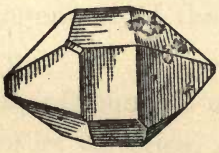
QUARTZ AND ITS VARIETIES

— INCLUDING —

ROCK CRYSTAL, AMETHYST, AGATE, JASPER,
AGATIZED WOOD, SMOKY QUARTZ, ETC.,
WITH A DESCRIPTION OF
LOCALITIES.

— BY —

ALBERT C. BATES.



PUBLISHED BY
ARTHUR CHAMBERLAIN,
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PREFACE.

QUARTZ and its Varieties was printed in parts, beginning in the June and ending in the December, 1895, number of THE MINERAL COLLECTOR.

In writing the articles, my aim has been to describe in detail the famous old localities which still afford specimens of the mineral, the more recently discovered and little known localities, and the character of the material found at each of them.

I have avoided, as far as possible, mention of the exhausted localities, or those which have afforded a very limited supply of specimens, even though they were of exceptional interest. I realize that many localities worth recording have not been mentioned, for the reason that the facts relating to them were not accessible to me.

The editor of THE MINERAL COLLECTOR, Mr. Chamberlain, and the few collectors who have expressed an opinion relative to the matter, believe that if the articles were printed in pamphlet form, they would be acceptable to collectors generally.

Because of the arrangement of the localities, an index is not considered necessary.

I shall be glad to be informed of any American localities affording quartz or any of its varieties, not fully mentioned in the following pages.

ALBERT C. BATES.

320 Roseville Avenue, Newark, N. J.
November 20, 1895.

PUBLISHER'S NOTE.

THE publishing of this article in pamphlet form from THE MINERAL COLLECTOR has naturally caused some discrepancies in referring to cuts. These I have noted below:

The frontispiece referred to on page 1, now faces page 8. Fig. 4, referred to on page 5, now faces page 24. Frontispiece referred to on page 10, now faces page 16. Frontispiece referred to on page 11, now faces page 16. Fig. 7 referred to on page 15, now faces page 24. Figures referred to on page 23, now faces page 28. Figs. 5 and 6 referred to on page 25, now faces page 24. The frontispiece referred to on page 27, now faces page 32. The frontispiece referred to on page 29, now faces page 32. The frontispiece referred to on page 35, now faces page 36. The frontispiece referred to on page 40, now faces this page.

ILLUSTRATIONS.

QUARTZ, HOT SPRINGS, ARKANSAS.

In the collection of
WM. H. ANDREWS, Esq.,
Gouverneur, New York.

QUARTZ AND ITS VARIETIES.

BY ALBERT C. BATES.

INTRODUCTION.

QUARTZ is the most widely distributed of the minerals, and is found in all quarters of the earth. The varieties of form and color embraced in quartz are infinite. Its beauty and usefulness in many ways, have been acknowledged from the earliest times. Nearly all collections of minerals include a greater number of specimens of quartz than of any other single species.

As it is well nigh impossible to make a complete collection of all the known minerals, there are collectors who seek to make a complete collection of a single species, and to this class I belong, selecting quartz in the belief that it is the ideal mineral.

The subject of the frontispiece is a part of my mineral collection, and was selected for illustration, first, because it consists almost entirely of quartz, and, second, to give an idea of how small a space may be used to good advantage, in the arrangement of shelves and drawers.

The cabinet is eight feet long by seven feet high, including the fifteen drawers. The shelves, painted white, slope back step fashion, which admits the light to the top and front of each specimen, and permits of freedom in handling. An alcove of any width and two feet deep, may be used in like manner to good advantage.

With this introduction to my subject, I should add that I have made no original investigation into it, and cannot, therefore, interest the student, but since I have gathered some facts by the careful observation of the specimens which have come under my notice, I may reasonably hope to interest the collectors of minerals.

There is very little popular literature upon the subject. Des Cloizeaux's work on quartz, published in France in 1854, is pronounced a classic, but no English translation of it has been made. Mr. George F. Kunz, in his work on "Gems of North America," has given more space to quartz than to any other mineral. The illustrations of quartz in that work are the most beautiful ever printed. As new finds of

quartz have been made, their occurrences and peculiarities have been recorded in *The American Journal of Science.*

It is difficult to photograph a group of crystals because of the reflected light. Some of the engravings will not, therefore, show to the best advantage the particular points I wish to illustrate.

North Carolina.

North Carolina is rich in minerals interesting to the collector. Alexander, Lincoln, Burke and other counties have for several years yielded crystals of quartz which have received much attention from crystallographers here and in Germany. Besides the usual forms presented, there were found many crystals showing planes not found elsewhere. Recent prospecting work by Mr. E. H. Harn, particularly in Lincoln Co., brought out several new forms and variations, due, probably, to a process of etching of the angles of the pyramid, and often of the prism.

The "thing" (gas, acid, water, pressure) which causes the etching, or erosive effect, is not yet determined. Several pockets containing these crystals, a few showing basal pinacoids according to some collectors (I cannot say authorities), have been found. Rare planes which delight the eye of the enthusiast are found in abundance.

Some crystals show a complete rounding with all sharp angles gone, as if eaten with acid, but are found bright and glassy—details of which will be given further on. Modifications and distortions are common. Inclusions of rutile, muscovite, tourmaline and other minerals are found in handsome specimens.

The prettiest, or as some people say, the "cutest" specimens of North Carolina quartz, are made up of several small doubly terminated crystals superimposed along the prism of a large crystal and generally in parallel position. One such specimen in my collection is about four inches long, with small crystals on all sides of the prism, and thickly grouped near the pyramid.

Some specimens are sold labelled "inclosing clay," and there is often plenty of clay inclosed, but nearly always in an open cavity. These cavities are often parallel to one angle of the pyramid, and formed one above the other the length of the prism; but why they should so arrange themselves is not an easy matter to determine. Some crystals contain one or more empty cavities, and I have seen others containing as many as forty cavities with liquid inclusions.

Bursting, caused by the expansion of the liquid contained in the cavities, admits a deposit of clay into them. This clay is of a rusty

iron color, and seen through a brilliant crystal in the "phantom" shaped cavities, makes attractive specimens.

The crystals vary much in color from limpid to citrine, amethystine and the smoky shades. As it is probable that these crystals will be offered for sale everywhere, I hoped to convey by illustrations a few of the more complex forms. But photography does not, in the attempts made by my amateur friends, properly bring out the planes, and hand-drawings and wood engravings are very expensive methods of illustration. I therefore depend upon description to convey to the reader the crystalline forms of a few selected specimens.

A single pocket has afforded crystals of true form, distortions, some few flattened out, the rare "s" and "x" planes, and others with as many as twelve reflecting planes. But the rarest and most interesting, are those showing a "basal pinacoid."

Now, what is a basal pinacoid? Webster defines it thus:

"Pinacoid. A plane parallel to two of the crystalline axes."

To convey an idea of the form simply, I should say that the termination ends with a blunt plane in place of the usual point. Very few of these so-called basal pinacoids are flat, but where they are flat, they are admittedly bases.

A great many crystals terminate in what are called "saw-teeth points", because they are as uneven as a fine saw, but sharp. Others terminate with the end bevelled and sometimes grooved, as if the angles had been eaten by acid. Others again are as completely rounded as a water washed pebble, but are always bright and smooth.

What are the causes of these phenomena? These crystals occur in pockets filled with clay, compactly laid together. The formation is very old. Hot springs may have made a perfect caldron of these pockets, and stirred their contents in such a manner as to cause the rounding and etched effects noticed.

Again, there is an abundance of minerals and rare earths at these localities which contain peculiar acids, and which may have produced on these crystals the effects I have mentioned.

Still, all this is mere speculation; but ideas are wanted, and some professors of mineralogy who have examined these crystals have not advanced easily acceptable notions of the causes of the etching.

To appreciate these crystals, one must have some knowledge of crystallography.

They are valuable intrinsically since they fetch high prices. From one to five dollars being readily paid for crystals showing an extra number of rare planes, and without much regard to beauty otherwise.

Very few of these crystals are doubly terminated, and none is perfect in the fullest sense. A comparison with crystals from other local-

ities readily reveals the characteristics I have endeavored to describe.

Of the rarer forms of these quartz crystals, perhaps the finest selected suites are owned by Mr. W. D. Schoonmaker of Brooklyn, Mr. Lazard Cahn of New York City, and myself; we being so fortunate as to have had sent us for inspection the contents of the pocket containing the "eroded" crystals. Mr. Harn, doubtless, saved a splendid suite for his private collection, which is rich in the more beautiful form and colors of these North American quartzes.

Mr. Cahn has kindly furnished me with a description of his views relative to these crystals as follows:

"During the past few months, Lincoln County, North Carolina, has furnished more crystals of quartz to New York collectors than all other localities put together. The quartz is interesting, because it exhibits, besides the ordinary $10\bar{1}1$ and $01\bar{1}1$ planes, lower rhombohedrons and low trapezohedrons; but its chief interest is perhaps due to the beauty and variety of the etching on its planes.

The most common, and perhaps the most beautiful of the etching, is the indentation of triangles, with their apices pointing toward the prism. These are usually very minute and of uniform size, but in many cases the size of these triangles varies on the same plane, and on two or three crystals that I have examined, the sides of some of the triangles measure a quarter of an inch. The triangular etching figures are not always indented, but are sometimes in relief, their apices then point upward. Both kinds are present on the faces of some crystals. Altogether, the most interesting that I have observed from this region, is a lot of thirty crystals of light amethystine color approaching pink. The quartz is in part clear, but the greater portion is filled with cavities and fractures. The crystals are very much eroded, and their edges so blunted and rounded that, at first glance, they appear to be pebbles; upon more careful examination, one can see that the rounding is due to erosion, and that the character of the etching changes with the plane, like planes being similiarly etched. Those of this series that have been best protected from the solvent are the most attractive. The usual rhombohedrons, $10\bar{1}1$ and $01\bar{1}1$, are pitted very finely; the form of the pittings is undiscernible with the naked eye, but the minute triangles can be seen with the aid of a triplet; they point downward, are of uniform size and in parallel position. The pittings leaves these planes dull. On the lower planes the solvent has been more active, and has produced a number of curious gutters, but has left the surface lustrous.

The etching of the quartz crystals from the adjoining counties, Burke and Iridell, has been ascribed to the action of alkaline carbon-

ates. The crystals under consideration have probably been attacked by the same substances.

The crystals have a multitude of planes. The edge between $10\bar{1}1$ and 0111 is replaced by a channelled plane, there are three rhombohedrons of the negative series steeper than $01\bar{1}1$, but only one steeper than $10\bar{1}1$. The trigonal pyramid $11\bar{2}1$ is present; all of its four edges are truncated. In the *m s z* zone there appear to be six or more trapezohedrons. Collectors should be grateful to Lincoln County, and to the workers there, for this highly interesting material."

I hope to have further contributions relating to these crystals from authorities on crystallography, to appear later on in this article.

There are mineralogists who think the peculiar planes of these crystals are not really due to etching, but were built up just as they were found. The great number of reflecting planes on some crystals certainly favor that theory; but the true causes of the peculiar forms have yet to be scientifically determined.

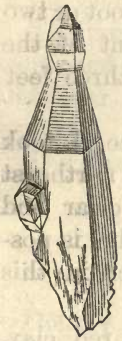


Fig. 1.

A few very pretty specimens of quartz crystals, single and in groups, were found in Catawba County, with an amethystine capping on a milky or clear prism. I am doubtful about the tops being "caps" properly so called, since there is no evidence in the crystals I have seen of an inclosed termination.

Figure 1 shows the enlarged top of one of those crystals found several years ago. Recent finds show tops much larger in proportion to the prism.

Groups of small amethystine crystals in parallel position on a milky quartz gangue are quite pretty. A few specimens show but one or two crystals, as in figure 2.

Crystals showing dislocation are of rare occurence. See Figure 4. These "dislocated" crystals appear to have been broken and then healed by natural process, but just how the operation is accomplished, I cannot learn from reading or inquiry.

The story of the occurrence of quartz in North Carolina was recently written for me by Mr. E. Harn, of Henry, that State, and I give it here as received:

"The quartz-bearing region of North Carolina, roughly speaking, or that portion that I wish to speak of, extends over an area of at least sixty miles in length, by some thirty miles in width. This territory comprises portions of Iredell, Alexander, Catawba, Cleveland, Lincoln and Gaston Counties, and has furnished more and finer examples of the quartz group than possibly any other section of like extent in the world.

Fig. 2.

The country is nowhere, with the exception of parts of Alexander and Cleveland Counties, hilly in a degree approaching mountainous, and was evidently in former geological times a low-lying range of hills covered with innumerable mud and hot water springs. This is borne out by the character of the crystals themselves, and the deposits or "pockets."

The quartzes of North Carolina are essentially pockets, as nowhere, to my knowledge, has there been a continuous vein yielding finely crystallized specimens struck.

This view may be shown to be erroneous in the future if any deep mining is projected in the State, but it is hardly probable. These pockets are very numerous, frequently occurring in groups of half a dozen within the compass of a quarter acre.

There is seldom any indication of wall rock, but this is not surprising when the great age of the strata is taken into consideration. What was the walling of the fissure, or more properly speaking, fumerale, is generally a lining of clays of various colors.

The extent of these pockets is limited, sometimes but a foot or two in circumference, and not any deeper. The average extent of the crystal bearing space would be about one foot by four, and three feet deep.

There are exceptions to this, of course; as an instance, I took from a single pocket on the farm of C. A. Wyout, one mile northeast of Henry Post Office in Lincoln County, on March 19th, clear and other crystals that weighed, when packed, 1439 pounds. This is possibly the largest pocket yielding good crystals ever struck in this State, or any other State for that matter.

