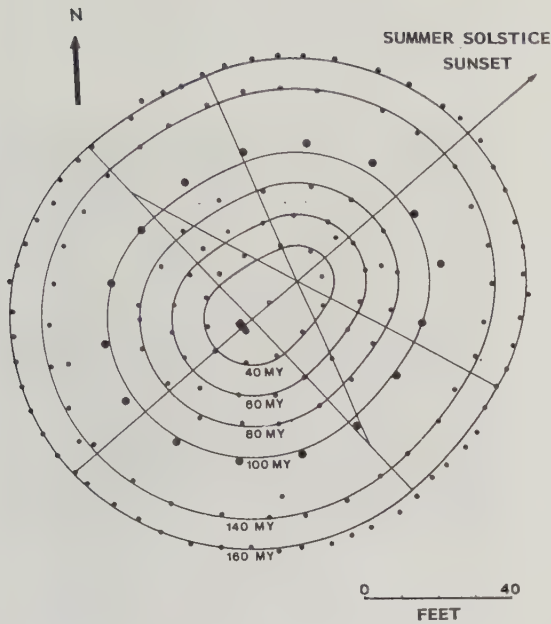
those woodhenges that might be anomalous in that:

(1) They might have been used for sophisticated astronomy; i.e., eclipse prediction; and

(2) They show such strong similarities to New World woodhenges (only one known) that a case for trans-Atlantic diffusion can be made.

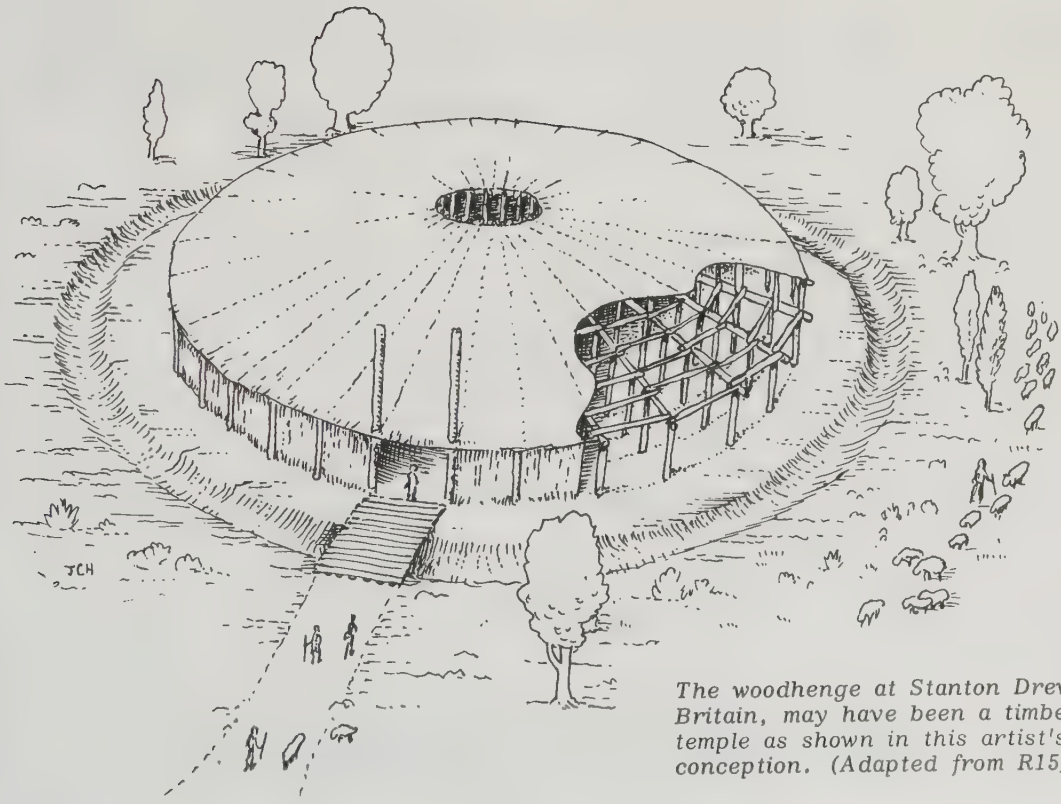
After reviewing our collected research material on woodhenges, it appears that woodhenges are not anomalous in any respect---interesting, to be sure, but no threat to any paradigms.

In the case of astronomy, it is true that the axis of the original British Woodhenge was aligned with the summer solstice (see sketch), but the struc-



ture was not used for astronomy. Indeed, its posts probably supported a roof that precluded observations of the sky. It was really a timber temple or meeting hall of some sort. Probably most British woodhenges were simply buildings and not observatories. For example, the multiringed array of post holes recently mapped out by magnetometers at Stanton Drew is thought to have been the foundation of an immense wooden "cathedral." (R17-R19) Even Stonehenge itself, usually conceived as built only of crude stones, may have been roofed over or ringed by a large wooden structure. This is one explanation of the notorious 56 Aubrey Holes. (R12, R14)

A British woodhenge with an axis of symmetry shared by six concentric egg-shaped rings of post holes. The axis points to the sunrise at the summer solstice. The units noted give ring circumferences in megalithic yards. (Adapted from R14)



The woodhenge at Stanton Drew, Britain, may have been a timber temple as shown in this artist's conception. (Adapted from R15)

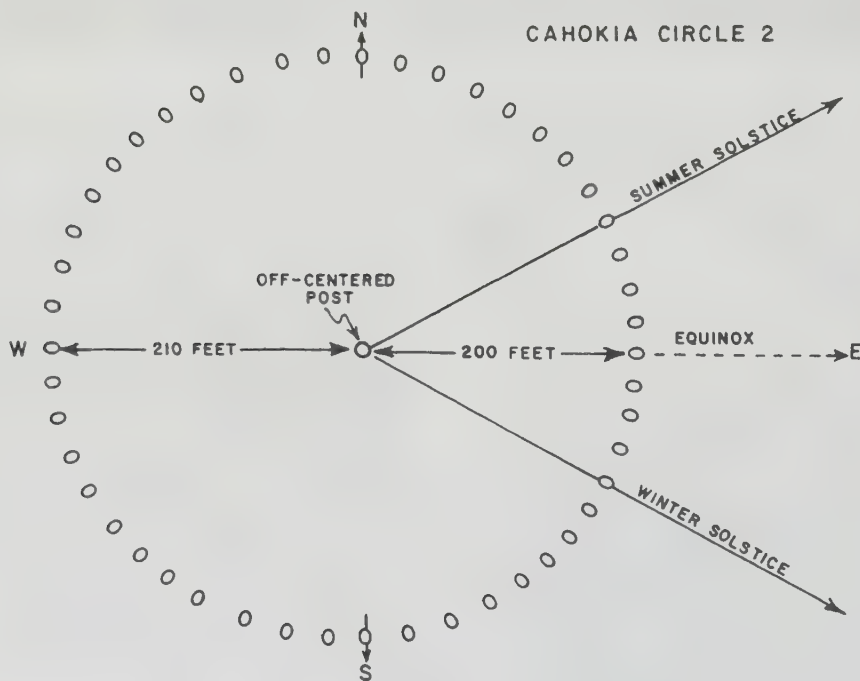
The so-called "woodhenge" at the American Cahokia site in Illinois was almost certainly devoted to astronomy, as indicated in the diagram. (R4, R6, R10, R16) It was basically a calendar site and not sophisticated enough to call anomalous in the context of the rather advanced culture of the Moundbuilders who constructed it. Cahokia's woodhenge has been dated at about 1250 A.D., some 3,000 years later than its British namesakes.

The great temporal gulf separating the Old World and New World woodhenges essentially bars any suspicions of trans-Atlantic influences. It is interesting to note, though, that both A. Burl and A.V. de Pradenne (R8 and R2, respectively) noted similarities between America Indian timber structures and those in Britain despite the time gap. This is doubtless a case of independent invention.

Since woodhenges, no matter where one finds them, display no anomalies,

it is not necessary to treat them in any detail. Rather, the accompanying diagrams and sketches will suffice as a survey of the species.

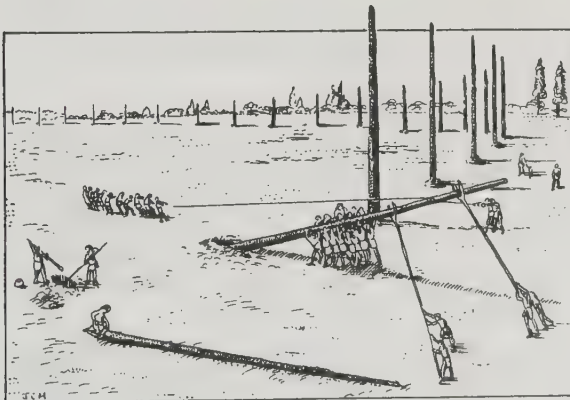
China. At this point we cannot resist adding some curious wooden structures discovered in the Lop Nur Desert in northwestern China. These are obviously not woodhenges but their geometry allows us to catalog them here. These Chinese structures consist of several concentric rings of short wooden pillars just a couple feet high. The outer circles are perhaps 50 feet in diameter as estimated from a photograph. These multi-ringed arrays apparently mark graves. In one, archeologists unearthed the desiccated corpse of a young, blond-haired woman---evidently one of the Caucasian mummies that have been turning up in China in recent years. (R20)



Astronomical alignments at the Cahokia, Illinois, woodhenge. (Adapted from Hicks, Robert D., III; "Astronomy in the Ancient Americas," Sky & Telescope, 51:372, 1976.)

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Sketch illustrating how the Moundbuilders might have constructed the American woodhenge at Cahokia, Illinois. (Adapted from R4)

MSM SHELL MOUNDS, CAIRNS, EARTHEN MOUNDS

Key to Phenomena

MSM0	Introduction
MSM1	Giant Shell Mounds
MSM2	The Shell Keys of Florida
MSM3	Curious Cairns and Rock Piles
MSM4	Cairn Lines
MSM5	Notable Earthen Mounds: A Survey
MSM6	Lines and Arrays of Earthen Mounds
MSM7	Enigmatic Mound Complexes

MSM0 Introduction

The structures attended to in this chapter were constructed by piling up huge quantities of soil, stones, and, rather surprisingly, innumerable discarded sea- and fresh-water shells. Some mounds and cairns also include kitchen debris and even human burials, but not in large amounts.

The simplest of the structures under scrutiny are isolated piles of construction materials; that is, the dirt mounds and stone cairns found virtually planet-wide. Next in complexity are the cairn and mound lines or rows, which are analogous to the stone rows of Sections MSH1 and MSH2. Finally, there are the mound complexes. These usually include many simple mounds, one or more flat-topped ("temple" or "pyramidal") mounds, as well as earthen walls, embankments, and the signatures of wooden structures long since decayed away. Mound complexes were, in purpose, small earthen cities and/or ceremonial centers.

Single mounds and cairns can be notable for their great external sizes and more-mysterious internal structures. Cairn lines or rows are uncommon and enigmatic in purpose. The purposes of mound complexes, on the other hand, are usually straight-forward; they were places to live and worship. The most mysterious of the mound complexes are those at Poverty Point and Watson Brake, Louisiana. Not only are their earthen structures puzzling in their geometries and purposes, but especially in the fact that the cultures that raised these strange edifices came out of nowhere and, apparently, disappeared the same way---long before the more-familiar Moundbuilders began piling up their mounds.

In the matter of categorization, the mounds and cairns considered here merge logically with the walls, embankments, ditches, and simple "defensive works" discussed in Chapter MSW. A close relationship also exists with the more complex earthen hilltop forts and stone forts covered in Chapter MSB in another volume.

MSM1 Giant Shell Mounds

Description. The presence of immense, artificial mounds of discarded shells along seacoasts, rivers, and lakes. Rivaling and resembling the earthen mounds of the Moundbuilders, the shell mounds were used for middens, burials, foundations for houses, lookout points, solar observatories, animal effigies, and probably rituals and ceremonies.

Data Evaluation. Most of our references are a century or more old and deal mainly with North American shell mounds. We know, for example, that Denmark and other countries have their shell mounds, but we have not yet acquired descriptions of them. This said, the Florida mounds are impressive and well-researched; they serve well as representatives of this unusual type of mound. Rating: 2.

Anomaly Evaluation. Shell mounds may attain the height of a five-story building, but sheer size is not a criterion for anomalousness in this instance. The accumulation of hundreds of millions of oyster shells is certainly interesting but does not challenge any theories about the capabilities of these seafood-loving cultures. Neither are the uses of a few shell mounds for simple solar observatories or as large-scale animal effigies considered beyond the capabilities of the shell-mound cultures. Rating: 4.

Possible Explanations. None required.

Similar and Related Phenomena. The shell keys (MSM2); effigy mounds (MGG in another volume); huge cairns (MSM3); huge earthen mounds (MSM5).

Entries

X0. Introduction. Wherever on our planet shellfish abound, one finds heaps of shells discarded by seafood lovers over thousands of years. Even though huge quantities of these shells have been burned to make lime, some very impressive shell mounds remain. In fact, some of these shell mounds are so large that we catalog them for their considerable

curiosity value.

Our short survey focuses on North America due to the restricted scope of our literature search; but it is likely that similar shell mounds are found just about everywhere shellfish and people occur together.

X1. North America. The most impressive shell mounds are those along the coasts of Florida, particularly the Gulf Coast. A special form of shell mound, called a "shell key," is so remarkable and unexpected that we catalog it separately in MSM2.

Florida. The shell mounds of Florida are so large and present in such numbers, especially along the Gulf Coast, that archeologists have been drawn to them since the early 1800s. Two of these shell heaps are worthy of special mention not only for their size but because they parallel in form and function the massive earthen mounds piled up inland by other Indian tribes from Georgia to the Canadian border.

Gulf Coast. The so-called "effigy" mounds are constructed from soil and are found in many states. These mounds are hundreds of feet in size and outline various animals or symbols. The most famous is Ohio's Serpent Mound.

Not to be outdone in this matter, the Florida Indians built their turtle mounds almost entirely from sea shells. S.D. Peet described one of these.

The turtle-shaped mound is the most remarkable. It is about five feet high, and is surrounded by ditches; lengthwise of the ditches are walls left at the natural level of the land, which correspond to the flippers of the turtle. The head and tail are projections from the mound itself. The entire length of the body is one hundred and eight feet, the width sixty-six feet. It is remarkable that carved relics resembling this mound in shape have been found in the shell heaps of Florida. (R4)

Another of our sources, D.G. Brinton, mentions a "Turtle Mound," which he places near New Smyrna. This mound is 30 feet high and built up almost totally of oyster shells. This seems to be a different turtle mound. (R1)

Crystal River. Some of Florida's most impressive shell mounds are located at Crystal River about 65 miles up the coast from Tampa. D.G. Brinton wrote the following about one of this group.

It is on all sides nearly perpendicular, the faces covered with brush and

trees, to which the visitors have to cling to effect an ascent. It is about forty feet in height, the top surface nearly level, about thirty feet in diameter, and covered with magnolia, live oak, and other forest trees, some of them four feet in diameter. Its form is that of a truncated cone, and, as far as can be judged from external appearance, it is composed exclusively of oyster shells and vegetable mould. These shells are all separated. The mound was evidently thrown up by the Indians for a lookout, as the gulf can be distinctly seen from its summit. There are no oysters growing at this time within four or five miles of it. This is evidently altogether different from the mere refuse heaps referred to elsewhere. (R1)

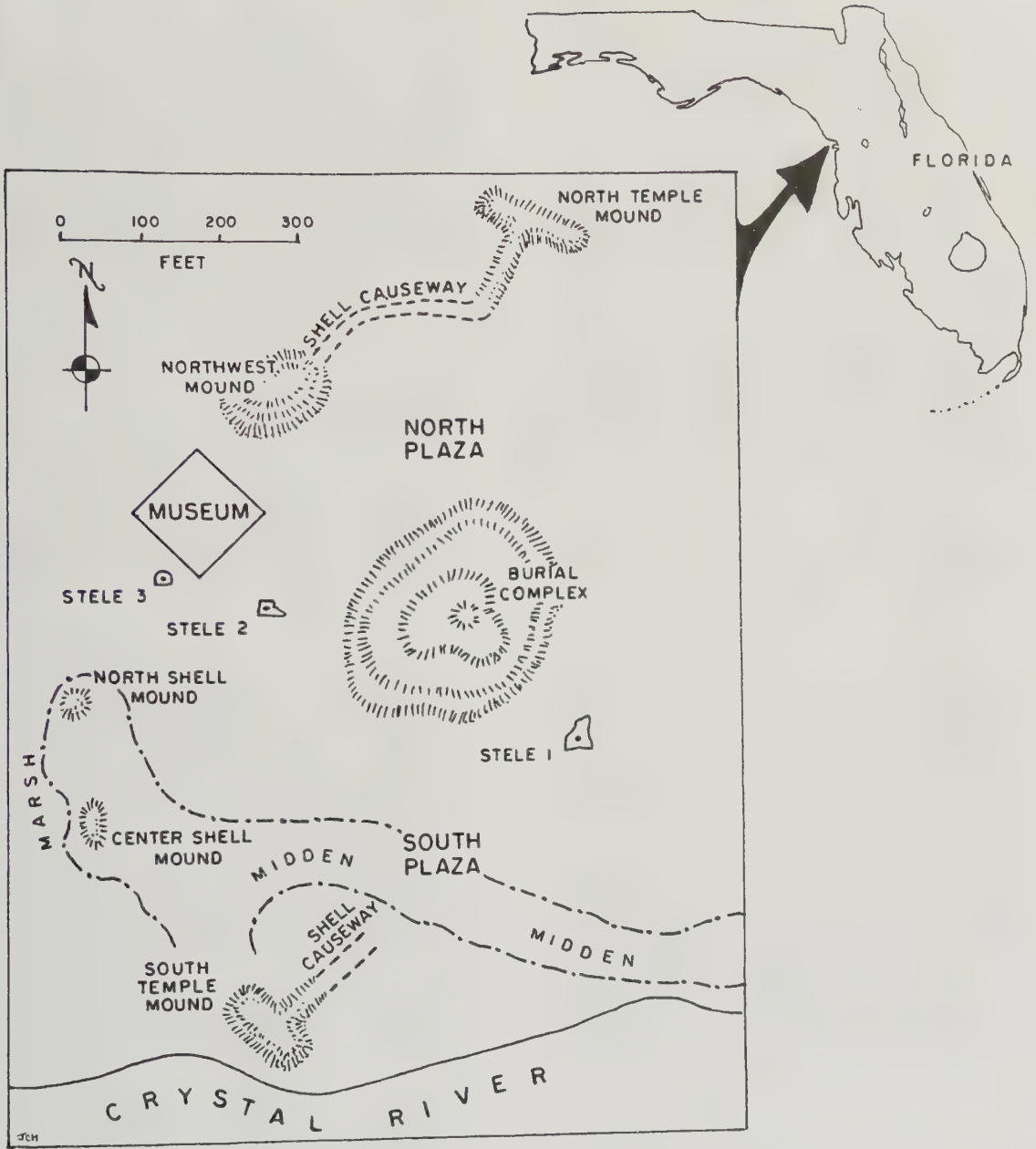
The Crystal River group of shell mounds was actually more than a lookout. Steles were discovered in area, leading C. Hardman, Jr.; to make a good case for the Crystal River mounds being a solar observatory. (R9)

It is also significant that the Crystal River mounds are flat-topped after the fashion of the earthen "temple mounds" built by the Moundbuilders.

Maine. The coast of Maine is strewn with heaps of shells discarded by Indians before the arrival of European settlers some 300 years ago. The most famous of these shell mounds is at Damariscotta. It is unique in that it is composed almost exclusively of oyster shells---virtually no clams ("quahogs"). Compared to the oysters on today's menus, the Damariscotta oysters enjoyed by the Indians were immense, as are the mounds of shells they piled up.

A.R. Wallace, of evolution fame, used the Damariscotta mound as one measure of man's antiquity in North America. He wrote:

The shell heaps of the Damariscotta River, in Maine, are remarkable for their number and extent. The largest of these stretches for about half a mile along the shore, and is often six or seven, and in one place twenty-five feet, in thickness. They consist almost exclusively of oyster shells of remarkable size, frequently having a length of eight or ten inches, and sometimes reaching twelve or fourteen inches. They contain fragments of bones of edible animals, charcoal,



Map of the ancient Crystal River site, Florida, showing shell mounds, causeways, and steles. The mounds are about 90 feet high and composed almost exclusively of oyster shells. (R.9)

bone implements, and some fragments of pottery. The surface is covered to a depth of several inches with vegetable mould, and large trees grown upon them, some more than a century old. (R3)

A half century after Wallace's comments, R.P. Goldthwait tried to attach some numbers to the Damariscotta shell mounds. He estimated the volume of shells (in 1935) as 438,000 cubic feet. This figure is low due to river erosion and the burning of the shells for lime. He puts of volume of shells at 768,000 cubic feet at the time settlers arrived about 300 years ago. This represents about 337,900,000 shells. Estimating the annual yield of oysters from surrounding waters, Goldthwait hazarded that the Indians had started feasting there about 950 years ago. (R8)

Alabama. There is no mystery as to how Muscle Shoals got its name. The shoals are composed of fresh-water muscles ("mussels") deposited by Indians.

California. At San Pablo, on San Francisco Bay, there was once an enormous shell mound, nearly a mile long, half a mile wide and more than 20 feet thick. Besides discarding shells there, the Indians also buried their dead in the mounds. Many Indian skeletons and mummies were extracted from the massive piles of shells of various species. (R3)

Alaska. In the Aleutians, massive shell deposits are draped with layers of mammalian bones. Marine and terrestrial mammal bones on top, blending to mostly seal and walrus remains, then those of small whales and dolphins, and, finally, the huge foundation of shells. It is thought that it took about 3,000 years to pile up these mounds. (R3)

X2. South America. No discussion of shell mounds would be complete without a mention of the "sambaquis" found along the coast of Brazil. "Sambaqui" is the Indian word for "shell mountain." Indeed these mounds do contain shells of many species, but archeologists also find fish bones, arrowheads, stone hammers, hearth remains, and human burials. At the Jabuticabeira-II site, the number of

human burials is put at 43,800! (R10)

Some of the sambaquis are 6,500 years old. (R10) Caspar provides a photograph of a sambaqui at Farol de Santa Marta. Judging by the nearby telephone pole, this mound is about 30 feet high and 200 feet long. (R10)

In the early 1900s, G. von Koenigswald examined some 150 sambaquis along the coast between Rio and the border with Uruguay. He reported that some of them reached heights of 60 feet---much higher than the usual telephone pole.

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MSM2 The Shell Keys of Florida

Description. Artificial islets off the southwestern coast of Florida composed almost exclusively of shells. The shell keys were like miniature tropical Venices with canals, boat ramps, walls, flat-topped mounds, and terraces.

Data Evaluation. So far, we have collected only two, century-old reports. One of these is a massive study by a professional archeologist. (R1) Without doubt, a tour through the volumes of the Florida Anthropologist would uncover considerable, more relevant material. Rating: 2.

Anomaly Evaluation. As with the ordinary shell mounds, size alone is not sufficient reason to confer anomalousness. The shell keys, however, are rather complex structures, being in effect small communities built offshore upon foundations made up almost entirely of shells. Their terraces and flat-topped mounds remind one of the complexes of the Moundbuilders of the Mississippi Valley. These factors combined with the novel construction material and marine-engineering expertise allow us to rate the shell keys at least at the curiosity level. Rating: 3.

Possible Explanations. The Moundbuilder influence extended into south Florida.

Similar and Related Phenomena. Giant shell mounds (MSM1); edifices and complexes of the Moundbuilders (MSM5).

Entries

X1. General observations. Florida's shell mounds (MSM1) are remarkable for their size and, in the case of the Crystal River group, for their apparent organization into a cultural complex. The so-called "shell keys" go several steps further. They are actually small, artificial islets built almost entirely from discarded sea shells. These shell keys are characterized by walls, canals, terraces, and flat-topped mounds, all constructed from untold quantities of oyster, conch, and clam shells. In many respects, the shell keys resemble the earthen complexes of the Moundbuilders ---not as ambitious, perhaps, but well-adapted to their tropical, maritime environment.

S.D. Peet marveled at the shell keys and related them to similar ancient maritime structures around the world.

Another class of coast structures has been recently brought to light off the coast of Florida. We shall, therefore, take up the description of these excellent specimens of the skill of the prehistoric people. They have been associated with the sand mounds and shell heaps of Florida, but they show

a more advanced stage, and should probably be classed with the mounds and earthworks of the Gulf States, for it is the opinion of Dr. D.G. Brinton, Prof. F.W. Putnam and others that they were erected by the same people.

The object of these remarkable "shell keys" is unknown, but they appear to have been walls, which surrounded the seagirt habitation of an ancient and unknown people. The reef-raised sea walls of shell surrounded central, half-natural lagoons, or lake courts, with the many channeled enclosures, which, when surrounded by the dwellings of the people who erected them, must have made the island a modern Venice. The houses were probably constructed altogether of wood, and perhaps covered with thatched roofs. The canals within the lagoon were dug out of low, swampy ground, and were lined with earth walls, which were covered with a tangled forest; making the ancient village resemble the villages on the coast of Benares or the Philippine Islands, more than the European Venice.



A shell key or island in Pine Island Sound, Florida. Note the sea wall, which is also composed almost entirely of discarded shells. (R2)

The islands lack the outside reefs which are found in the Caroline Islands, and there are no such artificial breakwaters, as are there, nor are there any such massive stone enclosures and shrines. (R2)

In the last paragraph, Peet was surely referring to the artificial islets of Nan Madol, off Pohnpei, in Micronesia, which were built from natural basalt prisms rather than shells.

F.H. Cushing wrote at great length of his explorations of the shell keys. One of his paragraphs and an illustration are sufficient for our purpose. The shell keys that Cushing investigated are located in extreme southwestern Florida, from Charlotte Harbor south along the coast to Marco.

Here is how Cushing described his venture into one of these long-abandoned, heavily overgrown artificial islets.

Threading this zone of boggy bins, and leading in toward a more central point, were here and there open ways like channels. They were formed by parallel ridges of shells, increasing in height toward the interior, until at last they merged into a steep,

somewhat extended bench, also of shells, and flat on the top like a platform. Here, of course, at the foot of the platform, the channel ended with a slightly broadened cove, like a landing place; but a graded depression or pathway ascended from it and crossed this bench or platform, leading to and in turn climbing over, or rather through another and higher platform, a slight distance beyond. In places, off, to the side of either bank, were still more of these platforms, rising terrace-like, but very irregularly, from the enclosures below to the foundations of great level-topped mounds, which, like worn-out, elongated and truncated pyramids, loftily and imposingly crowned the whole; some of them to a height of nearly thirty feet above the encircling sea. The bare patches along the ascents to the mounds were, like the ridges below, built up wholly of shells, great conch shells chiefly, blackened by exposure for ages; and ringing like potsherds when disturbed even by the light feet of the raccoons and little brown rabbits, that now and then scuttled across them from covert to covert, and that seem-

ed to be, with the ever-present grosbeaks above, and with many lizards and some few rattlesnakes and other reptiles below, the principal dwellers in those lonely keys---if swarming insects may be left unnamed! (R1)

Cushing's report, over 100 pages long, is his rather poetic response to his first penetration into the interior of one of these long-forsaken ancient islets.

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A shell key located in extreme southwestern Florida. (R1)

MSM3

Curious Cairns and Rock Piles

Description. Cairns and rock piles of unusual size, shape, constitution, location, and/or arrangement. See X1 below for a listing of types selected.

Data Evaluation. The assembly of this little collection of curious and odd cairns and rock heaps was only possible by appealing to a wide variety of sources---professional, amateur, and popular media. The quality of our references is therefore uneven. Usually, though, the descriptions and illustrations appear to be solid. Rating: 2.

Anomaly Evaluation. We characterize the cairns described here as "interesting," curious, and often impressive. Rating: 3.

Possible Explanations. None required.

Similar and Related Phenomena. Giant shell mounds (MSM1); long alignments of cairns (MSM4); earthen mounds (MSM5-MSM7).

Entries

X0. Introduction. Simply put, cairns are only heaps of rocks; and it is difficult to understand how a pile of rocks could pose problems of explanation. Most of the single, isolated cairns are merely trail markers, memorials, grave markers, the lithic refuse of farmers' fields, components of medicine wheels, and piles collected for similar mundane purposes. This said, some cairns do deserve the anomalist's attention---at least at the curiosity level. Here follows a list of the eight unusual types of cairns and rock piles treated in the following pages.

- X1. Extremely large cairns,
- X2. Effigy cairns,
- X3. Conical and pillar cairns,
- X4. Burnt-rock mounds,
- X5. Lime-coated boulder piles,
- X6. Cairns in solar alignments,
- X7. Submerged cairns, and
- X8. Cairn complexes.

The above list is certainly incomplete and represents only a preliminary survey. In addition, we consider "cairn lines"; that is, long lines of cairns marching off toward the horizon, to be interesting enough to place them in a separate section. (MSM4)

X1. Extremely large cairns. Our criterion for cairns in this category is height; acceptable cairns must be 10 feet high or more. It is unlikely that farmers clearing fields would pile stones this high.

North America.

New England. Beginning in the east, some stone piles in New England's Indian cemeteries rise as high as 15 feet and cover 500 square yards. J.W. Mavor, Jr., and B.E. Dix specifically mention cemeteries at Fall River, Massachusetts, and Charlestown, Rhode Island, in this context. (R16)

Ohio. Apparently the work of the Moundbuilders at nearby Newark. Ohio's

"Great Stone Mound" succumbed early to the settlers' need for building stones.

The great stone mound about eight miles south of Newark, and about one mile east of the reservoir on the Licking summit of the Ohio canal, was one of the most remarkable structures in the State. It was composed of stones, in their natural shape, as they were found on the adjacent grounds, laid up, without cement, to the height of from 40 to 50 feet, upon a circular base of 182 feet diameter. This was surrounded by a low fosse, and parapet of an ovate form, with a gateway on the east end, leaving a large open area on the west end of the mound, within the enclosure. (R2)

During 1831 and 1832, over 10,000 wagon loads were carted away. The only objects of note found during the cairn's dismemberment were 15 small earthen mounds at the ground level.

Wyoming. One of the very early issues in the "old series" of Scientific American contains the following statement, which is likely an exaggeration.

On the road to Oregon about one hundred miles west of Fort Laramie there is a pile of stones about 200 feet high, and 300 feet in circumference at the base. The stones vary in size from the size of one's thumb to that of a water pail, all placed as regular as masonry. This could not have been a freak of nature. They must have been piled up by men to commemorate some great event---but by whom and for what purpose who can tell? (R1)

We can accept the existence of a large cairn on the Oregon Trail, but the dimensions given are cause for alarm. The diameter of the base would be only about 95 feet---not reasonable for a stone pile without mortar 200 feet tall! Perhaps the height was only 20 feet.



This huge cairn atop Knocknarea, near Sligo, Ireland, is almost 200 feet long and 35 feet high. It probably covers megalithic tombs. (R8)

Europe

Ireland. Near Sligo, a most impressive cairn occupies the top of Knocknarea, a nearby mountain. It is 35 feet high and 200 feet in diameter. Legend has it that it covers one or more tombs, but no one really knows what lies underneath this incredible mass of stones. (R8)

France. In Brittany, in the company of innumerable dolmens, stone rows, and megalithic tombs, the archeological tourist can observe several very large terraced cairns. The largest and most interesting is the cairn or tumulus of Barnenez, located near Morlaix on Finisterre. Barnenez is difficult to classify. Being an immense pile (47,000 cubic meters) of rocks, it is undeniably a cairn. But with its terraced, rectangular appearance, it reminds one of the ancient ziggurats of the Middle East and the New World's terraced, pyra-

midal mounds. Barnenez could reasonably be cataloged with pyramids. Then again, it contains eleven burial chambers accessible through tunnels, so it is also a tomb. Whatever its appellation, Barnenez is a massive, uniquely configured pile of stones. In dimensions, following its restoration, Barnenez is 72 meters long, 18-27 meters wide, and 6 meters high. Its age is put at 4,700 years. (R18, R21, R22)

Also located in Brittany is another terraced cairn worth mentioning. It is named Dissignac. About 14 meters in diameter Dissignac is unusual because it is circular rather than rectangular like Barnenez. It bears a startling resemblance to Cuicuilco, the Mexican, circular, terraced pyramid. (R22) Of course, there is a 4,000-year difference in age. (See sketch on this mound on page 256.)



The terraced Barnenez cairn on Finisterre contains eleven burial chambers accessible through tunnels. Thought to be about 4,700 years old, the cairn is 72 meters long. (R18, Kadath)

X2. Effigy cairns. The Indians of Wisconsin and nearby states left behind many earthen effigy mounds as well as boulder effigies. Both of these structures depict animals and other objects on a grand scale. "Effigy cairns" are solid figures like the effigy mounds, whereas boulder effigies simply outline the subjects with stones. Some of these effigies are a hundred feet or more in length.

North America. Effigy cairns seem to be quite rare in North America. We have found only a single potential example.

Connecticut. J.P. Whittall, III, has described a peculiarly shaped cairn found in this state.

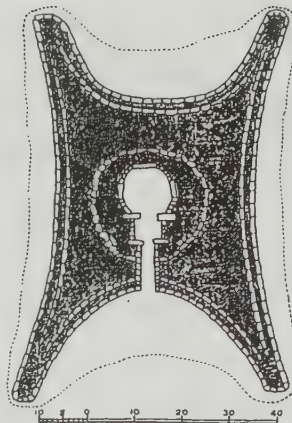
An unusual, large stone cairn is located atop Rattlesnake Hill in Connecticut's Natchang State Forest. At an elevation of 640 feet, it commands an almost 360° view. Its long axis is aligned with the Pole Star. The cairn seems to have been constructed according to some plan rather than just being a deposit of cleared stones. One's first impression is that it resembles a boat. Could it be a Norse "ship burial" such as found in Europe? It is impossible to prove such a conjecture without tearing the cairn apart. (R14)



Side view of a possible boat cairn located in Connecticut. Just a pile of rocks or a Norse artifact? (R14)

Europe. In contrast to North America, Europe is home to a variety of effigy cairns, such as those in Scandinavia depicting Viking ships.

Scotland. An elaborate sort of burial cairn was depicted by J. Fergusson in his masterful survey of antiquities. We reproduce here his sketch of one of the "horned cairns" in the Caithness megalithic complex. (R3)



A "horned cairn" in the Caithness megalithic complex, Scotland. The scale is in feet. (R3)

X3. Conical and pillar cairns.

North America. Two special varieties of cairns are found in abundance in New England and New York state. These are not haphazard piles of stones dumped by farmers. Rather, conical and pillar cairns are constructed with great care from carefully selected stones. As their name suggests, conical cairns taper towards their tops. Pillar cairns are more column-like and built with the precision necessary for stability. Still, the viewer is surprised that they haven't fallen over long ago. The age, purpose, and builders of conical and pillar cairns remain unknown.

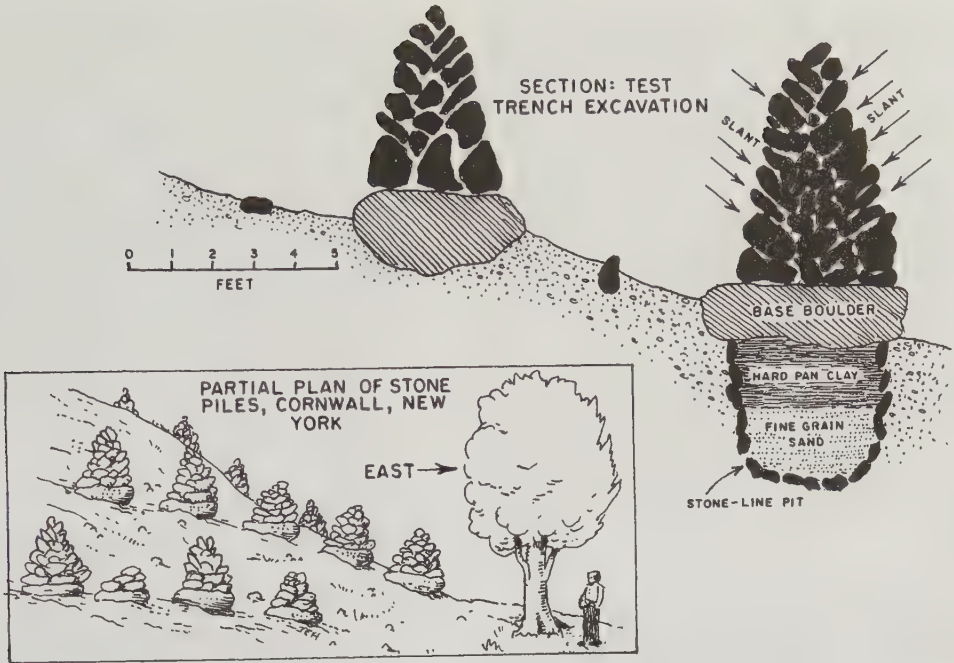
That the conical cairns were erected for some special purpose, perhaps ceremonial in character, is seen in the three features identified by S.M. Trento.

(1) Most were erected on large-surface boulders [for stability].

(2) They occur in clusters, ranging from ten to several dozen.

(3) A water source---stream, river, swamp, or lake---is always nearby.

(4) They're usually found at the upward slope on the east side of hills and mountains. (R11)



Cluster of cairns near Cornwall, New York. Similar cairns are found in southern New England. Their complex structure suggests that they are more than mere piles made by farmers clearing their fields. (R11)

A representative conical cairn is located in the township of Washington, in the Berkshires of western Massachusetts. It was present when European settlers first arrived. This cairn is 7 feet high, 7 feet in diameter at its base, and tapers to 3 feet at the top. It is capped with a white quartz stone. Two concentric stone circles are nearby. (R11)



A large, solidly built cairn located in the Taconic Mountains, New York. It is one of some 300 such cairns near Ellenville. (R12, R17, Kadath)

X4. Burnt rock mounds.

North America.

Texas. Apparently, the so-called "burnt rock mounds" are a speciality of southwestern Texas. J.C. Kelley and T.N. Campbell described them as follows.

Burnt rock mounds are low eminences or knolls which are made up of thou-

sands of densely packed angular fragments of limestone or other available country rock. They also contain varying amounts of soil, charcoal and ash, snail and mussel shells, animal bones, artifacts, and occasionally human burials. In outline, these mounds are circular or oval and, in size, they vary from a few square yards up to several acres. The thickness of the deposit also varies greatly, but even in the larger mounds it rarely exceeds six or eight feet. (R4)

Archeologists theorize that the burnt rock mounds are Indian kitchen middens into which were tossed fragmented stones that were used to contain cooking fires. Limestone, in particular, has the propensity to fragment into small pieces when exposed to heat and rain.

Europe

Scotland. One of archeology's most enduring puzzles is cross-referenced here. We refer to the Scottish "fused forts," which are barriers of large boulders that were intentionally fused together by intense heat. Presumably, the ancient Scots did this with massive wood fires. For details, see MSB in another volume.

Africa

Botswana. Strangely similar to the Texas burnt rock mounds are kitchen middens that contain layers of glassy refuse. In east-central Botswana, these glassy slag layers may occupy several hundred square meters. The source of the high temperatures required to fuse the debris is controversial. Lightning has been suggested, but the glassy layers do not look anything like fulgerites! (R20)

X5. Lime-coated boulder piles. The structure cataloged here may stretch the definition of "cairn" a bit.

Mesoamerica

Belize. In 1954, construction workers were attempting to level a shallow mound when their tractor struck what appeared to be a dump-heap of river boulders.

The boulders turned out to be arranged in a conical pile (termed a "round pyramid"), inside of which was a second conical pile of boulders. The outside pile was thickly coated all over with a layer of lime. Five steps were noted in one area, heightening the resemblance to the many, larger, true pyramids constructed by the Maya in Belize. (R5)

The early Lowland Maya did indeed build round structures in the area, but this particular conical pile of lime-coated, rough river boulders is apparently unique and enough like a cairn to include here. It is, however, probably generically related to later Mayan pyramids with square bases.

X6. Cairns in solar alignments.

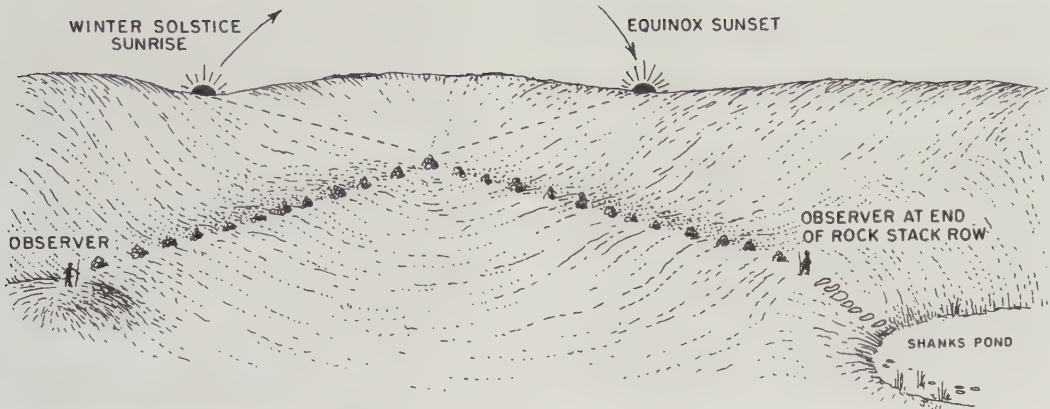
North America

Massachusetts. We catalog very long lines of cairns in MSM4. Meanwhile, at least two short cairn lines at Falmouth, Massachusetts, are worth noting because of their apparent solar alignments. As illustrated, the site consists of two rows of small stacks of rocks---just a few rocks in each pile, 2-3 feet high. One row is aligned with the winter-solstice sunrise, the other with the equinox sunset. These stacks of rocks may be of relatively recent origin, for they do not rest on bedrock or large, stable boulders, and have not yet fallen over with the passage of time, people, and environmental forces. (R16)

X7. Submerged cairns.

North America

Wisconsin. Professor J. Shertz, of the University of Wisconsin, has been trying to get to the bottom of the reputed stone "pyramids" submerged in Rock Lake, near Lake Mills, Wisconsin. Fishermen have hit the rock piles with their oars when the lake is very low; and others have spotted structures (perhaps as many as four) from the air. In 1937, a diver reported seeing a 29-foot-high "pyramid" in the murky waters. (R7) Recent divers have found boulder



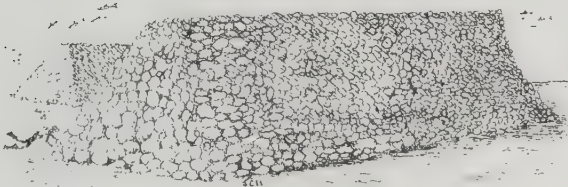
*Astronomically aligned rows of cairns,
Falmouth, Massachusetts. (R16)*

alignments; but the visibility is so poor that organized structures cannot be easily identified, if indeed there are man-made structures beneath the surface. (R13, R14)

Truncated earthen pyramids do exist at the nearby precolumbian Aztalan site; and strange rock piles exist elsewhere in Wisconsin. Consequently, one cannot brush off the idea that some edifices were built at Rock Lake when the water was much lower.

"Fringe archeology" has made much of these "pyramids," making many claims that are hard to refute given the inaccessibility of the Rock Lake structures. (R19)

It is a curious parallel, high definition sonar exploration of Loch Ness has revealed megalithic structures on the floor of the Loch!



Artist's concept of the Rock Lake submerged "pyramids" as presented in an 1970 issue of Skin Diver. (R7) Recent underwater photographs of these curious structures can be found in R19.

X8. Cairn complexes. A dozen or two cairns at one site is no cause to proclaim an anomaly. Cairns are often grave markers and their geographical concentration would only mark an ancient cemetery. But when cairns are present by the hundred, or of unusual design, or arranged in geometrical configurations, they should be cataloged.

North America

Rhode Island. A complex of 120 stone piles near Coventry has perplexed the local historians for years. Massed on a gentle slope just north of Turkey Meadow Brook, these carefully constructed cairns can hardly be the consequence of field clearing. In fact, 77 of them meet the exacting criteria for conical cairns set out in X3. They are built up from split, squared-off granite slabs. Most are 2-3 feet high, with three reaching 4 feet. For unknown reasons, they occur in clusters of from ten to several dozen. (R10)

New York. Near Ellenville, there exists a complex of 300 cairns. Judging from the photograph from Kadath appearing on p. 249, some of this number qualify as conical cairns by virtue of their careful craftsmanship. (R17)

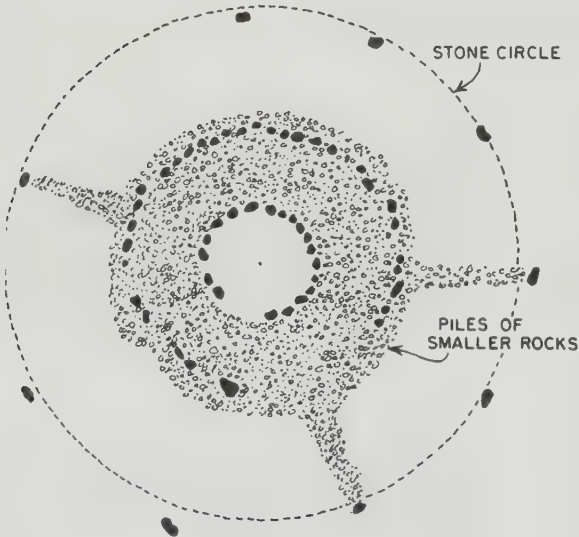
California. M.J. Rogers, in Ancient Hunters of the Far West, has provided an intriguing photograph of a ceremonial mesa in southeastern Inyo County. The

mesa floor is cloaked with a fabric of 28 abutting gravel cairns that are apparently arranged in a two-dimensional pattern. No dimensions are given. (R6)

Europe

Scotland. Cairns of various descriptions are scattered widely over Britain. Some of these are "ring cairns"; that is, stones piled in annuli, leaving an open space in the centers.

