the Mineralogical Record

Volume Twenty-two, Number Five
September–October 1991
$10


KIRWAN'S
MINERALOGY
1
KIRWAN'S
MINERALOGY
2

The Mineralogical Record Inc. is a non-profit organization
The Mineralogical Record magazine is published by the Mineralogical Record Inc., 7413 N. Mowry Place Tucson, Arizona 85741

Editing, advertising
Wendell E. Wilson
4631 Paseo Tubutama
Tucson, AZ 85715
602-299-5274
FAX: 602-299-5702

Circulation Manager
Mary Lynn Michela
(Subscriptions, back issues, reprints, book sales, shows)
P.O. Box 35565
Tucson, Arizona 85740
602-297-6709

Subscriptions
- **Individuals (U.S.):** $33 for one year; $63 for two years. (First-class mailing available; write to circulation manager for rates.)
- **Individuals (outside the U.S.):** $36 for one year, $69 for two years. (Airmail mailing available; write to circulation manager for rates.)
- **Libraries, Companies and institutions (worldwide):** $55 for one year. (First-class or Airmail mailing available; write to circulation manager for rates.)

Special second class postage
(USPS-887-700)
Paid at Tucson, Arizona, and additional offices. POSTMASTER: send address changes to:
7413 N. Mowry Place
Tucson, AZ 85741

ISSN 0026-4628

*Continued on p. 407

the Mineralogical Record

September–October 1991
Volume Twenty-two, Number Five

Articles

Columns

COVER: BERYL (emerald) crystal, 4.4 cm, found in 1991 in the pegmatite deposit at Jos, Nigeria. William Larson collection; photo by Harold and Erica Van Pelt.

Guest Editorial:

Suggestions for More Accurate Locality Notations

The vast majority of specimens field-collected in the eastern* United States by mineral collectors are accompanied by very little *useful* geologic or spatial-relationship data on their labels. Nevertheless, mineral specimen labeling has come a long way from the days when only a nearby town would be listed, and many collectors do attempt to be as responsible as possible in carefully noting whatever information they can observe. However, a more systematic approach is needed. The recurrent problem is a lack of reference points which can be used to establish a precise location within a quarry or general field collecting area. The collector sometimes does his best, but the points chosen are too often ephemeral (the quarry wall which changes tomorrow or next week), or subject to whimsical change (signs can be removed), or of short life (the tree or bush that dies and is removed). It's been over 25 years since I tried to find a pegmatite a "half-mile" from the Palermo mine, in New Hampshire. It was originally identified (in great detail), based on the species and *height*(!) of some surrounding trees. The experience was never forgotten. I met a nice black bear that day, and learned how not to describe the site of a mineral occurrence.

In large part, we manage as best we can. Mineral societies have an informal institutional memory, and the changes at the locality are verbally passed from one generation to the next. The problem of reference points is exacerbated, however, when the locality is subject to much change, such as by floods, fire and vegetation growth in the wild, or the removal or partial change of some reference points (mine dumps, for example), or all simple reference points (as with marble and granite quarries). For some mineral collecting localities, these problems might be nearly insurmountable. For others, however, there might be solutions available to concerned collectors and mineral societies.

I suggest that collectors obtain and use a grid reference map for significant localities. For many quarries and collecting localities, these have already been outlined by surveyors as an adjunct to property purchases and the attendant legal requirements. Such surveys may be a matter of public record and may be found in the county zoning offices. The accurate property boundaries provide good starting points. Quarry or property owners, if advised of your intentions and convinced that responsible collectors are involved, might be willing to share their own maps, plats (surveyor's detailed maps) or records. If none exists, the local mineralogical society might consider hiring a surveyor to prepare one, *in concert and by agreement with* the property owner. Be sure to have iron pipe used for the property markers (called a "stake-out"); the magnetic pipes will be useful in future years when magnets can be used to find them amid the abundant eastern vegetative overgrowth (and anomalous "findings" may reveal additional mineral deposits!). Courteous collectors with purely altruistic motives, will, of course, provide the owner with a free survey, free stake-out and free copies of the new plat; these courtesies might provide useful openings for other dialogue as well.

Having acquired the plat of the collecting locality, it is necessary to impose a grid on it for accurate siting of mineral occurrences and special topographical features. It may already have a grid, especially if it's a mining property. If so, *always use the one that already exists*; in that way, all local collectors, geologists and owners will be using the same standard. If a grid is not present, one is needed and can perhaps be supplied by the surveyor. Collectors intending to grid a locality themselves should seek counsel from experienced persons; field geologists and archeologists use these techniques all the time, and can provide advice and references. Perhaps regional groups (the local mineral museum, FM chapter, etc.) could start a reference collection of such locality grid maps. Scientists naturally think in metric units, but it's probably unwise in this instance. Small quarry owners and mine operators are, for the most part, unfamiliar with the metric system, and it's important to use units of measure which are comfortable for those whose permission and assistance is needed.

A number of factors are worthy of special consideration. Keep firmly in mind that occurrences exist in three dimensions; some vertical benchmarks will be needed, as well as some consultation with persons who frequently do mapping. Local geologists may be of much assistance and, with some incentive, might be interested in mapping the geology of the locality on the newly prepared grid. Such efforts can be symbiotic. Obtain the U.S.G.S. topographic map for the occurrence; elevation benchmarks can be found on it, and the vertical position of mineral occurrences can be established with some accuracy. Because they are inexpensive, order several; the quarry owner might appreciate the thoughtful gift of a map. Seek out local university geology departments to ascertain if the locality has already been geologically mapped, and to ascertain the status of geologic information on the deposit. There may be unpublished theses in the libraries of these local colleges and universities which can be very useful.

Why bother? Because this will help you to obtain a spatial documentation for all samples. New trends in mineralization, hints of yet-unfound but close-by deposits, and unsought surprises may become evident. The collector will enjoy his specimens more, and will be able to have more pride in his temporary curation of them.

Most importantly, it can also aid all who follow, and those who need assistance, or who eventually obtain the specimens. The identity of a species can be redetermined if lost, but the specific locality can never be. In addition, such careful notations will add a new and more professional dimension to field collecting; it will never be the same again!

Pete J. Dunn
Department of Mineral Sciences
Smithsonian Institution
Washington, D.C. 20560

*To a rough approximation, latitude and longitude can be used. For western localities, collectors can use Range, Township and subdivided section to indicate localities. Except for open-pit mines, many western localities are underground so surface maps are of limited utility anyway; mineral collectors must use detailed maps of underground workings.

notes from the EDITOR

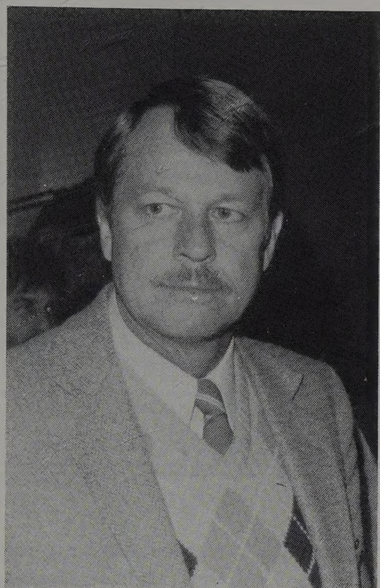


Photo by K. England 1985

CURATORIAL NOTICES

John Sampson White, Jr., 57, retired from his position as Curator in Charge of the gem and mineral collection at the U.S. National Museum of Natural History (Smithsonian Institution) in July of this year.

John White was born in 1933 in Monessen, Pennsylvania, and raised in Towson, Maryland. He developed an interest in minerals at age 14, and went on to earn a B.S. degree in geology from Franklin and Marshall College (1956) and an M.S. degree in mineralogy from the University of Arizona (1966). He worked as a high school science teacher in Maryland and as a geologist for American Smelting and Refining Company (ASARCO) in Tucson before being hired as a museum technician under curator Paul Desautels at the Smithsonian in 1963. During the following years he was promoted to Associate Curator, then Curator, and finally to Curator in Charge following the departure of Desautels in 1982. He has traveled widely on behalf of the museum, on collecting expeditions and to major gem and mineral shows where he has often lectured and displayed magnificent specimens from the Smithsonian collection.

John White has authored or co-authored over 60 articles (including seven new mineral descriptions), as well as countless essays and columns in the *Mineralogical Record,* and two books, *Color Underground* (1971), and *The Smithsonian Treasury: Minerals and Gems* (1991). In addition, he collaborated on the videotapes *Minerals and Rocks* (1979) and *Gemstones of America* (1990).

Among his best known achievements is the founding of the *Mineralogical Record* in 1970, and his years as editor (1970–1976) and publisher (1970–1983).

In 1978 he was honored by the naming of the new mineral species, *whiteite* (Moore, P. B., and Ito, J. I., *Mineralogical Magazine,* **42**, 309–323). The authors wrote:

> His liaison between [the] amateur and professional [mineralogical] communities has provided many examples of fine specimens for research that otherwise would have passed unnoticed, and he has played a major role in the renaissance of mineralogy as an amateur as well as professional pursuit.

Since that time the original species has been elevated to group status, now including three whiteite-derived species—whiteite-(CaFeMg), whiteite-(CaMnMg) and whiteite-(MnFeMg)—as well as keckite, rittmanite, jahnsite-(CaMnFe) and jahnsite-(CaMnMg).

He is a co-founder of the Baltimore Mineral Society, a Fellow of the American Mineralogical Society, and a member of the Mineralogical Association of Canada and the Mineral Museums Advisory Council.

Following his retirement, John White will be joining with What on Earth to open a new store in the Baltimore area this fall or in the spring. His successor at the Smithsonian has not yet been named.

Richard A. Souza, 39, departs his position as collection manager of the Section of Minerals at the Carnegie Museum of Natural History in Pittsburgh as of May this year. He leaves to take a position with the What on Earth company, as manager of their Galleria store in Pittsburgh.

Souza, a paleontologist by training (M.S. in geology from the University of Pittsburgh, 1989), was hired by the Carnegie in 1982 to oversee the mineral section's exhibit and education programs and to manage the museum's historic 23,000-specimen mineral collection.

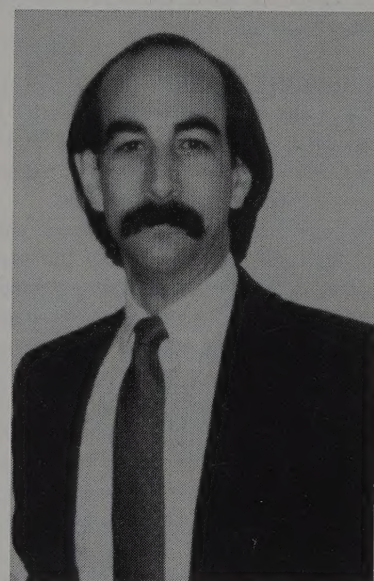
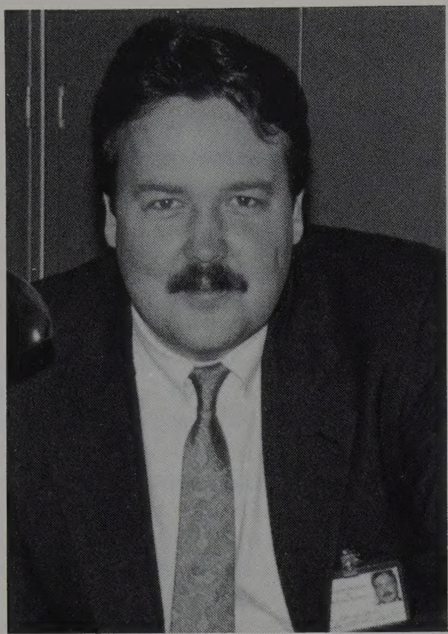


Photo by C. Wilson 1990

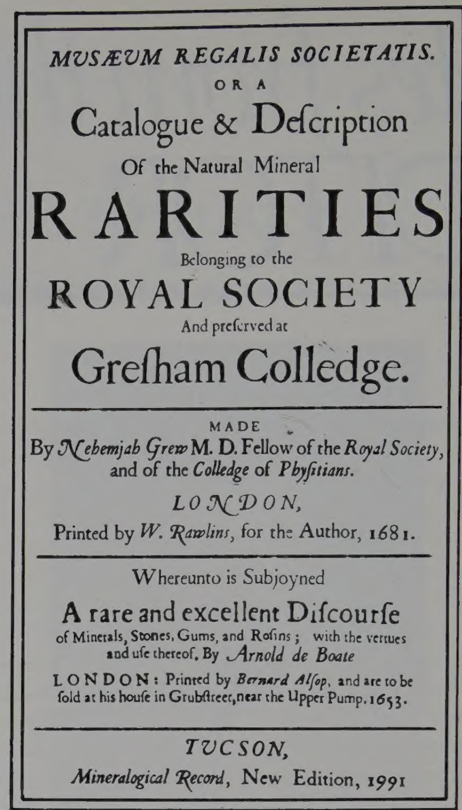
Since that time he has been involved in a major expansion of the mineral collection, through the financial assistance of the Hillman Foundation, and has traveled regularly to major mineral shows, exhibiting superb specimens from the Carnegie collection. He was instrumental in establishing a million-dollar endowment fund for the Section of Minerals, as well as the annual Carnegie Mineralogical Award, and in the preparation of the mineral section's lavish catalog, published as a supplement to vol. 21, no. 5 (1990) of the *Mineralogical Record*. His successor has not yet been named.

Joel A. Bartsch, 29, has been hired as curator of minerals at the Houston Museum of Natural Science (home of the famous Perkins Sams collection). He leaves his former position as curator of gems and minerals at the California State Mining and Mineral Museum in Mariposa, and before that was curator at the Lyman House Memorial Museum in Hilo, Hawaii.

Bartsch studied mining engineering at the Colorado School of Mines (1980–1982) and earned a B.A. degree in Liberal Studies at Concordia College, Austin, Texas, in 1986. He has been a mineral collector since the age of nine, and won the American Federation's National



Junior Trophy for his thumbnail specimens when he was 14. In recent years he has been a regular lecturer at the MSSC shows in California, as well as the Detroit Show and others.



MVSÆVM REGALIS SOCIETATIS.

OR A

Catalogue & Deſcription

Of the Natural Mineral

RARITIES

Belonging to the

ROYAL SOCIETY

And preſerved at

Greſham Colledge.

MADE

By *Nehemjah Grew* M. D. Fellow of the *Royal Society*, and of the *Colledge* of *Phyſitians*.

LONDON,

Printed by *W. Rawlins*, for the Author, 1681.

Whereunto is Subjoyned

A rare and excellent Diſcourſe

of Minerals, Stones, Gums, and Roſins; with the vertues and uſe thereof, By *Arnold de Boate*

LONDON: Printed by *Bernard Alſop*, and are to be ſold at his houſe in Grubſtreet, near the Upper Pump. 1653.

TVCSON,

Mineralogical Record, New Edition, 1991

ANTIQUARIAN REPRINT SERIES

Publication no. 3 in our Antiquarian Reprint Series is now ready: this time the chosen work is Nehemiah Grew's 1681 catalog of minerals in the collection of London's Royal Society. (For background on this early collection catalog, see the following article.)

The original 400-page catalog also covers plants, animals, and all sorts of miscellaneous curiosities; only about 100 pages applies to minerals, and so that is the portion we have reprinted. The rest, including an appended work on "the comparative anatomy of stomachs and guts," is not pertinent to a mineralogical library so we've simply omitted it. Because three-fourths of the original work is non-mineralogical, many collectors have been reluctant to pay the substantial price which an original commands; this new edition will, we hope, make the mineralogical portion more accessible. Two large plates of mineral specimens (uncolored) are included. And a new 10-page preface has been prepared to augment the new edition, thereby ranking it as more than a mere reprint.

Another early British work which has similarities is Hugh Plat's *The Jewel House of Art and Nature,* originally published in 1594 and reprinted in 1653. Actually it has little to do with mineralogy, dealing mostly with helpful hints on animal husbandry, winemaking, recipes, and so on. But the 1653 edition contains an appended second essay (like the appended treatise on stomachs and guts in Grew) which, in this case, is the part of mineralogical interest. It is called "A rare and excellent discourse of minerals, stones, gums and rosins, with vertues and use thereof," by Arnold de Boate (1600?–1654?).

It seemed natural, therefore, that we should combine the mineralogical chapter of the Grew catalog with the appended mineralogical essay in Plat (i.e., by de Boate) in our reprint edition, thereby having the best of both books and none of the dross. And so we have, thus eliminating the need to acquire expensive originals of not one but two rare seventeenth-century mineralogical works. I might add that, unlike other books in our series, these two works are in English, and can therefore be easily read and enjoyed.

The combined reprint of Grew and de Boate, plus the new preface, is nicely bound in quarter calf with gold stamping. The edition is *strictly limited to 50 copies.* Persons making a donation of $100 to the Record Library will receive one of these books in exchange, while they last. This is, I believe, a reasonable price considering our production cost of about $50 per copy, and considering that this series is produced as a fund-raiser for us as well as a literature-reclamation project. We appreciate very much the donations we are receiving, especially since we no longer have a fund-raising auction at the Tucson Show. So if you feel the *Mineralogical Record* merits your support, and you'd also enjoy receiving a rare and interesting piece of antiquarian reading, send your donation to the editor (4631 Paseo Tubutama, Tucson, Arizona 85715), and call first to reserve your copy (602-299-5274).

CALL FOR PAPERS

The thirteenth Mineralogical Symposium sponsored jointly by Friends of Mineralogy, the Tucson Gem and Mineral Society, and the Mineralogical Society of America will be held in conjunction with the 38th Tucson Gem and Mineral Show *Saturday, February 15, 1992.* Pyromorphite is the show's theme mineral. Papers on the descriptive mineralogy, paragenesis, classic and new occurrences of pyromorphite or secondary lead minerals are invited. Papers on other subjects—new species, new occurrences, etc.—are also welcome. An audience of knowledgeable amateurs as well as professional mineralogists and geologists is expected.

If you wish to present a paper, please write or call Dr. Carl A. Francis, Chairman (Harvard Mineralogical Museum, 24 Oxford Street, Cambridge, MA 02138) with your topic, a few sentences describing the paper and your address and telephone number. Presentations will be 15 minutes, followed by a brief question period. Following acceptance of topics authors are required to submit a 200–300 word abstract by September 15, 1991, which will be published in the January-February or March-April 1992 issue of the *Mineralogical Record.*

FAX LINE NOW OPEN

The Mineralogical Record editorial office now has a 24-hour FAX line available. Communications regarding articles, advertising and other editorial matters can be transmitted directly to the editor's desk by calling **602-299-5702.**

Nehemjah Grew's
MVSÆVM REGALIS SOCIETATIS
1681

Wendell E. Wilson
Mineralogical Record
4631 Paseo Tubutama
Tucson, Arizona 85715

Within just two decades of its founding in 1662, London's Royal Society of experimental scientists had accumulated a sizeable collection of minerals and other natural history curiosa. Nehemiah Grew, a physician and botanist, prepared an illustrated catalog of this early museum.

Changes in the intellectual attitudes of educated men in southern and western Europe accumulated gradually during the 15th and 16th centuries. Although the old concepts of scholarship based on Aristotelian philosophy and ecclesiastical authority were still widely held in the early 17th century, many learned men were beginning to feel that the long-accepted explanations of natural phenomena were inadequate, and that more rational guidance was needed.

Francis Bacon (1561–1626) was among the first to provide such guidance. In his *New Atlantis,* written between 1614 and 1618, he devised a plan for organizing a scientific research group. The staff of "Fellows" would include data gatherers in the field and data analyzers back at headquarters. In his *Novum Organum* (1620) he detailed his new approach to the systematic analysis of knowledge, intended to replace the deductive logic of Aristotle with the inductive scientific method. Bacon's ideas, ignored in the universities, spread through correspondence and by word of mouth, setting the stage for the emergence of "revolutionary" scientific organizations (Dampier, 1942).

THE ROYAL SOCIETY

During the 1640's, Britain was enmeshed in civil war which saw the beheading of the King and the dissolution of the monarchy under Oliver Cromwell. Despite the troubled times, a small group of scholars in London began meeting informally to discuss their shared interest in the new experimental science, a field taken for granted today but still fresh and avant garde in the 17th century (Lyons, 1968). In his memoirs the physician John Wallis (1616–1698) reminisced about those early beginnings:

> About the year 1645 . . . I had the opportunity of being acquainted with diverse worthy persons inquisitive into natural philosophy . . . particularly of what hath been called the *New Philosophy* or *Experimental Philosophy.* We did, by agreements, meet weekly in London, [with] a contribution for the charge of experiments, and with certain rules agreed upon amongst us to treat and discourse on such affairs. [Among us] were Dr. John Wilkins (Chaplain to the Prince), Dr. Jonathan Goddard, Dr. George Ent, Dr. Glisson, Dr. Merrett (Drs. in Physick), Mr. Samuel Foster (Professor of Astronomy at Gresham College), Mr. Theodore Haak (a German . . . then resident in London, who, I think, hosted the first occasion and first suggested those meetings) and many others.
>
> These meetings we held sometimes at Dr. Goddard's lodgings in Wood Street [because] of his keeping an operator in his house for grinding lenses; sometimes at The Bull Head [tavern] in Cheapside; and at Gresham College at Mr. Foster's lecture and, after the lecture ended, repaired sometimes to Mr. Foster's lodgings, and sometimes to some other place not far distant.

> Our business was to discourse and consider *Philosophical Enquiries* (forbidding matters of theology and state affairs) such as Physick, Anatomy, Geometry, Astronomy, Navigation, Staticks, Magnetics, Chymicks, Mechanics, and Natural Experiments. Some of which were then but New Discoveries, and others not so generally known and embraced as now they are, with other things pertaining to what hath been called the New Philosophy which from the times of Galileo in Florence, and Sir Francis Bacon in England, hath been much cultivated in Italy, France, Germany, and other parts abroad, as well as with us in England.

Robert Boyle (1627–1691), a member of the group, referred to it as "our Invisible College." In a letter to a friend in Cambridge Boyle wrote: ". . . I will conclude their praises with the recital of their chiefest fault, which is very incident to almost all good things; and that is that there is not enough of them."

When the monarchy was restored in 1660, group meetings became more regular and colleagues from Oxford frequently traveled to London to attend. By the end of that year they had decided to constitute themselves as a Society of Philosophers, a decision which received the approval and support of King Charles II, and his official permission in 1662 to entitle themselves the "Royal Society." Following Bacon's suggestion in *New Atlantis,* members were called "Fellows."

***Figure 1.* Coat of arms of the Royal Society, London. Their motto, *Nullius in Verba,* means "Nothing accepted on the basis of mere words alone."**

The fledgling society immediately came under fire from the university establishment, the church, and even the theater. The Fellows were vehemently accused of atheism, disingenuity, of attempting to supplant the universities, and of generally promoting distrust of the established professions. The playwright Shadwell ridiculed the Society in his comedy *The Virtuoso* (1676), drawing grist from the Society's published *Transactions* (John Dryden described Shadwell as a dramatist who "never deviated into sense"). A writer in the *Spectator* (31 December 1711) wrote sarcastically that the Royal Society:

> . . . had a very good effect, as it turned many of the greatest geniuses of that age to the dispositions of natural knowledge, who, if they had engaged in politics with the same parts and application might have set their country in a flame.

But the Society was simultaneously becoming widely known in learned circles. John Hoskins, in a letter of 1661 to a friend at Oxford, wrote:

> I wonder [why] you tell mee nothing of the famous Academy of our philosophical scepticks that believe nothing not tryed.

Lyons (1968) in his history of the Royal Society, wrote:

> They distrusted lengthy discussions and elaborate theories, preferring to concentrate first on the improvement of apparatus and instruments, being convinced that the close study of the realities of nature was the only sound way of advancing philosophy.

Challenging people's beliefs in superstition and mysticism can be hazardous, even today, so it took particular courage on the part of the Fellows to debunk public opinions on such matters. Nevertheless, they did. Lyons (1968) writes:

> One of the most valuable tasks which the Society set before itself from its earliest days was that of testing any legends or ill-supported statements, which were reported to it, by a critical verification of the facts. This procedure did much to discredit the belief in witchcraft, demoniac possession and supernatural intervention in human affairs . . .

The Society's first headquarters were at Gresham College, a former mansion house bequeathed to the city in 1596 to serve as a venue for daily lectures on "Law, Physick, and Rhetorick." They were given "one publick room to meet in, another for a repository to keep their instruments, books, rarities, papers and whatever else belongs to them" (Weld, 1848). According to a pamphlet of 1707, the rooms devoted to the repository were approximately 90 feet long and 12 or 12½ feet wide. Unfortunately, as the value of the land increased, the trustees of the college leased out more and more of the grounds for commercial use, and eventually in 1710 the Society moved out of the institution (Weld, 1848).

As it happened, the Royal Society might well have been formed in Connecticut instead of London. In response to religious discrimination, many Protestants had fled England for the colonies in America; and among these were the Winthrop family, staunch supporters of Francis Bacon and the New Philosophy. The elder, John Winthrop (1588–1649), emigrated to New England with his family in 1630, and his son, John Winthrop Jr. (1606–1676), built the first known collection of minerals in New England (Frondel, 1970). His great grandson, also named John Winthrop (1681–1747), similarly built a large mineral collection, some of which he donated to the Royal Society in 1734. When Winthrop Jr. returned to England in 1641 to obtain men and funds for the erection of an ironworks in Connecticut, he met with the philosophers in London and invited them to emigrate to America where they could live and work

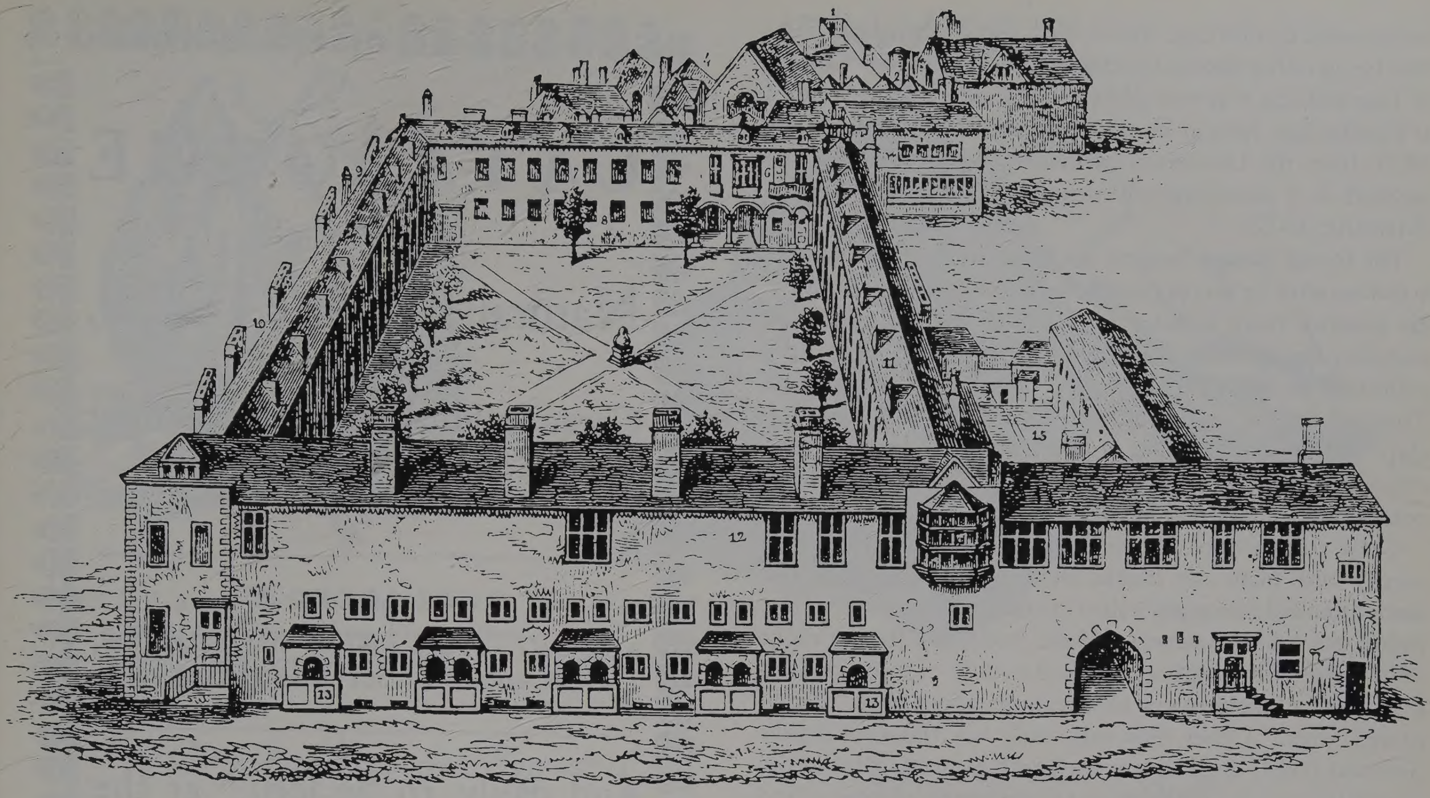


Figure 2. **Gresham College, London, where the Royal Society and its museum or "repository" were housed from 1662–1710 (Huggins, 1906).**

free from persecution. When Dr. Cromwell Mortimer, the Secretary of the Society, later wrote in 1741 to Winthrop (Jr.)'s grandson he observed:

> In concert with these and other learned friends, he [John Winthrop Jr.] was one of those who first formed the Plan of the Royal Society, and, had not the Civil War happily ended [when it did], Mr. Boyle and Mr. Wilkins with several other learned men would have left England and, out of esteem for the most excellent and valuable Governor, John Winthrop the younger, would have retired to his new-born colony and there established that Society for promoting Natural Knowledge.

NEHEMIAH GREW

In less than 20 years since the Royal Society received its charter from the King, the Society's museum or "repository" had grown so dramatically that it needed to be organized into a published catalog for reference. The job of producing this catalog was given in 1678 to Nehemiah Grew (1641–1711), M.D., Fellow of the Royal Society, and of the London College of Physicians.

Nehemiah Grew was born in Mancetter, Warwickshire, England, the son of a clergyman and schoolmaster (Hutton *et al.*, 1809). Following his early school years at Coventry

Figure 3. **Nehemiah Grew (1641–1711). (From *Cosmologia Sacra,* 1701; courtesy of the University of Illinois at Urbana-Champaign, Rare Book and Special Collections Library.)**

he attended Cambridge and in 1661 was awarded his B.A. Not being of the necessary religious denomination (Church of England, he was not allowed to pursue further studies at Cambridge; instead he traveled abroad and received his M.D. from the University of Leiden. Returning home he worked as a practicing physician for the rest of his life (Metcalfe, 1972).

The Royal Society became the focal point of his research activities after he was persuaded by several Fellows to move his practice from Coventry to London and study plant anatomy on the side. In fact, the Fellows had taken up a collection and raised £50 to induce him to make the move. Through the Society, Grew developed a working relationship with Robert Hooke (1635–1703), a pioneer in microscopy, and was allowed to use Hooke's newly developed compound microscope in his studies.

Grew's researches and publications were involved primarily with plant and animal anatomy; he originated and named the field of study called comparative anatomy. The publication of his *Anatomy of Plants* (1682) was the highlight of his career. But he also published a study of snow crystals in which he made many observations about their "determined form." Other than this, only his *Musaeum Regalis Societatis* (1681) dealt in any way with minerals. But in the year following its publication he was made curator of the museum, under the title *Praefectus Musei Regalis Societatis.* As curator of the collection, his duties were:

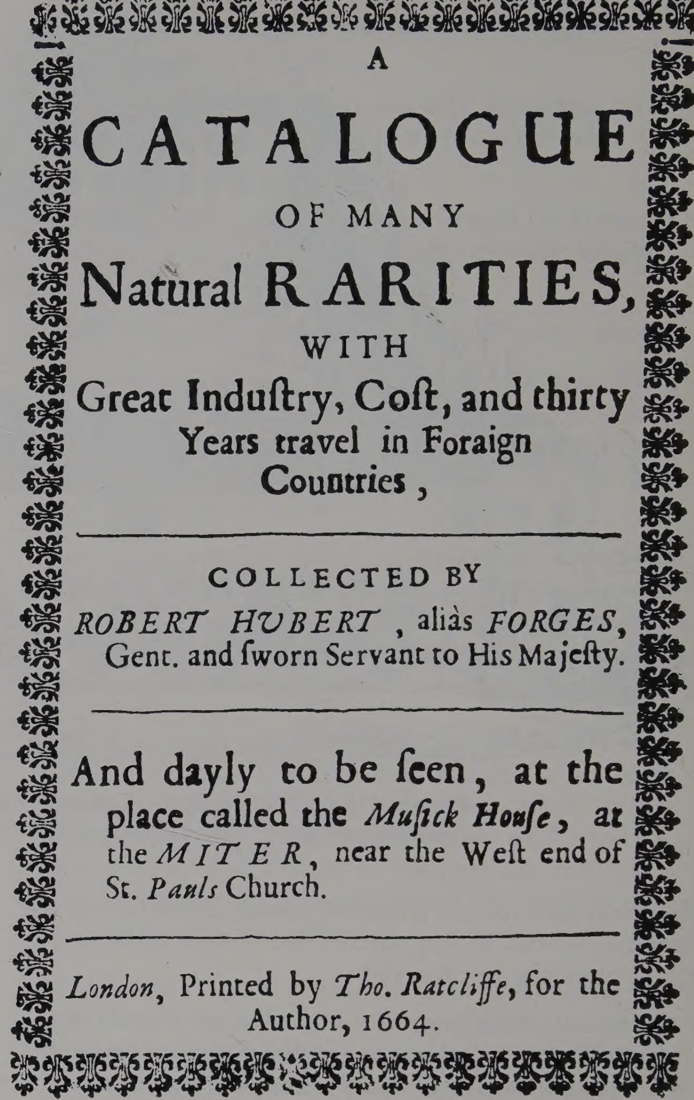
> . . . To make a short Catalogue of the Raritys, with a method for the ready finding them out: as also a catalogue of Benefactors, and the particulars given by them. That he enter into a book all such things as shall be given hereafter, with the name of the donor, and from time to time observe what may be necessary for the preservation and augmentation of the said Repository, and make a report thereof to the Council. And that he bring in to the usual Meetings of the Society such descriptions of natural things there contained, as have not yet been published in his book. (Weld, 1848)

These duties are not all that dissimilar to the duties of curators today.

THE MUSEUM COLLECTION

Because of the active and inquisitive nature of the Society, specimens of all sorts began to accumulate almost immediately upon its founding. Robert Hooke had been appointed the first curator in 1662. Although his principal duty was simply to provide for experiments at the weekly meetings, he was also enthusiastic about eventually assembling a "full and complete collection of all varieties of Natural bodies" (Edwards, 1931).

Daniel Colwall, Treasurer of the Society from 1665 to 1679, was a benefactor of Christ's Hospital in London. He also had been an advocate of the repository, and in 1668 he formally inaugurated the Society's museum, with a cash contribution of £100 for the purchase of the rarities collection of Robert Hubert. Hubert had collected "many natural rarities, with great industry, cost, and thirty years' travel in foreign countries," and had exhibited them to the public at a place called "Musick-House, at the Miter, near the West End of St. Paul's Church." He had been desirous of selling the collection to "a noble party," and had published a catalog in 1664. Why he was willing to accept such a bargain price from the Society is unknown, but the transaction was completed, and the Society took possession of all or most of his collection (Altick, 1978; Hunter, 1985).


A

CATALOGUE

OF MANY

Natural RARITIES,

WITH

Great Induſtry, Coſt, and thirty Years travel in Foraign Countries,

COLLECTED BY

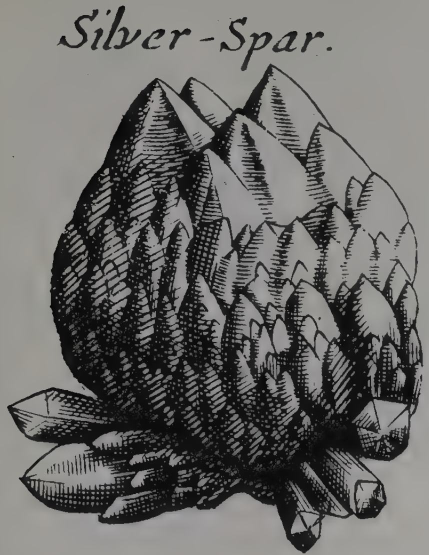
ROBERT HUBERT, aliàs *FORGES*, Gent. and ſworn Servant to His Majeſty.

And dayly to be ſeen, at the place called the *Muſick Houſe*, at the *MITER*, near the Weſt end of St. *Pauls* Church.

London, Printed by *Tho. Ratcliffe*, for the Author, 1664.

***Figure 4.* Title page of Robert Hubert's collection catalog (Beinecke Library, Yale).**

Specimens had been acquired by the Society at a modest rate previous to the acquisition of Hubert's collection, as gifts from Fellows, but once the museum was formally established the collection began to grow more rapidly. There was then in England no other public institution for the examination and preservation of natural history specimens. Potential donations from non-Fellows, however, were wisely subjected to a screening process "for fear of lodging unknownly buffooneries in these scoffing times." Nevertheless, one Fellow (Sprat, 1667) wrote: "We find many noble rarities to be every day given in." In addition, the Society at times employed field collectors to travel about and acquire natural history specimens. Other specimens were solicited by letter from the Society's many correspondents, and still others were contributed by Fellows of



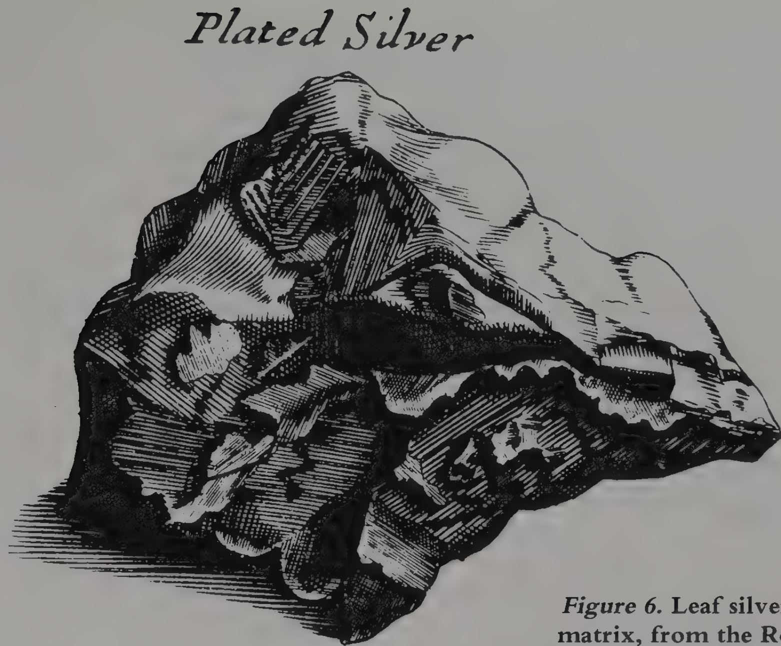


Figure 5. **A gray "silver-ore spare," possibly pyrargyrite (?), 3.8 cm, from the Royal Society museum (Grew, 1681).**

Figure 6. **Leaf silver on matrix, from the Royal Society museum (Grew, 1681).**

Figure 7. **Cerussite or anglesite (?), "of the bigness of a midling apple," from the Royal Society museum (Grew, 1681).**

Figure 8. **Pyrite crystal group from the Royal Society museum (Grew, 1681). "Mundick" is an old Cornish term for pyrites.**

the Society living abroad, including the Winthrops of New England (who sent botanical, zoological and mineralogical collections). By 1681 the collection numbered several thousand specimens, mostly zoological, mineralogical and anthropological, which had been received from 83 donors including Robert Boyle and Samuel Pepys. The "mineral" portion of the collection included approximately 250 fossils and 450 mineral specimens.