The crystals lie closely packed and embedded in the red clay. Great care is necessary in taking them out, to avoid breaking. This danger can be overcome by using a strong stick with the end pointed.

The points of the single crystals all lie downward or horizontal. In the case of groups, the points are almost invariably pointed downward.

The proportion of perfect crystals to those that are damaged, is extremely small, as a general thing. The method of prospecting and locating a vein is very simple. The ground is looked over carefully for surface specimens, and where these are found, a pick or shovel will soon reveal the pocket. Sometimes a vein of flints occurs, and very frequently leads to the treasure looked for, if followed.

Some noted localities for the different varieties are as follows: Amethyst on the farms of Caleb Wood and John Goodnight, in Northbrook township. These two localities have furnished possibly the

finest stones on the continent, but the deposits were small and long since exhausted.

Rutilated amethyst, on farms of Caleb Wood, Polo Yount and Henry Canipe, in Northbrook township in Lincoln County. The latter is exhausted.

Water bearing crystals of fine quality, as well as other fine crystals, have been found on the plantations of Dolph Budisill, Charles Shall, Daniel Lutz, Monroe Buttain, James Rhinehart, Richard Johnson and others, all in Bandy township, Catawba County. The latter belt has furnished some of the most perfect examples of smoky quartz in existence.

Mr. Lutz's plantation in particular, has yielded some fine specimens of a composite nature. Among them is a variety of milky quartz in slender finger crystals, tipped with a secondary deposit of pale amethyst. The present known pockets are all worked out.

Opal of fair quality has been found in small quantity in flint rocks on the plantation of Richard Johnson.

The largest groups have been found on the places of Mr. Wyout, mentioned before, and on a place three miles north of Hiddenite, in Alexander County. Some of the latter weigh as much as sixty pounds."

The quartz of Hiddenite are too well known to be mentioned by me.

Herkimer County, N. Y.

Doubly terminated quartz crystals are found at nearly all the localities where crystallized quartz occurs. It is easily noticeable, however, that each locality favors a preponderance either of groups of singly terminated or of loose doubly terminated crystals.

In the calciferous sandstone of Herkimer Co., New York, occur the most brilliant doubly terminated quartz crystals found anywhere, not excepting even those found in the marble of Carrara, much of the exquisite beauty of the latter specimens being imparted by the glistening white matrix.

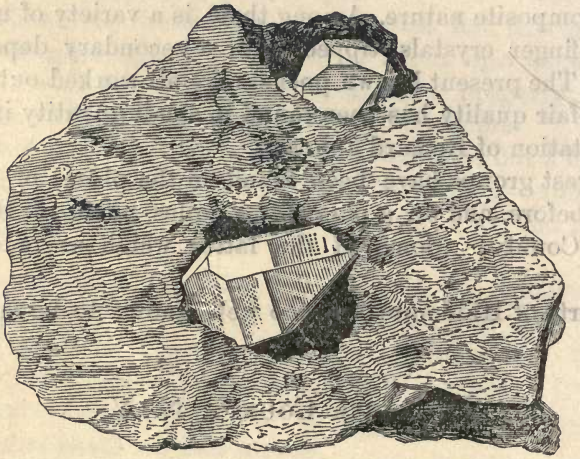
Very few clear Herkimer County crystals adhere to any matrix, since they occur nearly always loose in pockets. An occasional specimen is found on a matrix of pearlspar mixed with bitumen, but matrix specimens of any kind are scarce, even in small, carefully worked out pockets. The natives often select pieces of rock upon which they glue crystals, which they sell for matrix specimens; but these do not stand the test of time or water.

Some collectors consider glueing legitimate when the crystal is

known to belong to a pocket in a piece of rock which they have carefully tried to work out for a matrix specimen.

I have one matrix specimen showing a good sized crystal wedged in the rock, and protruding on two sides. A resident of Little Falls, who has an enormous number of all kinds of crystals stored away in old jars and tumblers, has also several glass-covered cases in his yard against the house, in which are large pieces of the sandstone with numerous cavities containing crystals, just as they were found after blasting.

Occasionally a pocket may be so broken into as to expose a crystal, but not to permit its falling out, as is shown in the illustration.



There are not enough matrix specimens of any kind to supply the demand. One dealer told me that he has had unfilled orders on his book for years, with directions to send when he can, and he has used every effort to secure a supply, with but meagre results.

During the progress of the building of railroads at various times through the County, great quantities of these crystals were found and sold by the laborers. Local dealers bought many a hatful for from one to five dollars. Boys sold crystals in small bottles or boxes to travellers at the stations or on the cars. But when the work on the railroad was finished, the supply of crystals was in few hands, and prices advanced to high figures.

A local dealer used to advertise "sixty-five crystals in a box, post free, for one dollar." Fine specimens have always brought good prices, and collectors who now seek perfect crystals of average size, must expect to pay fancy prices.

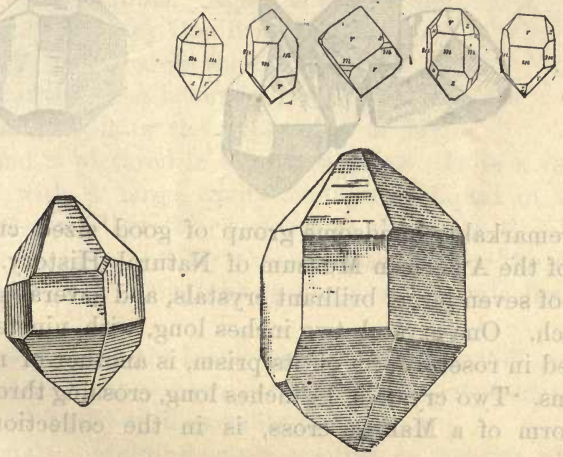
Fairly good crystals may be bought at from twenty-five cents up

THE MINERAL COLLECTION OF ALBERT C. BATES, NEWARK, N. J.

to five dollars, according to perfection and the dealer. The latter is mentioned because every experienced collector knows something about how values vary—"according to the dealer." Values are arbitrary in the mineral business—supply being a minor factor as compared with the demand and the perfection of the specimens to be priced. If we compare the prices asked for some rare minerals with the prices asked for some others which are found in abundance, we shall note the truth of this assertion.

I have seen Herkimer County quartz in groups of from two up to twenty-three crystals, but to my mind the most beauty has been concentrated in the perfect single crystal. "Whiter than the diamond, and frequently as brilliant," these crystals are without rival in the mineral kingdom.

If a thousand of these crystals were laid out for examination, they would appear at the first glance to be very nearly alike, but closer inspection would show much variation of form, such as distortions, modifications and shortened prisms. The following cuts show a fair range of the average forms.



Mr. Arthur Chamberlain's collection contains a fine series of these crystals, as it should, since he several years ago, purchased one of the best crystal bearing ledges in the town of Middleville, and has had first choice of the product of many blasts.

A collector who owns a good mineral locality is certainly in an enviable position. Mr. Chamberlain has been liberal in disposing of the many thousands of crystals which he personally has worked out, or has had worked for him.

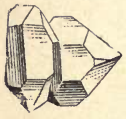
His finest specimen is a slightly flattened crystal about $1\frac{1}{4}$x1x$\frac{1}{2}$

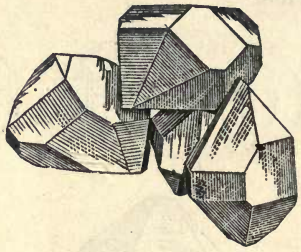
without blemish. Another about the same size incloses in one end the blackest lignite, and is a most attractive specimen.

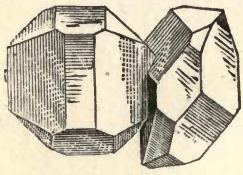
His exhibit of Herkimer County crystals is arranged on narrow, step-like shelves covered with black velvet, and the reflected light from several hundred as nearly perfect crystals as could be selected from the thousands he has handled, is dazzling. Here, also, are groups, phantoms, inclusions, movable bubbles, and bottles of the minutest crystals galore.

As there is a law for almost every natural occurrence, there may be one to explain the grouping of crystals; but if there be such a law, its application to Herkimer County crystals must be something like the law governing me in writing this article—go as you please.

As a result, these crystals are joined together pyramid on prism, end on end, two, ten, or twenty-three, as shown in the group belonging to Mr. Crim, illustrated in the frontispiece, and by the annexed cuts.







There is a remarkably handsome group of good sized crystals in the collection of the American Museum of Natural History. I have one fine group of seven large, brilliant crystals, and several groups of two crystals each. One crystal, two inches long, with nineteen small crystals grouped in rosette form on its prism, is another of my interesting specimens. Two crystals, 1½ inches long, crossing through each other in the form of a Maltese cross, is in the collection of Mr. Chamberlain.

These groups have to be handled carefully, because the crystals separate easily—a slight tap often being sufficient to part them. A transparent glue may be used with good results—the crystals adhering, when nicely glued, more firmly than in their original condition.

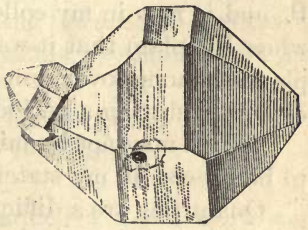
Inclusions of bitumen, commonly called carbon, are plentiful, and when found in brilliant crystals, are marvelously beautiful. The bitumen is either distributed through the crystals in minute specks, in hair like forms, like flakes, or in masses taking up more than half the crystal. Some crystals show "phantom" forms of the bitumen, but they are almost always in the singly terminated groups of crystals, and are of poor color.

Inclusions of pearlspar are comparatively rare, but may be found in pockets whose walls are lined with that mineral. In Mr. Chamberlain's collection there is a specimen which includes a crystal of pearlspar of an eighth of an inch in size. Another crystal with a "dry" cavity contains bitumen and a small perfect crystal of quartz! Inclusions of other minerals are beautiful and interesting.

I do not know why I say "interesting," because the word has grown to have very little meaning for me, when used in like manner by mineralogists. It is generally used, doubtless, for lack of a more comprehensive term with which to express an opinion of a specimen under examination.

However, much that passes for scientific opinion is of a happy-go-lucky order, and unless we have a reputation to protect, we need not analyze too closely.

Liquid inclusions are quite common. Nearly all these inclusions of liquid contain a movable bubble of air, as in figure.



Some contain, in addition, a speck of bitumen, or spar or sand, which follows the motion of the bubble. Again in others, the bitumen is so heavy that it falls to the bottom of the cavity while the bubble rises.

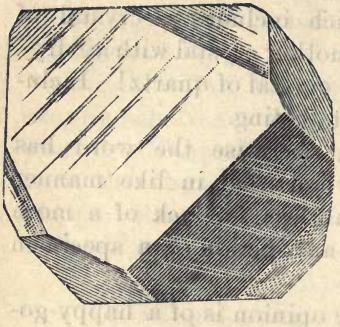
One of the most beautiful specimens of this character, is in the possession of Mr. Crim, and is pictured in the frontispiece. It is a very perfect single crystal with a large cavity containing liquid in which the bubble moves freely followed by a cleavage of calcite (?). The specimen is certainly unique, and Mr. Crim is authority for the statement that it is without rival among the millions of crystals found in Herkimer County.

Some crystals are found which contain several cavities filled with liquid, and I have seen groups of three crystals, each one of which contained liquid with movable bubble.

Crystals containing empty cavities, or cavities with dry bitumen or sand which may be shaken about, are not uncommon.

Crystals of a fine deep smoky color are rare, but crystals showing a streaked or unevenly distributed dark shade of color are quite plentiful.

A few crystals of light amethystine and also citrine color have been found. Size of specimens is always an item of interest to collectors. The largest crystal found at this locality, that I can learn of, was over five inches long, doubly terminated, and quite perfect.



I have one slightly smoky crystal of good form, four inches long. Very few perfectly formed crystals larger than the one shown in figure—which is drawn from nature, are found, and such specimens are valuable.

The quality, and not size, of any mineral should be the prime factor in determining beauty and value. Leaving the purely gem minerals out of consideration, perhaps quartz more than any other mineral requires the property of quality to be beautiful.

Herkimer County affords very few crystals with rare planes. I have been able to find one such, which is a clear crystal minus a half P., and is now in my collection. That it is rare will be more apparent when I explain that it was the only crystal found presenting unusual planes among over ten thousand crystals of average size, personally examined during a period of four years.

That I may not be misunderstood, I wish to say here that I mean to be precise in my statements, and to avoid exaggeration of any kind.

Quantities are a difficult subject to determine, and in the absence of real knowledge of what others have discovered, a mere statement of facts and not one of comparison, is the better plan to follow.

An illustration of this fact is now in mind. Mr. Harn in writing of his discoveries in North Carolina mentions that one pocket yielded crystals weighing, when packed, 1439 pounds, and that it was possibly the largest pockets ever found in the State, or any other State, for that matter.* Mr. Kunz, in the Eleventh United States Census reports for 1890, in writing of the quartz of Arkansas, says, "and in one instance thirty tons of crystals were found in a single cavity."

I never saw a twin crystal of quartz from Herkimer County. There are collectors who call a grouping of two crystals, especially those found in parallel position, twins. They are, however, simply groupings of crystals. It is safe to say that no other locality, so extensive as what is known as "Herkimer County," has adhered more closely to one general form of crystallization.