A remarkable concentration of 50 of these ring cairns occurs in the Clava complex of megalithic structures in Inverness. Accompanying the ring cairns



A ring cairn from the Clava megalithic complex, Scotland. (Adapted from R9)

are many passage graves and stone circles. Clava's ring cairns are actually set within larger-diameter stone circles. The open spaces within the cairns are capacious, raging up to 10.7 meters in diameter. The Scottish cairns therefore dwarf the North American cairns. Furthermore, the Clava cairns are all oriented, with their entrances facing south-southwest. Strangely, at Clava's latitude, there are no important astronomical targets in that direction. Cupmarks, hall-

marks of the megalithic age, also decorate some of the ring cairns. (R9)

The purpose of the Clava ring cairns and their generic relationship to the accompanying passage graves and stone circles still perplex archeologists.

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- R13. Smith, Susan Lampert; "Lake Mills' Lost Pyramids," Wisconsin State Journal, June 26, 1983. Cr. R. Heiden via L. Farish. (X7)
- R14. Whittall, James P., III; "The Boat Cairn, Chaplin, Connecticut," ESRS Bulletin, 12:39, December 1985. (X2)
- R15. Culotta, Elizabeth; "Divers to Probe the Mystery of Rock Lake," Milwaukee Journal, July 9, 1989. Cr.

- R. Heiden. (X7)
- R16. Mavor, James W., Jr., and Dix, Byron E.; Manitou, Rochester, 1989, pp. 56, 68, 89, 146, 214. (X1, X6)
- R17. Ferryn, Patrick; "Etranges Vestiges Mégalithiques en Amérique du Nord," Kadath, no. 72, p. 33. (X8)
- R18. Mahieu, Jean-Claude; "Faut-Il Elargir L'Horizon Culturel Olmèque?" Kadath, no. 76, p. 31, Autumn 1991. (X1)
- R19. Joseph, Frank; The Lost Pyramids of Rock Lake, 1992. (X7)
- R20. Thy, P., et al; "Implications of Prehistoric Glassy Biomass Slag from East-Central Botswana," Journal of Archaeological Science, 22:629, 1995. (X4)
- R21. Victoor, Jacques; "Barnenez: une Pyramide en Bretagne," Kadath, no. 8, p. 16, May-June 1974. (X1)
- R22. Gerardin, Lucien; "'Pyramides' Mégalithiques et Collines Artificielles," Kadath, no. 49, p. 8, Winter 1982. (X1)

MSM4

Cairn Lines

Description. Long lines of discrete cairns. The lines may be straight or sinuous. Cairn lines are analogous to stone rows (MSH2) in which heaps replace isolated standing stones. When the spaces between the cairns are filled in, we have linear cairns.

Data Evaluation. Scientific investigation of cairn lines is practically nonexistent. We have found only a single professional paper on the subject, plus a few mentions in popular works. However, good photographs of cairn lines in North and South America are available in our references, so their reality cannot be questioned. Rating: 2.

Anomaly Evaluation. While single cairns have many reasonable explanations (MSM3), cairn lines are impoverished in this regard. Astronomy does not seem to be involved. They might mark ritual paths, however lines seem to terminate nowhere in particular, not in places where ceremonies would be likely. Without convincing explanations, cairn lines remain mildly anomalous. Rating: 3.

Possible Explanations. Ritual paths, territory markers, cultural idiosyncracies.

Similar and Related Phenomena. Stone rows (MSH1, MSH2); rows of earthen mounds (MSM6); stone walls (MSW2).

Entries

X1. Cairn lines. Long lines of spaced cairns are mainly a New World phenomenon. But the North and South American species are quite distinct from each other in form and, in all probability, purpose.

North America. The North American cairn lines have long been neglected. We have little appreciation for how many there may be and where. Certainly, many were erased long ago by civilization. Few archeologists taken any interest in them. They are, after all, only crude rock heaps---not elegant pottery. Actually, we know of only one more-than-casual treatment of them, and it is the basis of what now follows.

Wyoming and Montana. G.C. Frison, at the University of Wyoming, seems to be the only scientist to have seriously investigated cairn lines. Happily, he lives where cairn lines are fairly common. Frison has examined and reported on five such lines in Wyoming and a sixth just across the state line in Montana.

First, we reproduce the abstract from one of his papers on the subject. This is followed by his description of the most impressive of the six.

Artificial cairns of varying sizes, generally hemispherical in shape, separated by varying distances, and made up of cobble-sized stones, are notable prehistoric manifestations in Wyoming and southern Montana. They may be of several meters diameter and over a meter in height. They may be contiguous for short distances and then may become much smaller and separated by several meters. They disappear for long distances and then reappear as a few discrete piles or a single pile, usually in a gap or a somewhat prominent location. Related sets of these stone piles may cover several miles as can be demonstrated along the southern Bighorn Mountains. Their age and function are still conjectural. (R4)

The longest cairn line, called "Henry Jensen's Trail" is made up of 136 known stone piles. It runs along an unwooded, hogback ridge for a distance of about a mile at an altitude of 6,200 feet.

The eastern end of the line is particularly noticeable because of several hundred meters of large piles that are nearly contiguous. Also on the east end, the line crosses exposed soft bedrock and parallels for a short distance what could be called a deeply cut trail in the formation. The cairn line terminates abruptly as the terrain begins to slope steeply into the valley of the Main Fork of Dry Creek. On the west end, the stone piles are much smaller and separated by longer distances. They apparently terminate abruptly with a small pile (about 0.2 m in diameter) in a juniper covered area of the east slopes of the West Fork of Dry Creek. (R4)

The ages of these cairn lines is not known, for artifacts are virtually nonexistent along their lengths. The consensus is that they are Late Prehistoric or Late Archaic. As for purpose, suggestions are many, but none is very convincing. The wide separations between cairns means they cannot be used in game drives as some have suggested. Another possibility is that the cairn lines are simply territory markers. (R4)

South America

Peru. The Nazca people made most of their famous "lines" by removing stones from the desert surface and exposing the soil underneath. These cleared strips stand out vividly when viewed from aircraft but are less impressive at ground level. Many of the Nazca lines are miles long and very straight; others trace out animal figures and abstract designs. They are one of archeology's enduring mysteries. We classify the "ordinary" Nazca lines along with other "geoglyphs" in MGG in another volume of this Catalog.

A few of the Nazca lines, however, are marked by small cairns and must be mentioned here. In his rambles around the Nazca Plain, T. Morrison espied one of these rare versions. The place was the Pampa of the Half Moon (Pampa de Media Luna). Out of the corner of his eye, Morrison detected regularity in the stone-strewn desert pavement. Stepping back two paces, a long line of small cairns snapped into focus.

There it was. A straight line, perhaps a mile long. At one end was a

large hill, and at the other I could just see a low mound. This line was different. Instead of the cleared desert pavement that made the San Jose lines resemble shallow troughs, the line on Half Moon Pampa had been built of small heaps of stones, set approximately two yards apart, with a smooth path running to one side where even the smallest fragments of stone had been cleared. I followed the line in both directions and found that larger stone heaps had been built at each end of the line: one at the foot of the hill, and the other in the central expanse of the pampa. (R2)

From the hill at the eastern end of the line, Morrison checked the azimuth of the cairn line. It was 240° , and probably of no astronomical significance. (R2, R3)

Actually, the Nazca lines in general provide little grist for the mills of the archaeoastronomers. The real purpose(s) of the lines remain unplumbed. Morrison favors the idea that some of the lines lead to small shrines, but this cannot account for the huge figures of birds, spiders, and designs sprawling across the high, dry desert floor.



Sketch of a line of small cairns on the Pampa de Media, Peru. (Based on a photograph in R2)

X2. Long, linear cairns. In some parts of the world, huge piles of stones accumulate when local custom dictates that natives passing by a particular cairn add a stone to it. On occasion, these perpetually growing cairns take on a long, linear form.

Asia

Tibet and Tartary. In this high and remote part of the world, travelers are surprised by the "mani" or long heaps of stones along the trails. These have an interesting but nonanomalous origin. In the referenced article, C. Horne is quoted as follows.

The Lama Tartars build long walls of loose stones, usually about 6 feet thick and 5 high; sometimes as at Nako, half a mile long. Every native passes them to his right; none seems to know why: hence there is a path worn on that side, and every one

adds a stone; they must be the growth of centuries, every generation adding some yards. The heaps often have flags stuck on them and scraps of paper, with some sacred writing, and also horns of ibex, wild sheep, goats, &c., and round boulder-stones, inscribed with the Buddhist prayer in a circle, are often laid on the top. A great mystery attaches to them; none can explain their uses certainly; some say they are devotional, others that they were built on return from long journeys. The farthest object I saw in Tartary was a long double range of these walls. (R1)

References

- R1. Walhouse, M.J.; "Non-Sepulchral Rude Stone Monuments," Anthropological Institute, Journal, 7:21, 1877. (X2)
- R2. Morrison, Tony; Pathways to the Gods, New York, 1978, pp. 37, 73. 66. (X1)
- R3. Ferryn, Patrick; "Il n'y pas que Nazca," Kadath, no. 38, p. 4, May-June 1980. (X1)
- R4. Frison, George C.; "Linear Arrangements of Cairns in Wyoming and Montana," in: Michael Wilson, et al, eds., Megaliths to Medicine Wheels, Calgary, 1981, p. 133. (X1)
- R5. Ferryn, Patrick; "L'Etranges Vestiges Megalithiques en Amerique du Nord," Kadath, no. 72, p. 4, Spring 1990. (X1)



Dissignac is a terraced cairn in Brittany. Diameter: 14 meters. (R22) See text on page 247.

MSM5 Notable Earthen Mounds: A Survey

Description. The near-worldwide existence of very large mounds constructed of earth, a few stones, and rubble. Generally, only mounds over 30 feet in height are cataloged, but a few smaller mounds of unusual configuration are also included. Most of the mounds considered are terraced and flat on top; these are the so-called "temple mounds." Mounds may be faced with stone for stability, and many conceal internal structures and tunnels. Pyramidal mounds usually possess rectangular bases, but some are round in shape. Stairways and ramps are common.

Data Evaluation. American and European mounds are generally well-studied and thoroughly reported in the archeological literature. The equally impressive mounds of Asia and Oceania, however, are not as carefully described in our present files. In addition, we have found no reports of very large earthen mounds from Africa. Rating: 2.

Anomaly Evaluation. As with the stone circles and cairns, sheer size does not make a mound anomalous. Even the wide geographical distribution of terraced, pyramidal mounds is not considered good evidence for diffusion and therefore do not flag an anomaly. The number of ways in which earthen mounds can be constructed is very limited. For this reason, the terraced pyramids, including those with stairways, are considered the logical products of independent invention in this catalog. Likewise, the common practice of burying old structures within mounds has always

been popular and planet-wide in its prevalence---nothing mysterious here, either. The only mysteries we see emerging from our survey involve the question of "purpose." Why the fluted structure of La Venta? Why the elaborate basin and drain on the Akapana? What lies buried under Monks Mound? These are interesting questions, but they hardly qualify as important anomalies. Rating: 3.

Possible Explanations. To modern humans, height is an important property in a structure. Early humans were no exception, and they piled up huge mounds to impress everyone. Later, as they learned how to work with stone, they built large pyramids and other edifices from this more durable material.

Similar and Related Phenomena. Lines of mounds (MSM6); mound complexes (MSM7); stone pyramids (MSB in another volume).

Entries

X1. North America (excluding Meso-america). The United States is dotted with thousands of earthen mounds all the way from Florida to Wisconsin and from New York to the Front Range of the Rocky Mountains. (R1) From this vast population of artificial hills, we choose two for further discussion.

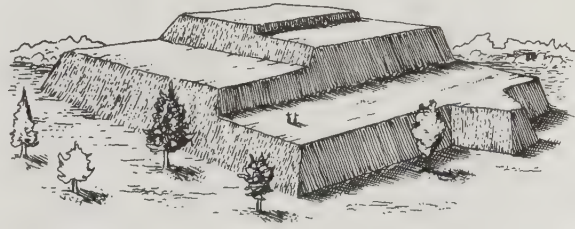
Illinois (Monks Mound). The most impressive concentration of mounds is located just a few miles northeast of East St. Louis, Illinois, on a wide expanse of fertile ground called American Bottom. Here, among some 120 smaller mounds, is one of the largest artificial earthen structures on the planet. Monks Mound is part of the Cahokia complex, which is named after the Indians living there when the first French colonists arrived early in the Eighteenth Century. (R6, R29) For a general description of this massive mound, we rely upon E.C. Krupp.

Monks Mound is the most obvious monument at Cahokia. Its size and shape make it unique, not only at Cahokia but anywhere north of central Mexico. Monks Mound was named for a community of Trappist monks who lived nearby in the early 1800s. They cultivated the first terrace of the huge earthwork, whose name now recalls the monks' brief presence here.

Four separate terraces were designed into Monks Mound. The fourth and highest, is 100 feet above the ground. The third terrace was built just 3 feet lower than the fourth, and together they form a split-level platform, on the upper half of which

a huge building, perhaps 50 feet high, was erected.

Monks Mound, at its base is 1037 feet long and 790 feet wide. It covers 15 acres and is entirely artificial. Twenty-two million cubic feet of earth were piled and sculptured into a structure dwarfed, in the Western



Sketch illustrating the four terraces of Monk's Mound. Recently, a layer of stones was discovered 40 feet below one of the terraces.

Hemisphere, only by the immense Pyramid of the Sun at Teotihuacan and by the Great Pyramid of Cholula. (R33)

What we now see as Monks Mound was apparently constructed between 900 and 1200 AD. The prevailing dogma has long been that the Indians who built Cahokia worked only with earth, never with stone. Indeed, suitable stone is scarce in the area. However, it has become apparent that something is concealed beneath all that dirt, and this is one



Monk's Mound as it appears today. Length 1,037 feet, height 100 feet. (Illinois State Museum)

reason why, besides size, of course, that we focus attention on Monks Mound.

On January 24, 1998, while drilling to construct a water-drainage system at Monks Mound, workers hit stone---at least 32 feet of it---perhaps a layer of cobbles or slabs of rock. This region of stone, of undetermined geometry, is located 40 feet below one of the terrace surfaces, but still well above the base of the mound. The stones could well be an artificial structure of some sort.

This discovery challenges the current thinking about the culture that built the Cahokia complex. Only further research will reveal the extent and configuration of the stony region and where the stones may have come from.

An editorial in the March 14, 1998, *St. Louis Post-Dispatch* put the Cahokia discovery in the larger context; namely, that New World archeology is in flux. One perturbation being the assertions that humans probably occupied the Americas long before 12,000 BP, and that some of them may have been Caucasian (e.g., Kennewick Man). We now quote two incisive paragraphs from this editorial.

This burst of uncertainty surrounding the meaning of the stones beneath Monk's Mound is just the latest discovery shaking what was settled fact.

Archeological finds are even challenging the conventional wisdom about when and how the Americas were settled.

It is a humbling and thrilling reminder that in all fields of human inquiry, what we take for certain knowledge at one point in history is highly mutable, subject to continuous revision, revolution and even rejection.

Georgia (Etowah Mound). Second in size only to Monks Mound in the States, Etowah Mound is one of three mounds in northern Georgia on the northern bank of the Etowah River, near Cartersville. DeSoto and his men might well have passed this way in the early 1500s. If they did, they could hardly fail to have been impressed by the 60-foot high Etowah Mound. It is flat on top, with room for perhaps a hundred people to stand and look out over the fertile land. One of the "temple mounds," the Etowah Mound is unusual in its broad ramp, 50 feet wide, that winds around to the top. One estimate puts the mound's volume at 4,300,000 cubic feet---quite a bit less than for Monks Mound, but still a lot of dirt to haul.

The Etowah Mound site is also noted for some remarkable artifacts. In the 1880s, J. Rogan, of the U.S. Bureau of Ethnology, unearthed some strange cop-

per plaques engraved with winged human figures wearing weird headdresses and eagle masks. These had an Aztec flavor; and, of course, the flat-topped temple mounds are also reminiscent of the Mesoamerican pyramids.



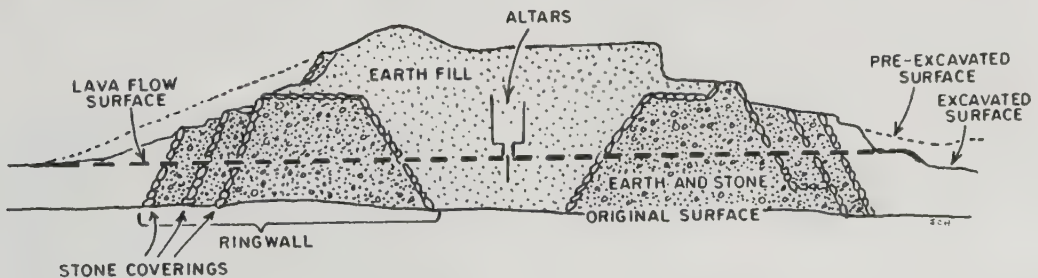
X2. Mesoamerica. Stone pyramids are scattered all over Mesoamerica. It is startling to drive along a road or walk a trail, turn a corner, and come face-to-face with a Mayan pyramid. This land also boasts some giant earthen mounds--- some resembling their lithic brethren--- but others unique and not a little mysterious.

Mexico (Cuicuilco). Just south of Mexico City a curious mound of clay, sand, and stones spawned a dating controversy in the early 1900s. The fireworks began in the 1920s when B. Cummings excavated this mound named Cuicuilco. It was immediately obvious to Cummings that this mound had been partially engulfed by a lava flow from a nearby volcano called Xitli. Quite reasonably, Cummings believed that any part of Cuicuilco covered by Xitli's lava must be older than the lava. However, geologist G.E. Hyde had asserted that this 15-mile-long tongue of black lava oozed around Cuicuilco about 7,000 years ago. This meant that at least the submerged parts of Cuicuilco had been built 2,000 years before the Great Pyramid. Cummings believed this discovery would revolutionize American archeology and he said so in several publications. (R11-R13) Indeed the 7,000-year date did fly in the face of every-

Mexico's Cuicuilco Mound is unusual in that it is circular. In this it resembles the Dis-signac cairn in Brittany (p. 256). Cuicuilco is partially covered by a lava flow. (R43)

thing else archeologists had found in the Valley of Mexico.

Since the lava itself could not be dated directly, its age had to be estimated from what could be found under this lithic blanket that is 5-to-30 feet thick. Human artifacts and, most important, carbonaceous material that could yield radiocarbon dates were needed. In 1958, R.F. Heizer and J.A. Bennyhoff published a radiocarbon date of 2422 years for carbonaceous material found under the lava. (R19) This figure was consistent with what the archeologists had already decided about the history of the region. A 1994 study by C. Cordova F. de A. et al supported this later date.



Section through the Cuicuilco Mound illustrating its complex internal structure. (Adapted from R27)

They had found a root that had been burned by the lava and carbon-dated it at 400 AD. (R45) In short, Cummings' revolution never came to pass because of the erroneous 7,000-year date he was given on the lava flow.

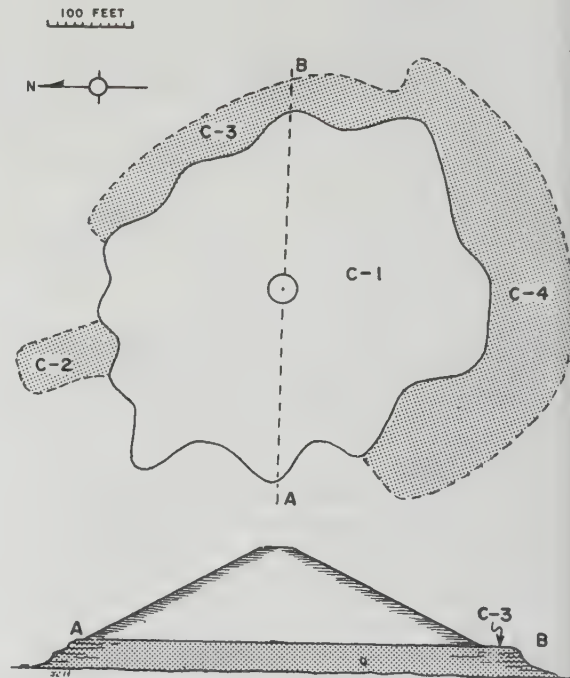
Even without the dating anomaly, Cuiculco remains interesting from an engineering standpoint. It is a stepped pyramid with a circular base about 145 meters in diameter. Its height is only about 20 meters. Apparently, it was built in stages like many other Meso-american mounds and pyramids. The builders of Cuiculco were apparently aware that such a huge mass of earth would slump under its own weight over the years, so they constructed a retaining wall of earth and stone around it and faced it with stones. The center core was then filled with earth, as shown in the cross section. (R27) It is thought that Cuiculco may have been a forerunner of the nearby pyramids at Teotihuacan. In other words, Cuiculco was a sort of dry run where new ideas were tested.

Mexico (Cholula). Also in the Valley of Mexico and, like Teotihuacan, built about the time of Christ, Cholula is one of the largest human-built structures on the planet. It is larger than the Great Pyramid in volume, but inferior to the largest Chinese earthen pyramids. But Cholula is not a masterly-crafted stone edifice like the Great Pyramid. Rather it is a mass of unbaked bricks with a core of mud and stones. But, big it is! It is a truncated pyramid about 210 feet high with a rectangular base measuring 367 by 348 feet. In active use for about 1,500 years until the arrival of the Spanish, workers occasionally added to the structure until it attained a volume just over 100 million cubic feet. The Spanish did some damage to the artificial mountain but could not remove it entirely. Instead, they made it their own by building a Catholic church on top of it. But far below, pagan influence survives in the bowels of the pyramid, where some 4 miles of tunnels thread through the mound concealing non-Christian motifs, notably, butterflies! (R27, R32, R43)

Mexico (La Venta). In what is now the state of Tabasco, the Olmecs (about 1,200-850 BC), forerunners of the Maya and Aztecs, erected a very strange pyra-

mid---at least, it's called a "pyramid." It is really an artificial hill of clay in the form of a fluted or ribbed cone 100 feet high. The purpose of the ten ribs has escaped all archeologists who have investigated this peculiar structure.

(R22) The fluted pyramid is the principal edifice in a complex that includes a small, stepped pyramid with a more conventional square base, also some mounds, platforms, and plazas.



The La Venta "fluted pyramid" is unique in its geometry. Unexamined structures lie buried beneath its clay surface. (C1, C2, C3, and C4 are platforms.)

The strange shape of La Venta's pyramid is enough of a reason to catalog it, but there is more. Magnetometer surveys have revealed the presence of a structure buried a meter or two beneath the clay. It seems to be a horizontal platform about 10 meters square, probably made of basalt, with walls running along its northern and eastern margins. (R24) Structures buried within larger structures are nothing new in

archeology, but why would the Olmecs have buried a useful platform under a mass of clay? One answer is that new rulers or priests wanted to obliterate signs of a hated religion or culture, just as the Spaniards did at Cholula!

Mexico (San Lorenzo). Before leaving the Olmec world, the immense mound at San Lorenzo must be mentioned. It is about 100 feet high---impressive, but only part of the story. This mound is an amazing 4,000 feet long and 2,000 feet wide! (R42)

X3. South America

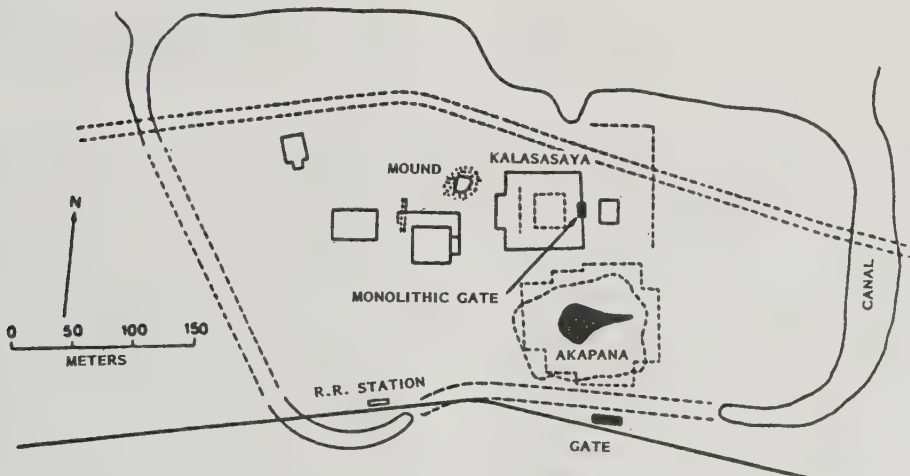
Ecuador (El Panecillo). Within the city limits of Quito rises a stange hill about 600 feet high. It is called "El Panecillo" or "the roll," because it is shaped like an Ecuadorian breakfast roll. The hill is so large that its contours are best seen from an airplane. On top of El Panecillo is a beehive-shaped building with a hole in the top called "La Olla" ("the kettle"). This curious structure was apparently in place when the Incas took over around 1,200 AD. On the doorway's arch a sun symbol is carved. The arch, incidentally, is a true arch with a keystone---very unusual in pre-

Columbian America.

So far, this small hill with its enigmatic building on top, a favorite place to visit for locals and tourists alike, hardly seems a candidate for this section. The potential anomaly is in the hill's structure. It could be artificial. Thus, a little natural hill would become a big artificial mound. Road cuts and drilling have found no stratification. As far as it has been plumbed, El Panecillo is made of a fine, yellow-brown earth and a few stones. This is suspicious geology high in the Andes. Unfortunately, the only information we have on El Panecillo comes from two popular, controversial books. (R25, R39) None of our professional-level archeology texts even mentions El Panecillo.

El Panecillo could be partially artificial with a large natural core. It might be better classified with the sculptured natural hills found in South America and Oceania. (MSE7)

Bolivia (Akapana). Farther south, at 12,000 feet, near the shores of Lake Titicaca, archeologists have no doubts about a huge structure called "the Akapana." It is the most prominent feature of the ancient city of Tiahuanaco. The Akapana is definitely artificial. It is also surrounded by an aura of mystery. These additional perplexities are conveyed, first, by an old, popular account



Some 200 feet high, the artificial hill called the Akapana dominates Tiahuanaco high in the Bolivian Andes.

of Tiahuanaco by A.H. Verrill, always the romantic writer, and, second, and more recently, by K.A. Bruhns, a professional anthropologist.

Nearest to the railway, and most prominent of all, is the so-called fortress or Akapana, a pyramidal hill of artificial origin that rises to nearly two hundred feet above the fairly level plain. It is accurately placed so that its four sides are in line with the cardinal points of the compass, and at the base measures about seven hundred by five hundred feet. Originally, no doubt, its sides were completely faced with cut stones like the pyramids of the Mayas and the Teocalli of the Aztecs. But few of these blocks remain, the greater portion having been broken up for use on the railway. Once, too, a significant stone stairway led to the summit of the hill where there was an immense basin, apparently for holding water, and, from this, a conduit or pipeline of beautifully cut stone troughs led down the pyramid. Why the ancient Tiahuanacans should have devoted such an immense amount of labor and time to erecting this great mound merely to place a basin at its summit, or why, once they had done so, they should have installed a drain, are unsolved mysteries. Assuredly it had some important and definite purpose. Possibly it was a sort of reservoir to be drawn upon in time of drought or necessity; but in that case the question of how water was conveyed to the summit is as great a mystery as the pyramid itself. (R15)

Nearly 70 years later, the Akapana still puzzles those who explore this stone-littered hill and follow the well-worn path to its top past the finely-crafted retaining walls and drain. Bruhns writes:

Somewhat later was the construction of the Akapana, an artificial platform so large that even specialists in highland Andean archaeology have referred to it as a natural hill. Originally it seems to have been a seven-stepped rectangular platform with a wide projection on its east side. The sides were faced with stone and there were a number of buildings on its top. The Akapana apparently had some symbolic association with the mountains to the

south of Tiahuanaco, perhaps as an artificial sacred mountain. The top and upper terraces were covered with water-worn green gravel brought from these mountains. Within the platform itself was a cut-stone drain which could be activated to let water rush along the steps of the pyramid. This building is truly unique in South America and the meaning of its elaborate water works and highly unusual form is only now being unraveled. (R44)

At the Akapana we see archeologists removing a thick veneer of dirt from buried structures. What would they find if they stripped the dirt from El Panecillo, the fluted "pyramid" La Venta, and other Mesoamerican mounds? Why were these New World cultures always burying older structures or building anew atop them?

X4. Europe

Britain (Silbury Hill). Silbury Hill is the largest human-built mound in Europe. It is located in central England, 5 miles west of Marlborough, and just about 1 mile south of the great stone circles and majestic avenues at Avebury. (R35)

Silbury Hill is not merely an immense, earth-covered burial site or barrow. In fact, no burials have ever been found there despite much tunneling. But it is not just a disorganized pile of dirt either, as E. Hadingham relates.

Silbury is in fact a huge mound, 130 feet high, founded on a natural chalk spur and built up with nearly nine million cubic feet of rubble. The mound was not crudely heaped up from the centre like a modern industrial tip, but was carefully engineered in a series of stepped horizontal layers created by concentric rings of chalk blocks. Three phases of construction have been identified, when work was twice renewed on a yet-more-ambitious scale. The precise connection with Avebury has not been established, although the carbon date for Silbury's first phase of about 2600 BC may well place it as contemporary with the first construction stages at Avebury, and this possibility is a



Externally, Silbury Hill appears to be merely an immense pile of dirt, but this is deceiving. Built about 2,600 B.C., it is 130 feet high. (Janet & Colin Bord, Fortean Picture Library)

striking indication of the labour resources available in early southern Britain. (R30)

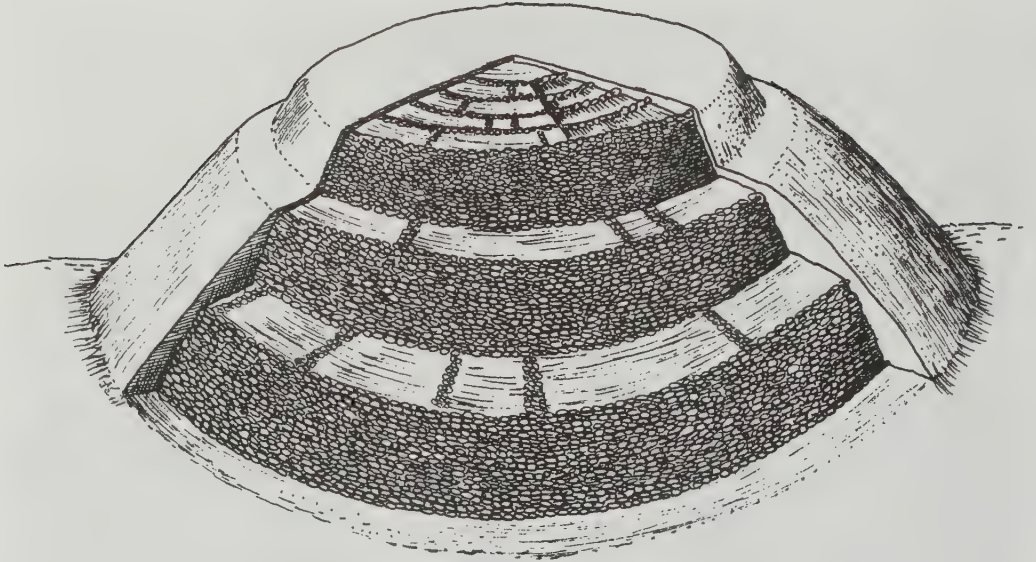
Conservatively, Silbury Hill required about 18 million man hours of digging earth, carving out obdurate chalk blocks, and transporting both to the site. As in the cases of the Akapana, El Panecillo, Monks Mound, and other artificial hills, a large flat space, 100 feet across, was provided on the top of Silbury. We can only wonder about the rites, ceremonies, and other functions these huge, flat-topped, carefully-engineered mounds supported. They must have been vital to the culture for it to invest all that time and labor.

France (Tumulus Saint Michel). Just across the Channel from Britain, in Brittany, another large mound commands a great megalithic complex. This is the Tumulus Saint Michel, which is smaller

but somehow reminiscent of Silbury Hill. Unlike Silbury, Saint Michel is definitely a burial site, for it conceals small chambers and other structures. (See sketch.)

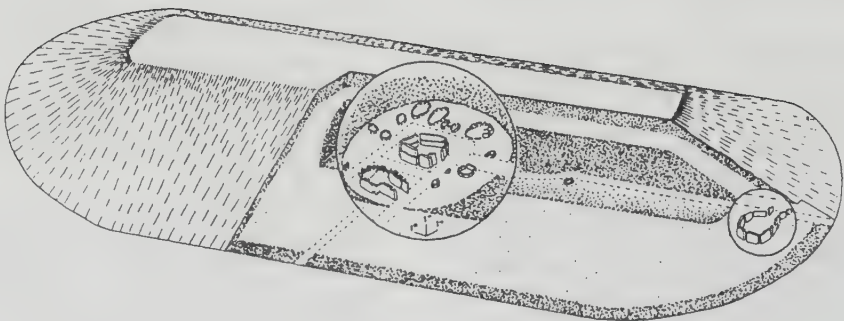
Tumulus Saint Michel is on the northeastern edge of the modern town of Carnac, but it is still a key feature of the surrounding megalith complex. From its top, the famous stone alignments of Kerlescan, Kermario, and Menec are clearly visible.

Today, Saint Michel is only about 40 feet high. Millennia ago it was much higher. The Romans leveled it to build one of their temples. We can only guess that its original top was flat and that people assembled there for ceremonies or other purposes. The graves around the site are dated earlier than 4,000 BC ---1,300 years before Britons started digging soil and chalk for Silbury. In fact, Tumulus Saint Michel could even be older than its burials, and it may have been built for different purposes. (R5,



Internally, Silbury Hill is a layered structure reinforced by concentric rings of chalk blocks. (Adapted from R42)

R38, R40)



Tumulus Saint Michel has been eroded by time and, especially, the Romans. It is only 40 feet high today. Burial chambers and other structures are contained within. (R40)

X5. Asia Minor. In the millennium prior to Christ, powerful rulers in what is now Turkey had truly immense burial mounds built over their graves. Little mystery is associated with these mounds, but their sizes demand that they receive some recognition here.

The first is the Tomb of Alyattes, which J. Fergusson ably described over a century ago.

Outside Egypt the oldest tumulus we know of, with an absolutely authentic date, is that which Alyattes, the father of Croesus, king of Lydia, erected for his own resting-place before the year 561 B.C. It was described by Herodotus, and has of late years been thoroughly explored by Dr. Olfers. Its dimensions are very considerable, and very nearly those given by the father of history. It is 1180 feet in diameter, or about twice as much as Silbury Hill, and 200 feet in height, as against 130 of that boasted monument. The upper part, like many of our own mounds, is composed of alternate layers of clay, loam, and a kind of rubble concrete. These support a mass of brickwork, surmounted by a platform of masonry; on this still lies one of Steles, described by Herodotus, and another of the smaller ones found close by. (R4)

A second great mound lies 100 kilometers southwest of Ankara. Dated at

about 718 BC, Midas Mound is 175 feet high. A wealthy man (unnamed by our reference) is buried there, thus the name given to the mound. (R49)

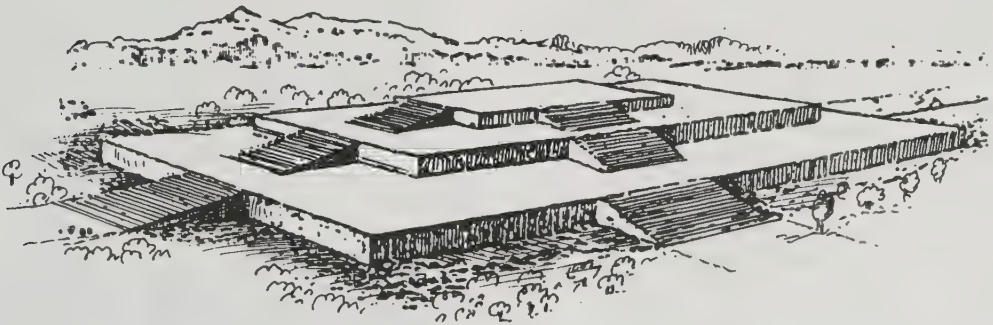
X6. Asia

China. Some of the world's largest mounds are virtually unknown to Western scientists because of the difficulties of doing archeological research in China. Like the New World's temple mounds, the Chinese structures are terraced, with flat tops, and are basically earthen mounds, sometimes faced with stones. The Chinese mounds were often built with steps up the pyramidal faces, making them look eerily like the Mayan and Aztec stone pyramids. This similarity, in fact, is one of the arguments diffusionists use in their claims of anomalous Asiatic influences in Mesoamerica.

Usually, the Chinese mounds are burial sites, and their interiors include elaborate rooms and grave goods.

A few paragraphs penned by R.A. Jairazbhoy are the closest we have found to a country-wide survey of giant earthen tombs in China.

Here briefly is what is known about this category of structures in China. Among the earliest surviving is the sacrificial altar of Chou, date circa 700-500 B.C., at Yang.tzu-shan in



The Chinese pyramids are basically huge, terraced earthen mounds. This one in Szechwan bears a striking resemblance to Mesoamerican pyramids. (Adapted from R28)

Szechwan. The three terraced platforms measure successively about 103, 67, and 31 meters on a side. Further pyramidal mounds with truncated tops of the Chou period are to be found in central Shensi near Hsien-yang. Some are 250 metres square, and some barely 4-5 metres, and they are described as princely graves. Then again there is the triple terraced platform at the Chou city of Hou-ma-Chen. It had a ramp on the south side, and the base of a structure at the top.

.....

The greatest example of course is the tomb of the Ch'in Emperor or Shih Huang-ti about 30 kilometres east of Sian-fu. The baseline of the pyramid is 340 metres square (as against the 226.5 of the Giza Pyramid of Cheops, and the 225 of Teotihuacan. Ssu-ma Ch'ien says it was begun in 217 B.C., and 70,000 soldiers were employed on it. He described the room with jewels, the automatic protection devices and symbolic representations, and refers to workmen and the emperor's wives being buried with him. (R28)

The tomb mentioned last by Jairazbhoy deserves more attention. It is often mentioned in books and articles (usually with various spellings), because it was near this tomb that workers digging a well in 1974 discovered a large, filled-in trench occupied by an "army" of about 6,000 terra cotta soldiers. (R41)

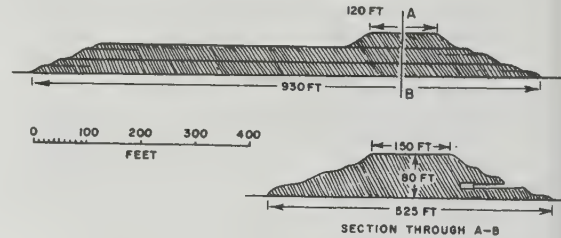
E.C. Krupp provides further details (and another spelling) in his Echoes of the Ancient Skies, referring to this tomb as an artificial "mountain." (R41)

Another significant datum is provided by P. Ferryn in Kadath (with still another spelling of the emperor's name). He puts the pyramid's volume at 1,960,000 cubic meters or about 70 million cubic feet. (R31)

Japan. In Japan, we find pyramidal earthen mounds very similar to those in China.

A particular form of grave is represented by the imperial graves of the dolmen period. They would be more appropriately termed princely graves, since they do not occur only in central Japan, where the Emperor always lived, but also in all the districts

where dolmens abound, and which must be considered as the seats of great feudal princes. These graves are often only a kind of unusually large dolmen mound, yet they are prominent not only by their often enormous dimensions, but they have other peculiarities. In contrast to the position of the dolmens on hills, these graves lie principally on plains. They are double mounds of characteristic form, consisting of a trapezoidal mound flat on top and often terraced, joined to a higher circular one likewise flat on top. Around the whole structure runs a large ditch or moat. The orientation of the long dimension is east and west. (R9)



The Japanese imperial graves resemble Chinese pyramids. (R9)

The dimensions on the accompanying figure confirm the huge sizes of the imperial graves. It is difficult to estimate the volume of the pictured mound, but it is certainly in the tens of millions of cubic feet. The presence of moats is intriguing because Stonehenge, Avebury, and many other British stone circles are encircled by ditches; i.e., "hengens."

X7. Oceania. The final leg of our round-the-world tour of large, earthen mounds crosses the wide Pacific. There, on many Polynesian isles, are unexpectedly large earthen mounds that we must attend to. We will not to detail here the even more fantastic sculptured natural hills located farther to the north in Micronesia, reserving them instead for MSE7.

Samoa. The ancient inhabitants of the romantic islands of Samoa must have had a special fondness for mounds, for they built many of them in several varieties. Most unusual from a geometrical perspective are the star-shaped mounds found, especially, on Savai'i and Upolu. Built up out of earth and stone blocks, they do not challenge the immense temple mounds described above in the matter of size. Actually, we have no precise measurements but, from the accompanying sketch, they look to be just a few feet in height. Nevertheless, they are sufficiently curious to mention here. (R37)



A star-shaped mound on Savai'i, Samoa.
(Redrawn from R37)

A much larger Samoan mound with more conventional geometry has been mentioned by P. Bellwood.

One of the most splendid mound groups in Samoa is to be found in the district of Palauli in southeastern Savai'i, centered on a huge flat-topped mound of stone blocks known as the Pulemelei. This covers 60 by 50 metres at the base, and rises 12 metres in height. At either end is a slightly sunken ramp to the top, together with a pavement, and numerous other platforms, roads and stone walls surround it as would befit a major ceremonial centre. On top of the Pulemelei are postholes and an oval of small stone cairns, but the function of the mound is uncertain. However, one might expect that major communal structures, particularly a



The Pulemelei mound on Savai'i, Samoa.
(Redrawn from R37)

large community house, may once have stood on top. The Pulemelei, as it stands today, is probably the largest surviving man-made mound in Polynesia. (R37)

It is not clear from Bellwood's words whether the Pulemelei is primarily made from earth or stones.

On the island of Upolu, about 3 miles east of the township of Apia lies the Vallale plantation. Here, amid rows of planted palms, is another ceremonial center consisting of immense earthen mounds, seven of which are truncated, rectangular pyramids so common elsewhere in the world. The largest of these surpasses the Pulemelei, on Savai'i, in the matter of size. At least it did at one time, for it may well have been leveled by now. Our report on this structure dates from 1944 and was penned by J.D. Freeman.

The largest and most important of the rectangular mounds is known as Laupule, and is truly an immense structure. It stands upon a narrow neck of land between the Tausala and Vaivase streams---the Tausala stream lying to the east and the Vaivase to the west. The mound occupies almost all the existing flat space. Each of the streams has eroded its bed until they are now about 150 feet below the level of the surrounding country, and thus the ground falls away steeply on either side of the mound. The

dimensions of the mound at its base are 346 feet by 314 feet. The height is approximately 40 feet. The sides of the mound are carefully and regularly graded, and the well-formed corners, despite their age, are still in a good state of preservation. The mound would seem to be composed entirely of earth; at least no other material is observable, even at the northeastern corner where a section has been exposed in the course of road construction. (R18)

Tonga. Deep in the South Pacific, just east of Fiji, on the islands of Tonga, native peoples scraped large mounds of earth for what seems to be a frivolous purpose: pigeon-snaring. These were not the huge piles of earth that dominate this catalog section, but their story is an engaging one.

First, bear in mind that carnivory on these romantic Pacific islands was difficult because large game animals were nonexistent. Captured enemies helped solve the protein problem, but pigeons were much more common, and some species were good-sized and delicious. So much so that eventually only island royalty was allowed to catch and eat them. Pigeon poachers were whipped or executed (and maybe eaten?) In fact, pigeon snaring became a royal sport. To this end, starting at least a thousand years ago, the king's loyal subjects grubbed up the thin island soil and piled it up into high mounds.

Tonga's pigeon-snaring mounds did not compete with Monk's Mound sizewise, being at most 115 feet in diameter and perhaps 15 feet high. But that's still a lot of dirt. On the tops of the mounds were smaller, beehive-shaped mounds with vertical slits in them large enough to conceal a human. From these blinds, the king and princes would swing nets on the ends of 12-foot poles to catch pigeons.

Of course, no self-respecting wild pigeon would ever fly over such a suspicious hill without some enticements. So, captive pigeons caged on the mound were set to cooing and other pigeons tethered by long strings were launched. Sure enough, wild pigeons were lured close enough to be snared. (R48)

Caroline Islands. A brief item from a 1905 number of the American Antiquarian introduces us to a large, unusually



A 1793 sketch of a pigeon-snaring mound on Tongatapu. The pigeon snarers hid in slits in the small, beehive-shaped mounds on top of the main mound. (R48)

shaped mound on an unnamed island in this group.

Giant Grave in the Caroline Islands.

This is a mound or barrow about ten feet high, twenty feet broad, and a quarter of a mile long. The name Kona occurs in Hawaiian and Peruvian as the name of a giant. The local tradition is that a giant is buried here, with the body on land and the legs stretching seaward to the island of Capan, near the edge of the lagoon. A Spanish historian, Perreiro, sets the mound down as a wall for defense. (R8)

Hawaii. At a remote corner of the Polynesian Triangle, Hawaii is better known for vacations, pineapples, and surfing rather than large earthen mounds. But from an old, obscure, and possibly inaccurate book, we read of the Hill of Kukii, located some 30 miles inland from Hilo.

The hill is so regular in its outline that it appears like a work of art, a giant effort of the Mound-Builders. Its general form resembles very much the pyramid of Cholula in Mexico, and from this fact I felt a great interest in climbing it. We proceeded, Conway, Eldhardt, Kaiser, and I, on foot up the grassy slope of the hill. There was an absence of all volcanic matter; no stone on the hill except

what had been brought there by the hand of man. As we arrived near the summit we came upon great square blocks of hewn stones overgrown by shrubbery, and on reaching the summit we found that it had been leveled and squared according to the cardinal points, and paved. We found two square blocks of hewn stone imbedded in the earth in an upright position, some fifteen feet apart, and ranging exactly east and west. Over the platform was rank grass, and a grove of coconuts some hundred years old. Examining farther, I found that the upper part of the hill had been terraced; the terraces near the summit could be distinctly traced, and they had evidently been faced with hewn stone. The stone were in perfect squares of not less than three feet in diameter, many of them of much greater size. They were composed of a dark vitreous basalt, the most durable of all stone.

