DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
J. W. POWELL DIRECTOR

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# MINERAL RESOURCES

OF THE

# UNITED STATES

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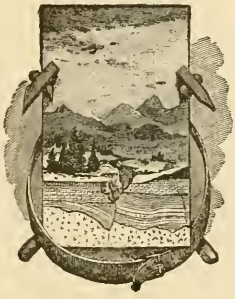

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# PRECIOUS STONES.

*Domestic production.*—Although so many varieties of gem stones are known to occur in the United States, many of which afford fine specimens, while a few valuable stones are exclusively indigenous, the annual output is still very small in comparison with the prospective extent of the field. It is impossible to obtain exact statistics of the product, but an extensive correspondence with experts and dealers justifies an estimate of between $50,000 and $60,000 as the sales in 1882 of cut gem stones of domestic production, exclusive of the gold quartz souvenirs, which should be credited to precious metal mining. The value of the stones before cutting was much less—probably little above $10,000, as about four-fifths of the market value of the stones represents the enhancement due to cutting. This applies more strictly to the common gem stones; and in the case of agates and moss-agates the value of the uncut stones is often not one per cent. of the price of the gems after cutting. The amount stated as the value of uncut stones is of those sold to be cut; besides which, as shown in the accompanying paper by Mr. Kunz, there are sales of small amounts, to tourists and collectors, of stones which are valued merely as specimens, and which do not reach the gem market.

Few persons are familiar with the appearance of gem stones in their native state; so that while quartz pebbles are often mistaken for rough diamonds, garnets for rubies, ilmenite for black diamonds, etc., on the other hand it is quite probable that many valuable occurrences have escaped notice. The competition of the cheap foreign cutting is also a disadvantageous factor.

*Imports and re-exports.*—The following tables show the values of foreign stones imported and re-exported during a series of years. They probably include small quantities of American stones, as these are sometimes cut in Europe and thus lose their identity.

*Precious stones imported into the United States during the fiscal years specified (specie values).*

[Dutiable.]

| | Values. |
|---|---|
| 1872 | $3,053,595 |
| 1873 | 2,870,690 |
| 1874 | 2,274,790 |
| 1875 | 3,399,593 |
| 1876 | 2,480,214 |
| 1877 | 2,114,704 |
| 1878 | 2,975,512 |
| 1879 | 3,842,007 |

| | Values. |
|---|---|
| 1880 | $6,698,488 |
| 1881 | 8,332,511 |
| 1882 | 8,444,525 |
| Calendar year 1882 | 8,154,397 |

*Precious stones of foreign production exported from the United States during the fiscal years specified.*

| | Values. |
|---|---|
| 1872 | $34,438 |
| 1873 | 9,393 |
| 1874 | 102,932 |
| 1875 | 185,231 |
| 1876 | 79,631 |
| 1877 | 51,730 |
| 1878 | 15,569 |
| 1879 | 5,785 |
| 1880 | 7,605 |
| 1881 | 64,256 |
| 1882 | 85,001 |
| Calendar year 1882 | 93,537 |

An annual importation of $8,000,000 worth of precious stones (to say nothing of the considerable quantities smuggled, which escape the record), shows that this country is an exceptionally heavy purchaser—as would be supposed even in the absence of statistics. The imports vary greatly in different periods and are largely determined, as may be seen by a comparison of the years cited, by changes in the general prosperity or by speculative profits. The new tariff law fixes the duty on precious stones of all kinds at 10 per centum ad valorem.

## AMERICAN GEMS AND PRECIOUS STONES. (a)

By Geo. F. Kunz.

In the United States, systematic mining for gems and precious stones is being carried on at only two places, viz., Paris, Maine, and Stony Point, North Carolina. In other cases where gems are found they are either met with accidentally, or occur in connection with other materials that are being mined, or in small veins which are only occasionally met with. They are often gathered with little system on the surface, as is the case with the sapphire, garnet, and olivine found in Montana and New Mexico; or from the beds of streams and decomposing rock, as

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*a* This paper is the result of an application by Mr. Williams to Messrs. Tiffany & Co., of New York City, for the purpose of obtaining certain facts relative to the gems and precious stones of the United States. I may here state that whatever information is presented is due to the usual courtesy and generosity of that firm, whenever they can assist in advancing science or art, in placing at my disposal not only all the facts and material at their command, but also the time required by me in collecting whatever other existing data there might be relative to this subject. In view of the little that has been published and the paucity of reliable facts, it is hoped that the deficiencies in this article may be overlooked.—G. F. K.

the moss-agate from Colorado; or on beaches, as the agate, chlorastrolite and thomsonsite from Lake Superior.

Nearly all the gems found in these ways are sent to the large cities in small parcels, or are sold at the localities to tourists, or are sent to other localities to be sold as having been found in the vicinity. Many of the gems are known only locally, some to mineralogists only, and others that are mentioned here are known only to a certain few who constitute the gem collectors of the United States, and whose one object is to find something that possesses the qualities of a gem or precious stone, for the purpose of enriching their cabinets; still a list of this kind will be of interest and value to the mineralogist and to many others who may have never known of their existence in this country, to whom this knowledge may have a commercial value, should some of these minerals be met with in sufficient quantities and of good quality; it may also direct attention to what has a value and has not heretofore been utilized. Wherever a gem is mentioned from the sale of which a small amount has been realized, it is mentioned merely to note its occurrence in this country, whereas in other countries the gem is often found of better quality and in larger quantities. A list is added of the principal gems that have not been found in this country, and also a list of those that have not been found elsewhere.

We know that the mound builders have worked the turquois mines of New Mexico, that they have made arrow and spear points of rock crystal, smoky quartz, and obsidian, and that they have buried crystals of quartz with their dead; that the fluorite of Hardin county, Illinois, was by them worked into ornaments, and that some of the most beautiful agatized and opalized woods, agates, jaspers, and obsidian were by them worked into arrow-points, and now after a long time are mounted as ornaments by the white man, the precious stones thus serving a double purpose.

*Diamonds.*—Diamonds have been occasionally found at a number of localities in the United States, but as yet at no place has more than an occasional crystal occurred, never enough to warrant any extended mining for them. The diamond found at Manchester, opposite Richmond, Virginia, weighing after it was cut over 10 karats, is worthy of mention. An occasional stone has also been found at the Portis mine, North Carolina, Hall county, Georgia, (*a*) and with platinum in Oregon. They are also reported from Idaho, San Juan county, Colorado, and from Cherokee Flat and several other localities in Butte county, California. A beautiful crystal that cut a remarkably fine three-eighths karat stone was found near San Francisco. Two crystals weighing over 2 karats each are on exhibition at a jeweler's in Indianapolis, and are said to have been found in Indiana. Within the past year a diamond is reported to have been found in Missouri by a hunter who was stopping to take a drink of water at a small brook. This diamond weighs 2½ karats, and by some

*a American Journal of Science*, II., ii., 253, and xv., 373.

experienced judges is pronounced of Brazilian origin, so that the occurrence is somewhat doubtful.