My opinion of these crystals is based wholly upon a careful examination of their external appearance, a method not to be relied upon to give correct results, if we accept Descloizeaux as a guide. He says: "The examination of the last two sections from Danphiné well proves the certainty of the fact upon which too much cannot be

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* See Part I. of this article, June number.

insisted : it is, that crystals, geometrically simple, may offer internal penetrations altogether unappreciable externally by crystallographic characteristics, and that a crystal of quartz, homogeneous throughout its entire mass, is one of the greatest mineralogical rarities known."*

Places are few where one may profitably work for crystals on other than private property, and even a hired privilege may not "pan out" the cost. The finest crystals are found in pockets which contain a stiff, pasty clay; the next best in pockets containing water, and the poorest are found in dry pockets.

Cavities lined with pearl-spar are interspersed with the pockets containing the quartz crystals, but few of the spar cavities contain any quartz crystals, or when they do they are of poor quality. The pockets are distributed through the rock in layers from two to three feet apart.

The natives delight in telling "yarns" about the number of crystals found in a single pocket, "a bushel" being the average quantity; but it is doubtful if more than a hundred crystals averaging half an inch in size were ever found in a single cavity.

The rock is very hard to drill, and prospectors seeking these crystals, must expend much time and labor to be rewarded.

NOTE, JUNE 15TH.—I have recently examined a lot of Herkimer County quartz crystals under a microscope, to ascertain primarily, whether there was any evidence that escaped the naked eye of external features, characteristic of twin crystals. I selected fifty crystals, averaging three-quarter inches long, and of a fine quality, for examination. I found but one prism showing striations. The pyramids of several crystals showed wavy markings, which may be evidence of twinning, but of no such character as is shown in crystals from other localities. The pure quality and perfect surface of these crystals, baffle the novice in the investigation of so complex a subject as that of twining in quartz crystals.

I discovered other peculiarities, however, which were very pleasing to me, and I suppose other collectors have noticed them also. The first crystal examined showed three minute crystals whose axes were parallel with that of the crystal which contained them. This seemed so remarkable, that I looked over the crystals for those showing minute inclusions, selecting twelve. The first one of these examined showed a single perfect crystal in the same relative position; the next showed six crystals, one of which was distorted, but all the terminations pointed one way, which was true also of each specimen examined with

* Translated by Mr. L. Cahn from Descloizeaux's "Memoire," page 146, Ed. 1855.

crystal inclusions. A few of those selected contained simple cavities, or both cavities and crystals.

The specimen described as containing a cavity in which is a loose perfect crystal, in Mr. Chamberlain's collection, should be remembered.

What, if any, bearing does the main fact here noticed, have upon our notions of the mode of crystal building? I shall examine crystals in other collections to see if there is any variation from the relative position of the enclosed crystals noticed in my own supply. I shall be glad to hear from any one who may make personal investigation of these crystals.

In writing this series of articles on quartz, my effort has been to present the subject in such a manner as to interest collectors who have not had opportunities of seeing what may be called the standard of excellence in specimens afforded by each locality considered.

I have long sought to learn this for myself, by viewing, as opportunity offered, the cabinets of my friends, of well known collectors, and of public museums. To wish to know the chief features of the finest specimens of any particular mineral, and who owns them, seems to me perfectly natural. That this curiosity is widespread, I have no doubt, since one has but to listen to the conversation of a company of collectors to notice the fact.

The specimens which I wish to dwell upon are those which present extraordinary forms, but it is difficult to convey a clear idea of them by description alone. I have said before that engravings are costly, and even they are not always satisfactory.

Certain features and peculiarities in the same species of minerals differ from each other according to locality, as natives of one country differ from those of another. This fact enables one familiar with the minerals of many localities to name at a glance the place of their occurrence, and this kind of familiarity it is well to cultivate.

Nova Scotia.

Nearly all the varieties of quartz occur in Nova Scotia. Localities are numerous, but few of them are easily accessible. Along the Bay of Fundy runs a sharply outlined precipice for one hundred and thirty miles, from Briar Island on the west to Capes Split and Blomidon on the east. Here and there masses of trap rocks, from 200 to 600 feet in height, overhang the coast.

The formation is the new red sandstone. Grey granite, gneiss and mica-slate prevail. Trap rocks are often imbedded in clay-slate,

and it is in this trap rock that many varieties of quartz are found. In the amygdaloid occurs the many beautiful zeolites which have made Nova Scotia dear to the collector of minerals.

There are many curious and beautiful fossils, besides amethysts, agates, chalcedonies, jaspers, smoky quartz, milky quartz, rose quartz, etc.

Amethysts are usually associated with cacholong in the form of geodes, and make attractive specimens, the purple color of the amethyst contrasting with the milky whiteness of the cacholong.

At Moose River Bluff, Basin of Minas, there occur in the trap rock, rosettes and radiating groups of crystals of a pinkish white quartz. The crystals are found in cavities of varying sizes, and may be loosened by a sharp blow of a sledge hammer, but not always with perfect results. A specimen is poorly shown in figure No. 7.

A fine lot of these rosetted crystals is in the collection of Rev. J. Selden Spencer at Tarrytown, N. Y. Dr. Spencer secured them at the locality several years ago, and they show the careful handling of the experienced collector.

Mr. H. D. Miller of Plainville, Conn., has made several trips to Nova Scotia in search of minerals, and was one of the first to introduce the zeolites he found to nearby collectors. His collection of Nova Scotia quartz includes many rare forms in fine specimens.

Crystals of milky quartz having a common centre, in ball-like masses, are found loose near McKay's Head, and are curious specimens.

I have seen but few specimens of other varieties of quartz from Nova Scotia, those described being in my own collection, and secured by exchange with collectors who have visited the localities. I can safely say that a quantity of good specimens can be sold in the vicinity of New York City.

Maine.

In Maine there are several well known localities where quartz is found. At Paris, Oxford Co., the so-called Mt. Mica ledge has furnished handsome specimens of rose quartz, but this fades quickly on exposure. The rose quartz from the Stearns ledge, in the same County, occurs in as handsome specimens, and does not fade.

I know of a piece of this quartz that has lain on a piazza roof for over seven years, which is to-day as bright and pure in color as when broken from the ledge. Both of these localities are about worked out.

At the last-named locality there is found a milky white quartz,

which, when cut into gems, resembles the moonstone. Mr. L. K. Stone, of Paris Hill, has cut several gems from this material, which are now in his collection. Polished balls, dishes and other objects cut out of rose quartz of fine quality from Oxford County, are in the American Museum Collection, New York City.

In Hebron, at the Mt. Rubellite locality, there were found, a few years ago, several small groups of quartz crystals with a coating of minute colorless crystals of apatite, which gave them a frosted appearance. At the same locality are found masses of crystallized quartz and cookite, some specimens of which are very pretty. The quartz is in long, slender, colorless crystals, and the cookite is of a light green color.

Quite fine cabinet specimens of smoky quartz have been found by Mr. Geo. L. Noyes, at the tourmaline locality in Greenwood, Maine. These were not transparent, but were clean and of a glossy black.

At Greenwood there is a vein of white quartz, some twelve or fifteen feet in width, in which occurs some of the finest specimens of rock crystals so far found in the State. The crystals are found in pockets and the largest measure about four inches long.

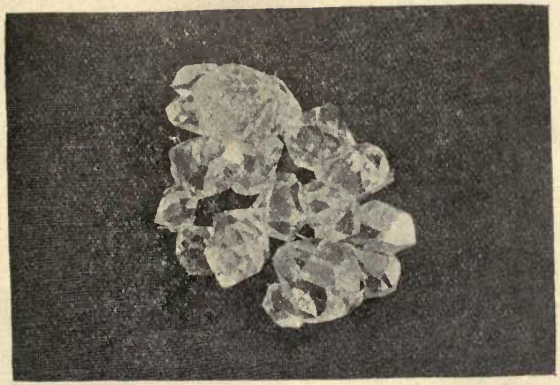
Several years ago a few larger crystals of smoky quartz were found at the beryllonite locality, near the base of Sugar Loaf Mountain, Stoneham, Maine. The largest weighed over one hundred pounds, parts of which were transparent, and afforded beautiful gems of a smoky brown color. These crystals came from a large pocket in a vein of feldspar.

Groups of transparent crystals, and others with a milky additional growth, occur at Stoneham. In examining one of these groups, I noticed that the broken crystals were transparent in the centre, with well defined markings of several layers of opaque new growth, and believing the addition was not simply a coating, but extended to a capping of the crystals, I had three sides of the prism ground down and polished, which disclosed a perfect phantom. This crystal is shown in the annexed engraving.

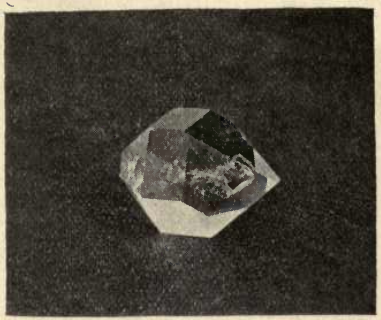
QUARTZ PHANTOM, STONEHAM, ME.

On Deer Hill, Stow, have been found a quantity of amethysts, shading from a smoky purple to the royal hues of that color. Gems cut from crystals from this locality are all illustrated in natural colors in "Gems and Precious Stones of N. A."

Mt. Mica is the most famous mineral locality



Group of Twenty-three Crystals.



Crystals showing Large Cavity containing Liquid, Movable Bubble and Movable Rhomb of Calcite.

QUARTZ CRYSTALS, HERKIMER CO., N. Y.

In Collection of A. B. Crim, Middleville, N. Y.

in the state, but quartz, although plentiful, has seldom been found in fine specimens. Crystals and masses of quartz are often the matrix of beautiful gem crystals of tourmaline, and if the quartz were transparent, so that cutting would show the tourmalines often found imbedded in it, handsome inclusions could thus be obtained.

New York State.

A few years ago a small lot of peculiar quartz crystals was found, surrounded by a graphitic powder, filling a crevice in the Marcellus shale in Oneida Co., New York. The crystals occur with a deep depression occupying the place of each plane of both prism and pyramid. The reason for the centre of the faces not filling up in conformity with the angles and edges, is not easy to give. It is easy, however, to conceive of a crystal forming in this manner by cooling after fusion, contracting in the process towards its own centre, thus depressing its faces, and leaving the angles and edges as well defined as originally taken. The graphite impregnates the crystals little more than superficially, but adheres tenaciously. What, if any, influence the graphite had upon the form of crystallization of the quartz, is another matter of which I can find little to help me determine.

Amorphous silicon, when strongly heated under certain conditions, is converted into graphitoidal silicon. These crystals were originally advertised as "Quartz crystals with sunken faces."

Pretty and odd crystals of quartz occur in the limestone quarry at Sing Sing, N. Y. Mr. Henry Fair has a fine series of these crystals. One specimen which he found in 1889 and presented to the New York State Museum at Albany, is in the form of a cross on a matrix of crystallized dolomite. The crystals are light yellow in color, and are each about two inches long. As will be seen in the illustration, the upper right arm is imbedded and the others are free and show the terminations perfectly

A few transparent crystals are found, but the majority are milky or opaque from impurities, small flattened and distorted crystals are found, and small groups of either singly or doubly terminated crystal occur sparingly. A few smoky crystals have been found, but of poor quality.

In the fall of 1890, Mr. J. L. Davison of Lockport, a well known collector of minerals, while out hunting in the woods near Theresa, Jefferson County, discovered a small lot of quartz crystals, which were exposed at the root of a large tree, which had recently blown down.

In the fall of 1894 Mr. Davison made excavations at the locality and brought out a fine lot of specimens. One group, about 12 x 18 inches, weighed over sixty-five pounds; the crystals varied from small up to two inches in diameter by three inches in length.

Another group about 8 x 10 shows more than onehundred crystals, the largest of which is three-quarter inches in diameter. There were a good many detached loose crystals, some of which show twinning plainly. Very good crystals of iceland spar were taken from the same excavation.

The quartz crystals are opaque with small transparent spaces. Nearly all of the crystals are capped with a thin coating of transparent quartz, thus showing the "phantom" clearly. The capping on a few of the crystals is so formed as to leave a sharply defined channel along each angle of the pyramid.

There are several localities in Jefferson Co., N. Y., where quartz occurs. At Natural Bridge, crystals up to four inches long are found coated with a calciferous material, which may be easily removed by acid.

At Sterling, Antwerp, Edwards and other places, doubly terminated dodecahedral crystals are found, sometimes loose or grouped on a matrix of quartzite and specular iron. The majority of the crystals inclose hematite, and are of a reddish brown color; others are found transparent and clean. The iron mines where the best crystals were found are now closed, and it is difficult to obtain good specimens. There are local collectors who work at the deposits to obtain material for sale, but they have peculiarly high notions of value.

Ellenville Lead Mines, Ulster County, N. Y.—This locality has furnished some of the most magnificent groups of quartz crystals ever found. Work ceased several years ago, and the mines became flooded with water.

There is an immense dump near the mine which is worked with some success by collectors who visit the locality. An old man who tends the railway crossing, whose shanty is near the dump, says that he can point out places where "plinty of foine crystals can be found if ye will only dig dape enough."

Large and small groups of much battered crystals line the walks leading up to several residences in the village. A few good groups sparkle amid the bottles on the shelves of several local bar-rooms;

but they are not for sale. So far as I can learn there are no really fine specimens in the hands of the best known dealers in minerals.

The most beautiful groups that I have seen are in the R. L. Stuart collection in the Lenox Library Building. These groups are ideal in size, form and quality. The largest groups are in the Museum of Natural History in New York City, the gift of Mr. Jackson Steward, who personally collected them.

The largest group measures about 36x22 inches, and is covered with brilliant crystals of various sizes. There are three other groups of much smaller crystals on matrixes nearly the same size, and several smaller groups with stouter crystals.