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By whom and when this hill was terraced and these stones hewn? There is a mystery hanging around this hill which exists nowhere else in the Sandwich Islands. (R3)

Other points made in the text but not reproduced above: (1) The distance from the base of the hill to the first terrace was nearly 300 feet; (2) A stone stairway up the side of the mound was seen; and (3) The natives testified that the mound was not used within their memory and that a similar mound could be found on Kona.

There is no way to tell if this is an artificial mound or sculpted natural hill. (MSE7) What is surprising is the fact that we do not find this remarkable mound mentioned elsewhere in our "mound" files!

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MSM6 Lines and Arrays of Earthen Mounds

Description. Large numbers of earthen mounds arranged in long lines or large geometrical arrays. Like the stone rows and cairn lines, lines of mounds may be straight or sinuous. The only mound array we have found is rectilinear, but in principle circular, hexagonal, and other array geometries would fit here.

Data Evaluation. Earthen-mound lines and arrays appear to be very rare. We have only a newspaper account of a long line of hybrid stone-earth mounds in North America that could just as easily be cataloged with the cairn lines (MSM4). Our file on mound arrays contains only one account (from South America) that is woefully short on detail, although it does come from a respected journal. Rating: 3.

Anomaly Evaluation. Long lines of earthen mounds were probably laid out for ceremonial purposes, just as were the cairn lines and stone rows. This explanation is reasonable, and there is nothing mysterious here. The great length of our only lone example, though, is impressive; but it nevertheless presents little engineering challenge.

Some mound arrays could well have natural origins. Mima mounds, for example, when closely packed tend to assume a hexagonal geometry. Mound arrays could also have a prosaic origin in human agricultural schemes, as in raised-field agriculture. A third possibility is that mound arrays were designed for ritual use, like some of the stone mazes.

As intriguing as mound lines and arrays may be, they are probably not anomalous---at least the ones we have come across are not. Rating: 3.

Possible Explanations. See above discussion.

Similar and Related Phenomena. Watson Brake mounds (MSM7-X2); stone rows (MSH1, MSH2); stone mazes (MSH5); Mima mounds (ETM1 in Carolina Bays, Mima Mounds); irrigation works (MSC5).

Entries

X0. Introduction. Notices of lines and arrays of earthen mounds have been elusive quarries in our literature searches. We have found only two qualifying examples; one in North America; another in South America.

Of course, disorderly fields of mounds abound. Some are apparently the product of industrious rodents; i.e., the controversial Mima Mounds seen in the untold thousands in North America and elsewhere. (ETM1 in Carolina Bays, Mima Mounds) Then there are the artificial mounds produced by raised-field agriculture. Finally, burial mounds (barrows) are numerous and widespread. The island of Bahrain, in the Persian Gulf, for example, is strewn with over 50,000 burial mounds or tumuli. (R2)

Here, though, we confine our attention to human-raised earthen mounds arranged in lines or rectilinear arrays---

and these are very rare.

X1. North America.

California. The town of Tecopa is situated just south of Death Valley. There, archeologists have been intrigued by a small maze of evenly-spaced rows of stones that were evidently heaped up by the same people who made the much larger circular maze described in MSH5-X2. This smaller Tecopa maze is the terminus of a long line of strange hybrid mounds, half-stone, half-sand. In 1977, a Placerville, California, newspaper printed an amazing aerial photograph of these mounds and the smaller maze just mentioned. The following text accompanied the photo.

The mystery is as intriguing as the evenly spaced, four to 15 feet apart, four-foot diameter mounds stretching for 10 square miles across the desert leading to a smaller, even-rowed maze near Tecopa, below Death Valley.

This phenomenon was also produced by scooping up rocks, but instead of being laid in long rows, the rocks were piled into perfect round mounds jutting above the smooth circles of hard-packed sand. The symmetry and engineering are unbelievable. How could the circles have been made so perfect without instruments? How could the long sequences of mounds be lined up so evenly, as far as the eye can see, in spite of the uneven terrain. (R3)

Logically, these lines of mounds could also have classified with the cairn lines. (MSM4) The Tecopa maze mentioned above is figured in MSH5-X2.

X2. South America.

Argentina.

An interesting explanation of certain curious mounds in the Lerma Valley of northwestern Argentina is advanced by Eric von Rosen in Ymer (Vol. 44, 1924, pp. 181-191). The mounds are at a place called Pucara (= fortress)

a few miles north of Rosario de Lerma. They are circular, barely half a meter high, 2.6-2.7 meters in diameter, and surrounded with a single or double ring of stones. One group includes over a thousand mounds arranged symmetrically in rows. Nearby are ancient dwelling sites. Excavation shows that the mounds were not used for burial purposes. In Boman's opinion (Antiquités de la Région Andine) they were for ceremonial usage. From their resemblance to certain mounds in central Africa it is, however, suggested that they may have been used in agriculture. (R1)

If the mounds were used in agriculture, why the single and double rings of stone? These features recall the Clava ringed cairns in Scotland. (MSM3)

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MSM7 Enigmatic Mound Complexes

Description. Very large, very early, city-like groupings of mounds, embankments, and other earthen structures, some of which were built by cultures of unknown origin for purposes poorly understood. The mound complexes singled out for special attention are those at Poverty Point and Watson Brake, both in Louisiana. Two later complexes at Newark and Portsmouth are mentioned because of their unusual configurations and the radical explanations offered for them.

Data Evaluation. Poverty Point and Watson Brake have received considerable attention from archeologists in recent years because of their sizes and antiquities ---they predate the works of the Moundbuilders by millennia. Poverty Point is especially well researched; Watson Brake is less so because it has only been recently recognized as a major archeological puzzle. Rating: 2.

Anomaly Evaluation. Poverty Point and Watson Brake cultures not only differ from each other in important ways but also from the that of the more recent Moundbuilders (Adena, Hopewell, etc.). All three cultures are also separated from each other by millennia. In fact, Poverty Point and Watson Brake reveal our ignorance of early human history in North America. We have little hint of where the builders of these remarkable mound complexes came from, or even where they dispersed to after their cultures collapsed. Even the purposes of the mounds themselves are unresolved, as are the reasons for their unusual geometries. Rating: 1.

Possible Explanations. None offered.

Similar and Related Phenomena. Notable earthen mounds (MSM5); earthen hilltop forts (MSB in another volume); long earthen embankments (MSW1).

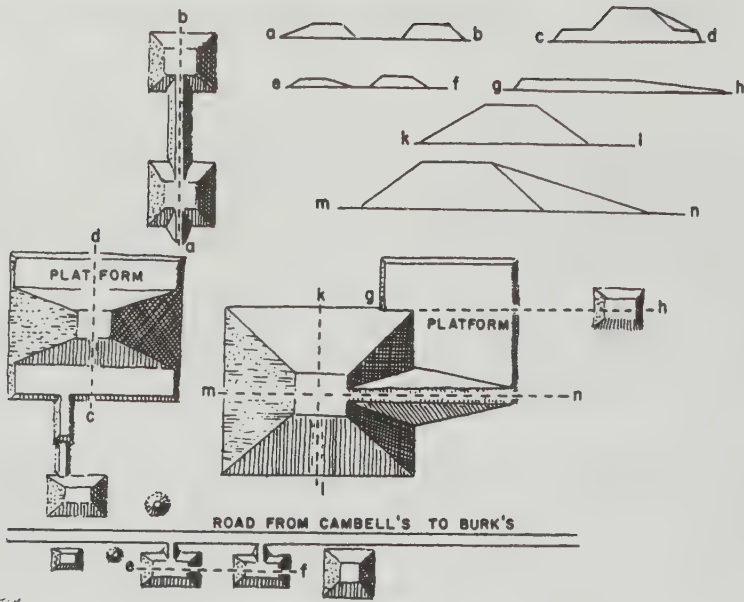
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X0. Background. The mound complexes that dotted the Mississippi Valley around 1,000 A.D. were large, city-like assemblages of earthen enclosures, temple mounds, burial mounds, watch towers, dwellings, and wooden structures of various sorts. In short, they were urban centers as surely any modern city, but without the concrete, steel, and traffic lights. The names Cahokia, Newark, Portsmouth, and Ocmulgee head the list of these bustling centers of trade and agriculture. Cahokia, in Illinois, was exceeded in population only by Constantinople and Seville. With up to 30,000 to 40,000 citizens, it was larger than London and Paris at that time.

Located at the confluence of the Mississippi, Missouri, and Ohio rivers, Cahokia, dominated by Monks Mound (MSM5), controlled the 125 square miles of the so-called American Bottom. But, as E.C. Krupp has observed, Cahokia's influence extended much farther.

Within its "city limits" over 100 mounds were built. The mounds did not stop at the edge of town, however, for Cahokia extended throughout American Bottom. It included at least 5 major satellite communities and numerous smaller villages and hamlets. Cahokia controlled both its local resources and the trade in exotic materials from other parts of North America so well its influence extended over a million square miles. (R8)

In her book The Land of Prehistory, A.B. Kehoe included a chapter entitled: "Cahokia: Hidden in Plain Sight." She wrote how early American settlers and historians alike, intoxicated by the "manifest destiny" of the new nation, almost completely overlooked the remains of the impressive civilizations that had preceded them. (R20) Today, of course, the accomplishments of the Moundbuilders and their contemporaries are better appreciated and the subject of many



The mound complex at Seltzertown, Mississippi.

books and papers. (R2, R5, R8, R13, R20)

We will not add to this already considerable literature but rather search for anomalies.

First, an anomalist must ask whether Cahokia and the many other mound complexes built by the Moundbuilders really present modern archeologists and anthropologists with any significant puzzles. As is our custom in this volume, we do not consider size to be necessarily anomalous. Cahokia was large for its time but was well within the engineering talents and societal capacities of the Moundbuilders. To be considered in this catalog, there must be unsolved puzzles or at least some engaging curiosities.

Happily, it turns out that Cahokia and its sister mound complexes were preceded by much older and much more mysterious mound complexes. The Louisiana sites at Poverty Point and Watson Brake provide us with more enigmas than an anomalist could wish for! In addition, even the ostensibly mundane Moundbuilder complexes at Newark and Portsmouth harbor minor curiosities worth noting.

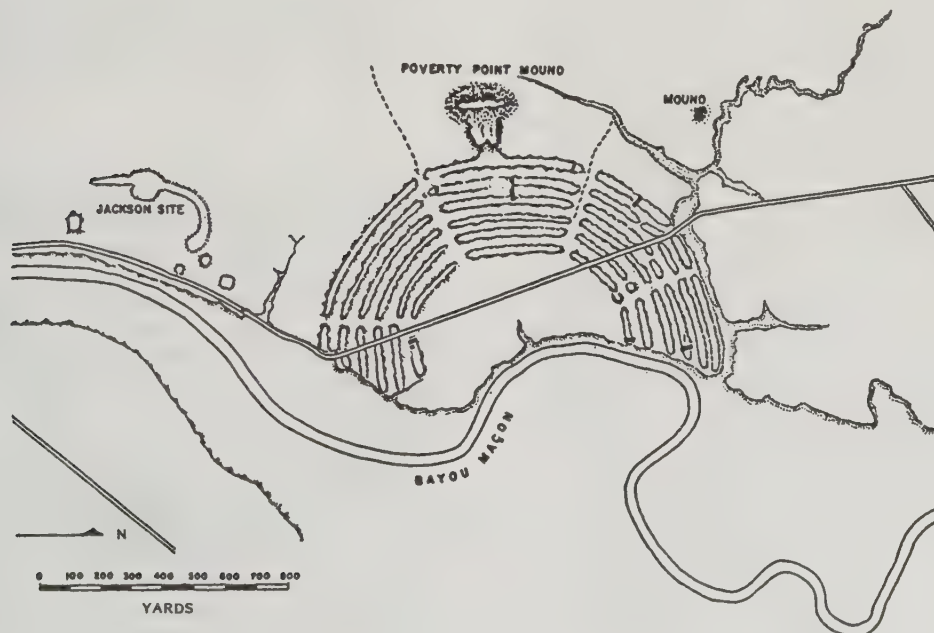
X1. Poverty Point (Louisiana). At Bayou Macon, on the Arkansas River, just 15 miles west of the Mississippi River, lies Poverty Point, without question one of the most puzzling archeological sites in North America. Poverty Point is isolated in time because it flourished between 1,200 and 800 B.C., some 2,000 years before Cahokia farther up the Mississippi, and 1,900 years after Watson Brake, another mysterious site in northern Louisiana. Poverty Point is also a cultural anomaly because its artifacts---there are millions of them---are completely unrelated to the later Moundbuilder cultures up river. And while there are hints of an Olmec influence in some of the Poverty Point artifacts, the connection is very tenuous. It is true that the Olmec culture was contemporaneous with Poverty Point, but it was centered a couple thousand miles away in southern Mexico; and there seems to be no artifact trail connecting the two cultures. Basically, we do not know where the Poverty Point people came from, where they went when their culture suddenly collapsed about 500 B.C., and why they labored so hard to construct their enormous annular mounds.

Describing Poverty Point requires many superlatives. These earthworks on the Arkansas River are the largest and most complex of all North America's geometrical mound complexes, including those of the Moundbuilders. (R4) The six concentric earthen rings at Poverty Point have an outer diameter of 3/4 of a mile. As the illustration shows, the rings are incomplete. It is assumed that the Arkansas River swept part of them away when it changed its course about 400 B.C. When they were complete, the combined length of the rings was about 11 miles. Even though the rings were only 5-10 feet high, their total volume was about 14 million cubic feet or 35 times that of the Great Pyramid. (R4) The Poverty Point engineers also built a giant earthen mound that was second only to Cahokia's Monks Mound. This mound, designated as Mound A, was about 70 feet high. About a mile to the north, Motley Mound is about 20 feet shorter. The two mounds and six huge rings represent an immense labor. Trenches dug through them indicate that they were built quickly and systematically---not spasmodically over centuries,

like so many other mounds and cairns. (R10)

Despite Poverty Point's size and unusual geometry, the site's importance was not realized until the 1950s. Mound A and Motley Mound had been noted in the Smithsonian's Annual Report for 1872, but the six overgrown rings remained hidden under vegetation until aerial mapping surveys discerned them in 1952. (R6)

The Poverty Point people certainly did not try to conceal their society from future archeologists. Besides the mounds, Poverty-Point artifacts overflow the museum trays. Over 100,000 baked-clay "balls" have been recovered, and there are doubtless millions still buried around the complex. Officially called "Poverty-Point Objects," the "balls" were probably used in cooking. Stones normally used for that purpose are very scarce in the region. The usual pottery shards are virtually nonexistent at Poverty Point, attesting to the site's antiquity. Instead, soapstone was imported from North Carolina and carved into bowls and other objects. (R4) Neither did the Poverty-Point people have bows and arrows.



The Poverty Point site, Louisiana, is the largest and most complex set of ancient earthworks in North America. The lower portion was washed away in a flood. (Adapted from R6)



Some of the curious fired-clay lumps called "Poverty Point objects." (R7)

Rather, they used spears, atlatls, and bolas. Yet, some 30,000 "microflints" ---tiny pieces of worked flint and chert ---have been dug up. Their use is controversial. Burials, so typical of the later Moundbuilders, are also practically nonexistent at Poverty Point. Perhaps cremation was the favored method of disposal or the warm, wet environment precluded lengthy preservation.

Originally, Poverty Point was thought to stand in geographical isolation, but now over 100 smaller, but related sites are known, mainly to the north along the great rivers of mid-America. Of these satellite complexes, Jaketown was the largest. In actuality, Poverty Point was the hub of a far-flung trading network encompassing almost one-third of North America and extending all the way to the Great Lakes. (R10) One trade route had to cross American Bottom, but a millennium later the Moundbuilders possessed no artifacts resembling those from Poverty-Point. The cultural connection was about zero.

This brief sketch demonstrates that Poverty Point was, 3,000 years ago, a dominant culture in North America. In addition to the plethora of artifacts and geometrical mounds, this culture left behind many unanswered questions. Here are a few of them.

- Why did the Poverty-Point culture suddenly collapse? (R7)

- Where did the Poverty-Point people go? Nothing found at American Bottom remotely reminds one of Poverty Point. (R13)

- How did the people at Bayou Macon live? There is little evidence of dwellings or agriculture of any sort. (R12)

- Why was Poverty Point a trading hub? Resources are scarce in the area. Its inhabitants had nothing of local origin to trade. (R12)

- How was the great mound-building effort sustained? The Poverty-Point people were apparently hunters and gatherers. Signs of agriculture and the other necessary infrastructure needed to sustain a big mound-building program have not been found. (R11)

- Where did the Poverty-Point people come from? There are Mexican overtones, but a 2,000-mile artifact gap exists. (R11)

- What was the purpose of the large geometrical mounds? Remains of cooking fires exist along the tops, but there are no remains of dwellings anywhere.

X2. Watson Brake (Louisiana). Just 65 miles from Poverty Point, 15 miles southwest of Monroe, archeologists have found additional enigmatic mounds at a place called Watson Brake---and they apparently predate Poverty Point by an astounding 1,900 years. Watson Brake is apparently the oldest mound complex in North America; and we are only now learning about it!

As frequently is the case, the local residents have known about the mounds for years, but archeologists weren't attracted to them until clear-cutting of the trees in the 1970s made the size and novelty of Watson Brake all too obvious.

Just how anomalous is Watson Brake? Archeologist V. Steponaitis, from the University of North Carolina, opined:

It's rare that archaeologists ever find something that so totally changes our picture of what happened in the

past, as is true for this case.

On what does Steponaitis base such a powerful statement?

(1) Watson Brake is dated at 3,000-3,400 B.C.---some three millennia before the well-known Moundbuilders started piling up earthen structures from the Mississippi Valley to New York State. In other words, the site is anomalously early according to the archeologists' calendar for the establishment of sophisticated cultural centers in North America.

(2) Indications are that Watson Brake was built by hunter-gatherers, but no one really knows much about them; there's an aura of mystery here. Where did they come from and go to? Watson Brake culture is completely disconnected from that of Poverty Point, despite their closeness.

(3) Watson Brake consists of 11 mounds---some as high as a two-story house---connected by a peculiar circular ridge 280 meters in diameter. The back-breaking labor required to collect and pile up all this dirt is incompatible with the life style of mobile bands of hunter-gatherers. The same puzzle appears at Poverty Point.



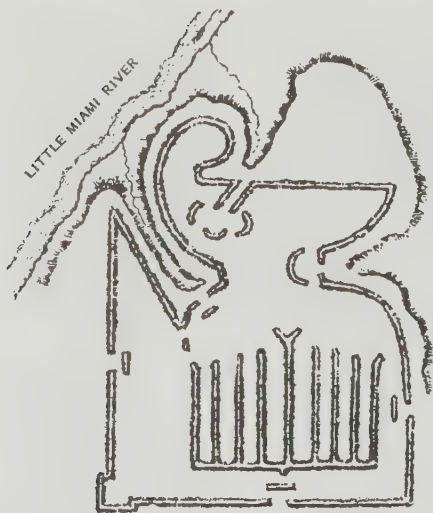
The mysterious ring of mounds at Watson Brake, Louisiana. These mounds may be 5,000 years old. (Smithsonian Institution)

(4) The purpose of the Watson Brake complex escapes us. Why the mounds? Why the circular ridge? As with Poverty Point, no burials have been found. Can we just shrug it off as a "ritual site"? Perhaps not, because no ceremonial objects have been unearthed. Since all artifacts found at the site are of local origin, Watson Brake does not appear to be a trading hub like Poverty Point. Little evidence has been found to indicate that the builders of the mounds permanently inhabited the area. (R15-R18)

The people who built Watson Brake pose many of the same questions we listed for the Poverty Point people. However, the two cultures do not seem to be associated in any obvious way. Their artifacts are very different, and they are separated by almost two millennia.

X3. The "Hanukkah Mound" (Ohio). In their classic Monuments of the Mississippi Valley, E.G. Squier and E.H. Davis figured a remarkable mound complex displaying a highly improbable geometry called the East Fork Works. This complex was located about 20 miles above Milford, Ohio. (R1) The East Fork Works disappeared long ago under the plow, so we cannot confirm directly today the truth of Squier-and-Davis' drawing. Neither could C. Thomas, of the Bureau of Ethnology, when he summarily dismissed the complex in 1894 as mostly fictitious. However, J.H. McCulloch has recently countered Thomas' assertion with two older maps that show the contested site, one of which Squier and Davis used to develop their Plate 34, Panel 2B. McCullough wrote:

Cyrus Thomas to the contrary notwithstanding, there is no reason to question the one-time existence of the East Fort earthworks as depicted by Squier and Davis, somewhere on or near the East Fork of the Little Miami, about 20 miles above its mouth. Their diagram is ultimately based on an 1823 U.S. Army Corps of Engineers map by Maj. Isaac Roberdeau that is still on file in the National Archives, and which is corroborated by a much earlier survey by William



The curious "Hanukkah" mound on the East Fork of the Little Miami. (Plate 34, panel 2B from R1)

Lytle of Cincinnati, published in 1811 by Hugh Williamson. (R14)

The complexity and peculiar configuration of the East Fork Works are almost reason enough to catalog them, but there is in addition something strangely familiar about part of the complex. D. Berry has pointed out what this is; and his observation is sufficiently iconoclastic to mention here. The bottom portion of the mound complex resembles the nine-branched candelabrum or menorah used in the Jewish celebration of Hanukkah! At the very least, this is an amusing coincidence. But, as is often the case, some maverick archeologists see in this weird configuration of mounds evidence of an ancient Jewish contact with the New World and the Moundbuilders! Improbable as this seems, we know of no less-anomalous reason for the nine parallel earthen strips.

X4. Portsmouth Works (Ohio). Many ancient cultures were fascinated by the heavens and copied them on earth in the form of various types of zodiacs. In this context it is not especially sur-

prising to find a scientist claiming that the Moundbuilders actually tried to mirror the heavens in their design of one of the mound complexes. In a 1925 number of Science News Letter, we find:

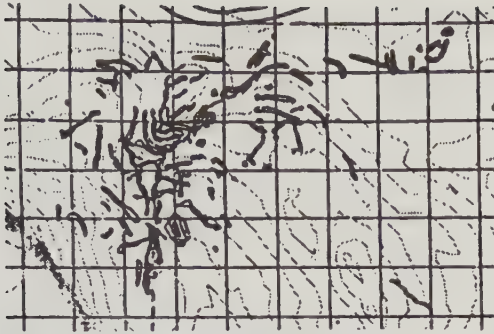
The most important aboriginal temple in the United States was built by prehistoric Moundbuilders in and around the present site of Portsmouth, Ohio. The ten miles of embankments still traceable there represent various heavenly bodies, including sun, moon, stars and [in addition] banks which accurately reproduce the form of two of the "seas" of the moon, used in ancient sky worship. Such are the conclusions presented to the American Association for the Advancement of Science by Stansbury Hagar, secretary of the Council of the Brooklyn Institute of Arts and Science. (R3)

We have found nothing further on this singular connection between the sky and terrestrial mound complexes. See MSE8 for other possible relationships between astronomical and archeological configurations.

X5. The Mosier Mounds (Oregon). On the south bank of the Columbia River, near Mosier, Oregon, archeologists have mapped a 30-acre complex of rock walls, cairns, pits, and troughs--a veritable maze of lithic structures. (See map.)

The most impressive features are alignments of stacked rocks that hug the contours of the slopes. Although their configuration suggests a battlement, the stone formations weave so sinuously that they cannot be defensive in nature. Some anthropologists suggest that these various lithic structures were used for burials, vision quests, and even the physical conditioning of the young men who were given the job of piling up all the stones!

No precise dates are available, but the Mosier Mounds probably predate European contact.



Map of the main concentration of Mosier Mounds. The heavy lines represent the stacked rocks. The grid squares are 20 meters on a side. (R21)

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MSO CARVED ROCKS, SPHERES, COLUMNS

Key to Phenomena

MSO0	Introduction
MSO1	Boulders with Triangular Holes
MSO2	Large, Precisely-Crafted Stone Spheres
MSO3	Carved Columns in an Ocean Trench
MSO4	Curious Arrays and Groupings of Stone or Wooden Columns
MSO5	The Latte Stones of the Marianas
MSO6	The Ancient Iron Pillar at Delhi
MSO7	The Cement-Like Cylinders of New Caledonia
MSO8	Unusual Gnomons
MSO9	Stone Chairs
MSO10	Curious Distribution of Large Stone Jars
MSO11	Enigmatic Configured Rocks
MSO12	The Haamonga Stones: A Trilithon in Tonga
MSO13	Tiahuanaco's Gateway of the Sun: Incredible Stonework

MSO0 Introduction

Simple stone, metal, and wood structures are the subject of this chapter. In contrast to the "rude" or unworked mehirs, dolmens, and rocking stones of Chapter MSD, the stones and structures introduced here have been shaped by human hands, sometimes with great precision. In fact, the incredible precision workmanship of some of Costa Rica's large stone spheres and Tiahuanaco's Gateway of the Sun easily justify the inclusion of such artifacts. Another property worth cataloging is the unusual distribution of some of these objects, such as those carved columns seen in a deep-sea trench and the geographically-separated fields of huge stone jars in Asia and Oceania. Also befitting this Catalog are those structures that are just plain hard-to-explain. We refer, of course, to the famous intihuatana at Machu Picchu and those weird cement-like cylinders buried in sand mounds on New Caledonia.

MSO1 Boulders with Triangular Holes

Description. Hundreds of large boulders marked by one or more triangular holes with rounded corners. The holes are of constant cross section but of varying depths. They were manufactured with high precision. So far, the geographical distribution of the holed boulders seems to be centered in north central North America, Minnesota in particular, although a few have turned up on the Atlantic coast.

Data Evaluation. These distinctive triangular holes are mentioned in a few mainstream archeology publications but summarily dismissed as the work of colonial farmers. More details have been published in "fringe" archeology books and serials. Often such publications are associated with controversial theories and must be scrutinized carefully.

The makers of the holes and their purpose are uncertain, although speculations abound. Likewise, the ages of the holes and distribution of the boulders thus marked are very uncertain. There is, however, no doubt that these enigmatic triangular holes exist in large numbers. Rating: 3.

Anomaly Evaluation. Of the several hypotheses mentioned in X3 below, the Norse-mooring-stone theory is the most popular, but it is placed in doubt by the anomalous distribution of some of the holed boulders (North Dakota and North Carolina).

Our view is that we have an easily verified phenomenon without a satisfactory explanation. An early Norse presence in Minnesota would be very anomalous, but we suspect that a less controversial explanation will surface eventually. It is quite possible that the holes may not even be man-made. Rating: 3.

Possible Explanations. See X3 below.

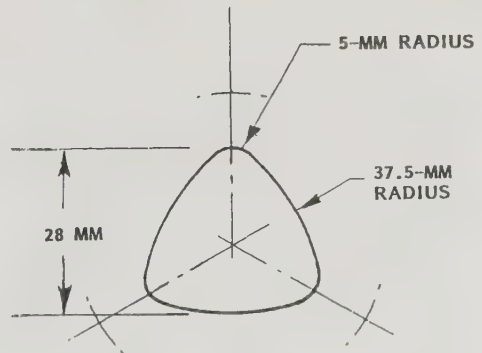
Similar and Related Phenomena. Claims of Viking artifacts in Minnesota (MMM in a future catalog volume).

Entries

X0. Introduction. Archeologists love to puzzle over pyramids, stone axes, and such obviously utilitarian productions of ancient humans. In contrast, simple holes in boulders are hardly the things important scientific papers are written about. Yet, scattered about the Great Plains are some 300 boulders of very hard rock (often granite), each possessing the same rounded triangular hole. Surely such a phenomenon would pique some archeologist's curiosity!

The holes are made with high precision to the dimensions shown in the figure. They are usually about 6 inches deep. Holes with a rounded triangular shape imply a sophisticated drilling technology. Steel tools and high craftsmanship are indicated.

Even though the holes have been known for over a century, only amateurs have shown much interest. A few



Cross section of a typical "mooring-stone" hole. Note the rounded corners. (MM = millimeters) (R6)

such enthusiasts have tracked down hundreds in Minnesota, North Dakota, South Dakota, Wisconsin, Illinois, and along the eastern seaboard. Many of them seem to be located on present-day lakes and rivers or now-dry waterways. This aquatic affinity has led to the theory that they are "mooring stones," especially Viking mooring stones! In truth, their real purpose is unknown.

How old are the holes? Weathering of those in granite suggest ages of at least several hundred years---well before the westward push of American settlers. The peculiar shape of the holes seems to rule out production by modern drills (usually round in cross section) for purposes of blasting or installation of surveyors' markers.

Another puzzle, probably related to the purpose of the holes, is the presence of large, smooth grooves on some of the boulders bearing the triangular holes. (R6)

X1. Two tales of discovery. To expand upon the above introduction, we present two first-hand anecdotes of discovery.

Fall 1919. Cormorant Lake, Becker County, Minnesota. H.R. Holand, a historian of Norse settlement in North America, in the company of several other men, was following up a report of a large boulder said to have a strange hole drilled in it. They found it.

It was about six feet long and on thrusting aside the thick underbrush that grew around it, we saw a neat little holed drilled in the surface of the rock. It was triangular in outline with the angles rounded off, about an inch and a quarter wide at the widest point. The depth was about an inch and a quarter, and, as the interior was distinctly visible in the bright sunlight, it could be seen that the inner surface of the hole was just as worn and mellowed by the slow weathering of time as was the general surface of the stone.


As we were discussing the significance of this discovery, our attention was called to another large stone half concealed in the brush only six feet away. This stone also had a small

triangular hole in its upper surface pointing toward the lake. It had the same diameter and shape as the former but was seven inches deep. Like the first, its inner surface showed an ancient weathered appearance. (R3)

A third boulder with a similar triangular hole was found later in the dense underbrush only 8 feet from the first.

Holand located many more such boulders in Minnesota. His enthusiasm for the search was fueled by his theory that these boulders had been drilled by Vikings for use as mooring stones. He postulated that these intrepid explorers had penetrated into the heart of North America through Hudson Bay and connecting lakes and rivers, probably in the 14th. Century. Not only had they drilled holes in boulders, but they had also inscribed an ominous message on the famous Kensington Stone found in the same general area.

September 1996. Near Raleigh, North Carolina. This recent discovery, far from claimed Viking inroads, was sent to us by someone who wishes to remain anonymous, and who had no inkling of other triangular holes and the Norse mooring-stone theory.

Soon after Hurricane Fran struck Raleigh in September 1996, I was walking one of my customary routes along a local creek when my attention was arrested by a ¼-ton granite boulder in the creek bed. The boulder had 3 holes drilled in its face, about 6 inches apart, and all in a straight line. (See photo.) I had not noticed this boulder before, so I'm fairly confident it was uncovered by the storm's 10-inch deluge of rain. Because the three holes seemed too close together to be blasting holes, I took a closer look at them and was surprised to see that they had "trianguloid" cross sections rather than round ones. By "trianguloid" I mean the cross section was thus:  Casts of the holes were made by using modeling clay. The expanded bases of the casts suggest that a shallow pit was pecked out of the granite before drilling began, and the constricted tips show that the first 3/4 inch of the drill bit was of a smaller diameter, perhaps to give



Photograph of a boulder with three triangular holes found in a North Carolina creek bed in 1966. Would three holes be required for mooring?

it greater penetrating power so that the holes could be started more easily. The smaller "pilot" holes were also trianguloid in cross section. (R8)

X2. Distribution of drilled boulders and ages of the holes. Most of the mysterious holed boulders on record are in Minnesota and North Dakota. This geographical concentration is understandable because these are the states where people have actively looked for such stones.

In Minnesota, for example, Holand and other champions of an early Norse presence have assiduously searched for what they believe are mooring stones---and they have found many!

The North Dakota holed boulders were reported by J.J. Olson, who was simply curious about them. He and others found them in the Turtle Mountains over 20 miles from water---hardly good spots for mooring boats! But like the Minnesota triangular holes, those in North Dakota are all the same size and shape. They are well-weathered as well, suggesting great age. Olson noted that local tombstones crafted from the same pink granite showed little of no weathering after a century's exposure to the elements. The holes, then, are probably several centuries old. (R6)

In the 1970s, additional putative mooring stones cropped up in Wisconsin (R4) and Illinois (R5). The latter are especially curious because one stone bears a carved face on one side, a font on the top, and a triangular hole on either side of the face.

The recent North Carolina find of three identical triangular holes in a row greatly expands the range of the phenomenon. (R8) It is roughly 100 miles from Raleigh to the Atlantic, and one doubts that the Vikings got that far inland and that far south. And why would three closely spaced holes be needed for mooring a boat on small creek? The age of this triplet of holes is indeterminant. It may have been buried in the stream bed for many years before the storm uncovered it.

J. Brønsted, a director of the Danish National Museum, asserted in 1953 that mooring holes have been drilled by fishermen along the North American Atlantic coast in modern times. (R1) However, we have no idea what these modern mooring stones look like, especially the cross sections of the holes.

We do know, however, that boulders were used for mooring the boats of fishermen in northern Europe. In Norway, in olden times, it was common for fishermen to chisel holes several inches deep in rocks along the shore. They drove iron bolts with attached rings into the holes and sealed them with molten sulfur or lead. (R3) High-precision, triangular holes would certainly not be required for this type of mooring. No iron bolts or remnants of sulfur or lead have been found in the holes under discussion---as far as we know.

Summing up, the ages of the holes are probably measured in hundreds of years, but we really cannot even be sure of this. The distribution of the holed boulders is not known with any exactitude. The focus of the phenomenon seems to be the upper midwest of the North American continent, but the search has been limited by the few people with the urge to find them.

X3. Possible uses of boulders with triangular holes. An acceptable explanation of these holed boulders must be consistent with their geographical distribution, apparent age, the holes' unusual trian-

gular cross section with rounded corners, the apparent uniformity of hole dimensions (except depth, which is variable), and the appearance of precision workmanship.

Mooring stones. The champions of an early Viking presence in North America have made this possible application the best-publicized. But it is difficult to imagine Vikings in the Turtle mountains of North Dakota or far inland in North Carolina. The only area where claims have been made for Viking artifacts (metal tools and weapons) is in Minnesota. (R3) Of course, we may be under-rating the Vikings; they seem to have touched the shores of most terrestrial land masses!

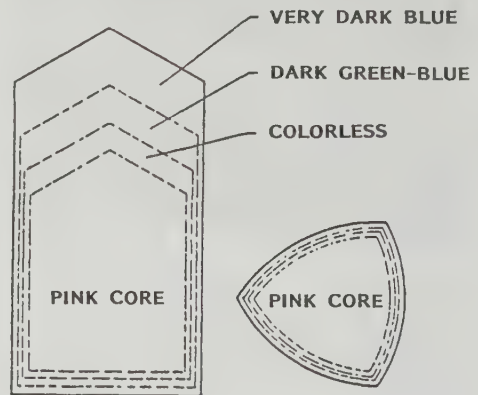
Blasting preparation. E. Wahlgren, one of the debunkers of the Kensington Stone, states that "local reconnoitering" in Minnesota suggested that the holes had been drilled by farmers in preparation for blasting using black powder. (R2) This doesn't explain the hundreds of holed boulders on remote lake shores. And why would farmers have made such precise, triangular holes, and then abandoned so many efforts? In any case, holes for blasting are usually larger and made with round cross sections. (R6)

Surveyor's marks. Wahlgren also advanced the proposition that the holed boulders were bench marks made by surveyors. (R2) J.J. Olson dismissed this suggestion, saying that surveyors would never have placed bench marks so close together. (R6)

Cam-wedging of temporary shafts. A strongly anchored but removable shaft for mooring or tethering could have been accomplished in the following way. A shaft with a triangular cross section and slightly smaller dimensions than the standardized holes could be inserted and given a twist of about 55°. This action would produce a tightly wedged anchoring point. Reversing the action would free the shaft quickly. (R6) This suggestion is consistent with the mooring theory and with the standardization of hole dimensions. It does not necessarily involve the Vikings.

Cavities left by weathered-out crystals. Sometimes, when igneous rock---such as granite---cools slowly, large crystals

will grow. Later, after weathering, these crystals may fall out leaving nicely geometrical holes. But what mineral exists in crystals with a triangular cross section? J.M. Saul has provided an answer: tourmaline. (R9)



Color zoning in a tourmaline crystal. Compare the cross section with that of a "mooring-stone" hole. (R9)

The weathering out of tourmaline crystals provides a neat, natural explanation for the holed boulders, most of which are of granite. However, one would not expect to find hundreds of crystal cavities all of the same size. Further, it is highly unlikely that all of the tourmaline crystals would have had their axes perpendicular to the boulder surfaces.

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MSO2

Large, Precisely-Crafted Stone Spheres

Description. Hundreds of granite spheres up to 8-feet in diameter, many displaying almost perfect sphericity. These remarkable examples of prehistoric stonework are mostly found in southwestern Costa Rica.

Data Evaluation. Although several hundred of these stone spheres have survived, many others have been smashed, stolen, or still lie buried in river silt. Many of the survivors have been moved from their original positions, thus further blurring the purpose of their makers. Stone-working tools have not been found, neither has the geological source of the granite.

Professional archeologists have investigated the spheres, but little has been found in the mainstream science journals. Much of our information comes from science magazines and Fortean publications. Rating: 3.

Anomaly Evaluation. The larger, more-finely crafted of the Costa Rican granite spheres pose questions that have not yet been answered satisfactorily.

- Who manufactured the spheres?
- When were the larger spheres carved?
- Where was the granite quarried?
- How were the spheres sculpted?
- How were the larger spheres transported?
- How did the sculptors achieve such precision with such large objects?
- Why were so many spheres made?
- Were some of the spheres buried intentionally or by river flooding?
- What was the purpose of the spheres?

We can guess the answers to all but the last with some confidence. The purpose of the large spheres, however, remains a matter of wild speculation. All in all, the Costa Rican spheres remain one of the New World's major archeological enigmas. Rating: 1.

Possible Explanations. Seven potential uses for the large spheres are discussed in X4 below. None is particularly convincing.

Similar and Related Phenomena. Several natural geological processes can create stone spheres of varying degrees of perfection (ESA3 in Neglected Geological Anomalies).

Entries

X0. Introduction. The ancient Greeks considered the sphere to be the perfect shape. Apparently, other cultures, some more primitive, have also valued the sphere as a symbol of perfection, perhaps one even worthy of veneration, and certainly a shape useful in various games of athletic skill. We can make these statements because stone spheres of various dimensions have been manufactured by many cultures for many purposes down the whole length of human history.

Without modern machining and casting techniques, ancient peoples had to manufacture their spheres from stone. To us, this sounds excessively laborious, but artisans in all ancient cultures were incredibly adept and patient when working stone. If they could manipulate the stones readily, they were able to craft exquisitely fine art objects, such as stone figurines, jade ornaments, and intricate figures in flint.

However, huge stone spheres, several feet in diameter, were another matter; in fact, they still are! Large blocks of rough stone can not be lifted and manipulated easily. It is difficult even today to hew large, precisely shaped spheres out of solid rock. Yet, for unknown centuries, the jungles and river silt of southwestern Costa Rica have sheltered hundreds, possibly thousands of multi-ton, nearly perfect, stone spheres. These are known locally as "Las Bolas Grandes." These are the spheres that beckon the anomalist.

X1. Discovery. In southwestern Costa Rica, the natives of the Diquis River Valley, where the river enters the Pacific, have always known of the great stone spheres lurking the jungle shadows. They paid scant attention to them except for the time it was rumored that they contained gold. They broke many apart and found nothing. The Spanish explored the area in 1522 but never mentioned the spheres in their records. Las Bolas Grandes remained officially undiscovered



One of Costa Rica's many precisely crafted stone spheres. Many are now used as decorations.

until the 1930s, when G.P. Chittenden came across them while he was searching for land suitable for banana plantations. He reported his discovery to D.Z. Stone, an authority on Costa Rican archeology. She visited the Diquis Valley between 1939 and 1941 and found many clusters of the spheres. In 1943, American Antiquity published a short paper on her findings (9:78, 1943). This seems to be the first mention of the spheres in an English-language science journal.

As the world of archeology ignored Stone's report, the United Fruit Company began planting its bananas. The workers found hundreds of the giant stone balls both on the surface and buried in the river delta's silt. Many were smashed by bulldozers; others were stolen; more were removed for lawn ornaments. We will never know the total number of the spheres. More importantly, we will never know how they were originally arranged; that is, the patterns in which their makers placed them. (R12)

X2. Declaring a mystery. As the bulldozers plowed up the jungle floor, D.Z. Stone, who was engaged on other projects, persuaded S.K. Lothrop, of Harvard's Peabody Museum, to visit the Diquis Valley and see the spheres for himself. Subsequently, Lothrop and his wife traveled to Palamar. Palamar is a United Fruit Company plantation near the Panamanian border. Given a house and access to the plantation, the Lothrops easily found many spheres to measure and ponder over. It is the results of their research that we find repeated again and again in most of our references. It was, in fact, an article in Natural History, by Lothrop's wife, Eleanor, that neatly defined the core mysteries of Costa Rica's stone spheres.

Why should hundreds of these perfectly shaped spheres, ranging in diameter from a few inches to eight feet, be scattered through the jungles of southwestern Costa Rica? How could prehistoric people have shaped them with only the crudest of tools? And how could they have moved them over hill and dale from the distant sources of stone? No other stone balls of like size have been found anywhere else in the world, except for a few in the highlands of Guatemala and in Vera Cruz. The smooth, beautiful, and almost perfectly rounded spheres give mute testimony to the artistic powers of an ancient people and tax modern's man's ingenuity in explaining their workmanship and significance. (R2)

Costa Rica spheres range from the size of a tennis ball up to 8 feet (2.4 meters). In weight, the smallest are only a few pounds, while the largest is estimated at 16 tons. It is the latter we are interested in here.

Types of stone. Mostly, granite was used, but three spheres carved from softer coquina limestone are known. The granite (really grano-diorite) is very hard to work without metal tools.

Sphericity. When several different diameters and circumferences are measured on a single large spheres, they differ by less than an inch for 6-foot spheres. This is remarkable precision for a primitive society. Curiously, the larger spheres are usually more nearly perfect than the smaller ones---the opposite of what one would expect.

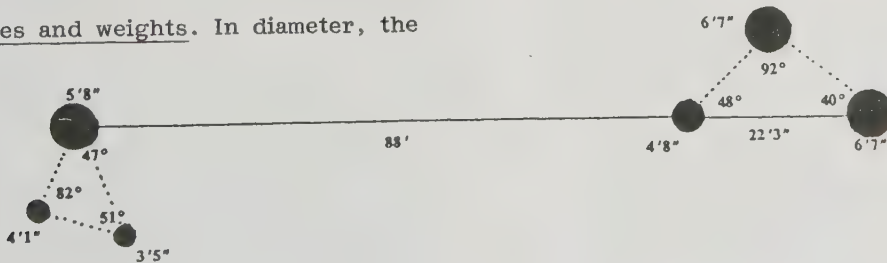
Sphere distribution. The large spheres, 2 feet and larger in diameter, are found mainly in the delta region of the Diquis River. A few have been found in the highlands of Guatemala, in Vera Cruz, Mexico, and possibly in Honduras.

It may not be pertinent here, but a finely crafted stone sphere, 2.5 feet in diameter, exists on Easter Island. Called Te Pito Kura by the Polynesian inhabitants, the stone is considered the "navel" of the island. (R1) The "mystical" power of the sphere is apparent here.

Disposition of the large Costa Rican spheres. Spheres are rarely found alone. Groups of three are common. One group numbered 45. Lothrop drew the accompanying sketch of two triads, and wondered if they had some sort of astronomical significance. (R2) Some stones

X3. Characteristics of the large stone spheres. (R6, R7, R10-R13)

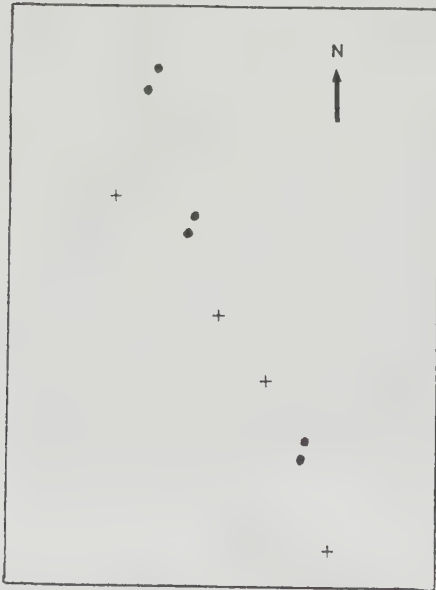
Sizes and weights. In diameter, the



Disposition of six stone spheres on Farm 4-35C, in Costa Rica. The significance of the triangular arrangements, if any, is unclear. (5'8" = 5 feet, 8 inches) (R12)

seem arrayed in ragged lines. The significance of these groupings should not be overplayed. It is not easy to roll heavy spheres on soft ground, but it is obvious that some have been moved. If the makers of the large spheres had a geometrical or astronomical plan in mind, it has been blurred by centuries of human interference. It is also possible that later cultures "recycled" the spheres and arranged them according to their own objectives. In addition, many spheres still lie buried in the river silt further obscuring any original intent of the makers. (It is generally assumed that some spheres were buried naturally by river floods, but intentional, ritual burial cannot be ruled out.)

Some of the larger stones are or were supported upon platforms of stones. Lothrop, in fact, found two completely buried spheres still on platforms. The significance of the platforms is, like just about everything else, unknown.



Arrangement of stone spheres on Farm 7, Costa Rica. These show no obvious organization of any kind. (+ = 6-foot-diameter spheres; ● = 5-foot-diameter spheres.) (R12)

Place and method of manufacture. No one knows where the spheres were quarried and fashioned into nearly perfect spheres. No stone-working tools or granite chips have turned up where the spheres now reside. They could have been shaped roughly at the quarry, wherever that is. There is granite in the mountains some miles away, but there are no signs of quarrying there. It is probable that the three limestone spheres were quarried at deposits near the Pacific shore, carved there, and then rafted up the Diquis River.