Many experienced geologists hold to the opinion that so many of the associations of the diamond are present in North Carolina that they have hopes of their being found there. The garnet districts of Arizona and New Mexico may also be looked upon as favorable for the occurrence of this gem.

No estimate can be put on the annual amount found. Many reported finds of diamonds of large value in the newspapers are either myths or are based on the finding of rock crystal or even glass, and a diamond value is attached, as in the case of the Missouri diamond mentioned above. It would be possible for diamonds to occur and be for a long time overlooked in a district inhabited or frequented by no one who really knows the diamond in its rough state, whereas rock crystal is often mistaken for diamond.

[Mr. John H. Tyler, sr., of Richmond, Virginia, furnishes the following account of the large diamond found at Manchester:

"This diamond was found in Manchester, Chesterfield county, just opposite Richmond, by a laborer engaged in grading one of the streets. It was brought to me to ascertain its character and value. I pronounced it at once a very valuable diamond, and recommended the finder to keep it carefully and to see me again about it. I did not know his name, and have not seen him since. The next I heard of this stone it was on exhibition at Ball, Black & Co.'s store in New York, and that it had been sold by the finder to some one in New York for $1,800, though I could have got for him $5,000 for it. I understand that it was sent to Germany to be cut. It was an octohedron, and had only one small black spot near one of the points, thus enabling it to be cut to great advantage. I was the first to examine and pronounce upon it."]

*Sapphires and rubies.*—Sapphires and rubies have been found at Vernon, New Jersey, but always more or less opaque, and although a number have been cut from this locality, the probability is that there has not been a single gem.

At the Jenks mine, Franklin, Macon county, North Carolina, where corundum mining was being carried on some years ago and has recently been resumed, the mineral being mined for use as a grinding and polishing substance, fully fifty gems were found, some of them weighing two karats. Only about one-half of these were of good color, most of which were really gems in every sense of the word.(*a*) The colors were rich blue, violet blue, ruby red, light red, pink, and yellow; and others were colorless. No one of these gems had a higher value than possibly $100. The smaller ones were the richest in color.

The principal locality for sapphires in the United States is in the garnet districts near Helena, Montana; Santa Fé, New Mexico; southern

*a* Collection of Dr. Jos. Leidy.

Colorado, and Arizona. Here they occur in the sand, associated with peridot, pyrope and almandine garnet. From this district they are sent to the cities in odd lots, as they happen to be met with, and no regular searching for them is carried on. They are often found with the associated gems on ant-hills, which abound in this district. Two gems (*a*) from here may be mentioned, although weighing only one-eighth of a karat each, one of which was a true ruby red, and the other a sapphire blue, colors rarely met with. The gems are usually of a light green, greenish blue, light blue, bluish red, light red, and red; also, of all the intermediate shades. They are usually dichroic, and often blue in one direction and red in another, or when viewed through the length of the crystal, and frequently all the colors mentioned will assume a red or reddish tinge by artificial light. A very interesting piece of jewelry (*b*) was made of these stones in the form of a crescent; at one end the stones were red, shaded to a bluish red in the center and blue at the other end; by artificial light the color of all turned red. Perfect gems of from four to six karats each are frequently met with. Occasionally crystals are found which would afford ruby and sapphire asterias of a poor quality.

The value of the gems that are cut of material found in this district amounts to fully $2,000 per annum. There are, however, a great many found that are never cut, owing to the higher cost of cutting, and the greater skill required in cutting this gem.

*Spinel.*—Spinel has been only occasionally met with in gem form in the United States. From the locality near Hamburg, Sussex county, New Jersey, may be mentioned specimens of a smoky-blue, a velvety-green, and a dark-tinted claret color; they are all very good gems and weigh about two karats each. (*c*) Some half dozen very fine ones from San Luis Obispo, California, of very good quality and weighing about two karats each, are also worthy of note. (*d*)

*Topaz.*—Topazes have been found in Arizona, New Mexico, and occasionally in southern Colorado. Those from the last-named locality are of a beautiful light-blue color, and one (*e*) of them weighed over 30 karats. They have also recently been found at Pike's Peak, (*f*) Colorado, and more recently at Stoneham, (*g*) Maine. At both the last-named localities they occur in large crystals, but if cut into gems would afford only small stones of little value. The color of the Pike's Peak topaz is light blue, and it is quite clear. The price of such stones is regulated by the color, perfection, and size. The supply yields less than

*a* Collection of G. F. Kunz.
*b* Collection of Tiffany & Co.
*c* Collection of Rev. Alfred Free.
*d* Collection of James W. Beath.
*e* Collection of Tiffany & Co.
*f* *American Journal of Science*, October, 1882.
*g* *American Journal of Science*, III., xxv., No. 146, p. 161; and New York Academy of Sciences, November 7, 1882.

$100 a year at present; but it is probable that this amount will be increased in the near future by the Pike's Peak production.

*Beryl, emerald, aquamarine.*—Emerald has been found at Stony Point,(*a*) Alexander county, North Carolina, in crystals, some from eight to ten inches in length associated with hiddenite, rutile, and garnet. The crystals as a rule have a white core, and although as mineral specimens they are grand, yet few gems have been found up to the present time, and these of second grade. Future developments may, however, bring some fine gems to light. Beryl, spodumene, and the associated minerals have been found on the Lyons property, adjoining that of the Emerald and Hiddenite Mining Company.

Aquamarine has been found at a number of localities in America, the principal among them being Royalston, Massachusetts; Actworth, New Hampshire; Grafton, Vermont; Burke county, and Stony Point, North Carolina; Paris, Maine; Fitchburg, Massachusetts; and Avondale, Pennsylvania. The richest known gems from any known locality have been found at Royalston, (*b*) Massachusetts, and although small are almost as blue as the sapphire. Large clear gems of a light-blue and sea-green tint have been found at Actworth, Grafton, and Stony Point, at the latter locality shading into the beryl-emerald. At Stoneham, Maine, two fine crystals have been found in a pasture; one of which will furnish a fine blue gem over 20 karats in weight. The crystal of which only one half was found is 5 inches long and 1 inch across; it is equal in color to any from Siberia, but has been badly broken by frost or by the hand of some one who was ignorant of its value.