There are two groups, the largest measuring about 24x15 inches, with crystals crowding each other as closely as possible, which measure from two inches to four inches each in diameter. These last-named groups are transparent only in spots, being for the most part milky and tinged with yellow. There is a glassy brilliancy on the pyramids, unlike that in quartz from any other locality with which I am familiar. There is another feature in these larger crystals peculiar to this locality, in that the angles and edges are built up perfectly, leaving the centre of the planes grooved, sometimes uneven, or with a number of small terminations, showing the length of the groove, evidence of effort to fill up even with the angles.

I realize the clumsiness of my effort at illustration, and ascribe it in part due to our general lack of knowledge of the forces at work during crystal building, and the consequent dearth of nomenclature with which to easily convey meaning relating to the subject.

Perhaps the best example of the last form of crystal described is in the Rutgers College Collection.

I have one large crystal of this character in my collection. and a group of small crystals on a matrix measuring 15 x 15.

A few good specimens of both milky and smoky quartz crystals have been found near Kingsbridge, New York City. Mr. F. Braun has collected small geodes of dolomite incrusted with drusy quartz in the upper part of the city.

Small greenish crystals of quartz on a zigzag shaped matrix of quartzite occur at various iron mines on Staten Island. The shade of color is peculiar to the locality, I think, since I have seen nothing like it from elsewhere. But few specimens are to be seen outside of cabinets of local collectors.

New Jersey.

The old Hoxie quarry at Paterson, N. J., furnished a few fine specimens of amethystine quartz pseudomorphous after pectolite. The finest specimen is in the collection of C. L. Hatch, and is of a brilliant purple color. But one really fine specimen of smoky quartz was found, which is in the cabinet of Dr. Stiles. The members of The Brooklyn Institute Mineralogical Club, to which the gentlemen named belong, secured nearly all the finest minerals from this locality. Dr. Joseph Hunt has a grand lot of the pseudomorphs, and was one of the first to report their occurrence at the Hoxie quarry.

About seven miles from Paterson, in the Orange Mountains, at Upper Montclair, is located the McDowell quarry. Here the amygdaloid lies between the trap and the brownstone, and in it has been found several fine specimens of pseudomorphous quartz. The original mineral is very much like the altered pectolite of Paterson, but the quartz has here replaced it more thoroughly, so that groups of perfectly terminated crystals are more common. Dr. Disbrow, of Newark, has a fine series of milky and amethystine specimens. One group of milky crystals in my own collection is as perfect a specimen as I have seen from this locality.

Crystallized quartz occurs sparingly in the Bergen Hill localities. Mr. Kato of Jersey City has found several specimens of milky quartz and a few transparent crystals.

A small lot of fair amethysts on trap rock, were found at the West Shore Railroad tunnel, Weehawken.

Connecticut.

Connecticut affords very little quartz in fine specimens. A collector who travels over the township of Haddam in search of specimens, will be surprised at the peculiar nature of the occurrence of the minerals which have made the locality famous. The country is hilly on both sides of the Connecticut River, and here and there huge bowlders stand out in relief, while others are nearly covered with soil, many of which show traces of the prospector's drill and hammer. I have walked in the company of a local collector over many miles of the township, and have seen scores of bowlders bristling with crystals of black tourmaline and muscovite. It is singular how well the last-named mineral resists the action of the weather. It was while thus prospecting that green gem tourmalines were found. An unusually large black crystal, sticking out of a bowlder twenty feet high, attracted

the attention of the prospector, and prying around it with an iron bar a pocket was broken into which was filled with a decomposed mass of mineral, out of which was taken the gem tourmalines and about one hundred pounds of quartz crystals. These crystals at one time were fast to the walls of the pocket, and were probably loosened by the slight local earthquakes which occurred at intervals during several years, and which were called "Moodus noises." A few of the crystals were doubly terminated, milky or opaque, and enclosed splinters of albite. The majority, however, were smoky, with transparent spots approaching the color of "Spanish topaz." I had one smoky crystal, about three inches long, sliced and polished to show the albite inclusions, which is very pretty. I have one smoky specimen weighing over fifteen pounds, beautifully crystallized on three sides. One quarry in Haddam has been more or less continuously worked for over one hundred years. Milky quartz crystals in a vein of white quartz near the quarry are quite plentiful.

Very good groups of milky crystals occur at the Lantern Hill Silex Mines, a locality a few miles from Mystic, Conn. There are several other places in Connecticut where quartz is found, but, so far as I can learn, only in small quantities and in inferior specimens.

Arkanses.

Arkansas is rich in crystallized minerals, and particularly so in one species—quartz.

A geological survey of the territory was begun in 1857 and two volumes of Reports were published in 1858 and 1860. Prof. F. L. Harvey published a pamphlet in 1886, entitled "Mineral and Rocks of Arkansas," in which he says that the State needs above all things a carefully conducted and detailed geological survey. His summary of the geology of the State is copied here:

"The topography of Arkansas embraces upland and lowland. The former includes the archean, silurean, subcarboniferous and millstone grit formations; the latter, cretaceous, tertiary, quaternary, and recent. The upland is that portion of the State west of 91° west longitude, and north of 34½° north latitude. The granitic axis of Arkansas begins at Fourche Cove near Little Rock, and runs along the border of the upland to the west boundary of the State.

"Igneous outcrops occur in Pulaski, Saline, Hot Springs, Montgomery, Pike and Sevier Counties, and there is good reason for believing these igneous rocks are continuous beneath the drainage of the country. Another axis of disturbance shows a granitic out-crop on Spavinaw Creek in the Cherokee country, west of Benton county. The stratified

rocks of Arkansas probably rest at no great depth upon an igneous platform.

"In northern Arkansas the disturbance shows itself in small faults, gentle folds, and slightly indurated shales; but as you approach the granitic axis, greater faults, strata with high dip, and talcose slates intersected with quartz and calcite veins become common. These disturbances are intimately connected with and determined the character of the mineral deposits of the State.

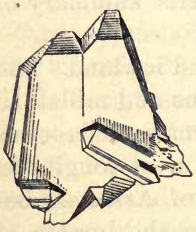
"The veins along the granitic axis probably were filled by percolating hot alkaline waters, which deposited the metaliferous compounds they contained. The veins and caverns of the silurian and subcarboniferous formations of northern Arkansas were, no doubt, filled in the same way. The water of Arkansas is still quite alkaline, and quartz crystals are at the present time forming about Hot Springs."

That quartz crystals are constantly forming I have no doubt, because the conditions of their occurrence are in ample evidence.

> "Seas, that daily gain upon the shore,
> Have ebb and flow conditioning their march."—*Tennyson.*

Then, too, the great and peculiar variety of groupings of crystals, the many phantoms often contained in a single crystal, and the inclusions of other crystals, suggest more or less constant growth.

Inclusions of crystals, sometimes called penetrations, which is erroneous, since the larger crystal has simply inclosed the smaller, are good objects for studying the forces at work in crystal building. It is fair to assume that the slender crystals were of symmetrical form before being inclosed in the larger crystals, but examples are common showing apparent *loss* of regular form of the slender crystal, as if the larger crystal in building had absorbed some part of it.



Crystals of apparently simultaneous growth do not have this appearance of loss of form, nor do the stouter crystals show it. When two or more crystals are joined or grouped, their forms are generally the same, but there are deviations, such as distorted or flattened crystals, joining others of symmetrical form.

One would think that the crystallographical influence exercised at a certain locality would be the same, but can it be the same and produce distorted and symmetrical crystals at the same time?

But nature plays many pranks with her superabundance of silica before collectors see the results, and careful study, and not mere speculation, is required to find out how the tricks are done. When

one group of crystals exhibits small and very large rhombohedral faces, distortions, modifications, with here and there what are called rare planes, a collector may look upon it and admire it for its beauty, but he will have a hard time of it if he seeks to learn the why and wherefore from the literature on the subject.

Dr. G. W. Lawrence, one of the leading physicians at Hot Springs, made the finest local collection of quartz crystals.

Dr. Lawrence was a graduate of the University of Pennsylvania and the author of many scientific papers. He was a typical, open-handed Southern gentleman, and when he wanted a specimen, he bought it regardless of price. Often large lots were bought in order to get a single desirable specimen.

Thousands of crystals that were of no use in his collection he gave to museums and collectors all over the world. He made a display at the Centennial Exhibition that was the delight and wonder of collectors.

He did not part with any of the best specimens shown, and when the Columbian Exhibition was announced he made extraordinary effort to increase his collection, expecting to exhibit it at Chicago. It was packed and ready to ship when he died.

This collection was purchased last winter by Dr. A. E. Foote, and the best specimens it contained are now in the cabinets of Messrs. W. W. Jefferis, C. S. Bement, Geo. Vaux, Jr., and the Wm. S. Vaux, and other public collections.

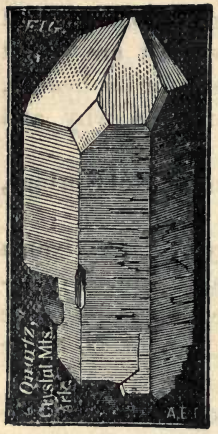
Figure 2, in frontispiece, shows a transparent flattened crystal inclosing diagonally its whole length a milky rounded crystal. I say crystal, because I believe it was such at one time, as I have an irregular milky crystal having a stalactitic appearance from same locality.

Figure 1 represents, also, a flattened crystal inclosing diagonally its entire length, a slender crystal of good form with termination protruding. These crystals, together with four others of the same character, are in the cabinet of Mr. George Vaux, Jr., of Philadelphia.

Figure 3 represents a group of brilliant flattened crystals. Figure 4 is a crystal with inclusions of chlorite. Figure 5 shows a crystal with several "phantoms of manganese oxide." Figure 6 shows in a very beautiful manner a highly developed "S" plane.

Figure 10 shows a crystal having the "S" plane at each angle, which occurs only in twin crystals.

This engraving is of additional interest to collectors, because it was executed by the late B. B. Chamberlain, a well known collector of the minerals found near New York City, and whose collection is now in the American Museum of Natural History.



Arkansas affords a variety of *qualities* and forms of quartz. Doubly terminated crystals, quite as brilliant as the average of those found in New York, are occasionally met with. There are very few cavernous crystals, although there are many found containing liquid, but they occur beyond the influence of frosts.

Very odd crystalline forms are found, notably the one illustrated in Figure 8, in frontispiece of August number. This specimen is opaque from impurities—chlorite and sand—and may be described simply as a capped crystal.

Milky, gnarled masses with some crystalline form are not uncommon. Distorted crystals are plentiful, and some are found with one rhombohedral face nearly the size of the entire crystal. Flattened crystals, some of which are quite broad and thin, and highly modified, are found plentifully in attractive specimens.

Figures 7, 8 and 9 represent crystals of that character, but they are extraordinary fine examples. Slender crystals, several inches long, called "slim jims" by the "crackers," occur in handsome groups, but they are brittle and break easily, "as if they had dried too quickly after forming."

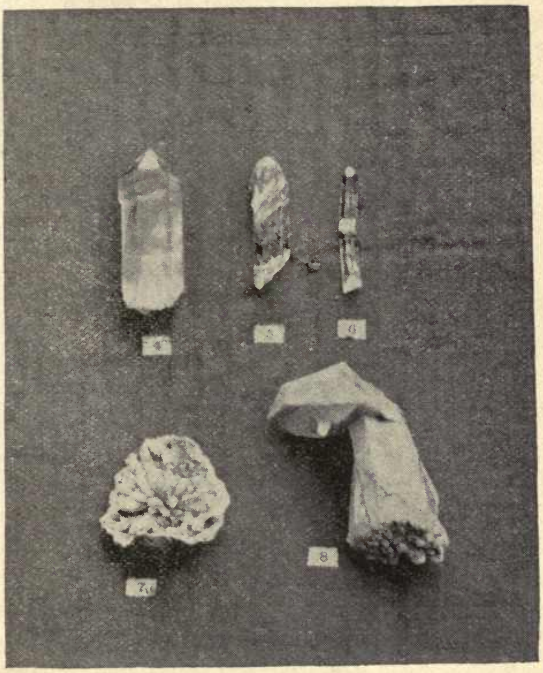
Groups of these slender crystals may be had with a large crystal on same matrix, and there seems to be something about such specimens especially attractive to the novice and collector alike. I have groups of these slender crystals running vertically through one large crystal which lies flat on the matrix.

The slender crystals were first formed, and the larger one must have been crystallized in true form later on, by creeping along among the "roots" of the slender crystals and inclosing them.

'Tis plainly to be seen, but hard to understand in a satisfactory way.

"O wad some power the giftie gie us,"
To see how the thing is done.

Doubly terminated slender crystals several inches long are common, and some are found cruciform. Others have crystals impigned on them, or adhering to the prism. Such specimens when of fine, clear quality, are delicately beautiful. The large cruciform crystals are much sought after, and where the crossing is perfect and the quartz of good quality, the specimen commands a fancy price. The finest example of this kind, is in the collection of Mr. Horace I. Johnson, of Waltham, Mass.



PECULIAR FORMS OF QUARTZ.

Collection of A. C. BATES.

Crystals containing one or more distinct phantoms, and especially if the phantoms are of milky color, are very attractive and are not of rare occurrence. Inclusions of chlorite sometimes take phantom form, or stream toward termination of crystals, as if some force had separated the fibres before crystallizing.

Dislocated crystals are occasionally met with, and two fine examples are shown in Figures 5 and 6 in August frontispiece. Such dislocations are caused by motion of the inclosing rock, the material of which is forced, or it may be transfused, into the rents, thus mending them.

Doubly terminated crystals occur plentifully, but singly terminated crystals are more frequently seen in collections and in the stock of dealers in minerals. These singly terminated crystals are generally broken out of a group, and when of good size, and with small crystals attached to the base, make attractive shelf specimens.