Assuming that the granite spheres came from the mountains, the task of transporting them over rough terrain and through thick jungle must have been formidable. It is doubtful that one could have rolled them very far! They could have been dragged on sledges like the megaliths described in Chapter MSD.

As for carving the hard granite into large, polished, precision spheres, this was apparently accomplished with simple stone tools. The granite could not have been cut into shape, it was doubtless pounded into near-perfection and then smoothed and polished with quartz sand or some other abrasive. The process was labor-intensive certainly and indicative of a society that had plenty of leisure time.

More challenging for the sphere-makers was determining sphericity. Measuring rods and strings are not very useful when the sphere-to-be is 6 feet in diameter. Perhaps departures from a perfectly spherical surface were detected with a circular wooden template of some sort. Pounding the offending areas would then have removed them so that the surface matched the template.

Artifacts in the vicinity of spheres. The Diquis Valley is noted for prehistoric artifacts made from gold. Whether the sphere-makers also made these or any other artifacts cannot be demonstrated. Stone sculptures of animals and other stone objects have been collected from the Valley, but these are of crude workmanship compared to the large spheres.

The spheres themselves cannot be dated. Lothrop, however, did find artifacts buried under some of the platforms supporting large spheres. These were of mixed ages, with the most recent attributed to the Chiriqui culture that existed at the time of the Spanish explorations in the Diquis Valley. This would imply

that the spheres might only be 400-500 years old. Even these dates are up in the air, because the spheres could have been crafted much earlier and simply rolled atop a more recently constructed platform. In short, no one is really certain who made the spheres and when, and even where.

Finally, we should add that, as far as we know, no human burials have been associated with the large spheres.

X4. Possible purposes. Since "who" and "when" seem to be beyond our reach at the present time, let us ask "why" the large spheres were so laboriously and precisely made. This may also be very difficult to answer because so many spheres have been moved, smashed, stolen, or remain buried in silt.

I.T. Sanderson listed seven possible uses for the spheres. (R4) We will follow his lead and thoughts,

Astronomy. The spheres may have had some astronomical function when originally emplaced, but we see no important solar or lunar alignments now. Neither can we discern star maps in the spheres we are able to chart today.

It is true that the Maya to the north were fascinated by the heavens, but the jungle of the Diquis Valley is hardly the ideal area from which to star watch. It is also not apparent why several hundreds of spheres would be needed for astronomical applications.

Ornamentation. In a society with plenty of leisure time, hours not needed for cultivating corn and fishing might have been applied to manufacturing status symbols for the for the society-as-a-whole (totems) or for rich and powerful individuals.

Frivolity. Sanderson wondered about and then discarded the notion that the large spheres might have been involved in games of some sort. After all, ball games were a passion of the Maya! But, the Costa Rica spheres are too large for anything except bases or reference points.

Under this heading of "frivolity," Sanderson could well have added "art." He didn't, so we will introduce the idea that the spheres are really objects that

were made, treasured, and displayed for their size, beautiful workmanship, and geometrical perfection.

Religion. Like the menhirs of the megalithic age, the spheres might have been involved in rituals that we can only speculate about. The spheres might have possessed some symbolic value, like the Christian cross.

Mechanics. Here, Sanderson injected a suggestion from one of his readers: Could the spheres have been used to make paths through the jungle?! Why bother? Sanderson retorted. It would have been harder to roll the spheres than chop out a path.

Topography. Boundary markers would be included under this heading. However, the dense clusters of spheres and their large numbers militate against this thought.

Money. On Yap, in Micronesia, large stone wheels were once used as island currency. Why not large stone spheres in Costa Rica?

It has been fun speculating above, but in truth we have no good clues as to why hundreds of large, precisely crafted stone spheres were deployed in the Diquis Valley and elsewhere in Central America. They are just as mysterious now as Eleanor Lothrop said they were almost a half century ago.

X5. An curious stone sphere from North Dakota. In the summer of 1998, a construction crew building a new road in Wells County, North Dakota, came across a near-perfect stone sphere in a gravel pit. Judging from a published photograph, the sphere is about 2 feet in diameter.

Although the object's surface area shows no tool marks, its virtually perfect spherical dimensions imply, at least, artificial origins. Nothing remotely resembling the ball was found by workers throughout the remainder of the road building project, and local residents could not recall ever having seen or heard of a comparable find in the Wells County area, (R14)

Comprised of dense, fine-grained sandstone, the North Dakota sphere seems man-made, but no artifacts or other signs of human activity were detected in the gravel pit. It is, therefore, not unlikely that the sphere is a product of the natural milling and abrasion forces present in streams and around glaciers.

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- R2. Lothrop, Eleanor; "Mystery of the Prehistoric Stone Balls," Natural History, 64:372, 1955. (X2, X3)
- R3. Harrison, James O.; "Riddle of Costa Rica's Jungle Spheres," Science Digest, 61:14, June 1967.
- R4. Sanderson, Ivan T.; "Things", New York, 1967, p. 59. (X4)
- R5. Anonymous; "Stone Spheres," Pursuit, 1:14, no. 4, 1968.
- R6. Stirling, Matthew W.; "Solving the Mystery of Mexico's Great Stone Spheres," National Geographic Magazine, 136:293, August 1969.
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- R8. Dehon, Robert; "Eparpillement de Spheres au Costa-Rica," Kadath, no. 8, p. 27, May-June 1974.
- R9. Harrison, James O.; "Digging into Costa Rica's Past," Popular Archaeology, 4:14, no. 1, 1975.
- R10. Safer, John; "Las Bolas Grandes," Oceans, 8:66, July/August 1975.
- R11. Clarke, Arthur C.; Mysterious World, New York, 1980, p. 55.
- R12. Shoemaker, Michael T.; "Strange Stone Spheres," Pursuit, 19:145, 1986. (X1, X3)
- R13. Shoemaker, Michael T.; "More on Stone Spheres," Pursuit, 20:13, 1987.
- R14. Gorman, William; "North Dakota Road Workers Unearth Stone Sphere," Ancient American, no. 27, p. 5, 1999. (X5)

MSO3

Carved Columns in an Ocean Trench

Description. Carved stone columns photographed at great depths in the ocean.

Data Evaluation. The observations consist of photographs taken from a research vessel funded by the National Science Foundation. The only mention we have seen in the literature is a short article in Science News. It is probable that more details exist in a formal report of the expedition's findings, but we have not seen reference to it. Actually, the photographs alone provide little for the archeologist to go on. Rating: 2.

Anomaly Evaluation. The age and makers of the columns cannot be deciphered from the photograph; neither can the reason for the remarkable location of the carved columns. The simplest and most likely explanation is the sinking of a vessel carrying construction materials. The Incas and other early South American cultures did construct large balsa rafts, but it is doubtful that these could transport heavy stone columns. The presence of the columns in a deep-sea trench dispels

thoughts of a foundered ancient city. There seems to be no good explanation for the columns. Rating: 2.

Possible Explanations. A disaster at sea, perhaps in post-Inca times.

Similar and Related Phenomena. Claims of an underwater roads, some walls, and buildings off the island of Bimini, in the Bahamas (MSB, MSR3).

Entries

X1. General observations. In 1966, the research vessel Anton Brunn was 55 miles off Callao, Peru. R.J. Menzies, from the Duke University Marine Laboratory, had deployed an underwater camera in his search for specimens of a fossil mollusc. At a depth of 6,000 feet, his camera photographed instead strange carved rock columns, some of which had writing on them.

Two upright columns, about two feet or more in diameter, were sighted five feet out of the mud. Two more had fallen down and were partially buried, and another angular squarish block was seen, said Dr. Menzies. (R1)

Menzies speculated that the columns might have toppled into the trench from a nearby island where Inca ruins are located. (R1) However, the Incas did not have a written language!

Reference

R1. Tufty, Barbara; "Found in the Pacific," Science News, 89:239, 1966. (X1)

MSO4 Curious Arrays and Groupings of Stone or Wooden Columns

Description. Large arrays of ancient stone or wooden columns without obvious purpose.

Data Evaluation. Four puzzling arrays of columns have been identified in South America. Details are lacking in the references we have, and some of the sites have been severely damaged. Rating: 3.

Anomaly Evaluation. In the Old World, arrays of stone pillars, wooden posts, and rough stones from the megalithic era are recognized. Some of these arrays are purely structural in that they held up roofs (i.e., the Stanton Drew posts in

MSH23-X1). Others had ritual and astronomical applications (the Carnac stone alignments). Some arrays of columns were probably only ornamental. The South American arrays doubtless had purposes such as these, but so little is known about them that we can only guess at their uses. Thus, some minor mysteries remain. Rating: 3.

Possible Explanations. The South American stone columnar arrays could have been either structural or ornamental. The wooden arrays could have held up roofs or had astronomical applications.

Similar and Related Phenomena. Stone alignments (MSH1-4); woodhenges (MSH23); medicine wheels (MSH22); stone arrays (MSH5).

Entries

X1. The monoliths of Tafi, Argentina.

Tafi is the name of a broad valley in the province of Tucuman, Argentine Republic. The well-known scientist, Professor Ambrosetti, in a recent visit there, had his attention called to an extraordinary collocation of monolithic pillars and stone enclosures, erected in remote ages by the native inhabitants. He describes them in Globus, Bd. LXXI., No. 11. The monoliths are from six to ten feet in height above the soil, some plain, others decorated with conventional designs, others rudely chipped into the likeness of faces, etc. They extend over a considerable area and their purpose is problematical.

Ambrosetti is inclined to attribute them to the predecessors of the Calchaqui Indians, who occupied this territory at the Conquest. He suggests that they are the work of the same people who erected the buildings of Tiahuanuco; a suggestion which I think is extremely probable for some of the decoration shown in his cuts is strikingly like that on the stone pillars of Hatuncolla, two leagues from Lake Titicaca, portrayed in Squier's 'Peru,' pp. 385-6. (R1)

X3. The log pillars of The Estaqueria, Peru. The Estaqueria is located southeast of Nazca, Peru, near Kahuachia. The Estaqueria was at one time a curious array of 12 rows of 20 log pillars each. Local charcoal makers have removed many logs from this large array, the purpose of which is obscure. The possibility exists that the pillars supported a large roof, perhaps something similar to the Stanton Drew structure in England (MSH23-X1). A huge Nazca graveyard is located nearby. (R2)

X4. Ica Desert, Peru. One hundred miles from The Estaqueria lies a trapezoidal clearing in which was discovered a field of over 300 wooden posts. (R2)

References

- R1. Anonymous; "The Monoliths of Tafi," Science, 5:724, 1897. (X1; X2)
 R2. Morrison, Tony; Pathways to the Gods, New York, 1978, pp. 21, 78. (X3, X4)

X2. The pillars of Hatuncolla, Bolivia. See the above quotation. We have no further data on this group of pillars, but we assume they also comprise a large array. (R1)

MSO5 The Latte Stones of the Marianas

Description. Tall, limestone pillars capped by hemispherical carved stones, arrayed in parallel rows, confined mainly to the Mariana Islands. Some of the latte stones tower over 15 feet high and weigh several tons.

Data Evaluation. The latte stones are so surprising and incongruous in their jungle settings that they have attracted the attention of both scientists and laymen. Consequently, we have found many reports describing these unusual megalithic structures in considerable detail. Rating: 1.

Anomaly Evaluation. Universally, scientists who have studied the lattes and their surviving stones are convinced that they were used only to support houses. They had no ritual or mystical purpose and are, therefore, not anomalous. They are, however, remarkable engineering accomplishments for their time and place. Rating: 4.

Possible Explanations. None required.

Similar and Related Phenomena. In tropical climes, it is common to see houses raised high off the ground.

Entries

X0. Background. Saipan, Tinian, and the other Mariana Islands evoke memories of World War II and the wresting of these gem-like, tropical islands from the Japanese. Like all other visitors to the Marianas, the American soldiers were struck by groups of tall stone pillars often capped by hemispherical stones. These groups of strange columns were called "lattes" (or "ladtes") by the descendants of the ancient Chamorros, who occupied the Marianas when Magellan "discovered" them in 1521. Some early Spanish records relate that the lattes once supported houses. (R6) Since some lattes are 15 feet high, houses elevated this high seemed unlikely to European visitors. Nevertheless, the natives persisted in calling the lattes the "Houses of the Old People." (R1)

Who would bother to erect multi-ton stone pillars just to support houses? And what domestic purpose could those strange hemispherical capstones serve? Beyond these practical considerations, the lattes also had a natural aura of mystery about them; they were and still are so incongruous standing erect among the palm trees. It seemed that they must have been more than simple house supports, perhaps the remains of some incredibly ancient temple where an un-



One of Guam's smaller latte stones.

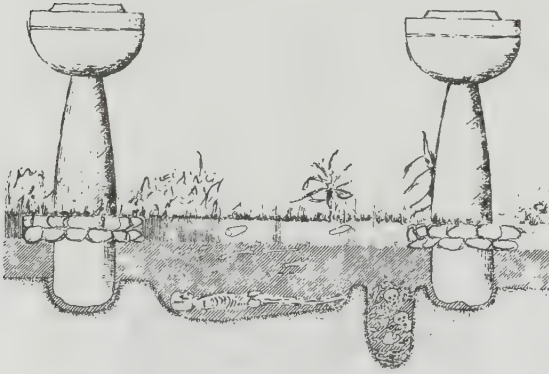
known race worshipped!

Granted that the lattes are generally very impressive. Some of the stone pillars are larger than the biggest stones in the Great Pyramid (R2); and some

lattes exceed Stonehenge in area. Despite appearances and subjective impressions, all archeologists who have studied the lattes are emphatic that they were only house supports. Yes, there were burials around them, since the people who raised the lattes customarily buried their dead under their houses. (R2) They also stored their canoes and other equipment beneath their houses. Lattes actually represent an intelligent sort of architecture on tropical islands. In fact, the natives of the Marianas still elevate their houses on supports, some as high as 10 feet. (R5) As for the curious hemispheres, their geometry discouraged rats and other vermin from invading the houses. (R2)



Latte stones were probably used to support the houses of the Chamorros, as shown in an artist's reconstruction. (Adapted from R5)



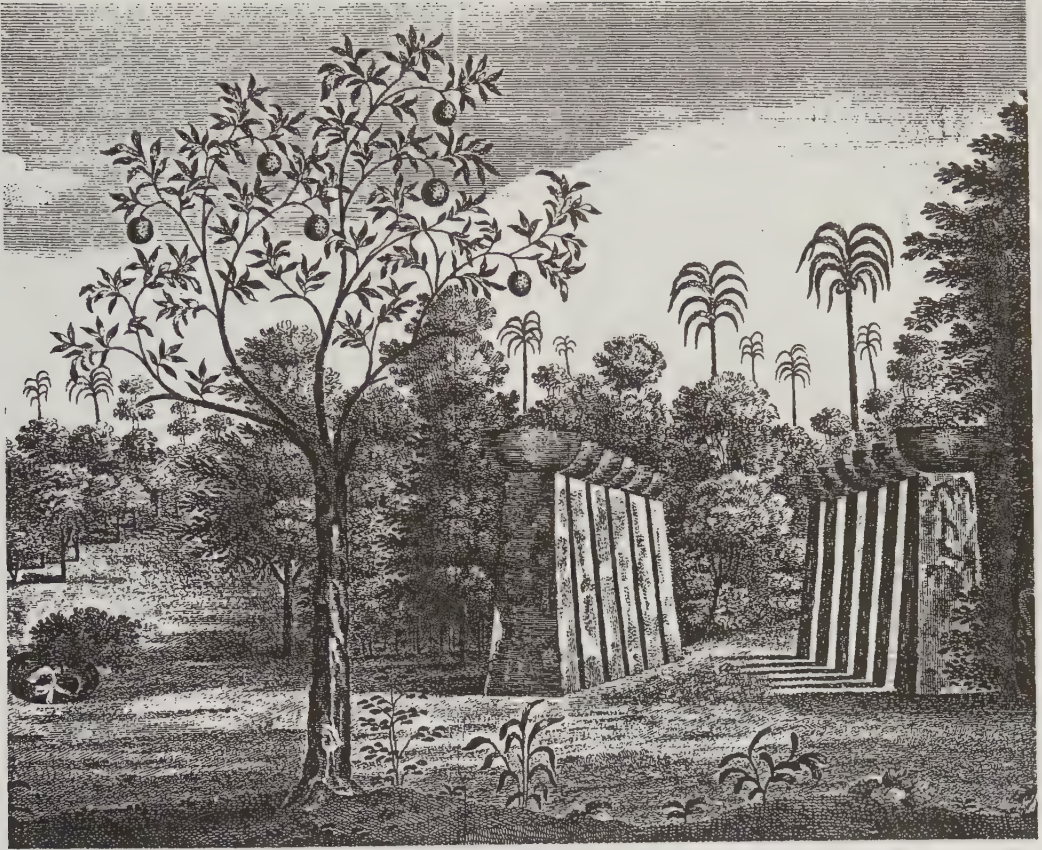
Excavations of latte stones on the Marianas revealed their bases and associated burials. (Adapted from R2)

Despite the frequent use of the word "mystery" in modern writings about the lattes, it seems clear that they are non-anomalous. For this reason we restrict our treatment to a short description of these very impressive structures. The large sizes of the stones used and the areal extent of the lattes represent a remarkable accomplishment by ancient engineers. In particular, the heavy hemispherical caps must have been challenges to raise into position. The lattes, therefore, demand some recognition in this catalog.

X1. Overview of the lattes. A good, although perhaps overly romantic, account of the lattes was written for a 1927 issue of Scientific Monthly by a Navy officer, P.J. Searles.

Dotting the islands [the Marianas] here and there are found those magnificent structures, the Lat'te, erected unknown centuries ago by a lost race whose name even is forgotten. Massive and imposing even when partially laid low by the hand of time working through earthquakes and typhoons, hid in the shadowy depths of the jungles, they convey an impression of high intelligence and skill on the part of their builders. Baffling to the scientist as well as to the layman, they represent an ancient epoch as mythical as Atlantis. What are they?

A Lat'te is composed primarily of upright monoliths called "halege," surmounted by hemispherical capitals called "tasa." The upright stones are usually placed in two parallel rows of from four to six stones in each row, the long axis of the Lat'te always being parallel with the line of the sea-



George Anson's 1742 drawing of the House of Taga with its 12 latte stones complete with capstones in place but minus the House. (R6, R8)

shore or a river bed. In Guam are found several different detailed forms. The uprights are sometimes slab-like, sometimes cut square; in fact, many shapes are extant. The capitals also vary in shape and size. Lat'te range from small rude structures constructed of natural boulders capped with coral heads, to massive stone columns, square in shape, fifteen or more feet in height and six feet in diameter, headed with enormous blocks of stone.

The Island of Tinian presents two of these largest of monuments carved by prehistoric man, part of the "House of Taga." The only standing survivors of ten original monoliths, these two shafts still rear their lofty

heads on the south-western side of the island, very near the beach. Three others are completely shattered as if by earthquake, two have lost their capitals, and three have fallen but still retain the "tasa" intact. They are all shaped like truncated pyramids, capped by hemispherical stones. The pillars are eighteen feet in circumference at the base and fifteen feet at the top. They are twelve feet high and support capitals five feet high and six feet in diameter. Each monolith weighs about thirty tons. The two parallel rows originally stood seven feet apart and formed a ground plan about fifty-five feet long by eleven feet wide. They are cut

from a rough metamorphosed coral known in the Marianas as "cascajo." (R3)

More than two decades after Searles wrote his enthusiastic paper, in 1949, two pieces of iron were discovered under the base of one latte pillar at a site on Saipan. These pieces of iron were not intrusive and indicate that at least one latte stone was erected after the arrival of the Spanish. The descendants of the Chamorros, therefore, evidently did build some of the lattes. (R5) We also now have some radiocarbon dates for the lattes, the earliest being 900 AD from a latte on Tinian. (R6)

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- R2. Gill, Lorin Tarr; "The Coral Tombstones of the Marianas," Art and Archaeology, 18:154, 1924. (X0)
- R3. Searles, P.J.; "Mystery Monuments of the Marianas," Scientific Monthly, 25:385, 1927. (X1)
- R4. Osborne, Douglas; "Archaeology on Guam: A Progress Report," American Anthropologist, 49:518, 1947. (X0)
- R5. Beaty, Janice J.; "Mystery of the Marianas Latte Stones," Pacific Discovery, 15:8, no. 1, 1962. (X0, X1)
- R6. Bellwood, Peter; Man's Conquest of the Pacific, New York, 1979, p. 283. (X0, X1)
- R7. Childress, David Hatcher; Ancient Micronesia & the Lost City of Nan Madol, Kempton, 1998, p. 118. (X1)
- R8. Morgan, William N.; Prehistoric Architecture in Micronesia, Austin, 1988, p. 116. (X1)

MSO6

The Ancient Iron Pillar at Delhi

Description. A tall, apparently rustless iron pillar, near Delhi, India, dated 300-400 AD. On the basis of its size and rustless condition, some claim that this tower is an anomalously precious artifact.

Data Evaluation. The Delhi tower has been thoroughly studied and pondered over by scientists and engineers. Several descriptions and metallurgical analyses have been published in the technical literature. Rating: 1.

Anomaly Evaluation. If the Delhi pillar had been forged as a single piece of iron, it would truly represent exceptional iron-working capability for the 300-400 AD period. The same is true for the development of rust-proof iron metallurgy. But, all modern studies of the pillar indicate that neither of these claims is true. Rating: 4.

Possible Explanations. None required.

Entries

X0. Introduction. Throughout India, tall pillars, long beams, and other iron objects demonstrate that iron-working was surprisingly sophisticated in this country as early as 300 AD. The three most famous examples of this precocious technology are: (1) A tall iron pillar at Delhi; (2) an even taller pillar at Dhar (R2, R3); and (3) 29 massive iron beams up to 35 feet long, 8 inches square, at Konarak (R3). It is the iron pillar at Delhi that has been the focus of two rather sensational claims.

- It represents an advanced method of iron forging that has since been lost. The basis for this claim is that European iron foundries could not have fabricated such a large pillar in one piece until the 20th. Century.
- The Delhi pillar does not rust, suggesting that 1600 years ago the Indians knew of secret metallurgical processes that modern engineers have not yet been able to duplicate.

We will see below that these claims are overblown.



Delhi's "rustless" iron pillar. (Indian Tourist Office)

X1. The Delhi pillar. Although over a century old, J. Fergusson's description of the Delhi pillar is both valid and engaging.

One of the most curious and interesting of this [early iron technology] is found in the existence of the celebrated iron pillar of Dhava in the courtyard of the mosque at the Hutub, near Delhi. This consists of a solid shaft of wrought iron, standing 22 feet, 6 inches out of the ground and is 5 feet 6 inches in circumference at about 5 feet from its base. When I visited it, the report was that Colonel Baird Smith had dug down and found its base 16 feet below the surface. Lieutenant Cole now brings home a report that it is 26 feet deep in the ground. Taking, however, the more moderate dimension, a single forging 40 feet long and 5 feet circumference was not made and could not have been made, in any country of Europe before the introduction of

steam-machinery, nor, indeed, before the invention of the Nasmyth hammer.

There is an inscription on the pillar which, unfortunately, bears no date; but from the form of the characters, the nature of the event it describes, coupled with the architecture of the capital of the pillar, it leaves no doubt that it was erected in the third or fourth century of our era.

It must be left to those practically skilled in the working of metals to explain how any human being could work in close proximity to such a mass heated to a welding heat, or how it was possible without steam-machinery to manipulate such an enormous bar of iron. The question that interests us here is, how long must the Hindus have been familiar with

the use of iron and the mode of working it before they could conceive the idea of such a monument and carry it into execution? It could hardly have been centuries, it must have been nearer thousands of years, and yet they erect rude-stone monuments in India at the present day! (R1)

The claim of a sophisticated technology capable of forging rust-proof iron. A close examination of the Delhi pillar proves beyond doubt that it was not forged in one piece. Rather, small discs of hot wrought iron were hammered together in a process called "forge welding." (R3, R7) Even though the Indian iron-workers were not as precocious as some have claimed, they did forge some spectacular iron structures, and probably led the world in this technology at that time.

The claim that the pillar never rusts. Did the ancient Indian metallurgists know how to make rustless iron? Not really, as D. Salwi assesses the situation.

It is not that the pillar is completely free from corrosion. As expected, the pillar has acquired a superficial layer of rust. But what is surprising is that this layer, an oxide of iron, has protected the rest of the pillar against the ravages of time. Some metallurgists hold the basic composition of the pillar, which is high in phosphorus and low in manganese in comparison with the iron produced by modern processes, to be responsible for the high corrosion resistance of the pillar.

It is also believed that the crude method of manufacture of the pillar, the repeated heating and hammering of wrought iron pieces, must have allowed the protective oxide layer

and slag to surface and be hammered to form a strong protective layer. (R7)

In addition to the foregoing factors, the climate at Delhi is so dry most of the year that rusting is greatly inhibited. (R4) The lower portion of the pillar has also been protected by ritual applications of oil. Finally, the Delhi pillar is the Indian equivalent of the Blarney Stone. A local legend holds that if you stand with your back to the pillar, reach around it, and clasp your hands together, fame and fortune will be yours. (R6) Thereby, the pillar is partially protected by human body oils.

Summing up, the Delhi pillar is a fine example of ancient iron-working, but there are no lost secrets or especially precocious technology, despite what you may read in some sensational books and magazines.

References

- R1. Fergusson, James; Rude Stone Monuments in All Countries, London, 1872, p. 480. (X1)
- R2. Hadfield, Robert; "Sinhalese Iron and Steel of Ancient Origin," Nature, 89:360, 1912. (X0)
- R3. Britton, S.C.; "Ancient Indian Iron," Nature, 134:238 and 134:277, 1934. (X0, X1)
- R4. Hudson, J.C.; "The Delhi Pillar," Nature, 172:499, 1953. (X1)
- R5. Thompson, F.C.; "The Delhi Pillar," Nature, 199:441, 1963.
- R6. de Camp, L. Sprague; The Fringe of the Unknown, Buffalo, 1983, p. 41. (X1)
- R7. Salwi, Dilip; "The Enigmatic Pillar of Delhi," New Scientist, p. 43, January 3, 1985. (X1)

MSO7 The Cement-Like Cylinders of New Caledonia

Description. Curious cement-like cylinders several feet in height buried in large sandy mounds on New Caledonia and the adjacent Isle of Pines, in the southwest Pacific.

Data Evaluation. Our only English-language report is from a Fortean journal. It is based upon a 1964 report, published in French, by a scientific society located on New Caledonia. No follow-up research has been found to date. It must be added that radiocarbon dates for seashells, as reported below, are not always reliable. Rating: 3.

Anomaly Evaluation. The "cement" cylinders and mounds could be anomalous in three ways:

(1) If the cylinders are "cement" and artificial, and if the radiocarbon dates are correct, we have evidence that humans reached New Caledonia several millennia before the accepted historical scenario for the peopling of the Pacific.

(2) If the above conditions are met, the use of cement precedes its use in the Mediterranean area by millennia.

(3) The purpose of large artificial mounds with cement cores is difficult-to-imagine.

Again assuming artificiality and correct radiocarbon dates, the mounds and their cement cylinders represent a significant archeological anomaly. Rating: 2.

Possible Explanations. The mounds on New Caledonia and the Isle of Pines could be natural. Large, now-extinct, "incubator birds" (megapodes), might have raked up the mounds and deposited their eggs in them, letting the sun's heat hatch them. Given such mounds of shelly sand, it is possible that rainwater might have cemented masses of sand into cylindrical shapes---much like beach rock is formed today in the tropics. (R2) This is not as far-fetched as it sounds, incubator birds are found today in Australia and on many of the islands of the South Pacific, where they construct immense mounds of sand and/or vegetation.

Similar and Related Phenomena. Incubator-bird nests (BBT27 in Biological Anomalies: Birds); the Bimini "road" (MSR3).

Entries

X1. General observations. We quote directly from our primary source on this phenomenon. The author, A.E. Rothovius, based his article upon the following reference: Revue de la Société d'Etudes Mélanésiennes, p. 24, 1964.

One of the most intriguing and baffling mysteries to confront archaeologists in recent years, has been the discovery in the Southwest Pacific Island of New Caledonia, and the adjoining Isle of Pines, of some remarkable lime-mortar cylinders that do not

appear to be of natural origin, and whose indicated age is far earlier than all previously known man-made cements.

Discovered by L. Chevalier of the Museum of New Caledonia in the island's capital, Noumea, these cylinders run from 40 to 75 inches in diameter, and from 40 to 100 inches in height. They are of a very hard, homogeneous lime-mortar, containing bits of shells which yield a radiocarbon dating of from 5,120 to 10,950 B.C.---even the lowest date being

some 3,000 years earlier than man is believed to have reached the South-west Pacific from the area of Indonesia. (Lime-mortars of the ancient Mediterranean civilizations do not date earlier than a few hundred years B.C. at the most.)

On their outside, the cylinders are speckled with silica and iron gravel fragments that seem to have hardened into the mortar as it set. This feature is of interest in connection with the tumuli or sand-and-gravel mounds in which the cylinders were found, and that are as peculiar as the cylinders themselves.

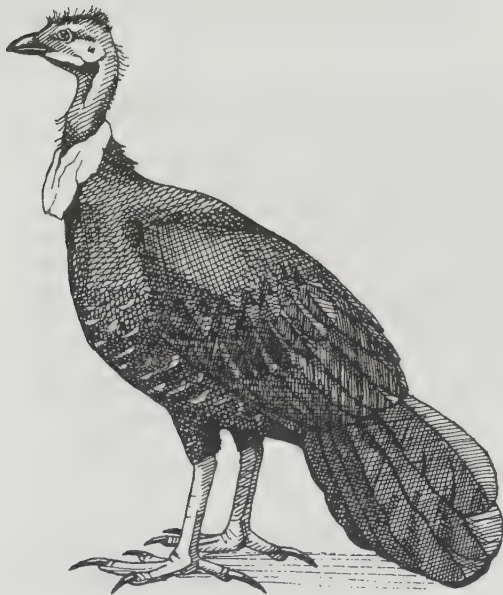
There exist 400 of these tumuli on the Isle of Pines, and 17 fo far located on New Caledonia itself, at a locality called Païta. On the Isle of Pines, the tumuli consist of a gravelly sand with high iron-oxide content; the Païta tumuli are of a siliceous

sand. In both places, the tumuli are from 8 to 10 feet high, and average 300 feet in diameter---bare and featureless, with little or no vegetation taking root in the sands of which they are composed.

To date, only four of the tumuli have been excavated. No bones, artifacts or charcoal were found despite a thorough search; yet three of the tumuli contained one cylinder each, and the fourth had two of them, side by side. In each case, the cylinders were positioned in the center of the tumuli (which appear to resemble giant ant heaps), set vertically.

The impression that Chevalier had, was that the mortar had been poured into narrow pits dug into the tops of the tumuli, and allowed to harden in position. Bits of sand and gravel composing the tumuli would naturally have worked into the mortar, thereby explaining their presence in the outer surfaces of the cylinder.

But what conceivable reason could there be for their being cast at all, in the first place? Natural origin appears ruled out---yet no evidence has been found of any human association with them, or with the tumuli which are also inexplicable as natural phenomena. (R1)



This Brush Turkey is one of the megapodes. Some birds in this group rake up huge piles of sand, earth, and vegetable debris in which they lay many large eggs. (Sketch by N.W.C. in *A New Dictionary of Birds*, A.L. Thomson, ed.)

Reference

- R1. Rothovius, Andrew E.; "The Mysterious Cement Cylinders of New Caledonia," *INFO Journal*, 1:15, no. 2, 1967. (X1)
- R2. Mourer-Chauvire, Cecile, and Poplin, Francois; "Le Mystère des Tumulus de Nouvelle-Calédonie," *La Recherche*, 16:76, September 1985. Cr. C. Maugé.

MSO8 Unusual Gnomons

Description. Vertical pillars, posts, and similar structures built so as to cast shadows that can be used to:

- (1) Determine time-of-day, the arrival of the solstices and equinoxes, and
- (2) Segment the solar year.

Data Evaluation. Archeoastronomy is a well-developed science with a large professional literature. Although ancient gnomons have not received as much attention as Stonehenge, we have easily found enough books and papers to establish whether gnomons are anomalous in any way. Rating: 1.

Anomaly Evaluation. Early humans could hardly have overlooked the relationships between shadow direction and length with the passage of time, both through the day and the year. That they would erect gnomons to facilitate time measurement and the determination of solstices and equinoxes can hardly be called anomalous.

The only significant gnomon enigma we have encountered in our literature searches has been Machu Picchu's inithuatana, a gnomon-like carved rock. If this structure is truly a gnomon, archeoastronomers have not been able to determine how it was used or for what purpose. Rating: 3.

Possible Explanations. For the inithuatana: none.

Similar and Related Phenomena. Calendar sites (MSH21); stone alignments (MSH1-4); the large menhir Er Grah (MSD3).

Entries

X0. Introduction. A gnomon is an erect structure configured to cast a sharp shadow on a graduated horizontal surface. The most common gnomons are seen in sundials, which have a history dating back to ancient Egypt. In modern sundials the gnomon is usually a triangle with the slanted edge directed toward the celestial pole. However, a simple post or column will do.

Ancient peoples could hardly miss the movement of the shadows of trees as the day progressed. Crude sundials were probably in use long before the ancient Egyptians. Today, sundials are often ornate and sophisticated, but they are employed mainly for decoration in gardens instead of telling the time of day.

There is nothing anomalous in the use of gnomons by ancient peoples for dividing the day into segments; no great leaps in intelligence or technology were required. Gnomons, however, can provide more than just the time of day; they can also indicate the solstices and equinoxes, thus segmenting the year.

Gnomons can even give rough estimates of distances between two sites on the same meridian from the lengths of the gnomon shadows on the same day. There is considerable evidence that ancient humans used gnomons for both determining the time of year and distance estimation. These first application is the subject of this section.

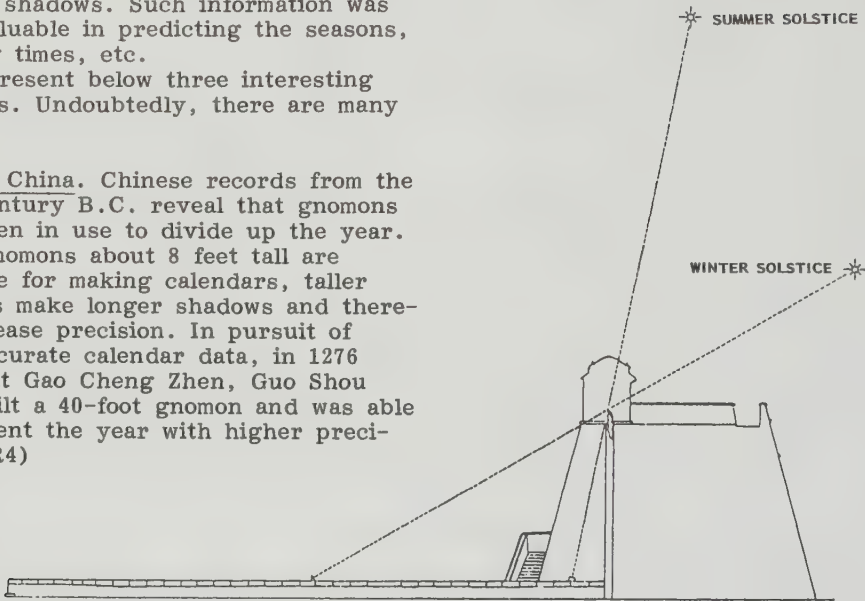
X1. Solstice determination. The longest and shortest days of the year occur on the solstices. It is then that the sun is at its extreme north-or-south positions. Gnomons can announce the solstices by the length of their shadows at noon. In the Northern Temperate Zone, for example, the sun is always in the south. At the winter solstice (about December 21), it is farthest south, and, at noon, a gnomon will cast the longest shadow of the year. About June 21, the sun is farthest north, and the noon shadow

will be shortest, indicating the summer solstice.

Several early cultures were sufficiently observant and astute to see that they could segment the year by watching gnomon shadows. Such information was very valuable in predicting the seasons, planting times, etc.

We present below three interesting examples. Undoubtedly, there are many more.

Ancient China. Chinese records from the 7th. Century B.C. reveal that gnomons were then in use to divide up the year. While gnomons about 8 feet tall are adequate for making calendars, taller gnomons make longer shadows and thereby increase precision. In pursuit of more accurate calendar data, in 1276 A.D., at Gao Cheng Zhen, Guo Shou Jing built a 40-foot gnomon and was able to segment the year with higher precision. (R4)



Observatory at Gao Cheng Zhen, 1276 A.D. (R4)

Indonesia (Java). In ancient Java, at latitude 7° south, gnomons were also used to divide up the year. Being just south of the equator, the gnomon shadow at the summer solstice fell on the north side, and on the south side at the winter solstice. (R3)

Easter Island. A more primitive type of solstice indicator was employed on Easter Island. The natives first bored holes in a rock platform; then, they inserted a tall pole in one of the holes to serve as a gnomon. At the summer solstice (about December 21 in the Southern Hemisphere), the sunrise shadow fell across one of the other holes, and so on for other marker holes and the summer solstice and the two equinoxes. (R1)

On Easter Island, we see that a gnomon shadow was used to mark the extreme positions of the sun on the morning horizon---shadow lengths were not involved. The sunrise position at

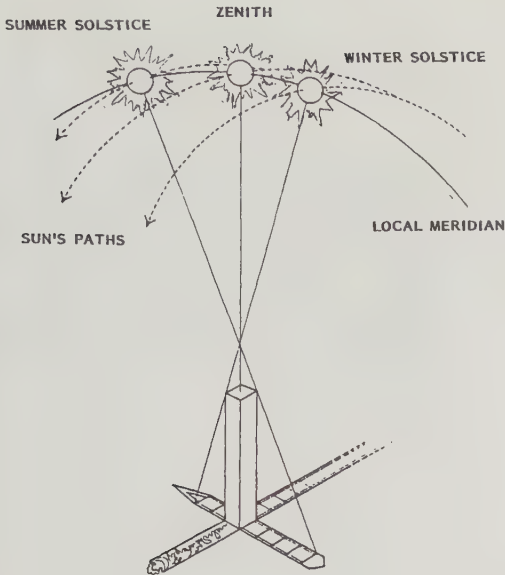
the equinoxes, however, would not have been easy to fix precisely by this method. The equinox hole would be approximately halfway between the two solstice marker holes.

See MSH21-X4 for an alternative way of using these pits to mark astronomical events.

X2. Equinox determination. The time of an equinox can be roughly indicated by a gnomon when its sunrise shadow falls halfway between the solstice points, as with the Easter Island scheme. However, gnomon shadows can also be used.

Peru. The Cuzquenos of 15th.-Century Peru apparently employed gnomons to estimate the timing of the equinoxes.

When the priests felt that the equinox



The lengths of the shadows cast by gnomons can be used to segment the year. (Adapted from R3)

was approaching, they took careful daily observations of the shadows cast by columns. The columns stood in the middle of a great circle filling the whole extent of the mesa or courtyard. Across the middle of the circle a line was drawn from east to west by a cord, the two ends being established by long experience. They could then follow the approach of the equinox by the shadow the column cast on this line. (R.T. Zuidema as quoted in R3)



The oft-photographed intihuatana at Machu Picchu, Peru. It is usually considered to be a gnomon, but questions still remain as to how the Incas actually employed it. The intihuatana seems unnecessarily complex for a gnomon.

X3. The intihuatana: a gnomon?

Peru. Many popular books on the Incas include a photograph of a peculiar structure carved out of the solid rock at Machu Picchu high in the Andes. A vertical projection on the carving suggests that it is a gnomon, and it is often called "the hitching post of the sun." Its name and ancient records imply that the intihuatana indeed did have some sort of astronomical application. Unfortunately,

modern astronomers have not been able to determine exactly what that application was. E.C. Krupp explains:

The intihuatana at Machu Picchu is a mass of granite about the size and height of a large dining room table. Carved from the rocky summit of an 80-foot-high natural pyramid, this peculiar combination of oddly angled surfaces, corners, and projections has defied interpretation. Its name, along with incomplete descriptions in the chronicles, suggests that it had something to do with measurements of the position of the sun. Offhanded and cavalier astronomical interpretation has declared the intihuatana to be a gnomon, but assertions of this sort solve nothing. How did it work? Was there some kind of ruler or tem-

plate or other piece of auxiliary equipment that was used in conjunction with the monument for measuring shadows? If so, how precise was the technique? Was the intihuatana used for systematic observation or ritual observation? Superficial pronouncements about the intihuatana obviously have not been confirmed by evidence from the site, and the meaning of the "sun's hitching post" still eludes us. (R4)

Another astronomer, G.S. Hawkins, has also fretted over the purpose of the intihuatana, its many angles and facets, and its asymmetry. He did add, though, that at Machu Picchu's altitude, the planet Venus would also cast a shadow! There might be a clue in this. (R2)

References

- R1. Dos Passos, John; Easter Island: Island of Engimas, Garden City, 1971, p. 131. (X1)
 R2. Hawkins, Gerald S.; Beyond Stonehenge, New York, 1973, p. 164. (X3)
 R3. Aveni, A.F.; "Tropical Astronomy," Science, 213:161, 1981. (X1, X2)
 R4. Krupp, E.C.; Echoes of the Ancient Skies, New York, 1983, pp. 47, 58. (X1, X3)

MSO9 Stone Chairs

Description. Chair-like structures hewn out of solid rock.

Data Evaluation. Except for a century-old paragraph in the American Antiquarian, stone chairs escape notice in the mainstream archeology books and journals that we have examined. We have found brief mentions in a popular archeology book and in a journal published by amateur archeologists. Rating: 3.

Anomaly Evaluation. Stone chairs sound uncomfortable, but we can hardly classify them as anomalous. We catalog them mainly because they seem to occur in strange places and under curious circumstances. Rating: 3.

Possible Explanation. Stone chairs may have been important in rituals or very formal deliberative proceedings, such as coronations or important trials.

Similar and Related Phenomena. Large stone jars (MSO10); rocking stones (MSD5).

Entries

X0. Introduction. None of our archeology books single out stone chairs for special inquiry. Yet, there they are, sometimes in large numbers and often in curious places and associations. We have uncovered only three stone-chair sites, but we suspect that there are many more

that archeologists have ignored as being unimportant or "uninteresting."

X1. General observations.

Ecuador. This item from an old issue of the American Antiquarian is self-explanatory.

Near Manti, Ecuador, is a remarkable archaeological relic, one of the most interesting monuments in South America of an unknown and extinct civilization. Upon a platform of massive blocks of stone, upon a summit of a low hill in a natural amphitheater and arranged in a perfect circles, are thirty enormous stone chairs, evidently "The Seats of the Mighty." Each chair is a monolith, cut from a solid block of granite, and they are all fine specimens of stone carving. The seat rests on the back of a crouching sphinx, which has a decidedly Egyptian appearance. There are no backs to the chairs, but two broad arms. This is supposed to have been a place of meeting---an open-air council of the chiefs of the several tribes that made up the prehistoric nation, which was subdued by the Incas of Peru several hundred years before the Spanish invasion. (R1)

One would think that many archeology books would carry photographs of this remarkable scene!

Columbia. In his comments on enigmatic South American artifacts, C. Berlitz compounded the stone-chair mystery.

...for example, there are carved stone chairs in uncounted numbers scattered through the highlands of Columbia without nearby vestiges of buildings...(R2)

Why so many stone chairs and why in such lonely circumstances?

Britain. In MSD5-X3, we illustrate two of several stone chairs found in association with British rocking stones. (R3)

References

- R1. Anonymous; "Finds in Ecuador," American Antiquarian, 22:129, 1900. (X1)
- R2. Berlitz, Charles; Mysteries from Forgotten Worlds, Garden City, 1972, p. 55. (X1)
- R3. Guynes, David; "The British Antiquary and the Rocking Stone," NEARA Journal, 20:1, Summer-Fall 1985. (X1)

MSO10

Curious Distribution of Large Stone Jars

Description. The presence of similarly configured, large stone jars at several sites separated by hundreds or thousands of miles. The jars, carved out of solid rock, may be 8 feet high and are so distinctive that they suggest a strong cultural connection.

Data Evaluation. Archeological research has focussed on the Plain of Jars in Laos. The almost identical jars in Celebes are not as well-researched; those in India, even less so. Our primary sources are a professional-level book and two science magazines. Rating: 2.

Anomaly Evaluation. If the geographically separated jars and their use(s) were independently conceived, there can be no anomaly. The facts so far and expert opinion support this conclusion. We, therefore, must consign these similar but far-flung artifacts to the curiosity file. Rating: 3.

Possible Explanations. Independent invention is most likely. The alternative possibility is the propagation of the stone-jar concept and use by a wide-ranging culture that happened to take root only in several widely separated places.

Similar and Related Phenomenon. The similarity of Old World and New World pyramids.

Entries

X0. Introduction. Some of the most unusual megalithic structures appear in Southeast Asia. These are finely crafted stone jars hewn out of solid rock, 3 to 8 feet in height, weighing up to 16 tons. Obviously, these huge jars are not used to transport anything, rather they seem to be outsize funerary urns. Whether made from granite or sandstone, they represent an immense amount of labor and deft craftsmanship. They also have a curious geographical distribution, and that is why they are worth our attention.

The best known jars are in Laos, but 2,000 miles to the east in Celebes are many more. To the west, about 750 miles away, there are more in northern India. Finally, some see similarities between the jars in these three sites and the strange, stone pits on Easter Island some 8,000 miles east of Celebes. In these far-flung occurrences do we have independent invention (at least thrice) or cultural diffusion?

X1. General observations. The best-studied stone jars are those in Laos, so we begin there.

Laos. In the 1930s, the French archeologist, M. Colani, did the pioneer research on the Laos stone jars. P. Bellwood summarized her findings, made at the famous Plain of Jars located at Ban Ang. Here, Colani found about 250 of the huge jars.