THE CATALOG

Grew entitled the 400-page catalog *Musaeum Regalis Societatis*[1] [Latin; "Museum of the Royal Society"]. As was typical of the times, he also gave it a longer and more descriptive subtitle in English: *A Catalogue & Description of the Natural and Artificial Rarities Belonging to the Royal Society and Preserved at Gresham Colledge.* At the same time, he took the opportunity to append a 42-page anatomical treatise of his own, and so the title page also reads: *Whereunto is Subjoyned the Comparative Anatomy of Stomachs and Guts.*

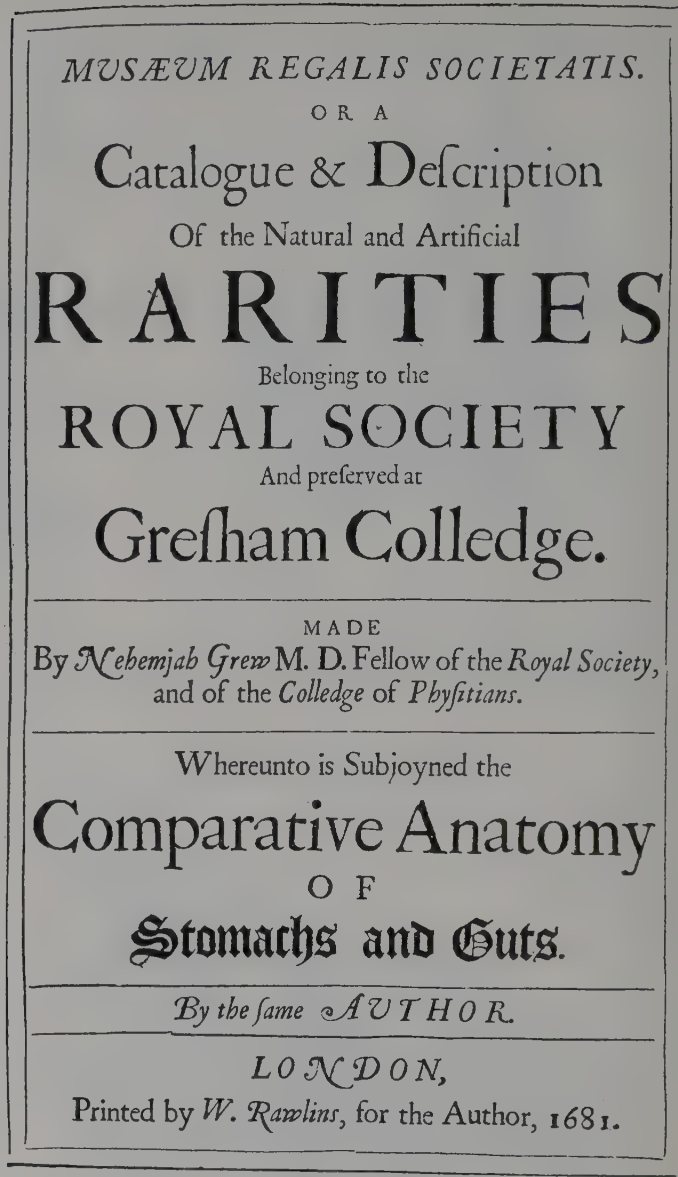
[1]*Musaeum Regalis Societatis. Or A Catalogue & Description of the Natural and Artificial Rarities Belonging to the Royal Society And Preserved at Gresham Colledge.* Made By Nehemjah Grew M.D. Fellow of the Royal Society, and of the Colledge of Physitians. Whereunto is Subjoyned the *Comparative Anatomy of Stomachs and*

A frontispiece engraving of Daniel Colwall (who, as mentioned, financially supported the establishment of the museum) and 31 engraved plates (also paid for by Colwall) comprise the illustrations. Of these, 18 show plant and animal specimens; included are various skulls and skeletons, tortoise shells, a rattlesnake's rattle, preserved fish, birds' nests, shells, starfish, insects, nuts, sponges, and a specimen identified as "skin on ye Buttock of a Rhinoceros." Plates 19 and 20 show fossils (and two small chiastolite sections); plates 21 and 22 show mineral specimens (including calcite, quartz, gypsum, silver, copper, hematite, and what appears to be cerussite or pyromorphite); and plates 23 through 31 show stomachs and intestines.

The text is divided into four major parts: (I) Animals, (II) Plants, (III) Minerals, and (IV) Artificial Matters. All sorts of highly curious objects are represented: An Egyptian mummy given by Prince Henry, Duke of Norfolk; a human fetus; the "Throttle Bone of a male Aqui-qui" monkey; tiger claws; a stuffed "Pigheaded Armadillo"; the "Horns of a Hare" ("So I find them inscribed," says the author, "Although it is probable that they are the hornes of a small kind of German Deer"); a 7¹/₂-foot crocodile (stuffed); the leg of a dodo; more than 30 lodestones; a porpoise skeleton; butterflies; coins; and a wide array of scientific and mechanical instruments and devices. There is an index of medicines, and a list of donors.

The catalog gives a good view of the extent of mineralogical knowledge in England three centuries ago. Grew made a crude effort at categorizing the fossil and mineral specimens, firstly into three broad divisions: (1) Stones (fossils, gems, "stones regular," and "stones irregular"), (2) Metals (gold, silver, copper, tin, lead, iron, antimony, mercury, etc.), and (3) "Mineral Principles" (salts, "sulphurs" and "earths"). In the first division, he attempted to distinguish gems by their colors, "stones regular" by the external shapes, and "stones irregular" by their hardness. These distinctions served him poorly and resulted in an irrational jumble, but inasmuch as the proper tools did not yet exist for structuring a rational crystallochemical classification, he can hardly be criticized for his approach.

He then gives a brief description of each specimen. Although he had available very little established descriptive terminology, he plunged ahead, coining his own terms where necessary and drawing frequently on the pre-existing reference works. Grew's citations show that he was well-versed in the early mineralogical literature, such as it was. He refers regularly to Agricola, and also to the then-little-known work of Johannes Kentmann (1565). Pliny, Tavernier, Gesner, de Boodt, de Laet, Robert Boyle and Athanasius Kircher are all cited. The collection catalogs published by Olearius, Aldrovandus, Worm, Imperato, Sepibus, Septalius, Calceolari and Besler were familiar to him, as well as the ancient works of Theophrastus and Dioscorides, and a wide range of medical works. Featuring prominently in his references are various accounts that had been published in the Society's *Philosophical Transactions*, many of them under his own editorship.


MVSÆVM REGALIS SOCIETATIS.
OR A
Catalogue & Deſcription
Of the Natural and Artificial
RARITIES
Belonging to the
ROYAL SOCIETY
And preſerved at
Greſham Colledge.

MADE
By *Nehemjah Grew* M. D. Fellow of the *Royal Society*, and of the *Colledge* of *Phyſitians*.

Whereunto is Subjoyned the
Comparative Anatomy
OF
Stomachs and Guts.

By the ſame AUTHOR.

LONDON,
Printed by *W. Rawlins*, for the Author, 1681.

Figure 9. Title page of Grew's *Musaeum Regalis Societatis* (1681). Mineralogical Record Library.

Despite Grew's thorough referencing, he was, like his Fellow colleagues in the Society, no slave to pre-existing authority, and he makes this irreverence clear in his Preface:

> I have made the Quotations, not to prove things well known to be true; as one (Aldrovandus) (and he too deservedly esteemed for his great Diligence and Curiosity) who very formally quotes Aristotle to prove

Guts. By the same Author. London, Printed by W. Rawlins, for the Author, 1681. Frontispiece, [12], 386 p., [4], [2], 43 p., 31 engraved (uncolored) plates. It was preceded by a prospectus in 1680.

Later editions (essentially identical except for an improved portrait of Colwall) were published by Thomas Malthus (1685, 1686), Samuel Holford (1686) and Hugh Newman (1694) (LeFanu, 1990). These are extremely scarce relative to the first edition of 1681. Most of the original handwritten manuscript is preserved in the British Museum.

The mineral section, augmented with new material, has been reprinted (1991) as *Musaeum Regalis Societatis. Or A Catalogue & Description of the Natural Mineral Rarities Belonging to the Royal Society and Preserved at Gresham Colledge.* Mineralogical Record, Tucson (edition limited to 50 copies).

a Sheep to be amongst the Bisulca; as if Aristotle must be brought to prove a Man hath ten Toes. But partly to be my warrant in matters less credible, [and] Partly to give the Authors that which is their due. Yet withall, To rectify his Mistakes where I found them. And to mind the Reader, Not to peruse the most Honest or Learned Author without some caution.

Many quaint and interesting entries may be found among the specimen descriptions, and many that give cause for lamenting the absence today of the original specimens. Here are a few selected excerpts to give some idea of the style and content [editorial annotations are added in square brackets]:

• The SMARAGDUS [=emerald or green quartz?], growing together with a pale *Amethyst* in one *Matrix*.

• A CLEAR and GREEN STONE, (a kind of *Smaragdus*) which, being heated red hot, shineth in the dark [=thermoluminescent] for a considerable time, about 1/16th of an hour. I tried the experiment myself also. And at the same time observ'd, That as it grew hot in the fire, its Green colour was changed into a Sky-blew; which it likewise retained so long as it continued to shine: but after that, recover'd its native green again.

• The MOTHER of the TURCOIS, as is supposed. Found in the Mines of *Herngrunt* [=Herrengrund] in *Hungary*. Here are two pieces. One of them, for the greatest part, blew; with some places black. The other, hath also a mixture of some parts that are Green.

• The RHOMBICK LEAD-SPAR [=anglesite]. Frequently found in the *Lead-Mines* in *Derbyshire*, and in others. 'Tis not of a Rhomboid, but a Rhombiek Figure, that is, a Diamond-square, or with the Angles unequal, the sides equal.

• BASTARD-AMIANTHUS. It grows in Veins in a Clay and Mundick [=pyrite] Load, between Beds of a Greenish Earth. The Threads are 1/3 or near 1/2 inch long, of a glossy black, and brittle. Given by Mr. Colepress, who observ's it amongst the *Cornish Mines*. The best is found in *Cyprus* and *India*. Of late, very good in some *Mines* in *Italy*. It was anciently spun into Sheets, in which the Bodies of Princes, laid on the *Funeral Pile*, were wrapped up, to keep them entire, when they were burnt, from the other ashes.

• Pure SILVER, naturally BRANCHED in the Mine. From a Silver-Mine in *Suecia* [=Sweden, probably Kongsberg]. Some of the Branches are blackish being tarnished; the rest of a clear silver colour. Some pieces of a white *Spar* [probably calcite], dissoluble with *Spirit of Nitre*, stick to them.

• A piece of CAPILLARY SILVER, or with smaller Branches, also from the Mine: whith a kind of white Rhombick *Spar* growing to it.

• Pure CAPILLARY COPPER from the *Mine* at *Herngrunt*. 'Tis very ponderous, the several *Styriae* or Capillary parts but short, of a redish Golden colour, growing together almost like those of the *Stone-Moss*.

• CRYSTALLINE LEAD, from the *Mine*. So I call it, not that it is clear [in other words, not that it is like "rock crystall" or quartz], but consisteth for the most part of *Hexagonal Points*. Of the bigness of a midling *Apple*.

• STYRIATED ANTIMONY [=stibnite], from the *Gold Mines* of *Chremnitz*. The *Styriae* in this are very fair.

• STYRIATED ANTIMONY, also Native, from *Cornwall*; called ROSCARROCKS. A Congeries [group] of strait, long, slender, and edged *Styriae* of a bright Steel-colour, almost like a cluster of small broken *Needles*.

• A rich piece of Native CINNABAR, from *Carinthia* [probably Idria, Yugoslavia]. It is entirely of a Scarlet colour.

• Native SULPHUR or BRIMSTONE, crystalliz'd, of a pale Golden colour, and semiperspicuous [=semi-transparent]. Sent from *Peru*. The like is described in *Calceolarius's Musaeum*, and by *Wormius*.

• A great *Crystalline* TALK-SPAR [=Calc-spar or calcite Iceland spar]. So I call it. Sent by Dr. *Erasmus Bartholine*, together with a large account of it, published in the *Phil. Transactions* (Num. 67). And by the Dr. himself (Experimenta Crystalli Islandici Dis-Diaclastici) in a distinct *Treatise*. 'Tis a foot long, 1/2 a foot broad, and two inches and 1/2 thick. Of a Rhomboid Figure . . . It breaketh also into parts of the same Figure . . . Colourless and transparent as the clearest *Chrystal* . . . The Objects seen through it, in certain positions, appear sometimes single, sometimes double, and sometimes sixfold. Which he [Bartholinus] ascribes to a *Refraction* peculiar to this *Stone*. And to me it seems probably that this various Refraction depends upon the structure of the *Stone*, as it is not one piece absolutely entire, but composed of several *Plates*, and those not all in a like manner but differently contiguous . . . It was dug out of a very high Mountain in *Island* [=Iceland], one whole side whereof consisteth of this *Spar*.

FINAL DISPOSITION

By 1775 the Society had for 65 years occupied two houses in Crane Court, given by Sir Isaac Newton in 1710 when Gresham College could no longer house the Society's Library, Museum and meeting facilities. Since 1710, however, the number of Fellows had grown by 250% and was still increasing; more spacious accommodations would soon be needed. In 1776 the government offered space in Somerset House, a new building then under construction. Unfortunately the amount of space was insufficient, but the temptation of having fine, new, rent-free quarters located in convenient proximity to other scientific societies was too much to resist, and the Society accepted.

In order to reduce the Society's space requirements to the footage available at Somerset House, it was decided in 1779 that the museum collections should be offered to the trustees of the British Museum.

The museum of the Royal Society had stood for many years as the largest and most important public natural history repository in London. But, since Sir Hans Sloane's massive collections had been established in 1753 as the foundation for the British Museum, that institution had far surpassed the Society. Thus it seemed most graceful and also practical that the Society should turn over its collections to be merged with the national repository. In June of 1781 the trustees officially accepted the Society's offer, thanking the Fellows for their "considerable donation." The houses at Crane Court were sold in 1782 for £1,000.

Today only some of the fossil specimens can be identified in the British Museum as having been received from the Royal Society (Smith, 1978). A thorough search by numerous curators and historians has, with one possible exception, failed to locate any of the Royal Society mineral specimens, and it is not even certain that many were transferred to the British Museum in 1781, considering the greatly deteriorated condition of the repository (Altick, 1978). The holotype specimen of columbite, reportedly

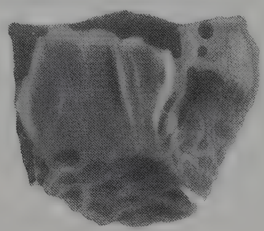


Figure 10. **The holotype specimen of columbite, as illustrated in James Sowerby's *Exotic Mineralogy* (1811), vol. 1, plate 6 (Wayne Leicht library).**

donated to the Society by John Winthrop when Sir Hans Sloane was President, has survived as part of Sloane's collection (Sweet, 1935). It is thus possible that other Royal Society specimens were acquired by Sloane, and have survived by that route. But in general the Royal Society's repository of minerals must be considered today as a lost collection.

ACKNOWLEDGMENTS

My thanks to Peter Embrey, Curtis Schuh, Si Frazier and Lawrence Conklin for reviewing the manuscript and providing helpful suggestions.

REFERENCES

ALTICK, R. D. (1978) *The Shows of London.* Belknap Press, London, p. 12–14.

DAMPIER, W. (1942) *A History of Science.* Cambridge, 514 p..

EDWARDS, W. N. (1931) *Guide to an Exhibition Illustrating the Early History of Palaeontology.* London, 68 p.

FRONDEL, C. (1970) Early New England mineral collections. *Mineralogical Record,* **1**, 6–10.

HUGGINS, W. (1906) *The Royal Society; or, Science in the State and in the Schools.* G. E. Stechert & Co., New York, 256 p.

HUNTER, M. (1985) The Royal Society's "Repository" and its background, *in* Impey and MacGregor, *The Origins of Museums,* Clarendon Press, Oxford, p. 153.

HUTTON, C., SHAW, G., and PEARSON, R. (editors) (1809) An account of some books (No. 78, p. 3037). *The Philosophical Transactions of the Royal Society of London from their commencement in 1665, to the year 1800.* Vol. 1—1665–1672, Baldwin, London, 660–661.

LeFANU, W. (1990) *Nehemiah Grew, M.D., F.R.S., a Study and Bibliography of his Writings.* Omnigraphics, Detroit.

LYONS, H. (1968) *The Royal Society 1660–1940.* Greenwood Press, New York, 354 p.

METCALFE, C. R. (1972) Nehemiah Grew, *in* C. C. Gillespie (Ed.), *Dictionary of Scientific Biography,* Scribner's Sons, New York, **5**, 534–536.

MURRAY, D. (1904) *Museums, their History and Their Use.* Three vols., James MacLehose and Sons, Glasgow, 339 + 363 + 341 p.

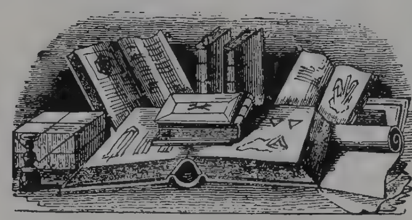
SMITH, C. W. (1978) Early mineralogy in Great Britain and Ireland. *Bulletin of the British Museum (Natural History), Historical Series,* **6**, no. 3, p. 50.

SPRAT, T. (1667) *History of the Royal Society.* London, 4 vols.

SWEET, J. M. (1935) Sir Hans Sloane: life and mineral collection. *Natural History Magazine,* London, **35**, 115–116.

WELD, C. R. (1848) *A History of the Royal Society.* John Parker, London, 2 vols., 527 p. + 611 p.

BOOKSELLERS



Michael Dennis Cohan
BOOKSELLER
Out-of-Print & Rare Books
Specializing in Geology, Mining & Related Subjects

502 W. Alder St. • Missoula, MT 59802 • (406) 721-7379

Books
Old & Rare
Bought & Sold

Catalog #1:
Mining, mineralogy, gemology & jewelry
Catalog # 2:
Early science, technology & scientific instruments

Catalog #3:
Scientific Instruments - 18th and 19th century mathematical, philosophical and optical instruments of all kinds - including microscopes, telescopes, globes and orreries, dials, compasses, surveying, navigating, drawing, calculating and laboratory apparatus

Send $2.00 each for: Catalogs #1 & #2
Send $5.00 for: Catalog #3

The Gemmary
P. O. Box 816
Redondo Beach, Ca 90277
(213)372-5969

Scientific Instruments

OLD & RARE BOOKS
Mineralogy • Gemology
Geology • Mining
Bought & Sold
Latest Catalog $2

Frederick Blake
• Bookseller •
12 Hempstead Ave., Rockville Centre, NY 11570 • Tel: (516) 678-4810

OUT-OF-PRINT
BOOKS
PERI LITHON BOOKS
Send $2.00
for latest catalog listing 100's on minerals, mining, geology, fossils, gems.

P.O. Box 9996
San Diego, CA 92169-0340
Tel.: 619-488-6904

BOOKS
USED, RARE AND OUT-OF-PRINT BOOKS
Prospecting Localities, Minerals, Gems, Fossils, Geology, Mining, Archeology, Meteorites. Send $2 for catalogue of several hundred items.

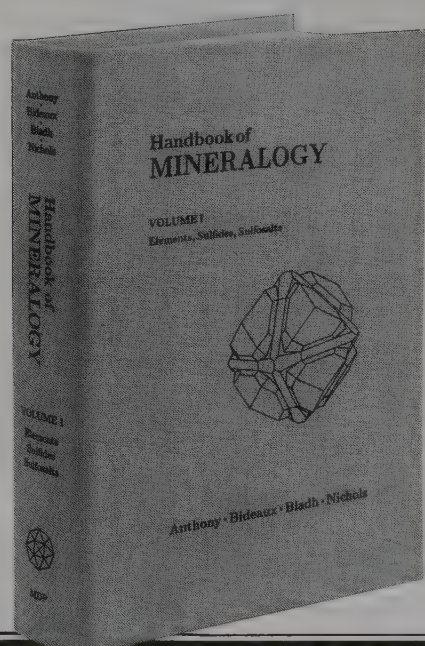
The Hannum Company
P.O. Box 1505
Ardmore, OK 73402
(405) 223-4826

Handbook of MINERALOGY

Anthony • Bideaux • Bladh • Nichols

NOW AVAILABLE: VOLUME I—Elements, Sulfides, Sulfosalts
Comprehensive descriptions of 588 mineral species.
Complete through December 1988.
588 pages + vii, 7 x 10 inches, Hardcover
ISBN 0-9622097-0-8
$82.50 + $5 shipping & handling (surface mail)
Prepaid orders only. Credit cards not accepted.

MINERAL DATA PUBLISHING
P.O. Box 37072, Tucson, Arizona 85740 USA
Richard A. Bideaux, General Partner (602) 297-4862



Taaffeite Crystals

Anthony R. Kampf
Mineralogy Section
Natural History Museum of Los Angeles County
900 Exposition Boulevard
Los Angeles, California 90007

Taaffeite is an enigmatic mineral much better known to gemologists than to mineralogists. Taaffeite was born into the mineral world as a gem and then only as a step-child of spinel. Its provenance could only be surmised and it suffered from descriptive flaws which lingered for three decades. Until now its crystals have never been adequately described.

DISCOVERY and DESCRIPTION

The story of the discovery of taaffeite has been recounted in detail many times (e.g., Anderson, 1968). Briefly, in 1945 Count Edward Charles Richard Taaffe recognized a 1.42-carat mauve cut stone (in a lot of spinel gems) to be something different. Count Taaffe, the son of a distinguished Austrian statesman, resided in Dublin, Ireland, where he made a modest income through the buying and selling of gemstones. He had little gemological equipment, not even a refractometer—yet it is said that his instinct for gem identification was remarkable. Using a 21-power binocular microscope he noted the very slight doubling of scratches on the rear facets of the small gem and knew this to be inconsistent with the isotropic nature of spinel. Count Taaffe sent the gem to B. W. Anderson and C. J. Payne at the Laboratory of the London Chamber of Commerce for further testing.

The characterization of the new mineral proved troublesome because of the paucity of material. The standard gemological properties, i.e., optics, specific gravity and hardness, were easy enough to measure, but crystallographic and chemical study required that very small fragments be removed from the gem. These analyses were performed by G. F. Claringbull and M. H. Hey respectively, both of the British Museum (Natural History). The description of the new mineral named *taaffeite* (pronounced "tarfite") was published by Anderson, Payne, Claringbull and Hey in 1951. During the descriptive process a second taaffeite gem weighing 0.87 carats was recognized. It was suspected that both gems originated in the gem gravels of Sri Lanka.

It was not until much later that two mistakes in the original description of taaffeite were discovered. In 1963 a crystal structure analysis by Peng and Wang showed the space group of taaffeite to be $P6_3mc$ rather than $P6_322$ as reported by Anderson *et al.* (1951). In 1981, Moor, Oberholzer and Gübelin based their description of the mineral taprobanite on a bright red 1.02-carat gem from Sri Lanka. They reported the ideal formula to be $BeMg_3Al_8O_{16}$, compared to $Be_2Mg_2Al_8O_{16}$ originally determined for taaffeite. In 1983 Schmetzer showed taprobanite to be identical to taaffeite and confirmed the formula given by Moor *et al.* (1981). The descriptive characteristics of taaffeite are summarized in Table 1.

OCCURRENCES

Schmetzer estimated that about 20 cut taaffeites existed in public and private collections at the time of his study. All of these were either known or assumed to be from Sri Lanka. During the last several years Sri Lanka has produced many more taaffeite specimens and it is likely that in excess of 1,000 faceted gems now exist in collections (D. P. Gunasekera, personal communication, 1990).

As with many of Sri Lanka's gemstones, taaffeite has never been found there *in situ*; however, a study by Munasinghe and Dissanayake (1981) suggests that many of Sri Lanka's gemstones are the result of granulite facies metamorphism of argillaceous sediments, followed by contact metamorphic desilication by basic intrusions. They attribute the formation of Be-bearing minerals to contact metasomatism caused by the subsequent intrusion of Be-rich pegmatitic fluids. *In situ* occurrences of taaffeite at several other localities provide further evidence of its paragenesis and crystal habit, as noted below.

Taaffeite was noted from Sianghwaling, Hunan Province, China, in 1956. This was the source of the material used by Peng and Wang for their structure work. Beus (1966) reports that taaffeite occurs there in metasomatic rocks in the contact zone between Be-bearing granites and limestone-dolomite.

In 1975 a similar occurrence of taaffeite in eastern Siberia was described by Kozhevnikov *et al*. Taaffeite was found in a mica-fluorite metasomatite intersecting a limestone-dolomite near the outer contact of a granite pluton. Taaffeite crystals up to 0.15 mm in size are described (Kozhevnikov *et al.*, 1977) as hexagonal dipyramids truncated by pinacoid* faces and occasionally also exhibiting small hexagonal prism faces. The faces were noted to be smooth and lustrous. The authors provide a crystal drawing, but no indices are given for the faces.

Taaffeite has been found as epitactic overgrowths on spinel from the Pitkäranta mining district, Karelian SSR, USSR (Schmetzer, 1983). Nefedov, Griffin and Kristiansen (1977) reported on the geologic setting, although they did not mention taaffeite. The deposits

*The basal faces of taaffeite crystals should properly be termed pedions rather than pinacoids because taaffeite belongs to the hemimorphic point group 6*mm*.

in this district are related to the intrusion of rapakivi granite into limestone and dolomite. They are contained in skarns and are relatively rich in several uncommon elements including Be.

Teale (1980) reported a contrasting paragenesis from the Mount Painter Province of South Australia. In this area taaffeite crystals occur in spinel porphyroblasts in an upper amphibolite-facies schist which is highly enriched in Mg and Al. The taaffeite crystals are described as bipyramids whose apices are truncated by basal pinacoid faces. Teale saw no evidence of metasomatic activity and concluded that the Be was an original constituent of the pre-metamorphic sediment.

RELATED SPECIES

The structure of taaffeite is closely related to the structures of högbomite and nigerite (Nuber and Schmetzer, 1983). It is based upon close-packed oxygen layers repeating in the 8-layer sequence (BCABCBAC . . .). Musgravite, $BeMg_2Al_6O_{12}$, is a derivative polytype with an 18-layer repeat. Musgravite has been reported as taaffeite-9R from high-grade metamorphic rocks in the Musgrave Ranges of central Australia by Hudson, Wilson and Threadgold (1967) and from a pegmatite in the granulite facies rocks of Casey Bay, Enderby Land, Antarctica, by Grew (1981). Pehrmanite, the Fe-analog of musgravite, was reported by Burke and Lustenhouwer (1981) from the Rosendal pegmatite on Kemiö Island in southwestern Finland. Both musgravite and pehrmanite are generally described as occurring in hexagonal plates or tablets.

MORPHOLOGY

Sri Lankan Crystals

Taaffeite crystals from Sri Lanka were not reported until the 1980's. Several waterworn crystals are now preserved in collections and one of these has been described by Saul and Poirot (1984). They report a truncated bipyramidal habit somewhat similar to the habits reported for taaffeite crystals from the occurrences in South Australia and Siberia noted above. Although Saul and Poirot provided a detailed crystal drawing, they did not report indices for the crystal's faces.

In the course of the present study five taaffeite crystals from Sri Lanka, including the one studied by Saul and Poirot, have been crystallometrically measured. Crystals from Sianghwaling, China, have been studied as well.

Because of their waterworn nature, the faces on four of the five crystals from Sri Lanka are insufficiently reflective to permit reflected-light goniometry. Nevertheless, all of these crystals are large and distinct enough to allow measurements to be made using a contact goniometer, at least for their principal faces. The crystal in the collection of the Smithsonian Institution is less waterworn, permitting reflected-light measurements to be made. Although this crystal is much larger than optimal for single-crystal X-ray diffraction techniques, it is the smallest of the Sri Lankan crystals studied and the precession X-ray method was successfully employed to verify its crystallographic orientation. The crystals from China are much smaller and of an ideal size for single-crystal X-ray diffraction. They also possess sharp, lustrous faces easily measurable by reflected-light goniometry. Descriptions of the crystals examined and the results of the morphological study are summarized in Table 2.

The crystals from Sri Lanka are all very similar in habit. The crystals studied are shown in Figures 3 through 8; Figure 1 shows an idealized crystal drawing. Each crystal exhibits a basal termination and an unequally developed set of hexagonal pyramidal faces of the form $\{11\bar{2}4\}$. All also exhibit at least one face corresponding to a second pyramidal form, $\{11\bar{2}2\}$. Although the crystals belonging to the Smithsonian Institution and the Gemological Institute of America (G.I.A.) have one or two very small faces of the opposing pyramidal form $\{11\bar{2}\bar{4}\}$, John Saul's crystal is the only one which is truly bipyramidal, and it is the only one exhibiting the two opposing basal pedions. John

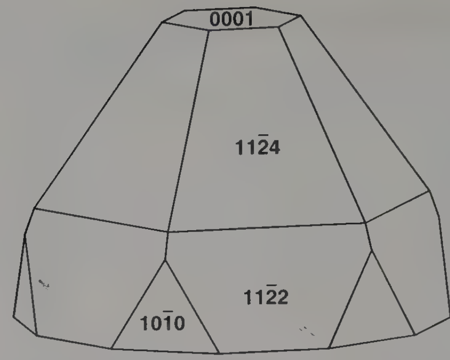


Figure 1. **Idealized orthographic projection of a taaffeite crystal from Sri-Lanka.**

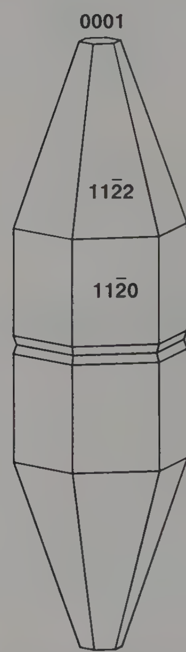


Figure 2. **Idealized orthographic projection of a taaffeite crystal from Sianghwaling, China.**

***Table 1.* Descriptive characteristics of taaffeite.**

Chemical Formula	$BeMg_3Al_8O_{16}$
Crystal System	hexagonal
Point Group	6*mm*
Space Group	$P6_3mc$
Cell Parameters (Å)*: a	5.876
c	18.34
Formula Units (Z)	2
Density (gm/cm³)**	3.605
Mohs Hardness	8
Cleavage***	{001} fair
Fracture	conchoidal
Optical Character	uniaxial (-)
Refractive Indices**: ε	1.717
ω	1.721

*Nuber and Schmetzer (1983)
**Moor *et al.* (1981)
***Not previous reported

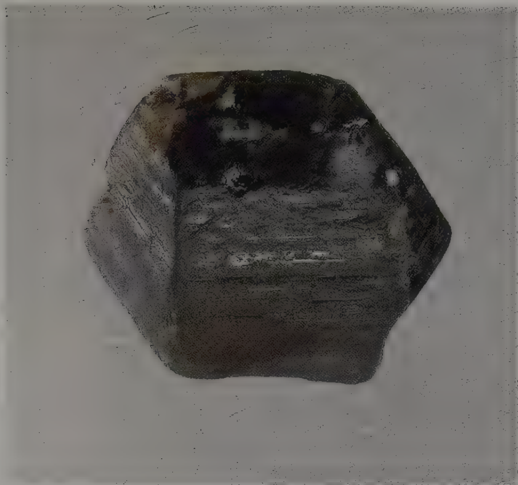


Figure 3. Taaffeite crystal from Sri Lanka (6.7 mm, 1.4 carats). Smithsonian collection.

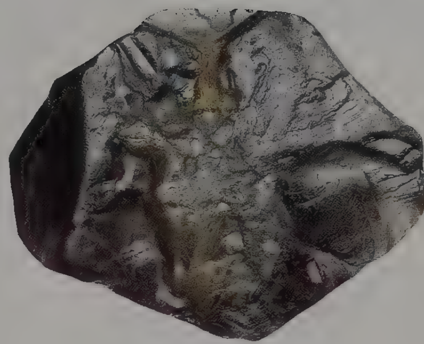
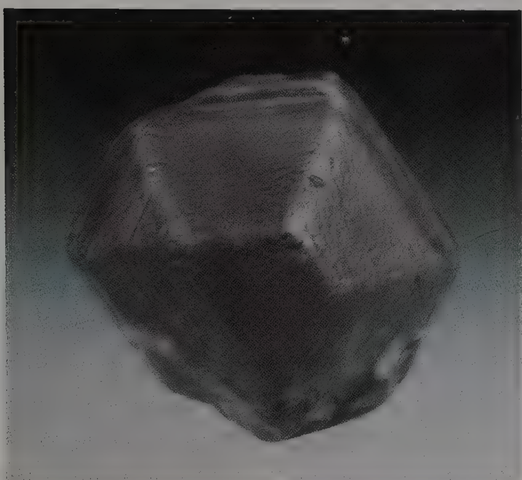


Figure 4. Base of taaffeite crystal shown in Figure 1.



WEW

Figure 5. Taaffeite crystal from Eheliyagoda, Sri Lanka (8 mm, 2.84 carats). Harvard University collection.

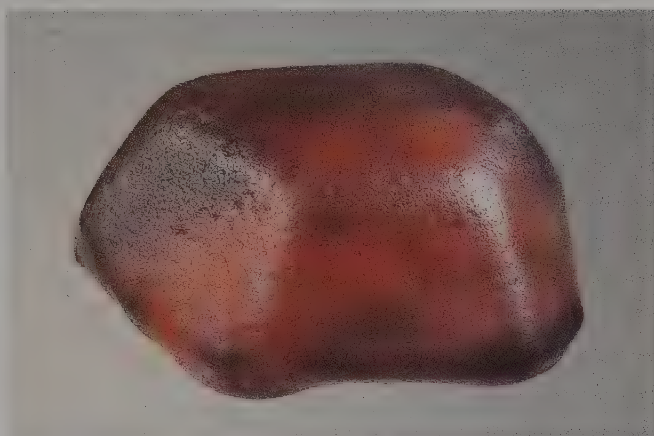
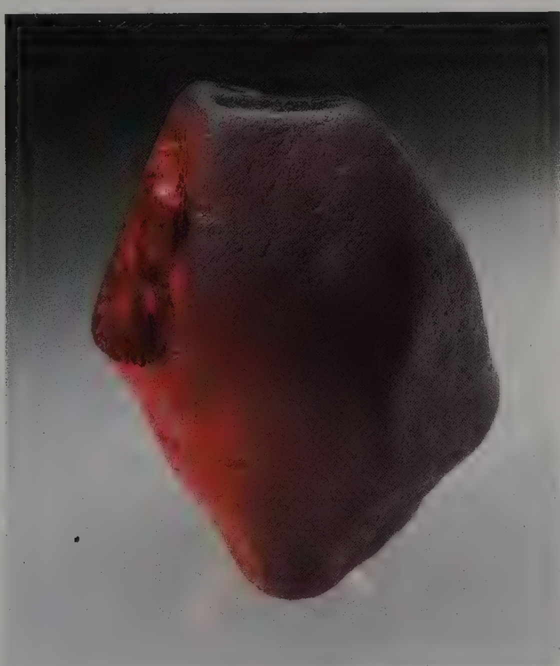
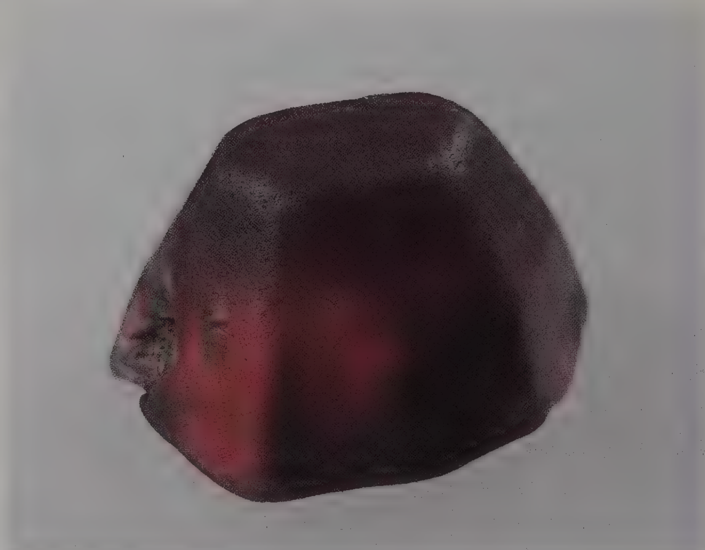


Figure 6. Taaffeite crystal from Sri Lanka (1.25 cm, 6.12 carats). G.I.A. collection.



WEW

Figure 7. Taaffeite crystal from Sri Lanka (1.5 cm, 11.23 carats). John Saul collection.



WEW

Figure 8. Taaffeite crystal from Sri Lanka (8 mm, 2.41 carats). Virchel Wood collection.