Capped crystals occur sparingly in fine specimens. A few are found with cavities, which once contained ankerite or dolomite, between the old and new crystals.

Crystals of large size, up to a foot or more in diameter, are not uncommon. Mr. W. E. Hidden, the well known mineralogist of Newark, N. J., has a perfectly terminated crystal about a foot long and seven inches in diameter, of splendid quality.

Nearly every collection contains one or more crystals and groups, or both, and the "great show specimen" of nearly every museum collection is a group of rock crystals from Arkansas.

Large pebbles are found in the river beds, and when free from flaws, may be made into attractive specimens by sawing off one end and polishing. I have seen beautiful specimens as pellucid as a quiet spring of clear water.

Dealers in minerals in preparing labels for quartz from Arkansas, give Hot Springs or near Hot Springs, as the locality. The probable reason for not being more definite in the matter of labelling, is that the crystals are gathered by farmers or professional "crackers," who bring the specimens to Hot Springs for sale, and the exact locality is considered of little importance by local dealers.

There is a difference in both the quality and form of the crystals found at Blue Mountain and Colliers Creek, which is worth distinguishing by exactness in labelling.

Authorities state that "smoky quartz is found as you go west from Hot Springs," but I have never seen a fine smoky quartz crystal from

Arkansas. Small doubly terminated smoky crystals are found at Magnet Cove, but they are not of fine quality. Chalcedony, agates, flint, buhrstone and silicified wood occur in considerable quantities.

Novaculite occurs near Hot Springs in various colors and grades of fineness, and is used for honestones, and is sometimes cut into ornaments. I have not treated the subject of Arkansas quartz crystals exhaustively, nor have I sought to do so, but rather to sketch the more common forms in a popular manner.

As the majority of the crystals found are coated with iron or foreign matter, a method for cleaning them may be of value to collectors not already familiar with some process.

Place crystals in an old iron kettle, cover with cold water, and for each gallon of water used, add one teaspoonful of oxalic acid crystals. Boil slowly, and add boiling water whenever necessary to keep crystals covered. Do not remove crystals until the water has been allowed to cool.

I have treated fine crystals by this process without injury, but much care is required. Long soaking in a stronger cold solution is also recommended.

Western Localities.

We are told that inorganic matter is without life or feeling, which we of course readily accept as truth. But, with a knowledge of quartz and some of its peculiar associations, and its character generally, one may, without doing violence to the imagination, see much in its variety of forms which is analagous to human nature.

A mountain maiden with mind serene is not more pure and beautiful than Nature's finest modelling in silica, and for the other extreme, the phlegmatic old man who knows little and cares for nothing, has his character reflected in the massive boulder, which refuses to be moved one jot without the use of force.

Silica is stealthy, and will creep in the dark upon some unoffending fellow mineral and rout it out of house and home, and occupy its place forever. No tears are shed, no prayers are said, as there might be were the same thing done by human beings; but reparation is sometimes sure and swift, and the individual crystals are covered up solidly.

There is a peacefulness in the life of most crystals accorded to but few organisms. But the organic and inorganic are of the earth, earthy—where is the material difference?

Searching for minerals has brought me into correspondence with quite a number of collectors in various parts of the country, and prin-

cipally with those who regularly visit localities which afford good specimens. I find that the number of actual collectors, those who seek for themselves, is very limited.

Digging out specimens helps make enthusiastic and intelligent collectors. I do not say that those collectors who buy nearly all of the specimens that they possess are not as intelligent and enthusiastic, but they lack the particular knowledge and intense interest which characterize the *workers* in Nature's fields.

There are but few collectors living in the far West, and it is that section we are now to consider, from whom I can get accurate information regarding quartz localities. Mr. M. Bixby contributes the following note on Bingham quartz—a fine specimen of which is shown in the frontispiece, and which is in his collection.

"Quartz crystals are frequently found at the silver mines at Bingham and adjoining districts, but the greater number of them are quite small and devoid of any particularly rare feature.

"The crystals are usually found in cavities planted on a mixture of quartz, pyrite, galena and sphalerite; the three latter minerals generally in small but perfect crystals, lining the cavities along with the quartz.

"A very few quartz specimens have been found showing a slender, singly-terminated crystal, penetrating a much thicker, doubly-terminated crystal, at the apex of one of its terminations, and thus supporting it clear of the matrix—the general appearance reminding one of a tinner's soldering iron.

"These crystals are generally milky, so that a termination can not be seen on the slender, supporting crystal, and I shall have to leave it to conjecture, as to whether the formation of the two crystals may be contemporaneous.

"The illustration gives a good idea, but the size of the crystals is enlarged about three times."

In the region around Keokuk, Iowa, and along the Fox River, Ill., there have been found great quantities of geodes, varying in size from a hickory-nut to a peck measure.

These geodes occur in a schist from which they may be easily removed; some are found loose in the beds of streams and in the soil.

The walls of these geodes are of various degrees of thickness, and are lined either with quartz crystals, or chalcedony, or both. The crystals in the geodes found at Niota, Ill., are often twinned and coated with chalcedony.

A collector who in 1868 worked all the localities, and broke open several hundred geodes, states that a dozen or more contained liquid or pasty bitumen, and that he observed no other liquid inclusion.

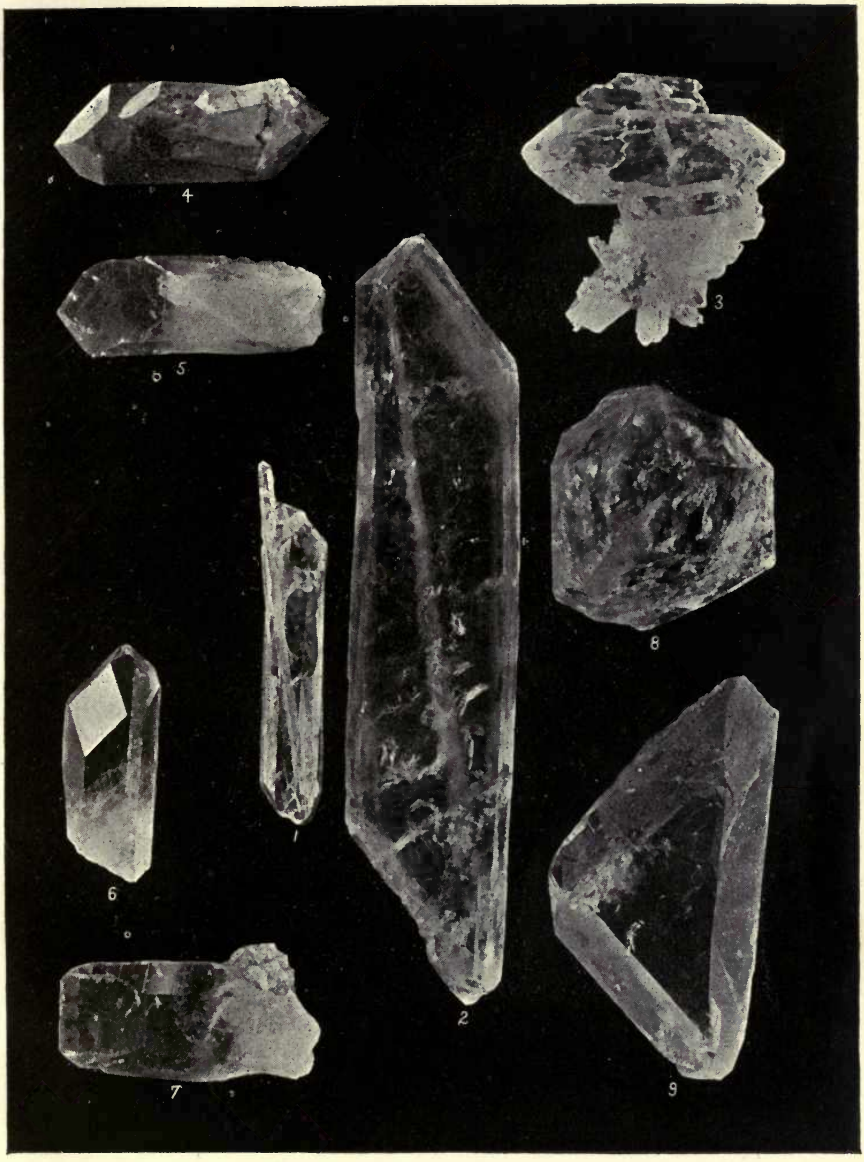
Looking up the literature relating to the subject, I find in Vol. VIII of *American Journal of Science*, an article entitled "Facts Tending to Illustrate the Formation of Crystals in Geodes," from which I copy the following paragraphs:

"Mr. Whitney states, that being in Georgia, in the year 1806, he was informed of the following facts, and saw the specimens by which they were established. On Brier Creek, a stream which passes through Millhaven, and empties into the Savannah River, and at the distance of two or three miles from the road leading from Savannah to Augusta, the people were occupied in excavating a raceway for a mill; the mill dam was built on a solid mass of agate which crossed the creek, and formed a natural basis for this superstructure. In clearing the passage for water below this dam, the workmen discovered a great number of hollow balls, in their form resembling bomb-shells. Some of them were as large as a man's head, and some even eight or nine inches in diameter. They had a dark rusty appearance, the crust looked like an iron ore, outside of a snuff color, inside of a light brown. When broken they proved to be mere shell, the walls of which were from five-eighths to three-fourths of an inch in diameter, and the capacity of the cavity was from a pint to two quarts or more. This cavity was filled with a milky fluid, so perfectly resembling white paint, or whitewash, that it was used to whiten the fireplaces and the walls of the rooms of the neighboring houses. Unfortunately no experiments were made to ascertain the nature of the fluid, or of the white matter suspended in it, and it is to be feared that the opportunity is now lost.

"'The region around is a sandy pine-barren, destitute of stones of any description, *on the surface*—but, for a mile around the place where the balls were discovered, were scattered numerous arrowheads, and fragments of agate, from which the arrowheads were chipped, by the aboriginal Indians.

"From *Bournon's Mineralogy*, Vol. II., p. 33:

"Count Bournon informs us, that in the vicinity of Lyons, in France, there is a calcareous rock, which contains here and there geodes often very large, having for their envelope silex mixed with lime—often alternating in concentric layers. In the midst of these geodes, beautiful crystals of carbonate of lime occur, mixed with those of quartz, which they rivalled both in perfection of form, and in transparency. Count Bournon caused numbers of these geodes to be broken; some of them were full of water; on a particular occasion a happy fracture left half of one of these geodes, containing unspilt the liquor which it had enclosed. Perceiving that the fluid moved heavily, in a kind of mass (almost like mercury), he concluded that it



RARE AND INTERESTING FORMS OF QUARTZ CRYSTALS FROM NEAR HOT SPRINGS, ARKANSAS.

Now or Recently in the Stock of Dr. A. E. Foote of Philadelphia.

Three-Quarter Size.

must be a very concentrated solution, and as it was in the middle of a very warm day in the month of July, the fluid was all evaporated, in little more than a quarter of an hour, and there remained in the geode, a spongy amorphous crystalline mass of carbonate of lime. This fact is certainly very instructive as to the formation of crystals in geodes. Count Bournon observed the same thing at Vougy, about the same period, but the geodes were composed of black oxide of manganese lined with crystals of carbonate of lime.

"Spallanzani remarks that the numerous beautiful rock crystals in the cavities of the Carrara marble, continue still to form, and from a pure acid fluid. Ripetti in his tract 'Sopra l'Alpe Apuana ei Marmi di Carrara, 1811,' adduces some new observations in favor of this opinion, and tells us, that on opening a drusy cavity, there was found 1½ lb. of the above fluid, and among the solid crystals, a soft mass the size of the fist, which, on exposure to the air, hardened into a substance having the characters of calcedony. According to Daubuisson and Beaudant, the opal of Hungary is sometimes found in a soft state."

A quantity of unusually pretty and interesting geodes, have recently been found loose in the soil of the Tertiary beds of the Bad Lands, on a creek between the Cheyenne and White Rivers, about one hundred miles southeast of Deadwood, Dakota.

The walls of these geodes are of chalcedony, and are lined generally with minute crystals of quartz, which resemble frost work. A few are found with well formed terminated crystals. A very few occur *filled* with transparent selenite crystals, and this with the translucent chalcedony and white quartz, is very beautiful. Others, again, are filled with minute rhombs of calcite, which rattle out on breaking open the geode.

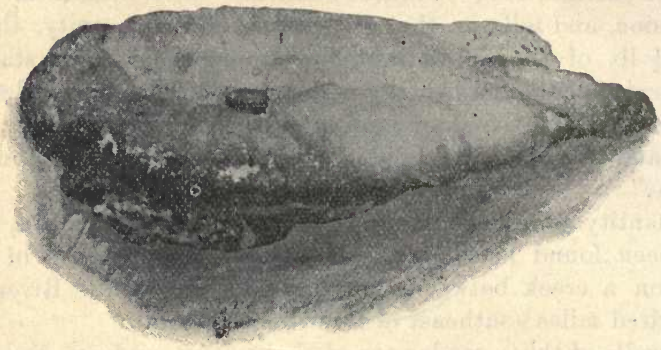
The fantastic columns, or stalactites, of minute white crystals in the majority of these geodes, sparkle in a strong light and renders them unlike the geodes from any other locality. A few have been found with lilac or faint amethystine tint, but the majority are white.

Mr. L. W. Stilwell, of Deadwood, has lived for many years near the Pine Ridge reservation of the Sioux Indians, and it is within the approaches to the Agency that these geodes are found. Mr. Stilwell is my authority for what is here written. He reports the locality as being known only to his own collectors, who have brought in nearly ten thousand geodes. Some seven thousand were smaller than hens' eggs, and a few hundred as large as geese eggs. The specimen shown in frontispiece is about two and one-half inches in diameter.