There are thirteen sites described by Colani, and the jars themselves are mostly of a rather bulbous cylindrical shape, often with very thick bases, and are worked from soft local stones. In one case, transport of stone from 46 kilometres away is pos-

sible, but most were made locally, which is not surprising when one considers that the largest one recorded may weigh about fourteen metric tons! The average size of the jars is around 1.5 metres in height and diameter, but heights and diameters of three metres or more do occur. Some also have rebated rims, perhaps for now-vanished wooden lids to protect the contents. Scattered around the jars on these sites are stone discs---some simple like those at the Hua Pan sites, others strangely complex. These discs do not seal tombs, and neither are they lids for the jars, as Colani has convincingly demonstrated. (R3)

The Laos jars are mostly fashioned out of sandstone, although a few were laboriously carved from much harder red granite. Besides the 250 jars at Ban Ang, there are about 80 more at Lat Sen, 155 at Ban Soua, 34 at Na Nong, and still more at Ban Hin, the latter group is made from red granite. (R4)

The natives in the areas where jars are located know nothing definite of their origin. It is customary to say the jars were made to celebrate a great military victory 1,500 years ago. Modern professional opinion is that they are funerary urns probably made more than 1,500 years ago. (R4)

Celebes (or Sulawesi). Celebes is a large Indonesian island just east of Borneo. Here, vats or jars very much like those seen in Laos were described by H.C. Haven in 1926. They are often accompanied by large stone images or statues bearing an eerie resemblance to the famous stone figures on Easter Island, a third of the planet's circumference away. As in Laos, the jars are clustered in groups. Haven wrote:



Sketch of some of the huge stone jars located on the Plain of Jars, Laos.

The first stone vats I found in Besoa were near the image "Tadoe Lakoe" where there were four or five together. The most interesting one was cracked and had more or less recently been turned on its side. It was of average size, about five feet in diameter by six in height, but its peculiar feature was a concave shelf about eight or ten inches wide inside the vat a few inches from the rim... Except for this shelf the inside of the vat was perfectly smooth and well worked, the outside somewhat weathered and less smooth on that account. The bottom of the vat outside was flat, with the edge bevelled off hexagonally. The vats in nearly every case were encircled by consecutive raised rings. (R1)

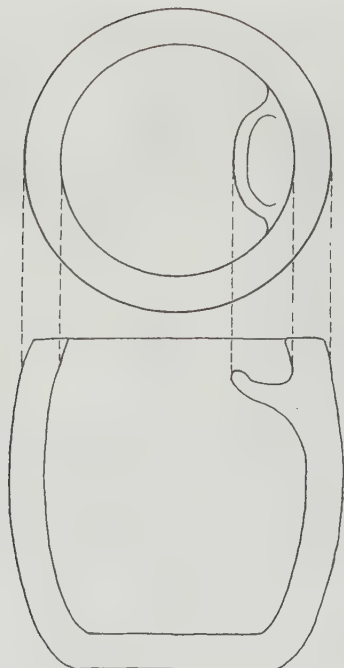
Again, like those in Laos, the jars of Celebes are accompanied by what appear to be lids. All are hewn from

single pieces of granite. The natives know nothing of their origin. The contents of the jars gave no hint of their purpose. (R1, R2) No dating available.

India. In 1929, two English explorers came across large stone jars in the North Cachar Hills in northeastern India. Most of the jars were simply cavities hollowed out of unworked boulders, but a few resembled the Laos and Celebes jars. (R3)

Easter Island. H.C. Haven was very impressed by the similarity of the Celebes stone images and the Easter Island statues. While no stone jars have been reported from Easter Island, there are some very curious pits carved out of solid rock. One pit was over 5 feet deep and $3\frac{1}{2}$ feet in diameter. Haven remarked:

Thus we see that Easter Island also has its circular vatlike pits near the



Internal structure of one of the stone jars on Celebes, Indonesia. (R2)

images. (R1)

X2. Diffusion or independent invention. After digesting the foregoing descriptions of the stone jars at four widely separated sites, the perennial question arises: Diffusion or independent inven-

tion? Bear in mind that nowhere else on the land masses and islands separating the jar sites in India, Laos, Celebes, and Easter Island are there additional large stone jars. In other words, there is no continuous cultural trail. Because of the great geographical gaps between the jar sites, Bellwood favors independent invention as the better explanation for the remarkable similarities among the far-flung stone jars. (R3) This, of course, is the perennial answer to the perennial question, whether the artifacts be pyramids, dolmens, or other homologous structures.

One can never disprove independent invention. But it does seem strange that four different groups of people, apparently not in communication with one another, would decide to spend untold weeks or months in carving giant stone funerary urns. In fact, why would any culture bother? But, then, why build the Great Pyramid?

References

- R1. Haven, H.C.; "The Stone Images and Vats of Central Celebes," Natural History, 26:272, 1926. (X1)
- R2. Haven, H.C.; "Huge Stone Jars of Central Celebes Similar to Those of Northern Indo-China," American Anthropologist, 35:545, 1933. (X1)
- R3. Bellwood, Peter; Man's Conquest of the Pacific, New York, 1979. (X1, X2)
- R4. Ciochon, Russell, and James, Jamie; "Laos Keeps Its Urns," Natural History, 104:48, September 1995. (X1)

MSO11 Enigmatic Configured Rocks

Description. Huge, deeply carved rocks with exaggerated reliefs of unknown cities or abstract collages of steps, seats, channels, niches, etc.

Data Evaluation. The professional literature we have reviewed says virtually nothing about the subject phenomenon. Our major sources, therefore, have been popular books. Yet, these publications provide photographs that cannot be denied. Unfortunately, the cultures that carved these bizarre rocks (mainly the Incas) left no written records to educate us about their purpose. Rating: 2.

Anomaly Evaluation. The standard mainstream explanation for the curious carved rocks described below invokes "rituals" of some undefined type. In truth, we can only guess the purpose of the "configured" rocks. They are so bizarre that the explanation may be beyond our ken and imagination. Rating: 2.

Possible Explanations. Rituals of some sort. What else is there?

Similar and Related Phenomena. Carved chairs (MSO9); the intihuatana at Machu Picchu (MSO8); sculpted hills (MSE7).

Entries

X0. Introduction. "Configured" rocks are a curious type of artifact bequeathed us by the ancient cultures of South America. These are not shallow petroglyphs, nor statuary, nor artificially shaped hills ("geoforms"), but something intermediate between petroglyphs and statuary. The carved chairs (MSO9) and the intihuatana at Machu Picchu (MSO8) fall into this category and could just as well have been included here.

The genre consists large, deeply carved and shaped stones or basement rock that look as though they might have been sculpted by a modern abstract artisan. Just as with the intihuatana, the real purpose of these configured rocks is obscure. They may have been places where rituals of some sort were performed, but that is just a guess.

X1. General observations.

Peru

Sayhuiti (Saihuite). West-southwest of Cuzco, Peru, near the town of Abancay, are the Inca ruins of Sayhuiti-Rumihuasi. Here one finds the Great Monolith, which Z. Sitchin nicely described in his book

The Lost Realms.

The site is known for its several monoliths and especially one called the Great Monolith. The name is appropriate since this huge rock, which from a distance appears as an immense bright egg resting on the hillside, measures about fourteen by ten by nine feet. While its bottom part has been carefully shaped as half an ovoid, the upper part has been carved out to represent in all probability a scale model of some unknown area. Discernible are miniature walls, platforms, stairways, channels, tunnels, rivers, canals; diverse structures, some representing edifices with niches and steps between them; images of various animals indigenous to Peru; and human figures of what look like warriors and, some say, gods. (R4)

E. Guidoni and R. Magni suppose that the Great Monolith is a model of some mountain sanctuary. (R2) If so, no one has associated it with any known sanctuary. Perhaps it is one of the "lost" cities of South America we hear so much about.

Kenko. Also near Cuzco is another "model" of a small town or sanctuary

carved deeply into a large, natural stone formation. (See MSE7-X1 for details.)

Concacha. Near Abancay, at a place called Concacha, is an even more enigmatic carved rock---"bizarre" might be a better descriptor. The rock is carved into wildly incongruous steps, platforms, niches, and channels. These features are all mixed up, almost nonsensical. Channels and grooves suggest that liquids may have been poured to enhance some sort of display or ritual. (R1, R4)

Bolivia

El Fuerte (The Place of Giants). This Bolivian site, near Samaipata, was developed in a huge area of red sandstone located atop a grass-covered hill. (See MSE7-X1 for details.)

Columbia

Sierra de Santa Marta. A photograph of another enormous, weirdly carved rock is printed in C. Berlitz's Mysteries from Forgotten Worlds. This irregularly shaped rock is about 20 feet high and

about as broad. The deeply incised carving is convoluted like the exterior of the human brain. In fact, if this rock were found on a reef, it would pass as a massive example of brain coral. (R5)

All of the sites just described have an eerie quality about them, like something out of one of H.P. Lovecraft's macabre stories. Strive as we might, we cannot imagine how these sites were used. Were the channels for holy liquids of some sort? Or blood? There are no written records, so we'll be forever perplexed by these strange configured rocks.

References

- R1. Bingham, Hiram; "In the Wonderland of Peru," National Geographic Magazine, 24:387, 1913. (X1)
- R2. Guidoni, Enrico, and Magni, Roberto; The Andes, New York, 1977, pp. 127, 167. (X1)
- R3. Childress, David Hatcher; Lost Cities & Ancient Mysteries of South America, Stelle, 1986, p. 327. (X1)



This intricately carved stone at Kenko, near Cuzco, may represent a small town or sanctuary. If it is a model, the full-scale structures have never been found.



*The curious carved rocks at Concacha, Peru, as photographed by H. Bingham almost a century ago.
(R1)*

- R4. Sitchin, Zecharia; The Lost Realms, Santa Fe, 1990, p. 196. (X1)
 R5. Berlitz, Charles; Mysteries from Forgotten Worlds, Garden City, 1972, photo following p. 158. (X1)

MSO12 The Haamonga Stones: A Trilithon in Tonga

Description. A massive trilithon (the Haamonga Stones) on a Pacific island in Tonga, consisting of three multi-ton slabs of coral rock. A basin and grooves have been carved on top of the lintel. An old account tells of a ditch and other upright stones in the area.

Data Evaluation. The Haamonga Stones have been described and pictured frequently in science magazines, journals, and books. However, the possible astronomical

applications alluded to below have not been studied in depth---as far as we know.
Rating: 2.

Anomaly Evaluation. The Haamonga Stones with their megalithic cast look very much out of place on a tropical Pacific island, but, while curious, such incongruity is hardly anomalous; neither is the social organization required to quarry, shape, transport, and erect the 30-40-ton stone slabs. For the anomalist, the most intriguing features of the Haamonga Stones are the grooves and basin atop the lintel. If either or both of these were employed in making astronomical observations, it would be unusual in the context of ancient Polynesian culture. Rating: 3.

Possible Explanations. The Haamonga Stones were erected to commemorate a king's two sons, as tradition has it, but were also used to predict the equinoxes or other astronomical events.

Similar and Related Phenomena. The astronomical applications of Stonehenge (MSH17); the Easter Island calendar site (MSH21-X4).

Entries

X0. Introduction. Trilithons are among the simplest megalithic structures, consisting of two upright stones connected at their tops by a cross bar or lintel. Trilithons have a wide geographical distribution: India, North Africa, and, of course, Stonehenge, in England. Despite this near-global scope, it is still startling to find a Stonehenge-like trilithon far out in the South Pacific on Tongatapu, an island in the Tonga group. One does not expect an echo of Stonehenge amid the palm trees. Furthermore, the Tonga trilithon, called the Haamonga Stones, seems to have had an astronomical application, as did Stonehenge. Because of the Stonehenge similarity and possible archaeoastronomical use, it is proper that we devote some space to the Haamonga Stones.

X1. General observations. The Haamonga Stones have impressed many explorers, travellers, and archeologists. From the many accounts, we select a very early one (1884) and a recent description by an archeologist (1979).

Thomson's account. B. Thomson's 1902 paper (R1) quoted the following description written by New Zealanders who visited Tonga in 1884.

The shape of the monument at first sight appears to be identical with the form so well known at Stonehenge,

namely, two upright stones with a third one lying across the top of them, but a moment's observation shows a very marked difference. Instead of the upper one being merely superimposed, in this case it is carefully inserted into the other two. A groove about two feet wide has been cut in each upright stone, and the upper stone, which has been carefully cut to the right size, has been placed in it, so that the ends are about flush with the outside of the perpendicular stones, while the top is about flush with the top of the stones; but, owing to the easternmost stone being a little lower than the other one, probably from breakage, it rises a little above it on that side. The horizontal stone lies east and west, and it is noticeable that, either by accident or design, there is a slight though perceptible inclination of the faces of the perpendicular stones toward the north, i.e., the north end of the opening between the stones is slightly narrower than the south end. On the centre of the top of the horizontal stone a hollow has been scooped out about the size of a coconut shell, and about 1½ inches deep, though whether this hollow has been part of the original design, or has been made at a subsequent period, it is impossible to say. Owing to the pressure of time and the absence of any correct tape or ruler, the measurements taken must be considered as approximate; they are, however,



The Haamonga Stones, Tonga.

roughly as follows:---Height of the perpendicular stones, 14 to 15 feet; depth of the horizontal stone, 4 feet 6 inches; distance between the perpendicular stones, 10 feet; base of the perpendicular stones, northeast side, 4 feet, northwest side, about 12 feet, or probably less; breadth of the perpendicular stones at the top, 7 feet, probably more. Thus it will be seen that the space contained between the three stones is nearly square, if not absolutely so...It seemed that there were some indications of a trench on both the north and south sides, and also that the trenches were part of a large circle, the stones being at the northernmost end (the end nearest the sea), but these indications are so faint that without further examination it would be impossible to pronounce with any certainty upon this. The stones are situated about 80 yards from the sea-shore. (R1)

From the above, we see that the Haamonga Stones were probably deliberately oriented. The possible presence of a surrounding ditch is reminiscent of

those ditches surrounding some British stone circles.

Bellwood's account. About a century later, some additional facts had been added.

On traditional grounds, one of the earliest monuments is said to be the massive trilithon called the Ha'amonga-a-Maui, located in eastern Tongatapu, which was constructed by the eleventh Tui Tonga (c. A.D. 1200) to symbolize his two sons and the bonds between them. It consists of two shaped coral uprights, each claimed by McKern to weigh 30-40 tons, and these each have deep notches in their upper surfaces to support a well-shaped lintel. The top of the lintel has a cup and grooves carved into it, and the present King of Tonga has suggested that these may have been used for recording equinoxes from star positions. Other large upright slabs of coral of unknown use stand nearby. (R3)

The "other" upright slabs added to the circular trench mentioned by Thom-

son enhance the similarity to European stone circles. They could have been employed for astronomical purposes along with the grooves. Could the basin on top of the lintel been used to float a crude magnetic compass? Or did it have some ritual application?

D.H. Childress, in his discussion of the Haamonga Stones, underscores the possible astronomical application of the trilithon. He also mentions that an Australian archeologist, D. Spennemann, estimated that it would have taken 1,000 to 1,200 people using coconut-log rollers to drag the heavy stones. That was a large fraction of the population of Tonga about 1,200 A.D. and implies a high degree of social organization. (R4)

References

- R1. Thomson, Basil; "Notes upon the Antiquities of Tonga," Anthropological Institute, Journal, 32:81, 1902. (X1)
- R2. Dieu, Jacques; "Tongatabu: Irritant Vestige en Polynesie," Kadath, no. 8, p. 31, May-June 1974. (X1)
- R3. Bellwood, Peter; Man's Conquest of the Pacific, New York, 1979. (X1)
- R4. Childress, David Hatcher; Ancient Tonga & the Lost City of Mu'a, Stelle, 1996. (X1)

MSO13 Tiahuanaco's Gateway of the Sun: Incredible Stonework

Description. An ornate gateway carved with extreme precision out of one piece of hard volcanic rock by artisans that supposedly possessed only stone tools.

Data Evaluation. Tiahuanaco's Gateway of the Sun is a major Bolivian tourist attraction. Many books delving into South American archeology mention it. From the broad spectrum of available literature, we rely upon three rather popular accounts that focus on the gateway's stonework. Rating: 1.

Anomaly Evaluation. Perhaps with modern drills and metal tools, artisans could cut out deep, precisely geometrical square and rectangular holes, but could they do the same with only stone tools? The exacting stonework seen on the Gateway of the Sun does not seem to challenge any archeological paradigms. Most likely it simply tells us how incredibly patient and adept the Tiahuanaco craftsmen were. Rating: 3.

Possible Explanations. None required.

Similar and Related Phenomena. Precision stonework seen in Inca buildings and walls (MSB in another volume and MSW3); elaborately carved rocks (MSO11).

Entries

X0. Introduction. Humans have a strong urge to build gateways or arches for victory processions and similar celebrations. Today, the Arc de Triomphe in Paris is the epitome of gateways. On Tonga, the Haamonga Stones (MSO12) might well have been a gateway for processions of some sort. But in the New World, the honors go to an elegant gateway erected some 13,000 feet high near the shores of Lake Titicaca in Bolivia. There, in the thin, cold air, stands the Gateway of the Sun amid the enigmatic ruins of the city of Tiahuanaco. We catalog this gateway because it is one of the most remarkable examples of precision stonework ever crafted in human history---and apparently without metal tools.

X1. General observations. The Gateway of the Sun is remarkable on two counts:

(1) The fascinating designs, symbols, and niches that decorate the two sides

of the gateway. The endless speculation about their meanings and applications is covered in a later volume. (MG)

(2) The high precision of the gateway's stonework, which is the subject of the present catalog entry.

Undeniably, the Gateway of the Sun is one of the most famous artifacts surviving from ancient South America. It was carved out of solid stone when the city of Tiahuanaco reigned supreme in South America---about 600-1,000 AD, perhaps a bit later according to some experts. Since the focus of this entry is the excellence of the gateway's stonework, we choose two quotations that emphasize this characteristic. The first is based upon E.G. Squier's classic work: Peru---Incidents of Travel and Exploration in the Land of the Incas. (Of course, Tiahuanaco was built before the heyday of the Incas.) The second quotation is from A.H. Verrill, a noted traveller, explorer, and scientist of the early 1900s. His admiration for the gateway is even less restrained than



Carved from a single block of hard andesite, the Gateway of the Sun at Tiahuanaco, high in the Bolivian Andes, displays intricate carvings as well as four deep, precisely carved, rectangular niches.

Squier's!

The most remarkable monument in Tiahuanacu, the "piece de resistance" from an archaeological point of view, is the great monolithic gateway which stands in the northwest corner of the area called the "temple." D'Orbigny says that when he visited the place (1833) it had fallen down. Every traveler that has visited it since then has found it standing erect. Who raised it, or for what purpose, is unknown. Entirely disconnected from any building or wall and facing inward toward the court, the presumption is that it has been moved from its original position. In all likelihood it once formed the entrance to one of the massive structures, perhaps the temple itself. Squier's description of this relic of American antiquity is so comprehensive and so clear in its details that most of the following is taken from his work.

The top of the monolith has been broken, some say by lightning and others by an earthquake, so that the two parts lap by each other, causing the sides of the doorway to incline slightly toward each other. Imagine a block of stone, somewhat broken and defaced on its edges, but originally cut with precision, 15 feet 5 inches long, 7 feet 2 inches high above the ground, and 18 inches thick. Through its center is cut a doorway, 4 feet 6 inches high and 2 feet 9 inches wide. Above this doorway, on its southeast front, are four lines of sculpture in low relief, like the Egyptian plain sculptures, and a central figure, immediately over the doorway, sculptured in high relief. On the reverse we find the doorway surrounded by friezes or cornices, and above it on each side two small niches, below which, also on either side, is a single larger niche. The stone is a dark and very hard trachyte. It is faced with a precision that no skill can excel; its lines are perfectly drawn, and its right angles turned with an accuracy that the most careful geometer could not surpass. Barring some injuries and defacements and some slight damages by weather, I do not believe there exists a better piece of stonemasonry, the material considered, on this or the other continent. The front, especially

the part covered by sculpture, has a fine finish, as near a true polish as trachyte can be made to bear. (R1, R2)

Trachyte is a hard, volcanic rock containing a considerable feldspar. The gateway's material is usually specified as andesite, but for stoneworkers there's not much difference between trachyte and andesite, they are both hard, igneous rocks.

We now pass along some of Verrill's enthusiasm for the gate's stonework.

This magnificent piece of sculpture measures nearly fifteen feet in length by eleven feet in height and two feet in thickness and is pierced by a rectangular doorway nearly five feet in height and over two feet in width. It is cut entire from a single block of andesite rock---the largest single piece of stone sculpture in the world.

.....

The opposite side of the portal, though wholly different, is even more remarkable. Here, the surface of the stone is bare of ornamental bas-relief carvings, but is decorated with a severe geometrical design. On the upper portion, at the opposite ends of the gateway, are four rectangular niches, two to a side, and on the lower portion there is a rectangular niche on either side of the doorway. These niches, which are cut into the hard rock to a depth of nearly six inches, together with their ornamental frames or borders, are so accurately cut and so mathematically perfect that even by means of a steel square and a millimeter scale I could not find a deviation or more than one-fiftieth of an inch in their angles or surfaces. This is perhaps the most astonishing feature of the Tiahuanaco stone work. (R3)

Given that the stone cutters had only stone tools at their disposal, how could they possibly have cut out geometrically perfect (within 0.02 inch) square and rectangular niches 6 inches deep? Just imagine pounding out a square hole in hard stone with another stone. But they did, and their expertise boggles the modern mind.

References

- R1. Anonymous; "The Ancient Ruins of Tiahuanacu," Pan American Union, Bulletin, 37:513, 1913. (X1)
- R2. De Ward, Sable; "An American Babylon," Pan-American Magazine, 31:108, July 1920. (X1)
- R3. Verrill, A. Hyatt; "The Oldest City in the New World," Travel, 53:12, September 1929. (X1)

MSR ANCIENT ROADS AND BRIDGES

Key to Phenomena

MSR0	Introduction
MSR1	Notable Ancient Roads: A Survey
MSR2	The Chaco Canyon "Roads"
MSR3	The Bimini "Road"
MSR4	The Maltese "Cart Ruts"
MSR5	Precocious Suspension Bridges

MSR0 Introduction

Great road systems were in place two millennia before the U.S. Interstate system. Both the Romans and Inca built road systems exceeding 10,000 miles in length. Remarkable as these ancient road systems were, we merely survey them here, preferring to focus upon Chaco Canyon's mysterious "roads," that putative submerged "road" off the isle of Bimini in the Bahamas, and those strange "cart ruts" that cross cross Malta's rocky terrain.

MSR1 Notable Ancient Roads: A Survey

Description. Ancient roads that are remarkable for one or more of the following characteristics:

- (1) Great length;
- (2) Early use of plaster or macadam-like surfaces;
- (3) Use of grooved stone pavement for wheeled, cargo-carrying trolleys;
- (4) Engineering sophistication far above the capabilities of indigenous peoples, implying unrecognized cultural contacts;
- (5) Carrying capacities far in excess of those believed to be required by the cultures involved; and
- (6) Existence of paved roads in unexpected places, such as Raratonga.

Data Evaluation. Most of the information provided below is derived from scientifically acceptable journals and books. Many of the references, however, are quite old, and we lack updating in some cases. Our file on ancient Asian roads is dreadfully thin. We have found nothing on old Australian roads, if such existed. In summary, our treatment of ancient roads probably misses some important engineering accomplishments of our predecessors. Rating: 3.

Anomaly Evaluation. Generally speaking, the roads cataloged below are easily within the engineering capabilities of the cultures involved. The roads are impressive and represent great labors and surprising sophistication, but they are not highly anomalous. Rating: 3.

Possible Explanations. None required.

Similar and Related Phenomena. Chaco Canyon roads (MSR2); the Bimini "roads" (MSR3); the Maltese "cart ruts" (MSR4); ancient bridges (MSR5).

Entries

X0. Introduction. Our history books relate how the Roman soldiers built roads when they were not fighting, which was most of the time. The Roman roads tied the Empire together and made it work. Two other great road systems were built in the Americas for the same military and political reasons: these were the Incan and Mayan road systems. These American roads were built for foot and animal traffic because wheeled vehicles were not used for transportation in Precolumbian Mesoamerica and South America. There were no carts or chariots rumbling along the Incan roads, just people and llamas.

Magnificent though they are, the Roman, Incan, and Mayan roads cannot be classified as anomalous. They of

course represent considerable labor, but they place no paradigms at risk. For this reason, our treatments will be brief. We prefer to devote space to the many less-well-known roads that have been found in unexpected places or were built for unusual purposes. In addition, there are two road systems that are so remarkable that they require separate treatment:

(1) The perplexing Chaco Canyon roads (MSR2); and

(2) The supposed "roads" found in shallow water off the Bahamian island of Bimini (MSR3).

New England. It is generally accepted that the Norse established a Precolumbian presence at L'Anse aux Meadows, but it is vigorously denied that these intrepid seafarers ventured farther down the Atlantic coast to New England. This declaration has not discouraged many claims of Viking buildings, epigraphy, and artifacts in the coastal states. The hotly debated Newport Tower, in Rhode Island, is a typical example. All of these suspect signs of Viking incursions are conventionally attributed to early European colonists from 1620 on.

Even so, some New England structures, including a few short pathways and "pavements," exhibit typical Icelandic characteristics. Some of these stone-paved roads lead down to the water just as they do in Iceland, where they are called "sjavar-gatas." "Roads" of this sort were found at Fort William Henry, near Pemaquid, Maine. Archeologists admit to the Icelandic character of these roads but point out that the presence of some bricks integrated into them rule out Norse construction. (R7)

Virginia. Our trawls through the old literature brought to light the following item from an 1852 issue of Scientific American. Not surprisingly, we have seen nothing further on this remarkable road!

We are informed by Col. Haymond and others, that a portion of a regularly macadamized road has been discovered on the opposite side of the river from this place [Fairmount]. We have not seen it ourselves, but learn that it extends pretty much along the bank of the river. Its width is about 16 feet, and the track well graded. The bed of stone seems to be about two inches thick, and made precisely after the plan of our macadamized roads. The discovery was made by the washing away of a hill-side, which partially covered the road. When and by what race of people this road was made is unknown at the present day, but it gives evidence of the existence of a population here at some former age of the world, as far advanced in civilization, or at least in the art of road making, as ourselves. There was found in the bed of the road a stump of the chestnut tree which was found to be about 150 years old at least and how much older our informant could not tell, as the stump was hollow. (R1)

The chestnut stump implies that the road was built before 1700. Not many macadamized roads were being constructed in North America at that date!!

Florida. More credence can be applied to an account of Indian-built roads in the region around the St. John's River, Florida. This is the same area where ancient canals (MSC8-X1) and many shell mounds were found (MSM1, MSM2) by early archeologists. Modern civilization has largely destroyed these signs of this unexpectedly sophisticated Indian culture.

As remarkable as the pyramidal mounds and artificial lakes are the highways, about 50 yards wide, sunk a little below the common level, and the earth thrown up on each side, making a bank about two feet high. From the St. John's to the Keys, these mounds, reservoirs, and highways were visible a few years ago. (R3)

United States. When Europeans arrived in North America, it was not a trackless wilderness as often stated in the history books. In fact, trails and paths centuries old led inland to the continent's heart, through the Rockies, and to the Pacific. Some impressive facts about the eastern portion of this network were penned by H. Mertz.

We are not devoid of information [concerning this network] for documents do exist tracing ancient overland pathways leading into Tennessee, Kentucky, Ohio and Michigan from the eastern seaboard. From these records we learn that a honeycombed network of trails once extended along the coast from Massachusetts to Virginia on the east, inland across the Blue Ridge westward to the Mississippi and from Tennessee northward to the Great Lakes---various trails being lined with well-defined stone markers. In diaries and journals of pre-Civil War days, marked trails not identifiable with the white man, naturally had been attributed by the narrator to historic Indians then living in the region. No one presumed otherwise. We now learn, however, that pathways from the east coast across the mountains to the west were not those of an historic Indian but bespoke of a darkly veiled past completely lost in history.

.....

Centuries ago a tangled web of highways threaded into this vast mid-western wilderness, each well-defined ---the better known perhaps being the Mohawk Trail through central New York State. Three others equally well-used stretched from east to west---the Kittanning Path, Nemacolin's Path and the Virginia Warrior's Path. Scores of secondary or subsidiary trails either connected or extended main trails---the Lake Shore Trail, the Mahoning Trail, the Great Trail, the Scioto-Beaver-Monongahela Trail, the Venango Trail and the Cuyhoga-Muskingum Trail being amongst the better known. (R30)

Of course, these trails are mostly obliterated now. A century or two ago, they were still plainly visible, cut one to two feet deep by thousands of passing feet and marked by upright stones for hundreds of miles. Mertz states that radiocarbon dating indicates that many of these trails are 2,000-3,000 years old. She maintains that they were not laid out by recent Indian tribes but a much earlier, still-unappreciated culture.

It must be added here that Mertz was greatly impressed with the immense quantities of copper extracted from the Lake Superior region and wondered if some of these trails had been used to transport it to the coasts where Precolumbian trans-Atlantic traders awaited! The trails alone, of course, cannot prove her surmise.

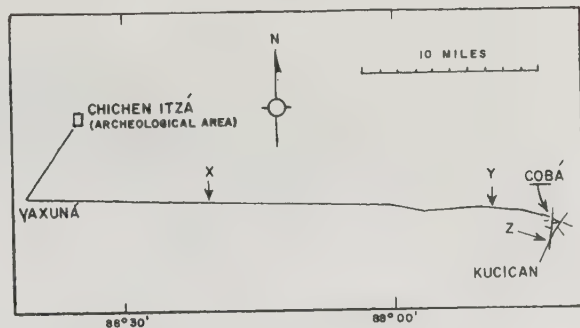
That this system of trails also extended to the West Coast is evident in a 1908 article by R.F. Gilder entitled "Pre-historic Thoroughfares."

Primitive man in crossing the continent clung to the great rivers of the West when journeying east or west. He usually followed the paths made by game which lead along the weathered ridges close by the rivers. Countless ages of use have cut those old trails deep into the earth...In Pottawattamie County, Iowa, in some places they have been worn six feet deep. Scattered along their edges for miles can be found flint flakes and chips showing how the Stone-Age artisan improved his time when journeying, by shaping out the implements required, scattering the debris as he traveled. I have followed these old trails on both sides of the river more than forty miles and

have found flint chips everywhere. (R9)

X2. Mesoamerica. In the Yucatan, the Maya constructed a network of roads or causeways called the "sacbe" system. "Sacbe" is a native word that means "Great White Way." (The plural is "sacbeob.") The first detailed description of the sacbeob came from T. Gann, who explored the region around Coba beginning in 1926.

One of the most striking features of Coba is the network of artificially constructed raised roads connecting the various groups around the lakes and running off in all directions to distant sites. One of these leads to Yaxuna, a distance of 100 km., terminating only 20 km. from Chichen Itza. These roads are raised above ground level and, for the most part, run perfectly straight. They are built of vertical slabs of roughly dressed stone, with an inside fill of large stone, covered with smaller stone. A fine plaster surface has now weathered away. (R14)



Map of the Yaxuna-Coba causeway, the greatest of the Mayan roads. It is 64½ miles long, 30-34 feet wide, and is surfaced with cement. (R18)

That these sacbeob were carefully engineered can be seen in a quotation from Gann's report.

The road represents an enormous expenditure of time and labour, involving the quarrying, transport, facing, and building-in nearly a million tons of stone, and is unique throughout the whole of the Maya area, for though cement-covered roads exist in and around many of the ruined cities, no such elevated causeway has been found elsewhere... On each side of the road were great quarries from which the stone used in its construction had been taken. Holes were apparently made around the great blocks, in which they built fires, and then pouring water into the red-hot holes, caused the rocks to split, so that slabs of it could be easily dug out. The sides were built of great blocks of cut stone weighing hundreds of pounds; the central part was filled in with unhewn blocks of limestone, and the top covered with rubble, which, as is indicated by the traces of it which remain here and there, was once cemented over... It was convex, being higher in the centre than on either side, and ran so far as we followed it, straight as an arrow, and almost flat as a rule. (R18)

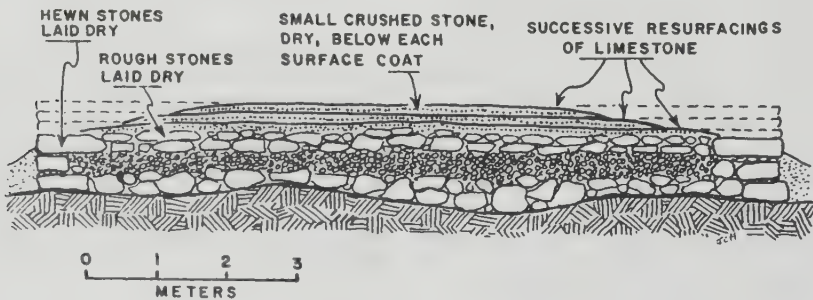
Almost certainly this was a roller used in constructing the road. (R16, R17)

Another interesting sacbe design feature was mentioned by M.H. Saville.

There is another road which unites Coba with Kucican, a ruin which we found some ten miles to the south, and for a number of miles has an elevation of six to seven metres. Near Kucican there are various passages made under the road, constructed with the typical Maya roof of the ancients. These tunnels would permit travelers to go from one side of the road to the other without having to climb over them. (R18)

When the details of the sacbe system became known to E. Smith, a proponent of diffusionism, he predictably saw a clear resemblance to the type of road construction used in Viet Nam and Indonesia in the same time frame. (R11) To Smith, this was still one more proof of an early oriental influence in Mesoamerica.

Finally, far to the west of the Yucatan on the Mexican west coast, there are still more ancient roads.



Section of a sacbe raised road running from Aka to Izamal, Mexico. Note the carefully layered roadbed and surface. (R22)

The Coba region is criss-crossed by over a score of shorter sacbeob. (R38) They are also found on Cozumel, an island off the east coast of the Yucatan. (R33)

The Maya did not have wheeled vehicles, but they knew of the wheel principle. Alongside one of the Coba sacbeob, they left a stone cylinder 13 feet long, 2½ feet in diameter, weight about 5 tons.

Baron von Brackel described several highways constructed by the ancient inhabitants in western Michoacan. They are six or seven feet wide, laid with unhewn large stones, the surface slightly shelving so as to shed the water freely, protected by stone facing, both above and below, where there is danger of the banks giving way. Their direction is almost recti-

linear, and evidently the deep ravines and water courses were crossed by hanging bridges, as the road continues on either side of them. The paving was so thoroughly done that many miles of it are in perfect condition. (R6)

Von Brackel suggested that these roads were built to speed the flow of copper and other minerals to the sea-coast. (R6) But, if so, to what Pacific destinations was the copper exported?

X3. South America

Western South America. When the Roman Empire was at its greatest extent, Roman roads reached from Hadrian's Wall in northern Britain all the way to Jerusalem ---unquestionably, one of the greatest engineering achievements of that era. But even before Roman hegemony, pre-Inca engineers in South America were building roads 100 feet wide stretching hundreds of miles. When the Inca began to establish their empire, they adopted the earlier roads, standardized and extended them. When at its fullest extent, the Inca road network was 5,600 kilometers (3,500 miles) long and included over 23,000 kilometers (14,400 miles) of interlinking roads. (R28) It exceeded the size of the Roman road system and had conquered great rivers, deep chasms, and the thin air of the high Andes---obstacles the Roman engineers never had to cope with.

From many references, including one entire book (R27), devoted to the Inca road system, we select one dating from 1872 which conveys the astonishment that the early explorers of South America felt when they viewed this "wonder" of the ancient New World.

Nothing in Ancient Peru was more remarkable than the public roads. No ancient people has left traces of works more astonishing than these, so vast was their extent, and so great the skill and labor required to construct them. One of these roads ran along the mountains through the entire length of the empire, from Quito to Chili [sic]. Another, starting from this at Cuzco, went down the coast and extended northward to the equator.

These roads were built on beds of "deep understructures" of masonry. The width of the roadways varied from twenty to twenty-five feet, and they were made level and smooth by paving, and in some places by a sort of macadamizing with pulverized stone mixed with lime and bituminous cement. This cement was used in all the masonry. On each side of the roadway was a very strong wall more than a fathom in thickness. These roads went over marshes, rivers, and great chasms of the sierras, and through rocky precipices and mountain sides. The great road passing along the mountains was a marvelous work. In many places its way was cut through rocks for leagues. Great ravines were filled up with solid masonry. Rivers were crossed by means of a curious kind of suspension bridge, and no obstruction was encountered which the builders did not overcome. (R2)

Naturally, much more is known about the Inca road system today. The "standard" width of an Inca road was about 24 feet, but they were often narrower in the high mountains. Like the Romans, the Inca installed distance markers along their roads. The Inca "milestones" were about 7,500 meters apart---equal to their "mile" or "topo." (R23) Road users were serviced by regularly spaced rest houses ("tampu"), where food could be had. Rapid communication throughout the empire was made possible by runners ("chaski") stationed along the roads and used in relay fashion. Messages and fresh fish for the Inca moved at about 240 kilometers per day. (R25) For extremely urgent messages, signal fires could transmit information from Quito to the Chilean terminus, 4,000 miles away in something like 6 hours. (R13)

Many of our references assert that some of the Inca roads usurp roads built by previous cultures. Because of these adaptations, it is difficult to know the real extent and nature of the pre-Inca roads. The best account of these earlier roads is by G. Savoy, who surveyed some of them from the air and inspected a few later by foot.

Savoy wrote how in 1963, while flying over Peru's Santa Valley, he noticed an unusually wide road below---much too wide to be Incan. Following it by plane, it crossed the Santa River, where there must have been a suspension bridge at



Map of major segments of the Inca road system. Heavy lines indicate surveyed sections. (Adapted from R27)

one time. Numerous secondary roads angled back and forth from the main thoroughfare.

We flew back and forth, keeping the road under the cowl of the aircraft, taking photographs before continuing south again. From what I could tell, we had located an important inter-valley highway unreported up to that time. Fragments of it might have been known, but the big highway we had been following was a continuous roadway linking up the coastal valleys. Far inland, it was a different system than those previously known on the western seaboard. The Inca built their roads in a straight line, but this larger one followed the natural course of the terrain. It swept past valleys and dry gorges ever advancing over the flatlands in a graceful manner. It continued into the Casma Valley. It would more than likely prove to be the key arterial of the Mochica or the Chimu nations who had dominated these valleys for several centuries before the latter was absorbed by the Inca. A road system such as this would have been useful to the Mochica-Chimu, who controlled these valleys. However, it was altogether possible that the Tiahuanaco or the earlier Chavin may have built penetration roads from the highlands while connecting these important valleys. Their influence was certainly felt on the coast. We had discovered this during our ground probes with archaeologists. (R24)

During later ground reconnaissance, the main pre-Inca highway was found to be 100 feet wide. One has to wonder why these earlier peoples needed such a wide road when the Incas, with their huge armies, could make do with 24 feet!

X4. Europe

Britain. Remnants of Roman roads can still be seen in Britain, as they can in other parts of Europe and the Middle East. But when the Roman legions waded ashore in 44 B.C., they found roads that had already been in use for over 1,000 years.

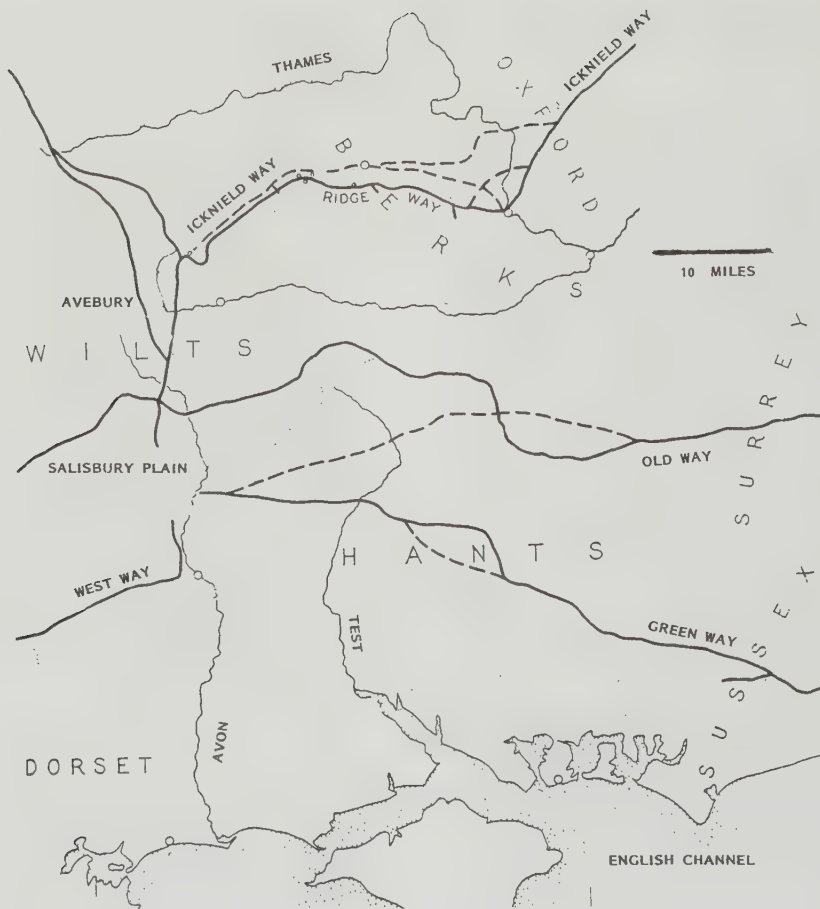
The "trackways" on the English Downs, in southern Britain, are particularly impressive. (See map.) In addition to the

just-mentioned map, H. Peake provided detailed descriptions of some of the more important trackways in a 1939 issue of Antiquity.

Along each of the main ridges runs an ancient track, not quite continuous today, but unbroken in places for many miles. This track follows the crest of the down where free from clay; where the crest is clay-capped, the track runs along the slope of the scarp. Some lengths have been converted into tarmac highways, others have been surfaced with gravel: but the greater part remains a broad, grassy way, scored with cattle tracks. By the side of these ways occur strange enclosures, surrounded by three interrupted ditches, that are called causewayed camps. Many of these have proved to be the work of the Neolithic people of the downs. More numerous still are the mounds, known as long barrows, many containing a chamber of large unwrought stones, which were the tombs of the same people. (R19)

The extent of one of these trackways was better conveyed by a somewhat romantic description of the Icknield Way by G.S. Hawkins. Hawkins was working out the archeoastronomical significance of Stonehenge and nearby Avebury when he learned about the Icknield Way.

I have stood in the great circle of Avebury near the southern end of that extraordinary prehistoric road called the Icknield Way and tried to imagine the appearance of the voyagers along that 200-mile artery which ran all the way from Salisbury Plain up to the Norfolk coast above London, widening in places into an ancient equivalent of a modern four-lane superhighway. I have not succeeded. Why would primitive people, possibly without wheeled vehicles, build such a wide turnpike? What sort of traffic moved along it, that broad highway, all those centuries before the Romans laid out their straight and narrow roads, another thousand years before Chaucer's pilgrims jostled each other along those winding country lanes to Canterbury. All that one can know is that on such ways passed such men and such spirit that there arose throughout the land those memorials to death and life which



Ancient trackways radiating from Salisbury Plain. Dashed lines indicate later trackways. (Adapted from R9)

have so long outlived their creators. (R21)

Britain is home to another very different sort of road: the wooden trackway. Much shorter than the Icknield Way, one of these, the so-called "Sweet Track," must not be ignored because it is one of the oldest man-made structures in Europe. Using radiocarbon and tree-ring data, the wood from which the Sweet Track was constructed was felled in 3,807 B.C. So, almost 6,000 years ago, Neolithic people built a elevated wooden trackway, some 1,800 meters long, that permitted them to conveniently traverse swampy ground in a region of southern Britain called the Somerset Levels. (R34-R36)

Greece. A radically different type of road connected the Gulf of Corinth with the Aegean Sea in ancient times. It was a railway or sorts. Only 4 miles long, the Diolkos, as it was called, was probably constructed about 600 B.C. All across this four-mile stretch of land, Greek engineers laid a pavement of limestone blocks and in them cut two parallel grooves about 5 feet apart. Trolley wheels fit neatly into these grooves and, presto, a ship railway was created. Small warships and empty cargo vessels were loaded on the trolleys and pushed and pulled from one body of water to the other. In this way, the long journey around the southern part of Greece (the Peloponnesus) was eliminated. The Corinth



Artist's rendition of the Sweet Track.

ship railway was used until about 900 A.D. It was one of the marvels of ancient engineering. (R41)

Beginning in 1881, a canal was dug across the isthmus of Corinth and is still in use.

The Diolkos reminds one of the Maltese "cart ruts" covered in MSR4.

left the she-wolf's lair. By the end of the Third Century B.C., the Chinese Imperial highways ran for 4,250 miles. The figure of 20,000 miles was attained by 200 A.D. (R41)

X5. Asia. In ancient times, Europe and Asia were connected by the Silk Road and other caravan routes. Further, some sections of the immense Asian land mass were knit by road systems, much as the Roman roads integrated Europe. Unfortunately, we have not yet found out very much about these Asian road systems.

India. From the Fourth to the Second Century B.C., the Mauryan rulers of the Indian subcontinent constructed a great road that Eratosthenes asserted was 2,600 miles long. (R37)

China. Imperial road-building in China began in the Ninth Century B.C.---a century before Romulus and Remus ever

X6. Africa

Egypt. The ancient Egyptians were first in many technologies, including the construction of paved roads. Considering the weights of the stone blocks they had to haul from their quarries to their building sites, hard road surfaces were essential.

Forty-three miles southwest of Cairo lies a basalt quarry favored by ancient Egyptian artisans. Old Kingdom craftsmen laboriously cut this hard, black, glassy rock into royal sarcophagi and pavements for the mortuary temples at Giza just outside Cairo.