Table 2. **Taaffeite crystals examined in this study.**

Collection	Locality	Fig.	Date Acquired	Dimensions (mm)* Weight (gms)	Description	Forms
Smithsonian 16641	Sri Lanka	3, 4	1989	6.7 x 5.9 x 4.1 mm 0.281	Pale grayish purple; slightly waterworn; pyramid truncated by a small basal termination; striations on pyramid faces; the base is a contact surface.	$\{0001\}$ small, $\{11\bar{2}4\}$ large, $\{11\bar{2}2\}$ small, $\{11\bar{2}\bar{4}\}$ small, $\{11\bar{2}1\}$ and $\{11\bar{2}3\}$ as striations, $\{10\bar{1}0\}$ small
Harvard 127214	Sri Lanka	5	1986	7.7 x 6.8 x 6.1 mm 0.567	Grayish purple; moderately waterworn; pyramid truncated by small basal termination; indistinct striations on pyramid faces; periphery of base polished with {001} cleavage surface at center.	$\{0001\}$ small, $\{11\bar{2}4\}$ large, $\{11\bar{2}2\}$ small
G.I.A. 15720	Sri Lanka	6	1986	12.3 x 10.0 x 5.5 mm 1.224	Pale grayish purple; very waterworn; pyramid truncated by large basal termination; irregular base with small polished areas; possible cleavage features on base.	$\{0001\}$ very large, $\{11\bar{2}4\}$ large, $\{11\bar{2}2\}$ very small, $\{11\bar{2}\bar{4}\}$ very small
Virchel Wood	Sri Lanka	8	1987	8.2 x 6.6 x 4.7 mm 0.481	Deep grayish purple; very waterworn; pyramid truncated by moderately large basal termination; completely polished base.	$\{0001\}$ large, $\{11\bar{2}4\}$ large, $\{11\bar{2}2\}$ medium
John Saul	Sri Lanka	7	1983	12.7 x 9.0 x 12.2 mm 2.246	Deep grayish purple; very waterworn; distorted dipyramid truncated two basal terminations; small prism faces; one polished pyramid face; external and internal {001} cleavage features.	$\{0001\}$ small, $\{000\bar{1}\}$ large, $\{11\bar{2}4\}$ large, $\{11\bar{2}2\}$ medium, $\{11\bar{2}\bar{4}\}$ small, $\{11\bar{2}\bar{2}\}$ large, $\{1000\}$ very small
Harvard 124696	China	2	1977	0.05 x 0.05 x 0.20 mm (avg. bipyramid)	Colorless to pale beige-gray; sharp, lustrous faces; prims and bipyramid truncated by small basal terminations; re-entrant at equator suggests contact twinning on {0001}.	$\{0001\}$ very small, $\{000\bar{1}\}$ very small, $\{11\bar{2}2\}$ large, $\{11\bar{2}\bar{2}\}$ large, $\{11\bar{2}0\}$ large

*Maximum diameter x minimum diameter x height

Saul's crystal exhibits two small prism faces of the form $\{10\bar{1}0\}$ and the Smithsonian crystal exhibits one such face.

The $\{11\bar{2}4\}$ and $\{11\bar{2}2\}$ forms on the Smithsonian crystal exhibit distinct striations perpendicular to the *c*-axis which are the result of alternating $\{11\bar{2}1\}$, $\{11\bar{2}2\}$, $\{11\bar{2}3\}$, and $\{11\bar{2}4\}$ forms. The Harvard University crystal exhibits similar striations, but because it has experienced a greater degree of abrasion, these striations were not distinct enough to yield reflected-light signals. Abrasion has obscured any striations that presumably were once present on the other Sri Lankan taaffeite crystals; however, larger scale oscillations of pyramidal forms can be observed on the crystals belonging to John Saul and the G.I.A.

The base of the Smithsonian crystal is an irregularly stepped surface which is generally parallel to (0001) (Fig. 4). This appears to have been a contact surface with another crystal and it is possible that this crystal grew epitactically on spinel, as has been observed for taaffeite from the Pitkäranta district, Karelian SSR.

Although cleavage has not been previously reported for taaffeite, planar features observed on three of the Sri Lankan taaffeite crystals appear to correspond to a {0001} cleavage. The base of the Harvard crystal is polished around its perimeter, but a depressed area at its center is a natural crystal surface which is lustrous and free from any natural abrasion. The surface is parallel to (0001) with minute steps similar to those observed on cleavage surfaces. Larger scale circular steps bounding the depression are rounded and lustrous, and seem to be conchoidal fracture surfaces. Although much more waterworn and irregular, the base of the G.I.A. crystal exhibits similar cleavage-like features bounded by conchoidal fracture surfaces. John Saul's crystal provides the strongest evidence of cleavage. One side of this crystal is irregular and exhibits one small, yet distinct, cleavage plane. In addition, this side of the crystal exhibits numerous very fine incisions perpendicular to the *c*-axis, several of which extend well into the crystal, forming minutely stepped lily-pad–shaped planes parallel to (0001). The edges of these internal planes are turned up in places, suggestive of a cleavage transforming to conchoidal fracture. The planar features do not appear consistent with parting resulting either from exsolution or twinning.

Besides the internal planar features observed in John Saul's crystal, several inclusions were observed in this and the other Sri Lankan taaffeite crystals studied. These appear to be crystals of apatite, zircon, uraninite and graphite, as well as two-phase (liquid-gas) inclusions. Gübelin and Koivula (1986) illustrate fluorapatite, monazite and phlogopite inclusions in Sri Lankan taaffeite gems. These inclusions are typical of those found in many of the gem minerals found in Sri Lanka and are indicative of a common origin.

Chinese Crystals

The Chinese taaffeite crystals examined correspond closely to the descriptions previously published for taaffeite from Mount Painter, South Australia and eastern Siberia. These crystals exhibit prominent pyramidal faces of the form $\{11\bar{2}2\}$ and prism faces of the form $\{11\bar{2}0\}$. Many crystals also have a matching set of $\{11\bar{2}\bar{2}\}$ faces resulting in well proportioned bipyramidal crystals. Small {0001} and $\{000\bar{1}\}$ pedions commonly truncate the pyramids.

Those Chinese crystals which are bipyramidal in habit generally exhibit a groove about their equators (Fig. 2). The crystals can be broken cleanly and relatively easily across this equatorial plane. Although the surfaces forming this groove were too small to yield reflected-light signals, it is likely that they represent pyramidal faces meeting at a re-entrant angle. Because taaffeite belongs to the hemimorphic point group 6*mm*, this suggests that the bipyramidal taaffeite crystals from China may be twinned by reflection on (0001). Precession X-ray photographs of untwinned pyramids approximate 6/*mmm* symmetry; therefore, X-ray diffraction could not be used to confirm the presence of twinning for bipyramidal crystals.

SUMMARY and CONCLUSIONS

Taaffeite has been reported from five localities world-wide. The gem gravels of Sri Lanka have yielded the only crystals of sufficient size and quality for use as gemstones. Sri Lankan taaffeite probably resulted from the introduction of Be during the contact metasomatism of a regionally metamorphosed and desilicated argillaceous sediment. Three of the four *in situ* occurrences are related to contact metasomatism of limestone-dolomite by Be-bearing granitic intrusions. At the fourth, taaffeite is found in a Mg-, Al-rich and Be-rich upper amphibolite facies schist. The formation of taaffeite apparently requires enrichments in Mg and Al relative to Si as well as the introduction (or original presence) of significant quantities of Be.

The general shapes of all taaffeite crystals described in previous reports are very similar to the habits described herein. That is, taaffeite crystals are generally pyramidal or bipyramidal and are often truncated by basal pedions. By contrast, the closely related minerals musgravite and pehrmanite occur as hexagonal plates or tablets.

Taaffeite crystals from Sri Lanka are most commonly mono-pyramidal, as might be expected for a hemimorphic mineral. The crystals reported from the Pitkäranta district, Karelian SSR, have not been described in detail; however, because they are reported to occur as epitactic overgrowths on spinel, it is likely that they are mono-pyramidal. By analogy and based upon examination of basal surface features on the Smithsonian crystal, it is possible that some of the Sri Lankan crystals formed as epitactic overgrowths on spinel as well.

Planar features observed on three of the Sri Lankan crystals most likely represent a {0001} cleavage. This cleavage tends to degenerate readily to conchoidal fracture.

The bipyramidal crystals from Sianghwaling, China, appear to be twinned by reflection on {0001}. The bipyramidal crystals reported from eastern Siberia and Mount Painter, South Australia, have not been described in detail, but they may also represent twins on {0001}.

ACKNOWLEDGMENTS

The following individuals are acknowledged for lending taaffeite crystals from the collections in their care: Paul Powhat for providing the crystal from the Smithsonian Institution; William C. Metropolis for providing the taaffeite samples from Harvard University; Loretta B. Loeb for providing the crystal from the Gemological Institute of America; John Saul and Virchel Wood for providing crystals from their personal collections. Thanks are extended to John I. Koivula for insights into the internal features of the Sri Lankan taaffeite crystals. Special appreciation is due to Dr. Wendell E. Wilson for suggesting this study, for providing assistance in locating crystals, for supplying some of the references, and for taking several of the photographs.

REFERENCES

ANDERSON, B. W. (1968) The first two taaffeites: An historical note. *Gems and Gemology,* **12**, 259–262.

ANDERSON, B. W., PAYNE, C. J., CLARINGBULL, G. F., and HEY, M. H. (1951) Taaffeite, a new beryllium mineral, found as a cut gemstone. *Mineralogical Magazine,* **29**, 765–772.

BEUS, A. A. (1966) *Geochemistry of Beryllium and Genetic Types of Beryllium Deposits*. Freeman, San Francisco.

BURKE, E. A. J., and LUSTENHOUWER, W. J. (1981) Pehrmanite, a new beryllium mineral from Rosendal pegmatite, Kemiö Island, southwestern Finland. *Canadian Mineralogist,* **19**, 311–314.

GREW, E. S. (1981) Surinamite, taaffeite, and beryllian sapphirine from pegmatites in granulite-facies rocks of Casey Bay, Enderby Land, Antarctica. *American Mineralogist,* **66**, 1022–1033.

GÜBELIN, E. J., and KOIVULA, J. I. (1986) *Photoatlas of Inclusions in Gemstones*. ABC Edition, Zurich, p. 174, 426.

HUDSON, D. R., WILSON, A. F., and THREADGOLD, I. M. (1967) A new polytype of taaffeite—a rare beryllium mineral from the granulites of central Australia. *Mineralogical Magazine,* **36**, 305–310.

KOZHEVNIKOV, O. K., DASHKEVICH, L. M., ZAKHAROV, A. A., KASHAYEV, A. A., KUKHRINKOVA, N. V., and SINKEVICH, T. P. (1977) First taafeite [sic] find in the USSR. *Doklady Academy of Science USSR, Earth Science Section* **224**, 120–121.

MOOR, R., OBERHOLZER, W. F., and GÜBELIN, E. (1981) Taprobanite, a new mineral of the taaffeite group. *Schweizerische Mineralogische und Pretrographische Mitteilungen,* **61**, 13–21.

MUNASINGHE, T., and DISSANAYAKE, C. B. (1981) The origin of gemstones of Sri Lanka. *Economic Geology,* **76**, 1216–1225.

NEFEDOV, E. I., GRIFFIN, W. L., and KRISTIANSEN, R. (1977) Minerals of the schoenfliesite-wickmanite series from Pitkäranta, Karelia, U.S.S.R. *Canadian Mineralogist,* **15**, 437–445.

NUBER, B., and SCHMETZER, K. (1983) Crystal structure of ternary Be-Mg-Al oxides: taaffeite, $BeMg_3Al_8O_{16}$, and musgravite, $BeMg_2Al_6O_{12}$. *Neues Jahrbuch für Mineralogie Monatshefte,* 393–402.

PENG, C. C., and WANG, K. J. (1963) Discovery of a compact structure with 8-layers—crystal structure analysis of taaffeite. *Scientia Sinica,* **12**, 276–278 (in Russian).

SAUL, J., and POIROT, J.-P. (1984) Le premier cristal de taafféite gemme? *Revue de Gemmologie A.F.G.*, Association Française de Gemmologie, **78**, 28.

SCHMETZER, K. (1983) Crystal chemistry of natural Be-Mg-Al-oxides: taaffeite, taprobanite, musgravite. *Neues Jahrbuch für Mineralogie Abhandlungen,* **146**, 15–28.

TEALE, G. S. (1980) The occurrence of högbomite and taaffeite in a spinel-phlogopite schist from the Mount Painter Province of South Australia. *Mineralogical Magazine,* **43**, 575–577.

A Notable Millerite Locality near Bedford, Indiana

Richard M. Ley
Roy F. Weston, Inc.
Weston Way
West Chester, Pennsylvania 19380

A roadcut locality open to collecting near Bedford, Indiana, has yielded millerite comparable to specimens from Halls Gap, Kentucky, and Keokuk, Iowa.

INTRODUCTION

The Bedford, Indiana, geode locality is situated in the rolling hills of southern Monroe County in south-central Indiana. The terrain is of low relief and distinctively karst, characterized by numerous sinkholes. Roadcuts are pale gray to dirty white in color and frequently rubbly in appearance. Terra rosa soils are common and scattered cedars dot the landscape. The geode locality occurs in a roadcut along State Route 37 (SR-37), approximately 109 km (67 miles) south of Indianapolis, and 17 km (10.5 miles) north of Bedford near the small town of Harrodsburg. The locality is in the roadcut just south of the Monroe Lake exit, north of Bedford. Collecting is good on either side of the road.

Quarrying of area limestones for the production of lime and dimension stone has been a steady source of economic wealth in Bedford and surrounding communities since the late 1800's (Ault *et al.*, 1975). Quarry excavations and the construction of new road grades provide the mineral collector with a wealth of collecting opportunities. Many of these localities are documented in Greenberg *et al.*, 1958.

GEOLOGY

The roadcut exposes the Harrodsburg Limestone, a Lower Mississippian unit which has a lower part that is subdivided into the Leesville and Guthrie Creek members. This and the overlying Salem Limestone comprise a portion of the Sanders Group (Shaver *et al.*, 1986).

The Harrodsburg Limestone is a fossiliferous, well cemented bioclastic calcarenite or calcirudite. Fossils consist of disassociated crinoid discs, segments of crinoid stems, and brachiopods. The formation is argillaceous with intervening beds of nearly pure calcium carbonate (Shaver *et al.*, 1986).

The geodes occur in a chert-rich layer 0.3 to 3.4 meters above the base of the formation (Shaver *et al.*, 1986). Locally, geodes are found in a zone approximately 3 meters in thickness extending from the top of the talus slope to a point approximately 2 meters overhead. This cherty layer is uncommon elsewhere in the Harrodsburg. Geodes also occur in the uppermost rocks of the underlying Borden Group (Rarick, 1979) and in the overlying Salem Limestone (Smith, 1965).

MINERALOGY

The variety of minerals offered at the SR-37 outcrop is rather impressive: at least nine and possibly as many as 13 of the over 20 documented minerals found in Indiana geodes occur at this single locality (Rarick, 1979; Greenberg *et al.*, 1958).

The typical mineral assemblage consists of quartz with either calcite, dolomite or barite. Somewhat less common are geodes with attractive and often spectacular mineral suites consisting of quartz, calcite, barite and millerite.

Barite $BaSO_4$

Barite is frequently found as dirty butterscotch-colored blades in geodes tightly packed with quartz and dolomite. The mineral is also found as attractive, translucent, pale yellow crystals tabular on {001}. Common forms include {001}, {101} and {011}. Crystals are typically 5 to 7 mm long and frequently contain small organic inclusions (Kevin and Stephanie Hansen, personal communication, 1989). Barite is the only confirmed sulfate at the locality.

Calcite $CaCO_3$

Calcite is quite common in geodes from the roadcut. Calcite typically occurs as subhedral crystal sections, scalenohedrons marked by rhombohedral terminations, rhombic cleavages, and, much more rarely, as dog-tooth spar. Most common are crystals with the forms $\{01\bar{1}2\}$, $\{10\bar{1}0\}$, $\{21\bar{3}1\}$, $\{40\bar{4}1\}$ and $\{10\bar{1}1\}$.

Crystals reaching 4 to 5 cm are common, and larger ones have been found by the author. Many crystals exhibit a peculiar etching, making the line of intersecting crystal faces somewhat indistinct. The calcite fluoresces from dull red to a somewhat brighter pinkish red under both shortwave and longwave ultraviolet light.

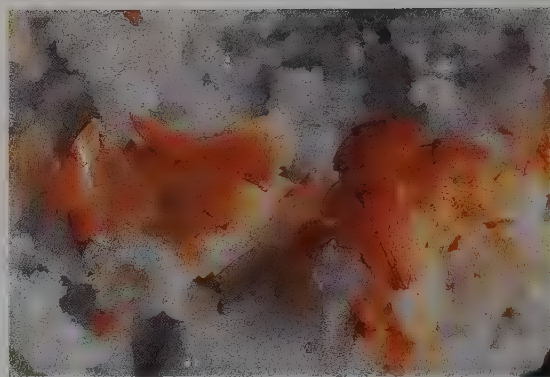
Dolomite $CaMg(CO_3)_2$

Dolomite is very common at the locality. The mineral occurs as creamy yellow to light brown saddle-shaped crystals or as massive pink aggregates. Iron oxides impart a dark brown to bright brownish orange color which tends to darken to an earthy brown after prolonged exposure to the atmosphere (C. Carnein, personal communication, WEW

Figure 1. Calcite crystals, 5 cm, with dolomite on drusy quartz. R. M. Ley collection.

Figure 2. Curved dolomite crystals in a fan-shaped aggregate, 1.1 cm across, with marcasite microcrystals. C. Carnein collection.

WEW



WEW

Figure 3. Dolomite crystal group, 2.5 cm, with iron oxide coating, on drusy quartz. C. Carnein collection.

WEW

Figure 4. Millerite spray, 2.5 cm tall, on drusy quartz. C. Carnein collection.

WEW

Figure 5. Millerite tufts, 2.5 cm across, on drusy quartz. R. M. Ley collection.

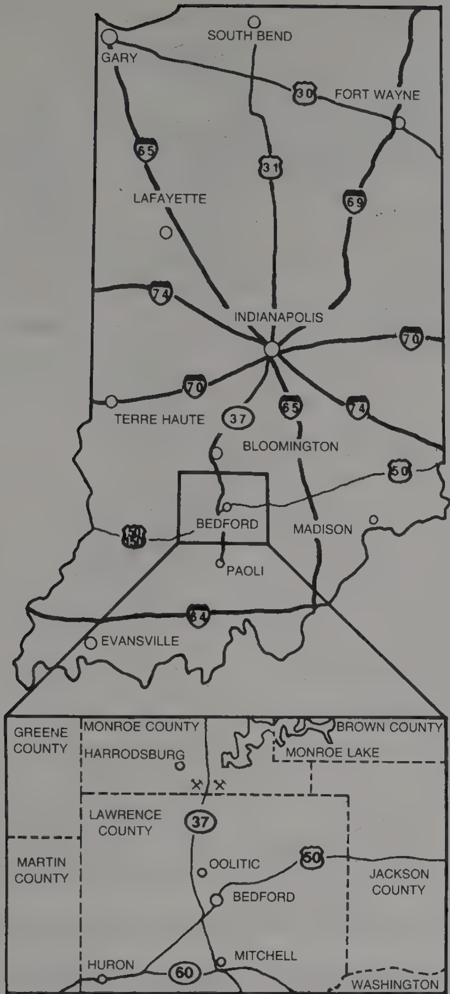


Figure 6. **Location map.**

1990). The mineral nevertheless appears colorless when crushed and observed under the microscope. The color is most prominent on the wide leading edge of the crystal. Crystal size averages 4 mm on the leading edges and tapers to approximately 2 mm at the base.

Marcasite FeS_2

The author is aware of only one example of this dimorph of pyrite. The mineral occurs as brassy, metallic, yellow, platy crystals reaching 2 to 3 mm in size. The marcasite occurs on orange ankerite/dolomite (Carl R. Carnein, personal communication, 1988). Marcasite, however, probably occurs much more frequently, being inadvertently mistaken for massive pyrite.

Millerite NiS

Millerite occurs as brassy yellow or dark to bright, metallic, grass-green mats, webs and sprays of free-standing prismatic crystals or as dark green inclusions in calcite. X-ray diffraction was used to verify that the green mineral is millerite and not the rarer honessite. In geodes that are broken, and where weathering has occurred, the mineral typically displays a steel-gray color. Crystal length occasionally reaches 2 to 2.5 cm, but 1 cm is more typical. Millerite is most frequently found in the geodes embedded in massive limestone rather than in the jointed limestones immediately adjacent. This makes geode extraction difficult, and one should take care when obtaining and opening geodes, because millerite crystals are fragile. Crystal quality and aesthetics equal or exceed those of millerite and/or honessite-bearing geodes from Keokuk, Iowa, and Halls Gap, Kentucky.

Pyrite FeS_2

Small, isolated masses of pyrite and/or marcasite are frequently encountered in geodes in the roadcuts along SR-37. However, in the small, heavily vegetated roadcuts leading to Monroe Lake, geodes commonly contain pyrite cubes embedded in and on quartz. Crystals are small, 1 to 2 mm, and are a tarnished, brassy yellow to silvery blue color. Pyrite may be found anywhere within the geode cavity, however the mineral tends to localize along the geode rind.

Quartz SiO_2

Quartz is by far the most abundant mineral at the locality. The mineral may occur as massive, dark blue-gray material that partially or completely fills the geode cavity, or as simple, equant, lustrous, water-clear crystals ranging from 1 to over 4 mm in size along the *c* axis. Common forms include $\{10\bar{1}0\}$ and $\{10\bar{1}1\}$. More rarely, spherical aggregates composed of lustrous crystal terminations are found in association with calcite and bladed barite.

Chalcedony forms porcelain-white to yellow-white, 2 to 3-mm thick botryoidal aggregates that commonly encrust clear quartz.

Sphalerite ZnS

Massive submetallic cleavages of sphalerite are relatively common in geodes at the SR-37 outcrop. Color ranges from dark brown to black. The mineral is encountered most frequently in almost cavity-free geodes in association with quartz and dolomite, and like pyrite it tends to concentrate near the geode rind. Rarely, attractive, euhedral, adamantine, root beer–colored crystals may be found. These crystals occur in geodes in the small outcrops along the road leading to Monroe Lake.

Species Reported from Nearby

The minerals reported in this paper were collected by the author, reported by others (marcasite), or examined in the mineral collection of Miami University, Oxford, Ohio. Several minerals have been found in geodes at other area outcrops which have not been described from this locality. These species (ankerite, aragonite, goethite, siderite, honessite) provide an impetus for continued collecting and discussion.

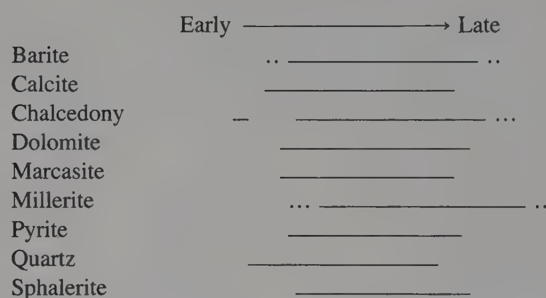


Figure 7. **Crystallization sequence of minerals at the Bedford geode locality.**

PARAGENESIS

The sequence of mineralization is described (in part) in the following section and is shown in Figure 7. Paragenesis was determined on the basis of hand specimen analysis.

Geodes at the SR-37 outcrop range in size from under 2.5 cm to over 1 meter in diameter. The smaller geodes tend to be nearly spherical while the larger ones are commonly slightly compressed to nearly elliptical in shape.

Geode origin has been a matter of considerable discussion for quite sometime. In the most widely accepted hypothesis, a geode represents an over-silicification of organic matter (Rarick, 1979). This hypothesis is supported by two lines of evidence at the SR-37 outcrop. In some instances geodes can be found surrounded by disassociated crinoid discs oriented so that they appear to flow about the geode. This would indicate that over-silicification of concentrated accumulations of crinoid discs occurred, causing the displacement of unaffected fossils as the geode developed. A second line of support is apparent where shaly intervals are exposed. In these places it is frequently possible to see where the geode has distorted the host rock by forcing sedimentary layers to conform around itself. In rare instances, some brachiopods can be found in close proximity to these geodes. They may have provided an *in situ* nucleus for the geodes.

Mineral fluids played an integral part in geode formation. The first material to form is an outer rind of chalcedony followed by a thicker inner rind of quartz deposited in concentric bands. Each band represents a successive growth layer. This phenomenon is difficult to distinguish with the unaided eye except near the quartz-chalcedony interface.

The origin of mineralizing fluids is not well understood. No orebodies or mineralized veins are reported in the area. One scenario would have mineral fluids emanating from a magmatic body at depth containing the metals barium, nickel, iron, and zinc. These fluids then migrated upward along extensive joint and fracture systems in the overlying sedimentary bedrock, acquiring, en route, silica, sulfide, sulfate, iron and carbonate from the limestones and shales. There is a vast literature, however, on simple fluid-rock interactions for these sediments in which magmatic influence is not required.

ACKNOWLEDGMENTS

The author would like to thank several individuals for their help in preparing this document. Dr. Carl R. Carnein (Loch Haven University) who first introduced me to the locality through numerous school-related field trips; Dr. John M. Hughes (Miami University) who provided all analytical work; Kevin Hansen (Weston) and his wife, Stephanie, Russ Turner, Dick Berry, Charles Young, and Steve Schuyler, all of Weston, who reviewed various drafts of this paper; and Mary Lou Fabian (Weston) who was instrumental in editing and typing this report.

REFERENCES

AULT, C. H., ROONET, L. F., and PALMER, M. V. (1975) The limestone industry of Indiana. *Indiana Geological Survey, Bulletin* **42-J**, 62.

GREENBERG, S. S., BONDY, W. M., and McGREGOR, D. J. (1958) Guide to some minerals and rocks in Indiana. *Indiana Department of Conservation Geological Survey Circular No.* **4**, 60.

HURLBUT, C. S., JR., and KLEIN, C. (1977) *Manual of Mineralogy.* 19th Edition After J. D. Dana. John Wiley and Sons, 532 p.

JENSEN, D. E. (1958) *Getting Acquainted with Minerals*. McGraw-Hill, 362.

RARICK, R. D. (1979) Indiana geodes—Some of nature's mysteries. *Outdoor Indiana,* **40**, no. 2.

SHAVER, R. H., AULT, C. H., BURGER, A. M., CARR, D. D., DROSTE, J. B., EGGERT, D. L., GRAY, H. H., HARPER, D., HASENMUELLER, N. R., HASENMUELLER, W. A., HOROWITZ, A. S., HUTCHINSON, H. C., KEITH, B. D., KELLER, S. J., PATTON, J. B., REXROAD, C. B., and WIER, C. E. (1986) Compendium of Paleozoic rock—unit stratigraphy in Indiana—a revision. *Department of National Resources Geological Survey, Bulletin* **59**, 203.

SMITH, N. M. (1965) The Sanders Group and subjacent Muldraugh Formation (Mississippian) in Indiana. *Department of Natural Resources Geological Survey Report of Progress,* **29**, 20.

TRÖGER, W. E. (1979) *Optical Determination of Rock-forming Minerals*. E. Schweizerbart'sche Verlagsbuchhandlung, 188.

German Dealers

The next time you're traveling in Germany, visit us for some German hospitality & see some exceptional specimens!

Old classics & recent discoveries, display specimens & rare species, fossils, meteorites, books & other collectibles.

Baumstark Mineralien & Edelsteine
Dipl. Min. M. Baumstark
Geppertstr. 20
D-7580 Bühl/Baden
Tel: 07223-1503
Fine Worldwide Minerals—esp. Bulgaria & USSR

Krystallos
Dr. Paul Meienberg
Ainmillerstr. 13
D-8000 Munich 40
Tel: 089-34-1338
FAX: 089-349-789
Only high-quality crystals for aesthetes, collectors, healers; >120 tumbled stones: T-W-Th, 10–6 and by Appt.

Bode-Verlag GmbH
Rainer Bode
Dürnberg 2
D-4358 Haltern 4
Tel: 0049-2364-16107
Emser Hefte, Mineralien-Welt, Fine Books

Exclusive Mineralien Brückner
G. Brückner
Box 1342
D-7840 Müllheim-Britzingen
Tel: 07631-12801
Fine Classic Minerals, By Appt. Only

Fleck Mineralien
Gisela & Klaus Fleck
D-8023 Munich-Pullach
Tel: 089-793-1793
Top Quality Specimens, Rare Species (list), By Appt. Only

Fossilien-Mineralien
B. A. Jürgen Schmitt
Weissadlergasse 8
near Goethe Haus
D-6000 Frankfurt a. M.
Tel: 069-282201-598448
Display fossils, Solnhofen, Bundenbach, Pfalz

Kristalldruse GmbH
Christian Weise
Oberanger 6
D-8000 Munich 2
Tel: 089-260-4018
FAX: 089-260-3499
Over 1,000 species; Rarities Bought & Sold; All German Books on Minerals, etc. [List]; M-F, 9:30-6, Sat., 9:30-1

Kristalle aus den Alpen
Werner Radl
Ketterschwangerstr. 12
D-8951 Rieden
Minerals from the Alps, Norway, Pakistan—Appt. Only

Kristallkeller–Nürnberg
Ulrike Buchner-Endres
Hefnersplatz 8
D-8500 Nürnberg 1
Tel: 0911-208485
Aesthetic Minerals for Collectors and Museums—By Appt. Only

Mineral Exquisit
Karin & Uli Burchard
Schlosstrasse 6
D-8050 Haindlfing-Freising
Tel: 49-8167-8567
Top-quality minerals, antique mineralogical

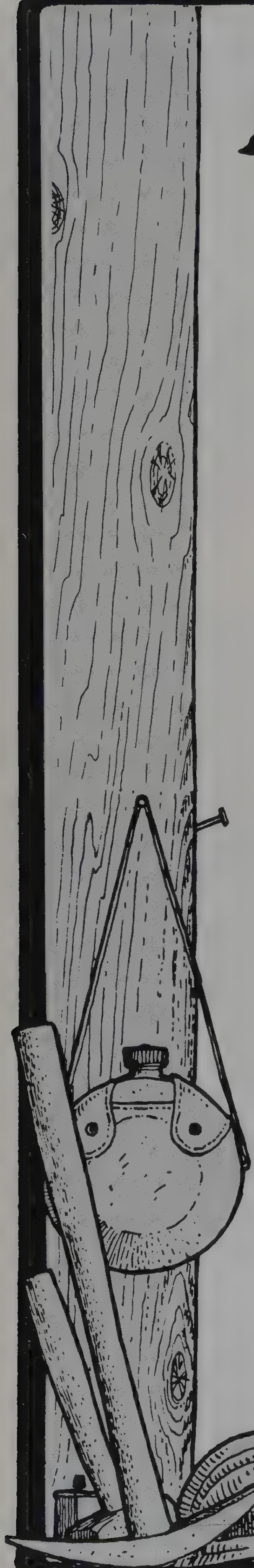
V + V Geo Expert
Michael & Nikolaus Vogt
Hoher Eschenweg 126
D-3005 Hemmingen 4
Tel: 495101-5003
FAX 49511-889838
Exceptional High-Quality Minerals and Fossils from Germany, Europe, Africa

Weerth Edelsteine u. Mineralien
Andreas Weerth
Hochfeldstr. 37
D-8180 Tegernsee
Tel: 08022/4330
Gem material from central Asia, Minerals from the Alps

Wilke Mineralien
Dr. H. J. Wilke & Else A. Wilke
Händelstr. 5
D-6116 Eppertshausen
Tel: 06071-31394
Exclusive Minerals, Classic Localities, Rare Species

Many of us have booths at the Munich Show—See you there!

Arizona Dealers



Bitner's, Inc.
42 West Hatcher
Phoenix, Arizona 85021
(602) 870-0075
Wholesale Minerals &
Fossils, by the piece,
pound or flat, since 1945

Cureton Mineral Company
Forrest & Barbara Cureton
P.O. Box 5761
Tucson, Arizona 85703
(602) 743-7239
Rare Minerals
Meteorites, Old Classics,
Wholesale & Retail.
By Appt.

Em's Gems Plus Three
Em & Ogle Love
8846 E. 35th Circle
Tucson, AZ 85710
(602) 886-6942
Fine moderately
priced (<$600)
specimens for collectors
and museums.
Shows only.

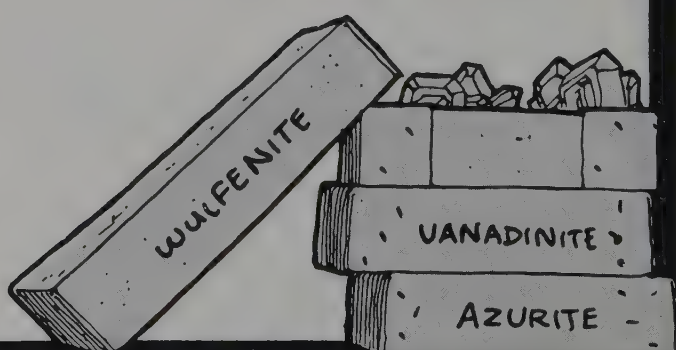
Fosters
Sarah Foster
& Wayne Richards
1511 E. Edgemont Ave.
Phoenix, Arizona 85006
(602) 265-1567
No List. See us at
Major Shows.

Kino Rocks & Minerals
6756 S. Nogales Highway
Tucson, Arizona 85706
9-11:15/Noon-5:30
(Closed Sun.)
(602) 294-0143

Rincon Mineral Co.
Bill Todzia
P.O. Box 26547
Tucson, Arizona 85726
(602) 889-8718
Wholesale only;
by Appt.

David Shannon Minerals
David & Colleen
6649 E. Rustic Drive
Mesa, Arizona 85205
(602) 985-0557

Maudine & Bob Sullivan
3202 Saguaro West Trail
Tucson, Arizona 85745
(602) 743-0081
See us at the major
shows only



California Dealers

Bourget Bros.
Anthony Chavez, Leonard Bourget
1636 11th Street
Santa Monica, California 90404
Tel: (213) 450-6556
FAX: (213) 450-2201
Wholesale and Retail

Coogan Gold Company
Ed and Kay Coogan
P.O. Box 1631
Turlock, CA 95381
Tel: (209) 634-5222

Si and Ann Frazier
Si and Ann Frazier
Suite 306, 6331 Fairmont Ave.
El Cerrito, California 94530

Galas Minerals
Chris and Agatha Galas
6000 Fulkerth
Turlock, California 95380
Tel: (209) 634-4292

Jewel Tunnel Imports
Rock H. Currier
13100 Spring Street
Baldwin Park, CA 91706-2283
Tel: (818) 814-2257
FAX: (818) 338-4617
Wholesale Only

Kassionas
John and Dolores Kassionas
P.O. Box 578
Alviso, California 95002
Tel: (408) 263-7784

Kristalle
332 Forest Avenue, #8
Laguna Beach, California 92651
Tel: (714) 494-7695

Lustig International
Hal & Shirlee Lustig
14270 Doolittle Drive
San Leandro, California 94577
Tel: (415) 351-4444
Minerals & Stands
Wholesale Only

Pala International & The Collector
912 So. Live Oak Park Road
Fallbrook, California 92028
Tel: (619) 728-9121
US Wats 1-(800)-854-1598

D. J. (Doug) Parsons
1119 S. Mission Road
Suite 243
Fallbrook, CA 92028
Tel: (619) 728-8251
FAX: (619) 728-8255
TELEX: 710 111 5543

Roberts Minerals
P.O. Box 1267
Twain Harte, California 95383
Tel: (209) 586-2110

Mark & Jeanette Rogers
P.O. Box 1093
Yucaipa, California 92399
Tel: (714) 797-8034

Bruce & Jo Runner
13526 South Avenue
Delhi, California 95315
Tel: (209) 634-6470
Micromount List $2
TNs, MIN, CABINETS

Silverhorn
Mike Ridding
1155 Coast Village Road
Montecito, California 93108
Tel: (805) 969-0442

Weber's Minerals
605 San Dieguito Drive
Encinitas, California 92024
Tel: (619) 436-4350

THE SMOKEY BEAR QUARTZ CLAIMS

LINCOLN COUNTY, NEW MEXICO

Tim Hanson and **Bob Thompson**
207 Eaton Avenue SW
Socorro, New Mexico 87801

A 1987 rediscovery of superb smoky quartz crystals in New Mexico has caused excitement in the collector community the world over, and also in the United States Forest Service. Thousands of excellent specimens have been produced, some with crystals well over 40 cm.

INTRODUCTION

The Smokey Bear quartz deposit is located in the southeast quarter of Section 29, and the southwest quarter of Section 28, T10S, R11E, NMPM, in the White Mountains Wilderness, Lincoln County, New Mexico, at an altitude of about 10,650 feet (see the U.S.G.S. *Nogal Peak* 15-minute quadrangle, 1982). The deposit is aligned along the north side of a northwest-southeast-trending ridge, from 250 to 1500 meters southeast of Peak 10825. Access is by pack trail from the Sierra Blanca ski area.

Late in June, 1987, one of us (BT) came across a U.S. Geological Survey publication mentioning a locality that had produced smoky quartz crystals up to 20 cm in size during the 1940's (Segerstrom *et al.*, 1979). A quick reconnaissance produced literally a hat-full of specimens with crystals to 3.8 cm (1.5 inch) in length. They were heavily encrusted with an opaque layer of organic material, clay and silica. After laborious cleaning with hydrofluoric acid the crystals proved to be of exceptional quality. Further exploration was obviously merited.

HISTORY

The deposit was first located by Roy LaMay and Ernest Purcella on November 10, 1943, and named the "Crystal" claim for obvious reasons. They maintained their claim until 1949. On July 12, 1963, Arvel Runnels with the help of James Clayton staked the "Bonita Crystal" claim. Runnels held the claim for a year. The following year the Bon & MJ group of claims was located over the deposit by Bear Creek Mining Company. They were maintained into the 1970's, but the exact location of the quartz remained unknown to the greater mineralogical community. Segerstrom *et al.* (1979) wrote in United States Geological Survey Bulletin 1453, page 102:

> It was learned during the wilderness investigation that a former claimant mined several hundred pounds of the crystals and reportedly sold them to rock collectors at prices averaging about $5 per pound. The crystals are the smoky variety and are covered with a thin silicate crust; their only value would be as mineral specimens.

Our name "Smokey Bear" was chosen for the deposit for several reasons: The deposit is near the area where the bear cub named Smokey was found (in 1950 he was adopted by the U.S. Forest Service as its national fire prevention symbol); the quartz is smoky; the terrain is rugged, making collecting "a bear"; and our camp was raided several times by bears that did considerable damage.