These geodes are so very pretty and cheap, that every collection should contain a series.

Chalcedony geodes sometimes lined with drusy quartz and filled with water, are found at Tampa Bay, Florida. The forms of some of these geodes are very peculiar, nearly all of them being alterations from corals and sponges. Mr. Chamberlain has one very odd specimen showing a stalactite of chalcedony in the middle of it.

Small chalcedony geodes called hydrolites, filled with water and containing a movable bubble, are found at Astoria, Oregon. The water cannot be preserved in them any great length of time unless the geodes are varnished. The following engraving of a Uraguay hydrolite shows the general appearance of these geodes.



Fine masses of chalcedony are found along the Cheyenne River in the Bad Lands. A blueish-white chalcedony is found filling the narrow cavities of bones, which are found in considerable quantities in the same region.

Reading over what I have written, I notice an almost constant repetition, but it is in the terms used, and I can think of no way to relieve the subject of it, and treat it seriously. Reading the article is like looking over a collection of the material of which it treats, one grows tired of the difference in the sameness, to coin a phrase, and there is little use in denying it.

I have observed "that tired feeling" come over my friends as drawer after drawer was placed for their inspection, and I have learned partially how to avoid it:

Show a collection as you would serve courses at dinner—a little wine, figuratively speaking, now and then and champagne last, with a reserve in the cellar. An apt anecdote or illustration would make serviceable breathing spots; but, dear reader, any oddity that I may possess does not partake of the nature of the story-teller or artist.

Let us now proceed to the consideration of the quartz of Colorado.

The mineral locality known to collectors as Pike's Peak, covers an

area as large as the State of Connecticut. Quartz abounds in this region, but it is inferior in quality to the Swiss or North Carolina varieties, although local dealers prefer it for cutting purposes.

The smaller crystals sometimes show many interesting planes, such as steep trapezohedrons and many rhombohedrons higher than the unit. The "S" plane is quite common, and in one example a trigonal pyramid lower than the "S" plane was observed. The largest crystal of which I can learn as coming from this section weighed about one hundred and fifty pounds, and had nothing but its size to commend it.

In Black Bear Cañon occurs interesting smoky topaz coated with small white opaque quartz crystals, which in form somewhat suggest rice, and they are called rice crystals. They are of value to local lapidaries, who cut them up in sections parallel to the base, polish them, and sell them to tourists for watch charms. They are very attractive.

Onegite occurs at Crystal Peak, Colo. Onegite is a fine acicular göthite inclosed in smoky quartz. The quartz is often banded parallel to prismatic plane. Crystals four inches in diameter have been found, covered with opaque white quartz, and discolored by limonite, with outer bands of mixed smoky and amethystine onegite, and a center of dark smoky color. Polished basal sections are in demand, both by tourists and collectors.

Near Bidell, Saguache Co., Colo., are found quantities of small amethystine tipped crystals, often containing byssolite and chlorite, and exhibiting a wealth of planes.

Cripple Creek produces large quartz crystals of clear colorless quality, often six inches long by two inches in diameter, showing splendid large phantoms of amethyst.

Quartz of fine quality occurs in the gold and silver mines of Gilpin Co., Colo., rivalling in transparency the crystals found in Herkimer Co., New York. Groups of crystals showing etching suggestive of Poretta and North Carolina crystals, and others of scepter form are to be had. These groups are associated with siderite, pyrite, chalcopyrite, galena, tetrahedrite and enargite.

The minerals associated with the quartz of Colorado are numerous and interesting. At Crystal Peak, quartz is found with albite, göthite, topaz, phenacite, biotite, albite and limonite. Fine specimens of amazonstone and smoky quartz are as beautiful as they are highly prized, and bring fancy prices.

At Mt. Antero the quartz is associated with phenacite, garnet, bismuthite, beryl, bertrandite, orthoclase, muscovite, colorless and purple fluorite and hematite.

I am indebted to Mr. L. Cahn for much information regarding the quartz localities of Colorado.

Hollow crystals of quartz, often radiating from a center of chalcedony, and always associated with it, are found about three miles southeast of Pinal, Arizona.

In many instances the hollows seem to be formed by a peculiar grouping of several crystals expanding from a root centre, as the petals of a daisy, which, in form, the finest specimens much resemble. The prisms are striated and the pyramids exhibit rhombohedral faces with plane *l* slightly developed.

In some examples the hollows seem to be contained in a single crystal, which are seldom more than an inch long. The top of the widest hollow is about a half inch across, which tapers down to the base of the crystal. Fine specimens are rare, and one less than two inches across having several of the hollow crystals well developed, commands from two to five dollars.

Mr. F. G. Hillman, of New Bedford, recently sent me a selection of chalcedony specimens labelled "from near Socorro, N. M." All the forms of the mineral are exhibited: mammillary, botryoidal, stalactitic, twisted, gnarled and drusy. The variety of colors shown is remarkable: red, pink, milky, deep and light green.

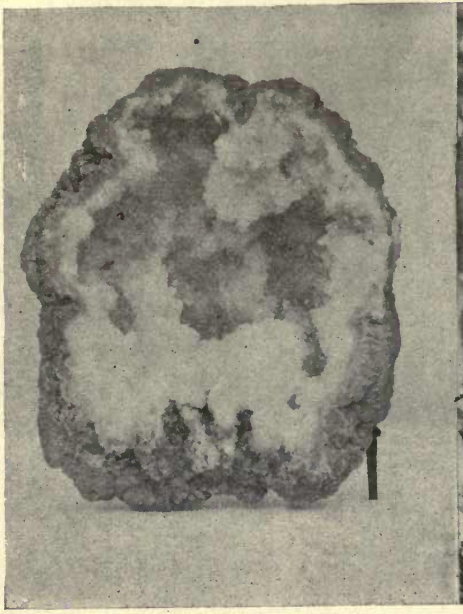
Tufts of radiated crystals of transparent quartz are sprinkled over the surface of some of the specimens. The underside of several of the specimens have a deep mould of scalenohedral form, evidence that the chalcedony occurred on crystals of calcite.

At the Redington Mine, Lake Co., California, are found showy specimens of translucent chalcedony on cinnabar. The deep red color of the cinnabar makes an effective background for the chalcedony. A sharp contrast in color to the last named specimens is found in the quartz on chrysocolla occurring at Globe, Arizona.

The quartz crystals are small and colorless, and enhance the rich green of the chrysocolla seen through them. Specimens of fair size having an even or oval surface are very beautiful. One such about 4x6 is in the collection of the American Museum of Natural History, New York, and I have heard visitors exclaim over its beauty, as they stood before the case containing it.

Groups of quartz crystals inclosing epidote, and fine doubly terminated crystals over an inch long filled with chlorite, are found near Valley Springs, California.

Long slender quartz crystals of a smoky amethystine tint, showing smoky phantoms peculiar to crystals of this color, are found at the Black Jack Mine, Silver City, Idaho. Some of these crystals contain small floating bubbles.



QUARTZ GEODE,

CHEYENNE RIVER, BAD LANDS.

Collection of W. URBAN, JR., Brooklyn, N. Y.

SCEPTER QUARTZ,

BINGHAM, UTAH.

Collection of M. BIXBY, Salt Lake City, Utah.

QUARTZ INCLOSING STIBNITE,

HUMBOLDT CO., NEV.

Collection of A. C. BATES, Newark, N. J.

A vein of crystallized quartz over one hundred feet long, was discovered about 1890 by Mr. John Blackiston, at Placerville, California. The vein is much decomposed and filled with red mud, and contains thousands of loose quartz crystals.

These crystals vary in size from very small to very large—one taken out in 1893 weighing one hundred and four pounds. Others forty to fifty pounds each were quite perfect, and of fine quality.

Splendid frosted and fantastic forms of chlorite are frequently found inclosed in fine transparent crystals. I have seen several crystals inclosing what appears to be a calciferous substance about the size and shape of a pea, and of a cream white or buff color.

Breaking up a few crystals to discover the nature of the inclosed substance, I found the white cavities empty, and the buff ones filled with a siliceous powder. The form of these cavities indicate that the inclosed material was not crystallized. Beautiful phantoms, ranging from a faint tracery to distinct forms both of chlorite and successive layers of quartz, are quite common.

The majority of the crystals are doubly terminated—one end by the usual pyramid, the other by several imperfect pyramids. The finest inclusions are in singly terminated crystals, which occurred in groups in the wall rock.

Mr. Blackiston is an invalid and a veteran of the late War, and according to his history of the method of the disposition of some of the best material taken from his property, he has been shabbily treated.

Quartz inclosing other minerals is not an uncommon occurrence, but in the finest specimens found in this country, the quartz is massive, or without crystal form.

The specimen shown in the frontispiece is a group of two transparent crystals 2½x2, filled with stibnite and casts of that mineral, and was found not far from the sulphur mines of Humboldt Co., Nevada. It is a part of a group, and is by far the finest specimen of an American quartz crystal with inclusions that I have yet seen.

Quartz, its varieties and the localities at which it occurs, could, as a subject upon which to write, be made almost interminable. But as I purposed at the beginning to confine this article to a concise description of specimens from the best known American localities, a little further journeying, now in the West, and in the next part back to the South and East, and my purpose will have been accomplished.

Many new beauties in this mineral, both of form and quality, have been opened out to me as I have pursued the subject.

As I have examined specimens, what appeared for the moment to be a glimpse into the mysterious forces at work in crystal building,

has been dissipated before I could obtain a fuller grasp. Ideas are elusive things.

Conviction comes with substantial evidence, when the material before us for consideration is a natural product. Of the circumstantial evidence surrounding crystallization of quartz, there is plenty, but it is not convincing. Favorable conditions may sometimes inductively teach us the truth.

Mr. Bixby contributes the following notes on a new find of quartz in Utah:

Good clear and milky quartz crystals enclosing a greenish acicular tourmaline, are found in the hills, about 12 miles from Frisco, Utah. The crystals are found over a very small area, probably not more than 100 feet square, and on the outcrop of a mineral-bearing vein. The vein carries chalcopyrite, and transparent selenite is found in it, inclosing this mineral. The clear crystals have so far been found loose in the soil, on the surface, or in small pockets in the vein formation a few inches deep. Milky or semi-transparent crystals inclosing tourmaline, are found imbedded in a material which seems to be a mixture of hematite and manganese, with traces of copper, and also planted on massive quartz, and a radiated fibrous black or dark brown tourmaline, which, in thin particles, shows a reddish color by transmitted light. I have seen no clear crystals so planted or imbedded, except one group of fine transparency on a quartz base, embracing about twenty-five crystals, to one of which was attached a small perfect pseudomorph of hematite after calcite. The crystals are mostly small, from $\frac{3}{4}$ to 2 inches long, and very many of the terminations have been bruised by natural causes. The tourmaline is sometimes so fine as to be scarcely visible in the crystals, and runs through them in all directions, though the most of it is parallel to the sides. I have also noted the fibrous tourmaline standing up between quartz crystals, like bristles, coated with a dark substance, probably hematite, and this coating being removed by acid, the olive green color of the fibres became visible, as in the crystals. Some have been found enclosing minute crystals and fragments of a mineral appearing like hematite. The crystals are generally of the ordinary habit, and I have noted some showing rare modifications or forms.

Jasper is found in handsome specimens in several places in the United States. In Oakland County, Michigan, jasper is found in rounded masses of deep red color, with narrow bands of black, in a matrix of quartz and flint, the whole making an attractive pudding stone.

Near Collyer, Kansas, is an inexhaustible deposit of banded red, yellow and white jasper, which takes a high polish, and when so treated, makes most attractive specimens.

Agate also is found in several States and Territories. On the shores of Lake Superior fine agate pebbles abound, which, when cut and polished, exhibit delicate colors.

Agates of great beauty are found in Colorado, but very few of those sold at the tourists' resorts of that State are of native origin.

Most every mineral collection contains specimens of Wyoming moss agates in rolled pebbles. Recently large masses weighing over a hundred pounds have been found, mostly of a milky white color with occasional clear spaces, and filled with moss like forms. Sliced thin sections make beautiful objects for the microscope.

"Dr. McCulloch instituted a very ingenious inquiry into the nature of these vegetable appearances of different colors visible in the more transparent chalcedonies, which are termed mocha, and more particularly in those which are less so, termed agate. Close observation, added to chemical experiment, induce the conclusion that many of these appearances are owing to the existence in the stone of aquatic confervæ; that these plants sometimes appear perfectly in their natural form and color; in others they seem to be coated by oxide of iron, which occasionally hides the forms of the plants, and discolors it. Mosses and some varieties of lichen have been observed; and occasionally chlorite, which sometimes is so disposed as to represent a vegetable."

Silicified wood is found in Texas, California, Colorado, Michigan, and other States and Territories, but the most extensive deposit is near Corrizo, Apache County, Arizona, and is known as Chalcedony Park. The Park is about one mile square, and is surrounded by low hills, and was probably the bed of a lake (see frontispiece). There are two other deposits of the same character—one eight and the other sixteen miles from Chalcedony Park. The trees rest on layers of sandstone of several colors, the topmost of which is white, and which was the original matrix of the wood. None of the trees are standing, nor are there any roots to be seen.

Trees 150 feet long and over three feet in diameter are found broken into many sections and small fragments. In the cavities of the heart of these trees, beautiful groups of amethysts are sometimes found. "The most remarkable feature of the Park, is a natural bridge formed by a tree of agatized wood spanning a cañon 45 feet in width." (See frontispiece). This tree is over one hundred feet long, three feet in diameter at the smallest end, and four feet at the other—both ends being imbedded in sandstone.