The entire amount of beryl gems found in the United States in the last ten years would not bring over $2,000, and they are scarcely known to others than collectors.

*Phenakite.*—Phenakite has recently been found at Pike's Peak, Colorado, (*c*) in crystals of sufficient size and quality to furnish fair gems. Some fair sized crystals of remarkable clearness were found here recently. They are equal in point of quality to any found elsewhere, and further finds may produce crystals equal in size to those from Siberia. Though rare, this gem is colorless, and hence its value is almost purely mineralogical.

*Zircon.*—Zircon has not yet been found in this country in pieces sufficiently large or good to warrant cutting. Some very small crystals of good color have been found in Burke county, North Carolina, and the ends of some of the Saint Lawrence county, New York, zircons might cut into very small imperfect gems; but nothing further of more than mineralogical value has been found.

*Garnets.*—The garnets found in New Mexico and Southern Colorado,

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*a* Cf. paper by Mr. W. E. Hidden, p. 500, of this report, and *American Journal of Science*, xxii., 489, 1881.

*b* Collection of G. F. Kunz.

*c* *American Journal of Science*, October, 1882.

and there called "rubies," are as fine as those from any other known locality, the blood-red being the most desirable. Very fine almandine, hyacinth yellow, and other colors, are also found associated with olivine and sapphire. Chester county, Pennsylvania, has afforded some fair gems, and some quite fine ones have been found at Stony Point, North Carolina, and at other localities, but the only ones used as gems are from New Mexico, Arizona, and Colorado, which yield annually about $5,000 worth of cut stones. As an example of their quality, a remarkably fine one was sold to a gem connoisseur for $50, but equally good stones have often sold for much less.

*Essonite* (*cinnamon garnet*).—Essonite has been found in very fine crystals at Phippsburg and Warren, New Hampshire; Raymond, Maine; and at many other points in America. Yet only occasionally crystals are found that will cut gems even of value to collectors.

*Grossularite* has recently been found in perfect, opaque crystals in Gila cañon, Arizona.

*Tourmaline.*—The principal source of tourmaline in the United States is the famous locality, Mount Mica, at Paris, Maine, which place has from time to time produced some of the handsomest achroites, rubellites, indicolites, and green tourmalines known. The tints of the green, blue, pink, and yellow tourmalines found here are usually of the light and most desirable shades. (*a*) Work is now being carried on. The yield for 1882 was something over $2,000, and the entire quantity of gems that have from time to time been taken from this locality at the higher rate asked for them as American gems would possibly amount to from $50,000 to $65,000.

Colored tourmalines have been found at Hebron, Norway, and Auburn, Maine. Extended work may bring as fine gems to light here as at Paris, Maine, as the indications are equally good at all these places.

Colorless and brown tourmalines, which cut into fair gems, (*b*) have been found at De Kalb, New York. The fine black from Pierpont and the fine brown from Gouverneur, in the same State, have no value as gems.

*Iolite.*—Iolite has been found at Haddam, Connecticut, in pieces of a dark-blue color and sufficiently clear to cut small gems, but these were of local and mineralogical value only, owing to their small size.

*Spodumene.*—Spodumene has been found transparent at two localities in the United States, the variety hiddenite or "lithia emerald" at Stony Point, Alexander county, North Carolina, and a variety of amethystine color at Branchville, Connecticut.

Hiddenite, (*c*) or "lithia emerald," is found associated with emerald, beryl, rutile, and garnet; the more valuable is the rich grass-green, and is rarely met with. Quite perfect gems of good color, weighing 2½ karats, have been cut. The light-green, yellow, yellow-green, and colorless

*a* Collections of Dr. A. C. Hamlin, Dr. Joseph Leidy, and Prof. C. U. Sheppard.
*b* Collection of Dr. Joseph Leidy.
*c* Cf. paper by Mr. W. E. Hidden, p. 502 of this report.

have a lower value. The green is a new and strictly American gem, and the demand exceeds the supply. This and the tourmaline are the only gems that are being actively mined at present. The total sale of gems found and sold from the beginning of operations in August, 1880, to the close of 1882, amounted to about $7,500, the yield in 1882, during which only preparatory work was being done, being about $2,000 worth of gems.

The Branchville spodumene (*a*) would afford only very small gems of a light amethystine color. The alterations in color which have taken place have entirely changed it to what might almost be called a defunct gem, which would otherwise have afforded material for gems over one inch in thickness and several inches in length. The color before the alteration was probably much richer. The Branchville variety has only a mineralogical value.

*Danburite.*—Danburite (*b*) has been found in considerable abundance at Russell, New York. Only an occasional crystal is clear enough to cut even a small gem. The color is usually wine-yellow, honey-yellow, or yellowish brown. It has not yet been used as a gem.

*Rock crystal* (*quartz*).—Rock crystal is found at a great many localities in America. In Herkimer county, at Lake George, and throughout the adjacent regions in New York State the calciferous sandstone contains single crystals, and at times cavities are found filled with doubly terminated crystals often of remarkable perfection and brilliancy; these are collected in numbers, cut, and often uncut are mounted in jewelry and sold to tourists under the name of "Lake George diamonds." Those sold in large cities under the same name are, however, often simply paste or glass, which possess more brilliancy but have not the same durability. Of the Herkimer crystals possibly $3,000 worth are sold per annum. In Arkansas, at Crystal Mountain and in the region for about forty miles around Hot Springs, large veins of quartz are frequently met with. The quartz is taken to Hot Springs and Little Rock by the wagon load by the farmers, who often do blasting to secure the crystals, looking for them at such times as their crops need no attention. In the course of a year possibly 100 loads are sold, principally as mementos, to the visitors at these resorts. Crystals are also sent to other localities for sale. Usually only one-half of the crystal is clear, and a clear space over two inches square is quite uncommon. The sale of the uncut ones from this region amounts to fully $10,000 per annum.

At Hot Springs clear, rolled pebbles are often sold, that have been found on the banks of the Ouachita; these are more highly prized than the crystal, as the common fallacy prevails that they cut clearer gems. The scarcity of these and the demand for them has so worked upon the cupidity of some that they have learned to produce rolled pebbles by putting numbers of the crystals in a box which is kept revolving for

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*a American Journal of Science*, I., 318, 1879.
*b American Journal of Science*, III., XX., III., 1880.

a few days by a water power. Any expert, however, can discern the difference, since the artificial ones are a little whiter on the surface.

Many localities in Colorado furnish fine specimens, and all along the New Jersey coast at Long Branch, Atlantic City, Cape May, and other places, transparent pebbles are found in the sand, and are sought after and found by the visitors, who often have them cut as souvenirs.