During July of 1987 the authors conducted further exploration of the deposit, and determined that it was of significant scientific and economic value to claim. In addition, a 1985 Bureau of Land Management's land status map (with misprinted mineral ownership overlay), showed the area open for mineral location (*Ruidoso*—SE 11 Sheet, 1985). So, in early August we posted several claims over the deposit in accordance with the laws of the State of New Mexico and the Mining Law of 1872.

The question of the wilderness area did come up early in our explorations; however, the Nogal Peak Quadrangle covering the area seems to indicate that the deposit is approximately bisected by the wilderness boundary. Since our original discoveries were apparently outside of the wilderness area, we felt that "extralateral rights" would also give us clear claim to the down dip exposures of the vein within the wilderness.

August and September were spent collecting specimens, primarily, if not exclusively from collapsed surface pockets. Collecting the specimens was easy. Packing them out was another matter, and required a great deal of effort. Nevertheless, we managed to bring to light many specimens of incredible beauty and scientific interest.

Our collecting ceased in late September with the advent of winter weather, a shortening day, a stampede of competitors and a filing of claims to protect our discovery rights. From October 1987 to January 1988 we worked full-time cleaning and preparing the specimens for the February 1988 Tucson Gem and Mineral Show.

At the February 1988 Tucson Gem and Mineral Show we set up shop in the Community Center wholesale section. We had fair sales and good reviews:

> . . . newly discovered New Mexico smoky quartz, including cabinet size plates thick with lustrous, gemmy, and sparkling

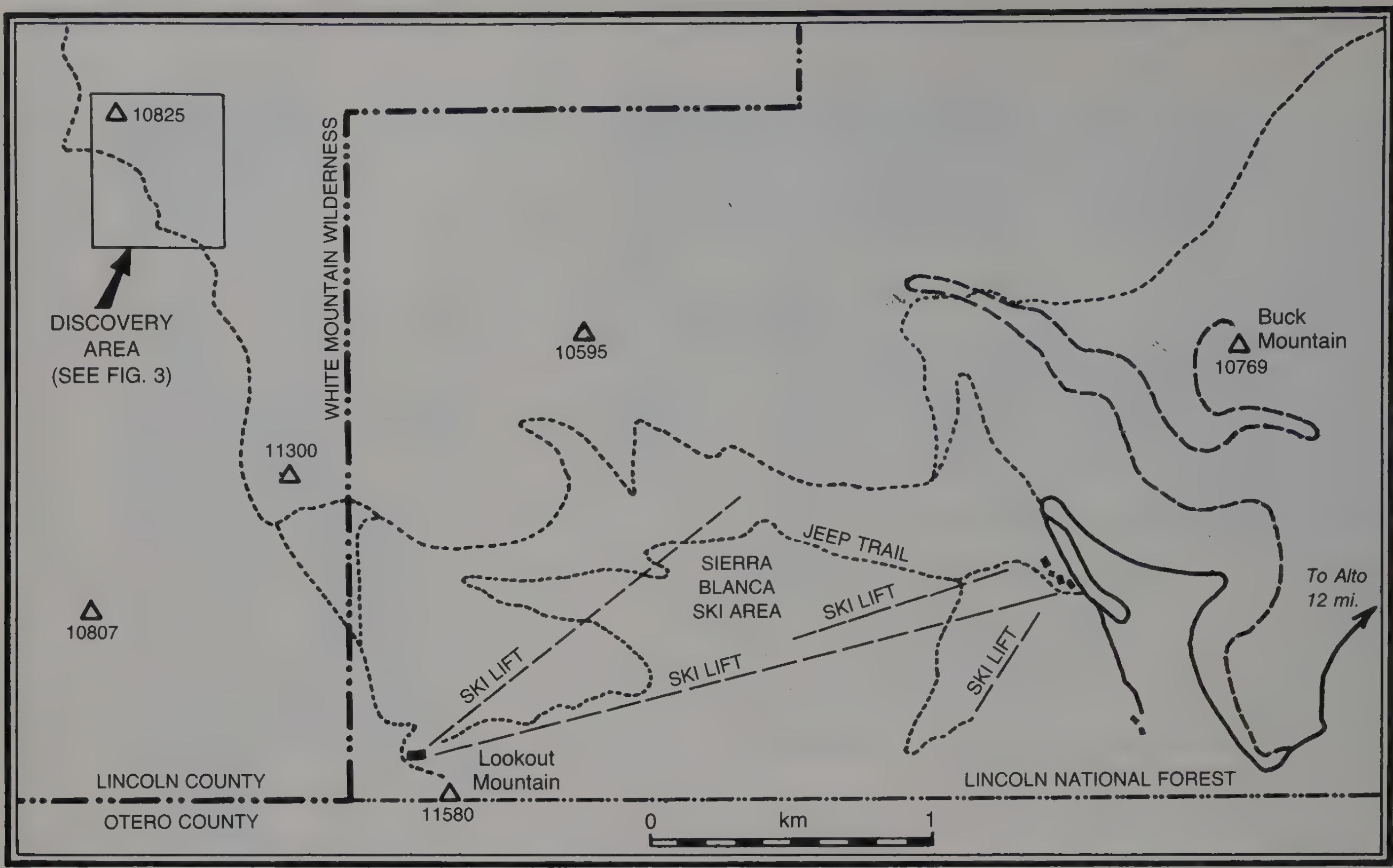


***Figure 1.* Location map.**

> crystals to several centimeters, and other cabinet pieces with large, thick singles amid the smaller crystals. Some of the specimens coming out of this find are highly attractive and very distinctive . . . another example of an instant classic, which is no small feat considering how many fine smoky quartz localities exist worldwide. (Wilson, 1988)

During September, 1987, we had resisted attempts by third parties to collect our pockets and surrounding areas, relying on the location and mining laws of 1872. However, our competitors determined accurately that the deposit was almost entirely in the White Mountain Wilderness Area and was therefore removed from mineral location. However, as a wilderness area, it was open to the hobby mineral collector and closed to commercial collecting.

Late June of 1988 brought reports that U.S. Forest Service agents had questioned mineral dealers in Albuquerque, New Mexico, concerning the buying and selling of the smoky quartz. A few days later, on a reconnaissance trip into the collecting area, one of us (TH) was confronted by five rangers investigating the site. They were clothed in military fatigues, had surveillance equipment and carried M-16 assault rifles. When confronting Tim they read him his rights and proceeded to confiscate his rock hammer and chisel. They drove to his home and confiscated his personal collection. They did so under U.S. Title 18 Code 641, theft of government property.

At Tim's home he asked one officer what would happen to his material. The officer replied that the crystals would probably be destroyed!

In July of 1988, a New Mexico mineral dealer selling specimens that we had collected telephoned us with the information that his shop had been raided by armed Forest Service agents and local police officers. This dealer reported that several customers were frightened by this incursion, and that he really resented being treated as if he were a dangerous felon.

A July 28, 1988 U.S. Forest Service press release stated in part:

> Federal agents from the USDA Forest Service and the USDI Bureau of Land Management today searched [mineral] businesses in Santa Fe and Albuquerque, New Mexico, as part of a continuing investigation of the theft of smoky quartz crystals from national forest lands.
>
> Search warrants were issued. . . . Agents were seeking smoky quartz crystals which were stolen from the White Mountain Wilderness of the Lincoln National Forest in Southern New Mexico. Since the quartz crystals are located on government land, their removal without permit becomes theft of government property under 18 U.S. Code 641.
>
> Searches are being made of retail outlets where the crystals may be on sale to the public, since the store owners may have purchased them from suspected thieves. At least 50 retail outlets may have purchased the crystals.
>
> The suspected thieves have been identified. . . . No suspects are in custody.
>
> The loss to the government has been estimated in the "tens of thousands of dollars." Conviction of the theft can result in 10-years imprisonment and up to a $10,000 fine.

A report by Susan Landon (*Albuquerque Journal,* July 30, 1988) quotes special agent Noel Johns (one of the U.S. Forest Service's crack drug agents, see *Readers Digest,* August 1988: "Drug Outlaws In Our National Forest," by Richard and Joyce Wolkomir, pages 193–200) as saying that the New Mexico specimens are a type of smoky quartz "found nowhere else in the world."

We immediately retained an attorney, pulled all of our specimens off the market and began a long campaign to recover from a concerted attack by the Forest Service that destroyed our business and our personal reputations.

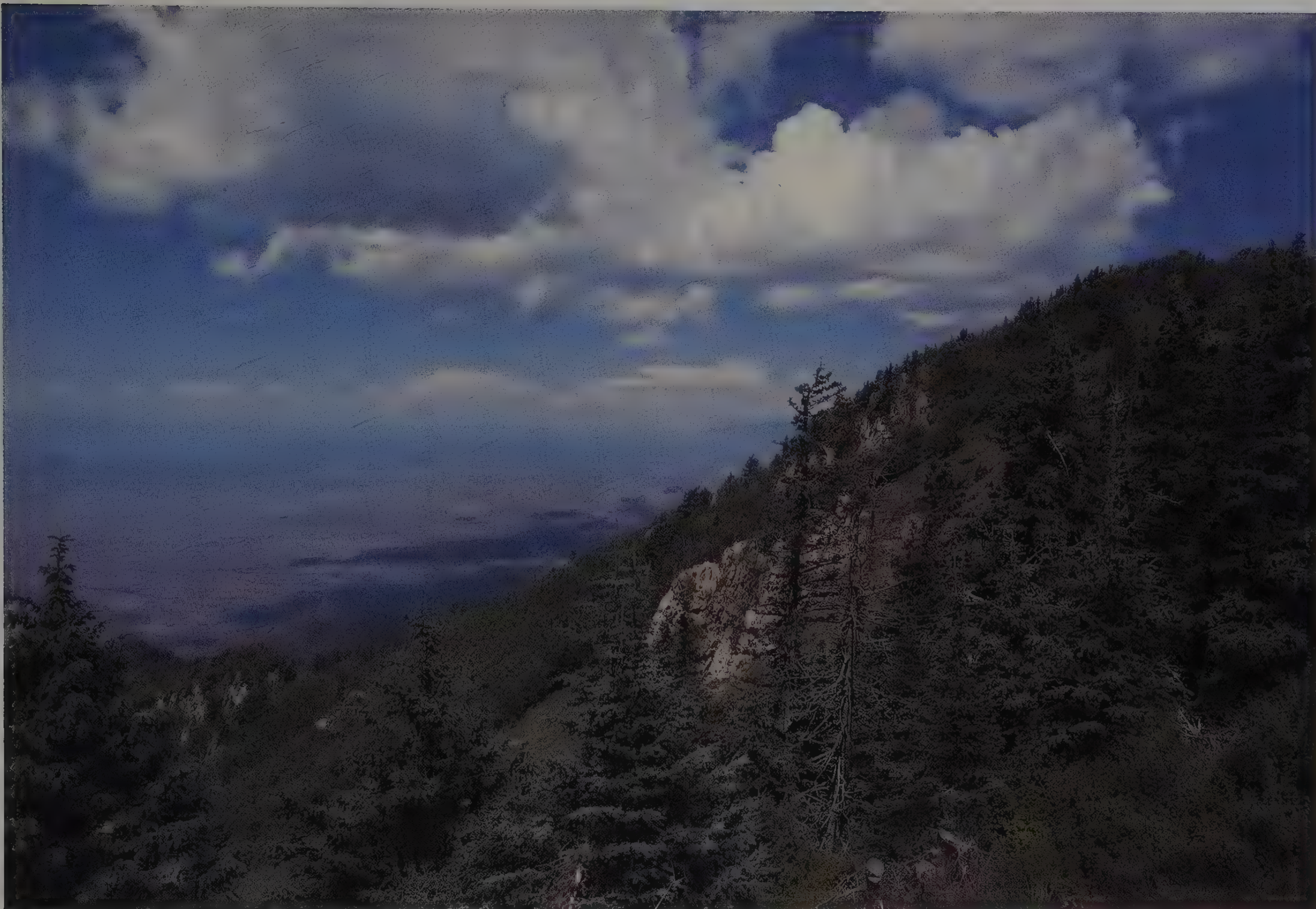


Figure 2. **Steep, partially forested terrain in the area of the claims.**

An August 5th U.S. Forest Service press release states:

> Federal agents . . . searched two businesses in Tucson on Thursday as part of a continuing investigation. . . . [Following] searches of businesses in Santa Fe and Albuquerque, agents said that [smoky quartz] crystals were found in all of the searches.

During the next year, rumors of confiscations persisted. There were unconfirmed allegations of wire-tapping and mail interceptions by persons or agencies involved in this case, as well as further intimidation of mineral dealers and private collectors who had obtained specimens from us. Even specimens that were given to public institutions or private individuals were under scrutiny. We also heard through "the grapevine" that persons identifying themselves as U.S. law enforcement agents visited various mineral dealers in Europe asking questions about, and attempting to confiscate, smoky quartz specimens.

Perhaps the most bewildering aspect of this entire investigation is that the U.S. Forest Service never made any attempt to contact us directly. The only time that any of them attempted to speak with us is on June 23, 1988, when Tim encountered the investigation team on his way to the deposit, primarily to do research for this article. This entire fiasco could have been resolved if the Forest Service had come to us and said "We have a problem . . . ." Instead, they chose to use intimidating tactics in order to "Make an example of us."

Of course, their exaggerated press releases brought many more collectors to the area in search of quick riches. On one day in the summer of 1989, according to a fairly reliable source, there were at least 23 people collecting specimens there.

At one point, when it looked as if we were going to face major felony charges, we hired a registered minerals surveyor to determine the actual position of the deposit in relation to the wilderness boundary. The surveyor managed to obtain (with reluctance on the part of the local U.S. Forest Service office) the official description of the wilderness boundary from the U.S.F.S., which indicated that the entire area of our claims was probably within the wilderness area. Interestingly, the official boundary description is topographic rather than legal. (See Title 16 U.S. Code 1132.2, "The Secretary of Agriculture shall maintain available to the public, records pertaining to the said wilderness areas, including maps and legal descriptions, copies of regulations governing them, . . . Maps, legal descriptions, and regulations pertaining to wilderness areas within their respective jurisdictions also shall be available to the public in the offices of the regional foresters, national forest supervisors, and forest rangers.")

Ultimately, the U.S. Attorney representing the Forest Service indicated that the maximum that we could be charged with was a violation of 36 CFR 261.9.b, a misdemeanor with a $100 fine. However, we chose not to accept this offer, and pressed for a civil settlement. Although it would have cost us a lot less to accept the misdemeanor charge, we felt that we had been victimized, and deserved vindication. To settle for less than complete exoneration of criminal wrongdoing was unacceptable.

On June 14, 1989, the U.S. Attorney's office for the District of New Mexico was ready to settle the case. We entered into a "Settlement and Release Agreement" which included the following:

The United States agreed not to pursue action, criminal or civil, against us for the removal or subsequent sale of the Smoky Quartz New Mexico Crystals.

We agreed to indemnify and hold harmless the United States and its departments, agencies and employees from any and all other claims and actions.

Shortly after the agreement was signed, Tim requested the return of his confiscated property, other than smoky quartz. His request was denied. Likewise, mineral dealers attempting to recover their confiscated stock have also been denied.

One week before the 1989 New Mexico Mineral Symposium, four individuals were issued citations. Pat Haynes reported in the *Mineral News*:

> The big news was talking to collectors who, the previous weekend, were issued $100 citations for a violation that was something to the effect of "removing natural features from a National Forest." (This has been done a few times during the last couple of years for mineral collecting in restricted areas in Wilderness Areas. The regulation is: 36 CFR 261.9 (b). Ed.) It seems that the Forest Rangers responsible for the White Mountain Wilderness Area do not want to allow any collecting of the Smokey Bear prospect quartz crystals. Specimens are confiscated and citations are issued.

The cited individuals, Ray DeMark (*Zuni Mining & Minerals*), Wayne Holland (*Gold Strike Mining Company*), Brian Huntsman (*Midnight Mining*), and Mike Sanders challenged their citations. They went before the Federal Magistrate judge in Alamogordo, New Mexico, on April 2, 1990. They won their case—the clincher being that Mr. DeMark had obtained written permission beforehand to "rock hound." The U.S. Forest Service was ordered to return all confiscated material.

Rumors indicated that the U.S. Forest Service continued their investigation and patrol for Smokey Bear quartz through February 1990. Considering the large amounts of material that showed up at the September 1990 Denver Gem and Mineral Show and Houston Show without any confiscations, and the dismissal of the charges on April 2, 1990, it appears they have given up their witch hunt.

GEOLOGY

The Smokey Bear claims lay atop the Three Rivers stocks. This intrusive body is exposed over 75 square kilometers surrounding Sierra Blanca Peak. The stock is a miarolitic leucosyenite consisting of up to 80% anorthoclase phenocrysts coated with microperthite or alkali feldspar grading into microperthite. The phenocrysts reach 2 cm and occasionally have miarolitic centers to 2 mm. K-Ar dating indicates crystallization during the Oligocene period 25.8 $\pm$1.1 million years ago. The other constituents are hornblende, biotite, magnetite, apatite, zircon, orthoclase and quartz (Giles and Thompson, 1972).

Unusually large miarolitic cavities lay along a vertical shear zone trending N33°W. One cavity measured 1.0 meter wide, 1.2 meters high, and 15.0 meters long, plunging 30° and striking S26°E. When the shear zone and 29 other fractures are plotted on a Wulff net their pattern indicates the principal stresses. When the plane containing the major and minor stresses is compared to that of the N33°W plane, their intersection delineates the same observed orientation of the miarolitic cavity described above. This suggests that the stress field which created the miarolitic cavities also caused the shear zone that preferentially bisected these cavities after the syenite solidified.

In addition to the stress field, xenoliths appear to have played an important role. They are found exclusively at the cavity-syenite boundary. Apparently, these fragments either added volatiles or sufficiently reduced the local mean stress for the volatiles to collect and form miarolitic cavities.

Just north of the deposit is a finer grained (0.3 to 0.7 mm) equigranular syenite (Giles and Thompson, 1972; Sergerstrom *et al.*, 1979). It intruded nearly parallel to the N33°W shear zone. Also, it is suspected of being the heat source that drove the mineralizing fluids into the fractures and most of the miarolitic cavities, resulting in the mineral assemblage found today.

MAJOR POCKETS

For convenience in discussions and record-keeping, the major pockets found have been given names. Following is a description of their individual contents.

Gem Forest #1

On the second trip to the deposit, an open pocket with dimensions near 50 cm (h) by 50 cm (w) by 1 meter (d) was discovered. This pocket produced long, thin crystals to 7.6 cm (3 inches) in length. After cleaning, these specimens are highly lustrous and gemmy.

Gem Forest #2

Similar to Gem Forest #1 above, Gem Forest #2 was unfortunately heavily intergrown with plant roots which caused much cluster and plate damage. The suspected allanite crystal was found here.

Bear Den

So far, Bear Den is one of the largest pockets found. It is approximately 1.7 (h) by 3.2 (d) by 5.1 meters (w). This was a highly prolific pocket characterized by crystals which are in general darker colored and more stubby than those of other pockets. They have fair luster. The largest crystal found in this pocket is 6.5 by 20 cm. Numerous large plates were extracted, the largest being 40 by 75 cm and thickly covered with crystals from 1 to 15 cm.

The Seam

When the Seam pocket was first discovered, it appeared to be merely a thin vein or seam of quartz with little promise. However, it eventually opened up into a diagonal pocket with dimensions of near 1.2 (h) by 3 (d) by 5 meters (w). The Seam produced the widest variety of crystal sizes. They range from small needle-like crystals of around 1.5 mm by 2 cm in size to one crystal of over 40 cm (16 inches) in length. Unfortunately, this crystal was contacted with matrix along its entire length, so was not good enough to keep. Luster on crystals from this pocket is generally dull; however, it did improve with depth. Color ranges from slightly to moderately smoky. Apatite occurs as very thin needle-like crystals included in quartz, or on quartz, as a minor but not uncommon occurrence.

The Tardis

For those not familiar with the *Dr. Who* science fiction books and television series, this pocket was named after a vehicle which is larger on the inside than on the outside. Although the physical dimensions of this pocket were only 50 cm (h) by 50 cm (w) by 70 cm (d), it produced enough specimens to fill a pocket three times its size! Crystals from the Tardis range from 0.4 mm by 2 cm to 3 by 17.5 cm in size. Luster on these crystals is superb, and the phantoms are very sharp.

Energy Center

Energy Center is a group of adjacent, possibly interconnecting pockets. The largest is approximately 1.4 by 1.6 by 1.7 meters. Fluorite is abundant here as colloform growths of white to beige microcrystals. This group contained by far the most valuable pocket found, with a large quantity of high-quality specimens of smoky quartz crystals up to 22.5 cm in length. Quartz from this zone has excellent luster and sharp phantoms of medium smoky color. Several major specimens were found, including a 23 by 55-cm plate of 6-cm to 18-cm crystals standing in sharp contrast to numerous patches of white colloform fluorite.

Old Timer

The Old Timer is the largest of the pockets worked by the original locators. It is nearly 1.0 (w) by 1.7 (h) by 2.3 (d) meters. What came out of the pocket previously is unknown, but if the specimens left laying about and those we dug are any indication, it must have been very good. Quartz from this pocket is characteristically colorless near the terminations, becoming increasingly smoky near the base of the crystals. Their luster is excellent and the phantoms are sharp. One

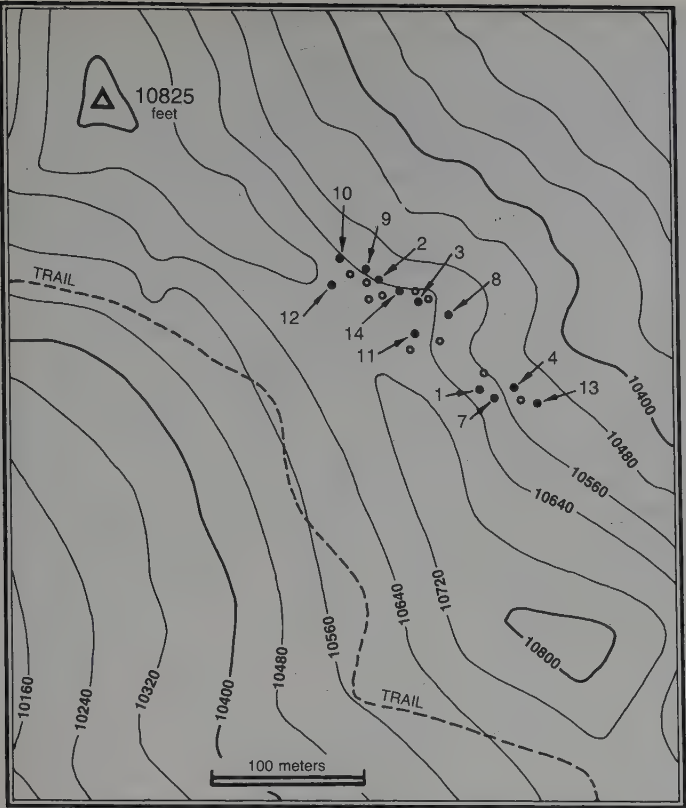


Figure 3. **Smoky quartz pockets in the area of the Smokey Bear claims. The major pockets were assigned the following names:**

1. Bear Den	**8. Misery**
2. Buster	**9. Old Timer**
3. Energy Center	**10. Polar Bear**
4. Fluorite #1	**11. Ridge Runner**
5. Gem Forest #1	**12. Ridge Top**
6. Gem Forest #2	**13. Seam**
7. Highway to Hell	**14. Tardis**

Other pockets, unnamed, are indicated by open circles.

major crystal group measures 12.8 by 18.2 by 20.4 cm with a long, doubly terminated crystal laying across smaller crystals and one 5 by 15-cm crystal towering above all others.

Ridge Top

Although not a large pocket, it produced fairly large quartz crystals averaging 2.3 by 10 cm and a few up to 8 by 26 cm. Ridge Top was one of three pockets that produced crystals showing distinct amethyst phantoms.

Polar Bear

Polar Bear produced the best amethyst phantoms of excellent quality, with superb luster.

Buster

A very small pocket which produced perhaps the most aesthetic cabinet-size specimen found to date: a 12 by 16 by 20-cm cluster of smaller crystals averaging 2 cm, with two larger doubly terminated crystals around 15 cm in length.

Fluorite #1

This pocket is only significant in that it was the main source of the green octahedral fluorite.

There were several other pockets of varying size that produced quartz of varying quality; none were particularly interesting compared to those listed above.

MINERALOGY

Allanite-(Ce) $(Ce,Ca,Y)_2(Al,Fe^{+3})_3(SiO_4)_3(OH)$

Allanite is suspected to have been present and responsible for irradiating the quartz to its characteristic smoky color. Allanite occurs commonly with the smoky Japan-law twinned quartz at the Mina Tiro Estrella and Capitan claims in the nearby Capitan Mountains. However, at the Smokey Bear claims only a few traces remain, generally as a black resinous coating on rock. One black 6-mm crystal resembling allanite from the Capitan Mountains claim was discovered, but was lost before it could be positively identified.

Apatite $Ca_5(PO_4)_3(F,Cl,OH)$

Apatite occurs in a long prismatic habit, terminated with a basal plane. Crystals to 3.2 cm long, in radiating aggregates and smaller singles, are found. They are often overgrown by or included in smoky quartz crystals or encrusted with a microcrystalline coating of quartz. The apatite is generally translucent, ranging in color from light green to colorless.

Fluorite CaF_2

Fluorite occurs as green octahedrons, some with purple centers, in aggregates of over 7.5 cm, with single crystals usually 3 to 8 mm (rarely to 1.7 cm). Fluorite also occurs as colloform aggregates of white to beige microcrystals. It is the last mineral of importance to be deposited.

Ferrimolybdite $Fe_2^{+3}Mo_3O_{12}\cdot 8H_2O$ (?)

Ferrimolybdite occurs sparsely as yellow powdery coatings.

Quartz SiO_2

Quartz is, by far, the most interesting mineral present. It is primarily smoky in color with phantoms; colorless to milky crystals are also common; amethyst phantoms occur only very rarely.

Crystal sizes range from 0.2 to 40.0 cm, averaging about 7 cm. In addition, roughly one crystal in 2500 is doubly terminated.

The smoky color is believed to have been created by ionizing gamma radiation (the process has been described by Nassau, 1988). When a gamma ray passes through impure quartz it can expend part of its energy into an O^{-2} ion within an $Al^{+3}(Na^+,H^+)(O^{-2})_2$ contaminant cell. When this excitation occurs, an electron is stripped away from its paired oxygen electron. This event leaves behind an O^{-1} ion. The unpaired valence electron around the O^{-1} ion is the reason for the smoky color.

An unusual aspect of Smokey Bear quartz is the phantoms. They appear as alternating colorless to lightly smoky planes parallel to the terminal rhombohedron. The darker the phantoms, the higher the aluminum content. The aluminum (and iron) content variation of the quartz is likely the result of a fluctuating boiling zone, dynamic cycling, and changes in oxygen potential.

Upon comparison of the phantoms, a definite pattern appears. Phantoms, like tree rings, delineate stages of growth. A study of these (phantomchronology) has given us a comparable record of quartz crystal growth throughout the deposit. This log may be used to compare the growth stages of individual crystals from separate pockets. The complete growth period ranges from nucleation, through an inclusion period, a rare amethyst period (limited to a few northwesterly pockets), an inclusion period, dark and light smoky phantom series, and finally to termination.

After irradiation the quartz is suspected to have undergone a flash heating to over 440°C. At this higher temperature, displaced electrons can move back to their original positions ($O^{-1} + e^- \rightarrow O^{-2}$), thereby, bleaching smoky quartz back to its original colorless state (Cohen, 1989). Evidence for this occurrence is four-fold. Firstly, some crystals have burst along fluid inclusions, separating their tips from their bases. The crystal tips are completely clear; their bases, kept cooler by the

Figure 5. **Smoky quartz group, 15.5 cm, from the Buster pocket, Smokey Bear claims.**

Figure 4. **Washing a museum-size specimen of smoky quartz with colloform fluorite spherules, from the Energy Center pocket.**

surrounding rock mass, remained smoky. Secondly, fluid inclusion temperatures range from 417° C to 440° C (Dave B. Mitcheltree, 1989, unpublished report). Since crystal growth occurred within this range, crystal bursting must have occurred above 440° C. Thirdly, some crystals have quenching fractures as a result of rapid cooling and/or heating. Lastly, a breccia pipe is exposed on the northwest extension of the vein. This suggests an explosive eruption of hypothermal fluids. This eruption would be analogous to shaking a pop bottle up then uncorking it. As this eruption occurred, hotter water streamed upwards into the cooler environment of the smoky quartz. A few crystals burst, exposing the points to the hotter water. The points were bleached colorless; the bases acted as heat sinks and remained smoky. This theory is opposed to freeze-thaw theory which would explain the fluid inclusions bursting but not the color loss.

Also, in our explorations during and after our collecting project of 1987, we found similar smoky quartz crystals in the area, but outside of the wilderness boundaries. Crystals may be found about 800 meters to the south on the slopes of the Sierra Blanca Ski Area (leased by the Mescalareo Apache Indians), and in the valley east of the major deposit. In both cases, so far, the specimens found are "float," but surely pockets occur.

CURRENT STATUS

As of this writing collecting is allowed; however, this could change at any moment. Collecting is restricted to removal of one specimen of surface material only. This effectively deters the casual collector, because the deposit is very remote. If you should decide to visit the locality, first call or write to determine the current collecting status:

Lincoln National Forest,
Smokey Bear Ranger District
Attn: District Ranger
901 Mechem Drive
Ruidoso, NM 88345
(505) 257-4095

Remember this locality is isolated, subject to frequent storms and at a high altitude with rugged relief. Words cannot describe how bone-chilling cold and wet one can get. The risks of hypothermia, high-altitude sickness, and heart attack should not be taken lightly. Other hazards are vertical relief and wildlife. Be prepared.

NOTE

Old specimens collected before January 1, 1984, should carry no restrictions as to their sale or trade, since they were collected before the ban on commercial collecting in a wilderness. The labels from

Figure 6. **Cabinet-size crystal group of smoky quartz from the Smokey Bear claim. Kirby Siber collection; photo by Roland Stucky.**

this era should read similar to this: "Crystal" or "Bonita Crystal" claim, Lincoln County, New Mexico.

World-class quartz crystals have been found in other Lincoln County localities, notably the Japan-law smoky quartz twins from the Mina Tiro Estrella claim. They come from a valid claim.

If you ever intend to enter any public land administered by the United States Forest Service for any purpose, we suggest that you carefully read and understand the law as specified by U.S. Code; 36 CFR Part 261.

ACKNOWLEDGMENTS

We would like to thank Robert M. North, former mineralogist for the New Mexico Bureau of Mines and Mineral Resources, for his identification of the apatite and colloform fluorite. We would also like to thank Robert Eveleth, Mining Engineer, and Marc Wilson, mineralogist (NMBMMR), for supplying legal references.

(continued overleaf)

REFERENCES

COHEN, A. J. (1989) New data on the cause of smoky and amethystine color in quartz. *Mineralogical Record,* **20**, 365–367.

GILES, D. L., and THOMPSON, T. B. (1972) Petrology and mineralization of a molybdenum-bearing alkalic stock, Sierra Blanca, New Mexico. *Geological Society of America Bulletin,* **83**, 2139.

HAYNES, P. E. (1989) 1989 New Mexico mineral symposium. *Mineral News,* **5** (12), 4.

JOHNS, N. G. (1988) United States District Court, Judicial District of New Mexico, Search Warrant dated July 21, 1988, Case Number 88–1789M, attachment 3.

KOHNEN, T. (1990) The gem and mineral shows in Denver, 1990. *Mineral News,* **6** (10), 2.

LANDON, S. (1988) U.S. agents confiscate rare crystals. *Albuquerque Journal.*

MITCHELTREE, D. B. (1989) Fluid inclusion study of the Smokey Bear quartz deposit quartz, White Mountain Wilderness, Lincoln County, New Mexico. Unpublished Report, Geoscience Department, New Mexico Institute of Mining and Technology.

NASSAU, K. (1988) The 13 colors of gems and minerals. *Lapidary Journal,* **41**, 35 and 69.

SEGERSTROM, K., STOTELMEYER, R. B., and WILLIAMS, F. E. (1979) Mineral resources of the White Mountain Wilderness and adjacent areas, Lincoln County, New Mexico, *U.S. Geological Survey Bulletin* **1453.**

SMITH, A. (1990) News from the Houston Show, September 1990. *Mineral News,* **6** (10), 3.

UNITED STATES DEPARTMENT OF THE INTERIOR (1985) Surface minerals management map, "Ruidoso"—SE 11 sheet, U.S. Printing Office: 1984–780–279/25,000.

UNITED STATES DEPARTMENT OF THE INTERIOR—GEOLOGICAL SURVEY (1988) Collecting rocks, U.S. Printing Office, 557, 218, 760.

UNITED STATES FOREST SERVICE—BUREAU OF LAND MANAGEMENT (1983) Wilderness on federal lands in Arizona: Q's & A's about wilderness and wilderness study areas managed by the Forest Service and Bureau of Land Management.

UNITED STATES GEOLOGICAL SURVEY (1982) Nogal Peak, New Mexico 15-minute Quadrangle.

WILSON, W. E. (1988) What's new in minerals. *Mineralogical Record,* **19**, 116, 211.

WILSON, W. E. (1989) What's new in minerals. *Mineralogical Record,* **20**, 70–71.

WOLKOMIR, R., and WOLKOMIR, J. (1988) Drug outlaws in our national forests. *Readers Digest,* August, 193–200.

EDITOR'S NOTE

Although the authors of the above article were displeased with the treatment they received from the U.S. Forest Service, it should be noted that in many areas of the United States the Forest Service is accommodating and friendly toward mineral collectors and researchers. And considering the chances agents face of encountering drug smugglers or other armed and dangerous miscreants, it is quite reasonable for Forest Service personnel to go armed. In any case, the best procedure is always to contact the Forest Service in advance of any collecting forays into restricted or possibly restricted areas.

THE RESURRECTION OF STERLING HILL

Pete J. Dunn
Department of Mineral Sciences
Smithsonian Institution
Washington, DC 20560

Bernard T. Kozykowski
Route 55
Barryville, New York 12719

Locality preservation, only a conceptual ideal for many, is in vigorous practice at Sterling Hill in Ogdensburg, New Jersey. Private investment and inspiration, legions of volunteers, and dedicated leadership are preserving a famous locality. The Sterling Hill Mining Museum is operational.

INTRODUCTION

Located in the New Jersey Highlands, some 45 miles from New York City, are the two most unusual and enigmatic mineral deposits on our planet. The closely related Franklin and Sterling Hill orebodies are located in the boroughs of Franklin and Ogdensburg, respectively, in Sussex County, New Jersey. These orebodies are exotic in many ways; foremost among these is the abundance and unique association of the primary ore minerals: willemite, franklinite and zincite. The deposits are host to more than 330 minerals (a mineralogical record), which is approximately 10% of all known species; Franklin and Sterling Hill are the type localities for 67 species (also a record), about half of which are found nowhere else. These include species with names drawn from the local area, such as ogdensburgite, minehillite, franklinfurnaceite, kittatinnyite, sussexite, wallkilldellite, sterlinghillite, hardystonite and others. The deposits are renowned for their fluorescent minerals; over 70 species found there exhibit fluorescence under ultraviolet radiation. The deposits' reputation for well-crystallized specimens, unique assemblages, brightly fluorescent minerals, giant crystals, rare and exotic species, and a very colorful mining history, ranks them first among the mineral localities most interesting to the serious collector.

The Franklin mine closed in 1954 and only scattered structures remain of operations there. The Sterling mine closed in 1986, and might have suffered the same demise. However, herculean efforts have been made and are still underway to preserve as much of the mine as can be saved, and the property has been converted into a mining museum.

It is not the purpose of this paper to provide detailed descriptions of the history, geology or mineralogy of the Sterling Hill deposit, but rather to provide a general framework for understanding the importance of the Sterling mine's preservation and the tour offered there. Historical aspects are still being researched; the given information is based on what has thus far been published, and may be changed as new information is developed. Because there are very few large, deep mines in the East, and no deposits like those at Sterling Hill and Franklin elsewhere on our planet, the preservation of Sterling Hill is a very important undertaking to scientists, collectors and historians alike.

EARLY HISTORY

The Sterling Hill and Franklin deposits have an extensive and colorful history, only a small part of which is related here. Much of the local history pertains to both deposits, and Franklin was clearly dominant until 1954, but the following partial historical summary is written with an intentional focus on Sterling Hill.

The earliest discovery of the Sterling Hill orebody is shrouded in speculation. The orebody had been exposed by erosion, probably during the late Precambrian (there is proof of this at the neighboring Franklin deposit) and was again denuded by Pleistocene glaciation. The massive east limb of the deposit was boldly exposed on the wall of the beautiful Wallkill Valley, and must have been obvious to any passersby. The local Indians, a tribe of the Lenni Lenape, visited the valley and were most likely aware of the deposit, which had colorful rocks on the surface unlike those found anywhere else in their domain (indeed, in the world!). The Lenni Lenape might well have been the first human discoverers, and the first local mineral collectors as well; lennilenapeite is named in their honor.

