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MINERAL RESOURCES

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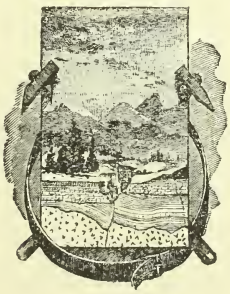
DAVID T. DAY

CHIEF OF DIVISION OF MINING AND MINERAL RESOURCES



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PRECIOUS STONES.

By George F. Kunz.

INTRODUCTION.

The principal features of the precious-stone industry in the United States for the year 1900 may be summarized as follows: The continued mining of the fine blue sapphires in Fergus County, Mont.; the development of the fancy-colored sapphires in Granite County, Mont.; the systematic working of the beryl deposits in Mitchell County, Mont.; the increased output of the turquoise from Nevada and from Grant and Santa Fe counties, N. Mex.; the great sale of the turquoise cut with the rock under the name of "turquoise matrix" from all localities; the cutting and selling of the western North Carolina emerald with its gangue under the name of "emerald matrix;" the mining of the purple-pink garnets in Macon County, N. C.; the discovery of colored tourmalines at a new locality in California; the further advance in the price of diamonds; the continued popularity and demand for pearls, emeralds, and rubies; the importation of nearly $4,000,000 worth of rough diamonds, that were all cut in this country; the stability of the diamond-cutting industry in the United States, even with the limited output of the South African mines; the continued importation and sale of the Queensland and New South Wales opals, and their cutting from the rough in the United States; and the presentation by J. Pierpont Morgan to the American Museum of Natural History of the great Tiffany collection of gems and precious stones shown at the Paris Exposition of 1900 and the Clarence S. Bement collection of minerals, many specimens of the latter collection being gem minerals of great beauty in their natural state.

DIAMOND.

UNITED STATES.

In the United States diamonds are found in three distinct regions, as follows: (1) In Wisconsin, Michigan, Indiana, and Ohio, in the vicinity of the Green Bay lobe of the continental glacier; (2) in Georgia,

North Carolina, South Carolina, Tennessee, and Kentucky; and (3) in California, adjacent to the watersheds of the San Joaquin and Sacramento rivers, where they were first found in the United States.

Diamonds have been reported from at least six or more localities in Georgia, but these are doubtful occurrences. All these occurrences have been described in previous reports of this Bureau.

The whole subject of diamond occurrences in the United States has been reviewed and brought up to date by the author, in a paper which will appear as a Bulletin of the United States Geological Survey. The discoveries reported during the last year are as follows:

An interesting occurrence of a diamond in Indiana, discovered within the last year, is recorded, with full details. The stone was an octahedron of $4\frac{3}{4}$ carats, with a yellow tinge, and had a black spot not quite central. It has since been cut into two stones, probably in the hope of eliminating the flaw, but without success, as both are affected by it. Their color is a peculiar greenish yellow, and their weights are $1\frac{1}{8}$ and eleven-sixteenth carats, respectively.

This diamond was found in panning for stream gold, in material derived from glacial drift. In these respects its occurrence resembles most nearly that of the diamonds from Plum Creek, Pearce County, Wis. The glacial deposits of Brown and Morgan counties, Ind., contain a little gold, which is occasionally sought for in the stream beds, where some concentration has occurred. Late in the autumn of 1900 a farm hand of Mr. R. L. Royse, of Indianapolis, while panning in this way on a small tributary of Gold Creek, in Morgan County, about 9 miles northeast of Martinsville, found this diamond. He sold it to his employer, Mr. Royse, for $25, from whom it was afterwards purchased by Mr. C. E. Nordyke, of Indianapolis. The latter gentleman had it cut in Cincinnati by the Herman Keck Company, and retains the two stones above described.

Prof. W. S. Blatchley, State geologist of Indiana, says that two or three other small diamonds have been reported from the same neighborhood. The glacial material there was brought, according to Professor Blatchley, by the first ice invasion. This is another point of resemblance to the Plum Creek, Wis., occurrence, and of difference from those of the Kettle moraine localities. The relations and probable connections of these two sets of occurrences are discussed by Prof. William H. Hobbs, in his paper, elsewhere referred to, on The Diamond Field of the Great Lakes.

The recent discovery of two diamonds in Tennessee is apparently well authenticated. Mr. H. W. Curtis, a jeweler of Knoxville, purchased one early in 1899 and another in February, 1900, both from the neighborhood of Knoxville. The first weighed 3 carats, but no further particulars regarding it have been obtained. The second

weighed $1\frac{3}{16}$ carats, and is described as white and flawless. It was found on the bank of Flat Creek at Luttrell, Union County, by an old gentleman; he noticed it as a peculiar bright pebble lying on the ground and picked it up. It was brought to Mr. Curtis, who recognized and purchased it.