To transport the heavy blocks of basalt from the quarry to Giza, the Egyptians built a quay on Lake Moeris, which then had an elevation of 66 feet above sea level and was located $7\frac{1}{2}$ miles southeast of the quarry. (The Lake

is now much smaller and 148 feet below sea level, indicating a large climate change.) Then, when the Nile flooded and its waters reached a gap in the hills separating the Lake and the Nile, the Egyptians were able to float the blocks of basalt over to the Nile and down to Cairo.

Good thinking! But how did they transport the heavy blocks $7\frac{1}{2}$ miles from quarry to quay? The answer: What was apparently the first paved road on the planet. This 4,600-year-old engineering feat averaged $6\frac{1}{2}$ feet wide and was paved with thousands of slabs of sandstone and limestone, with some logs of petrified wood thrown in. Since the slabs show no grooves, it is thought that the stone-laden sleds moved on rollers. (R39, R40)

Rift Valley. Remnants of old roads can also be seen in Subsaharan Africa. Unfortunately, we have only this tantalizing summary now quoted from Nature.

Capt. G.E.H. Wilson discusses in Man for November the evidence for the existence of a forgotten civilization in the Rift Valley, East Africa. The existence of ancient works, terracing, grading roads (the so-called elephant tracks) and irrigation works---canals and drainage---is now established not only in Tanganyika, but also in Abyssinia, Uganda, Kenya and Northern Rhodesia...The roads, clearly not elephant tracks, point to a high state of civilization. They are difficult to locate, though in places they are part of roads in use today. The points at present suggest a system of communication running north and south on the eastern side of the Great Lakes, pointing to outlets by way of the Nile in the north and by Rhapta in the south, with possibly an intermediate route via Mombasa, the origin of which may prove very much more ancient than is thought. (R15)

X7. Oceania

New Zealand.

The Journal of the Polynesian Society for December, 1903, contains a description of an ancient road called the

"Great Road of Toi." It follows, generally, the foot of the hills, cutting across the mouths of the valleys, leaving the level flat to the seaward. It is about 22 or 23 miles in length, and is paved with flat volcanic or coral stones. Its width is about 15 or 20 feet. In several places, at the sites of old villages, are to be seen stone seats, where local gossips used to sit and learn the news of passers by. (R8)

We know nothing additional about the Great Road of Toi, but there is a very similar road on Raratonga northeast of New Zealand.

Cook Islands. Raratonga is a member of this picturesque group of Polynesian islands. The entire island is ringed by a road, parts of which are paved with finely cut and fitted, flat slabs of basalt. Where not so paved, the road is covered with basalt and coral gravel. Called the Ara Metua, the road connects the settlements located around the fringe of the island. Parts of the Ara Metua are kerbed with fitted blocks of prismatic basalt. Occasionally, these kerb stones are arranged to create rectangular enclosures. Stone seats installed within the enclosures were said to be used by sentries who monitored traffic along the road. According to New Zealand archeologists, the Ara Metua is probably over 1,000 years old. (R32, R42)

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MSR2 The Chaco Canyon "Roads"

Description. A unique complex of well-engineered roads associated with the major Anasazi ruins in and around Chaco Canyon, in northwestern New Mexico. The Chaco Canyon roads are characterized by their great lengths, straightness, alignments, and the frequent presence of roadside shrines.

Data Evaluation. The Chaco Canyon roads have been vigorously studied by archeologists on the ground and, more recently, by thermal-imaging from aircraft. There is a large body of pertinent literature. Rating: 1.

Anomaly Evaluation. The anomaly of the Chaco Canyon roads resides in our ignorance of their purpose; that is, how they were really used by the Anasazi. Most archeologists and anthropologists lean towards the theory that they were ceremonial highways. Others, in the minority, opt for a multifunctional status, including commerce, communication, and application of military might. This divergence of views allows us to assign a low level of anomalousness. Rating: 3.

Possible Explanations. See above discussion.

Similar and Related Phenomena. British trackways, pre-Inca roads (MSR1); Chaco Canyon buildings (MSB in another volume); double stone rows and avenues (MSH3); multiple stone rows (MSH4); linear earthworks (MSW1).

Entries

X0. Introduction. Northwestern New Mexico was once the center of a great pre-historical cultural phenomenon. At its focal point was Chaco Canyon, a creation of the Anasazi, who flourished there between 900-1150 A.D. At Chaco Canyon, the Anasazi constructed a complex of "great houses," the principal one being Pueblo Bonito. Together, the great houses offered about 700 rooms to visitors as well as numerous ceremonial chambers called "kivas." Additional Bonito-style structures were built in outlying areas encompassing an area of about 100,000 square miles, reaching into Arizona, Utah, and Colorado. All of these buildings were expertly constructed using the same massive core-veneer masonry. Everything in this immense region was carefully planned, symmetry was revered, as were celestial alignments. The Anasazi knew what they were doing, but even after a century of archeological research, we are not so sure.

Apparently, the Anasazi did not occupy Chaco Canyon on a permanent basis. There is no evidence that it was a commercial center. Burials are extremely rare, so Chaco Canyon was not a vast mortuary like some of the Old World megalithic sites. There are signs that there

were periodic episodes of mass food consumption and ritual smashing of pottery. Then, quickly, somewhere around 1150, Chaco Canyon was abandoned, and whatever was transpiring there ceased.

Clues to the meaning of the Chaco Canyon phenomenon may be found in the curious "roads" that are obviously associated with the great houses in the canyon proper and the outlying areas. Some of these well-engineered roads do lead to Chaco Canyon, but others do not. The Anasazi roads are totally unlike the Inca and Roman roads because they do not seem to have been used for commerce, the extension of military power, or for the communication of administrative orders. The Chaco Canyon roads were not ordinary roads. That is why they are cataloged separately.

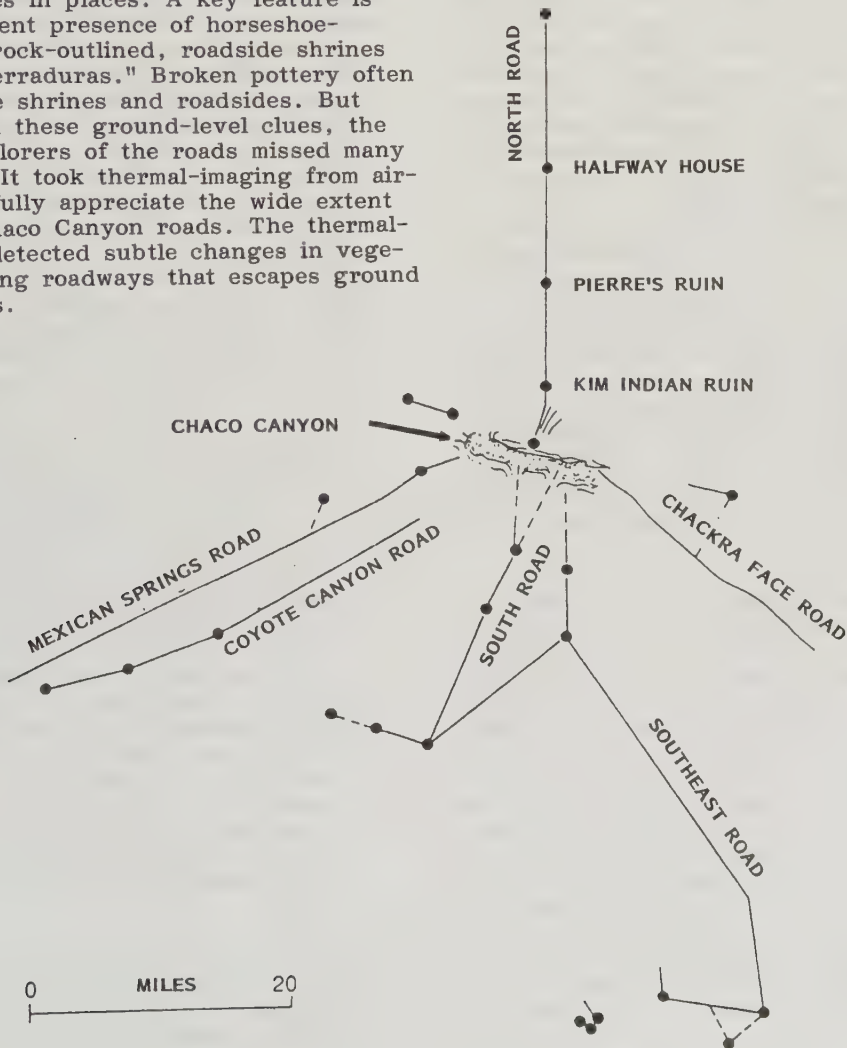
X1. General observations. The Chaco Canyon road system is at least 1,000 miles long, perhaps even 1,500 miles, but it is not all interconnected. There are isolated sections. Most of the roads are about 30 feet wide, well-engineered,

and run straight for long distances, often in predetermined directions.

Despite their size, anyone unfamiliar with them could walk right across a road and notice nothing. With a little instruction, the roads begin to stand out—but not vividly. There is usually a swale—a slight longitudinal depression where the roadbed was built. The worked soil along the road is usually a bit darker than the surrounding terrain. The disturbed soil also favors certain plants, such as sage brush and mustard weed, and these betray the presence of a road. Earthen berms and curbstones mark the road edges in places. A key feature is the frequent presence of horseshoe-shaped, rock-outlined, roadside shrines called "herraduras." Broken pottery often marks the shrines and roadsides. But even with these ground-level clues, the early explorers of the roads missed many of them. It took thermal-imaging from aircraft to fully appreciate the wide extent of the Chaco Canyon roads. The thermal-imaging detected subtle changes in vegetation along roadways that escapes ground observers.

Curiously, no discarded road-building tools been found alongside the roads.

By following the subtle signs just mentioned, one can walk along Chaco Canyon roads and observe that they do not swerve around obstacles, such as hills, mesas, and streams. Steep inclines are negotiated by steps cup into the rock and by wooden ramps. Straightness was obviously a passion of the road-builders and more important than easy walking. In this there may be a clue as to the purpose of the roads.



Map of the major roads leading to Chaco Canyon, New Mexico. (Adapted from R6)

Frequently, the roads lead to high points on the horizon and to outlying buildings where more shrines were located ---but not always. Some roads terminate nowhere in particular! For all the labor lavished on the road system, there is a strange lack of unification!

Another puzzling fact is the existence of doubling, even quadrupling of a few sections of some roads. Why would parallel roads be needed when a single road, 30-feet wide, would have been more than adequate for the sparse population?

In the large, the Great North Road and the South Road form the backbone of the Chaco Canyon road system. These are regional features that connect many outlying shrines and great houses to the focal point at Chaco Canyon. But what does it mean when when the 5-mile-long Coyote Canyon Road stands isolated south of Chaco Canyon totally unconnected to the system. Other long road segments also stand alone. (R4)

At the practical level, the roads have been characterized as "over-engineered and under-used." (R4) They certainly represent a huge investment of time and resources. Strangely, the periods of road-building seem to have been correlated with droughts---just when the Anasazi should have been concentrating on survival instead of public works!

Whatever the Anasazi were up to at Chaco Canyon, the Great North Road was central to it. Yet, even this vital feature is perplexing. K. Gabriel describes it in these words.

The North Road leaves Pueblo Alto [one of the great houses in the Canyon] on a bearing of 15° east of north, but within four kilometers it assumes a bearing that varies little from true north. The North Road can be traced for more than fifty kilometers, past Kim Indian Ruin, the Pierre's Ruin community, and Halfway House to the traces of an earth and juniper stairway that descends into Kutz Canyon. In some areas there is no trace of a road for as many as twelve and a half kilometers. In other areas, the North Road exhibits double, or even quadruple parallel road segments. The ultimate destination of the road is unknown although the prevailing thinking is that the road continued down Kutz Canyon to Salmon Ruin. Some believe it went on to Aztec Ruin, which post-dates the road, while others believe

that if the road continued beyond Kutz Canyon, it would have stuck to the bearing of true north. (R5)

Thus, we know only the southern anchor point of the Great North Road, not where it went, if anywhere in particular. Was it originally continuous? Why the parallel segments?

How does one explain the Chaco Canyon roads? A general consensus holds that their purpose was ceremonial, perhaps like the British megalithic avenues and trackways or the wide, pre-Inca roads in Peru. On holy days, walking en masse with your family and neighbors to a shrine or great house could have been a social unifier, as must have been the building of the roads themselves. Converging at Chaco Canyon, entering the kivas, feasting, and ritually smashing pottery could have been the Anasazi equivalent of attending mass at a great cathedral. Walking in a procession to Chaco Canyon may have been akin to medieval pilgrims wending their way to Canterbury or Moslems visiting Mecca. This may all be surmise, but there are few artifacts that suggest other purposes.

Nevertheless, some scientists do dissent as in the following paragraph.

Not all archaeologists agree with the new thinking. Gwinn Vivian, associate director of the Arizona State Museum in Tucson, believes the roads were multifunctional, that they were also a symbolic means of linking scattered populations to central pueblos in Chaco Canyon. "The roads did serve to facilitate communication and transportation between Chaco and the outliers," he says. He doesn't subscribe to the view that the roads lead to ceremonial sites in the landscape. "As far as I can see, Chaco roads have definite end points, and they end at the outliers." He also believes that the Great Houses were essentially dwellings, "with historical analogs in multistoried pueblos that the Spanish found and which exist today." (R4)

Manifestly, Vivian's views contrast starkly with those mentioned before the quotation.

In fact, there is some hard evidence that the roads were part of a communication network. Several of the prominent sites along the road system show signs of signal fires. These could have transmitted

information by night, while mica mirrors served the same purpose during the day.

In the end, though, the preponderance of evidence suggests the roads were ceremonial highways or "power corridors" serving transcendental ends.

X2. Related prehistoric roads. The Chaco Canyon roads are different; they stand out boldly against the other prehistoric roads of the North American Southwest.

Actually, the Anasazi did construct multifunctional roads in Utah and elsewhere. Used for trade and communication as well as ceremonial processions, the Utah roads are worn as much as 3 feet deep into the terrain. They have variable widths: 15-45 feet. About half of them are not straight. In their general plan they display the hallmarks of Anasazi road-engineering, but were obviously heavily used in nonceremonial activities. (R5)

Almost 1,000 miles south of Chaco Canyon, in the Mexican state of Zacatecas, there seems to be a small version of Chaco Canyon at La Quemada. The roads there are much the same as those at Chaco, but there are only 102 miles of them in a much smaller area. The La Quemada roads lead to defensible geographical prominences rather than shrines and buildings, implying that their main purpose was military in nature. (R5, R8)

The Anasazi did not live in a vacuum. To the south were the Hohokam and Mogollon spheres of influence. A strong Mesoamerican influence diffused northward

across Hohokam and Mogollon territories via well-known trade routes. Other trails connected the Anasazi with Nevada and California tribes.

One cannot confuse the Chaco Canyon roads with these busy trade routes. Rather, they are to be compared with the "ceques" that emanate from Cuzco, Peru, some of the Nazca lines, and the Icknield Way in Britain; all of which also await full decipherment.

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MSR3 The Bimini "Road"

Description. The presence of a formation of stone blocks just off the shore of North Bimini, Bahamas, that appears to be man-made. The debate over artificiality has been less than rational because some cult archeologists claim that this "road" or "wall" was built by the fabled Atlanteans.

Data Evaluation. Our information sources clump into two groups: (1) investigations by mainstream scientists; and (2) parallel studies by archeological revisionists. Actually, both groups publish similar observations. The basic descriptions of the Bimini Road are much the same---as they should be. It is the interpretation of the available facts that is an issue here. The controversy might be settled if some underwater excavation was done. If artifacts or obvious signs of human masonry were uncovered, artificiality would be proven; otherwise, the Bimini Road will remain just plain beachrock in the eyes of most. Rating: 2.

Anomaly Evaluation. Mainstream scientists are already convinced that the Bimini Road is a natural formation. On the basis of the available evidence, they are probably correct. The apparent regularity of the stones in the Bimini Road is a weak argument for artificiality, because nature regularly produces many types of geometrically regular formations (patterned ground, block fields, etc.). Still, the Bimini Road is unusual from a geologist's perspective for at least four reasons.

- (1) The sharp 90° bend in the Road;
- (2) The Road's angle with ancient beach lines;
- (3) The Road's high degree of regularity; and
- (4) The Road's great depth in view of its youth (2,200 years) and the low rate of sea-level changes in the area.

At the very least, the Bimini Road is a geological curiosity. Rating: 3.

Possible Explanations. The Bimini Road is most likely a natural formation, albeit a peculiar one.

Similar and Related Phenomena. Beachrock formations in many tropical seas. Patterned ground (ETP1); rock cities and block fields (ETP2); natural polygons (ETP3). ETP entries are in the Catalog Carolina Bays...

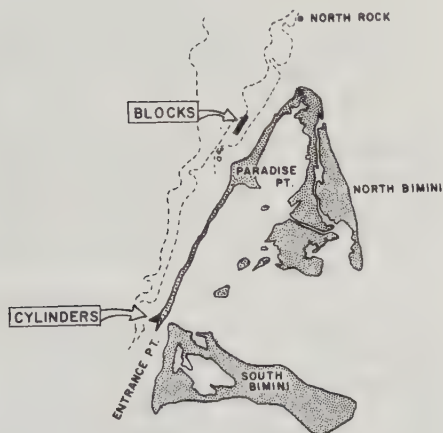
Entries

X0. Introduction. Fantastic claims have long plagued mainstream science. One of the most instructive encounters between the skeptical scientists and "maverick" archeologists began in 1968. In that year, Bahamian natives led J.M. Valentine to a strange formation of rocks off Paradise Point, North Bimini. Beneath about 15 feet of warm Caribbean water, Valentine saw a long, linear formation of squarish stones. So regular was the rock formation that he thought the stones might be the ruins of an ancient megalithic structure.

Although underwater ruins are rather common in the Mediterranean, they are exceedingly rare in the Bahamas. What made Valentine's discovery exciting to "cult" archeologists was its fulfillment of a prediction made in 1940 by E. Cayce, the "Sleeping Prophet." During one of Cayce's many, many "readings," he foresaw that circa 1968-1969 the western part of sunken Atlantis would rise!

To be sure, large, squarish stones do exist off Paradise Point, but are they handiwork of nature or ancient man, per-

haps the work of the Olmecs or Maya? Avant-garde archeologists have had a field day with Bimini's long line of regularly arrayed stone blocks. Do they constitute a road or a wall? It doesn't matter which, whatever it is, it seems to be artificial; and this challenges conventional archeological thinking. The ensuing debate persists to this day, despite many scuba dives by both scientists and not-so-scientific individuals. It is only fitting that the Bimini Road lies at one corner of the Bermuda Triangle!



Locations of cylinders and blocks found in shallow water off Bimini, Bahamas. (R1)

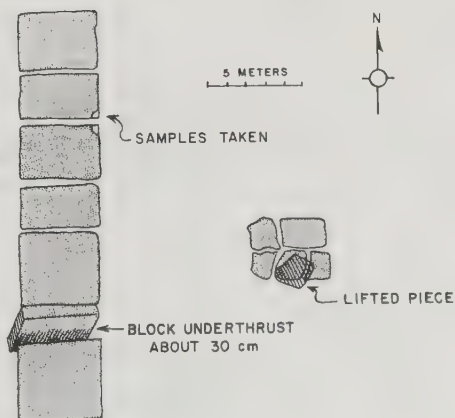
X1. General observations. J.M. Valentine had announced his discovery of the Bimini Road in the *Muse News*, a Florida museum newsletter. It was quickly picked up by the popular magazine *Argosy* and followed by two books. By 1971, it was a fixture of cult archeology.

Actually, science responded more quickly than usual to those rash claims about Atlantis and megalithic ruins. The results of first professional reconnaissance of the Bimini Road appeared in an article by W. Harrison that was published in *Nature* in 1971. We quote liberally here because the scientific position regarding the nature of the Bimini Road has changed little since 1971. Harrison wrote:

The most obvious "pavement-like

stones" or blocks form single or double lines roughly parallel to the present shoreline. The blocks here are between 60 and 90 cm thick, somewhat pillow-shaped in cross section, their originally right-angled corners having been trimmed back, chiefly by boring molluscs and sea urchins. All of the blocks are of coarse-grained limestone lying on a stratum of denser limestone of finer grain. Shifting sands cover this underlying formation in most places, giving the impression that the blocks have been placed there. Erosion at the interface of the two rock types has caused many of the largest blocks to fracture, either under their own weight or when storm swells have caused heaving and fracturing.

Although casual inspection of structures such as the fractured rock of [the figure] might suggest small slabs that have been cut and fitted, closer examination of the opposing faces of the lifted and the unmoved pieces indicates an exact correspondence of bedding planes and surface morphology, so that all pieces are from the same original block. Similarly, the margins of adjacent large blocks correspond to one another, indicating that all blocks have developed by fracturing of an originally coherent formation. At no place are blocks found to rest on a similar set beneath. Samples of several blocks indicate that all are composed of shell-hash cemented by blocky cal-



Harrison's drawing of some of the blocks in the Bimini "road." (R1)

cite, a type that originates only in the fresh water vadose or phreatic zones. The rock was thus almost certainly lithified during the lower relative sea level of the Pleistocene.

.....

The overall result is a field of blocks that at first sight appeared to have been fitted together, and this has led to statements such as (some) "human agency must have been involved". The blocky remains of the limestone outcrop are, however, no more enigmatic than other subaerial or subaqueous outcrops of jointed limestone found in various stages of fracture and decay in the northwestern Bahamas. (R1)

In short, the Bimini Road is simply common beachrock which has a strong natural tendency to fracture into blocks.

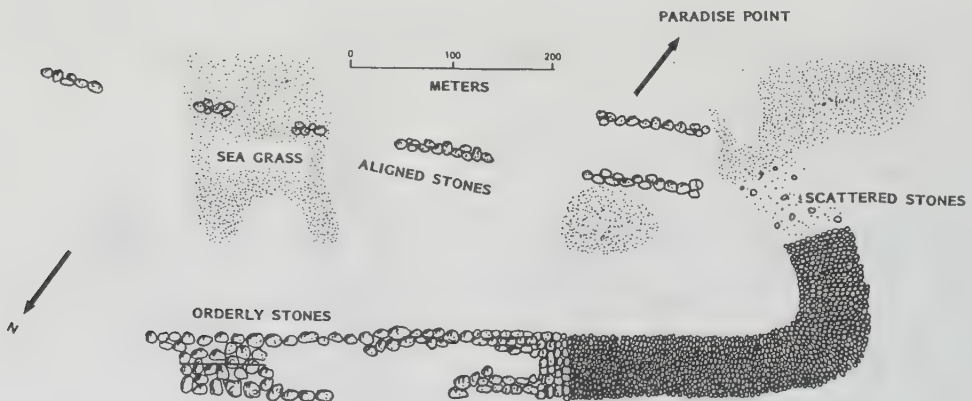
To a scientist, Harrison's article in a major, peer-reviewed, science journal would appear to dispose of any claims of artificiality. It did not in the minds of many amateur and cult archeologists.

In the mid-1970s, expeditions to Bimini, led by D. Zink, kept the Atlantis idea alive. Zink's teams made many dives, taking an abundance of photographs, drawing detailed maps, and retrieving many samples. In his 1978 book *The Stones of Atlantis*, a classic of its genre, Zink summarized his conclusions in a single paragraph.

The upshot of our work in 1974 was a growing feeling among us that the so-called Road site was not a natural formation but could, instead, have been engineered by man. The straightness of its 1900-foot length suggested the precision of a survey. The order of the various rows of blocks; the fact that they are not attached to the sea floor, our chartwork that showed their overall orientation about seven degrees out of alignment from the present beach line---all led us to conclude that we were very likely dealing with an underwater archaeological site. If Dr. Valentine's theory of Bimini as a megalithic site were valid, perhaps it would be a good idea to find a specialist in this field to join us in the search. (R2)

Basically, Zink's argument for human construction of the Bimini Road is based upon its geometry: it looks artificial. However, beach rock all over the world is notorious for its tendency to fracture into squarish blocks.

E.A. Shinn, of the U.S. Geological Survey, also investigated the Bimini Road and similar rock formations in the Bahamas. He arrived at conclusions that differed radically from Zink's. His photos demonstrate vividly how beach rock has this natural tendency to fracture into rectangular blocks, creating strips of pavement-like blocks essentially identical to the famous Bimini road.



Curious distribution and organization of stones off Bimini. (Adapted from R3)

Shinn concluded as follows:

What can now be said is that the supposedly man-made rocks are of natural origin; that they are more or less in their natural position relative to each other and to the shoreline; that the process that gave them their shape is natural; and that they formed about 2,200 years ago and are thus too young to be attributed to Atlanteans if they were man-made. It is not clear how they came to be 15 feet below sea level, but the best explanation involves both rising sea-level and undermining of sand. (R4)

These professional assertions that the Bimini Road is natural geological formation has had no effect on the "cult" status of the site. The Road is now a tourist attraction. To some it is a "power center" like Stonehenge, Giza, and Cuzco. No amount of professional assurance will suffice, as seen in the following rebuttal by W.M. Donato in the Ancient American.

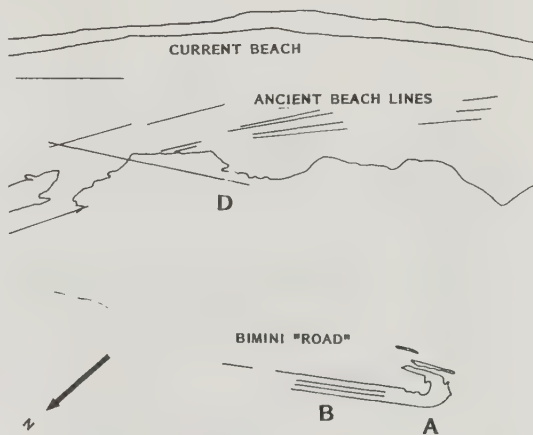
Skeptics of the "Road's" artificiality have invented an implausible explanation for its existence. They assert that the structure is nothing more than beachrock. Beachrock is indeed present at North and South Bimini, and it can break into generally right-angled shapes resembling rough squares and rectangles. Critics believe that sand was washed out from under the beachrock and set them down in straight lines. Yet, what is the mathematical probability that literally scores of stones could be positioned in virtual perfect alignment, not only in a common line but also with respect to each other? If we include all the stones on the Road, and not just those on a leading edge, we may very well be talking about hundreds of stones. In order for the critics' scenario to work, the subsurface terrain would have to be on a slant, though in reality it is flat. It's rather difficult to have rocks slide down an incline that doesn't exist! Furthermore, we don't see this process with similar alignments closer to shore, which we should, according to uniformitarianism. (R11)

Summarizing, the scientific community is convinced that the Bimini Road is simply beachrock, while many amateur archeologists hold that the rocks are too regu-

lar to be natural and are arranged in a suspicious configuration to boot.

A more dispassionate study of "archeological anomalies in the Bahamas," by D.G. Richards, was published in 1988 in the off-mainstream Journal of Scientific Exploration. After a review of the history of the controversy, Richards identified three features of the Road and its surroundings that he considered anomalous.

These are located at A, B, and D in the accompanying drawing, which is based on an aerial photo taken at 6,000 feet. A is a 90° bend in the renowned "Road." This bend is decidedly anomalous for a beachrock formation. B consists of parallel rows of stones, which Richards considers atypical of beachrock formations. D is made up of regularly spaced piles of stones and extends over 1½ miles, cutting diagonally across ancient beach lines. These are also very suspicious because of their regularity and extent.

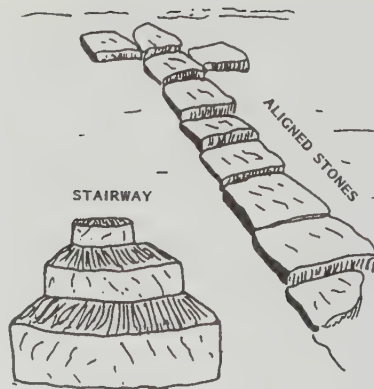


The Bimini "road" and other puzzling topographic features off the coast of Bimini. (Adapted from R10)

Next, with the help of Landsat photos of the area, Richards located other "regular" features, such as a triangle, a pentagon, and a sharp, right-angle corner with mile-long sides. Inspecting these regularities from a small boat, he found no structures visible on the surface of the sea floor. Rather, the patterns had been created by sea grass and white sand. Even so, these super-

ficial patterns could reflect the presence of artificial structures under the sediments. Certainly, if these regularities were observed in a photo taken over land, archeologists would rush to dig away the overburden. But this was Bimini, and everyone knows that no "high cultures" ever lived there! (R10)

The impression left by Richards' study is that scientists might do well to suppress their disdain for "cult" archeology and investigate the Bimini Road area more carefully. There really might be something hidden under the sands!



Rock alignment and "stairway" found at a depth of 22 meters off Lanzarote, Canary Islands. (R9)

X2. Other "Biminitis"

Australia. On Heron Island, on the Great Barrier Reef, beachrock is forming today. A photograph of this formation in Shinn's debunking article (R4) has a strikingly artificial look.

North of Sydney, there are great masses of regularly fractured beachrock. Underwater photos of these formations look eerily like the Bimini Road. (R6)

Of course, these other occurrences do not prove that the Bimini Road is natural, but they definitely strengthen the position of the skeptics.

Lanzarote, Canary Islands. Here, too, one finds a submerged, Bimini-like row of apparently man-made blocks of stones. Some 22 meters down, the blocks are arranged in a sort of staircase, as shown in the figure. The steps, however, are 40-cm high, too big a step for humans. Is this structure a submerged pier, an altar, or something else? No one knows. Possibly relevant is a statuette, stylistically Olmec, which was also found in Lanzarote waters. (R9)

Unfortunately, we do not know what kind of rock is involved here. Also, the depth is much greater than at Bimini. Remarkably, archeology revisionists see the hand of the Olmec at Bimini, too!

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MSR4 The Maltese "Cart Ruts"

Description. On Malta, the presence of many miles of pairs of parallel grooves worn into the solid rock, often to depths of a foot or more. The date, purpose, and nature of the vehicles that made these so-called "cart ruts" are controversial. In fact, carts may not have made them.

Data Evaluation. Several good aerial surveys and ground-level studies by scientists are available. It is difficult to obtain a complete picture of the cart-rut phenomenon because so many are covered by artificial terraces. Rating: 2.

Anomaly Evaluation. The age of the ruts and the type of vehicle that made them are still subjects of conjecture. Nevertheless, despite their strangeness, the Maltese cart ruts are only minor archeological mysteries for reasonable explanations are available. The only problem is a lack of consensus. Rating: 3.

Possible Explanations. The cart ruts were obviously made by vehicles. Wheeled carts pulled by humans and slide-cars using draft animals are both good possibilities,

Similar and Related Phenomena. Similar ruts, definitely made by wheeled carts, can be seen in Greece and on Sardinia. (R7)

Entries

X0. The Mediterranean island of Malta is criss-crossed by many pairs of parallel ruts, separated by a near-constant distance of 4½ feet. These grooves have been worn into solid limestone to depths as deep as 2 feet. It is quite apparent that these ruts are very old and were made by vehicles of some sort. Although they are called "cart ruts," they may not be. This presumption and other surmises about the age and purpose of the ruts have been challenged by modern research. Today, the Maltese cart ruts are not as mysterious as they seemed a century ago.

X1. General observations. Although the Maltese cart ruts have been recognized in the literature for 300 years, the first serious studies of them appeared in the 1920s in papers by E.G. Fenton and T. Zammit. For an overview, we quote from a summary of Zammit's work that was printed in Nature in 1928.

Prof. Zammit has published in Anti-
quity for March a study of the cart-
tracks of Malta, illustrated by a num-
ber of excellent air photographs. His

conclusions as to the origin, purpose, and date of these ruts or deep grooves on the limestone, which are of such frequent occurrence in the island, are the result of a long and exhaustive examination. There can be little doubt that they were made by a wheeled vehicle---strong, heavy carts with wooden wheels without metal tyres. The sharp curves preclude the idea of a sledge with runners. They are triangular in section, and can easily be distinguished from the grooves, rectangular in section, made by the modern metal-tyred wheel. Further, it must be concluded that human power was used for traction, as the ancient ways show no sign of being cut up in the way in which modern tracks have been cut up by the hooves of animals. It is also probable that the tracks were started by human labor and deepened later by use. There are definite signs that they were first carefully laid. In only one case does a pair of tracks appear to enter the sea, namely, at the Bay of St. George at Birzebuggia, where they probably appear on the other side of the bay now covered with silt and field soil. There is nothing to suggest the existence of

these tracks when the island was connected with the continent, quite independently of the fact that the island could not have been inhabited by an industrial population at the end of the Ice Age. Nor are they so late as the Roman occupation. Further, they are earlier than the rock-cut tombs of the Phoenician occupation, one of which cuts right across one of the cart tracks. As they do not go near the megalithic monuments they were not used for carting stone for these buildings. They were used by the energetic neolithic population for carting earth for their terrace cultivation made necessary by the bare character of the high lands and for carrying water to the ships of a busy maritime traffic in harbours near which were no springs. (R5)

For a closer look at the dimensions and extent of the ruts, we go directly to Zammit's 1928 paper.

They consist of pairs of parallel grooves running for long distances on the hard coralline limestone patches, now straight and now curved as if avoiding an obstacle or having to change their direction. The grooves are mostly V-shaped, usually from 10 to 20 inches wide (25-50 cms) on the surface, and about 4 inches (10 cms) at the bottom. Between the two grooves, measured at the middle part, the distance is nearly always 4 feet 6 inches (1.37 m). Naturally the depth of the grooves varies with the lie of the ground; if there is a strong tilt sideways, one of the grooves is shallow whilst the other is very deep. Grooves over one foot deep are very common. The carts that ran over these roads had an axle-tree about four and a half feet long and the wheels had to be very high to move freely in the grooves.

.....

These cart-tracks, for no other name can be given to them, are to be met with on practically every stretch of barren land on the slope or on the top of a hill. They are sometimes seen to run in single pairs wending their way over hill and dale but more often they run in groups, crossed occasionally by other tracks coming from a different direction. In some cases

their number is so great that one wonders how many carts had been detailed to carry on this heavy traffic. (R8)

Zammit, like many other investigators of the cart ruts, was convinced that carts were the vehicles that made them. This may not have been the case, as we shall see.

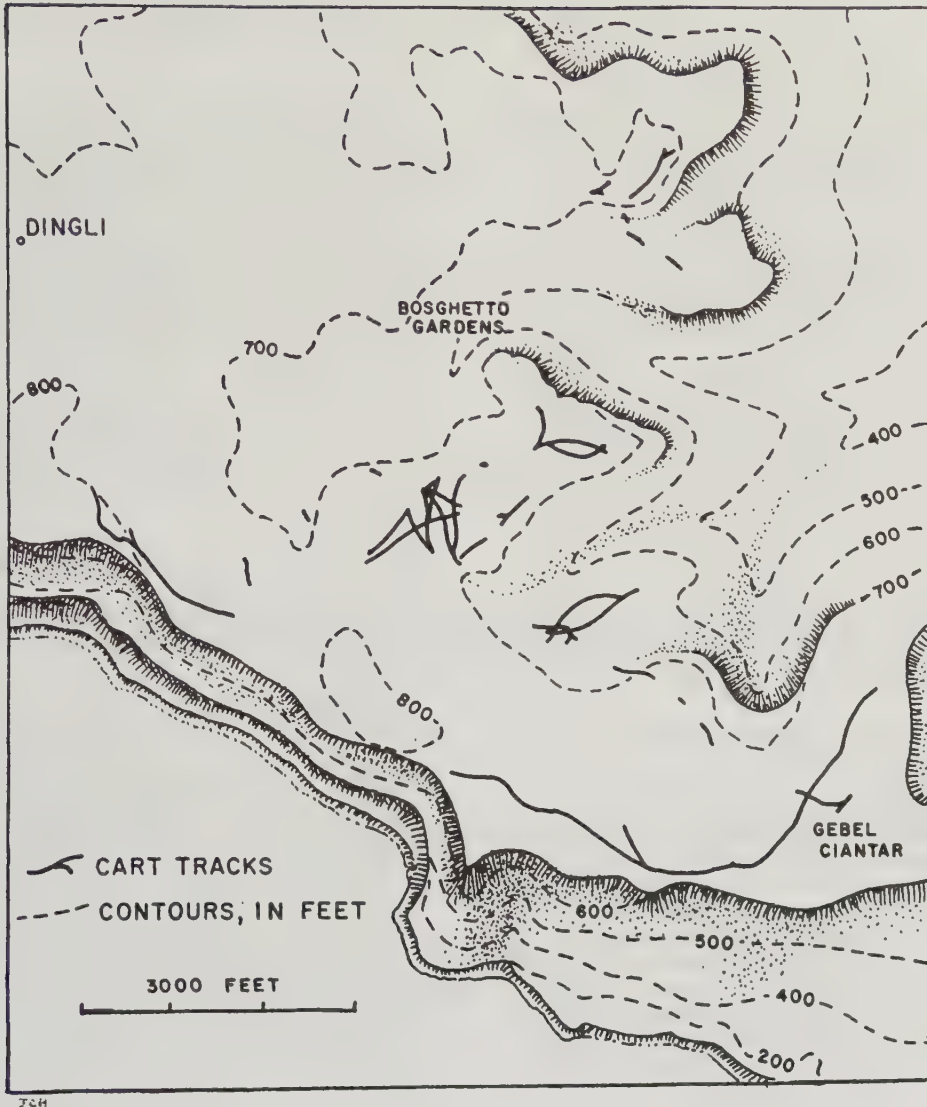
We have seen no estimate of the combined length of all cart ruts. In fact, this would be difficult to obtain because many are now covered with soil introduced by farmers to create the many terraced fields on Malta. Some individual ruts run for more than 2 miles. Considering the sheer abundance of tracks on the island, their combined length must be in the neighborhood of 100 miles, perhaps much more depending upon how many are now concealed.

In a 1954 paper in *Antiquity*, H.S. Gracie interpreted the Maltese cart ruts in a way substantially different from his predecessors. Instead of large-wheeled carts grinding out the ruts as humans pulled them over the bare rock, Gracie proposed that draft animals pulled "slide-cars" over a soil-covered landscape. Slide-cars consist of two wooden shafts supported in front by a draft animal with the back ends ("heels") dragging along behind. A carrier, perhaps a basket, was located in between. Slide-cars have been used for millennia all over Eurasia.

In practice a slide-car operator would probably follow the track of his predecessor, with the slide-car's heels grinding out deeper ruts through the soil and into the rock beneath. This type of vehicle accounts nicely for the V-shaped ruts with their rounded bottoms. The frequent multiplicity of cart ruts could have occurred over the years, as different routes were taken across the fields, which were always being artificially resurfaced by Malta's farmers.

As for the frequent claim that draft animals were not used because the areas between the ruts show no signs of wear by hoofed animals, the layer of soil proposed by Gracie would have protected the underlying rock from hooves.

To better understand Gracie's theory, we must understand that Malta is covered with artificial terraces or soil deposited on the barren rock. The highlands of Malta, as is common around the Mediterranean, are mostly denuded of trees. Heavy rains quickly erode unterraced fields exposing the barren rock. Soil



Map of some of the prehistoric Maltese "cart tracks." (R9)

from the lowlands is used to maintain the terraces.

This type of farming points to one of the likely purposes of the vehicles that produced the cart ruts: they carried soil to construct and replenish terraces. A second probable application was the transport of fresh water from the island's few good springs to settlements and ships in the harbors.

Some writers have suggested that the cart-rut making vehicles transported stone from quarries to the impressive megalithic buildings for which Malta is noted. However, few cart ruts go anywhere near these ancient buildings.

Actually, Malta's megalithic buildings are far older than the cart ruts. Gracie attempted to fix the probable age of the latter in the following paragraph.

The date of this road system is more difficult to arrive at. Tracks pass over Punic graves in at least four places. At Imtarfa, the lip of the rut is a sharp right angle, indicating that the rut is older than the grave, which has cut through and truncated the rut. Professor Zammit claimed that the grave goods dated from 600 B.C., but Dr Baldacchino, Director of the Valletta Museum, considers that they may be up to a few hundred years later than this. We have seen that the tracks are older than the bulk of the terracing but the date of this work is not known. Zammit found traces of its going on in Roman times at Tarxien. Finally the land at St. George's Bay has sunk at least three feet since the tracks were made. Unfortunately one cannot say how long this might have taken. Local movements in this area can be quite rapid, but one would expect such a subsidence to have been noticed if it had taken place in historical times. It seems reasonable to put the date before the advent of the Romans in 217 B.C. (R9)

Gracie collected his divergent views in a final paragraph.

To sum up it appears that a simple system of natural tracks joining settlements with each other and with springs and the sea was formed about the beginning of the first millennium B.C. but possibly earlier. The land was soil-covered and only one track of a group was visible at any one time. The tracks were worn down by friction and not deliberately cut. The vehicle

in use was some form of slide-car, which became larger and more strongly made as time went on. (R9)

Some sensational accounts of the cart ruts declare that some end at cliff edges, implying some great unplumbed mystery as to the purpose or age of the cart ruts. This situation occurs at only one cliff. There, the cliff has broken away. Examination of the fallen section reveals that the cart ruts in question had taken a sharp turn before the edge and thereafter ran parallel to the edge. No mystery here! (R8)

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- R9. Gracie, H.S.; "The Ancient Cart-Tracks of Malta," Antiquity, 28:91, 1954. (X1)

MSR5 Precocious Suspension Bridges

Description. The deployment of long, sophisticated suspension bridges by the Maya and the Inca. In this engineering development, New World cultures preceded Old-World technology by several centuries.

Data Evaluation. Mayan suspension-bridge technology has been deduced from damaged and dispersed structural remains. For this reason, our knowledge of the Mayan engineering is not on as firm a foundation and that of the Incan bridge-builders. One Incan suspension bridge survived for 500 years until 1890 and has been closely studied. Rating: 2.

Anomaly Evaluation. Apparently, the concept of the suspension bridge was developed independently by the Maya and Inca. Their technologies were at once precocious and ingenious, illustrating high levels of civil engineering skills in the Precolumbian New World. We cannot label such technical developments as anomalous, but they are remarkable enough for their times and places to record here. Rating: 4.

Possible Explanations. None required.

Similar and Related Phenomena. Ancient macadamized roads (MSR1); Oak Island shaft and tunnels (MSE4); Costa Rican stone spheres (MSO2).

Entries

X0. Introduction. Bridges are essential in any large road network. Most ancient bridges were simple wood or stone structures that are not unusual enough for us to catalog. The Romans employed the arch in many of their bridges and aqueducts but, even 2,000 years ago, this engineering stratagem was old hat in Europe. But in the New World, the arch was practically unknown, yet the Mayan and Incan civil engineers had great rivers and deep chasms to conquer. Their solution was the suspension bridge. Two remarkable examples of their inventive genius are worth our attention here.

X1. Mesoamerica

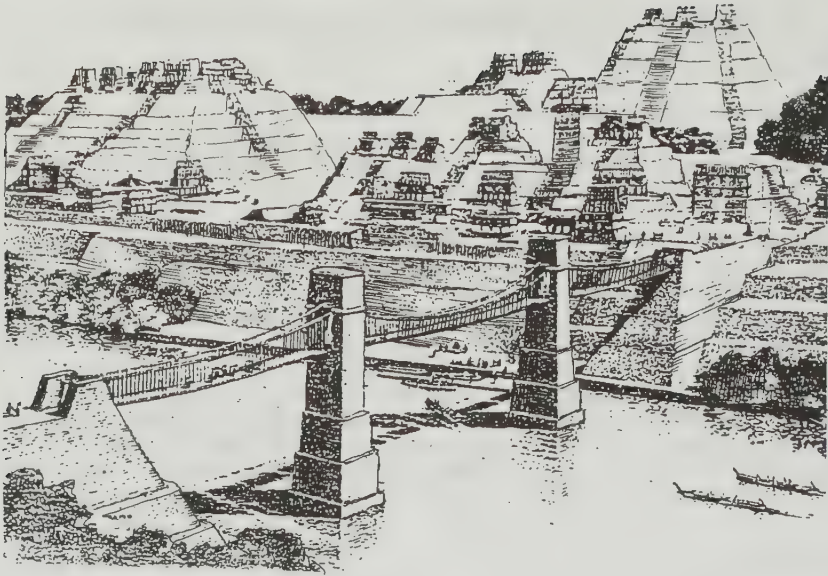
Mexico. During the Seventh Century A.D., the Maya wished to link the ceremonial center of Yaxchilan with the agricultural regions on the other side of the Usumacinta River in Mexico. This region receives heavy rainfall, and floods are common. A reliable, year-round bridge was essential.

From a superficial reconnaissance, it

is not obvious how the Usumacinta was bridged by the Maya. However, a large pile of stones in the river provided a clue for engineer J.A. O'Kon. Could they have been part of an ancient bridge pier? From aerial photographs, he located a nearly submerged second pile of stones 203 feet north of the first pile. This pile could have been the second pier of a suspension bridge. O'Kon also found traces of bridge abutments down river where flood waters had deposited them. Most interesting of all was a large, carved stone that resembles the rope guideways used in the construction of modern suspension bridges. It was hard to escape the conclusion that the Maya had been pioneers in suspension-bridge engineering.

Assembling all the available evidence, O'Kon was able to reconstruct on paper what the Maya had done with their limited engineering materials: stone, wood, and fibrous plants.

According to O'Kon's reconstruction, the bridge across the Usumacinta consisted of three spans with a total width of 600 feet. Its wooden deck was 10 feet wide and was suspended by thick hemp ropes---probably bundles of six 1-inch ropes. The towers of the two bridge



Artist's rendition of the Mayan suspension bridge at Yaxchilan, Mexico. (Adapted from R3)

piers were 35 feet across and built up from large, flat stones (4 x 4 feet) set in the bedrock. The south bridge tower was 75 feet from the edge of the river. Enough of it survived for O'Kon to determine that it was constructed of a facade of stone masonry wrapped around a core of cast-in-place concrete. (R3)

Normally, we don't think of the Maya building concrete structures. Incidentally, European engineers did not build a larger suspension bridge until 1377!