It has been suggested by Farrington (1852) that the Sterling Hill deposit might have been found, tried, and found lacking by Dutch miners who were sent as prospectors by their Governor in 1624, and

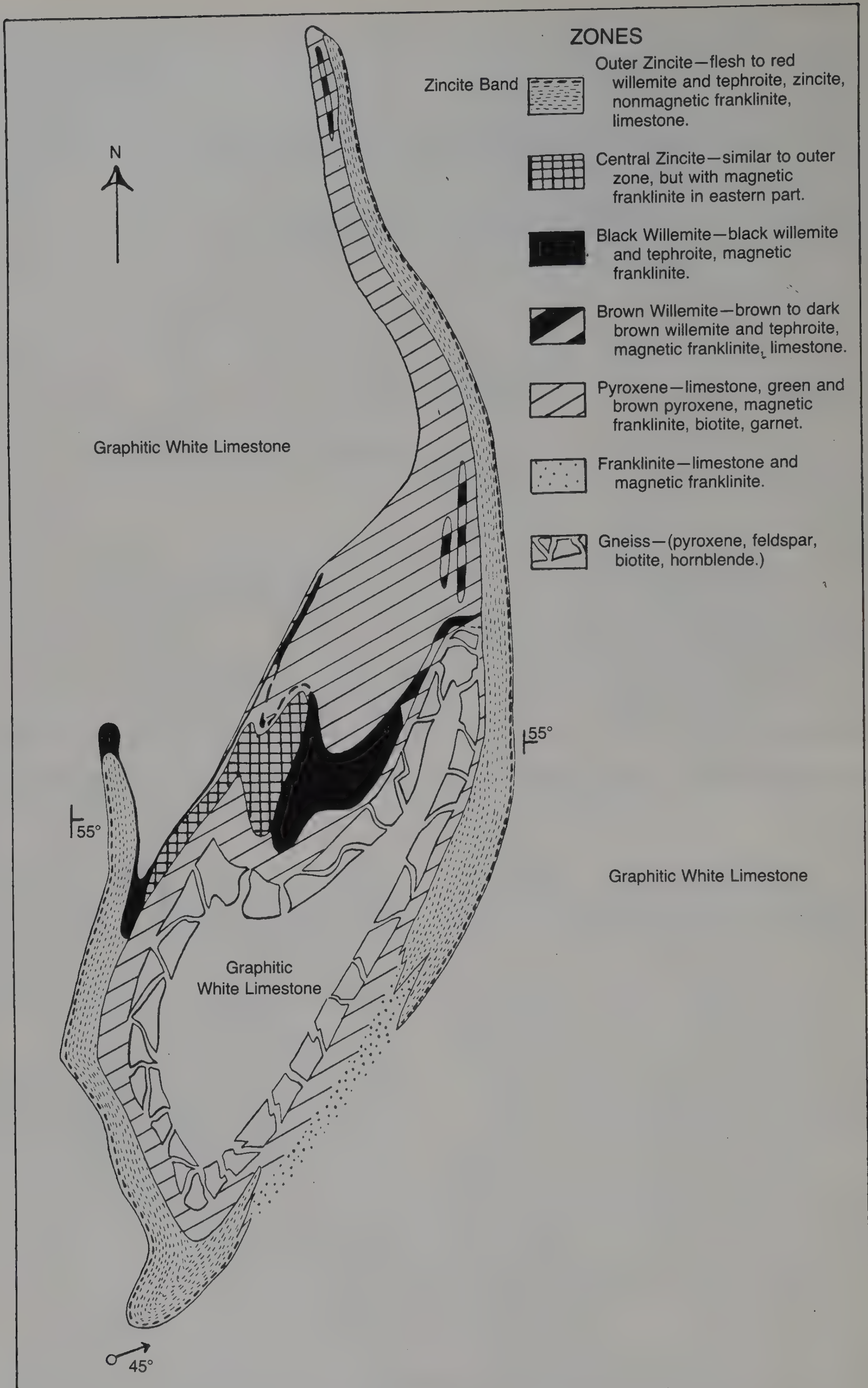


Figure 1. Plan-view of the Sterling Hill ore deposit from Metsger *et al.* (1958). Areas marked as "limestone" are marble. The "north" arrow is for an internal New Jersey Zinc Company coordinate system; true north is approximately 19° west of the direction shown here. Scale was not provided.

***Figure 2.* View of Plant Street level from the southeast. The Sterling Hill Exhibit Hall is the large central structure. The ore conveyor and shipping bins are in the background. Photo by Bernard Kozykowski.**

who had entered the nearby Minisink Valley by 1640. Presumably they might have found the Sterling Hill deposit while wending their way up each river valley as they moved inland from the Hudson River, and up the connecting Wallkill River which drains both the Franklin and Sterling Hill deposits. The Dutch mined copper ore at Pahaquarry, near the Delaware Water Gap, and might also have tried the Sterling Hill ore for copper (Farrington, 1852). Although no records remain of the probable Indian or Dutch efforts, speculations regarding them are reasonable conjecture and consistent with local legends and folklore.

Although early 18th-century land records reportedly refer to a "Copper Tract" in or near the area now known as Sterling Hill, copper was not economically recovered here. The abundant, then-unnamed zincite, however, could well have been mistaken for cuprite. Also, there are some secondary copper minerals exposed locally at the surface, and these might have been more abundant in historical times. A 1749 survey mentioned "old mine holes," later described by Alger (1845) as crude shafts some 5 or 6 meters into the marble; Farrington (1852) also reported old shafts and mining galleries there. Dendrochronological studies of a red cedar tree growing in the ancient pits dated the pits to *not later than* 1739 (Jackson, 1852; Farrington, 1852). Lord Stirling (William Alexander) owned or leased part of what is now Sterling Hill between 1761 and 1776, and attempted in vain to use the ores. In 1772 several tons of "red ore" (later named zincite) were shipped to Swansea in Wales for smelting, but this effort was unsuccessful as well.

The true nature of all three of the abundant primary ore minerals at Sterling Hill was then wholly unknown to science. The chemical composition of zincite was determined in 1810, and those of franklinite and willemite in 1819 and 1822, respectively. It is important to realize that the exploitation of the ores here went hand-in-hand with the development of the sciences of mineralogy, petrology and economic geology; with the development of the zinc and zinc-based paint industries; and with the growth of the United States as a nation.

THE STERLING HILL ORE DEPOSIT

The orebody at Sterling Hill is completely encased in the Precambrian Franklin Marble, as is its sister-deposit at Franklin, some 3 miles north. The deposits were strongly metamorphosed approximately 1 billion years ago, and the original mineralogy is unknown. The orebody is chemically and mineralogically zoned, but its detailed geology has not been described; only general relations appear in the literature (Metsger *et al.*, 1958). The ore, while deeply buried, is inferred to have sunk through the less-dense marble (Metsger *et al.*, 1969), and to have been strongly folded during the sinking process.

The orebody is shown in Figure 1. It has a hook-like surface expression and at depth has the general form of a syncline, plunging 45° to the east-northeast. According to Metsger *et al.* (1969), the orebody is:

> a complex series of attenuated isoclinal folds, which modify the west limb of a larger, but similarly attenuated, isoclinal syncline. Structures in both the ore and the infolded wallrock demonstrate extreme plastic deformation during folding. The structural complexity of the ore body is much greater than that of the surrounding region.

It is not our intent to describe the geology of the deposit in detail; its structural complexity precludes any simple description.

The surface manifestations of the orebody, as encountered by a visitor, are a long east limb, a shorter west limb, and a cross-member nearly connecting both limbs. Much of the geology of the orebody is still discernible at the surface; in part, it can be studied in place, even today. It is a spectacular resource for scientists and collectors alike.

MINING AT STERLING HILL

At Sterling Hill, as well as at the nearby Franklin deposit, there has been a long history of numerous small, uncoordinated mining operations; many passed into obscurity without a trace. For the purposes of this limited discussion, it is convenient to consider Sterling Hill mining in three distinct phases which overlapped in time. These are: mining of iron ore; mining of secondary, mostly surficial zinc deposits; and mining of the primary zinc ores.

Mining of Iron Ore

Although Sterling Hill is a zinc deposit with franklinite, willemite and zincite as the primary ore minerals, there was a period of iron mining. The franklinite ore at the extreme southern end of the deposit is anomalous; it is zinc-poor and iron-rich, and was mined as an iron ore from about 1877 to 1882. Approximately 45,000 tons were mined in the first two years. The ore was obtained from the deposit at the east side of its southernmost keel, near where the two limbs of the deposit join, and near the Noble mine which was worked for hemimorphite (locally called calamine), as discussed below. The iron ore was removed in part through a 97-meter haulage tunnel through the east side of the hill; the opening of this tunnel is still visible from Plant Street. The ore, although low in zinc, was still franklinite (not easily smeltable then in pure form), and could only be simply processed if mixed with other iron ore (such as locally abundant magnetite) in a proportion not exceeding one-fifth of the total furnace charge. As mining progressed, however, the ore became increasingly zinc-rich and thus (at the time) unusable; iron-mining operations were then permanently suspended.

Mining of the Secondary Zinc Deposits

Deposits of hemimorphite overlying the orebody, and mined from open pits, were known to Dr. George Cook, the State Geologist, prior to 1864; but nothing is known of their discovery. The smaller of these pits was between the orebody limbs, over the southernmost bend in the orebody, and was called the Noble pit or Noble mine. It was worked from 1860 to 1870 for hemimorphite.

The larger pit, north of the Noble mine, was also situated between the east and west limbs of the orebody, and south of the cross-member. It was called the Passaic pit or Passaic mine and was worked by the Passaic Zinc Company. Hemimorphite was mined in great abundance here and was washed free of mud in a primitive, on-site log-washer. Specimens of this white, lustrous, rough-surfaced hemimorphite have been distributed world-wide, and were referred to as "calamine" and "maggot-ore." The name "Passaic mine" was also applied to the concurrent mining activities of the Passaic Zinc Company in primary ore.

Sterling Hill is well known for enormous crystals (tens of centimeters) of augite (jeffersonite), fayalite (roepperite), gahnite, franklinite and other minerals. These were first found at the surface, in the weathered material in the open pits, and have since made their way into collections around the world.

Mining of the Primary Zinc Ores

Early efforts

Organized mining of the primary zinc orebody was undertaken prior to the exploitation of the calamine pits, by the Sussex Zinc and Copper Mining and Manufacturing Company and the New Jersey Exploring and Mining Company. These firms merged and were acquired by the New Jersey Zinc Company in 1852; in 1880 the name of the company was changed to the New Jersey Zinc and Iron Company. These companies operated the first underground workings to be known as the Sterling mine, located in primary ore on the northern part of the east limb of the orebody. Mining continued sporadically, possibly until 1896; the published record of operations is incomplete (Shuster, 1927).

In the same general area, a shaft referred to as the Pierce shaft was in place by 1868 and, like the Passaic Zinc Company's operation, had its own engine-house and blacksmith shop. It was likely operated by the New Jersey Zinc Company.

Early holdings of the Consolidated Exploring and Mining Company were acquired by the Passaic Mining and Manufacturing Company (later renamed the Passaic Zinc Company), which mined primary ore both at the southern end of the east limb and along the west limb; they also mined hemimorphite in the Passaic pit. Later, the Passaic Zinc Company sunk a 152-meter shaft, known as the Marshall shaft, in the primary ore of the east limb, and operated small crushing mills.

Thus we find that there were periods when three separate mining companies operated here simultaneously. For example, in 1868 the New Jersey Zinc Company was mining primary ore along about 150 meters on the north end of the east vein; the Passaic Mining and Manufacturing Company was mining primary ore on an equal portion at the southern part of the east vein; and a Mr. Noble was mining secondary ore at the bend at the convergence of the veins. There were numerous other shafts and openings, but they were unnamed for the most part. On-site transportation of ores was by company-owned cable and rail trams.

The Sterling Hill properties, together with those at Franklin, were unified in what was called The Great Consolidation in 1897. This ended an extended 40-year period of litigation and resulted in the unification of the competing mining interests at Franklin and Sterling Hill under one umbrella company, the second New Jersey Zinc Company. Henceforth all the former operations at Sterling Hill were referred to collectively as the Sterling mine, a term that had previously been of more restricted use, as noted above.

Post-consolidation mining

After the 1897 consolidation of the various mines and entities, attention turned to the larger deposit at Franklin. There, after a period of deliberation by the new company, a new shaft (the Palmer shaft) replaced the Parker Shaft, and a new mill (Mill #2, or the Palmer Mill) replaced the Parker Mill (Mill #1). Both were completed by the end of 1910.

There was apparently very little activity at Sterling Hill during this period (1896–1910), and the mine was full of water in 1901. Once the Franklin operations were well underway, however, organized activity returned to Sterling Hill, and exploratory drilling commenced in 1910. A new shaft was developed and a new concentrating mill was constructed between 1913 and 1915. This new shaft, which reached a depth of more than 564 meters, was known by several names (Operating shaft, East shaft, and later, the Old shaft). The concentrating mill, known as the Sterling Mill, was modeled after the new mill at Franklin. The Sterling Mill processed 450 tons of ore per day to produce ore concentrates, which were then shipped by rail to Palmerton, Pennsylvania, to be processed into zinc metal (spelter), zinc oxide and other products.

Mining in the last 40 years

Franklin was the larger deposit, and was more easily worked; thus it continued to draw most of the local attention and resources of the New Jersey Zinc Company until the mine was exhausted and closed in 1954. As the demise of the great Franklin mine approached, increasing attention was focused on the Sterling Hill deposit.

Starting in the late 1940's, and continuing until the late 1950's, the New Jersey Zinc Company refurbished the Sterling mine, adding a new crushing mill, shops, headframe, hoist-house, conveyor, loading and shipping equipment, and a new five-compartment shaft (the West shaft, or the new shaft). The West shaft was accessible not only at the surface (headframe area) but also through an adit driven 137 meters west into Sterling Hill. Additionally, another shaft was developed underground (the North shaft), which operated from the 564-meter (1850-foot) level to a depth of 830 meters, well below the bottom mining level (785 meters), to exploit a deep northward extension of the orebody, called the north orebody.

Economic factors, including a drop in the price of zinc, resulted in a slowdown, and the mine was shut from 1958 to 1961. During this time, much planning was done and the method of mining was changed. The new facilities became fully operational in 1961, and the mine continued in operation until its eventual closing in 1986.

After these improvements in the facilities, the Sterling mine's ore was subjected only to on-site bulk-crushing and pulverizing, and then shipped unsorted to the New Jersey Zinc Company's processing facilities at Palmerton, Pennsylvania. The East shaft was abandoned and used only for ventilation, and the old Sterling Mill was subsequently demolished.

CLOSING

The Sterling mine was operated at a near skeleton-staff level in its last years, in part due to the low price of zinc and in part due to numerous other economic and mining factors. The mine was closed on the eve of Good Friday, in March of 1986. The workings were dismantled in late 1987, and the shafts were capped in early 1988.

The company had been embroiled in ongoing property-tax disputes with the Borough of Ogdensburg for years and this legal activity played a pivotal role in the mine's closing well before it was exhausted. The story has been partially told from the perspective of the Borough's mayor (Horuzy, 1990). The details of the dispute need not be described here, but it can be said that misjudgments were made. In April of 1988 the Borough took title to the property by foreclosure and entered into a period of deliberation as to the disposition of the property. After lengthy consideration, it was decided to sell the property at auction.

ACQUISITION BY THE HAUCK BROTHERS

On March 7, 1989, the Borough of Ogdensburg auctioned off the approximately 70-acre lot, having partitioned it into a nearly 40-acre undeveloped woodland parcel and an approximately 30-acre parcel containing the Sterling mine. The undeveloped non-mining area was purchased by Ahmed Elbarki for $665,000, and the Sterling mine and its various above-ground facilities were purchased for $750,000 jointly by Richard Hauck and Phillips Enterprises. Subsequently, the Sterling mine parcel was partitioned further, part being divided off to Phillips Enterprises, Ltd., which now owns the top of the hill, including the former hoist-house, crushing building, and various shops. The Hauck brothers, Richard and Robert, who formally took title to the mine property on June 16, 1989, have retained the mine workings, adits, shafts, open-pits, ore-loading bins, core-shed, mine office, the administration building and change-house on Plant Street, and the headframe structure on top of the hill. In 1989, the Sterling Hill Mining Company was formed, and a massive and vigorous effort to preserve this mineral locality commenced.

RESURRECTION

At first there was euphoria, a surge of joy in the mineral community seldom experienced in the local area as uniformly as it was then; the whole local *mineralculture* celebrated. At last there was real hope that the same fate would not befall Sterling Hill as happened at Franklin, only a few miles north, where only remnants remain of a once-great mining and milling operation. After the well-deserved celebrations, the work began.

All was not sweetness and light. The New Jersey Zinc Company had recovered some of their capital by selling off many salvageable assets. At the surface much of the mining equipment was gone, but some would be recovered later underground. The physical plant that remained was in poor condition; the immediate challenges were daunting and great efforts were needed just to preserve the infrastructure and basic necessities. The capital improvements needed immediately included new roofs on half the structures, new heating systems for surface buildings, and a totally new electrical service to the mine site itself, with much rewiring to provide full electrification of the facilities.

***Figure 3.* Sign at entrance to the Sterling Hill Mining Museum, complete with the Museum's logo, designed by David Woods.**

Also needed were new connections to the local water system, new septic systems and septic fields, and even new roads. All this had to be given priority, ahead of the principal goals of locality preservation. These basic but very costly needs were attended to promptly; full attention and energy were then turned to the more important, awesome, and challenging tasks of redevelopment and the creation of the Sterling Hill Mining Museum.

Like the physical facilities, the mine was also in need of attention. The entrance to the main adit had been sealed with 20 cubic meters of concrete which had to be painstakingly chopped out, inasmuch as blasting would have damaged the surrounding structures. After much back-breaking labor, the Haucks were in the mine within a week of taking title to the property, and its repair and renovation began immediately.

A COMMUNITY EFFORT

Although it was the motivation, inspiration, hard work and investment risks of Richard and Robert Hauck that led to the successful preservation of Sterling Hill, they did not do it alone, and they are both very emphatic on this point. The credit is widely shared. A great many people stepped forward to help, to work for free, to donate their time, talent and equipment, to prepare exhibits and to assist in funding. The helpers came from near and far, and from all vocations: ex-miners (young and old), geologists, mineral collectors, professionals, business people, electricians, plumbers, mechanics, mineralogists, community leaders, memorabilia collectors, aficionados of all kinds and, in particular, former zinc company employees, all proud that something of their heritage was to be saved.

This great assemblage of helpers did not merely applaud, wave their arms, or cheer; they dug dirt, smashed concrete, removed debris

Figure 5. **In ultraviolet light, the same image as seen in Figure 4, showing much red-fluorescent calcite, green-fluorescent willemite, and many other fluorescent minerals. Photo by Henry Van Lenten and Ron Cedar.**

Figure 4. **In visible light, the Rainbow Room with the area of Figures 6 and 7 shown at the distant end behind a safety barrier ~11 feet long. The zinc-miner (6'2" tall) is studying a large exposure of willemite and calcite, and boulders of ore brought up from deeper levels. Photo by Henry Van Lenten and Ron Cedar.**

by the thousands of cubic meters, and they did it together, in unison. They were often knee-deep in rock, mud, muck and grease; they went wherever hard work was needed. They scraped, painted, restored and recovered whole areas previously left to rot and rust away, and they did all sorts of things one would never think of doing for mere money. Together, inspired by the dedicated leadership of the Hauck brothers, they shoved, pulled and energetically wrested the Sterling Hill Mining Museum into existence. Less than 15 months after taking title, the Sterling Hill Mining Museum was opened to the public. When you go there, find some of these helpers (it's easy) and thank them. It's a heritage we can all share.

At present (April, 1991), the pumps have been restarted and the rate of rising of groundwater has been appreciably slowed. The operation is State-certified to discharge pumped water. Present pumping is from a reservoir on the 500-foot level to which the surface inflow is directed. Plans are to use sump pumps to raise water from below the 600-foot level to the 500-foot level reservoir, from where it will be pumped to the surface, thus keeping the mine dewatered to below the 600-foot level. Much of the geology of Sterling Hill can be studied on and above this level. With pumping, the potential for continued scientific research here is unlimited.

THE MILL RUINS

Earth-moving was needed on a large scale to make this former industrial site accessible to the public and to make the property safe for visitors, as well as to enhance the tour. In the extensive process of earth moving, a long-forgotten basement in the foundation of the original Sterling Mill (built in 1913–1915) was uncovered, along with the top station for the old East shaft. The mill had been razed in the 1960's, covered with rubble, soil and tailings; it had been largely forgotten. The discovery of the mill's basement provided the Hauck brothers with 5 immense rooms, each approximately 5 x 24 meters, totalling over 560 square meters. It was a wholly unexpected bonus! This space and the connected old-shaft station are intended for future development.

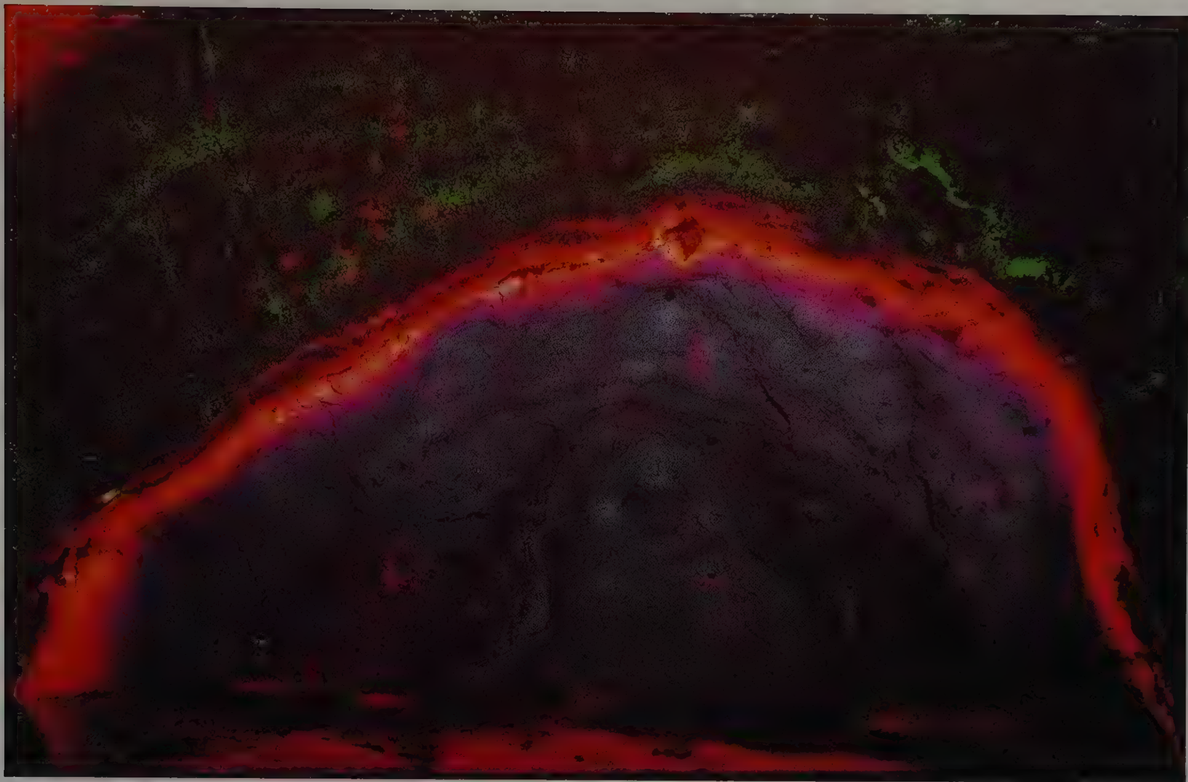


Figure 7. **In ultraviolet light, the same area shown in Figure 6 shows much veining of the dark zinc orebody (here only weakly fluorescent) by green-fluorescent willemite. Note that the host calcite fluoresces bright red near its contact with the orebody. The violet areas in these photos are false color and are due to the reflection of the visible component of the intense ultraviolet lamps used. Photo by Henry Van Lenten and Ron Cedar.**

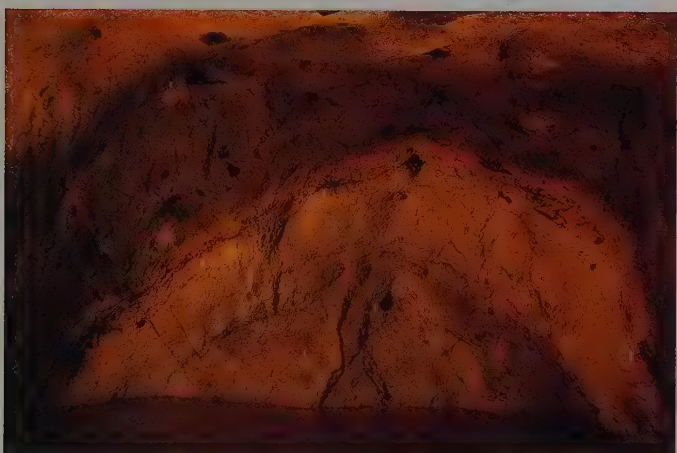


Figure 6. **In visible light, the west vein of the orebody (dark band) is exposed at the end of the Rainbow Room. The white (yellowish here) rock is the Franklin Marble. Photo by Henry Van Lenten and Ron Cedar.**

THE RAINBOW TUNNEL AND THE RAINBOW ROOM

The main adit, 137 meters in length, ended at the large shaft-station of the West shaft. To provide a greater experience for the visitor, a new 73-meter drift (The Rainbow Tunnel) was driven from a point near the shaft, southward toward the open cut. This effort consumed 2 tons of dynamite fired in 49 shots, and was completed on June 6, 1990. Just inside the egress from this long, new tunnel, a smaller heading was driven westward to intersect the west limb of the orebody. At this point, a small stope or room has been developed within the ore itself (Figs. 6 and 7). Because the ore (willemite) and its host rock (calcite) are fluorescent, the west limb of the orebody gives a brilliant and colorful response to ultraviolet light. Visitors stand within the mountain, in the midst of the orebody, surrounded by the great vein of red and green-fluorescing minerals and by great boulders of multi-colored fluorescent ore brought here from deeper levels (Figs. 4 and 5). The effect is truly spectacular on each and every visit.

THE STERLING HILL EXHIBIT HALL

The miners' change-house for showering and changing into street-clothes is located on the lower street-level, on Plant Street. This massive brick structure contains a great cathedral-ceilinged room, 15 by 30 meters, which was totally cleared; its walls and ceilings were sandblasted with over 8 tons of grit to expose the original brick and wood, and it was refurbished. Of over 6 tons of lockers once in place, only a few rows remain, newly adorned with the names of some of those who have helped to make this project happen.

This former change-house is now a fine exhibit hall with over 60 displays of mining memorabilia (local and otherwise), mining technology, minerals, blasting equipment, ultraviolet generators, mining-safety equipment, mining tools, antiques, and equipment for surveying, mineralogy and analysis. There are special exhibits on The New Jersey Zinc Company, the nearby Edison iron mines (an important part of local history) and many more subjects. Mineral specimens have a principal and special place in this exhibit hall. They vary from cabinet specimens collected long ago at Franklin and Sterling Hill to recently mined boulder-sized ore specimens which will delight geologists and collectors alike.

Figure 8. **Exit from the Rainbow Tunnel at the north side of the Passaic pit. The west limb of the orebody is to the left.**

Figure 9. **Entrance to the Sterling mine main adit on the main level. Tram-cars are used to transport materials to and from the shaft.**

MINERALOGICAL ACTIVITIES

Not only is the surface level of the mine being restored, but subsurface levels are being studied by qualified staff and by approved scientific investigators. Research on the deposit, its structure, geochemistry, genesis, and its minerals is being conducted at the mine and in numerous distant laboratories. Sterling Hill has long been recognized by scientists as a geologically important site, and much work is underway there.

Mineral-specimen preservation operations are conducted by experienced staff familiar with the mine geology. Such operations since the mine was reopened have resulted in the recovery of many hundreds of significant specimens of barite, franklinite, mcgovernite, realgar, zinkenite, stilbite, wollastonite and other minerals, some of them the best of their kind ever recovered from Sterling Hill. Enormous geologic specimens, too, are being collected, permitting the preservation of whole assemblages.

THE TOUR

The tour of Sterling Hill actually begins as one approaches on local routes. The headframe, conveyors and other structures all attract attention from a distance. Upon entering the main gate on Passaic Avenue, one passes an electric tram complete with locomotive and ore cars, which appropriately sets the theme for the museum. High overhead hangs the huge ore-conveyor; to the left stand four 8-story-high loading tanks once full of pulverized ore awaiting shipment.

After parking, one enters the mine-office building atop the site of the old Pierce shaft's blacksmith shop, which has been converted into public-use facilities. It now houses the ticket-office, a food concessionaire (week-ends and peak periods) and a museum-shop. The shop contains, in addition to books and educational materials, souvenirs promoting the deposit and museum, and various tourist items. Most importantly, the mineral collector is not forgotten and ten full vertical cases of mineral specimens are available for purchase from such dealers as Lawrence Conklin, Excalibur, Jim's Gems, Kristalle, Herbert Obodda, and the Sterling Hill Mining Company. The available specimens are from worldwide localities, and especially from the local zinc deposits.

Leaving the museum shop under the direction of a tour guide, one notes that there are also many exhibits outside. Nearby, where the footwall of the east limb of the orebody is in full view, one can see the East shaft (a.k.a. the Old shaft), the old mill ruins, and the more recent conveyor and ore-loading facilities, together with over 112 pieces of huge mining equipment.

The tour proceeds underground by entering the well-lit main adit, then passes the old safety exit (an old, now-defunct miners' emergency ladderway to the 1850-foot level), and proceeds to the West shaft. Along the way one passes the lamp-room which houses mining cap lamps, recharging equipment, maintenance facilities and other equipment used by the current staff. Then one arrives at the shaft-station, an immense chamber the size of a barn, and an important focal point of the tour. Here one experiences the scale of the mining operation while observing the immense machinery of the shaft-operations. The visitor is immediately aware that not all exhibits are in the formal exhibit hall; many are on the route, carefully perched and placed for

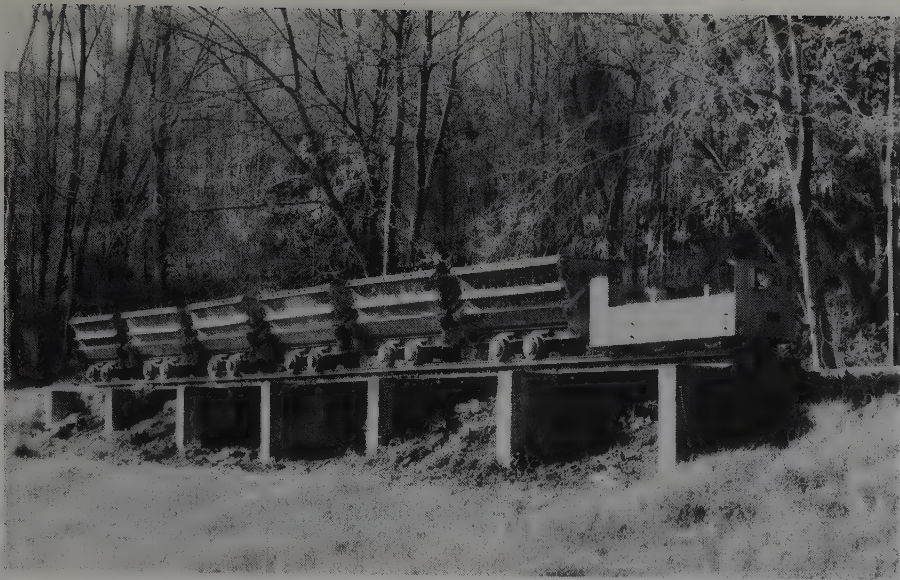
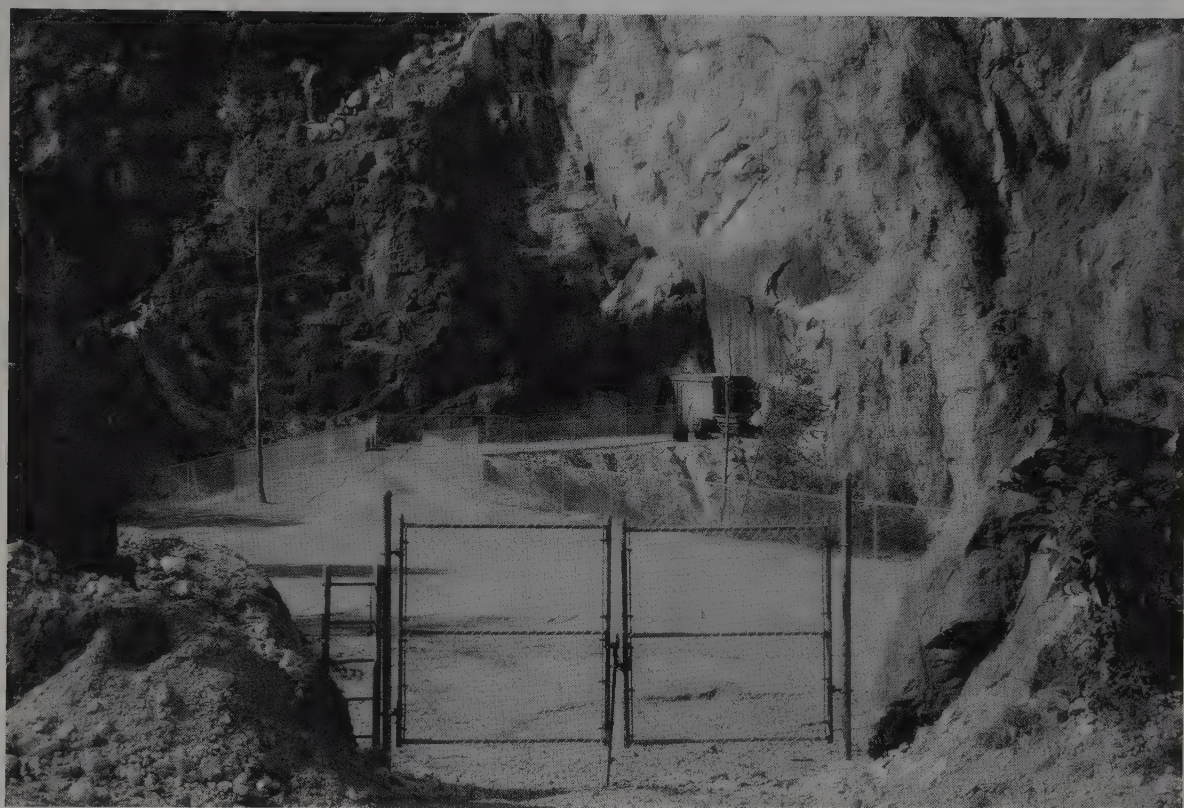


Figure 10. **Electric locomotive and ore cars at the entrance to the Sterling Hill Mining Museum.**

Figure 11. **View of the area around the Passaic pit, viewed from the east. The door is an exit from the Rainbow Tunnel, the west limb of the orebody is to the left of the door, and the cross-member of the orebody is to the right. The Passaic pit is also visible.**



educational and instructive effect. Moving toward the new southward-driven tunnel, one encounters an area where small objects can be tossed through a grizzly (a heavy steel screen for sizing ore), below which they fall with a resounding clatter down a huge ore-pass to about the 600-foot level. Further along, one passes a large historical exhibit of approximately 30 large mining drills, dating from 1905 to the present, and the "cap room," once used to store fuses and blasting caps; near this room is a core-drilling exhibit, complete with drill cores, showing how to "read-the-rocks."

The visitor then enters the newly-driven Rainbow Tunnel, which passes through white Franklin Marble, and observes fresh exposures of faults and joints. A bit further along, one enters the magnificent Rainbow Room described above. Dark at first, it soon becomes aglow with brilliant fluorescent colors. Here, most visitors stand in awe. It is difficult to depart. Another new adit, opposite the Rainbow Room, was driven to the east in the winter of 1990–1991 in an attempt to expose more of the orebody. It is 36 meters in length and will be used to illustrate drilling and excavation methods, and provide a darkened area for the examination of fluorescent specimens which are available for sale.

Leaving this fascinating underground walk, one emerges from underground and passes the foundations and ruins of the old mill, the "miners' passageway" leading to the exhibit hall described above. After enjoying all the exhibits, visitors can wend their way back upstairs to the museum-shop and parking area. The tour may start at different places along the way, due to weather or other local conditions, but will cover the same ground and exhibits.

The tour takes approximately 90 minutes; depending on how long one lingers with the exhibits, this can stretch to two hours. Group tours are available and can be geared to special interests: historical societies, schools, scouts, and mineral societies all have differing emphases and the tour guides can accommodate these. Restroom

Figure 12. **Sterling Hill Exhibit Hall in old miners' change-house; the baskets above were used to dry miners' clothing between work shifts. Photo by Bernard Kozykowski.**

facilities are more than adequate, and access for the handicapped is available. Parking is abundant and free, busses can be accommodated, and a picnic area is provided with ten tables. Visitors are advised to bring sturdy walking-shoes, secure child-restraints, and protection from the elements since part of the tour is in open-air. The mine is cool (56° F) year-round so a sweater or jacket is suggested. The length of the tour is less than a half-mile of very easy walking; half the distance is outdoors. Tours are given as needed, 7 days a week (the last tour is at 3:30 p.m.), and the facility is staffed from 10 a.m. to 5 p.m. The museum is open from March 1 through November 30 and has reduced rates for groups (10 or more) and for children. The mailing address is: Sterling Hill Mining Company, 30 Plant Street, Ogdensburg, New Jersey 07439; the telephone number is 201-209-7212.

AMENITIES AND DIRECTIONS

The Sterling Hill Mining Museum is located at the intersection of Plant Street and Passaic Avenue (enter from Passaic Avenue) in Ogdensburg, Sussex County, New Jersey. It is just a few miles south of Franklin, and about 45 miles from New York City in distance (and a million miles from it in all other respects). Motels are present in the area, but not listed in quality guides (for cause); campgrounds are available. There are many other local tourist attractions. While in the area, the mineral enthusiast might also wish to visit the fine and newly expanded Franklin Mineral Museum and the famous Buckwheat dump, only three miles distant in Franklin, and open from April 15 to November 15. It is located on Mine Hill, at 6 Evans Street in Franklin, NJ 07416; the telephone number is 201-827-3481; call for schedule before coming. The Paterson Museum is less than an hour away, and the Rutgers University Museum just a bit further. One can also venture into New York City to visit the American Museum of Natural History.

Once in the area, from Franklin, take Route 517 South three miles to Ogdensburg (toward Sparta). In the center of Ogdensburg, turn right on Passaic Avenue, cross through the intersection with Plant Street/Cork Hill Road at the bottom of the hill, proceed a few hundred feet uphill on Passaic Avenue, under the railroad trestle, and immediately turn left at the entrance to the Museum. Alternatively, follow Route 517 North from Sparta to Ogdensburg, turn left on Passaic Avenue and continue as above. Upon entering the property, drive straight ahead and follow directional and parking signs carefully; they are there for your safety.

EPILOGUE

The Sterling mine is alive and well, the museum is well designed and interesting, and the walk-in tour is a great and exciting experience. Hundreds of years after mining was first tried here, this famous place is available to all. Stop in and enjoy!