Large masses of clear rock crystal have been found in North Carolina, and would be of use in the arts.

At all of these places large quantities of the quartz cut in gems, seals, and all manner of ornaments are sold as having been found in the vicinity. Sometimes even the stones that have been found by the visitors and brought by them to be cut are exchanged for those already cut and brought here from Bohemia, Oldenburg, and the Jura, where cutting is done on a large scale and by cheap labor; the cut stones costing delivered in America not more than one-tenth of the price of cutting done here, as the rock crystal in the articles really costs very little.

The annual sale of cut stones and money expended in cutting, at the different localities, may amount to $20,000 or more per annum, and the sale of specimens to as much more.

The clear crystal for optical purposes used in this country is almost entirely Brazilian, not that the American is not fine enough, but the good material found here rarely reaches the proper channels, and the Brazilian is cheap and is used from custom.

*Smoky quartz or cairngorm.*—Smoky quartz, smoky topaz, or cairngorm, is found in large quantities at and near Pike's Peak, Colorado. It is also found to some extent at Anteros Summit, Colorado; Magnet Cove, Arkansas; Burke and Alexander counties, North Carolina, and at other points. The Pike's Peak material is sent abroad in large quantities for cutting, and the larger part is returned to be sold in tourists' jewelry, principally at Denver and Colorado Springs, Colorado; Hot Springs, Arkansas, and other western cities and resorts. The sum realized from the cut material amounts to fully $7,500 annually, and the crystals sold to fully $2,500 more.

*Rose quartz.*—Rose quartz occurs in large masses at Albany and Paris, Maine; Southbury, Connecticut, and at many other places in America, but as yet it has not been used at all in the arts or as a gem.

[*Gold quartz.*—Rich pieces of gold quartz are worked into jewelry and souvenirs on a considerable scale in San Francisco, and to a less extent in many of the larger towns in the mining regions. Some of the gold mines in California, Oregon, Idaho, and Montana have furnished very fine specimens, which are especially handsome when the quartz is clear and the gold penetrates it in compact stringers. Gold miners, however, often have a prejudice against what are known as "specimen mines;" that is, mines furnishing ore of this class. A few years ago it was estimated that $50,000 worth of this gold quartz was thus manufactured

annually, but both the demand and the supply have latterly declined.—A. W., jr.]

*Amethyst.*—Amethyst has been found on Deer Hill, at Stowe, in a vein fully one-quarter of a mile long, and at other places in Oxford county, Maine; Chester county, Pennsylvania; in Colorado and Virginia and other regions, although not affording as large fine gems as the Brazilian or the Siberian. It is not used except for mineralogical gem collections. There are a great many amethyst crystal groups sold to tourists and collectors, and the sales from this source may amount to from $1,500 to $2,000 per annum.

*Sagenite.*—Sagenite, "rutile in quartz," "*flèche d'amour*," or "Venus's hair stone," is found at many localities in the United States. The principal supply comes from Iredell, Alexander, and other counties in North Carolina. The rich red, golden yellow, brown, and intervening shades are often cut into oval seals and charms for use as jewelry. The stone gives a very pleasing effect by sun or gaslight. The quantity used annually will amount to over $250 as gems, and as much more for mineral specimens.

*Thetis hair stone.*—Thetis hair stone, near Sneach Pond at Cumberland, Rhode Island, is occasionally met with in fair pieces, and is used to a limited extent in jewelry, probably less than $100 per annum.

Hornblende in quartz is found at Diamond Hill, Rhode Island, and is used to some extent in jewelry, principally in the cheaper grades. The amount used annually is probably worth about $500.

*Agate and chalcedony.*—Agate and chalcedony are found in a great many localities in America. Among them may be named Agate bay, Lake Superior, where large numbers of small banded agates, usually of a red color, are found. These are quite extensively cut and are sold to tourists who visit Lake Superior. Some fine large agates are found in different parts of Colorado and through the Rocky mountains, many of them very beautiful; though only a small proportion are cut or polished, owing to the cheapness of the agates from Brazil and Uraguay, which are cut and sold at so much lower rates in Germany. Nearly all the polished agate specimens sold in America are from the German market. Possibly $2,000 worth of American agates are sold annually.

*Moss agate.*—Of all the American stones used in jewelry there is no other which is sold so cheaply, and of which so much is sold, as the moss agate. Those found in the brooks and streams called "river agates" are the most desirable. Nearly all are sent abroad for cutting and then most of them are returned for home use. When this stone was fashionable fine ones were worth from $10 upwards, and as many as $20,000 worth were sold a year, but at present they are used only in cheap and tourists' jewelry. The principal sources of supply are Utah, Colorado, Montana, and Wyoming Territory. At present the moss agates collected amount to about $12,000 to $15,000 worth per annum, and the demand is declining.

*Silicified wood.*—Wood agate, wood opal, and silicified woods of all kinds are found in great abundance in Colorado, California, and others of the western States and Territories. For colors, variety, and the polish they admit, they are unequaled elsewhere; a great many articles of cheap jewelry and a variety of fancy articles are made from this material and are sold principally to tourists. Some pieces having a marked and desirable peculiarity or beauty are often sold at fancy prices. The quantity annually cut and sold amounts to nearly $10,000, and besides a large quantity is sold as cabinet specimens.

*Jasper.*—Jasper is found at many localities and in a great variety of colors in the United States. A fine green jasper is reported to have been found at Norman's Kill, (*a*) New York, fine red, yellow, and brown at Murphy's, Calaveras county, California, in great variety, and also in parts of Colorado. Near Colyer, Graham county, Kansas, is a bed of banded jasper; the colors are mainly red and yellow, with bands of white, and these bands are so remarkably even that the stone would furnish an excellent material for cameo work. Should this style of jewelry come into vogue again this may prove of considerable value; as it is, the beautiful red and yellow are so strikingly relieved by the white that it makes a fine ornamental stone. Jasper is very little used in the arts, for so common a stone, and the entire annual sales would not be more than $1,000.

*Novaculite.*—Novaculite is found at Hot Springs, Arkansas, and has been used to a very limited extent for cutting figures, such as owls and birds, for jewelry. It is pure white, and makes a very pretty ornamental stone. The amount sold is now less than $100 worth per annum.

*Epidote.*—Epidote, although found in many localities in the United States and in very large crystals ranging from brown to green in color, is only translucent or semi-opaque when in very minute crystals, and no American gems of this mineral have come to our notice.

*Idocrase.*—Idocrase, although found in fine crystals of a dark-brown color at Warren, New Hampshire, Sanford and Raymond, Maine, and other localities, rarely occurs with sufficient transparency to cut even small desirable gems.