The polished sections of these tress exhibit the richest colors in a great variety of shades. The Drake Company have on exhibition in New York City a quantity of polished sections of agatized wood of

all sizes, set up in mantels, and as tiling for fire-places. Large sections, gorgeous in natural colors, are shown for use as table-tops.

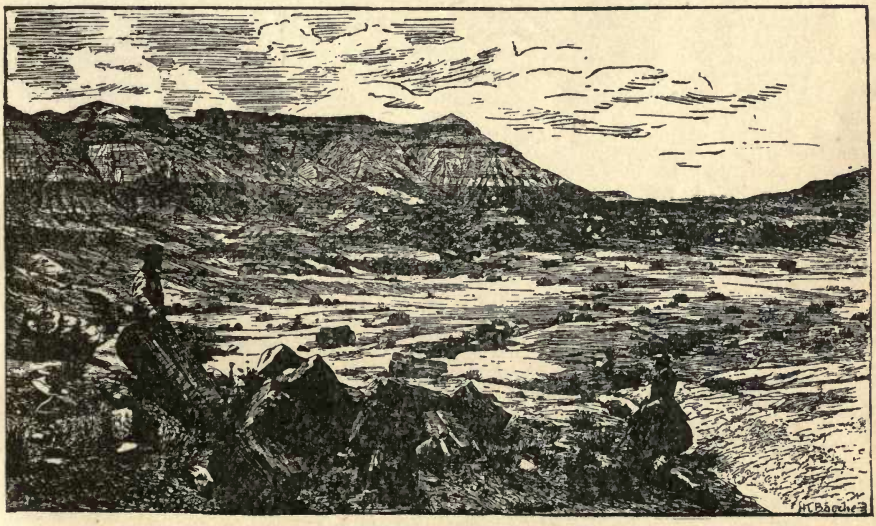
Theories as to the probable causes of silicification of wood are numerous, and the following opinion of scientists who have made a study of the subject, will prove interesting to those not already familiar with their writings.

Mr. Geo. F. Kunz, in his admirable work, "Gems and Precious Stones of North America," says:

"The general theory of petrification is derived as follows: When the wood is soaked in a strong solution of iron sulphate (copperas), then dried, and the same process repeated until the wood is highly charged with this solution and then burned, the structure of the wood will be preserved in the peroxide of iron that remains; also it is well known that the smallest fissures and cavities in rocks are speedily filled by infiltrating waters with mineral matters; hence wood buried in soil soaked with some petrifying material becomes highly charged with the same, and the cells filled with the infiltrating material, so that when the wood decays the petrifying material is left, retaining the structure of the wood. Furthermore, as each particle of organic matter passes away by decay, a particle of mineral matter takes its place, until finally all of the organic matter is replaced. The process of petrification is therefore one of substitution as well as of interstitial filling. From the different nature of the process in the two cases, it happens that the interstitial filling always differs, either in chemical composition or in color, from the substituting material. Thus the structure remains visible, although the mass is solid."

Prof. James D. Dana offers the following explanation of the phenomenon. "The wood, or often trunks of trees, and sometimes standing forests, which have been petrified in the Rocky Mountain region, have in general been buried under volcanic debris, which constitutes beds of great extent in many regions. This volcanic material, called tufa, undergoes partial alteration through the action of the waters or moisture it may contain, or that may filtrate through it. In this alteration or partial decomposition much silica is set free, and makes the waters or moisture silicious. The silicious solution then made penetrates the wood that is buried in the tufa. Very slowly the silica is deposited in all the cells of the wood; and as the wood decomposes, silica takes the place of the particles of the fibres until finally the wood becomes wholly silica or quartz." Concerning the color, he adds that the brownish-yellow is limonite, which if heated will turn red.

Dr. A. A. Julien read the following paper before the New York Mineralogical Society in January, 1892:



VIEWS IN CHALCEDONY PARK, APACHE CO., ARIZONA.

"In the jasperized wood from Arizona, many of the wood-cells are traversed by the well-preserved mycelium of a fungus, secreting iron-oxide, of which the still living species has already been described.

The fine threads are silicified and heavily coated with yellowish to reddish brown ferric oxide, and, by their minute and close branching, form spongy masses of cylindrical shape, often somewhat curved or spiral, and of a little less diameter than the wood-cells along which they lie. It was often noticed in a thin sliced section of the silicified wood, that these spongy cylinders of iron-oxide adhered mostly to the same side of the wood-cells which enclosed them. In other cases, the walls of several wood-cells appeared to be broken down, in the vicinity of the larger ochreous cylinders, as if by erosion through the agency of the organism, producing irregular cavities, now filled with clear quartz.

Another mode of growth of the funges was well shown in many branching plants which have insinuated themselves within the thin lamellæ, which make up the walls of the wood-cells, and so have crossed over several cells through and inside of their walls, but without entering the cells.

The mode of introduction of the fungus into the wood is clearly shown in many thin veins of agate which cross the sections, and indicate cracks in the trunk of the original tree. In these veins, as well as in the erosion cavities referred to above, many fungus spores were observed, sprouting into mycelium, of which some of the branches were noticed, penetrating through the walls of the neighboring wood-cells.

From these, as well as from other facts observed on the plant now living, the following conclusions were drawn:

1st. That the tree fell and was submerged in a shallow sheet of gently running water, such as that which oozes through the cedar swamps of the Alantic Coast down to the sea, at the present day.

2nd. The wood-tissue of the tree was attacked by the water fungus immediately after its fall, and this growth mainly progressed on the lower side of the cells in the prostrate tree. After the decay and loosening of the bark, the floating spores of the fungus evidently made their entrances into the tree, through the crack in its trunks.

3rd. The slowly moving current under the swamp brought by infiltration into the wood-cells, a constant supply of water charged with organic salts of iron, etc. The coloration of the wood has been effected, not by the chemical or mechanical agency, but entirely by organic secretion and deposit of ferric oxide, etc., by this interesting species of water-fungus.

4th. The complete silicification of the wood finally ensued, with a

deposit of the chalcedonic and crystalline quartz, producing varieties of jasper, banded chalcedony, ruin-agate, etc.

In the silicified wood from Barillas Springs, Texas, still more delicate and complex forms of the same fungus were detected in a perfect state of preservation."

Mexico.

Mexican quartz is famous the world over, and has an individuality of its own which is readily recognizable by those familiar with it, even though its variety of forms and colors exceeds that of any other North American locality.

Mr. William Niven, the well known mineralogist, has made repeated collecting trips through Mexico, and his knowledge respecting localities, the people and their institutions, is both extensive and interesting. Mr. Niven is a good observer, and the small affairs incident to life do not escape him. Consequently his stories of travel are replete with the detail of his observations, which enables one to see as he has seen.

A collector seeking large lots of minerals in Mexico must call at the homes of the men who labor in the mines, and take such specimens as have escaped injury at the hands of the children, who use them as pretty playthings. The homes are adobes, dug-outs, hovels or huts, infested generally with insects and filth.

Men who work all day more or less under ground, carrying upon their backs sacks containing 150 pounds of ore, and receiving in return 25c. (Mexican money), must necessarily live in squalor.

These laborers do not know mineral specimens by their proper names, as quartz, amethysts, apophyllite, etc., but by some term which includes all crystallized minerals: Thus, at Guanajuato the term is "Cheekeely," signifying sample; at Pachuca, "gallos," anglicized rooster. It seems funny to think of an amethyst being called a rooster.

Specimens may be bought by tourists at fancy prices of people who deal in minerals at the mining centers, but a collector, seeking material to ship and sell may buy very cheaply of the miners, if he will suffer the inconveniences and torments a sojourner among them must encounter.

With all their squalor, the Mexican Indian laborers are very polite people. Once interest them, and often your presence alone is enough for that, their politeness is extreme; but it is not sincere.

The mines of Pachuca and Guanajuato are essentially silver. The ore of the former is in quartz veins, which afford great quantities of

milky quartz crystals. Specimens are often found sprinkled with balls of bright pink rhodocrosite.

Milky quartz occurs at the Mina de Dolores, at Rey del Nonte, near Pachuca. Very ltttle amethystine quartz is found, but Mr. Niven saw one doubly-terminated crystal of deep color, nine inches long by one and a half inches in diameter, quite perfect, and worth, according to his estimation, one hundred dollars. Mr. Niven hopes soon to secure this crystal.

There are two noticeable features of the Pachuca quartz: That the crystals of a group vary much in length, and that they are brittle. They seem to have grown quickly, and with too little real substance, and sometimes specimens seem to me to have lost their moisture, thus rendering them brittle.

The mines of Guanajuato are many and have been extremely rich in minerals, yielding their stockholders handsome cash returns, and collectors a quantity of splendid specimens.

The Valenciano Mine, famous as the place of occurrence of the mineral valencianite, was of great extent, but is now filled with water and abandoned. A miner entering it in its later days, was obliged to walk an hour and a half to reach the spot at which he was to work. A tunnel cut the vein at right angles, and then followed it down a long series of levels. Water followed the windings in a trough of rock at one side of the passage, and found its way out of the mine through a tunnel made to carry it off.

All of the ore from this mine was carried in bags upon the backs of men up to the ore house at the mouth of the tunnel. The condition of the mine necessitated labor of this sort, and men willing to perform it for a miserable subsistence were at hand. But the song from start to finish was up, up, up! attuned to the surging of the hurrying water. I don't know whether or not to be glad that the water now prevents such awful labor. Fair specimens of quartz and amethysts were found at the farthest end of this mine.

The Mina de Luz—"Mine of Light"—afforded excellent specimens of quartz. The Mina de las Rayas is another of great extent, Mr. Niven after entering having walked continuously for an hour and a half to reach the quartz pockets, securing beautiful amethyst and milky quartz groups.

The chief features of the quartz of this district are in the delicacy of the tints and blending of quality and color, and in its associations with other minerals. Bands of amethystine tints in the matrix, and on up to the tips of the crystals of a group, are not unusual. Oval groups of short crystals with an amethystine blush appeal to all lovers of beauty. And then there are groups of the deepest royal purple,

some with quite transparent tips, and others showing phantoms.

Groups of quartz, either milky or amethystine, with fine calcite crystals, small and large, sprinkled over them, are common. Transparent crystals with hollows in the faces of the pyramid, are frequently found.

Scepter crystals, some in curious combination with crystals of peculiar shape, are occasionally met with, a few specimens of which I have secured, and two are shown in the frontispiece.

Crystals inclosing floating bubbles are rare. The specimen shown is a good one, the bubble moving in a zig-zag cavity over two inches long.

There are other places in Mexico where quartz occurs, but they are not very well known and but few specimens have been offered for sale in this country.

The amethyst is a variety of quartz or rock-crystal, distinguished by its fine violet blue or purple color. This tint seems to be caused by a minute mixture of the peroxide either of iron or manganese, and is lost when the stone is exposed to the action of fire.

The amethyst is one of the precious stones mentioned in the Bible. Commentators generally are agreed that the amethyst is the stone indicated by the Hebrew word "achlamah," an opinion which is abundantly supported by the ancient versions.

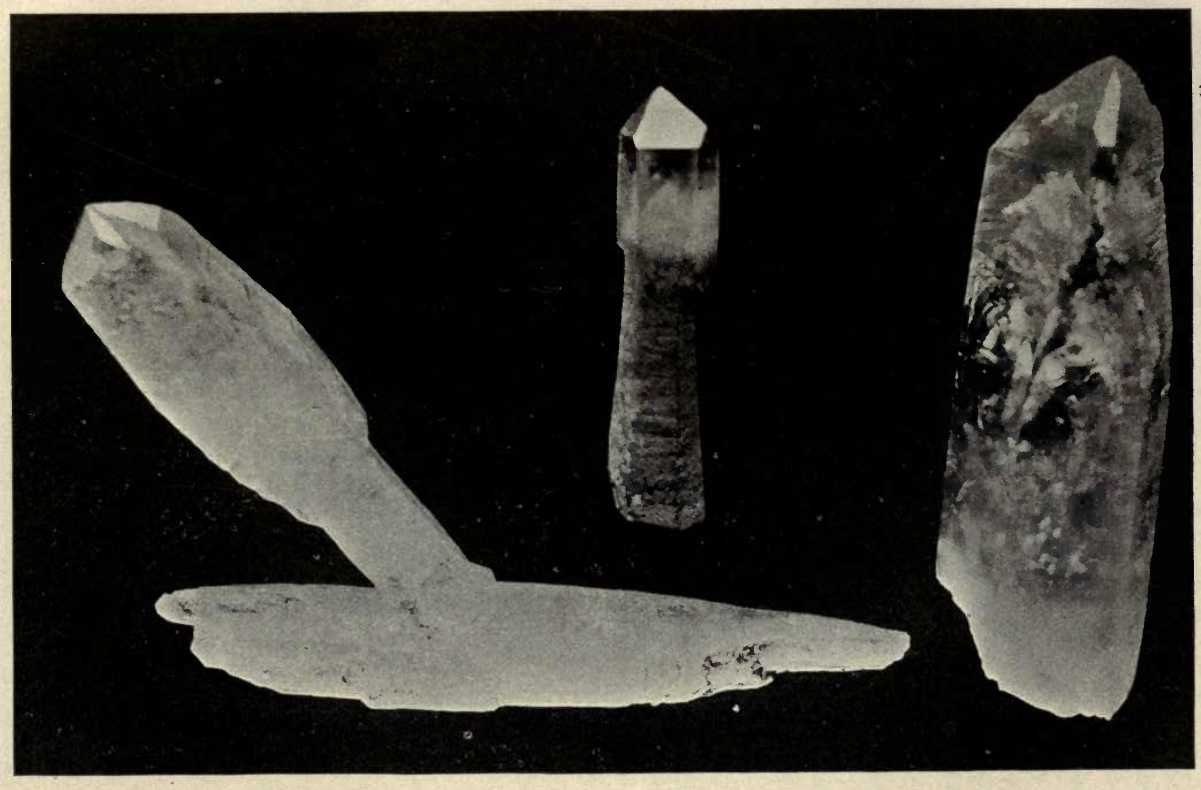
The amethyst, according to Pliny, got its name, ἀμέθυστος, from its supposed power of preventing drunkenness.