ACKNOWLEDGMENTS

The views expressed herein are those of the authors and do not imply any endorsement by the Smithsonian Institution. We are indebted to the following persons for critical readings: John L. Baum, Richard C. Erd, Elna Hauck, Richard Hauck, Robert Hauck, Robert Metsger, Steve Misiur, Steven Morehead, Daniel Russell, Earl Verbeek, and Herb Yeates. Henry Van Lenten and Ron Cedar were of special assistance in photographing the Rainbow Room under ultraviolet illumination, and have our deep gratitude.

REFERENCES

ALGER, F. (1845) On the zinc mines of Franklin, Sussex County, New Jersey. *American Journal of Science,* 1st Series, **48**, 252–264.

FARRINGTON, A. C. (1852) [Historical sketch of the zinc mines of New Jersey.] In *Reports of the New Jersey Zinc Company,* 16–25.

HORUZY, P. (1990) *The Odyssey of Ogdensburg and the Sterling Zinc Mine.* Sterling Hill Mining Company, Ogdensburg, New Jersey.

JACKSON, C. T. (1852) [Geologic report and ore estimate]. *Reports of the New Jersey Zinc Company,* 10–15.

METSGER, R. W., TENNANT, C. B., and RODDA, J. L. (1958) Geochemistry of the Sterling Hill zinc deposit, Sussex County, New Jersey. *Geological Society of America Bulletin,* **69**, 775–788.

METSGER, R. W., SKINNER, B. J., and BARTON, P. B., Jr. (1969) Structural interpretation of the Sterling Hill ore body. *Geological Society of America, Program with Abstracts,* Part 7, 170. *Economic Geology,* **64**, 833.

SHUSTER, E. D. (1927) Historical notes of the iron and zinc mining industry in Sussex County, New Jersey. Privately published by the Franklin Kiwanis Club.

Recent research on the deposits was the subject of a Symposium at Lehigh University in May of 1990. The Proceedings volume (118 pages) is available postpaid for $15 from (payee): Franklin-Ogdensburg Mineralogical Society, P.O. Box 146, Franklin, NJ 07416.

Colorado Dealers

Caviano Mineral Gallery
5910 South University
Littleton, CO 80121
303-798-6696
Mon-Sat 10-5:30, Sun call first
Quality Minerals from the
Ray Thompson Collection

Collector's Edge
Bryan & Kathryn Lees
402 Gladiola Street
Golden, CO 80401
303-278-9724
We Buy Collections

Collector's Stope
Jim & Patti McGlasson
7387 S. Flower Street
Littleton, CO 80123
303-972-0376
Fine Minerals, Species, Micromounts

Colorado Mineral & Fossil Show
September 11-15, **1991**
Holiday Inn-North Denver
4849 Bannock Street
THE SATELLITE SHOW!
10 a.m. to 10 p.m. Daily
NOW OPEN SUNDAY

Columbine Mineral Shop
Benjy & Liz Kuehling
633 Main Street, Ouray, CO 81427
303-325-4345, 9 a.m. to 9 p.m.
Open 7 days, May 1-Oct. 31
Off-season by Appointment
Fine Minerals for Collectors

Crystal-Linn International
Martin Zinn
P.O. Box 2433
Evergreen, CO 80439
303-670-1960
Display Quality Minerals

Genesis Epoch
Mel & Pam Bersch
2417 Sandridge Court
Grand Junction, CO 81503
303-242-3134 (call for appt.)
Fine Minerals & Fossils

Glacier Peak Gems & Minerals
Joseph & Susan Dorris
Box 4
USAF Academy, CO 80840
719-685-4479 (by appointment)
Top Minerals—Colo., Pakistan, Mex.
Write for Mail Order List

Golden Minerals
Don E. Knowles
13030 West 6th Place
Golden, CO 80401
303-233-4188
Largest Comprehensive Stock in Colorado

Green Mountain Minerals
Stanley Korzeb
13812 W. Dakota Avenue
Lakewood, CO 80228
303-988-2642 (Call for Appt.)
Species, Fine Minerals, write for List

Bill Hayward Minerals
Bill & Christopher Hayward
3286 Quitman Street
Denver, CO 80212
303-455-1977 (Call for Appt.)
Colorado & Pikes Peak Minerals

L & T Creations
Lee A. McKinney
1800 Winfield Drive
Lakewood, CO 80215
By Appt. Only 303-232-6451
Colorado Amazonite

LJP—Colorado
Larry & Carmen Piekenbrock
P.O. Box 1758
Boulder, CO 80306
303-666-6926 (by Appt. only)
Colorado & Western Minerals

Mike Madson Minerals
Mike & Sharon Madson
3201 Snowberry Court
Grand Junction, CO 81506
303-243-2234
Wholesale Minerals

Mineral Treasures
Dee Belsher
9250 W. 100th Circle
Westminster, CO 80021 (Denver area)
303-466-4128 (by appointment)
Fine Mineral Specimens

Mountain Minerals International
Dudley Blauwet, Kevin Ringer
P.O. Box 302
Louisville, CO 80027-0302
303-665-0672, Buy/Sell/Trade
Minerals, Gems, Gem Rough

Red & Green Minerals, Inc.
Denzil Wiggins
7595 W. Florida Avenue
Lakewood, CO 80227
303-985-5559
Custom Jewelry, fine mineral
specimens, lapidary & jewelers'
tools & supplies

The Rock Hut
Jim & Irene Witmer
706 Harrison Avenue
Leadville, CO 80461
719-486-2313
Specimens, Unique Gifts, Jewelry
Open 7 days/week

The Sunnywood Collection
Bill & Elsie Stone
12068 E. Amherst Place
Aurora, CO 80014
303-696-0044 (by Appt. only)
Fine Minerals & Fossils,
Mounted on Exotic Hardwoods

Williams Minerals
Keith & Brenda Williams
P.O. Box 1599
Idaho Springs, CO 80452
W: 303-567-4647, H: 303-567-4647
Dealers of Fine Mineral Specimens,
Mining Artifacts and Antiques

Worldwide Resources
Dennis O. Belsher
P.O. Box 636
Golden, CO 80402
303-322-4748
South American Minerals

Mineral Stories

Lawrence H. Conklin

The Russian Check

During the 1990 Tucson Gem and Mineral Show, Bill Larson of Pala International permitted the curators from the Fersman Mineralogical Museum in Moscow to sell mineral specimens from his booth. Some very nice specimens indeed were displayed, and most were snatched up by eager buyers as quickly as they were put out.

Luckily, I was present when a superb alexandrite on matrix was offered for sale. As I debated the pros and cons of the purchase, while holding the piece firmly in my hand, Bill (carefully observing and calculating my interest in the piece) sidled up to me with some encouraging words. Bill loves making a sale, even if it's not for himself.

"That's a pretty good piece," he said. "You could probably remove the larger crystal from the matrix, cut it, and still have a matrix piece worth the cost."

His words, although possibly even true, were not enough to get me off the fence; I was still undecided.

Then he added: "And another thing . . . by the time your check gets back to Moscow, gets deposited in a bank there and clears, you'll probably get at least 90 days time."

Now *that* was salesmanship, and really got my attention, although sometimes I think that the road to Mineral Dealers' Hell is paved with 90-days-credit. So, after thinking a few seconds longer, I said the only thing possible under the circumstances: "Sold."

That year I had driven to Tucson from my home on the East Coast, the trip each way taking about four days. As it happened, that check cleared my bank in Connecticut before I had cleared the banks of the Rio Grande on my return trip! The Soviets had opened a temporary bank account in Tucson, and my check had been deposited the day that I wrote it. People do learn.

The Dubious Chabazite

[The following story is from Frederick A. White of Tulsa, Oklahoma.]

In June of 1973 I took part in a field trip with the Bergen County (New Jersey) Mineralogy and Paleontology Society. We visited the garnet occurrence at Green's Farms in Roxbury, Connecticut.

While a small group of us was digging quietly, Dr. Charles Sheer of the Columbia University Department of Chemistry (who was also a member of the society) appeared. With a big smile he announced, "Look at this chabazite specimen I just found."

A charming lady looked up from her digging and exclaimed brightly, "Wow! Now tell me please, why is it pronounced *cab*-azite instead of *chab*-azite?"

"Probably," he replied, "for the same reason chemistry is not pronounced *chem*-istry" (sound the *ch* as in *ch*urch).

The Roxbury garnet locality is well known for its metamorphic rocks and minerals, but chabazite is a zeolite and would not be expected in such an environment. So, unable to hold my tongue and conceal my skepticism any longer, I asked, "Where *exactly* did you find this chabazite specimen?"

An even broader smile than before spread across his face. "Well," he answered, "I found it here in my jacket pocket. I put it there last week when I visited the Upper New Street quarry in Paterson, New Jersey, and had forgotten all about it!"

An Underground Story

[The following story is related second-hand by Wendell E. Wilson.]

The late Dick Jones (profiled in vol. 14, no. 5) was a famous Arizona commercial collector and mineral dealer for many years, and had no shortage of hair-raising stories to tell. One evening over dinner, after we had been working on his article on the Old Yuma mine, he told this one:

Dick made it a habit of exploring abandoned mines for minerals, particularly in areas where other collectors had not ventured. In the Southwest this is easier than it sounds; a particular quadrangle map can easily have dozens if not hundreds of mines marked (most of them unnamed), and only a few of them might be popular with or known to local collectors.

On one particular afternoon, while exploring a large stope in an obscure mine, he and his two collecting partners discovered some attractive calcite crystals. Over the next several hours they chiseled and hammered out a number of fine specimens. While this was going on, Dick happened to notice that when they hammered, a light sprinkling of dust fell from the ceiling around the margins of the stope. When they stopped hammering, the dust stopped falling. This was cause for some concern. So they interrupted their work and carefully examined the ceiling all the way around; but they saw no obvious danger or instability.

Still suspicious, they walked into a connecting drift leading out of the stope, climbed up an incline to the next higher level, doubled back and found themselves in another large stope directly above the one in which they had been working. The "floor" of this stope was the "ceiling" of the stope below. They walked all over it, examining the floor for any cracks or fissures. They jumped up and down on it as hard as they could, to see if anything would happen. But it held firm and solid. So they looked at each other, shrugged, and returned back down to the lower stope, where they hammered happily for several more hours. Toward evening they debated whether to continue working on through the night, but fatigue got the best of them, and they elected to pack up and go home for some much-needed sleep.

The debate had revolved around the fact that they had not yet finished removing all of the collectible crystals; and in Arizona you do not leave a half-excavated pocket unguarded any longer than necessary, no matter how remote and inaccessible it might be. Other field collectors will float in from far and wide, drawn by some mysterious instinct. Therefore, Dick and his partners returned promptly after about eight hours to finish the job.

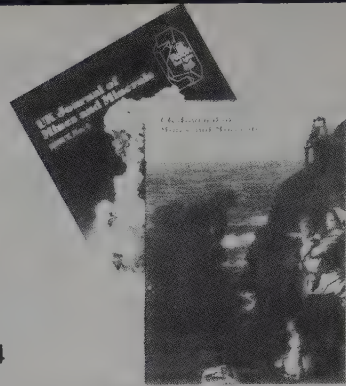
But this job had finished itself while they slept. The entire ceiling block separating the upper and lower stopes, perhaps 100 feet across and 10-20 feet thick, had dropped like a wine-press. Timbers that had stood near the entrance to the lower stope were not merely broken but squashed and extruded into the drift, looking like broom-heads or bundles of long toothpicks.

Sometimes it pays to take a break, even if you haven't finished the pocket.

Contributed stories are welcome. Write to:

Lawrence H. Conklin
2 West 46th Street
New York, New York 10036

U.K. Journal of Mines and Minerals



$30 Three Issues!
($30 air mail from UK)

Remit to: J. Schmitt.
812 Imperial Court,
Hartland,
Wisconsin 53029
Tel: (0414) 3673674

DEVON & CORNWALL
SPECIAL TOURS OF MINE SITES
& MINERAL MUSEUMS

Details from
MINERAL SEARCH
24 Pembridge Crescent
London W11 3DS, United Kingdom
Tel: 011-4471-229-2616

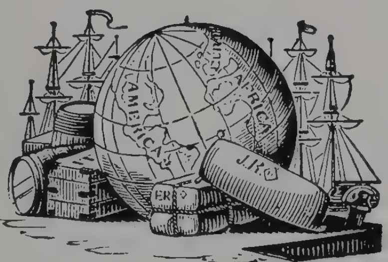
COMPLETE SET V.1–21
Mineralogical Record
$1300 + shipping
Kassionas Minerals
P.O. Box 578, Alviso, CA 95002

---

josep barba

wholesaler of minerals and fossils specialized in Spain and Bolivia

loreto, 8 - 08029 barcelona - spain
tel. (3) 430 33 81 - fax (3) 226 18 15



INTERNATIONAL MINERAL EXCHANGE

Buying Quality Specimens & Collections
Sales by Appointment & Selected Shows

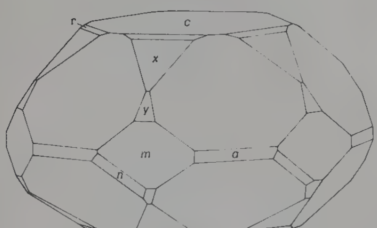
GERALD AND JEANNINE CLARK
P.O. Box 11090, Costa Mesa, CA 92627
Tel: (714) 540-0810

Looking for
Meteorites?

Swiss Museum offers free sales list.
Swiss Meteorite Lab.
Museum Bally-Prior
Kreuzackerstr. 16a
CH-5012 Schoenenwerd
Switzerland
FAX: 064-41-63-44
We also buy meteorites!

G. Carlo Fïoravanti

mineralogist



Apatite *Carrara*

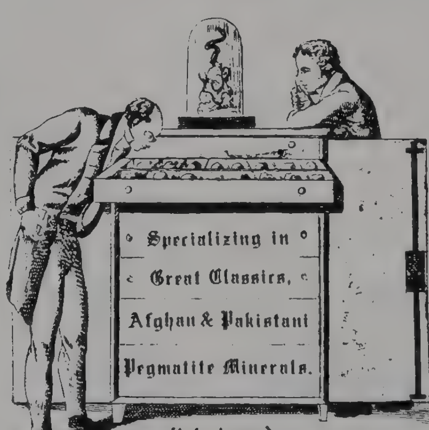
19/20 Via Pie di Marmo
Rome, Italy

Located between Piazza
Venezia and the Pantheon

Mon. 5-8 pm; Thurs. & Fri.,
11-1 pm, 5-8 pm; Sat. 11-1 pm

Phone: 06-6786067

Fine Mineral Specimens



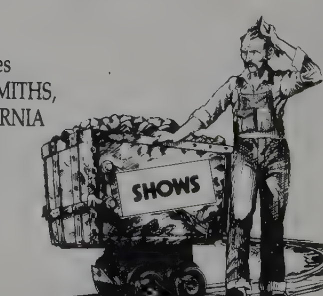
H. Obodda

Box 51
Short Hills, N.J. 07078
(201) 467-0212

THE
ROCKSMITHS
Inc.

Aug. 30-Sept. 1	South Bend, IN (MW Fed.)
Sept. 6-8	Houston, TX
Sept. 7-8	Danbury, CT
Sept. 13-15	Denver, CO (Merch. Mart)
Sept. 14-15*	Richmond, CA
Sept. 21-22	Richardson, TX
Oct. 5-6	Franklin, NJ
Oct. 12-13	Topeka, KS
Oct. 18-20	Mundelein, IL (Chic. area)
Oct. 19-20	Oklahoma City, OK
Oct. 26-27	Warwick, RI

*Indicates
ROCKSMITHS,
CALIFORNIA
Show



5th & Toughnut, Box 157, Tombstone, Arizona 85638

What's New in Minerals?

ANNUAL WORLD SUMMARY OF MINERAL DISCOVERIES

George W. Robinson
Canadian Museum of Nature
P.O. Box 3443, Station D
Ottawa, Ontario, Canada K1P 6P4

Vandall T. King
P.O. Box 90888
Rochester, New York 14609

We are grateful for the numerous contributions from the dozens of collectors, curators and mineral dealers who have shared information or provided photographs enabling this report to be assembled. In this regard, we would especially like to acknowledge the continued support from Ray DeMark, Torgeir Garmo, Robert Gault, Neil Hubbard, Pierre Laville, Frank Melanson, William Pinch and Wendell Wilson. As in past years, the information is presented geographically, with emphasis placed on truly new finds rather than continuing supplies of known materials. Because this report is presented each year at the Rochester Mineralogical Symposium, the time period covered is from April 1990 to April 1991.

Part I: United States

ARIZONA

Brilliant orange crystals of wulfenite up to nearly 2 cm were collected only three weeks before this year's Tucson Show at the Rowley mine near Theba, Maricopa County, by George Godas (*Arizona Crystals,* 6304 S. Clark Dr., Tempe, AZ 85283). Many of the smaller crystals are transparent and occur with yellow mimetite on plates of barite matrix up to about 8 x 20 cm. A few also have what appears to be microcrystals of transparent to white willemite in association. George also collected some interesting vanadinite from the Ramsey mine near Quartzsite. The crystals are typically 1–4 mm in length and form curved, color-zoned brownish green individuals with brownish orange edges. Semiquantitative SEM-EDS analyses of one of these crystals performed at the Canadian Museum of Nature indicate both zones are indeed vanadinite, and not pyromorphite as previously thought. Descloizite is also present as microscopic, bladed, green-brown crystals.

Each year David Shannon (6649 E. Rustic Dr., Mesa, AZ 85205) seems to turn up new and interesting finds somewhere in Arizona. This year's discoveries include black wulfenite crystals and coronadite pseudomorphs after wulfenite from the Glove mine, Santa Cruz County; transparent *untwinned* crystals of aragonite from Beaver Creek, near Camp Verde, Yavapai County; and wickenburgite as small, bright white, hemispherical aggregates of acicular crystals associated with yellow mimetite and minor calcite from a small prospect pit near the Moon Anchor mine in Maricopa County.

The Ray mine in Pinal County has produced a new lot of the superbly crystallized native copper for which it is so well known. The new material greatly resembles that found a decade ago; it consists of flattened, twisted, spinel law twinned crystals up to 10 cm in arborescent groups up to nearly 10 x 20 cm. Hundreds of excellent specimens were available at the Denver Show from Copper City Rock shop (566 Ash St., Globe, AZ 85501).

There were a number of fine specimens of hematite and quartz from the Veta Grande claim near Quartzsite to be seen at this year's Tucson Show. Some of the better specimens were available from Robert and Sarah Griffis (*Haystack Minerals,* P.O. Box 55820, Valencia, CA 91385) and Les and Paula Presmyk (*De Natura,* P.O. Box 1273, Gilbert, AZ 85234).

Patrick Haynes (*Virgin Mining Company,* P.O. Box 1531, Cortez, CO 81321) reports finding the rare species bokite, schubnelite and fervanite in petrified wood from the Triassic Shinarump conglomerate at the Monument No. 2 mine, Apache County (*Mineral News,* **7**, no. 1, p. 9).

John Marshall of Dedham, Massachusetts, has collected some very unusual cuprite from the dumps of the Silver Bell mine north of Tucson. The cuprite occurs in a limonitic gossan as black chalcotrichite along with cubic and dendritic crystals up to 2 mm. The chalcotrichite occurs sprinkled like jackstraws on the gossan, or rigidly arranged in a three-dimensional architecture resembling the framework of a modern high-rise building.

Bill Hawes (P.O. Box 4535, Grand Junction, CO 81502) found some excellent blue-gray, columnar leadhillite crystals to 1.4 x 4 mm at the Grand Reef mine in Graham County.

ARKANSAS

Some excellent *faden* quartz has recently been collected by *Starfire Mines* (Star Rt. 1, Box 306, Mt. Ida, AR 71957) in Montgomery County. The individual crystals occur as transparent, doubly terminated tabular individuals to 7 x 12 cm in groups and clusters. More very good blue cookeite on quartz is being found by Jim McNeil (1175 Mt. Moriah Rd., Memphis, TN 38117) at the Stand on Your Head claim in Saline County. Some of the cookeite fluoresces pale green in longwave ultraviolet radiation (*Mineral News,* **6**, no. 11, p. 9).

CALIFORNIA

There were some extraordinarily large (15–20 cm!) crystals of hanksite from Searles Lake in San Bernardino County seen at the Tucson Show this year, along with a smaller number of sulphohalite specimens. Some of the best of these were available from *Ordway's Minerals* and Jim McGlasson (*Collector's Stope,* 7387 S. Flower St., Littleton, CO 80123).

The Katrina mine near Pala has been reopened in anticipation of discovering more of the excellent spodumene (kunzite) crystals for which it is well known. The new drift is about 15 meters to the southwest of the former opening. The work is being conducted sporadically by a group of collectors; to date the pockets found have contained smoky quartz crystals up to 10 cm, some of which show what appear to be circular "radiation burns" up to 1 cm. Nearby, Blue Shepard (*Pala Gems*) is operating the Stewart mine, and has found some exceptional blue-purple lepidolite crystals (to 4 cm), one cluster measuring over 20 x 30 cm! Massive lepidolite with rubellite as well as a few small green and pink elbaites have also been recovered.

An unusual suite of iron sulfate minerals has recently been found as an outgrowth of an Environmental Protection Agency study of acid mine waters by D. Kirk Nordstrom and Charles Alpers at the Iron

Mountain mine in Shasta County. Due to a unique combination of geological conditions (which include record-breaking pH values of *less than* -1 for naturally occurring aqueous solutions!), stalactitic growths of coquimbite, melanterite, rhomboclase, voltaite and other sulfate species are forming at an accelerated rate. Some of these formations exceed 2 meters in length. These minerals are presently under investigation at McGill University, the U.S.G.S. at Menlo Park, California, and at the Canadian Museum of Nature, with a descriptive article in preparation.

COLORADO

Keith Williams (*Williams Minerals,* P.O. Box 1599, Idaho Springs, CO 80452) recently obtained a small lot of interesting galena crystals from the Tucker vein, Hayseed Tunnel, Chase Gulch, Gilpin County. These were collected in mid-January this year and consist of lustrous, "floater" cubes with octahedral faces that average 2–4 cm. A few of the crystals have skeletal or "hopper" cube faces.

There was a large find of amazonite crystals made west of Harris Park, Park County, last July. The crystals are typically pale blue, and 5 to 15 cm in size. The find included a number of good Manebach twins. Details of this discovery are given in *Mineral News,* **6**, no. 10, p. 1. Specimens are available from Bryan and Kathryn Lees (*Collector's Edge,* 402 Gladiola St., Golden, CO 80401). Eugene Foord, U.S.G.S., Denver, has identified color-zoned brown to black zinnwaldite crystals associated with some of the amazonite from the Harris Park locality.

The Lees also have more of the scheelites from level 5 of the East Camp Bird mine near Ouray (as does Mike Madson, 3201 Snowberry Ct., Grand Junction, CO 81506) and some interesting quartz speliothems from level 6 of the East Camp Bird mine, which were collected last April.

The Krystal Krown, Purple Haze and Rainbows End claims in Larimar County have recently produced some very good specimens of purpurite-heterosite, sicklerite-ferrisicklerite, alluaudite, triplite, graftonite and other phosphate species. Some of the purpurite occurs in 10–20 cm blocks and shows a spectacular purple color. Specimens are available from *Storm Mountain Minerals and Mining* (P.O. Box 7268, Boulder, CO 80306).

A number of exceptional specimens of pascoite have been collected by Patrick Haynes of Cortez. These consist of bright orange encrustations of 1–2 mm crystals on a dark colored matrix, and are from the Slick Rock–Egnar area in San Miguel County. Metarossite also occurs at the same locality.

GEORGIA

For some reason one normally doesn't associate gem-bearing pegmatites with Georgia unless that someone happens to be Beau Gordon (*Jendon Minerals,* P.O. Box 6214, Rome, GA 30162), who recently collected some gemmy blue aquamarine crystals up to 5 cm long in smoky quartz from a pegmatite near Booger Bottom, Meriwether County. Larger crystals to 5 x 10 cm were also found, but they tend to be opaque, and of a more yellow-green color. Microcline crystals to 5 x 5 cm partially replaced by kaolin were also recovered.

IDAHO

Scott Adams Minerals (1033 Broadmoor Dr., Napa, CA 94558) had some good pyrrhotite crystals from Owyhee County for sale at the Tucson Show last February. The crystals average 3 to 5 cm, have a brown tarnish, and resemble those from Santa Eulalia, Chihuahua, Mexico, or the Bluebell mine at Riondel, B.C., Canada.

IOWA

David Shannon recently obtained a good lot of millerite in quartz geodes from the Ollie quarry, south of Iowa City in Keokuk County.

MAINE

Mineralogical history is in the making in the state of Maine with *Plumbago Mining Company* (P.O. Box 449, Casco Bank Building, Rumford, ME 04276) currently working the famous Mount Mica pegmatite near South Paris, and *Sugar Hill Minerals* (P.O. Box 565, Norway, ME 04268) working the Bennett quarry a few kilometers to the east near Buckfield. Last summer's work at Mount Mica produced numerous pockets of quartz crystals, a few small tourmaline pockets and tons of good quality lepidolite. A great deal of development work was accomplished for continued mining this year. A number of interesting species have also been found in small pods of triphylite replaced by siderite. These include eosphorite, hydroxylapatite, roscherite, hureaulite, jahnsite, mitridatite, moraesite, and several unknowns, two of which appear to be new species. Lastly, Paul Moore reports that he has identified glucine from Mount Mica.

Sugar Hill Minerals discovered some very interesting etched goshenite crystals up to 7 cm at their workings at the Bennett quarry, near Buckfield. The pocket was found near the area which produced the "Rose" and peach morganite crystals reported here last year. Milky quartz crystals up to 100 kg and a number of very fine (and indeed, under-appreciated!) cookeite specimens helped round out the year.

Newry has long been known as a source of beryllonite, but specimens have now been found for the first time at the Bell pit. Donald Cooke of Spencerport, New York, found a specimen of clear montebrasite crystals (to 5 mm) associated with minor siderite in massive gray quartz. In the center of the vug is a clear, etched cogwheel crystal of beryllonite. Additionally, a specimen in the Bjareby collection from the Harvard quarry near Greenwood, has been found to contain fibrous, clear beryllonite crystal sections up to 1 mm in quartz crystal vugs.

Drs. Martin Yates and Frank Howd of the University of Maine found wagnerite from the Black Hawk mine, near Blue Hill. The wagnerite occurs as tan, 1-mm and smaller grains in cordierite-bearing and gahnite-bearing quartzite.

Specimens of a red, powdery coating on fine-grained stibnite found by Cliff and Effe Gray of Dover-Foxcroft at the Drew Hill sulfide veins in Linneus, were submitted to the Canadian Museum of Nature for identification. X-ray powder diffraction patterns and qualitative EDS microprobe analysis of this material indicates it is the rare mineral schafarzikite. Associated species include metastibnite, native sulfur and valentinite. Previously, similar red coatings have been thought to be kermesite.

Gene Bearss of Sanford, Maine, discovered a new locality for landesite at the Emmons quarry, near Greenwood. The landesite occurs as brown bipyramidal crystals up to 2 mm in cavities in altered lithiophilite.

Outstanding sprays and clusters of brilliant black stilpnomelane crystals up to 1 cm have been found at a large roadcut along route 27 in Jim Pond Township. The micaceous crystals occur in a ferroan carbonate mineral and were reported by Charles Guidotti of the University of Maine, Orono.

Powdery sulfur-yellow coatings of vanmeerscheite/metavanmeerscheite up to 1 mm have been found by one of us (VTK) in cleavelandite next to altered uraninite at the Dunton quarry near Newry. The identification has been confirmed by X-ray and chemical analyses by Gene Foord, U.S.G.S., Denver.

Wodginite has been found at four different localities in Maine. Jim Mann of Bethel, Maine, found a 1-cm, black, partially terminated crystal embedded in albite at one of the rose quartz crystal prospects near Newry. Cliff and Effe Gray of Dover-Foxcroft found small (to 2 mm) black wodginite crystals, also embedded in albite, at Black Mountain near Rumford. A third occurrence of the mineral was found by David Wellberg of Rangely, Maine, at the Bemis Stream prospect, in D township. The crystals occur up to 4 mm in cleavelandite and quartz. Dr. Michael Wise of the Smithsonian Institution has identified wodginite as inclusions in manganotantalite from the Bennett quarry in Buckfield. Lastly, some crystals which look suspiciously like wodginite were found in albite from the Harvard quarry near Greenwood; their identification is pending.

Henry Barbour of Fryeburg, has found a second locality for wulfenite in Maine. The wulfenite forms elongated, blocky, orange crystals to 4 mm in vugs in albite at the Upper Colton Hill pegmatite quarry, near Stow. Bright green, massive pyromorphite is sometimes associated. Henry reports that he has also found a large suite of rare-element minerals including monazite, uraninite and bismuthinite in addition to crystals of amethyst in parallel growths to 15 cm.

MICHIGAN

A remarkable specimen of native copper was recovered from the floor of Lake Superior off the Keweenaw Peninsula last June. The specimen, which consists of a single slab approximately 3 meters long, has been named *The Manitou,* and was on display at this year's Tucson Gem and Mineral Show. For those desiring smaller specimens, Lance Hampel (*Precious Earth,* P.O. Box 39, Germantown, WI 53022) may be able to help with a newly acquired lot of arborescent crystallized specimens from the White Pine mine in Ontonagan County. Many of these have a silvery, iridescent patina that has been shown by qualitative SEM-EDS analysis to be composed largely of copper arsenide(s) and/or sulfide(s). There are a few native silver specimens in the lot, and some of the copper has native silver associated. The specimens are probably among the best crystallized copper and silver ever found at the White Pine mine.

John Medici (7272 Macbeth Drive, Dublin, OH 43017) reports that some very fine specimens of celestine have been collected over the past year from the quarries at Holloway, Rockwood and Maybee in southeastern Michigan. Some of the crystals from Rockwood are dark blue in color, and associated with white quartz, which makes them very aesthetic. One crystal weighs 5 kg.

MISSOURI

Excellent specimens of calcite, galena, siegenite and other minerals have recently been found at the Miliken and West Fork mines in the Viburnum Trend, approximately 150 km south of St. Louis. Descriptions of these minerals are given by Weinrich (*Mineral News,* **6**, no. 8, p. 1–2).

Joe Kielbaso (*Gemini Minerals,* P.O. Box 52, Tipp City, OH 45371) and Neil and Chris Pfaff (*M. Phantom Minerals,* P.O. Box 12011, Columbus, OH 43212) have recently obtained some very interesting crude pseudohexagonal, blocky to platy hematite crystals with etched, multiple-growth faces from the Pea Ridge mine, near Pea Ridge, Washington County. The crystals, which occur up to 7 cm, come from a breccia zone and are associated with minor drusy quartz and calcite. Cubo-pyritohedral crystals of cobaltite to 2 mm on a brecciated matrix have also been collected at the Pea Ridge mine.

MONTANA

D. J. Minerals (P.O. Box 761, Butte, MT 59703) has obtained some interesting specimens of axinite, epidote and tourmaline from Jefferson County, and Thomas Bleck reports finding doubly terminated crystals of epidote at Pat's Gulch, near Avon, Powell County (*Mineral News,* **7**, no. 1, p. 5).

NEVADA

Some of the best spessartine we have seen in a long time from Garnet Hill, near Ely, was collected last summer by Darryl MacFarlane (*Grenville Minerals,* P.O. Box 453, Kingston, Ontario, Canada K7L 4W5) and Kim Cathcart (8445 Rancho Destino, Las Vegas, NV 89123). The specimens consist of lustrous trapezohedral crystals up to 2 cm in cavities in rhyolite. Matrix specimens up to 10 x 20 cm were recovered. Garnet Hill is in a National Recreation Area where mineral collecting with hand tools is permitted, but for those of us with too many kilometers to drive (or with weak backs!), there is always Kim or Darryl.

Glaukosphaerite occurs as microscopic green spherules with heterogenite at the Key West mine, Clark County. Details of the occurrence are given by Martin Jensen (*Mineral News,* **6**, no. 11, p. 1–2). A second reference by Jensen (*Mineral News,* **6**, no. 7, p. 1–4) describes an occurrence of centimeter-sized bournonite crystals associated with quartz, tetrahedrite and a number of other minerals from the Little Gem mine, near the ghost town of Tenabo, in the Bullion district in Lander County.

Jim McGlasson had a number of interesting new Nevada specimens at last year's Denver Show. Among these were very fine microcrystals of gold from Willow Creek, Pershing County, large plates of gray-white phantom calcite crystals from the Nebraska vein, 5 level, Betty O'Neal mine, Lewis district, Lander County, and some interesting skeletal and sceptered quartz crystals from the Summit King mine in Churchill County.

Some very large (half meter-long) quartz crystals have been found in Lyon County. These crystals tend to be tapered and are pale smoky in color. A few have inclusions of an acicular green mineral (possibly actinolite). *Harvey Gordon Minerals* (1002 S. Wells Ave., Reno, NV 89502) displayed three such pieces in his case at this year's Tucson Show. In addition to the quartz, Harvey also came up with some very unusual greenish brown orpiment crystals from near Eureka, Eureka County. SEM-EDS investigation of these crystals has shown that the unusual color is due to the incorporation of finely disseminated pyrite and clay minerals (possibly illite) within the crystals during their growth. Many of the crystals are doubly terminated, and may be as large as 3 x 8 cm.

Dark brown to reddish brown dodecahedral crystals of andradite (?) garnet have been found near Tonopah, Esmeralda County. Some of the crystals approach 2 cm in diameter and occur in small groups to 5 cm. Specimens are available from *Haystack Minerals*.

Scott Adams Minerals has obtained some excellent transparent wulfenite crystals (to 1 cm) on dark brown limonite from the Downeyville mine, Nye County, and *Jendon Minerals* has some exceptional, lustrous, olive-green vesignieite crystals (to 2 mm) from bench 5225 of the Newmont mine, near Carlin. The specimens are among the best vesignieites ever found anywhere.

NEW HAMPSHIRE

Larry Venezia (115 Coleridge St., East Boston, MA 02128) reports that the Wise mine near Westmoreland, is producing green octahedral fluorite crystals up to 7 cm in flat plates of crystals to 20 x 20 cm. This locality is currently being worked by a consortium of local collectors known as the *Resurrection Mining Company*.

NEW JERSEY

After a monumental effort by Richard and Robert Hauck and their army of dedicated volunteers, the *Sterling Hill Mine and Museum* opened its doors to the public last August. Underground tours are available daily. Though not an immediately high priority, a number of specimens have, nevertheless, already been salvaged, including some of the best mcgovernite ever found, zinkenite, chabazite, large crystallized specimens of both franklinite and willemite, realgar, stilbite, smythite and other minerals, in addition to excellent fluorescent specimens of barite and wollastonite. Many of these minerals are currently available from *Willis Earth Treasures* (116 Prospect St., Stewartsville, NJ 08886) and a number of the Franklin area dealers. The Sterling Hill Mine and Museum is open seven days a week, and well worth a visit for anyone even remotely intrigued by minerals or mining. For information, contact the museum at 30 Plant St., Ogdensburg, NJ 07439, or by phone at (201) 209-7212.

Jack Troy, a long-time collector of New Jersey minerals, found an interesting assemblage of minerals at a construction site on the Bulls

Ferry Road in North Bergen. Excellent micromounts of allanite, quartz, pyrite, apatite and apophyllite have been collected. The apophyllite is of special interest, due to its unusual morphology. Jack also reports finding good microcrystals of stilbite from another site on North Hoyt Street in Fort Lee, but the locality is now built over.

NEW MEXICO

The Blanchard mine at Bingham, and the nearby Mex-Tex mine continue to produce interesting mineral specimens year after year. Perhaps one of the most exciting recent finds has been the "V" twinned cerussite crystals collected on the third of September last year at the Blanchard mine by Ray DeMark (6509 Dodd Pl. N.E., Albuquerque, NM 87110). The crystals were excavated from a series of collapsed pockets within a meter-wide vertical zone in the Sunshine #5 tunnel. While most are in the thumbnail size category, a few up to 4 cm were found along with a single crystal 6 cm long. The majority of the crystals are white and lustrous, though some of the larger ones were coated with iron oxide or drusy hemimorphite. This is probably the most significant occurrence of cerussite ever found at the mine. Ray also collected some microcrystals (0.2 mm) of yellow-green to olive-green corkite associated with colorless pyromorphite on quartz from the Sunshine No. 1 tunnel. Specimens of some of these and other Blanchard mine minerals are currently available from *Carousel Gems and Minerals* (1202 Perion Dr., Belen, NM 87002).

Rich masses of pale lavender spurrite occur at South Sisters Peak, Tres Hermanas district, Luna County. Specimens are available from *David Shannon Minerals*.

Patrick Haynes had a large selection of interesting New Mexico minerals available at the Denver Show last September. These included gasparite-(Ce) from the Beryllium Virgin claim, Paramount Canyon, Sierra County; agardite-(La) from the Red Cloud copper mine in the Gallinas Mountains, Lincoln County; sky-blue apachite, mottramite, mimetite and wulfenite, all in good microcrystals, from Socorro Peak, Socorro County; and good maxwellite and squawcreekite microcrystals from the Squaw Creek tin mine in Catron County.

Very sharp pseudomorphs of dolomite after pseudohexagonal, twinned aragonite crystals up to 5 cm have been found in Cottonwood Draw, north of Acme, Chaves County. Specimens are available from Mark Rogers (P.O. Box 1093, Yucaipa, CA 92399). Mark also has some interesting pseudocubic quartz crystals up to 2 cm from Riverside, east of Artesia, Eddy County. The crystals vary irregularly in color from gray-tan through dull red-brown, but are uniformly turbid.

Ray DeMark has found millimeter-sized, prismatic, pseudohexagonal, twinned, green chrysoberyl crystals with octahedral brown gahnite crystals in a fuchsite-quartz schist at La Madera mountain, near La Madera.

OHIO

There were a number of excellent Ohio specimens seen at this year's Tucson Show. Some were old and others new. The old ones consisted mainly of Clay Center fluorites and Lime City celestines from the Cal Gettings collection, a portion of which was acquired by Don and Gloria Olson (P.O. Box 858, Bonsall, CA 92003). The new material was a find of elongated pale blue celestine crystals from Sandusky County. Most of these are single crystals ranging from 1.5 to 3 cm wide and up to nearly 20 cm in length, with sharp "spearpoint" terminations. Some have good phantoms. These are available from Henry and Patsy Schmidt (*Mineral Miner,* P.O. Box 903, Ravinia Station, Highland Park, IL 60035).