*Chrysolite, olivine, peridot.*—Peridot is found of very good quality in small, olive-green, pitted grains or pebbles, associated with garnet and sapphire, in the sands of Arizona, New Mexico, Colorado, and Montana. This material affords smaller gems than those from the Levant, and as the demand seems to be for the large peridots and also the richer olive-green color peculiar to these, and not to the American, for these reasons only a small number of the American are cut into gems, and $500 will fully cover the amount sold annually.

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*a* A fine specimen of heliotrope or bloodstone is reported to have been found here, but the same finder reported a similar and entirely unreliable occurrence in Texas, and the stones from both are evidently of foreign origin.

*Rutile.*—Rutile has been found of sufficient compactness and luster in Alexander county, North Carolina, and at Graves mountain, Georgia, to be used as a gem.(*a*) The rutile from the former locality, when cut, more closely resembles the black diamond in color and luster than any other known gem. If enough could be found fit for cutting, it would become popular as a rich mourning gem. The rutile from Graves mountain, when cut, more nearly approaches the garnet in color, and is therefore not as desirable.

*Hematite.*—Hematite, although found at many localities in the United States, is rarely compact enough for cutting, and is not used for that purpose, owing to the cheapness of the foreign mineral and cheap-cut gems sent to this country. Some exceptionally small, richly-colored pieces have been found near Gainesville, Georgia. The cut specimens sold at the Lake Superior resorts are almost entirely of foreign stone and cutting.

*Isopyre.*—Isopyre(*b*) is found in small veins from one to three inches in width at the iron mines near Dover, New Jersey. In color it very nearly resembles the darker green jasper, or, in other words, bloodstone without the red spots. It is used only as a gem in the cabinets of collectors.

*Prehnite.*—Prehnite (*c*) has been found at a number of localities in the United States, and gems have been cut from material found at Bergen Hill and Paterson, New Jersey.

*Zonochlorite.*—Zonochlorite has been found only at Neepigon bay, Lake Superior, and is scarcely known as a gem, except to collectors, some of the specimens showing the rich dark-green tints, arranged in concentric layers, and are very beautiful.

*Turquois.*—This stone has been found at three localities in the United States—Los Cerillos, New Mexico, Turquois mountain, Cochise county, Arizona, and at a point in Southern Nevada. At the latter place it occurs in veins of small grains in a hard shaly sandstone. The color of this turquois is a rich blue, almost equal to the finest Persian, and the grains are so small that the sandstone is cut with the turquois in it, making a rich mottled stone for jewelry. The principal sale for this stone is in San Francisco. At Los Cerillos some pieces have a decided blue color when found or broken, but show a marked tendency to turn green, and usually become quite green in a very short time.

At Turquois mountain the normal color appears to be green, although at times a faint shade of blue is perceptible.

[Prof. W. P. Blake writes to the *American Journal of Science*, March, 1883, concerning this new locality of green turquois, as follows:

"In this *Journal*, March, 1858, I directed attention to the occurrence in New Mexico of a green turquois highly prized as a gem by the aborigines and known as '*Chal-che-we-te.*' The completion of the railway

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*a American Journal of Science*, III., xxi., 1881, i., 227.
*b* Collection of F. A. Canfield.
*c* Collection of G. F. Kunz.

along the valley of the Rio Grande has made the Cerillos mountain, in which the gem occurs, much more accessible than it was, and the ancient mine has been reopened and worked to some extent by Eastern capitalists, as made known by Professor Silliman. The stone is in consequence more abundant than before, and at Wallace Station on the railway very good specimens can frequently be obtained of the Pueblo Indians.

"I have recently visited another locality where chalchuite occurs and was mined by the ancients. This is in Cochise county, Arizona, about 20 miles from Tombstone, in an outlying ridge or spur of the Dragoon mountains, and not far from the stronghold of the Apache chief, Cochise, so long the terror of that region. This elevation is now known as the 'Turquois mountain,' and as there are several deposits of argentiferous ores near it, a mining district has been formed called the 'Turquois district.'

"At the turquois locality there are two or more ancient excavations upon the south face of the mountain, and large piles of waste or *débris* thrown out are overgrown with century plants, yuccas and cactaceæ. It has not been worked for a long time, and probably never by the Apaches. The excavations are not as extensive as at Los Cerillos, and it is more difficult to find specimens of the mineral. It is evidently much less abundant than at the New Mexican locality. Enough of the gem was obtained, however, by searching in the waste heaps, to show that it is identical in its appearance with the New Mexican chalchuite. The rock is also similar, and the chalchuite occurs in seams and veinlets rarely more than an eighth or a quarter of an inch in thickness.

"The color is light apple-green and pea-green, precisely that of the New Mexican stone, as generally seen. There is in some fragments a faint shade of blue as at Los Cerillos, but the true normal color appears to be green rather than blue.

"The specific gravity I find to be, of two different fragments, 2.710 and 2.828. The first was slightly porous and earthy, and the second dense, hard, and homogeneous. These results are higher than I obtained with the specimens from the surface at the New Mexican locality, viz., 2.426 to 2.651. Two determinations recently made gave 2.500 as the specific gravity of two partly-cut stones from the old Cerillos locality."

Mr. F. F. Chisolm furnishes the following additional particulars concerning the New Mexican turquois:

"Turquois is found in the Rocky Mountain division only on Mount Chalchihuitl, in Santa Fé county, between the Santa Fé and Galisteo rivers, about 20 miles southeast of Santa Fé. The mountain is composed of eruptive rocks, probably of Tertiary age, and is distinguished from the other peaks of the Cerillos range by its white color. The origin of the Los Cerillos turquois, in view of late observations, is not doubtful. Chemically, it is a hydrous aluminum phosphate containing 3.81 per cent. copper. Neglecting this constituent, the formula for turquois requires, phosphoric acid, 32.6; alumina, 46.9; water, 20.5.

"Evidently the decomposition of the feldspar of the 'trachyte' furnished the alumina, while the apatite or phosphate of lime, which the microscope detects in thin sections of the Cerillos rock, supplied the phosphoric acid. It seems probable that the bluish-green color of the mineral is due to the associated copper, which is derived from the copper ores occurring in the Cerillos mountains.

"The turquois occurs in thin veinlets or concretions throughout the mass of yellowish white rock. The concretions or 'nuggets' are covered with a crust of nearly white aluminous rock, and on being broken generally afford the commoner and less valued varieties of the stone, such as are cut roughly and sold on the Atchison, Topeka, and Santa Fé trains by the Indians at the towns of Wallace and Algodones. Fine stones of sky-blue color and of considerable value are extremely rare, and many tons of rock may be broken before finding a stone which could be classed as a gem.