X2. South America

Peru. As they were extending their road network northward, circa 1350 A.D., the Incan civil engineers encountered the Apurimac River. We do not know whether the Inca had learned about the Mayan suspension bridge built seven centuries earlier across the Usumacinta River, but they somehow arrived at a similar design. V.W. von Hagen has provided a colorful account of this Incan structure.

The Andean Indians had no wood

readily available; they did not know the arch [?]; they knew and often used the cantilever type of bridge, but this could only be used to bridge rivers not much more than forty feet in width; so they perfected the suspension bridge. The Incas reversed the arch curve and gave it wings---and it became the hanging bridge. First in construction---the cables; those of this particular bridge were accurately measured by an American [G. Squier] in 1864; they were 148 feet long (add an additional forty feet for embedding). They were as thick as a man's body, plaited and twisted as rope cables are, made in fact from the same material as modern rope is---the cabuya (a plant related to the agave, the fleshy-leaved century plant). The cables were spun at the edge of the river to be bridged, and then taken across to the other side. They were then buried deep in the earth and held by six wooden beams ('as thick an oxen' says Garcilaso 'the Inca'), then raised onto tall stone pillars which supported the cables. The action was repeated on the other side. Three other cables, tied

to the base of the stone towers, formed the 'floor' of the bridge; the suspension cables and the floor cables were then held together by additional cables and the floor of the bridge had wooden supports. The middle of the bridge sagged from its own weight, and there were no guy ropes to steady it so that in the high winds it swayed dangerously. The early Spanish crossed it with fright and terror, and their letters are filled with their complaints about it. (R1)

This particular Incan bridge was in use until 1890---over 500 years!

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MSW WALLS, EMBANKMENTS, DITCHES

Key to Phenomena

MSW0	Introduction
MSW1	Notable Linear Earthworks, a Survey
MSW2	Notable Rude Stone Walls, a Survey
MSW3	Transoceanic Distribution of Precision-Fit Stone Walls
MSW4	Cyclopean Walls
MSW5	Natural Walls That <i>Seem</i> Artificial

MSW0 Introduction

The subjects of this chapter are among the simplest of ancient engineering structures. Their construction usually required only the stacking of local rocks or the digging and piling up of dirt. Such elementary processes become remarkable only when the resulting structures are so large that we wonder where all the manpower came from. But such giant structures do exist, so, obviously, enough people were recruited for the tasks at hand. As we shall repeat below, "size" alone is not considered anomalous in this catalog. Neither do we see any precocious engineering innovations employed in the building of walls, embankments, and trenches.

Admittedly, some of these structures are mildly puzzling because we do not really understand their purposes. In these situations, when confounded by mysterious walls and embankments, archeologists usually fall back upon "defense" or "ritual" explanations. They may well be correct in most of the cases provided below, but an element of doubt often remains, as seen in the case of the long, meandering East Bay walls in California.

In only one situation do we see the possibility of an important anomaly. It involves the always-contentious question of transoceanic diffusion of culture before European seafarers began exploring the planet. Easter Island is once again the site of an anomaly, specifically the precision-fit ahu (platform) at Vinapu. It so closely matches Incan masonry that diffusionists insist that the Inca made the long voyage from Peru before the Polynesians arrived from the west. This claim is emphatically rejected by mainstream science.

Summarizing, ancient walls, embankments, and ditches are often remarkable for size, extent, complexity, and workmanship, but they offer little to the anomalist.

MSW1 Notable Linear Earthworks, a Survey

Description. Raised earthen embankments and ditches that meet one or more of the following criteria:

- (1) High embankments (over 5 feet);
- (2) Deep trenches (over 5 feet);
- (3) Great length (over 1,000 feet);
- (4) Obscure purpose;
- (5) Complexity (networks of many interrelated earthworks);
- (6) Engineering difficulty (deep, smooth-sided trenches cut into rock);
- (7) Unexpected location (Easter Island); and/or
- (8) Properties that intrigue the compiler.

Data Evaluation. Archeological research and the resulting professional literature are fairly robust for North America, Mesoamerica, Europe, and (somewhat surprisingly) Africa. We have found virtually nothing for South America and Asia, and absolutely nothing for Australia. Our treatment is, therefore, geographically tilted. Rating: 2.

Anomaly Evaluation. Size is not anomalous here, nor are any of the earthworks examined unduly sophisticated or complex for the cultures that apparently built them. Nevertheless, some of the engineering is remarkable, as with the long Mayan, rock-cut trenches. Although the purpose(s) of the British cursuses are not known for certain, a reasonable guess is that these parallel embankments probably channeled the flow of people in ritual processions. Extremely long, linear earthworks, such as the Devil's Dyke in Britain, are impressive in terms of their lengths, but they seem to be ill-conceived militarily. In sum, linear earthworks may have much curiosity value but are scarcely anomalous. Rating: 3.

Possible Explanations. See above discussion.

Similar and Related Phenomena. Double stone rows and avenues (MSH3); stone walls (MSW2-MSW4); earthen hilltop forts (MSB in another volume).

Entries

X0. Introduction. Earthen embankments are simply linear mounds. These are seen in profusion in the mound complexes mentioned in MSM7, where they formed defensive walls around the complexes. Many British stone circles are also surrounded by earthen embankments and the ditches from which the earth was "borrowed." In fact, these circular embankments and ditches are the "henges" in the words "Stonehenge" and "woodhenge." Additional impressive earth-

works are seen in the British hilltop forts, such as Durrington Walls; and also in New Zealand, where the Maoris built elaborate hilltop forts called "pas." We classify those earthworks built to defend specific locations as "forts" and treat them separately in Chapter MSB in another volume.

There are in addition linear earthworks that are not dedicated to point defense. These are the subject of this section, providing that they: (1) pose problems



A defensive earthwork of the Moundbuilders in Genessee County, New York, as surveyed by Squier and Davis in the early 1800s. About 600 feet in diameter, it superficially resembles British hilltop forts. (R1)

of explanation; or (2) are sufficiently curious; or (3) are of such great length and engineering sophistication that we cannot ignore them. They take several forms.

(1) Isolated embankments, usually accompanied by parallel trenches, that may run for miles. The British call these earthworks "dykes" or "ditches." Dykes and ditches were almost certainly defensive in most cases. Similar structures occur in the Americas, Africa, and Asia.

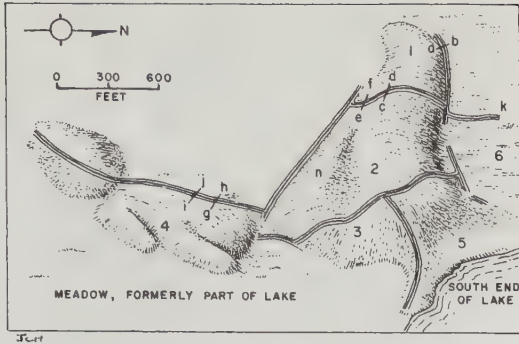
(2) Long, parallel pairs of embankments. The British have named these "cursuses." Their purpose is not easy to find. They are probably analogous to the stonelined "avenues." Similar earthworks are seen in some North American mound complexes.

(3) Long embankments and trenches found in unexpected places, such as New England and Easter Island.

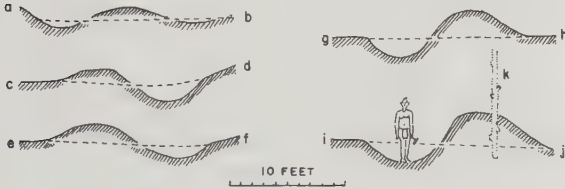
X1. North America.

Massachusetts. Ordinarily, one does not imagine that the land the Pilgrims first annexed was dotted with great earthen fortifications. But apparently the Indians of eastern Massachusetts were once not only numerous but contentious, for they constructed some surprising defensive works. Even after four centuries of plowing and Interstate construction, some impressive remnants survive. In 1911, when these engineering works were doubtless more obvious than they are today, C.C. Willoughby wrote the following about one such site.

The most extensive and best preserved earthwork of this type known to the writer lies in the town of Millis, about 20 miles south of Boston. It is situated on the shore of South End Pond, an expansion of Boggestow Brook which flows into the Charles River. The general character of the earthwork is shown in [the figure]. The hills which make up the greater



Embankments and trenches at South End Pond, Massachusetts. Cross sections shown below. (R3)



portion of the enclosed areas are covered with trees and the land has never been cultivated. The greater part of the land bordering the hills has been under cultivation for many years and it is quite certain that portions of the embankments have been levelled and the corresponding trenches filled. About 6,000 feet, or approximately 1-1/7 miles of embankments remain. The combined length of areas 1 and 2 is nearly 2,100 feet, and the amount of land in areas 1, 2, 3, 4, and 5 is approximately 31 acres.

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It seems probable that the embankments supported palisades, and that in the enclosures thus formed were many bark- or mat-covered houses. Apparently these works formed one of the most extensive Indian strongholds thus far known in New England. (R3)

It is not clear that this curious collection of embankments would slow a determined enemy down very much! However, the same can be said for some of the British hilltop forts, which display many wide openings in their walls. (MSB in another volume)

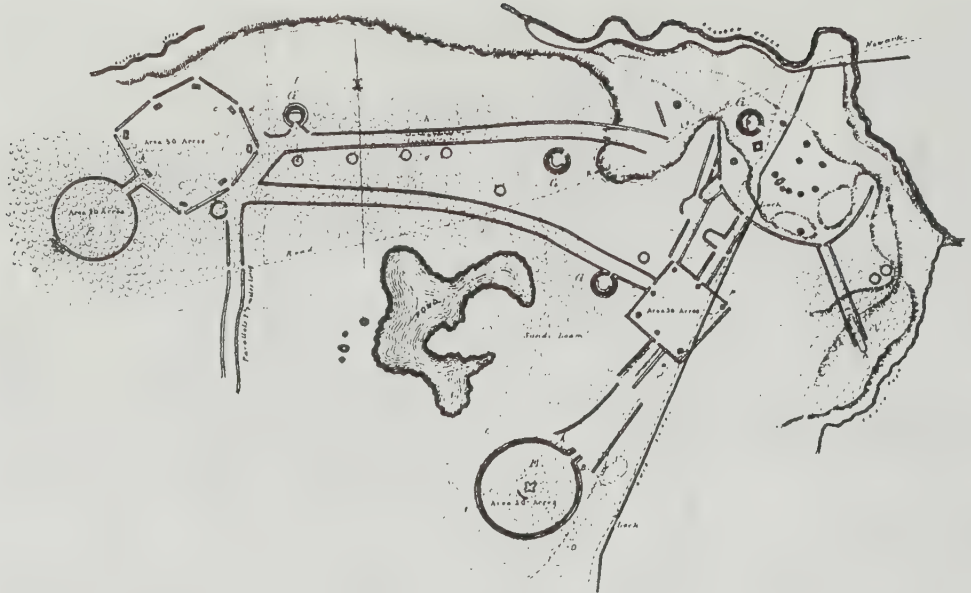
Ohio. The Newark Works of the Mound-builders are worth a few lines (plus the accompanying figure) because of the long, parallel embankments connecting various parts of the mound complex. From Squier-and-Davis' plan of the Newark Works, one pair of embankments runs for 2½ miles! These seem to be analogous to the British cursuses, at least in size, layout, and construction.

British Columbia. The Moundbuilders never extended their reach west of the Rocky Mountains. In fact, earthworks of any consequence are rare along the Pacific Coast. Consequently, earthen structures do not have to be large to excite the curiosity of archeologists, particularly when they are neatly laid out as if by a surveyor and have no obvious application to Indian life.

Near Rose Point, the most northeastern part of Graham Island of the Queen Charlotte Group, in the Haida Indian area of British Columbia, is an unusual prehistoric earthwork. Published accounts of earthworks in western North America are so rare that a note of this one may be useful. The information was collected during a brief visit made in 1919 for the Victoria Memorial Museum.

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The earthworks consist of ridges of earth about twelve to eighteen inches high outlining long rectangles as illustrated. Two low ridges in the northwest part of the earthworks, one of them at an angle to the other ridges, may be the remains of decaying timber. These are represented by dotted lines on the map. All of the complete rectangles are approximately one hundred feet long. Two complete rectangles and four parts are about fifty feet wide; one is about twenty-five feet wide, and another rectangle parallel to it at a distance of thirty-five feet. All of the rectangles are longer easterly and westerly. It is surprising that lengths of these longitudinal ridges are equal, that they are an even hundred feet long, that the lengths of so many of the transverse ridges are equal, one rectangle being exactly half as wide as the others, and that the width of an incomplete rectangle is measurable in multiples of all of the other measure-



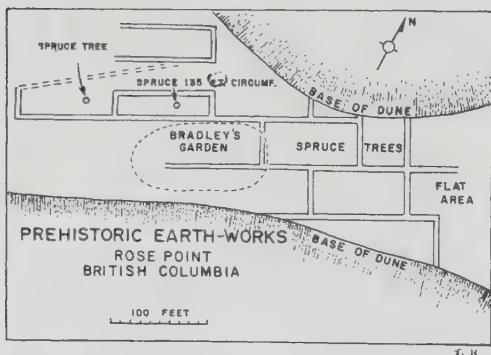
The extensive Newark Works of the Moundbuilders, Ohio. This is one of their major complexes. (R1)

ments. (R4)

The precise layout of these earthworks reminds one of how European megalithic sites seem to have been built using a "megalithic yard" and, arguably, 3-4-5 triangles! (MSH9, MSH10)

As the figure indicates, the site is partially overrun by moving dunes, so

we have no fix on the actual extent of the works. The large trees growing within the site suggest an age of at least 200 years. The purpose of these neatly laid out ridges is obscure. They may have been associated with Haida buildings or, perhaps, agriculture.



Curious earthworks in British Columbia, Canada. (R4)

X2. Mesoamerica. We are treated to many photographs of the Mayan pyramids but see little if anything in the media of the great earthworks the major Mayan population centers constructed to deter their bellicose neighbors, protect their farms, and channel the flow of people and goods along the long causeways connecting their cities. These Mayan fortifications were multi-kilometer embankments and wide ditches that often cut deeply into the bedrock. While not anomalous, they represent major, generally unappreciated, engineering accomplishments.

In his 1976 survey of the Lowland Maya fortifications, D. Webster identified 15 major fortified centers. We select two of these to demonstrate how ambitious these structures were.

Honduras. Los Naranjos ("the orange trees") is classified as a "pre-classic" Mayan site. Strong Olmec influence is apparent. The original defensive ditch was probably built between 800-400 B.C. Webster's words are as follows:

Extensive earthworks which may represent the earliest fortifications in Mesoamerica were located during the French excavations at Los Naranjos, in the Lake Yajoa district of southern Honduras. An earthwork system composed of ditch and embankments, approximately 1,300 m long, screens the eastern approaches to the principal, and earliest, architectural group at the site. At its northern end the ditch terminates near an extensive swamp, while the southern end approaches the lake shore itself (this pattern is reminiscent of the northern ditch at Tikal, which articulates at either end with large logwood swamps). The ditch and embankment are variable in size throughout their length and are much eroded and silted up; judging from the published profiles the ditch was about 10 m wide and 7 m in depth, as measured from the top of the adjacent embankment. (R22)

A 7-meters-deep trench would be difficult to scale and certainly represents a lot of digging.

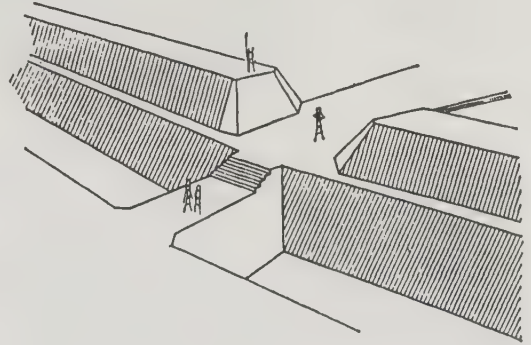
Guatemala. In the tropical rain forest around Tikal, the Maya left behind hundreds, probably thousands of pyramids, shrines, and other structures---all made primarily of stone. So when archeologists serendipitously come across an artificial earthen embankment-plus-ditch miles in length, it is something worth cataloging. D.E. Puleston and D.W. Callender, Jr., provided the first details on this remarkable structure, which was probably built during the "classic" phase (200-900 A.D.) of the Lowland Maya. They wrote of their discovery as follows:

For the weeks, months, and even years one spends carrying out fairly routine work, there is always the possibility of stumbling onto something important that is totally unexpected. The discovery of what appears to be a 9.5-km. long defensive earthwork 4.5 km. north of the Great Plaza of Tikal is an example of just

such a chance. The earthworks lie directly between Tikal and the nearest large site, Uaxactun. These two sites are about five hours apart in terms of walking distance; the earthworks are one hour's walk north of Tikal. Frankly, a defensive barrier of this magnitude, or for that matter of any magnitude, was not one of the things we expected to find in the process of a project to explore and map the outlying areas of Tikal.

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The trench is the most prominent feature of the earthworks, but when it was first discovered it appeared to be nothing more than a natural arroyo or ravine. As we followed it, however, it soon became evident that it was not a natural formation. First, it had a continuous raised embankment along the south side, and second, it passed up and down over hills, following a fairly straight line. (R18)



Reconstruction of the Becan defensive system built by the Maya, showing a causeway, embankment, and ditch. (R22)

The ditch dimensions are impressive. It is about 4 meters wide and just as deep, penetrating into the limestone bedrock as much as 3 meters. Anyone falling into the ditch would have had considerable trouble getting out due to the steep sides. The 9.5-kilometer-long barrier was interrupted by an easily defended causeway. Obviously, this

embankment-ditch system was not a trivial undertaking.

X3. South America.

Venezuela. Trenches quite different in size and purpose are found in the Rio Negro region of Venezuela---and very likely elsewhere, too. Rather than being measured in miles, as at Tikal, the Venezuelan ditches average about 300 feet long; they are about 6 feet deep and 6-9 feet wide. J.M. Crucent lists a dozen locations where excavations of this sort have been discovered.

The locals assert that these trenches used to be filled with briars and pointed sticks to trap attacking enemies. However, Crucent reviewed the archeological evidence and personally inspected one of the excavations. He doubts that they were for defense. Since paddles were frequently found within the trenches, he suspects that in the past the natives hid their canoes in the trenches so they would not be stolen, as they might well have been if left on the river bank. (R12)

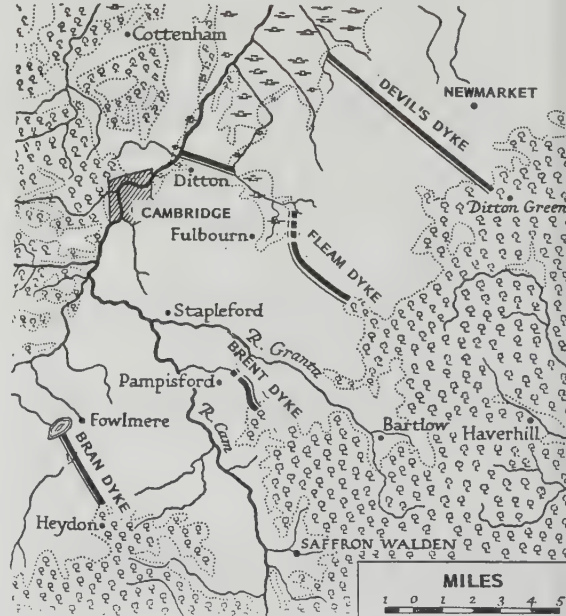
These Venezuelan trenches obviously contain little grist for the anomalist.

X4. Europe. Surely Britain is not the only area of Europe where massive earthen embankments were raised, but we have not found reports of such structures elsewhere. It may be because we rely primarily on English-language journals.

Britain. The ancient inhabitants of Britain had ample supplies of stones with which to construct thousands of stone rows, stone circles, and cairns. Despite this ready availability of lithic material, many of the British stone circles are surrounded by embankments and the trenches from which the earth was extracted. In addition, two other sorts of linear embankments exist in Britain; and they are spectacular enough to catalog, even though some date only from the Middle Ages. These are the "dykes" and the "cursuses." The former seem to have been primarily defensive in purpose, although some question this. The latter, the cursuses, are harder to explain.

Dykes. Dykes are simply linear embankments running parallel with the trenches from which their earth was dug. The British archeologists also call the same structures "ditches." There were apparently two episodes of dyke/ditch building.

The earliest dykes appeared during the Iron Age in Bedfordshire and Hertfordshire. Actually, these are usually designated as "multiple ditches." The favorite configuration consisted of three embankments and three ditches, all parallel. Up to 130 feet in width and several miles long, these were in all probability defensive in purpose. Unfortunately, in 3,000 years they have been largely obliterated by farming. We really know little about them and how effective they might have been. (R26)



Map of four dykes near Cambridge.
(Adapted from R24)

The dykes we usually read about were built just after the Romans pulled out of Britain in 410 A.D. The best known are southeast of Cambridge, where four dykes, each separated by several miles, block or control traffic along an ancient trackway known as the



Devil's Dyke at Wheathamstead, Herts. (Janet & Colin Bord, Fortean Picture Library)

Icknield Way. Of these four, Devil's Dyke is the most impressive. It runs straight for $7\frac{1}{2}$ miles. Its ditch is 17 feet deep and 65 feet wide on average. In all four dykes, the ditches are on the southeastern sides, suggesting that aggression was expected from that direction. (R26)

Militarily, though, an embankment $7\frac{1}{2}$ miles long would have required perhaps 13,000 foot soldiers to man it, and in the Fifth Century, armies in Britain were nowhere near that large. Tests proved that a fit soldier can cross an unprotected dyke in 30 seconds. It would have been impossible to defend the entire $7\frac{1}{2}$ miles, particularly if feints were employed to draw soldiers away from sections of the dyke. (R24)

It seems that the steep-sided Mayan fortifications (X2) were much more ef-

fective in this application. Yet, several other dyke systems exist in Britain. Perhaps we do not understand how they were really employed. For example, R. Muir ventures that the dykes would have been much more effective in protecting against cavalry attacks. (R24)

Because of its size, Offa's Dyke must not be omitted here, even though it is hardly ancient, having been built between 757 and 796. Offa, the king of Saxon Mercia had this immense earthwork constructed to seal his kingdom off from the troublesome Welsh. As N. Pennick and P. Devereux describe it, Offa's Dyke was an ambitious undertaking.

Offa's Dyke is the largest singly-conceived earthwork in Britain and the longest of its kind in Europe. It is longer than the two Roman walls---



Offa's Dyke on Llanfair Hill, Shropshire. (Janet & Colin Bord, Fortean Picture Library)

Hadrian's and the Antonine---put together. The border between England and Wales, as defined by the dyke, runs for 150 miles (241 km), with about 80 miles (129 km) of earthwork still existing. In many places the earthwork consists of a westward ditch about six feet deep (1.8 metres), defending an earth rampart to its east which attains around 25 feet in height (7.6 metres). The whole defence is about 60 feet (18 metres) wide. (R26)

But if Devil's Dyke, only $7\frac{1}{2}$ miles long, would have been difficult to man, Offa's Dyke would have been impossible to defend. (R25)

Perhaps folklore has the dyke story correct after all. It testifies that the Devil started to build Devil's Dyke as a channel to the sea so that he could drown all the inhabitants of Sussex, who were becoming too religious for his liking!

(R21) As far as we know, folklore is silent about Offa's Dyke.

Cursuses. The name of this variety of British earthwork derives from the Latin word for "racetrack," but the cursuses are rather straight, not oval, and they were certainly not places where horseraces were held.

Basically, a cursus consists of two, long, parallel earthen embankments with parallel ditches on the outside. Within a cursus, a wide avenue was available for processions or other events we can only guess at. Since cursuses are often associated with barrows, they were most likely used in burial rituals, but this is surmise. No one is certain what these 4,000-year-old, walled, earthen avenues were really used for.

With the help of aerial photography, over 50 cursuses have been located in Britain. Most date back to 3,000-2,000 B.C. and are contemporaneous with

Stonehenge and Avebury.

The Dorset Cursus is the largest--- actually, it appears to be two cursuses joined end-to-end. (R26) This cursus is such a large structure that a brief description is in order.

Of all the early prehistoric monuments of Britain the Dorset Cursus is both the largest and at the same time the least known. Its claim to pre-eminence in terms of mere size is sufficiently established by the facts that it is six miles in length, contains an area of two hundred and twenty acres, and in its original state comprised a volume of earthwork amounting to some six-and-a-half million cubic feet. The significance of these figures may be better appreciated by a comparison with Avebury, which had originally an earthwork volume of about three-and-a-half million cubic feet, or with the Stonehenge Cursus, which is a little less than one-and-three-quarters miles in length, and encloses only seventy acres. (R15)

The width of the Dorset Cursus, as measured from the outer ditches in fairly constant at about 300 feet. Much of this cursus has been obliterated or reduced in size over the millennia, but at one spot, the embankment stands about 4 feet above the surrounding turf. Several barrows are located along its length, adding to the suspicion that cursuses were somehow used in funeral rites. (R15)

X5. Asia. So far, we have collected only one account of large, linear earthworks in Asia. There must be more in the unsurveyed literature.

India. After providing a sketch of the cyclopedic stone walls near Sigiri, Sri Lanka, J.B. Andrews appended a few sentences concerning some earthworks near Mysore, in southern India.

I also visited this winter the kadangas, long lines of huge earthworks situated in the mountains of Coorg, some hours' journey from the town of Mysore. I may confirm what Dr. Richter in his Manual of Coorg says of their resemblance to the so-called

British earthworks and dykes, such as the Wansdyke, even in the occasional presence of supporting forts or camps. They are of unknown antiquity, thousands of years old according to the imaginative native traditions. The Coorg Chronicle narrates their being repaired three or four hundred years ago, in some sections with stone, it is said. Some of the kadangas are of great length, traversing the province from north to south. Their height is some 30 feet from the bottom of the fosse to the top of the vallum. (R2)

The lengths of the kadangas are uncertain from the above description, but referring to a map of India, we seem to be talking about scores of miles at least. Age is also indeterminate from what we have at hand.

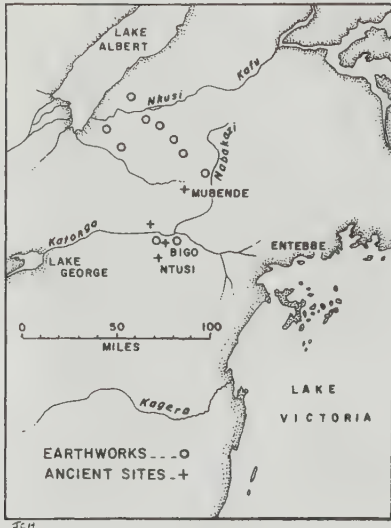
X6. Africa. During the Iron Age, southeastern Africa was evidently wracked by warfare. Great defensive earthworks were thrown up in Uganda, Kenya, and probably other countries.

Uganda. Some of the most impressive earthworks are located in the region around Bigo, about 60 miles west of Entebbe and the shores of Lake Victoria. (See map.) The Bigo works enclose an immense area. (See accompanying plan.) Deep trenches are the dominant features, some hewn out of solid rock, as P.L. Shinnie relates below.

The most surprising discovery was that the silted ditch went down to a depth of twelve feet: cut into solid rock on which pick marks could be seen, it is most impressive testimony to the ability of its creators. (R17)

More on the Bigo site and neighboring Ntusi works appeared in a 1953 paper by M. Gervase in Antiquity.

The Ntusi site lies approximately 7½ miles within the Katonga line of fortification, the most elaborate system of earthworks reported in Africa. In each case these fortifications are concentric, at Bigo the outer ring of bank and ditch is 2 ¾ miles in extent. Taken together, Kagogo, Bigo



Locations of earthworks in western Uganda. Details of the Bigo complex shown below. (R13)

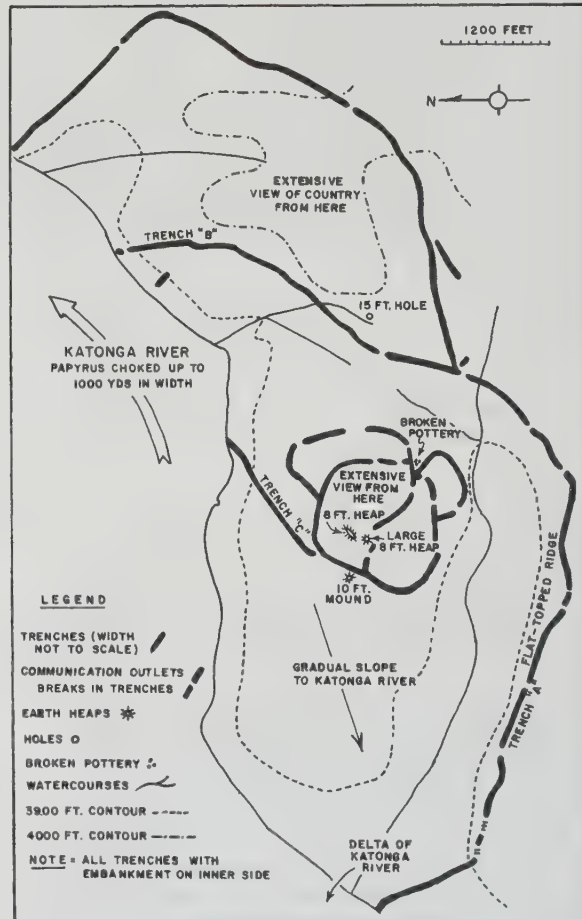
and Kasonko, all on the south banks of the Katonga River, command the river frontage for 5 miles on either side of Bigo ford. But Bigo at least is far more than a fortification. The ditches of the inner circuit are still 19 feet deep in some places, and a depth of 12 to 14 feet is usual. The normal width is from 6 to 8 feet. The earth bank that surmounts the inner side of the ditches nowhere rises higher than 4 or 5 feet. Much of the earth removed was used to make square earthen mounds within the bank, presumably as a foundation for grass houses. (R13)

Another notable prehistoric Ugandan trench, named Nsa za Kateboha, is situated in the Bugoma Forest. It measures 7-12 feet in depth, 10-15 feet in width, and is 1,700 feet long. More interesting than its dimensions is the fact that it is named after Kateboha, "a semi-legendary figure who, according to local tradition, is said not to have been an African." (R14)

An African Quetzalcoatli? Interestingly, other Ugandan earthworks in northern Buddu are known to natives as Biggo bya Muzenyi, which translates into "The Stranger's Forts"! (R10)

X7. Oceania. The multitudinous islands of the Pacific are not famous for earthworks of any kind. Although Tonga is noted for its curious earthen mounds (MSM5), and in the Marquesas one finds defensive earthworks on some hills. The latter are cataloged with the Maori pas and other hilltop forts in MSB in another volume.

When searching for linear earthworks in Oceania, we find only a single ditch worthy of note, but there is quite a story surrounding it.



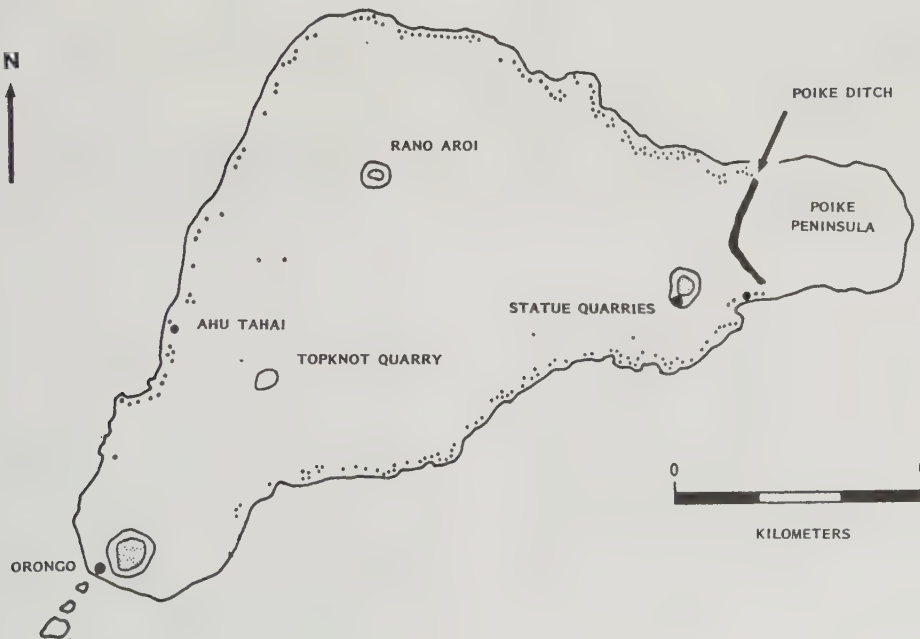
Plan view of ancient trenches at Bigo, Uganda. (R17)

Easter Island. The eastern end of Easter Island, the Poike Peninsula, is separated from the rest of the island by a peculiar trench called the Poike Ditch or Iko's Ditch. The present-day natives tell how the island was once populated by two distinct groups of people: the Long Ears and the Short Ears. Eventually there was a non-amicable separation, with the Long Ears retreating to the Poike Peninsula. Under their chief, Iko, they supposedly dug the Poike Ditch as a defensive work. In a final battle, the Long Ears were overcome and all but one perished and were consumed by fire in the Poike Ditch (also called the "Long Ears' earth oven"). This rich tale is told in more detail by T. Heyerdahl in his book *Aku-Aku*. (R16)

P. Bellwood, well aware of the story about the final battle, describes the Poike Ditch in a more restrained fashion.

The 'Poike Ditch' itself is a most unusual earthwork, and comprises 26 sections of disconnected ditch, each five metres wide and three or four

deep, running in a line for about 3 kilometres. The ditches are separated by uncut causeways, and my own impression is that this is not a defensive structure at all, and it may well be partly a natural structure. [K.P.] Emory has in fact pointed out that the ditches could have been used as sheltered cultivation areas for bananas, sugar cane and taro. However, during their excavations in the fill of one of the ditch sections, Heyerdahl's team found that it had been in use some time during the seventeenth century on the evidence of a carbon-14 date and obsidian hydration dates. So the tradition of the battle could have some historical validity, and perhaps we could compromise and have a battle story in which one side attempted to defend itself behind a preexisting line of cultivation hollows. (R23)



Map of Easter Island showing the Poike Ditch, major quarries, and statue sites or ahus (small dots). (R23)

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MSW2 Notable Rude Stone Walls, a Survey

Description. Ancient walls built of loose, unshaped stones that are of remarkable size (one over 100 miles in length) and/or erected for a purpose that so far has escaped us. As customary in this catalog, walls employed in unusual ways or with high curiosity value are included.

Data Evaluation. Ancient rude stone walls have not received the professional attention they deserve. Simple stone rows get more respect! This is particularly true in North America where walls are automatically written off as the products of colonial farmers. In South America, some of the world's greatest walls remained undiscovered until their true extent was discerned from aircraft. These are still relatively unknown. Generally, then, walls have been neglected in favor of research on pyramids, archaeoastronomy, and stone circles. Much of the work reported here was accomplished by dedicated, non-academic archeologists. Rating: 2.

Anomaly Evaluation. Wall size is not deemed anomalous in this catalog, even though the structure may run over precipitous terrain for scores of miles. Nevertheless, we do include some "Great Walls" simply for because they are remarkable, unappreciated engineering accomplishments. Other walls, though much smaller are more mysterious because they were built for reasons we have not yet fathomed. The East Bay walls in California fall into this category. Yet, even these enigmatic structures merit only a minimum anomaly rating because no important paradigms are at risk. Rating: 3.

Possible Explanations. The majority of the walls cataloged below were erected for defense, to mark property lines, or for use in game drives. The several walls without apparent purpose may have been built for rituals, much like some of the stone rows.

Similar and Related Phenomena. Cyclopean walls (MSW3); precision-fitted, Inca-style walls (MSW4); "natural" stone walls (MSW5); stone rows (MSH1, MSH2); cairn lines (MSM4); stone arrays (MSO4, MSH5); stone meanders (MSH6); linear earthworks (MSW1); stone buildings, forts in particular (MSB in another volume); the Great Wall of China and the like (nonanomalous).

Entries

X0. Introduction. Walls built up from loose, unshaped stones are among the simplest structures bequeathed us by ancient cultures. We find such walls in great profusion on all continents save Antarctica, but only a scant handful are sufficiently "interesting" to devote catalog space to. Notwithstanding their simplicity, rude stone walls attract an anomalist's attention if they: (1) have no obvious purpose; (2) are employed in unusual ways, such as game drives; and (3) are of such great size (length, height, width) that they are justifiably called "Great Walls."

Several legitimate varieties of walls are treated elsewhere. The "cyclopean walls," so-called because of their im-

mense stones, are found in section MSW3. In MSW4, we attend to the precision-fit, "Inca-type" walls, which have excited wonder for centuries. Stone walls that are integral parts of buildings, especially forts designed for point defense, are relegated to Chapter MSB in another volume. It is there that we describe the famous "fused forts" and the massive foundation stones of the temple at Baalbek.

X1. North America. Stone walls are a defining feature of glaciated parts of

North America. They mark the boundaries of farmers' fields and those property lines eulogized by R. Frost. Obviously, we cannot claim that such walls are anomalous. Elsewhere on the continent, low stone walls were piled up by native peoples to channel the movements of bison and caribou during game drives. These long, unsophisticated structures are a bit more interesting because they are analogous to the strange "kites" of the Middle East. (X4) In other places, there are walls run for miles without discernible purpose; or they cover large areas in curious networks. Such lithic enigmas are the primary subject of this entry, but we will not neglect walls that merely pique our curiosity.

New York (Ramapo). The Ramapo Mountains rise just north of the New York-New Jersey state line and about 10 miles northwest of the Hudson River. Hikers in these low ridges may come across some "Supposed Prehistoric Walls," as they were called on an 1845 map of the area. Indeed, strangely configured stone walls are draped over some 200 acres of the Ramapo ridges almost within sight of the Empire State Building. Additionally, sixteen stone cairns accompany these meandering walls. For at least two centuries, the salient questions have been: Who built these strange walls and why.

The walls were carefully laid up. Wall heights vary from 1-4 feet, widths from 6-10 feet. Some of the cairns are a surprising 8 feet high. In several places the walls are interrupted by openings 8 feet wide.

A long report by E.J. Lenik summarizes a thorough mapping and archeological investigation of the Ramapo walls made in the early 1970s. (R19, R20) He reports that no Indian artifacts were found along the walls; neither was there any evidence of Precolumbian contacts by Europeans. (The latter finding doubtless disappointed those amateur archeologists who had been hoping the walls were raised by European visitors to the New World thousands of years ago.)

In the absence of ancient artifacts, could the walls simply mark recent property lines? The erratic courses of the walls rule out this easy answer.

After the foregoing eliminations, the best remaining explanation for the walls is that they are the consequence of colonial field and pasture clearing. But this is not completely satisfying. The

soil in the area is very rocky and not well suited to agriculture. Further, the accompanying map indicates that the walls by themselves would have made poor livestock enclosures unless they were augmented by wooden fencing atop the low walls and along the unwallled sections. Of course, this fencing, if it did exist, rotted away long ago. (R24)

In the end, we are left with the uneasy feeling that we still do not know the whole story about the Ramapo walls and the accompanying cairns.

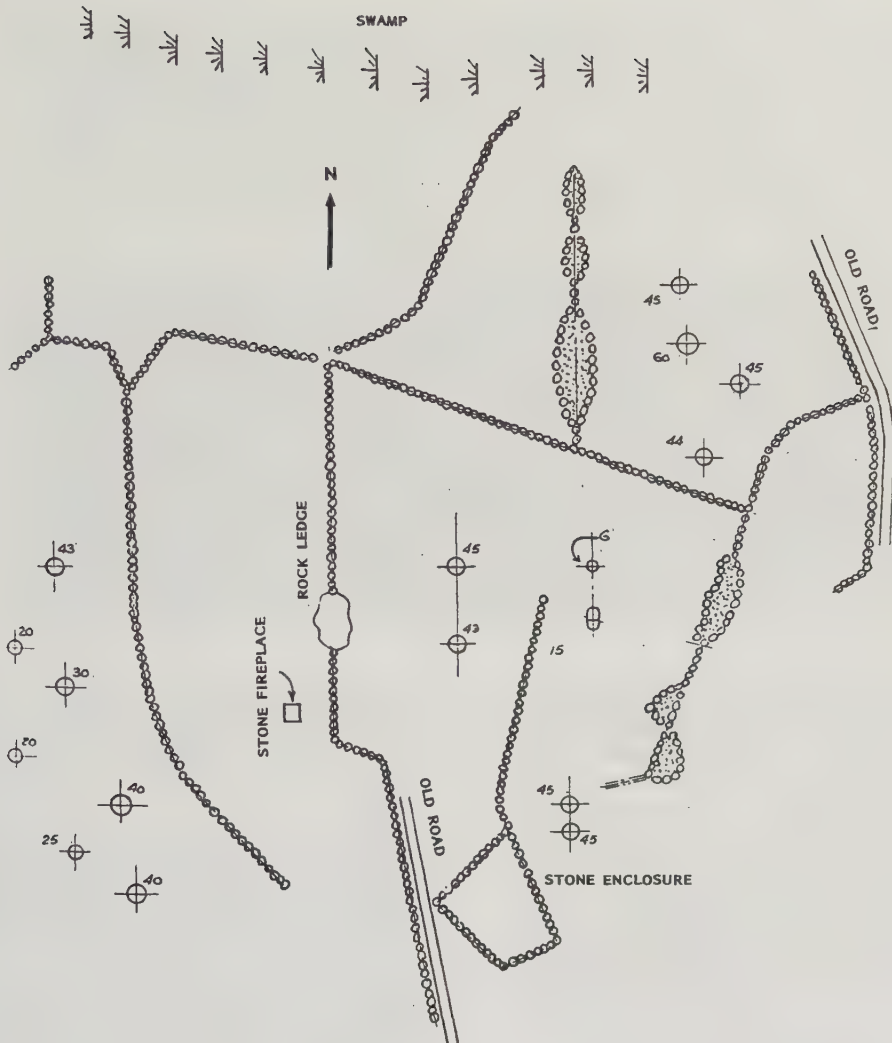
It must also be pointed out that the stone structures at Ramapo bear some resemblance to similar structures at the Mystery Hill complex in New Hampshire. (MSB in another volume)

West Virginia (Mt. Carbon). Along the top of Armstrong Ridge, near Mt. Carbon, the discerning eye can pick out the remnants of a 10-mile-long wall. No one knows who built this wall. Early settlers quizzed the local Indians about its origin, and they were told that long ago the area had been occupied by a race of fierce white warriors that had been exterminated by their forefathers! (Similar, apocryphal tales about ancient white races crop up all over the world, so we can probably discount this possibility!)

S.M. Trento has personally investigated the Mt. Carbon wall and described how it probably looked centuries ago.

The wall was a marvel of careful engineering. Its foundation width of 8 feet tapered up to a height of 7 feet. The wall was constructed about 300 feet below several high ridgetops. It followed the weathered contours and ravines of the ridge slope, forming a vast enclosure that faced outward toward the river below. Many of the blocks of black flint making up the wall came from an outcrop much lower down on the slope, meaning that the builders had to carry tons of rock uphill. Two large stone piles, perhaps towers of some sort, measuring 20 feet in diameter by 20 feet high were also found inside the walled enclosure. (R35)

If it were not for the 10-mile length of the wall, one would be tempted to call the Mt. Carbon wall part of a hill-top fort. But, it would have taken thousands of men to defend a 10-mile wall,



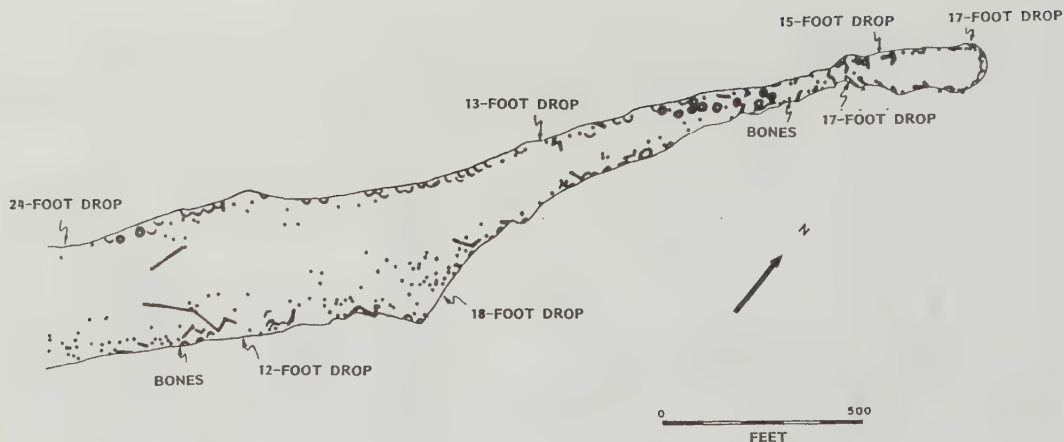
Map of the Ramapo Walls, New York. The circles indicate stone mounds with diameters given in feet. (Adapted from R20)

and such numbers should have left ample record of their occupation of the enclosure, as well as the bones of their attackers, whoever they might have been.

So, for the present, we will classify the Mt. Carbon structure as a "wall."

Idaho. When a far-flung, boulder-structure complex was first discovered in Owyhee County, Idaho, it was initially thought to be an extended fortification of some sort. But when the rock cairns

and boulder alignments were all mapped, the structure was obviously an indefensible assemblage of stone piles and walls. Instead of a fort, it was a "game-drive fence" designed to channel the movement of bison herds to the brinks of precipitous cliffs, where many would either fall to their deaths or be so seriously injured that they could be easily dispatched. Quite understandably, such structures---and there are many of them in the states and provinces adjacent to



Map of basalt boulder structures in Owyhee County, Idaho. Solid dots = stone piles. Solid lines = stone breastworks and fences. (Adapted from R25)

Idaho---are also called "buffalo jumps."