PENNSYLVANIA

There was a very exciting, albeit brief, find of amethyst made last summer at the Rhone-Poulene Rorer construction site near Collegeville, Montgomery County. The discovery was originally made by a Virginia Polytechnic Institute student doing soil sampling in the area, and the news was relayed to Pennsylvania collector Bryon Brookmyer (502 No. 40th St., Harrisburg, PA 17111) through Bob Downs and Susan Eriksson of V.P.I. The occurrence, which is now under buildings and parking lots, consisted of hydrothermal quartz veins cutting a Triassic sandstone member of the Passaic formation. Bryon reports that collecting was fun but frantic. Amethyst crystals were recovered in all sizes up to 30 cm and in varying degrees of clarity. Some of the crystals show scepters, and many are more prismatic than those from most other eastern U.S. localities.

UTAH

Tooele County produced a number of interesting specimens last year. David Shannon had some very good conichalcite, adamite, austinite and barium pharmacosiderite with hidalgoite from Gold Hill at last year's Denver Show, and Richard Whiteman (*Red Metal Minerals,* P.O. Box 45, Hancock, MI 49930) had some interesting white calcite stalactites up to 6 cm, dusted with gray birnessite. Phil Richardson, of Salt Lake City, had some interesting distorted pyrite cubes from Bullion Canyon in the Dugway Mountains, and attractive coralloid growths of calcite crystals from Lion Hill, near Ophir. Phil also had some of the rare species, gillulyite, from the Barrick gold mine near Mercur.

Patrick Haynes also featured some rare species from Utah, including the new hydrated uranium selenite, haynesite, and boltwoodite from the Repete mine, in San Juan County, along with what is believed to be the second world occurrence of the mineral swamboite, from the White Canyon district, also in San Juan County.

Last summer, Rex and Ed Harris (*Tina's Jewelry and Minerals,* Delta, Utah) collected what may be two of the finest red beryl specimens ever found at their Violet claims in the Wah Wah Mountains. These exceptional doubly terminated crystals are each 2.7 cm long, and are now in the John Barlow collection (see *Mineralogical Record,* **22**, p. 53–54).

VERMONT

Ken Hollmann (P.O. Box 134, Center Rutland, VT 05736) has brought to our attention an interesting alpine vein occurrence in a roadcut on U.S. Rt. 5, just north of Putney. Excellent micromounts of anatase, harmotome, pyrite (including elongated bars and acicular crystals with right-angle bends), brookite, prehnite, calcite and other minerals may be collected in the narrow quartz veins that cut the host phyllitic rock. The occurrence was first noticed in 1986 during highway construction work, when some of the best specimens were collected and preserved by dedicated Vermont collectors, Earl and Marie Melendy, of South Londonderry.

Part II: Canada

BRITISH COLUMBIA

A small lot of chalcopyrite crystals on quartz has been found near Courtenay. The chalcopyrite crystals are lightly etched and form equant, striated individuals up to about 3 cm on small milky quartz crystals. Specimens are available from Rod and Helen Tyson (*Tysons' Minerals,* 10549 133rd St., Edmonton, Alberta, Canada T5N 2A4) and *Lois Christianson Minerals* (200 Napier St., Barrie, Ontario, Canada L4M 1W8).

Teckcorp has ceased operating the Afton mine near Kamloops. However, shortly before its closure, Michael Evick, Curator of Minerals at Glenbow Museum, and Kamloops collector Sid Baker were able to collect some good microcrystals of ferrierite on native copper. Good micromounts of crystallized copper and calcite have also recently been found at the Ajax pit, nearby.

MANITOBA

The past year has seen a continuing supply of excellent gypsum crystals on the market from the Red River floodway near Winnipeg.

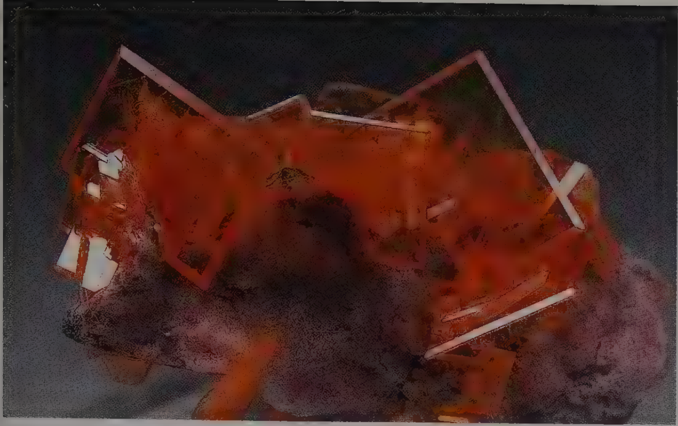


Figure 1. **Wulfenite crystal group, 3.3 cm, collected by George Godas at the Rowley mine, Maricopa County, Arizona.** WEW

Figure 2. **Gypsum crystal group, 7 cm, from the Red River floodway near Winnipeg, Manitoba. G. Robinson photo; Canadian Museum of Nature specimen.**

Figure 3. **Antimony crystals with calcite, 10 cm, from the Lake George antimony mine, New Brunswick. G. Robinson photo; Rod and Helen Tyson specimen.**

The pale yellow to amber clusters and crystal rosettes are some of largest and best the locality has ever produced. Tysons' have a good supply available.

Toronto area collector David Joyce has reported a new find of cubanite crystals from the Inco's T-3 mine at Thompson. The 1 to 1.5-cm twinned crystals occur on small groups of milky to clear quartz crystals and somewhat resemble those from the more famous Henderson mine occurrence in Chibougamau, Quebec. Associated species include calcite, pyrite and pyrrhotite. So far only a few specimens are known.

NEW BRUNSWICK

Rod and Helen Tyson recently obtained an excellent lot of crystallized native antimony from the Lake George Antimony mine at Lake George. Most of the specimens are thumbnails, though a few larger pieces were also recovered. The crystals look a bit like etched, aluminum-coated dolomites that average 1 to 1.5 cm, making them some of the largest and best native antimony crystals ever found anywhere. A few were associated with elongated pale yellow-white calcite crystals. The specimens were apparently collected about two years ago from a single occurrence in the mine, which is now unfortunately closed. (See the article in *Mineralogical Record,* **22**, 263–268.)

NORTHWEST TERRITORIES

The Polaris mine on Little Cornwallis Island is one of the world's northernmost mines. Hence, it is not surprising that we seldom see specimens from there. This is unfortunate, as the mine produces some extraordinarily fine galena crystals. The crystals are typically cubic with small octahedral faces, and are extremely lustrous. In fact, some are so lustrous that they look as though they were chrome-plated (even though they haven't been). The ice-filled pockets in which they occur have protected them against ground water alteration. Rod and Helen Tyson had a few of these available at last year's Denver Show, along with their usual fine selection of other Canadian minerals.

Dr. Richard Herd and Gary Ansell of the Geological Survey of Canada were fortunate to return to Mt. Walker on Somerset Island last summer to collect more of the fine sapphirine crystals discovered by Dr. Herd a few years ago. The crystals form tabular, gray-blue pseudohexagonal individuals that average 2 to 3 cm in diameter. Most of the better specimens consist of single crystals with little or no matrix attached.

QUEBEC

The past year has seen a large number of very fine vesuvianite specimens available from the Jeffrey mine at Asbestos. Some truly magnificent purple and green vesuvianite specimens are available from Frank and Wendy Melanson (*Hawthorneden,* R.R. #1, Eldorado, Ontario K0K 1Y0), Celestin Arsenault (237 rue St.-Joseph, Asbestos, Quebec), Gilles Haineault (*Collection Haineault,* 2266 St.-Alexandre, Longueuil, Quebec J4J 3T9) and others. Clearly the finest pieces offered for sale, however, were those in the possession of Rod and Helen Tyson at the Tucson Show. In addition to a 15 x 20-cm group of sharp green crystals were two single green crystals nearly 11 and 18 cm long, respectively. Though requiring repair due to natural breakage, these two specimens still have to rank among the best for the species.

For the first time in several years, specimen production at the Poudrette quarry on Mont Saint-Hilaire appears to have entered a recession, with only two somewhat significant discoveries over the past year. The first of these was made by staff of the Canadian Museum of Nature last May, and consisted of a small find of what is probably some of the best behoite recovered from the locality to date. The behoite forms spherical aggregates of gray-white bladed crystals up to about a centimeter in diameter, associated with bladed crystals of pink albite, elpidite, smoky quartz and some sphalerite. The second major find consisted of a large pocket found over the summer that produced good smoky quartz crystals, hilairite and a single crystal of sphalerite approximately 10 x 10 cm, collected by Tony Gordian of Montreal.

As research continues, the species list for Mont Saint-Hilaire gets longer and longer, with 262 confirmed species at the time of this writing. New additions over the past year include native antimony as tiny, irregular, dark gray grains in sodalite syenite xenoliths; nordite, as pale green hemispheres up to 0.25 mm associated with lueshite in sodalite syenite xenoliths; melanterite, as pale blue acicular crystals up to 2 mm associated with halotrichite and pyrrhotite; and loparite, as very small (0.2 to 1.5-mm) black, cubic and octahedral crystals associated with sodalite, ussingite, villiaumite and other minerals in sodalite syenite xenoliths. Additionally, there are four more new species on the list, all with I.M.A. approvals and publications in press. These minerals were all former unknowns, whose descriptions are given by Chao *et al.* (*Mineralogical Record,* **21**, 363–368). In summary, UK #63 is now **nalipoite**, UK #59 is now **normandite**, UK #62 is now **rouvilleite** and UK #81 is now **silinaite**. Lastly, UK #74 has recently been identified as the rare species lintisite.

Good specimens of titanite, zircon, chabazite and stilbite were collected by the Canadian Museum of Nature last June at a roadcut near Matilda Lake, south of Arundel, Argenteuil County. These and other species occur in calcite-cored veins in a feldspar-pyroxene metasyenite skarn. Perhaps of greatest interest to the collector are the crystals of zircon, the best of which occur as terminated pink prismatic individuals up to 5 cm long.

A number of very fine zircon crystals were also collected by museum staff at Kipawa last June. Approximately 200 doubly terminated brown crystals ranging in size from 1 to 5 cm were recovered, along with good specimens of miserite, vlasovite and eudialyte.

SASKATCHEWAN

Rod and Helen Tyson have recently obtained more of the attractive dark blue and purple halite from the Potash Corporation of Saskatchewan mine at Lanigan.

YUKON TERRITORY

The Canadian Museum of Nature recently received a most unusual specimen of leaf silver from *Archer, Cathro and Associates, Ltd*. The specimen comes from the Lucky Queen mine near Keno Hill, but its uniqueness lies not in the silver, but rather its matrix—ice! While certainly rare, this paragenesis has been reported previously by Boyle (*Geological Survey of Canada Bulletin* **111** (1965), p. 207). These occurrences are not well understood. In some areas it appears that the silver and ice crystallized contemporaneously, and in others it appears that the ice probably filled in open space around previously existing silver. In some instances there is also evidence to suggest that the silver actually may have precipitated along fractures in the ice and thus have formed *in situ*.

Part III: Other World Occurrences

AFGHANISTAN

While good crystals of lazurite have not exactly been scarce on the market over the past few years, there appeared to be more larger and better ones available in Tucson this year than ever before. The most complete locality information we have seen for these is Firgamu village, Kokcha River valley, Badakhshan Province, though others give the locality as "Sar e Sang," Nuristan. Some of the best have been available from *Mountain Minerals International* (P.O. Box 302, Louisville, CO 80027) and François Lietard (*Minerive,* Au Bois, 42520 Roisey, France), though dozens of other dealers also had very good material.

Mountain Minerals International also had some new tabular yellow apatite crystals to 1.5 cm from Nuristan, and some dark brown-black dravite crystals in mica schist from Pech, Nuristan. Also worthy of mention were gemmy tabular crystals of morganite with aquamarine cores nearly 12 cm in diameter, on matrix, from Laghman, available from *International Mineral Exchange* (P.O. Box 11090, Costa Mesa, CA 92627); a small lot of beryllonite crystals from Paroc, near Pachigram, Kunar, Nuristan, which were available from *Minerive*; and a small lot of transparent, dark green diopside thumbnails acquired by *Hawthorneden,* but labeled only as coming from Afghanistan. We have also noted similar appearing diopside labeled as coming from near Kaflu in Pakistan. Such locality confusion seems almost a norm for specimens from this part of the world, and only time will tell if there is really more than one occurrence and, if so, where.

ANTARCTICA

One rarely has the opportunity to obtain interesting minerals from Antarctica. At last year's Denver Show, however, *Ausrox* (42 Hex St., Tottenham, Melbourne, Victoria 3012, Australia) had specimens of osumilite-(Mg) from the Tula Mountains, Enderbyland.

ARGENTINA

The theme mineral at last year's Denver Show was rhodochrosite, which perhaps prompted the appearance of some of the best large slabs of that mineral yet seen from the La Capillita mine, in Catamarca province. Excellent specimens were available from *St. Paul Gems and Minerals* (P.O. Box 2010, La Puente, CA 91746) and others.

Mark Rogers and Cal Graeber (P.O. Box 47, Fallbrook, CA 92028) shared an interesting lot of martite (hematite pseudomorphs after magnetite) from Volcan Payun Matru, Malargue Department, Mendoza Province. The black crystals form elongated skeletal octahedra to 3 x 15 cm. The surface texture of these pseudomorphs is somewhat like very fine sandpaper, and the skeletal faces show numerous "herring bone" ribs.

AUSTRALIA

For the past few years Robert Sielecki and Janine Rea (*Ausrox*) have continued to bring interesting new Australian minerals to the North American market. This year's batch included terminated dark green crystals of atacamite to 1.5 cm from the Poona mine, Moonta, South Australia; wilkinsonite from Warrum Bungle Volcano, New South Wales; armenite from Purnamoota, New South Wales; and an interesting suite of phosphate minerals, including kidwellite, cyrilovite pseudomorphs after strengite, and 2-mm platy switzerite crystals from the Iron Monarch pit, Iron Knob, South Australia.

There has also been some very good erythrite collected at Carcoare, New South Wales. Specimens are available from *Hawthorneden*.

BRAZIL

Pierre Laville (Rua Joao Lira 42-1001, Rio de Janeiro, Brazil 22430) frequently finds himself in the enviable position of being among the first to see the annual new treasures produced by Brazil's gem pegmatites. This year Pierre reports a new find of gem-quality aquamarine crystals that, in his words, "made the year really worthwhile." The find, which came in September last year, was made at a pegmatite near Jaquetô, in Bahia State, and consisted of about 140 kg of lovely blue facet rough. About 30 excellent, clean, barrel-shaped crystals were found, the largest and best of which weighs 375 grams. Most are doubly terminated. A number of these spectacular crystals did turn up in Tucson, and were available from Alvaro Lucio (Av. Celso P. Machado 751, Caixa Postal 1286, 30000 - Belo Horizonte, M.G., Brazil), Mike Ridding (*Silverhorn,* 1155 Coast Village Rd., Santa Barbara, CA 93108) and others. (See the photo in the May-June Tucson Show report.)

Other interesting discoveries Pierre reports include more very fine fluorapatite and muscovite specimens from the Aldeia (Zé Pinto) mine; a new pocket containing about a dozen excellent elbaite scepters found at Barra de Salinas in November; and some of the best rubellite ever found at the Cruzeiro mine. Some of the latter material could be seen at the *Rocksmiths'* (Box 157, Tombstone, AZ 85638) booth at the Tucson Show, where large raspberry-red crystals to 7 x 14 cm were available. The Rocksmiths also had a good selection of small (2–3 cm) gray-blue to purplish blue elbaite crystals with red tips from Lavra do Pederneira, Santa Maria do Suassui, Minas Gerais; quartz scepters from 5 to 15 cm from Serra Negra, Baixo, Minas Gerais; a good selection of magnesite and uvite from Brumado, Bahia; and 2–4 cm single crystals of dark blue fluorapatite from Capim Grosso, Bahia.

Hawthorneden has also handled some very good new Brazilian material over the past year. Among others were large (3 cm), exceptionally well crystallized balls of stokesite and lustrous manganotantalite crystals, both from the Corrego do Urucum pegmatite near Galileia, Minas Gerias; etched (resorbed) beryl crystals from Mina Chia, Linopolis, Minas Gerais; and brazilianite with roscherite from Conselheiro Pena, Minas Gerais.

Tysons' also have some new materials from Brazil, including some display-quality black stalactitic masses of romanechite from Minas Gerais and a number of very pretty pastel-pink to green flower-like groups of quartz from Rio Grande do Sul.

From the north of Brazil, Dr. Reinhard Wegner of the Federal University in Campina Grande, Paraiba, has obtained some rather attractive small groups of barite crystals from a limestone quarry near João Pessoa, Paraiba. The crystals vary in color from colorless to pale yellow to gray, and form bladed, tabular aggregates up to about 8 cm, though most are in the 2 to 5-cm range. Some of the aggregates form quite good rosettes. Pyrite and calcite are sometimes present. Other interesting items reported by Dr. Wegner include almandine in trapezohedral crystals up to 3 cm in quartz-feldspar "nodules" in a gneissic unit from Serrote Redondo, approximately 9 km south of Pedra Lavrada, Paraiba; hydroxylherderite in twinned crystals up to 6 cm from Frei Martinho, north of Picui, Paraiba; terminated, prismatic crystals of schorl-dravite up to 10 cm in mica schist from Serra Branca in Rio Grande do Norte; and colquiriite from the Serra Branca pegmatite, approximately 13 km south of Pedra Lavrada, Paraiba. The colquiriite occurs as microscopic, colorless to white hexagonal plates on fracture surfaces in altered triplite. As far as we know, this is the second world occurrence for the species, and the first time it has been found in crystals.

Carlos Barbosa (Rua Cel. Roberto Soares Ferreira 586, Bairro Vila Bretas, Governador Valadares, CEP 35030, Minas Gerais, Brazil) is always finding outstanding and unusual Brazilian minerals. Some of his recent finds include an alpine cleft occurrence near Governador Valadares, which produces superb large siderite crystals in addition to red-brown monazite crystals up to 1 cm associated with crenulated clinochlore crystals. Carlos also found what was thought to have been the first occurrence of bavenite in Brazil, but X-ray identification of one specimen at the Canadian Museum of Nature has shown the "bavenite" to actually be bertrandite. This mineral occurs as tiny (1 mm) bladed white crystals on the edges of yellow muscovite crystals at the Taveres quarry near Linopolis, Minas Gerais. Whether or not *all* specimens from this occurrence are bertrandite is, of course, unknown. Last, but certainly not least, was a 1.5 x 3-cm flat nugget of crudely crystallized palladian gold (porpezite) from Itabira, Minas Gerais, now in the collection of William Pinch of Rochester, New York.

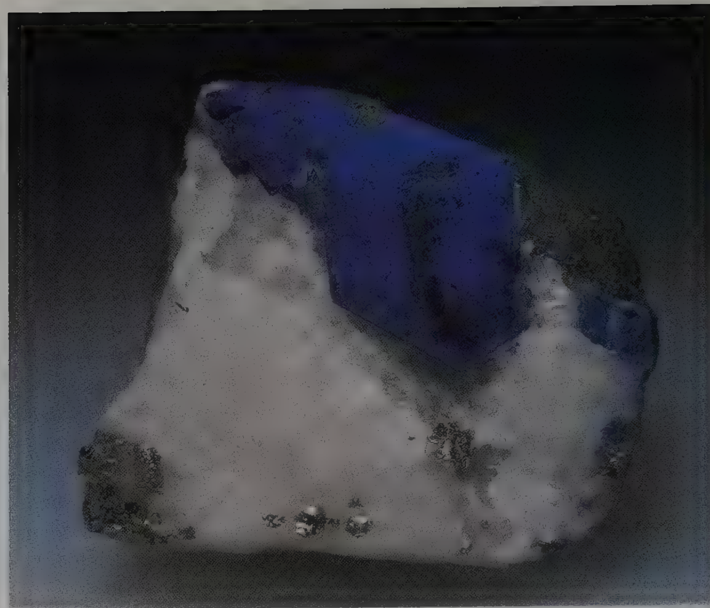
A new find of sellaite crystals has been made at the Pomba pit at Brumado in Bahia. The large, 2-cm colorless crystals are unusual in that they have attractive smoky patches irregularly developed on their outer edges. Other finds at Brumado include transparent, tabular, pale yellow twinned crystals of dolomite up to 6 cm, and dickite as fine-grained coatings and loose "sand" in cavities of various minerals.

Luís Leite (Av. 25 de Abril, No. 50, 3.° Esq., 2800 Almada, Portugal) has obtained some exceptional, lustrous, dark red-to-black manganotantalite crystals up to 8 x 10 cm from São Jose da Safira, Minas Gerais. The terminations of these crystals appear symmetrically formed, but the point of attachment consists of etched slits, suggesting an original contact with cleavelandite that has since dissolved away. Leite also has some excellent schorl crystals to 1 x 7 cm from Padre Piedaade, Minas Gerais, a locality which also produces aquamarine crystals with pointed terminations consisting of first and second-order pyramids and small basal pinacoids.

Other recent discoveries in Brazil that have come to our attention include gray spinel octahedrons to 4 mm from Countagarlo, Rio de Janeiro; columbite crystals to 3 mm which occur in placer workings at São Jose da Safira, Minas Gerais; free-standing, globular dendritic growths of coronadite from the Cruzeiro quarry, São Jose da Safira, Minas Gerais; large rhombs of siderite with dolomite and stilbite (?) from Pedreira Atalaia, Pico do Ibituruna; and etched, transparent, tapered aquamarine crystals from the Fernandes quarry, Mimoso do Sul, that look somewhat like glass cigars.

Lastly, Russell Behnke (161 Sherman Ave., Meriden, CT 06450) warns he has recently seen some of the new tourmaline gems from Paraiba being offered as containing inclusions of native gold! While we are unable to confirm or deny that such a natural occurrence does exist, it certainly seems more likely the inclusions should be of a sulfide mineral, perhaps pyrite or pyrrhotite. Until more information is available, *caveat emptor!*

Figure 4. **Vesuvianite, 10 cm, from Asbestos, Quebec. G. Robinson photo; Rod and Helen Tyson specimen.**



WEW *Figure 5.* **Lazurite crystal, 1.9 cm, from Sar E Sang, Nuristan, Afghanistan. François Lietard specimen.**

Figure 6. **Zircon crystal, 4 cm, from near Matilda Lake, Quebec. G. Robinson photo; Canadian Museum of Nature specimen.**

CHILE

Forrest and Barbara Cureton (*Cureton Mineral Company,* P.O. Box 5761, Tucson, AZ 85703-0761) had a most unusual specimen at the Tucson Show, consisting of 2–4 mm yellow-brown powellite crystals on drusy, green atacamite (?) from Antofagasta. The specimen now resides in the collection of William Pinch.

CHINA

For the past few years there have been more and more interesting minerals from China showing up on the Western market, thanks to the intrepid Doug Parsons (1119 S. Mission Rd., Suite 243, Fallbrook, CA 92028). In fact, some may now almost be considered "standard" material. However, we should remember that only a couple of years ago it was virtually impossible to find *any* good Chinese minerals except for perhaps an occasional cinnabar or two. In addition to more of the "standard" calcite, fluorite, quartz, cinnabar, realgar, orpiment, scheelite, wolframite, etc., last year Doug's travels to the Orient were rewarded with some new things such as hemimorphite, columbite-tantalite, stannite, cosalite, topaz, and aquamarine (some with morganite cores). Doug also brought back more of the fabulous stibnite crystals from the Xikuangshan antimony mine near Lengshuijiang, Shaoyang County, Hunan, along with some interesting large valentinite and cervantite pseudomorphs after stibnite up to 35 cm, resembling those from Catorce, San Luis Potosi, Mexico.

CONGO REPUBLIC

At the Tucson Show last February, Cal Graeber was able to acquire a small lot of very fine dioptase specimens from an apparently new locality at 'Mbumba, near Sanda. The crystals form elongated rhombohedra, and resemble other Congo dioptases.

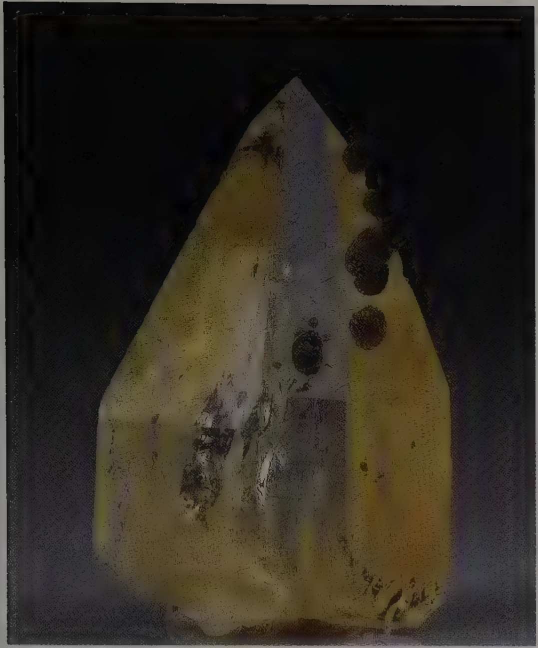


Figure 7. Brazilianite crystal, 1.5 cm, with small roscherite clusters, from Linopolis, Minas Gerais, Brazil. G. Robinson photo; Frank Melanson specimen.

WEW

Figure 8. Dioptase crystal group, 4.5 cm, from 'Mbumba, Congo. Cal Graeber specimen.

WEW

Figure 9. Cosalite crystals inside a 4-cm quartz crystal from Chenzhou, Hunan, China. Doug Parsons specimen.

WEW

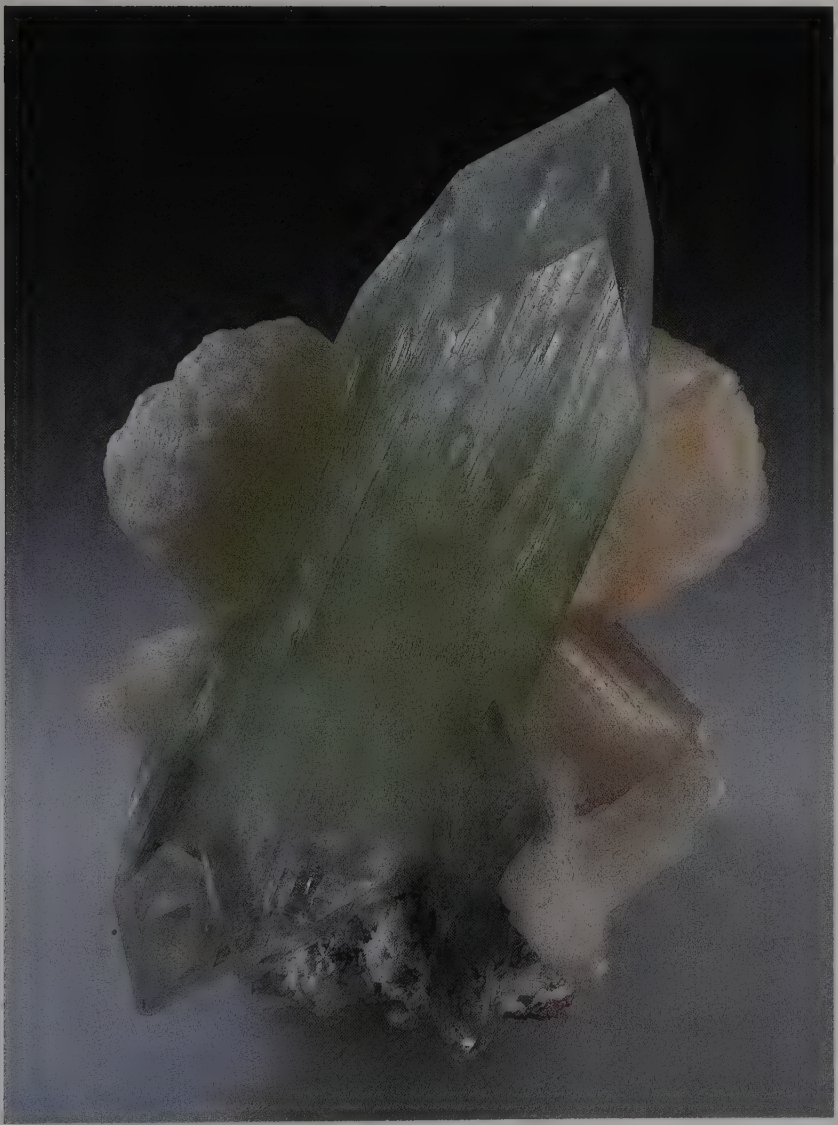


Figure 10. Apophyllite crystal, 8.1 cm, from Aurangabad, India. Ken Roberts specimen.

CZECHOSLOVAKIA

There continues to be a steady, but small supply of excellent dyscrasite crystals from Příbram seen at the major U.S. shows. Some very fine pieces have been available from Victor Yount (Rte. 3, Box 250, Warrenton, VA 22186) and E. Schmidt (ESM-JMPEX, Friedhofstrasse 3, 8591 Tröstau, West Germany).

FRANCE

More of the superb, large stolzite crystals from the St. Lucie mine, Sainte-Léger de Peyre, Lozére, showed up at this year's Tucson Show. The tabular tan-colored crystals resemble wulfenite, and occur in small groups or as single crystals up to 2.5 cm across. Excellent specimens were available from Domeneque and Mercedes Mauduit (*Esmeralda*, 288 Basses Ribes, 06130 Grasse, France). (See the photo in the May-June Tucson Show report showing a Jérôme Adani specimen.)

Also seen at the Tucson Show were some new specimens of epidote and quartz from "Queiras." The epidote somewhat resembles that from Mineral County, Nevada, and occurs as single crystals up to about 5 cm in length, or as smaller, 1–2 cm crystals with quartz in plates up to 25 cm. Specimens are available from *Les Pierres en Fleur* (Rue Du Didier Collonge, 38080 L'Isle D'Abeau, France).

Alain Carion (92 rue St. Louis en L'Ile, 75004 Paris, France) had a number of newly collected gypsum crystals from an excavation near the Paris suburb of Angervilliers, at this year's Tucson Show. The crystals are transparent to white, and form spiky rosettes and spherical aggregates up to about 10 cm in diameter.

GREAT BRITAIN

As per usual, Neil Hubbard (122 Cordery Rd., Evington, Leicester, England LE5 6DF) has found a considerable lot of minerals from Great Britain over the past year. In England, roscherite has been found in a peculiar gray apatite-quartz breccia with reddish brown, fine-grained apatite veinlets at the Clitters mine near Gunnislake. The roscherite is dark greenish gray, and forms cauliflower-like botryoids up to 3 mm. Elsewhere in Cornwall, cumengite has been found in blue, bipyramidal crystals up to 0.5 mm in fractures and vugs in a quartz-galena matrix from Gunver Head, in Padstow; and the Geevor mine near St. Just, has recently produced cabinet-sized specimens of clear to milky quartz associated with calcite and chlorite. In Cumbria, mattheddleite has been found at two new localities in Caldbeck Fells: the Red Gill and Upper Roughton Gill mines. The specimens from Red Gill consist of colorless prisms of 0.5 mm forming botryoidal aggregates or jackstraw clusters of crystals to 1 mm on pseudohexagonal leadhillite crystals associated with blue-green caledonite crystals in small vugs in quartz. Mattheddleite from Upper Roughton Gill also forms colorless prisms of a similar size and appearance, but associated with acicular to prismatic crystals of lanarkite up to 3 mm. Minor caledonite is present on some specimens, and both associations include galena with gray alteration rims of cerussite.

In Wales, red to brown, free-standing terminated crystals of piemontite up to 1 mm occur in vugs with blocky white celsian crystals to 2 mm at the Benalt mine, Rhiw, Gwynedd. A few specimens have associated paracelsian, and make excellent micromounts.

Exceptional micromounts of strontianite have been collected at the Muirshiel mine, Lochwinnoch, Strathclyde, Scotland. The gray crystals occur up to 3 mm and are twinned, forming straight-armed triskelions as well as pseudohexagonal, flat, bipyramids arranged in pagoda-like growths to 1 cm. The matrix appears to be pink barite.

INDIA

There has apparently been another discovery of very fine cavansite specimens from Wagholi, near Poona, in addition to some new and very large apophyllite crystals with stilbite from near Jalgaon, in northern Maharashtra. While there are hundreds of dealers with very fine Indian zeolites, so far the best of these new materials have been carried by Rustam Kothavala (511 Van Buren Ave., Oakland, CA 94610), Dr. J. P. Zaveri (D-311, Manju Mahal 35, Nargis Dutt Rd., Pali Hill, Bandra (W), Bombay, India) and Miriam and Julius Zweibel (812 N. Ocean Blvd., Suite 204, Pompano Beach, FL 33062).

IRAN

Minerive had an interesting lot of epidote crystals from Iran at this year's Tucson Show. The specimens consist of 5 to 20-cm groups of dark green lustrous crystals with minor amounts of quartz. Unfortunately, locality details are lacking.

JAPAN

Long thought to be exhausted, the famous anorthite locality on Miakajima Island was recently visited by Hidemichi Hori (P.O. Box 50, Nerima, Tokyo 176, Japan), who was able to relocate the site and collect a number of good crystals up to 3 x 5 cm, including some that are visibly twinned, and some with a sunstone-like schiller.

MADAGASCAR

There has been a continuing supply of very fine quartz specimens from the mines at Tambobolehibé on the market over the past two years. Specimens are available from *Hawthorneden* and numerous other dealers.

MALAWI

Dry Creek Minerals (9900 El Chorlito Dr., Rancho Cordova, CA 95670) acquired a superb lot of aegirine crystals from Mt. Malosa, Zomba district, Malawi, which were offered at this year's Tucson Show. The crystals are exceptionally lustrous and average 3 to 8 cm in length. Most are very well terminated and a few are associated with minor amounts of smoky quartz and feldspar. Little detail is known about the locality. What other uncommon alkalic species might also be present? Only time will tell.

MEXICO

There have been a number of new specimen discoveries made over the last year in Mexico, which we will try to briefly summarize here. Among the major finds from Chihuahua are some very fine crystals of hemimorphite up to 7 cm in groups many times that size. These were found on Level 16 of the El Potosi mine in Santa Eulalia. Also new from the El Potosi mine are some reddish colored calcite specimens, whose color is probably due to finely disseminated inclusions of iron oxide. These form modified rhombohedral, often twinned, crystals that average 3 cm on large (35 + cm) pieces of red iron oxide gossan matrix. Don and Gloria Olson and *Willis Earth Treasures* featured good specimens of these at the Denver Show, and others were available from Bob and Vera Turner (*Natural Connection*, 520 Marthmont Way, El Paso, TX 79912), *Arkansas Minerals* (Rte. 9, Box 818, Hot Springs, AR 71913), and a number of other dealers at the Tucson Show. David and Karen DeBruin (331 Marquette St., Fond Du Lac, WI 54935) report there were about a dozen specimens of citrine crystals recently found at the El Potosi mine. Most are thumbnails, with only one or two larger pieces in the lot (which was reportedly acquired by Bob and Vera Turner). Lastly, Ron Pellar reports that some lustrous, transparent, yellow bipyramidal crystals of adamite up to about a centimeter in size have recently been collected from a mine in Santa Eulalia by Peter Megaw.

Also seen at the Tucson Show were a number of excellent adamites from a small find at the Ojuela mine, Mapimi, Durango. These consist of golden-tan prismatic crystals up to 2 cm on drusy gray adamite in cavities in a red-brown limonite matrix. Specimens were available from *Carousel Minerals*.

Sharon and Eugene Cisneros (*Mineralogical Research Company*, 15840 E. Alta Vista Way, San Jose, CA 95127) have acquired some very good pyrargyrite specimens from Taxco, Guerrero, in addition to some fine polybasite, stephanite and pyrargyrite from Fresnillo, Zacatecas. Both lots consist largely of thumbnail to small cabinet-sized specimens, with crystal sizes averaging 1 to 1.5 cm on most pieces. The pyrargyrite, for the most part, appears to be reasonably fresh and of good color.

Other Mexican minerals of interest noted at the Tucson Show include some sceptered amethyst crystals recently collected by Wayne Thompson (1723 E. Winter Dr., Phoenix, AZ 85020) from Las Vigas, Vera Cruz; lots of good danburite and datolite from Charcas, San Luis Potosi; and even a large collection of some old-time Laguna agates being dispersed by David Wilber (3857 Crownhaven Ct., Newbury Park, CA 91320).

Lastly, after the Tucson Show, it is reported that a dealer showed up with some small geodes from near Chihuahua City, Chihuahua. These appear to be from a rhyolitic flow, and contain centimeter-sized, transparent, lilac colored crystals of amethyst with multiple terminations similar to the quartz from the Jeffrey quarry in North Little Rock, Arkansas.

NAMIBIA

Last May, workings in the upper levels of the Tsumeb mine produced a quantity of extremely fine azurite specimens. Some specimens are associated with green smithsonite, or have been partially replaced by arsentsumebite. The color combinations are striking, as are the crystals themselves, some of which are nearly 10 cm in length, with excellent luster. Both Miriam and Julius Zweibel and Don and Gloria Olson had specimens available at last year's Denver Show. Also new from Tsumeb is a find of dioptase from the "zero level." The bright lustrous crystals are typical for the locality, but apparently come from a near-surface working. Specimens were available from Larry Introna (P.O. Box 4147, Cape Town 8000, South Africa) at the Tucson Show.

The Rosh Pinah mine, located in southern Namibia, recently produced some very fine honey-yellow barite crystals in cockscomb-like aggregates up to 15 x 20 cm. Specimens of these and other minerals were available from *Namibia Minerals* (P.O. Box 5159, Suurbekom 1787, South Africa) at the Tucson Show.

Also seen at both the Denver and Tucson Shows was a new lot of green elbaite and smoky quartz specimens, reportedly from near Usakos. The elbaite forms oil-green trigonal prisms up to about 15 cm in length with steep rhombohedral terminations. Many have gemmy areas, and greatly resemble the more familiar Brazilian material. Both Wayne Thompson and *Pala International* (912 So. Live Oak Park Rd., Fallbrook, CA 92028) have specimens available.