A diamond of $4\frac{1}{4}$ carats has been found in Alabama, in Shelby County, about 30 miles south of Birmingham. It was found by a little girl in earth used to fill up some low spots in a garden; some of this earth was close to the house, where water dripped on it from the roof, and here, after a rain, which had washed it clean, the child noticed the diamond and picked it up. It is estimated that the stone, which was pronounced an excellent one, would cut into a gem of $1\frac{1}{2}$ carats, or perhaps a little more. It was sent to New York and examined, but remains in the possession of the finder.

SOUTH AFRICA.

The annual report of the De Beers consolidated mines for the year ending June 30, 1900, issued by the great corporation, of which Hon. Cecil J. Rhodes is life governor and the eminent American engineer, Mr. Gardner F. Williams, is life manager, is a very voluminous document. It contains much unusual matter, connected with the African war, the siege of Kimberley, and the resulting interference with the operations of the company. Mining was suspended soon after the outbreak of hostilities, and the town was invested for five months, during which time all the energies and resources of the place were taxed for its protection. The mines of the company were an important factor in the defense of the town, as fortifications were constructed of and upon the extensive heaps of "tailings" of blue ground and débris; and on occasions of special peril some of the mining galleries were utilized as bombproof refuges for women, children, and the sick. Operations were resumed in March; but up to the end of the fiscal year of the company, in June, they were carried on only on a limited scale, in consequence of the difficulty in obtaining coal and laborers. Subsequently, however, as announced at the shareholders' meeting, on December 28, the work was again getting into a more normal condition.

In consequence of these great interruptions, which involved direct expenses and stopped the yield of diamonds for nearly half the year, the company decided to pay no dividend for the year ending June 30, 1900. They have declared one, however, for the six months ending December 28, and hope in a short time to pay a bonus to the shareholders, to compensate in part for the loss of the usual dividend in the previous year.

Compared with the preceding year the actual diamond output was reduced by more than one-half; but as the prices were higher the

value of the product was just about one-half. The figures are given in the table which follows.

Production of the De Beers and Kimberley and Premier mines from 1898 to 1900.

DE BEERS AND KIMBERLEY MINES.

Year ending June 30—	Loads of blue—		Carats of diamonds found.	Amount realized thereon.	Loads of blue remaining on floors.
	Hoisted.	Washed.			
1898	3,332,688	3,259,692	2,603,250	£3,451,214	2,377,913
1899	3,504,899	3,311,773	2,345,466	3,471,060	2,937,784
1900	1,673,664	1,522,108	1,000,964	1,794,222	2,722,595

PREMIER MINE.

1898	1,146,984	691,722	189,356¾	£196,659	727,039
1899	2,032,771	1,662,778	496,762¾	567,360	1,097,032
1900	980,210	736,929	220,762¾	276,191	1,340,313

GUIANA.

Diamonds appear to be quite widely distributed over the globe, and new localities are coming to view year by year. The latest development is that announced from British Guiana, as reported to the Department of State by the American consul at Demerara, Mr. George H. Moulton. The existence of diamonds in Guiana has been known for some years, and quite a number of small stones were found as far back as 1890. Three years later the colonial commissioner of mines alluded, in his report, to their known occurrence in gold placers, and predicted the discovery of "dry mines."

Diamond mining is now carried on about 250 miles south of the town of Bartica, which is situated at the confluence of the Essequibo and Mazaruni rivers. The spot is about 4 miles from the latter stream, and is reached by a narrow trail through a tropical jungle, through which everything must be carried by men. The journey from Bartica is long and hazardous. In March, 1900, 282 stones were brought out and sent to London, where they were valued at $12 per carat. Later, 400 more were brought down—obtained by 9 men in 18 days, working with crude methods. They are octahedral crystals, ranging from very small size up to a carat and a half.

From all reports a larger increase is predicted for the coming year, both in the number of stones produced and the extent of the deposits.

In Dutch Guiana also diamonds have been found for years past in the tailings of gold washings. They have been for the most part small, and have attracted little attention, the gold being the main object; though one fine stone is reported to have been found by a Mr. Fennelly about ten years ago, who sent it to the United States and had it cut. Mr. J. H. Abbott, of Revere, Mass., who resided for a long

time at Paramaribo, and was extensively engaged in gold mining in Dutch Guiana, has described the frequent occurrence of small diamonds in the "tailings," and believes that there may be rich possibilities of larger stones in the clay of the river bottoms below. No attention has been given to diamond mining, and the clay is unexplored. Old worked-out gold claims, he thinks, that can be bought for a trifle, may yet prove of value as diamond beds. A serious difficulty, however, is the unhealthfulness of the climate in these interior districts. White men can live well enough along the coast, but the interior is extremely malarious. Mr. Abbott describes the gold and diamond region as consisting of two belts, each about 25 miles wide, reaching from the coast inland across the three Guianas. The French section, nearest the coast, was operated first, then the Dutch, and then the British. It is in working this latter district for gold that the diamond discoveries above noted have been made in British Guiana.

BRAZIL.