"The observer is deeply impressed on inspecting this locality with the enormous amount of labor which in ancient times has been expended here. The waste of débris excavated in the former workings covers an area of at least 20 acres. On the slopes and sides of the great piles of rubbish are growing large cedars and pines, the age of which must be very great. That considerable quantities of the stone have been obtained can hardly be questioned. The early Mexican settlers attached great value to the turquois, as do the Indians of the present day. It is a matter of history that these mines were well developed in 1680, in which year a large section of the mountain suddenly fell in as a result of undermining the mountain by the Indian miners, killing a considerable number of them."]

All the American turquois is sold to either tourists or collectors, or in the jewelry trade only as oddities. The material cut and sold as gems annually amounts to about $1,500. That cut into specimens and sold amounts to fully as much more.

*Labradorite* (*Labrador spar*).—Labrador spar is found in large quantities in Lewis and Essex counties, New York, and in bowlders all the way down to Long Island and New Jersey in the drift from the New York counties named above. It is scarcely used at all in the arts, owing to the cheapness and superiority of the same mineral from Labrador.

*Amazon stone.*—Pike's Peak, Colorado, and several localities in North Carolina, furnish this mineral, which is often cut and is generally used in cheap and tourists' jewelry. The quantity of material thus cut and sold amounts to over $1,000, while that sold as mineral specimens brings probably two or three times that amount.

*Sunstone.*—Sunstone of very good quality, almost equal to the Norwegian, is found at Media, Delaware county, Pennsylvania, and at Orange Court-house, Amelia county, Virginia. It is as yet used to a very limited extent, and the annual sales may amount to about $250.

*Moonstone.*—Moonstone of very good quality, resembling the St. Goth-

ard variety, and not the Ceylonese, is found at Media, Pennsylvania, and at Orange Court-house, Virginia. The quantity sold amounts possibly to over $250 annually.

*Elæolite.*—Elæolite has been found in some abundance, and of a very compact, rich, flesh, cinnamon, and yellow-brown color that would warrant its use for certain purposes in jewelry, at Magnet Cove, Arkansas.

*Obsidian.*—American obsidian is scarcely used at all in jewelry, although found in masses in California and others of the Pacific States. The Pitt River country is a well-known locality, and furnishes handsome specimens of "mahogany obsidian." The streaked marekanite, so called, has been used, but to a very limited extent, probably amounting to not more than $100 annually.

*Chlorastrolite.*—Chlorastrolite is found only at Isle Royal, Lake Superior, where it occurs in the form of rolled pebbles which have fallen or worn out of the trap rock. They are entirely opaque, of a green color, mottled with stellations, and admit of a high polish. It is one of the few strictly American gems. Large numbers are sold annually to tourists who visit the Lake region. Chlorastrolites measuring one inch in length and of good color have sold for $50. The annual sales amount to fully $2,500.

*Thomsonite.*—Thomsonite is found at Grand Marais, Lake Superior; in color flesh-red, with zones of green, red, and white, resembling the eye-agate, the peculiarly soft tones of color making it a very pretty stone. It is cut to some extent, and possibly from $500 to $750 worth is sold every year, principally to tourists.

*Diopside.*—This mineral has been found at De Kalb, (*a*) New York, in short, stout, oily green crystals, in color resembling the crystals from Ala, in Piedmont. Specimens have been found sufficiently large and clear to cut into gems weighing from 6 to 8 carats each, and recently crystals have been obtained which in size and perfection rival the foreign, and some will furnish gems of 12 to 15 karats each. This is the only known locality for this gem in the United States.

*Opal.*—Opal has not yet been found in the United States of sufficient merit to entitle it to the name of a gem.

*Willemite.*—This stone (*b*) has been found sufficiently transparent at Franklin, New Jersey, to make a very fair gem. The color is of a rich yellow, in shade between the topaz and chrysoberyl from Brazil, with the vitreous luster of the Tavetsch titanite. One crystal furnished seven gems, one of them weighing over 8 carats. As this gem occurs in colors of rich brown and one of the richest greens, we may in time expect to see gems in both these varieties.

*Rhodonite.*—Rhodonite is found in a number of localities in the United States. At Cummington, Massachusetts, it occurs in fine large pieces of a rich red color, occasionally beautifully streaked with the black ox-

*a* New York Academy of Sciences, March, 1882.
*b* Collection of F. A. Canfield.

ide of manganese, equal in every respect to the finest from Russia. It also occurs in pink and flesh colored masses mixed with rhodocrocite, at the Alice mine, Butte City, Montana. It has been very little used in the arts.

*Bowenite.*—This variety of serpentine is found in some quantity at Smithfield, Rhode Island. Its rich color, peculiar toughness, and hardness, recommend its use where jade has heretofore been employed.

*Williamsite.*—This variety of serpentine from Texas, a town of Lancaster county, Pennsylvania, has been used to a limited extent as a substitute for jade, it being more easily cut and usually of a more pleasing color. The amount realized from this stone is not more than $100 per annum.

*Fluorite.*—Fluorite has been found at many localities in the United States, some of the richest colors in Hardin county, Illinois, at Rose Clare, Shawneetown, and Elizabethtown. In the mounds in this region it is occasionally found shaped into ornaments by the hand of prehistoric man. (*a*) This is the only use it has had as yet as an ornament in the United States. The amount mined here for the arts figures over $15,000 per annum.

*Fossil coral.*—The fossil corals found in Iowa, near Dubuque, have been used to some extent in jewelry, shaped into stones for cuff, shirt, and vest buttons, the light cream color making a very quiet, rich stone for this purpose. The amount used is less than $250 per annum.

*Malachite.*—Malachite, although occurring in many localities in the United States, and in considerable abundance at times as one of the ores, or associated with the other ores of copper, is however very rarely found in a form fit for cutting, and no cut specimens have come under our notice.

*Jet.*—This substance has been found in abundance and of very good quality in El Paso county, Colorado, and in some parts of Texas. As yet it has not been utilized in the arts, although it is likely to be at no distant day. A large number of pieces have been polished for cabinet specimens, and the sale of these in the last seven years has probably amounted to several thousand dollars.

*Andalusite* is found at a number of localities, and recently in crystals one inch in diameter and six inches long at Gorham, near Sebago lake, Maine; yet no transparent gem stones have been furnished from any American locality.

*Chiastolite* (*macle*).—Many hundred beautiful crystals of this mineral, with its curious cross-like markings, have been found; yet no use has been made of it for gem purposes, although a number are sold abroad for this purpose. There are occurrences at Lancaster, Massachusetts, and in California.