NORWAY

Torgeir Garmo (*Fossheim Steinsenter,* 2686 Lom, Norway) has reported a number of interesting new Norwegian materials found over the past year, among them some very rare species such as lisetite from Liset, Selde; and Nybøite from Nybø, Vågsøy. Other finds of more common species include groups of gray-green fluorapatite crystals several centimeters across from Øyna, Froland; clear, brownish crystals of axinite to 3 cm, associated with datolite, pink fluorite, smoky quartz and apophyllite from a hydroelectric powerplant tunnel, near Bergen; groups of chlorite-encrusted axinite crystals to 15 cm associated with adularia and albite from a roadcut occurrence in Ulvik; transparent yellow titanite crystals up to 7 cm and single, terminated crystals of clinozoisite up to 6 cm from Radøy Island, north of Bergen; transparent, colorless quartz crystals in hundred-kilogram quantities from two new (undisclosed) localities currently under claim in northern Norway; various excellent calcite crystals from a new (?) locality in Telemark; native gold with tetradymite, nagyagite and other tellurides from the old mines at Bømlo; an array of various kinds of quartz crystals (phantoms, *fenster,* smoky, etc.) from several localities (Lifjell, Telemark; Nørefjell, Krødsherad; Valdres, and Hardangervidda); some of the best almandine (?) garnets ever found in Norway, from an undisclosed locality in Finnmark; sharp, white diopside crystals weathered out of marble from near a hydroelectric powerplant magazine near Mo I Rana in northern Norway; and amethyst scepters up to 2.5 cm associated with calcite from near Kirstiansund, south of Åheim on the west coast.

PAKISTAN

It seemed like there was hardly a mineral dealer in town at this year's Tucson Show who didn't have at least some Pakistani minerals for sale. Beautiful aquamarine and muscovite specimens from Nagir could be seen virtually everywhere, and it is impossible to list all the dealers who had excellent material. It would be equally impossible to write this report, however, and not mention the truly superb pieces displayed at the Denver Show by *Mountain Minerals International* (see *Mineralogical Record,* **22**, p. 55) or at the Tucson Show by Andreas Weerth (Hochfeldstrasse 37, D-8180, Tegernsee, Germany) and the collecting triumvirate of Wayne Thompson, Gene Meieran and Ed Swoboda. The pink fluorapatites, fluorites and aquamarines displayed by these gentlemen are definitely in the "have to be seen to be believed" category.

PERU

While perhaps not available in prolific numbers, several very fine specimens of rhodochrosite have been recovered from the Uchucchaqua mine, Lima Department, over the past year. Some of the more recent material is of an opaque pink color, resembling some of the old time Silverton or Butte specimens. Don Knowles (*Golden Minerals,* 13030 West 6th Place, Golden, CO 80401) had an enormous selection of fine Peruvian specimens available at the Denver Show, and Domeneque and Mercedes Mauduit had a good selection of the newer rhodochrosites at the Tucson Show.

POLAND

Some highly unusual crystals of zincite turned up at the Tucson Show this year. They consist of multicolored, elongated, tapered, transparent crystals several centimeters long, and in groups up to 10 cm. These crystals reportedly formed during a great mine fire at the Olkusz mine in Silesia, but a number of skeptics have suggested they are synthetically grown. Another common opinion is that they may be a smelter product from the Olkusz mine. Hopefully more information on their origin will emerge. Specimens were available from Danuta and Jacek Wachowiak of Krakow, and John Medici of Dublin, Ohio.

PORTUGAL

Sometimes we get so used to seeing quantities of good minerals at the world's major mineral shows that we start to take them for granted. Such has been the case, perhaps, with the numerous fine specimens of ferberite, fluorapatite, arsenopyrite, and other minerals that are currently available from Panasqueira. There are a lot of new specimens to choose from, which was easily proven by a visit to Sebastian Rodrigues Rosa's (*Geofil,* Av. Nossa Senhora de Rosário 1042, 2750 Cascais, Portugal) room at the Tucson Show.

ROMANIA

There appears to be a quantity of very fine Romanian minerals currently available on the market. In addition to a continuing supply of very fine stibnites from Baiuz, there is also a large number of extremely aesthetic specimens of quartz, sphalerite, rhodochrosite, tetrahedrite, barite and other minerals from Cavnic to be seen. Probably the largest selection of these minerals currently available is that of *Hawthorneden,* acquired on a recent trip to eastern Europe.

SOUTH AFRICA

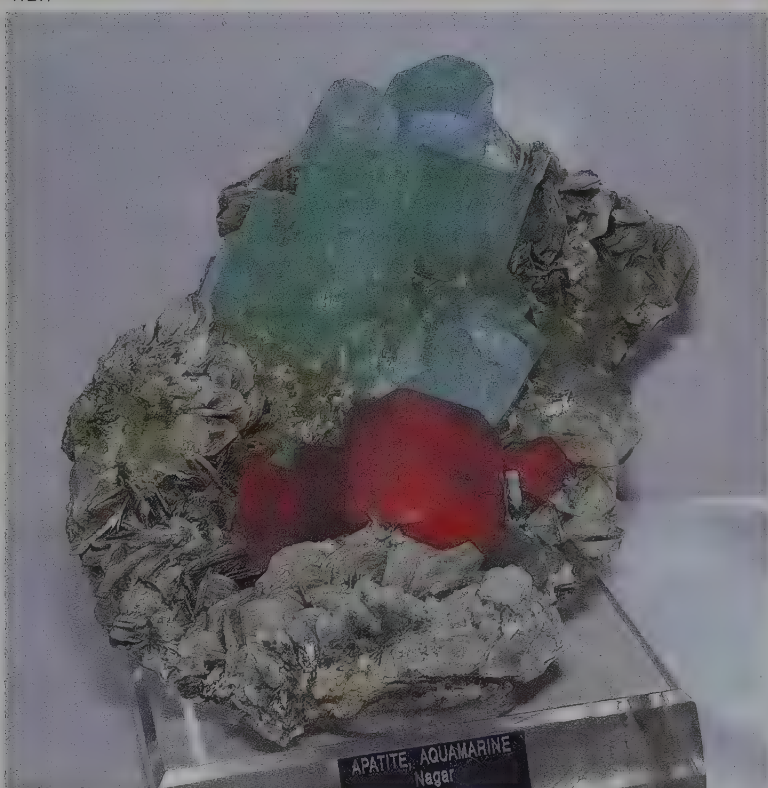
Larry Introna has acquired some excellent scalenohedral calcite

WEW

Figure 11. Aegirine crystal, 3 cm, on gray microcline from Mt. Malosa, Malawi. Dry Creek Minerals specimen.

WEW

Figure 12. Very large group (35 cm) of golden-orange calcite crystals from the Malmberget mine, near Gallivare, Sweden. Kongsberg Mining Museum specimen, shown in their exhibit at the 1991 Tucson Gem and Mineral Show.



WEW

WEW

Figure 13. Wire silver, 4 cm, from Dzezkazgan, central Kazachstan, USSR. Bryan Lees specimen.

Figure 14. Pink apatite crystals with aquamarine crystals on matrix, about 16 cm, from Nagar, Pakistan. Wayne Thompson, Gene Meieran and Ed Swoboda specimen.

crystals up to 5 cm in clusters up to 25 x 25 cm. The calcite has a pale pink color, probably due to inclusions of iron oxide, and is from the N'Chwaning II mine near Hotazel, in northern Cape Province. Larry has also acquired some mottled, smoky brown, okenite-like clusters of acicular xonotlite up to 3 cm from the nearby Wessels mine near Kuruman. This xonotlite may rank among the finest specimens of its species. Also reported by Larry were some opaque to milky watermelon tourmaline crystals up to 10 cm embedded in white feldspar from N'Dorabees, Namaqualand.

Luís Leite has also acquired some excellent xonotlite from the Wessels mine, but in snow-white fans of 2-cm fibers embedded in matrix. Luís also has some excellent, pale pinkish tan bultfonteinite crystals to 3 mm in clusters up to 6 x 6 cm from the N'Chwaning II mine, in addition to some unbelievably large cleavages of portlandite (to 3 cm!) which looked more like brucite than the porcelaneous masses we usually associate with the species.

SPAIN

Superb, gem-quality sphalerite from Santander has been known and seen on the market for years, but what *other* species have you ever seen from this important locality? At this year's Tucson Show, William Pinch was fortunate to obtain a very fine specimen of cockscomb marcasite crystals on dolomite from Mina Riocim, Santander. The crystals have a bright golden iridescence and form attractive flower-like aggregates several centimeters across.

SWEDEN

Certainly one of the highlights of this year's Tucson Show was the fabulous display provided by the Norwegian Mining Museum in Kongsberg. After recovering from the initial shock of experiencing half a dozen wire silvers, each better than anything you probably even dreamed could exist, your eye was drawn to the upper right part of the display where there sat a calcite specimen that could also have easily come from a dream world, but didn't. It was from a relatively recent find at the Malmberget mine, near Gallivare, in Lappland, Sweden. The specimen consists of a large (approximately 25 x 35 cm) plate of sharp, transparent, golden yellow, scalenohedral crystals averaging 5 to 8 cm, with several slightly larger "butterfly" twins. Collector Peter Lyckberg (Box 310042, S-40308, Gothenburg, Sweden) who obtained the specimen, explained that the Malmberget mine is a large working iron mine, and that while calcite has been found in the past, the recent find of the large "butterfly" twins was an exceptional one. In addition to calcite, there have been a number of good stilbite specimens also found over the past year. These cover a large range of colors and habits, and like the calcite, occur as fracture fillings in the host rock. Based on the geology and size of the mine, Peter suggests there is a fairly good possibility we may see more interesting things from Malmberget in the future.

SWITZERLAND

Some very fine specimens of quartz have been collected in the Bedretto Valley, near Ticino, in southern Switzerland. The crystals are water-clear and occur in clusters and plates of prismatic crystals, aptly termed "needle" quartz. *Siber and Siber* (Zürichstrasse 188-190, 8607 Aathal, ZH Switzerland) provided a very attractive display of these at this year's Tucson Show.

A few specimens of acicular, yellow tripuhyite crystals up to 1 mm from Mangan Grube, Faletta, Graubunden, have been noticed in dealers' stocks over the past year. Ordinarily, the mineral is found only in powdery coatings and masses.

U.S.S.R.

Again this year the Fersman Museum attended the Denver and Tucson Shows with a stock of fine and often rare mineral species for sale. Included among this year's goodies were brookite crystals on quartz crystals from Dodo, Urals; superb alabandite as pure, 3-cm black cleavages in matrix from Alakhjun, Yakutiya; excellent, lustrous red cinnabar crystals up to 1 cm on matrix from Chauway, Kirgizia; serandite in ussingite from the Lovozero massif, Kola; sogdianite with 4 x 5 cm (!) cleavages of zektzerite, and sharp, terminated, 5-mm, yellow-green crystals of steacyite in syenite, both from Dara-i-Pioz, Tien-Shan, Tadzhikistan; gray-white, "sandy," stellate aggregates of celestine from Ungaza, Tadzhikistan, Kazakhstan; and well-formed modified octahedrons of black spinel up to 3 cm with green pyroxene from Aldan, Yakutiya, in addition to numerous other fine specimens. A number of these and other Russian minerals are also available from *Mineralogical Research Company* and Bryan Lees, including some fine bornite crystals and wire silver from Dzezkazgan, central Kazachstan.

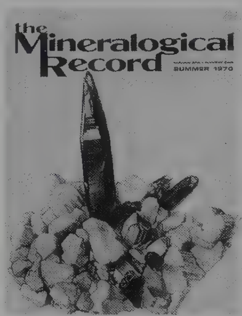
YUGOSLAVIA

Larry Venezia and Gilbert Gauthier (7 Ave. Alexandra III, Maisons-Laffitte, 78600 France) had an excellent assortment of hyalophane crystals up to 10 cm from Serajevo at this year's Tucson Show. The bright, lustrous crystals are golden tan in color and exhibited excellent twinning.

ZAIRE

Gilbert Gauthier reports that the Kakanda mine in Shaba has produced a first-time find of bright pink to raspberry-red cobaltoan calcite-sphaerocobaltite crystals. The crystals range from millimeter-sized singles up to 5-cm multiple growth crystals on a dolomitic matrix. Gilbert also reports that the Mashamba West mine has re-opened and has produced some new items. These include caramel-colored to yellow, lustrous, prismatic crystals of calcite with rhombohedral terminations, up to 5 cm, associated with minor malachite; more cuprite crystals, but generally of lower overall quality compared to previous finds; and malachite crystals in flattened stellate groups up to 8 cm. These somewhat resemble flattened mushrooms, with the "underside" showing a gill-like structure.

Mineralogical Record BACK ISSUES!



v.1/#2 Moctezuma mine, New England minerals, Bavenite, Minas Gerais **$15**

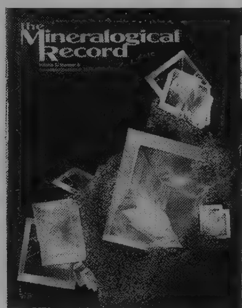
v.1/#3 Eakerite (NC), Rutile (CT), Cornetite (AZ), Mineral Rings & Cylinders **$15**

v.1/#4 Columbian Emerald, Natrolite (OR), Benstonite (IL), Långban (Sweden) **$15**

v.3/#3 Tasmanian Crocoite, Val Malenco (Italy), Tetrahedrite (Chihuahua) **$15**

v.3/#4 Boron Minerals & Deposits (part I), Fairfax Quarry (VA) **$15**

v.3/#5 Boron Minerals & Deposits (part II), Amethyst, Ferrier Collection **$15**



v.3/#6 79 Mine Issue (AZ) (first color special issue) **$20**

v.5/#5 Julcani District in Peru, Indian Mtn. (AL), Capelinha (Brazil) **$15**

v.8/#5 Characterization of New Species, Twinning, Axinite (Brazil), Green River (WY) **$5**

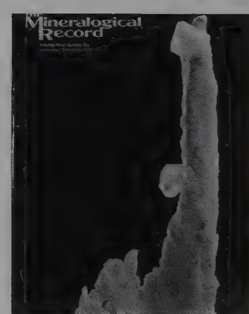
v.8/#6 California Issue Benitoite, Gold, L.A. County Museum, Himalaya mine **$7**

v.9/#2 Bou-Azzer (Morocco), Jeffrey Quarry (AR), Amity (NY), Greenbushes (Australia) **$5**

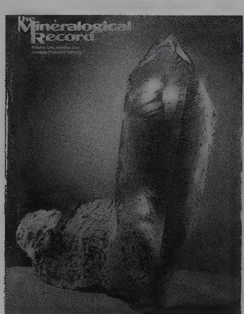
v.9/#3 Kalahari rhodochrosite, Paterson (NJ), Brumado district (Brazil), Bosch Collection **$7**

v.9/#4 Elmwood (TN), Chester (MA), Pyrite XL Forms **$5**

v.9/#5 Turkish Kämmererite, Afghan pegmatites, Chuquicamata (Chile) **$7**



v.9/#6 Libethenite (Zambia), Quartz & Pyrite (WA), Hydroboracite (CA) **$5**



v.10/#1 Hydroxylherderite (Brazil), Books on U.S. minerals **$5**

v.10/#2 Jeffrey mine (Quebec), Alpine Rodingites, Fluorite (Germany) **$5**

v.10/#3 Taewha mine (Korea) Japan Twins (Quartz), Bancroft (Ont.), Franklin **$5**

v.10/#4 Chañarcillo (Chile), Chihuahua Geodes, Curetonite, Cassirer Memoirs (part I) **$5**

v.10/#5 Thomas & Wah Wah Ranges (Utah) (famous for Topaz, Red Beryl, etc.) **$7**

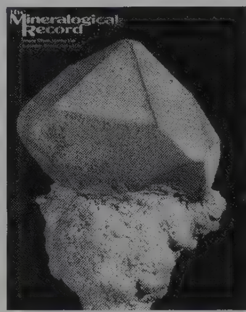
Postage $1 per copy– Order 10 copies or more and **we pay all postage.**

Order From: Circulation Manager
Mineralogical Record
P.O. Box 35565
Tucson, Arizona 85740

Supplies are Limited

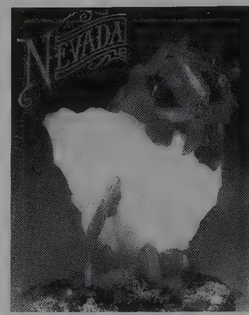
Mineralogical Record BACK ISSUES!

v.15/#4 Sterling mine (NY), Burra mine (Australia), Lotharmeyerite, Jack Boyle **$7**



v.15/#5 Jacupiranga mine (Brazil), Jensen quarry (CA), Cunha Baixa mine, Paulkerrite **$7**

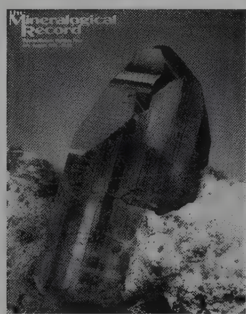
v.15/#6 Bad Ems (Germany), Touissit Vanadinite, Hawleyite (IN), Fluorapatite (SD) **$7**



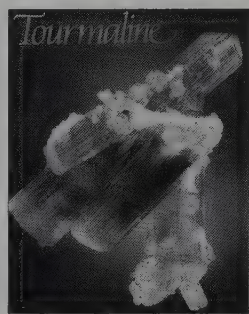
v.16/#1 Nevada Issue! Comstock Lode, Getchell, Steamboat, Majuba Hill, White Caps **$7**

v.16/#2 Romero Museum, Phenakite & Bahianite, Mammothite, Sodium-pharmacosiderite **$7**

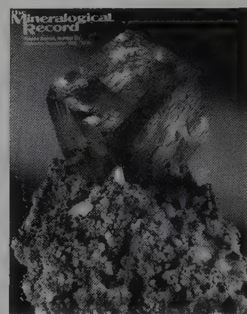
v.16/#3 Colorado-III Issue! Leadville, Rico, Cresson Vug, Pikes Peak, CSM Museum **$7**



v.16/#4 Kingsgate mines (Australia), Mauldin Mountain Phosphates (AL) **$7**



v.16/#5 Tourmaline Issue! (112 p.) Elba, Maine, Pakistan, Nepal, California, etc. **$10**

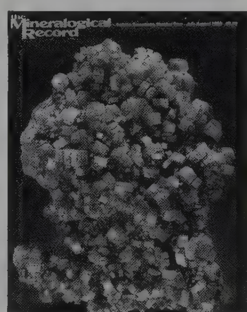


v.16/#6 Graves Mtn. (GA), Gardiner Complex (Greenland), Canaphite, Hutchinsonite **$7**

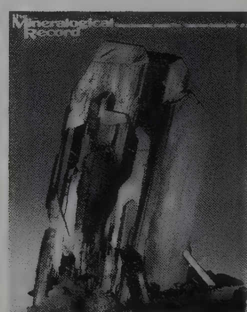
v.17/#1 Silver Issue! Kongsberg, Michigan, Silver Islet, Batopilas, Germany (scuffed) **$10**

v.17/#2 J. C. Holmes claim (AZ), Austrian Minerals, Marsturite, Franklin (NJ) **$8**

v.17/#3 Knappenwand (Austria), Laurium (Greece), Senaite (Brazil), Chalcophyllite (New Zealand) **$8**



v.17/#4 National Belle mine (CO), Tip Top mine (SD), Stoneham Barite (CO) **$8**



v.17/#5 Black Hills type localities, Urucum (Brazil), Kalkar quarry (CA), Kremsmünster **$8**

v.17/#6 Bleiberg (Austria), Brochantite (OK), Arsenopyrite (Ont.), Author's Guide **$8**

v.18/#1 Gold-II Issue! Australia, Calif., Breckenridge, Hopes Nose (England), etc. **$12**

v.18/#2 Elk Creek (SD), Teyler's Museum, Ramsbeckite, Neotocite, Phosphosiderite **$8**

v.18/#3 Uranium minerals (Sardinia), Garnet Hill (NV), Photographer's Guide, Library Guide **$8**

v.18/#4 Carrara Marble (Italy), Marburg Museum (Germany) **$8**

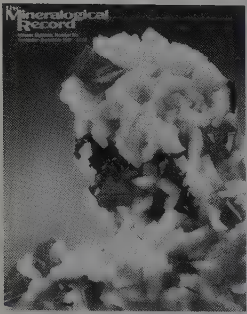
v.18/#5 Hale Creek Inesite (CA), Vanadium Minerals Review, Peking Museum **$8**

Postage $1 per copy–Order 10 copies or more and **we pay all postage.**

Order From: Circulation Manager
Mineralogical Record
P.O. Box 35565
Tucson, Arizona 85740

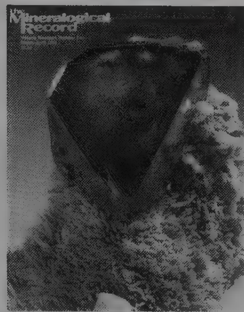
Supplies are Limited

Mineralogical Record BACK ISSUES!



v.18/#6 Stereo Issue—includes stereo viewer! Calcite, Pyrite, Morgan Hall (AMNH) $8

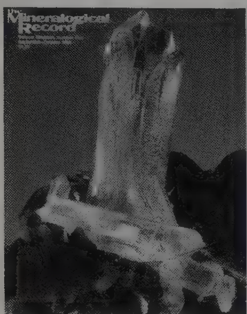
v.19/#1 Mineral Museums of Eastern Europe Full-color 72-page book-issue $10



v.19/#2 Iron Cap mine (AZ), Ouray (CO), Anatase (CO), Peter Zodac Collection $8

v.19/#3 Table Mtn. Zeolites (CO), Tonopah-Belmont mine (AZ), Parker Cleaveland $8

v.19/#4 Ichinokawa mine (Japan), Bandora mine (CO), Chernikovite, Getchell arsenates (NV) $8

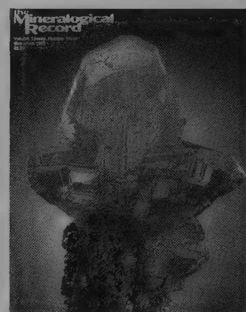


v.19/#5 Almaden (Spain), IMA, J. Berzelius, Probertite, Osarizawaite $8

v.19/#6 Australia Issue! 152 pages and much color photography! $12

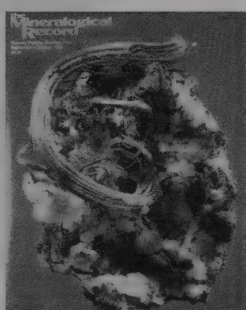
v.20/#1 New Mexico Issue! 96 pages and much color photography! $10

v.20/#2 Little Three mine (CA), Zaragoza Gypsum (Spain), Calif. Locality Index $8



v.20/#3 Ouro Preto (Brazil), Anjanabonoina (Madagascar), Port Radium Silver (Canada) $8

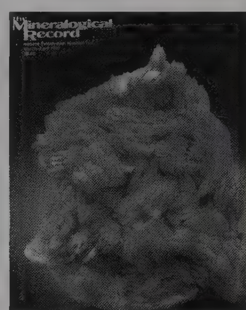
v.20/#4 Katanga Uranium Issue! Shaba (Zaire) deposits, much color photography! $10



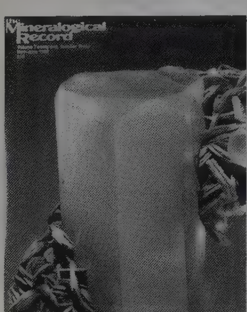
v.20/#5 Brazilian Diamonds, Leveäniemi mine Phosphates (Sweden), Phoenixville (PA) $8

v.20/#6 Spanish Pyrite, Pint's quarry (IA), Beaverdell (Br. Col.), Hollister (CA), Blue Ball (AZ) $8

v.21/#1 Special 20th Anniv. Issue! Roebling, Canfield, Bement, Paris Exp., Transylvania $10



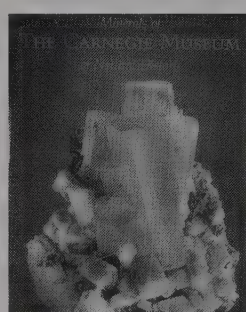
v.21/#2 Thornberry Axinites (CA), El Dragón mine (Bolivia), Silver District (AZ), Goldschmidt $8



v.21/#3 American Amethyst Localities, Terlingua, Davis Hill, Edgarbaileyite, Faden Qtz. $10

v.21/#4 Mont Saint-Hilaire Issue! 112 pages and much color photography! $12

v.21/#5 Rose qtz. (Brazil), green Apatite (Brazil), stereo photogr., Carnegie Museum Catalog $12



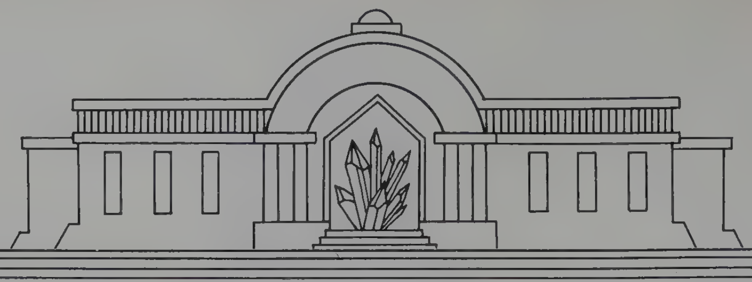
Carnegie Museum Catalog Magnificent, 32-page, full-color catalog **free** in each v.21/#5.

v.21/#6 Nanisivik mine (Canada), De Kalb (NY), Murfreesboro (AR), Australian Diamonds $10

Postage $1 per copy– Order 10 copies or more and **we pay all postage.**

Order From: Circulation Manager
Mineralogical Record
P.O. Box 35565
Tucson, Arizona 85740

Supplies are Limited



THE MUSEUM DIRECTORY

Museum of Geological Sciences, V.P.I.

Curator:
Dr. Susan C. Eriksson
Tel: (703) 231-6029
2062 Derring Hall
Virginia Polytechnic Inst.
& State University
Blacksburg, VA 24061-0420
Hours: 8–4 M–F, 10–2 Sat.
Specialty: Virginia and worldwide minerals & fossils

Montana Tech Mineral Museum

Curator:
Richard Berg
Adjunct Curator:
Lester G. Zeihen
Tel: (406) 496-4414
c/o Montana Tech
Butte, MT 59701-9981
Hours: 8–5 M–F Oct.–Apr.
& Sunday afternoons
Specialties: Montana & Idaho minerals; systematics

Glenbow Museum

Curator (mineralogy):
Michael S. Evick
Tel: (403) 264-8300
Glenbow Alberta Institute
130 Ninth Avenue S.E.
Calgary, Alberta
Canada T2G 0P3
Hours: 10–6 Tues–Sun
Specialties: W. Canadian and worldwide minerals & gems

Harvard Mineralogical Museum

Curators:
Dr. Carl A. Francis
William Metropolis
Tel: (617) 495-4758
24 Oxford Street
Cambridge, Mass. 02138
Hours: 9–4:30 M–Sat; 1–4:30 Sun
Specialties: Systematic Mineral Collection

William Weinman Mineral Museum

Curator:
Kim B. Cochran
Tel: (404) 386-0576
P.O. Box 1255
Cartersville, GA 30120
Hours: 10–4:30 Tue–Sat,
2–4:30 Sun.
Specialty: Georgia & worldwide minerals & fossils

Geology Museum Colo. School of Mines

Curator:
Virginia A. Mast
Tel: (303) 273-3823
Golden, Colorado
Hours: 9–4 M–Sat, 1–4 Sun.
(closed on school holidays & Sundays in the summer)
Specialties: Worldwide minerals; Colorado mining & minerals

A. E. Seaman Mineralogical Museum

Curator (mineralogy):
Stanley J. Dyl II
Tel: (906) 487-2572
Michigan Technological Univ.
Houghton, Michigan 49931
Hours: 9–4:30 M–F
Specialty: Michigan minerals, copper minerals & worldwide minerals

Houston Museum of Natural Science

Curator (mineralogy):
Joel Bartsch
Tel: (713) 639-4673
1 Hermann Circle Drive
Houston, Texas 77030
Hours: 9–6 M–Sat; 12–6 Sun
Specialty: Finest or near-finest known specimens

Natural History Museum of Los Angeles County

Curator (mineralogy):
Dr. Anthony R. Kampf
Tel: (213) 744-3328
900 Exposition Blvd.
Los Angeles, CA 90007
Hours: 10–4:45 Tu–Sun.
Specialties: Calif. & worldwide minerals, gold, gem crystals, colored gemstones
Support organization:
The Gem and Mineral Council

Sterling Hill Mining Museum

Curators:
Robert Hauck
Richard Hauck
Tel: (201) 209-7212
30 Plant Street
Ogdensburg, NJ 07439
Hours: 10–5 M–Sun, Mar.–Dec.
Specialty: Local mining & minerals

Carnegie Museum of Natural History

Collection Manager:
Position currently open
4400 Forbes Avenue
Pittsburgh, PA 15213
Hours: 10–5 Tues–Sat,
10–9 F, 1–5 Sun,
closed Mon. & holidays
Specialty: Worldwide minerals & gems

Jurupa Earth Science Museum

Curators:
Dr. Jack Nieburger
William Hudson
Tel: (714) 685-5818
7621 Granite Hill Dr. (Hwy 60)
Riverside, CA 92509
Hours: 1–4 Tues–F, 10–5 Sat.
Specialty: Crestmore & worldwide minerals & fossils

Museums listed alphabetically by city

New Mexico Bureau of Mines & Mineral Resources Mineral Museum
Mineralogist/Curator:
Marc L. Wilson
Tel: (505) 835-5246
Campus Station
Socorro, NM 87801
Hours: 8–5 M–F & by Appt.
Specialty: New Mexico minerals

M.Y. Williams Geological Museum
Curator: Joe Nagel
Tel: (604) 822-5586
University of British Columbia
6339 Stores Road
Vancouver, B.C.,
Canada V6T 1Z4
Hours: 8:30–4:30 M–F
1:30–4:30 W (Collector Shop)
Specialty: B.C., Pacific NW, Canada; Exhibit Quality

Private Museums

Hampel Mineralogical Museum
Curator:
Lance T. Hampel
Tel: (414) 255-4540
P.O. Box 39
Germantown, WI 53022
Hours: by Appt.
Specialty: Midwest minerals

Museo Mineralógico M. Romero
Curator: Jorge Díaz de León
Tel: (238) 3-00-07
7 Norte #356
Tehuacán Puebla, México 75700
Hours: 10–12 noon M–Sat
4–6 p.m. M–F & by Appt.
Specialty: Mexican Minerals

POSITION OPEN

The Carnegie Museum of Natural History
Head, Section of Minerals

The Carnegie Museum of Natural History is seeking a Head for its Section of Minerals. The position is responsible for management of all aspects of the Section, care and management of the mineral and rock collections, maintenance of the Hillman Hall of Minerals and Gems, development of associated educational activities in conjunction with the Division of Education both within the museum and as out-reach programs, developing traveling and temporary exhibits, and representing the museum to the national and international minerals community. The museum is especially interested in the conservation of mineral and rock specimens.

Qualifications include advanced training in minerals and earth sciences (Ph.D. preferred), ability to effectively budget and manage all aspects of an active section, familiarity with database systems, and museum experience. The Section of Minerals is within the Earth Sciences Division of CMNH. The Section Head is expected to maintain the Section at the highest standards and to work with museum administration and other staff on common projects. Salary and title will depend on the experience and qualifications of the successful applicant.

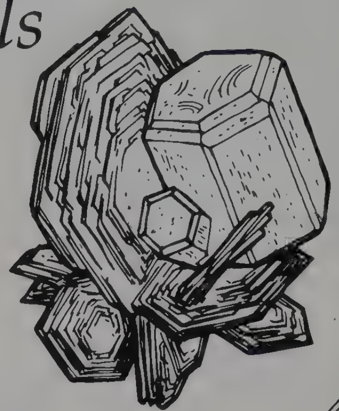
Interested candidates should send a résumé and the names of three references to Dr. James E. King, Director, The Carnegie Museum of Natural History, 4400 Forbes Avenue, Pittsburgh, PA 15213 by October 30, 1991. CMNH is an AA/EOE Employer.

VALADARES
minerals

Edson & Laercio Endrigo

* *fine mineral specimens from Brazil*
* *Wholesale & Retail*
* *Call or write for information*

RUA CAPOTE VALENTE, 513
AP. 133 CEP 05409 PINHEIROS
SÃO PAULO-SP, BRAZIL
Tel: (011) 64-5317



Fine Australian & Worldwide Specimens — Micro to Museum Sizes
Rare Australian Species, Meteorites & Tektites

Robert Sielecki
exploration geologist
Janine Rea
mine geologist
42 Hex St., Tottenham
Melbourne, Victoria 3012
Australia (phone (03)314-9612

See You In:
Denver
Munich
Paris
Tucson
1991–1992

PLANET3
QUALITY MINERAL SPECIMENS

CHRIS GOSSO

23 CAMDEN ST.
TORONTO, ONTARIO, CANADA
M5V 1V2
416-367-8696

Cureton Mineral Company

We have a large selection of Platinum Group Minerals in stock at this time, including:

Atokite	Geversite	Keithconnite	Plumbopalladinite
Bowieite	Insizwaite	Kotulskite	Tetraferroplatinum
Cabriite	Irarsite	Maslovite	Tulameenite
Cuproiridsite	Isoferroplatinum	Niggliite	Unnamed $PdBi_3$
Foordite	Kashinite		

Many are individually microprobed and are provided with photomicrographs showing the exact location of the mineral. Please write for more information.

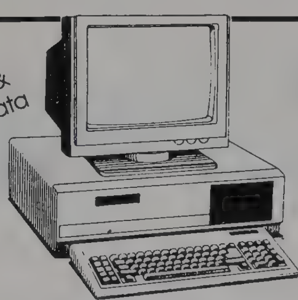
Want lists are welcomed. Our August 1991 meteorite list is now available.

Now Accepting VISA and MASTERCARD

Forrest & Barbara Cureton

P.O. BOX 5761, TUCSON, ARIZONA 85703-0761 • TEL 602-743-7239

Now with Type Localities & X-ray Powder Data



MINERAL
A Mineral Reference Manual for the IBM-PC (with Hard Disk)

MINERAL is an up-to-date mineral database containing information on all valid mineral species, and over 350 unnamed minerals. The information, compiled by E. H. Nickel and M. C. Nichols, is accompanied by a data-management system which permits very rapid searching by name, synonym, elements, radicals, type locality, hardness, specific gravity, X-ray powder data, crystallography, classification, related species and JCPDS number. Other information includes the chemical formula, origin of the name and three references. Semi-annual updates are available. (You will receive a copy permission statement to sign before shipment.)

Complete MINERAL System: U.S. $479 prepaid, postage included worldwide.

Aleph Enterprises
P.O. Box 213, Livermore, California 94550 • (415) 443-7319

Mineral List Available

WHOLE EARTH MINERALS
P.O. BOX 50008
RENO, NEVADA 89513

CRESTMORE / JENSEN QUARRY MINERALS
75 Species, Crestmore Quarry
25 Species, Jensen Quarry
Sent $1 for catalog to:
Jurupa Mtns. Cultural Center
7621 Granite Hill Drive
Riverside, CA 92509 (714-685-5818)

David & Celia Lare
Jeffrey Mining Co.
Specializing in Fine Mineral Specimens Wholesale & Retail
Route 1, Box C20A1 • Saulsbury, TN 38067
(901) 376-1149

Volunteer Coordinators Eastern U.S.
Charles & Marcelle Weber
1172 West Lake Ave.
Guilford, CT 06437

Advertising Information
All advertising in the Mineralogical Record must be paid in advance of the closing date. Telephone orders not accepted. Write to the editor for rates.

Closing dates:

Jan.-Feb. issue	Oct. 15
March-April issue	Dec. 15
May-June issue	Feb. 15
July-Aug. issue	April 15
Sept.-Oct. issue	June 15
Nov.-Dec. issue	Aug. 15

An additional 20 days past the closing date are allowed in which advertisers may make changes (excluding size changes) in ads already paid for.

Design
Wendell E. Wilson

Graphic Production
Capitol Communications
Crofton, MD

Printing
Waverly Press, Easton, MD

Color Separations
Hollis Phototechnics
Tucson, AZ

Circulation
P.O. Box 35565
Tucson, AZ 85740
602-297-6709

Editing, advertising
4631 Paseo Tubutama
Tucson, AZ 85715
602-299-5274

Foreign Payments
Remittance may be made in local currency, at *prevailing exchange rates,* without surcharge, to the following people:

Belgium
Paul Van Hee
Marialei 43
B-2120 Schoten

Canada
Mrs. J. W. Peat
36 Deepwood Crescent
Don Mills, Ontario M3C 1N8

Great Britain
Paul Lowe
"Endsleigh"
50 Daniell Road
Truro, Cornwall TR1 2DA

Italy
Renato & Adriana Pagano
P.O. Box 37
I-20092 Cinisello Balsamo MI

Japan
Tsukasa Kikuchi
P.O. Box 18, Hongo
Tokyo 113-91

Netherlands
W. J. R. Kwak
Kabeljauwallee 23
6865 BL Doorwerth (Gld)

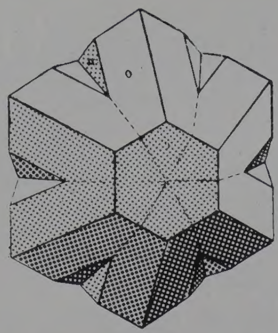
Norway & Sweden
Geir Wiik
N-2740 Roa
Norway

South Africa
Horst Windisch
30 Van Wouw Street
Groenkloof, Pretoria

West Germany
Christian Weise Verlag
Oberanger 6
D-8000 München 2

Affiliated with the Friends of Mineralogy, an independent, non-profit organization devoted to furthering amateur and professional interests in mineralogy. For membership information contact Richard Thomssen, Treasurer, P.O. Box 1656, Carson City, NV 89702

Opinions expressed
are those of the authors and do not necessarily reflect those of the Mineralogical Record Inc., its editorial staff or directors.



Advertisers Index


VICTOR
YOUNT
CERUSSITE from Touissit, Morocco
Photo by Harold
and Erica Van Pelt
SEE ME AT THE
TUCSON COMMUNITY
CENTER
Tucson, Arizona
February 1992
Pasadena (Nov. 25-26)
Detroit
Franklin, NJ
Munich
Springfield
Denver
45 miles from downtown Washington
Route 3, Box 250 • Warrenton, Virginia 22186 • (703) 347-5599
By appointment only / No lists


Topaz
Photo by
Harold and Erica
Van Pelt, Los Angeles
© 1989
Importers-Exporters of
colored gemstones & fine
minerals • Member AGTA
Pala International
912 So. Live Oak Park Road • Fallbrook, California 92028 • (619) 728-9121 • U.S. WATS 1-(800)-854-1598
CABLE: Palagems • TLX-695491 • FAX 619-728-5827