The Idaho example we are focussing on consists of many stone piles, breastworks, and walls. These structures are often 4 feet high and, as the map shows, they collectively form a structure that is over 7,500 feet long. Even though such game-drive structures are not anomalous, they are interesting enough to add to our survey of walls.

L.D. Agenbroad, the geologist who investigated the Idaho game-drive fence, has pointed out that these fences are rather common and, apparently very old. He wrote:

The presence of numerous boulder structures in a complex of bison drives in southwestern Idaho indicates that they were an integral part of the entrapment features. The abundance, size, diversity, and magnitude of boulder structures at these sites is unprecedented, to my knowledge, in bison drive sites of any age. Time depth of the traps (based upon projectile-point typology) indicates use of these features over a period of some 7,000 years (7,300 to 125 yr B.P.). The boulder structures, as presently known, undoubtedly represent cumulative efforts of construction and modification throughout this time period. (R25)

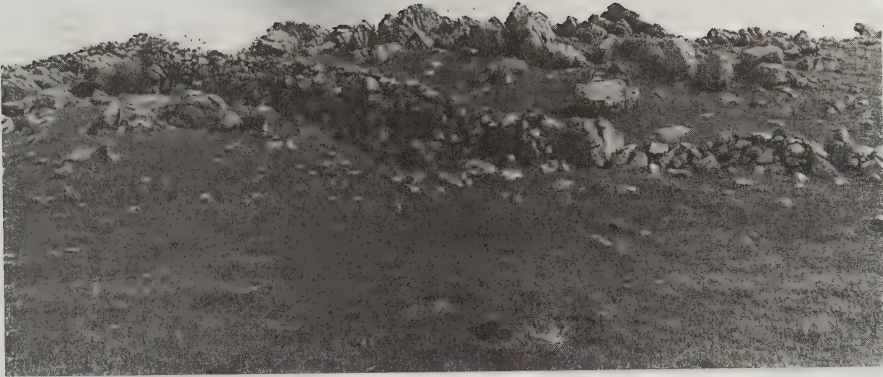
In northern North America, similar game-drive fences are found across the continent from Alaska to Labrador. Of course, the prey differ with locality, with caribou replacing bison in many regions.

Labrador. In Labrador, in prehistoric times, caribou herds were funnelled into killing areas rather than precipitous "jumps" by convergent game-drive fences. (R26)

Greenland. To the east of Labrador lies Greenland---actually part of Europe according to geographers. Here, too, there are game-drive fences that the Eskimos constructed to funnel caribou into shallow waters, where they were slaughtered by spears from kayaks. (R2, R3)

California. Herds of bison and caribou never wandered across northern California, so we do not expect to find ancient game-drive fences there. Nevertheless, we do come across some very mysterious walls---many miles of them. They have puzzled San Francisco Bay Area residents for over a century. (R1)

Ranging along the hills east of San Francisco Bay, the long stretches of walls are constructed from closely fitted basalt boulders. Some of these boulders weigh close to a ton. In some places, the



A section of the East Bay walls near Milpitas, California. This portion is 6 feet high and runs for about a mile along a hilltop. (R. Swanson)

walls reach five feet in height and three feet in width. The larger stones that serve as wall foundations are deeply embedded in the soil, suggesting great age. The walls extend for many miles along the hill crests from Berkeley to Milpitas and beyond---even all the way to San Jose, 50 miles south. Naturally, time and civilization have destroyed some of the walls, but what remains is most impressive. (R27, R28)

The searches of property records going back to the Gold Rush and the studies of Spanish-mission records give no hints of who built the walls or why. Evidently they are centuries old, possibly prehistoric.

Why would anyone build miles of walls from ponderous boulders along ridge crests? The walls twist and turn abruptly. They enclose nothing and appear to serve no practical purpose. At least, they serve no modern purpose. Near Mt. Diablo, a stone circle 30 feet in diameter has been discovered near the walls, thereby deepening the mystery.

Scientists show little interest in these

walls. One even stated:

I don't know of anyone who's come up with a credible explanation. I think what you're getting is an indication that there isn't any academic work in it. (R28)

In truth, this attitude makes sense to a professional scientist. There are only stones on the ridges, no artifacts, no astronomical alignments, and little that could be parlayed into a respectable research paper. Filling this scientific vacuum have been the dedicated labors of enthusiastic amateur archeologists.

For almost two decades, R. Swanson has been searching out the enigmatic stone walls that festoon the Berkeley Hills and far beyond. He summarized some of his findings in a 1997 article.

On the crest of the Berkeley hills there is a long line of large rocks, some are three feet in length, they may weigh a half ton. A century ago they ran for miles on these dry,



*Six-foot-high wall in southern Alameda County, California. This section is over 2 miles long.
(R. Swanson)*

wind-swept crests then down in a line to what is now the botanical gardens.

.....

In the past twelve years, I have visited over forty miles of these stone structures. To call them walls is something of a misnomer. Some do go in a straight line, others twist like a demented snake up a steep hillside, others come in a spiral two hundred feet wide and circle into a boulder with a six-inch knob carved on the top of it. Some are massive, over six feet tall and run for miles.

In the same article, Swanson related how a local TV station that wanted to film the walls took him for a helicopter ride. As expected, all along the East Bay hills they discerned line after long line of walls. Then, when the copter passed over Mission Peak toward Mt. Allison, mile upon mile of still more walls appeared. Numbed by these new discoveries, Swanson remarked:

I could see years of work just laying there waiting for me. (R34)

To the west, across the Bay, in Marin County, Point Reyes juts out into the Pacific. Here stretches another mysterious "wall." Actually, it is a line of carefully arranged stones rather than a true wall. More properly, this wall belongs in MSH2 along with other stone rows. However, everyone calls it a "wall," so we enter it here along with the East Bay walls.

Many of the stones comprising the Point Reyes wall are less than 2 feet high. Altogether, there are about 400 of them, all carefully laid in a straight line that bisects the Tomales Point peninsula. Both ends terminate in steep cliffs.

The Point Reyes wall is too low to confine animals. Its straightness suggests that it might be a boundary marker of some sort. Others note that it defines a line of sight to Mt. St. Helens in Oregon and might have had some ritual or mystical significance to whomever built it. Unfortunately, no one knows who did



The "wall" on Point Reyes, California. (R. Swanson)

build it---or when. The wall looks old, but there are no artifacts to date it properly. If this "wall" were seen on a British moor, it would probably be classified as the work of the megalith builders. Not so, on this lonely, wind-swept point of California real estate!

in a paper Ives published in the American Anthropologist.

These walls have been described as fortifications by McGee and some of the early Spanish writers, but this wall, like many of the others known in Sonora, is poorly placed strategically. Three sides, the north, west and south are open to attack...No evidence of habitation was found at the Quitovaquita trinchera. The structure was certainly not an irrigation dam, for it could not impound water, and there is no water to impound at this place except during the summer rains, and very little then. It was not a corral, for it is open at the ends, and could not confine any animal more active than a turtle. Lumholtz suggests that the trincheras were religious structures. Considering the location of some of these structures, and their apparent uselessness for any other purpose, this suggestion has its merits. (R11)

Elsewhere in ancient Mexico, the Maya erected walls that were obviously defen-

X2. Mesoamerica.

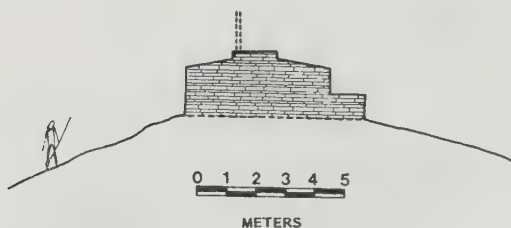
Mexico. Curious isolated stone walls are positioned along many hills of Papaveria, a region just south of the Arizona-Sonora border. Called "trincheras," these walls have no obvious application to Indian life.

R.L. Ives described one trinchera located on a knoll near the border town of Quitovaquita. The wall was 300 feet long, 3 feet high, and 2 feet wide. No other structures of any sort existed near the trinchera. Neither were there any artifacts that could provide clues as to the purpose and age of the wall. The puzzlement of the archeologists who have examined the trincheras is evident

sive. In terms of labor invested and amount of stonework, these walls are just as significant as all those Mayan pyramids and ball courts we see in the popular archeology books. Two brief examples will have to suffice, because we cannot claim that these walls are anomalous.

Tulum, on the Atlantic coast south of Cancun, was defended by several stone walls. Tulum's "Great Wall" is 400 meters long, 8 meters wide, and 3-4 meters high. Built of dry-laid stones, it is the largest structure on the site! (R18)

West of Tulum, the smaller, less-well-known Mayan site of Chacchob was originally ringed by a wall 1,410 meters in circumference. Its height ranged from 1.5 to 3 meters, and it was about 5 meters wide. Its military effectiveness was increased by positioning the wall on sloping ground, as shown in the sketch. Perhaps most impressive is the wall's volume: 14,800 cubic meters (525,000 cubic feet). (R23)



Reconstruction of the Chacchob wall in the Mayan lowlands. (R23)

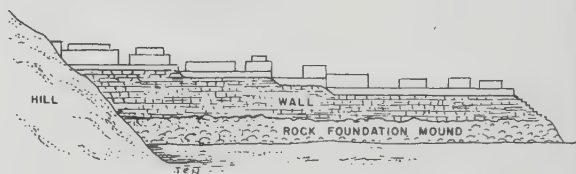
The Mayan city walls emphasize the fact that these cities were often at war with another. They are, however, less challenging from an engineering standpoint than the great embankment-trench systems the Maya constructed in Guatemala. (MSW1)

In 1953 walls of great size and unusual design were reported from the Mexican state of Chiapas. These walls are quite different from the Mayan walls common 100 miles to the east. R.S. Russell provided details in a 1954 issue of *American Antiquity*. The first two paragraphs describe the ruin in general.

The ruin most thoroughly studied

consists of a 200 by 680 foot integrated rock complex of very squat structures inclosed by a low wall or rampart. No structures exceed 15 feet in height. The commanding elevation of the complex was obtained by building it on top of a great, field-rock mound, which in turn was built on an elongated natural hill. At the base, the mound is approximately 700 feet long, with a varying width between 300 and 400 feet. In one place, on the south side where the hill was indented, the mound is approximately 70 feet high. Its average height is probably about 25 feet.

The builders utilized multiton, weather-formed boulders lavishly in foundations and supporting walls. Some of them have been roughly squared. Structures and the ramparts are built of, or faced with, roughly squared limestone slabs. A size of between 3 and 4 feet square by 8 to 10 inches thick seems to have been almost standardized.



Great North Wall, Chiapas, Mexico. (R37)

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This complex is built upon a large foundation mound of piled field rock and is oriented almost east-west. The north side of this mound slants up to a massive vertical wall upon which the complex stands. This wall is built of large, weather-made boulders some of which are multiton. A few appear to have been roughly squared. Because the complex floor rises in a series of four levels, the height of this supporting wall increases from 15 to approximately 50 feet. It is 650 feet long. (R37)

X3. South America.

Peru, Northern Peru was the center of the Chimu Empire, which thrived in the coastal valleys until the Incas finally conquered them in 1475. To defend themselves against the encroaching Incas and earlier enemies, the Chimu built wall after wall beginning about 500 B.C. Most of the Chimu walls were of modest size, only 1.5-2.0 meters high and made from local fieldstone. Some extended for 10 kilometers from the coastline inland toward the Andes. (R21)

The Chimu's "Great Wall of Peru" was much more ambitious in scope. However, its size cannot be appreciated at ground

level. Doubtless many archeologists had walked past it or over it without suspecting its real size. The invading Spaniards apparently knew nothing of it; neither did the leading Peruvian archeologists prior to 1931. It was that year that the Great Wall was finally discovered by the Shippee-Johnson Aerial Photographic Expedition. From the air the Great Wall's true extent was finally appreciated, and it finally got into the archeology books.

Starting from the Santa River delta, the Expedition's first flight found that the Great Wall traverses the foothills along the course of the Santa and penetrates far into the Andes---perhaps as



Map of the Chimu's Great Wall of Peru.

far as 50 miles inland. (R14)

Following their momentous discovery, Shippee and his companions made a second aerial reconnaissance of the wall. This time they noted something they had missed on the first flight: the presence of a number of circular and rectangular forts along the length of the wall. One of these forts, built of stone, boasted walls 15 feet high and measured 200 by 300 feet in area.

Shippee et al decided that the massive structure they had seen from from their airplane required a closer look from the ground. At Chimbote, they loaded their camera equipment onto an old Ford and headed for the nearest section of the wall. After the Ford could go no farther, they struggled along on foot, carrying their heavy camera equipment, until they finally arrived at the wall. Shippee wrote:



Aerial view of the Great Wall of Peru.

The wall, as far as we followed it, now averages about 7 feet in height. It is built of broken rocks set together with adobe cement, and, where it has not been greatly disturbed, its outer surface is so well chinked with small rocks that it would be practi-

cally impossible to scale it without ladders. In occasional places, as seen from the air, the wall must still be 20 or 30 feet high where it crosses gullies. We found it impossible to make anything like accurate measurements. The rocks that have slipped from the top with the beating of the winds and the occasional rains spread away for a considerable distance on either side of the wall and aid the drifted sand in obscuring its base. We estimated that, in its original state, it was about 12 or 15 feet thick at the base and was built to taper upward to an average height of 12 or 15 feet. (R8)

In the late 1950s, explorer G. Savoy also took to the Peruvian skies and found additional Chimu-built "Great Walls," though they were not as "great" as the one discovered by the Shippee-Johnson Expedition. Nevertheless, one of them is remarkable enough to add to the "Great Wall" dossier. Savoy wrote as follows:

One sunny morning, we were pleasantly surprised to discover a second Great Wall in the Nepena Valley. It originated near the coast with a group of walls that coursed inland over the rolling hills and finally narrowed to a single wall that ran across the coastal desert among spurs of the Andes, where it was lost in the uplands beyond Moro. Although many expert archaeologists had excavated ruins in this valley, none had noted the existence of the wall. We spotted secondary walls which cut through urban layouts suggesting that the main wall might have been built over an older settlement. It runs for many miles along the north bank of the river, but for the most part is in a poor state of repair. (R15)

A few days later, a flight over the Casma Valley south of the Nepena Valley netted Savoy still another Great Wall.

Bolivia. The Inca who conquered the Chimu---despite their Great Walls---built their own Great Wall farther south in Bolivia. Naturally, it was bigger than those of the Chimu!

The Inca's ability to build with stone is well-known. One of their most ambitious projects---the so-called "Great Wall of the Incas"---is rarely mentioned in

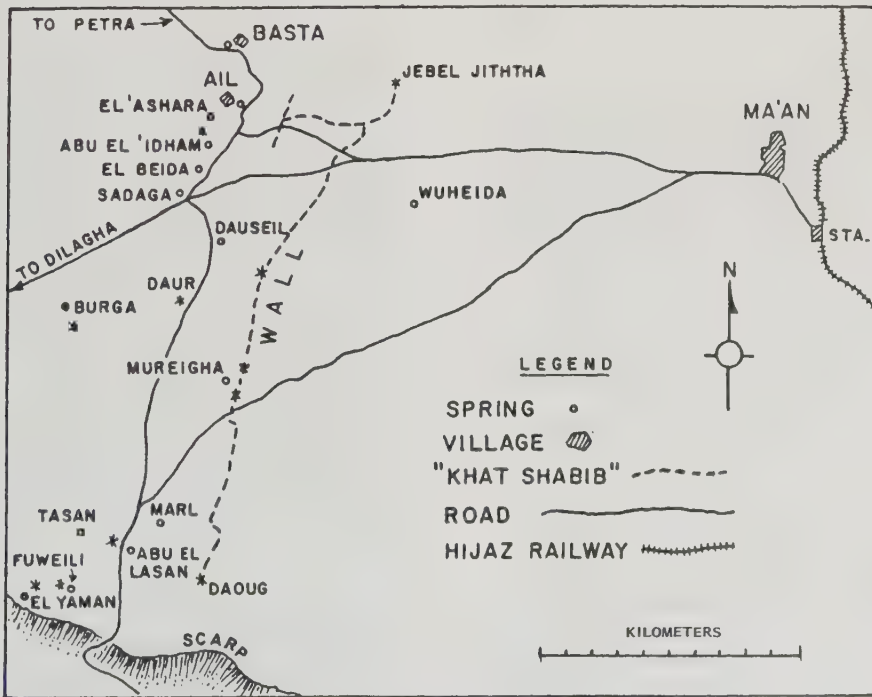
the literature and is poorly investigated in the field. Probably about 150 miles in length, it cannot compare with China's Great Wall, but it seems to be the longest in South America. It is built at altitudes of 8,000-12,000 feet in extremely rugged terrain. It runs along high ridges and is studded with stone forts at strategic intervals. Even though the Inca Wall is only a few feet high, it would certainly slow down a force charging up precipitous terrain at two miles altitude. It is constructed mainly of broken stones and cannot be compared to the precisely shaped and fitted stones that typify the walls seen in the major Inca cities, such as Cuzco.

The true extent and condition of the Great Wall of the Incas are not accurately known. Only a few easily accessible sections have been checked out. The theory is that the Incas built it to discourage invasions by lowland Indians. Like the Chimu Great Walls, it seems to have met with only small success in this regard. (R31)

X4. Middle East. The lands of the Middle East, now so dry and barren, were not always that way. Once water was more abundant, and large game animals flourished, even lions. These lands have also seen many cultures come and go, as well as invaders from all parts of the world. It is, therefore, not surprising to find that many stone walls have been erected over the millennia for sundry applications. Strangely for this war-racked region, none of the more interesting walls were military in purpose.

Jordan. In the 1940s, while flying over the Ma'an District of what was then called Transjordan, A. Kirkbride, a British Army officer, noticed a stone wall that reached some 20 miles in length. This wall seemed to serve no obvious purpose, so Kirkbride decided to inquire further,

The local inhabitants told him that the wall had been built by the Amir Shebib el Tubba'i el Himyari and was called Shebib's Wall. This identification of the builder meant that the wall dates



Map of Shebib's (or Kirkbride's) Wall, Jordan. (R12)

from the 10th. or 11th. Century.

Still wanting to learn more, Kirkbride mounted an expedition by horseback. He reported as follows:

Having collected all available information about Shebib, the next thing was to visit the wall itself. It proved to be a single layer of rough blocks of stone laid upon the surface of the ground, over a width of about two metres, with larger blocks standing upright in the centre of the strip at more or less regular distances of about five metres. Circular arrangements of similar rough stone appear to have existed at irregular intervals and, where the line crossed important tracks, there appeared to have been breaks or gates so as not to impede traffic.

.....

The nature of its structure indicates that it could not be defensive; its general alignment, the presence in its centre of the upright stones and the fact that, at one point, it runs over a sheer cliff of some fifteen metres in height are conclusive evidence that it was a boundary line and not a causeway.

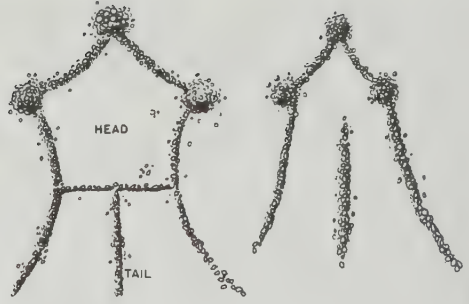
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The most impressive thing about the line is the physical effort which must have gone to build so substantial a boundary mark. One is left with the feeling that the differences over ownership needed to goad the authorities to undertake such a work must have been serious indeed. (R12)

The volume of Shebib's Wall (sometimes called Kirkbride's Wall) has been estimated at over 2,100,000 cubic feet. (R17)

Building Shebib's Wall was a formidable task, but for us it remains a curiosity rather than an anomaly.

Much of the Middle East. In the 1920s, pilots flying the mail run between Cairo and Baghdad noticed many patterns of stone walls resembling "keyholes" or "kites." (R4, R5, R13) The term "kite" is particularly appropriate because many of these structures look very much like the well-known aerial toys. The tails of these terrestrial kites, however, may stretch out for 18 miles! They are,



Typical Arabian "kites." (R5)

therefore, worthy of our attention if only for their great sizes.

Thousands of these kites decorate the deserts and plains of the Middle East. Most are V-shaped terminating in a roundish cul de sac studded with large rock piles. (See illustration.) Most of the wall arms are 300-3,000 meters long. They are constructed of basalt rocks from ancient lava flows. Artifacts found nearby suggest ages of at least 7,000 years. Younger, but very similar, structures have been found in Central Asia.

A. Betts of the University of Sydney has been exploring these walls and attempting to discern their purpose. The best explanation seems to be that the ancient inhabitants of the region drove herds of wild animals into the wide mouths of the kites and then slaughtered them when they were trapped and confused at the corral-like ends. (R33)

The kites, therefore, are the Middle East version of the game-drive systems found all over northern North America. (X1)

As with most of the walls presented in this section, the kites are so large that they represent a great deal of labor. But most are simple structures that do not place any archeological or anthropological paradigms at risk.

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MSW3 Transoceanic Distribution of Precision-Fit Stone Walls

Description. The existence in Europe, South America, and Oceania of walls constructed of large, irregularly shaped stones that are fitted together without mortar and with extreme precision; i.e., so closely that a knife blade cannot be inserted between them.

Data Evaluation. Walls fitting the above description have amazed travellers for centuries, particularly in Peru and on Easter Island. Consequently, these walls are well-documented. Similar walls in Europe, however, seem to have attracted little professional attention. Also, doubts have been expressed about whether the examples of Peruvian and Easter Island stonework are really comparable, thereby undermining any claims of cultural diffusion. Rating: 3.

Anomaly Evaluation. Inca-style walls represent an unusual, perhaps unique, variety of stone masonry. If the Vinapu wall on Easter Island is truly Inca-inspired, the claim that ancient Peruvians visited Easter Island long before the Polynesians arrived would be supported. This possibility is vociferously rejected by mainstream archeologists. Rating: 1.

Possible Explanations. Incan and Easter Island stonework are only superficially alike and were independently invented.

Similar and Related Phenomena. Inca stoneworking techniques as seen in buildings (MSB in another volume); cyclopean walls (MSW4).

Entries

X0. Introduction. One of the wonders of ancient South American architecture has been the Inca's capability to construct walls and buildings with large stones that were shaped to fit together with such precision that, as the common saying goes, "one cannot insert a knife

blade between them." Adding to this remarkable aspect of Incan masonry is the irregular shape of some of the fitted stones. A famous example is the "stone with twelve corners" at Cuzco.

Archeologists and engineers have argued long and hard about how the

Inca managed to precision-fit their odd-shaped stones together. Fascinating though their unusual technique may be, we are concerned here with a somewhat different subject; namely, does the appearance of precision-fit, Inca-type walls in Oceania and elsewhere prove the pre-Columbian, transoceanic transfer of Inca-style masonry? If the answer to this question is affirmative, we have an important anomaly on our hands because, despite T. Heyerdahl's marine exploits, the archeological establishment frowns mightily upon this idea.

Readers interested in the associated question about how the Inca actually built their walls should refer to Chapter MSB in another volume.

X1. South America.

Peru. The best place to begin our inquiry into the diffusion question is South America, more precisely, Peru, where the most famous examples of Inca-type masonry are seen.

The accompanying photograph of one of the Incan walls is really all one needs



Incan stonework, Peru.

to define the type of architecture under discussion. Many of the stones weigh several tons; they are often irregular in outline; they nestle closely together, so closely that we frequently come across descriptions such as the following.

It has often been pointed out that the workmanship in Inca masonry is of a superb nature with joints so perfect as not to permit the penetration of a penknife. It is a further matter of note that each stone is so formed that it can occupy one and only one position in the walls, and that no mortar was used in the construction. (R1)

Of course, all Incan masonry does not aspire to such standards. Neither can we be certain that the Inca alone invented the type of masonry that we here associate with them.

X2. Europe

Greece. Precision-fit stone walls are not uniquely Incan. A salient example can be seen on the hill of St. John Prodromus (John the Baptist) located near the Acheron River, Epirus, northwestern Greece. On this hill there is a remarkable building built in the late Fourth or early Fifth Century B.C. The central structure consists of thick walls built from heavy, polygonal stone blocks. (See sketch.) The irregular stones fit snugly together much like some of those at Cuzco. Yet, the Greek masons did their work over 1,000 years before the Incas. We can only speculate as to the methods they used; they may have differed from those of the Peruvians.

There may well be similar walls elsewhere in the Mediterranean region.

Given the immense time gap separating the Greek and Incan walls and the emphatic lack of Greek artifacts in Peru, independent invention seems a much more probable explanation of the wall similarities than postulating ancient Greek contacts with South America.



Polygonal stonework at an ancient fortified site in northeastern Greece. There is a superficial resemblance to Incan stonework. (R7)

X3. Oceania. In the matter of precision-fit walls, the diffusionists have more going for them in the Pacific. They are also helped by anomalies in plant distribution and some cultural similarities between Asia and the eastern arc of the Pacific Rim. Indeed, some claim that the Pacific was crossed, west-to-east, centuries before Europeans arrived in the Pacific. However, it may well be that the Incan masonry know-how passed from east-to-west---just the opposite direction of flow!

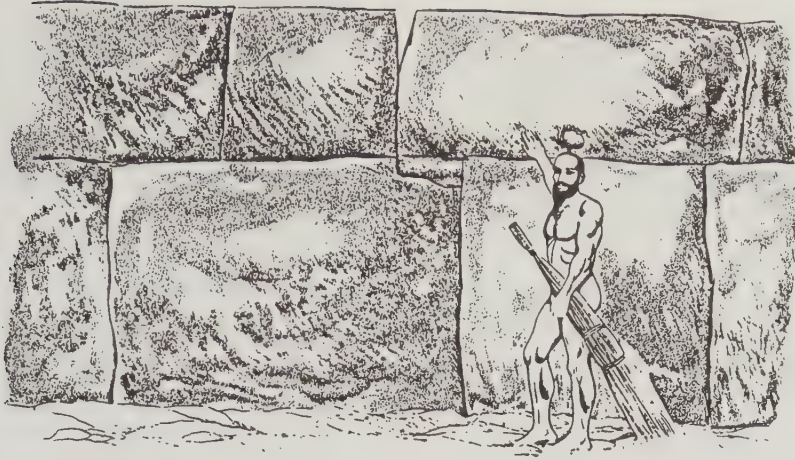
Easter Island. T. Heyerdahl has long championed the theory that the earliest colonists of Easter Island came from South America long before Polynesian immigrants arrived from the west. One of Heyerdahl's bits of evidence is the platform (ahu) at Vinapu, on the southwestern tip of Easter Island. The masonry displayed at this ahu so closely resembles that seen in Incan stonework that many travelers have remarked on it. (R4, R5) The accompanying sketch

clearly reveals the precise nesting of irregularly shaped, large stones.

We will allow Heyerdahl himself comment on this remarkable similarity of the Vinapu ahu stonework to that seen in Peru.

All who have seen this unusual piece of stonemason's work have been struck by its remarkable resemblance to the grand mural constructions of the Inca empire. There is nothing like it on the tens of thousands of other islands in the vast Pacific. Vinapu alone stands as a mirrored reflection of the classical masterpieces of the Incas or their predecessors, and it is all the more striking because it appears on the particular Polynesian island nearest to the Inca's own coast. (R3)

Heyerdahl adds that radiocarbon dating indicates that the real discoverers of Easter Island arrived over 1,000 years before the Polynesians. Their structures



Precision stonework at Vinapu, Easter Island. (R6)

had no parallel in the buildings erected by the later arrivals. In fact, many of the early structures were pulled down by the newly arrived Polynesians.

As reasonable as Heyerhahl's theory sounds, it seems that the masonry of the ahu at Vinapu is actually not a mirror of that in Inca-land. H.D. Skinner has pointed out a significant difference. In the Incan walls, the stones we see are tongued far back into the wall's interior. Such walls are virtually indestructable in earthquakes.

Not so the Polynesian veneer of stone slabs carefully fitted edge to edge which gives a final smooth surface to the rough stone-work of Vinapu. This facing is not tongued back into the ahu but is more an exterior coating. It is already crumbling away from the mass of the Vinapu ahu. Its resemblance to the stone-work of Cuzco is superficial. (R2)

Tonga. Thousands of miles west of Easter Island, a wall on Tonga roughly resembles that at Vinapu, as related by D.H. Childress.

The Langi Tauhala, a pyramidal platform at the old fortress of Tongatapu is a cut stone block massive in size and similar to the stones at Baalbek, Lebanon, the largest cut stones in the world, weighing an estimated 2,000 tons apiece. The largest stone

at Langi Tauhala is 7.4 meters in length and 2.2 meters in height; it has a thickness of 0.4 meters and weighs an estimated 30 or 40 metric tons. It is part of a wall that is 222 meters long, and had been built at a time of great antiquity.

It is also interesting to note that the largest block is notched, and that the next block is cut to fit into this notch. Such construction indicates that the builders were aware of earthquakes and general cataclysmic shifts of the earth. "Keystone" cuts and such are ways of binding walls together, and had been done at Tiahuanaco and Ollantaytambo in South America. (R6)

On Tonga, therefore, we also see a wall of precision-fit, irregular stones. But Tonga is so far from Easter Island and South America that no one, not even Heyerdahl, has ever suggested that the Inca or their ancestors might have voyaged that far.

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MSW4 Cyclopean Walls

Description. Rude walls constructed of very large, roughly worked stones piled in courses without great precision. Cyclopean walls, named for the mythical race of one-eyed giants, are massive and imposing. Obviously designed for defense, they date from perhaps 2,500 B.C.

Data Evaluation. Cyclopean walls are recognized forms of ancient architecture. They are often remarked upon in the mainstream literature. Except for one astounding report in a popular book (R3), the data must be assigned a high rating. Rating: 1.

Anomaly Evaluation. The only justification for this entry is the adjective "cyclopean," which implies walls built of stones so large that we might question the ability of ancient humans to build them. Upon investigation, however, cyclopean walls are certainly remarkable but would hardly tax ancient engineers. Much larger stones were quarried and maneuvered in the Middle East in the same time frame. Rating: 4.

Possible Explanations. None required.

Similar and Related Phenomena. The truly immense stones at Baalbek (MSB in another volume).

Entries

X1. Europe

Spain. In the walls at Tarragona, a city some 100 kilometers southwest of Barcelona, on the Mediterranean, we see the classic cyclopean architecture. Happily, the Tarragona walls have remained essentially undamaged even though they

must be 3,000-4,000 years old. One of the walls surrounding the hill of Tarragona and was 4 kilometers long---very impressive, but so crude in its construction that it cannot be considered anomalous.

The workmanship of the walls is typically cyclopean. It consists of huge blocks of stone two metres (6½ feet) long and occasionally attaining a length of three or four metres (about 10-13 feet); they are almost unshaped, only roughly trimmed and generally of irregular contours, presenting an often barbaric ensemble that is increased by the picturesqueness of this form of architecture. Combined as this is with the rest of the facing, the whole acquires a certain rhythm and uniformity in spite of its variety. With the big blocks were mingled small ones to fill the gaps. The wall was constructed of two superimposed courses of big blocks, united by small stones, earth and every kind of material collected indiscriminately. The total width is six metres (19½ feet) on the average, though there are sections which are both narrower and wider. The maximum height still preserved reaches to six metres in several places, and occasionally surpasses it. (R1)

The Tarragona walls were probably built about 1,200 B.C. Similar cyclopean walls are found at La Almazora, Spain, and elsewhere around the Mediterranean.

Greece. Another cyclopean wall guards the ancient acropolis near the town of Paralimni. Called the "Wall of the Dymaeans." It is dated by artifacts as being built between 2,500 and 2,000 B.C. As we can see from the following quotation, it closely follows the plan of the Tarragona wall in Spain.

On both sides the acropolis is defended by a cyclopean wall, built of massive, unhewn blocks placed one upon another as if by chance. The spaces between the blocks are filled with smaller stones and clay. Two sections of the wall were repaired in ancient times with smaller stones. The whole length of the wall is 175 meters (about 576 feet); it is five meters thick, eight meters high. (R3)

X2. Africa

Morocco. In 1958, divers spotted what might be called a cyclopean wall at a depth of 14 meters in the Mediterranean off the coast of Morocco. The stone blocks are reputed to be 8 meters long and 6 meters high. The wall, if that is what it is, is estimated to stretch along the sea floor for all of 9 miles. (R3)

This is an incredible distance and, as the sketch shows, this wall seems to be constructed from nicely squared stones. Since this information comes from a popular book and we have seen no confirmation of the find in the professional literature, we must be very wary here. This entry must be substantiated before we can consider it further.



Sketch of an underwater wall off Morocco. It is reported to be 9 miles long! (Adapted from R3)

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MSW5 Natural Walls That *Seem* Artificial

Description. The existence of natural rock formations that give the appearance of being artificial walls and, indeed, have been claimed to be the work of ancient cultures. Usually, these walls turn out to be outcroppings of jointed sandstone, limestone, or some other common rock.

Data Evaluation. The claims of buried or partially exposed artificial walls usually crop up in newspapers or popular magazines, both of which lack the credibility of science journals. For most of the examples of the phenomenon at hand, we have found assessments by professional geologists that effectively quash the wild claims of ancient masonry. Walls still unchallenged by science have been reported in suspect sources and cannot be given much weight. Taken together, the data strongly support the natural origin of all of the "walls" described below. Rating: 1.

Anomaly Evaluation. Although some "fringe" archeologists will object, we see no anomalies here, only cases of mistaken identity. Rating: 4.

Possible Explanations. None required.

Similar and Related Phenomena. Geological processes regularly produce phenomena that appear artificial, such as patterned ground, hexagonal basalt prisms, and spherical concretions (Anomalies in Geology).

Entries

X0. Introduction. On rare occasions, the forces of nature create structures that look very much like human-made walls. Sedimentary rocks, limestone and sandstone especially, often occur in regularly spaced horizontal layers (strata). These flat sheets of rock may also be divided vertically by cracks called "joints." The combination of horizontal layering and vertical cracking can create the appearance of artificiality. It is understandable how such natural formations may deceive non-geologists into thinking that they have discovered an ancient wall when they see an outcropping of such sedimentary rocks.

We have found several such examples of mistaken identity in our literature searches. Most are certainly natural, but a couple remain suspiciously artificial in the eyes of some.

X1. North America

Kentucky. The report presented below is over a century old. We have never seen anything further on this "fossil

wall." Presumably, geologists eventually did put the matter in proper scientific perspective.

The Lexington (Ky.) Press says the workmen engaged in quarrying rock for Mr. Shannon, one mile from town on the old Frankfort pike, came upon a massive stone wall. It had every appearance of having been built by human hands, the mortar seams and joints being very plain. Above it about ten feet of drift and twenty feet of rock had been removed by the workmen, and on the side exposed the men had advanced fully forty feet from where they first struck rock. Thus it was firmly embedded in a solid limestone quarry, which certainly has formed about it since the wall was built. The face of the wall was well dressed, and its massive appearance gave evidence of the skill of hands perished long centuries ago, and could well be envied by the best of the stone masons today. (R1)

The Editor of Scientific American added that he would be "glad to see the report of some competent geologist upon

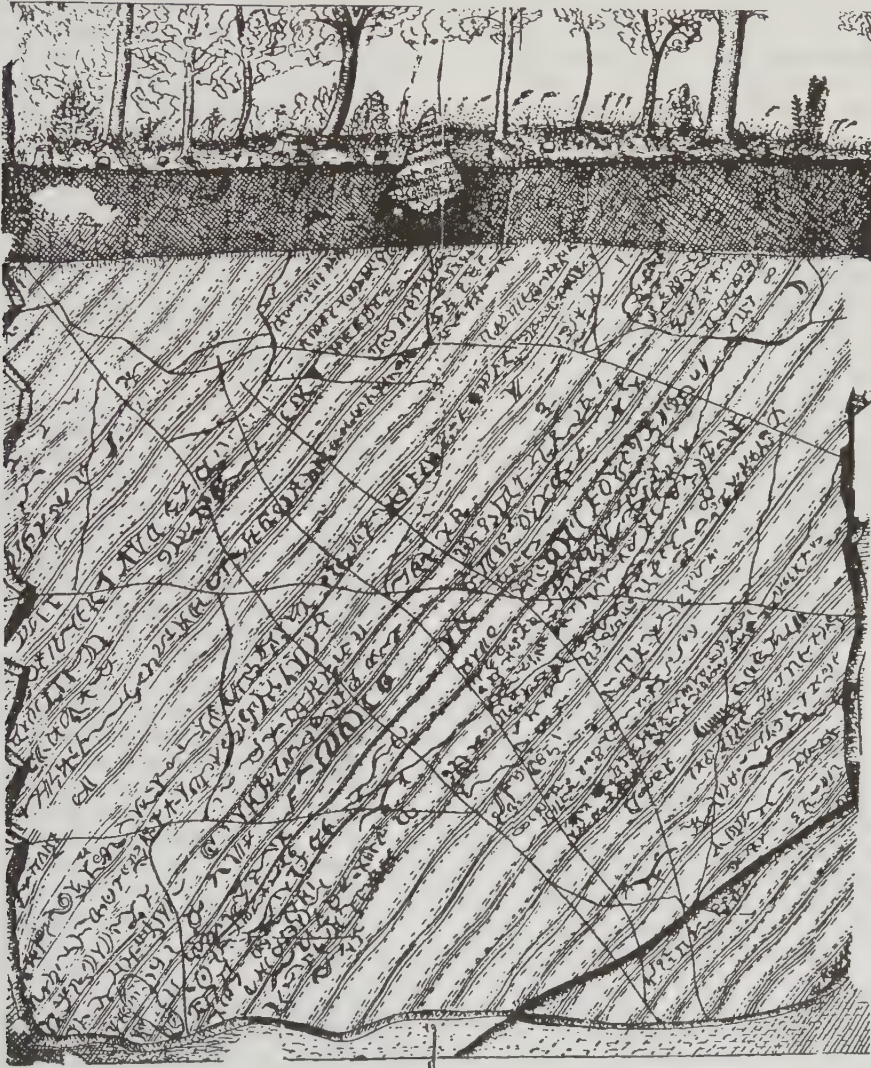
the 'fossil' wall." This was a wise caveat because in 1882 newspaper accounts were less reliable than they are today.

Tennessee. One of our favorite anomalies over the years has been the ancient "inscribed wall" at Chatata, near Cleveland, in Bradley County, Tennessee. The quotation marks are intended to warn the reader that said wall is probably not human-made, and its "inscriptions" are likewise natural rather than arti-

ficial.

The history of the Chatata wall is long and convoluted. (R2) Discovered over a century ago, new facts are still coming to light today, as reviewed by D.E. Wirth in an issue of The Ancient American. (R6)

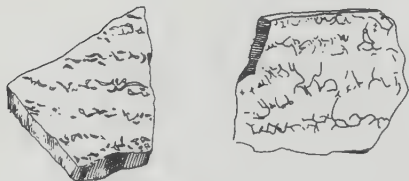
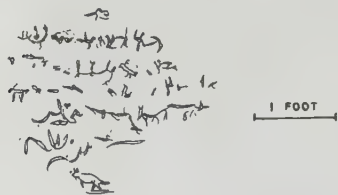
The wall was originally almost completely buried. It attracted attention only because its course was marked on the surface by stones projecting from the ground every 25-30 feet over a gent-



Sketch of the Chatata Wall, Tennessee, from the archives of the Smithsonian Institution. (R6)

ly curving arc about 1,000 feet long. One of these surface stones seemed to be inscribed with strange symbols. Excavations, supported at first by the Smithsonian Institution, revealed a 3-ply sandstone, wall-like structure seemingly cemented together by a reddish mortar. Splitting the sandstone sheets revealed diagonal rows of markings like those illustrated.

At first, both wall and inscriptions were proclaimed to be artificial. More recent studies by geologists point to natural origins for the wall, the mortar, and even the inscriptions themselves. The latter may be no more than the burrows of mollusks. This interpretation does make sense because the so-called inscriptions were almost completely



Enlarged view of some "inscriptions" on the Chatata Wall, Tennessee. (R2)

covered by the "mortar"---hardly a good way to convey messages! Also, the inscriptions themselves do not really look regular enough to be man-made. For these and other reasons, the Chatata wall now seems more of a geological curiosity rather than an archeological anomaly.

Nevertheless, at least two nagging questions remain:

- Why were there regularly placed stones on the surface over the wall?

- Early investigators also reported

seeing petroglyphs of animals, the swastika, the serpent symbol, and other recognized Indian symbology. Whatever happened to these?

We must add that an incredible variety of complex markings occur on rock surfaces. Often human origins have been proclaimed only to yield eventually to natural explanations. (See ESX6 in Neglected Geological Anomalies.)

Texas. The town and county of Rockwall, Texas, were named for a peculiar rock formation that looks very much like an artificial wall. Some local residents are certain that further digging would reveal the remnants of a buried civilization. Geologists laugh at this idea because they have determined that the "wall" is merely a regularly jointed sandstone "dike." (Sandstone "dikes" are vertically oriented sheets of sandstone formed when slurries of sand are forced into rock fissures where they then become lithified.)

G. Howell provided some details on Rockwall's "wall" in a 1939 number of Nature Magazine.

The "wall" at Rockwall, regardless of theories, is an interesting formation. It appears at intervals over the county and in part of the county to the north. It was discovered when the first town well was dug. There are definite corners to the structure, but there are many angles, also. Moreover, the depth has not yet been determined; while the width varies from one to fifteen inches. Since the height is known to be at least forty feet, it seems unlikely that it could ever have been a wall and remain standing or offer substantial protection. Nevertheless, many people who see the "wall" believe that "injuns" built it. One man has claimed to have discovered a perfect arch. The surface in many places seems to have been plastered with a smooth substance. (R3)

The fact that the "wall" strays into the neighboring county to the north suggests the great length that would characterize a dike rather than a human-made wall. Further, no artifacts of an ancient civilization have ever been uncovered. The geologists have won this

argument. Today, Rockwall's "wall" is more apt to be regarded with amusement rather than a relic of an ancient civilization. (R5)

X2. South America

Paraguay. Our only suspicious South American wall is reminiscent of the "inscribed wall" at Chatata, Tennessee (X1), for it, too, is said to bear writing and symbols. Details about the excavation of the Paraguayan wall are unknown; neither has notice of it been taken by any science journals we have examined. One would expect that archeologists would flock to study this amazing structure. At this point, we must advise "caveat emptor," because we suspect this wall may not exist at all.

A great wall, 4,500 feet in length and at least 120 feet high, hidden for countless years within the heart of a mountain ridge, Cerro Cora, in the northeastern part of Paraguay may hold the secret of a past civilization.

This wall, judged by engineers to be an excellent work of engineering, is built of great blocks of red granite polished to a high luster on the face of the stone. On this polished face appear, it is reported, drawings portraying animals and footprints, both animal and human, and many signs which may be hieroglyphics. The blocks fit together with perfect precision. (R4)

The compiler considers this report to be of doubtful authenticity, to say the least.

X4. Oceania

New Zealand. Some 30 kilometers south of Lake Taupo, in New Zealand, stands an enigmatic array of stone blocks. It "looks" like a wall; a human-built wall. It also "looks" old; perhaps 2,000 years old according to some. Who built it? In 1996, passions were running high in New Zealand, where three hypotheses were being advanced:

(1) The wall was built some 2,000 years ago by the first settlers of New Zealand, the Waitahas, who were subsequently nearly exterminated by the Maoris, who arrived only 800 years ago. There are political problems with this theory, for the Maoris insist they are the original New Zealanders and therefore are due compensation for lands expropriated by later Europeans.

(2) The wall is merely what's left of a sawmill built only 50 or so years ago.

(3) The wall is simply a natural rock formation that has happened to split neatly into rectangular blocks---like those slabs of beach rock that comprise the controversial Bimini "road" in the Bahamas.

Before speculating further, let's take a look at the wall itself.

B. Brailsford, of Christchurch, has been the chief investigator of the Kaimanawa wall, aided by American D.H. Childress, and others. The stones that make up the wall are 4-ton blocks of ignimbrite, a soft volcanic rock that could have been easily dressed with stone tools. The wall is topped by a red beech tree 2.9 meters in circumference and over a meter of accumulated humus. According to Brailsford, who was interviewed by The Listener:

There was no doubt that the stones had been cut. The four visible stones in the front wall were a uniform 1.6 metres tall, and 1 metre wide. In one place he could insert his arm into a root-ridden cavity and feel the back face---and the front face of the next tier. The faces were uncannily smooth, with no saw or adze marks. The interstices where the blocks join were knife-blade thin.

Further up the hill, the tops of other stones protruded, suggesting a more extensive structure was buried in the hill. (R7)

Supporting the contention that a pre-Maori people lived in New Zealand are the bones of the kiore, a type of rat alien to New Zealand, which was likely introduced by the first settlers. Some kiore bones have been dated as 2,000 years old---centuries before the first Maoris arrived.



The controversial Kaimanawa Wall, New Zealand, is characterized by stone blocks that appear to be artificial. The investigators are B. Brailsford (above) and D.H. Childress (below). (T. Brown)

Needless to say, New Zealand archeologists and anthropologists are not anxious to drastically revise their fundamental paradigm assigning the discovery and colonization of New Zealand to the Maoris. But Brailsford and Childress are even more iconoclastic: They suggest links to a pre-Polynesian culture; a culture that left similar megalithic structures elsewhere in the Pacific and along the west coast of South America!

The publicity accorded the Kaimanawa Wall by New Zealand newspapers (R7, R8) stimulated the scientific community to take a close look at the controversial "wall." The New Zealand Department of Conservation asked geologist P. Wood for his assessment.

He identified the rock as the 330,000-year-old Rangitaiki Ignimbrite. Following the line of blocks both hori-

zontally and vertically, and photographing them in series, he revealed a system of joints and fractures natural to the cooling process in ignimbrite sheets. What Brailsford had taken to be manmade cut, stacked blocks were no more than a type of natural rock formation. (R9)

P. Andrews, the author of this article likened the regular jointing of the "wall" to neatly hexagonal prisms seen in many basalt flows. He supplied two photographs of the "wall" in the article. One was like the accompanying photo and showed regular jointing; the second, from the same outcrop, displayed angled fractures and joints that certainly do not look like the work of humans.

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