*Natrolite* occurs at many localities in beautiful crystals, but too small to cut for gems.

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*a* Collection of G. F. Kunz.

*Catlinite* (*pipestone*).—This mineral is found in large beds in the upper Missouri region, and in Pipestone county, Minnesota. As yet it has only been used by the Indians. It would furnish a cheap ornamental stone.

*Axinite* has not been found in fine or large enough crystals to furnish gems.

*Titanite* (*sphene*).—This mineral is met with in abundance in fine black and brown crystals, yet no gems have been found in the United States, although it occurs in such rich, vitreous, yellow gems in Switzerland.

*Cassiterite* has not been observed except in fractured crystals, and none have been found clear enough to cut even a small gem. The wood-tin of Durango, Mexico, is used to a very limited extent on the Pacific coast, the stone being simply polished flat.

*Amber* has been found at Gay Head, Martha's Vineyard, and Nantucket, Massachusetts; at Harrisonville, (*a*) Gloucester county, near Trenton, near Camden, and all through the marl region of New Jersey; and at a number of other localities in the United States; but only rarely of a quality or in sufficient quantity to warrant its use in the arts.

*Jadeite.*—An impure variety is found near Easton, Pennsylvania; and it has recently been brought from Alaska in the form of ornaments, and has also been found in place there. This mineral has not been used in the arts as yet from any American locality.

*Ilvaite.*—This mineral has not been found in compact or large enough pieces to afford gem stones.

*Lapislazuli* has not been found at any American locality.

*Pyrite* is found in beautiful crystals, and in compact masses of a fine yellow color at many American localities, notably in Gilpin county, Colorado. It has little or no value as an ornament, although it has been used to some extent abroad in former times.

*Sodalite* is found associated with cancrinite, elæolite, and in fine blue patches and masses, some several inches across and one inch thick. Fine pieces are of rare occurrence, and the stone is only a mineralogical gem.

*List of gem stones known to occur in the United States.*

| | |
|---|---|
| Achroïte (tourmaline). | Catlinite. |
| Agate (quartz). | Chalcedony (quartz). |
| Agatized wood (quartz). | Chiastolite. |
| Almandine (garnet). | Chlorastrolite. |
| Amazon stone (microcline). | Chondrodite. |
| Amber. | Chrysolite. |
| Amethyst (quartz). | Danburite. |
| Aquamarine (beryl). | Diamond. |
| Asteria. | Diopside (pyroxene). |
| Beryl. | Elæolite (nephelite). |
| Bloodstone. | Emerald (beryl). |
| Bowenite (serpentine). | Epidote. |
| Cairngorm (quartz). | Essonite (garnet). |

(*a*) *American Journal of Science*, March, 1883.

Flèche d'amour (quartz).
Fluorite.
Fossil coral.
Garnet.
Grossularite garnet.
Heliotrope.
Hematite.
Hiddenite (spodumene).
Hornblende in quartz.
Idocrase.
Indicolite (tourmaline).
Iolite.
Isopyre.
Jade.
Jasper (quartz).
Jet (mineral coal).
Labradorite.
Labrador spar (labradorite).
Lake George diamonds (quartz).
Lithia emeralds (spodumene).
Macle.
Malachite.
Moonstone (feldspar group).
Moss agate (quartz).
Novaculite (quartz).
Obsidian.
Olivine (chrysolite).
Opalized wood (opal).
Peridot (chrysolite).
Phenakite.
Prehnite.
Pyrope (garnet).
Quartz.
Rhodonite.
Rock crystal (quartz).
Rose quartz (quartz).
Ruby (corundum).
Rubellite (tourmaline).
Rutile.
Rutile in quartz (quartz).
Sagenite (quartz).
Sapphire (corundum).
Silicified wood (quartz).
Smoky quartz (quartz).
Smoky topaz (quartz).
Spinel.
Spodumene.
Sunstone (feldspar).
Thetis hair stone (quartz.)
Thomsonite.
Tourmaline.
Topaz.
Turquois.
Venus hair stone (quartz).
Willemite.
Williamsite (serpentine).
Wood agate (quartz).
Wood jasper (quartz).
Wood opal (opal).
Zircon.
Zonochlorite (prehnite).

*List of species and varieties found in the United States, but not met with in gem form.*

Axinite.
Andalusite.
Cassiterite.
Chrysoberyl.
Cyanite.
Ilvaite.
Opal.
Prase (quartz).
Sphene.
Titanite.

*List of species and varieties not yet identified in any form in the United States.*

Alexandrite.
Cat's-eye chrysoberyl.
Cat's-eye quartz.
Chrysoberyl cat's-eye.
Chrysoprase.
Demantoid.
Euclase.
Lapislazulite.
Ouvarovite.
Quartz cat's-eye.

*List of gem stones occurring only in the United States.*

Bowenite.
Chlorastrolite.
Chondrodite.
Hiddenite.
Lithia emerald.
Novaculite.
Rutile.
Thetis hair stone.
Thomsonite.
Willemite.
Williamsite.
Zonochlorite.

## THE DISCOVERY OF EMERALDS IN NORTH CAROLINA.

By W. E. Hidden.

Sixteen years ago the site of the North Carolina emerald mine was covered with a dense primitive forest. Less than ten years ago the locality was, mineralogically, a blank; nothing was known to exist there having any special interest or value. It is certain, though, that this region has produced, of late years, some of the most remarkable and beautiful specimens of emerald, spodumene, beryl, quartz, rutile, and monazite thus far discovered in the United States.

In a few localities in Alexander county crystals would be found of the common opaque beryl, but now and then a semi-transparent prism, having a decided grass-green tint, much resembling the famous crystals from Siberia, would be found and offered for sale in the county towns. These came to have the name among the farmers of "green rocks" and "green bolts."

In a period of about six years there were found loose in the surface soil, on three plantations in this county, a few beryls having a tint verging distinctly on the true emerald color, none of which crystals, however, were deep colored enough or sufficiently transparent for use as gems. It was the sight of two of these so-called "green bolts" that prompted me to visit the locality where they were found, and to make a search there for the true emerald. I cannot understand why prospecting was not commenced long ago, where such favorable signs were so common; that such indications could receive only passing notice seems inexplicable. No higher inducement than the following had ever been held out to the farmers to look for these "green bolts": "A visiting collector had offered the munificent sum of one dollar for a dark green transparent crystal as long as his finger."

Such is the history of the emeralds found in this county before I commenced systematic mining for them. The location of the mine now being worked was obtained in the following manner: A corps of workmen were employed to dig a series of deep ditches in directions that would cut the strata at different angles. The site chosen for work was on the spot where at least six of these "green bolts" had been found. This location was shown to me by the farmer who had picked up the crystals while plowing. Not knowing then their manner of occurrence *in situ*, and having no precedent to work by, I expected by this plan to strike a vein bearing them.