Pennsylvania has no extensive deposits of crystallized quartz, but the mineral is widely distributed within her borders and in considerable variety. In bygone years many interesting specimens were found, a goodly number of which have a permanent place in the cabinets of local collectors.

As becomes collectors living in a State which has furnished them a great variety of beautiful minerals, they are conservative, and select specimens with rare judgment and keen discrimination.

The amethysts found in Delaware County are superior to those afforded by any other American locality. One has but to see the magnificent specimen from Upper Providence in the collection of the American Museum of Natural History, or an illustration of it in natural colors in "Gems and Precious Stones of North America," to appreciate the truth of the assertion.

This specimen is a cluster of royal purple crystals, not of gem quality, and the largest crystal measures four and one half inches across the prism.



ODD GROUPING TRANSLUCENT QUARTZ. AMETHYST. LARGE LIQUID CAVITY.

QUARTZ CRYSTALS FROM GUANAJUATO, MEXICO.

Collection of A. C. Bates.

The finest gem crystals that I have seen were found near Chester, in a sandy soil intermixed with clay. The purple color is very unevenly distributed through the majority of the crystals found at this locality. Some are purple in the centre, others purple in one or both ends, the other parts being colorless. In the more transparent crystals a smoky phantom may occasionally be seen in the purple parts. I have from this locality a brilliant cut gem over an inch across, with a smoky phantom in its center. Unlike most amethysts, it is more beautiful by artificial light than by daylight. Several collectors whose opinions are of value, pronounce it the finest gem amethyst which has come under their notice from any locality.

In Birmingham crystals are found in groups, or on a quartzite matrix. In Middletown, Concord, Marple and other places both singly and doubly terminated crystals of good color have been found.

Fine specimens of amethyst from any of the Delaware County localities fetch high prices.

Prase is found at Blue Hill in doubly terminated crystals, seldom more than one inch long, and in rosettes and bunches of crystals up to three inches across. This is the finest distinctly green crystallized quartz found at any American locality. Nodular aggregations of quartz coated with a micaceous substance are found at the same place.

Very good specimens of lamellar quartz, called cleavable quartz by local collectors, occur in loose boulders, milky and transparent in spots, at Overbrooke and Howard House, Delaware County. At Henderson Station, Montgomery County, transparent and milky groups of quartz crystals occur implanted on crusts of quartz. The crystals taper toward the pyramid, which generally exhibits one prominent rhombohedral plane.

At Hitners, curved and dislocated crystals are found. Drusy quartz and chalcedony of several shades of honey color, some quite brilliant, are found at the old Corundum Mines in Newlin.

Doubly terminated quartz crystals, opaque and quite rough and pitted, are found at the lead mines at Phœnixville.

A few very interesting pseudomorphs of quartz after twin crystals of feldspar were found in 1893 by Mr. Elmer Benge at the Old Copper Mines near Shannonville. The pseudomorphs were all of the same general character, but of different sizes, the largest crystals found being over five inches long and coated with drusy quartz, and standing in relief in a thick shell of quartz.

The largest specimen is now in my collection, and, though homely, is unique among pseudomorphs.

Asbestus altered to quartz, is found at Marple. At Newton, what

is said to be serpentine altered to quartz is found in large masses, with cavities in it filled with minute quartz crystals of bright brown color.

Many other quartz pseudomorphs have been found, several having been described in the *American Journal of Science.*

One of the most attractive groups of quartz that I have seen from a Pennsylvania locality is in the American Museum of Natural History collection. The specimen is about 9x12 inches, with brilliant crystals an inch or more in length sticking out in all directions. Lying flat in cruciform position on one side of the group are two crystals, the longer of which measures nine inches. The contrast in position and color between the small and large crystals is very striking. The specimen is labelled from

PAXINOS, NORTHUMBERLAND COUNTY, PA.

The siliceous oolite found in Centre County, was described by Geo. R. Wieland in THE MINERALOGISTS MONTHLY, Vol. VI, No. 1, which is quoted in full:

"In the midst of the wide valley formed by the Appalachian Mountains as they stretch through Centre County, Pa., is an area of secondary highlands, itself divided into hills and valleys, known as the Chestnut Ridge. It extends about parallel to the northeasterly and southwesterly trend of the mountains, quite across Centre County, occupies an area some thirty miles long and two to three miles wide, is poorly watered, of a light sandy soil, and mostly covered by forests of pine, oak and chestnut. Though not wholly unfertile, and slowly being obliterated by farms, this region is in some of the older maps marked as the "Barrens," and is still often locally so-called. The underlying rock is a sandstone, and scattered over the surface is much loose sandstone and flint. Here and there are beds of limonite and hematite, abandoned or still being worked. In fact it ranks as a rich iron region.

So much of detail in the description of this area, for the fact that amongst the rocky debris of its soil and surface is found irregularly shaped boulders and fragments, much weathered and iron stained, at first sight very rough looking, but really the most singular and beautiful of all the oolites, called siliceous oolite.

The name arises from the fact shown by the following analysis:

Single Spherule from Pennsylvania Siliceous Oolite.

Silica	99.99
Iron	.01
	100.00

Single Spherule from Iowa River Oolite.

Silica	2.54
Iron	trace
Calcium Carbonate	97.44
	99.98

While traces are met with (the oolite being very variable in appearance and quality) at various points in the Chestnut Ridge country, the most frequent occurrence is marked by a line running northeast from Scotia and terminating two miles north northwest of State College, where the blocks are quite numerous and reach a weight of as much as four hundred pounds, and where all the finer specimens are obtained. Many of the pieces from this point are free enough from iron and cleavage to admit of getting good cabinet specimens showing to perfection the wonderful regularity in the size of the spherules, the concentric lines, and, under the lens, when polished, the groups of interspherules. Occasionally the blocks contain cavities lined with quartz crystals. Sometimes a section shows a porous structure, the position of the spherules being occupied by spherical cavities lined with drusy quartz, presenting an appearance as of many minute quartz geodes broken open in matrix.

Whether this oolite is of organic origin or not is uncertain. Where it came from remains an unanswered question. Roughly speaking, the Chestnut Ridge region belongs to the Canadian period, but no connection between the siliceous oolite and the underlying rocks has yet been established. A strata of lime silica oolite in conjunction with silica lime oolite, of peculiar structure, crops out in a higher horizon (ordovician?) on the State College grounds, but no one has been able to say positively that this occurrence is even a neighbor to that of the siliceous oolite. Nor does any part of this region show a conclusive evidence of glacial action. Consequently the origin of this oolite remains, for the present, one of the unsolved geological paradoxes, and the collector must content himself with its beauty.

Later.—Since completing the above article, I have made a discovery which surprises and astonishes me. I have found between Rockwood (a station on the Cincinnati Southern Railway, in Roane County, Tenn.) and the Tennessee River, siliceous oolite in place, both as a stratified rock and in masses embedded in a magnesian limestone. I first noticed rough looking pieces among loose surface flint in surroundings that strikingly remind one of the Pennsylvania occurrence. But further search revealed the beds.

Whether or not they have been noticed before I cannot say, but am under the impression that no regular survey of this section has

ever been made. It is quite probable that further investigation will develop facts of interest as well as throw much light on the origin and character of siliceous oolite as found in Pennsylvania."

For a structural description of siliceous oolite, with further comparative analyses, see Barbour and Torrey in the Sept., '90 Number, of the *American Journal of Science.*

Mr. F. B. Jones of New York, sent a quantity of this oolite to Oberstein to be cut into cubes and balls, with very handsome results.

West Paterson, N. J.

As work progressed at this locality during the season of 1895 there was found a considerable quantity of quartz lining cavities in the trap rock. Milky quartz in crusts of drusy crystals, groups of stout crystals, and large masses of bright purple amethysts were, found. Quartz pseudomorphs after natrolite (?) sprinkled thickly with small crystals of quartz occur in handsome specimens.

Other minerals associated with quartz occur in very showy specimens. Large transparent crystals of heulandite and apophyllite on masses of short milky quartz crystals occur plentifully in one part of the quarry. The large masses of pseudomorphous quartz found at Hoxie's Quarry a few years ago, were quite different from any so far found at this locality.

Amethyst crystals of a light purple or pink color are found at Clayton, Rabun County, Ga. The color is unevenly distributed, and transparent crystals are rare. Crystals with cavities containing liquid and movable bubbles, some quite large, have been found in fair quantities. The crystals are generally terminated at each end in several pyramids; the prism planes are uneven, the whole having the appearance of a multiple crystal. Crystals up to three inches long have been found.

Transparent quartz crystals from one-half to one and a half inches long, inclosing petroleum in one or more cavities, are found at Guntersville, Alabama. There is one pleasing feature about these crystals, —the liquid inclusions will not freeze should they be left in a cold room, as will most other liquid inclusions with which collectors are familiar.

At Newport, Kentucky, there are found doubly terminated quartz crystals of the average size of those found in Herkimer County, New York, but much inferior in quality. The majority of the crystals are wonderfully distorted; some are flattened and others are cavernous.

Mr. E. H. Harn has done a good deal of prospecting work in the neighborhood of Henry, Lincoln County, N. C., this year, and with

satisfactory results. A great many interesting quartz crystals, some pretty groups of crystals, and a quantity of massive quartz filled with rutile, have been gathered in.

None of the material, however, differs much from that already described in the first part of this article, excepting a lot of what has been termed " porcelain top " crystals, which are both attractive and unique. The crystals appear to be glazed or enamelled with a pinkish white substance resembling some porcelains, hence the name. The glazing is but a thin coating on the usual crystals found at this locality.

Messrs. Geo. L. English and Company have this year exhibited a great variety of the quartz from Lincoln County.

Itacolumyte or flexible sandstone occurs at several places in the Southern States, the most notable of which is Linville Mountain, Burke County, N. C. This mineral is made into specimens by sawing or cutting it into strips up to two feet long, by from one to six inches wide, the thickness depending on the splitting of the stone when quarried. I quote what follows from a newspaper clipping:

The peculiarity of the stone is that, while it looks just like an ordinary piece of sandstone, it is capable of being bent in the hand with considerable less force than is required to bend a piece of wet leather of equal thickness. When examined with a lens, by reflected light, the particles of which it is built up are seen to be movable individually by using a needle point. When a thin slice of the stone is looked at under a lens, by transmitted light, the fragments are seen to be locked together, like the parts of a section puzzle toy, fixed, but not loosely. Of course, there is no means of flipping out the various sections of the stone, as the interlocking is not only in one plane, but in every direction. The simplest way of explaining how this stone was formed is to say that the grains of sand were once cemented firmly together by another material, which has been partly dissolved, leaving countless natural ball-and-socket joints of jagged shape behind.

Mr. D. B. Corson of Concord, New Hampshire, recently sent me for examination several colorless slender quartz crystals, averaging two inches long, which were found at Strafford, Vermont. These crystals are very brilliant, some are doubly terminated, and all taper so that the alternate planes of the prism are nearly lost just before reaching the pyramid. The terminations are sharp, and a few show the " S " plane exquisitely.

One Western locality in particular I failed to mention while discussing that section. At Seven Rivers, New Mexico, small doubly terminated ferruginous quartz crystals are found. The smaller crystals averaging half an inch in length have a uniformly red-brown color, and are quite perfect. The larger crystals average one and a

half inches in length, and are of a dirty brown color, but some are as bright and perfect as the smaller ones.

Now-a-days one seldom sees any of the amethysts from the mines around Thunder Bay, Lake Superior. Years ago they were plentiful, and old collections usually contain several fine specimens.

A collection made by an old sea captain living at Nantucket, contains three bright specimens which are carefully preserved by his daughters. The locality was a favorite resort of the late Dr. A. E. Foote, who collected and sold many remarkable specimens of the amethysts.

A recent letter from a mining engineer living at Rat Portage, Ontario, stated that he had for sale eight specimens averaging 6x6 inches, price $60.00 for the lot. He also stated that specimens were very scarce, because of work having ceased years ago at the best localities.

The crystals are generally stout and short, dark amethystine in color, ferruginously flecked just under the surface of the pyramidal faces, and nearly always very bright in their general appearance.

Asteriated quartz occurs as a constituent of a granitic vein in pieces not larger than a small egg in the neighborhood of the Gatineau, Canada. The stone is perfectly transparent, and by reflected light exhibits a star of six rays. A few rare specimens show this effect in ordinary light. Ottawa lapidaries charge from four to ten dollars per specimen, according to quality.

There is a large deposit of massive quartz, milky white, transparent and some slightly ferruginous, two miles west of Westminster Park, Wells Island, St. Lawrence River. This quartz is suitable for commercial purposes, and is close to navigation, but no mining has yet been done at the locality.

Other near-by islands of the Thousand Island group have large veins of milky quartz in granite.

Quartz of good quality that is free from impurities is valuable, and parties having extensive deposits should notify their State Geologist of the fact, and request the address of people seeking such material.

The End.

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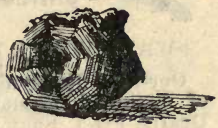

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