Five weeks were spent (July–August, 1880) before any success was met with, and then at a depth of eight feet was discovered a "blind vein" (so called because it had no outcrop) bearing very small emeralds. In this vein, and outnumbering the emeralds fifty to one, was discovered the new emerald-green gem, which was such a surprise to the scientific world, and which was destined to answer the same purpose and have

equal value with the gem I had been seeking for. I refer to the emerald-colored spodumene now known as "hiddenite."

The search for emeralds in North Carolina is so interwoven with my discovery of emerald-green spodumene that I cannot tell the story of one without the other; the two minerals occur intimately associated, and while mining for the one the other is constantly found.

This blind vein yielded very handsomely of the new mineral, but very sparingly of emeralds. A tunnel for the purpose of drainage was cut to this vein, a distance of 261 feet, mostly through rock. A shaft was sunk upon it to the depth of 56 feet, at which point it showed its pocket nature by "pinching out." Up to this time over 80 of these veins have been found within an area of 40 feet square, carrying emeralds and hiddenites. All these veins maintained nearly the same character of dip, thickness, length, and associations. Other pockets were found that yielded only quartz, rutile, mica, and monazite crystals of great beauty; others yet whose walls were covered exclusively with finely crystallized dolomite, calcite, apatite, rutile, pyrite, quartz, or mica. In one instance a pocket contained only mica crystals and one pellucid, colorless beryl that had both ends brilliantly terminated. I mention the above associated minerals to show the diversity in these pockets, although they are so near together. In the rock mining the presence of small streaks of massive quartz or of mica bedded in a contra-direction to the strike of the country rock, leads to an open pocket containing gems not many feet distant.

The largest emerald yet found in this mine was 8½ inches long and weighed nearly nine ounces. It was the largest of nine fine crystals contained in a single pocket; (*a*) their color was excellent, and they were all transparent, though somewhat flawed. The greatest number of emerald crystals found in one pocket at this mine was 74. This find occurred in the spring of 1882. Some of these were between 2 and 5 inches long; the majority were very small.

This mine is situated about 35 miles southeast in an air line from the Blue Ridge mountains. The contour of the country is low-hilly; its altitude about 1,200 feet. The prevailing rock is gneiss, the strata running north-northwest and south-southeast with a nearly vertical dip. The gems and crystals occur in open pockets of very limited extent, which are cross-fractures or shrinkage-fissures. They are usually nearly perpendicular in position. The most striking feature of the geology of this region is the great depth of earth "that everywhere mantles and conceals the rocks. This is readily discovered to be, for the most part, merely the result of the decomposition *in situ* of the exposed edges of underlying strata" (Kerr). At this mine the unaltered rock is found at a depth of 26 feet, and is of unusual hardness, especially where it walls the gem pockets.

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*a* For complete description of this remarkable pocket, see Transactions of the New York Academy of Sciences, March, 1882.

My prospecting has proved these gems to exist in a narrow belt running east and west, and scattered over a distance of three miles; in this belt signs of cross-fissures are very abundant, and it is a very common occurrence to find crystals of beryl, quartz, rutile, etc., perfectly preserved, scattered over the surface soil.

In regard to the commercial value of the North Carolina emerald it should be stated that the majority of the crystals have had little value for gem purposes; as cabinet specimens they were unprecedented, and as such had ready sale at prices ranging from $25 to $1,000 each. The best cut stones did not exceed in value much above $32 per carat. From the largest crystals gems could have been cut, but as scientific specimens the crystals in their entirety had greater value. The smallest crystals have thus far had the best color, and have furnished the purest gems. It may be interesting to note that the entire expenses of the work at this locality, done under the writer's supervision, have been more than repaid by the sales of gems and crystals discovered there.

## HIDDENITE—THE NEW EMERALD-GREEN GEM.

By W. E. Hidden.

This new variety of spodumene was unexpectedly discovered in the manner described in the foregoing section. It was named by Prof. J. Lawrence Smith, of Louisville, Kentucky, who was the first to determine its true chemical nature. (*a*)

Crystals of spodumene, quite transparent, of a pale yellowish-green color, had been found in the surface soil some five years ago, before the discovery of this gem variety was made, but they were so rare and unattractive as to receive only passing attention; so much did they resemble the pyroxene found at Traversella, Switzerland, that they passed under the name of diopside. Their mode of occurrence is precisely that of the emeralds at the same locality. Hiddenites and emeralds are found intimately associated, but one or the other always predominates in number; there will be many crystals of hiddenite and only a few emeralds, or *vice versâ*.

The color of hiddenite is emerald green, of various shades, deepest and richest when viewed through the longest axis, and verging more on the yellow shades of the emerald, when examined through the prism. The gems usually are of a delightful green, which is distinct from that of the emerald, having more liquid brilliancy and fire. They rarely contain flaws. The rough mineral occurs as slender prisms, with the color generally more intense at one of the extremities. The largest crystal yet found is 2¼ inches long. The largest cut gem weighed about 2½ carats. The prismatic cleavage is remarkably perfect, yielding surfaces of the highest luster; this feature is a source of trouble to the

*a American Journal of Science*, Vol. XXI., p. 128.

lapidaries, as the gem is liable to split while undergoing the cutting process. The stone is found to be harder across the ends than across the sides.

*Composition of hiddenite.*

| | Smith. | Genth. |
|---|---|---|
| Silica | 64.35 | 63.95 |
| Alumina | 28.10 | 26.58 |
| Iron oxide | .25 | 1.11 |
| Chromium oxide | ..... | .18 |
| Lithia | 7.05 | 6.82 |
| Soda | .50 | 1.54 |
| Potash | ..... | .07 |
| Water (loss by heat) | .15 | ..... |
| | 100.40 | 100.25 |

Its behavior before the blowpipe is peculiar. When heated to redness, but not fused, it loses its color, but regains it on cooling—a reaction analogous to that afforded by the emerald. Its specific gravity is 3.19. Its hardness across the crystals is above that of the emerald. In value it ranges from $32 to $200 per carat, according to the depth and purity of its color. The demand, at home and abroad, has from the first been far in excess of the production of the mine.

A force of 20 men (at times 30) are kept constantly at work in the gem quarry, and a company is engaged at present in solving the problem of mining gems, *in situ*, at a profit. The nominal capital is $200,000, with a paid up capital of $20,000. The title of the company is "The Emerald and Hiddenite Mining Company." Its success thus far has been very flattering.