An extensive drought in the diamond region of Brazil has rendered accessible stream beds not usually available by the rather crude methods there employed. As a result, an increased production of diamonds is reported, even to the extent of a threefold amount; though this estimate is hardly probable. Accurate data are not obtainable, however, as the duty of 16 per cent on the value for exported gems and a municipal tax of 1 per cent lead to a great amount of concealment and smuggling. It is stated that small rubies, suitable for watch jewels, are abundant in the diamond district, but that the low prices now prevailing do not render their collection profitable. It is perhaps a question whether these "rubies" may not more probably be pyrope garnets, as in South Africa.

INDIA.

M. G. Ramond has published[1] an abstract of the latest and best information concerning the geology of British India, summing up the extended work of Prof. R. D. Oldham in his Manual of the Geology of India. While this article is strictly geological and does not deal with the production of precious stones, the subject of diamond occurrence is briefly alluded to as follows:

> It is in the ancient Paleozoic region of the peninsula that the only formations belong in which, up to the present time, the diamond has been found in India. The only mines exploited have been among the Upper Vindhyan group, * * * at the base of the subdivision known as the Rewa slates, in the Karnoul and Cuddapah group, near Banganapali, and in the valley Mahánadi, near Sambalpur. But nowhere does the diamond exist in place; it is the alluviums and conglomerates that yield it. In India, therefore, it is always of detrital origin.

[1] Annuaire Géologique Universelle, Vol. X, 1893, pp. 595–654; Paris, 1895.

NEW SOUTH WALES.

A valuable résumé of the diamond developments in New South Wales (repeatedly referred to in former reports of this Bureau) appeared in the annual report of the department of mines and agriculture of that colony for 1898. Diamonds were first discovered in 1851, on the Turon River and at Reedy Creek, near Bathurst. By 1860 they had been noted in four other districts of the colony, and subsequently at a number of points, widely separated, as also in adjoining sections of Victoria and South Australia. The first important discovery was in 1867, at the Cudgegong River (Mudgee), and from 3,000 to 4,000 stones were obtained in that year. In 1872 the Bingera district came into prominence and attracted a host of diamond seekers; but the stones proved small and not very marketable, and interest fell off for some years. The Bingera district, however, has been reopened since 1883, though with more or less interruption from lack of water, but it is now the second in importance of the New South Wales diamond fields. The chief one is in the Tingha division, at Boggy Camp, near Big River, Auburn Vale. The first discovery here was about 1884. This, too, is at times interrupted like the preceding.

RUSSIA.

The occurrence of diamonds in the Ural region of Russia was referred to in a previous report.[1] A small pamphlet prepared for the Paris Exposition of 1900, on the mines of Lysva district, gives some later notes.[2] The general facts as to diamond occurrence in the valley of the Adolpho-log, a tributary of the Paludenka River, and the character of the gravels in which they are found, are much as stated in the report of this Survey for 1898. The total number obtained, however, is given as now exceeding 200. The stones are colorless, pure, and transparent, but for the most part small, the largest weighing 3 carets.

L. Jaczewsky[3] discusses the finding of a second diamond in the gold washings of Baladin, on the Melnitschnaja, a tributary of the Jenissei. The second diamond was found in the Rudkowshy mine, on the Totschilnij-Kljutsch, 25 kilometers above where the Melnitschnaja flows into the Pit. The diamond is colorless and transparent, partly showing a cross twinning. It weighed thirteen-hundredths of a gram = one-half caret, with numerous partly developed, rounded trexatohedral.

P. Jeremejeff also describes this same diamond as being found in the gold washings of the northern Taiga, in the Jenisseien Government.[4]

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[1] Twentieth Ann. Rept. U. S. Geol. Survey, Part VI (cont'd), p. 565.

[2] Mines et Usines Metallurgiques du District de Lysva (Oural), Domain du Compte P. P. Schouvaloff.

[3] Trans. Russian Imp. Min. Soc., Pt. 2, No. 36, 1899, pp. 42–43.

[4] Trans. Russian Imp. Min. Soc. Pt. 2, No. 36, 1899, p. 34.

DIAMOND DRILL.

An important work by Mr. G. A. Denny, the mining engineer, which appeared in England during the past year, discusses the use of diamond drills exhaustively and exclusively.[1] The work is designed as "a practical handbook of the use of modern core drills in prospecting and exploiting," and goes into all the aspects of the subject—geological, mechanical, engineering, etc.—with tables and estimates as to the cost of machinery and of working.

In regard to the carbons employed, Mr. Denny enters briefly into the advantages of certain varieties of carbon, giving the first place, by general consent of operators, to the black carbonados of Brazil, "which combine with exceeding hardness the amorphous structure * * * rarely attained in the ordinary white stone." Any variety of diamond free from flaws and not too highly crystalline may be used; but flaws are frequent in all diamonds but the carbonados, and render the stones liable to break under the pressure to which they are subjected in the "crown" of the drill.

The carbons are set in the end of an iron ring, or "crown," which of course wears rapidly in hard rock, notwithstanding the protection afforded by the carbons. Frequent resetting of the stones is therefore required. In the Transvaal mines beds of hornstone are frequent, and diabases that are even harder, as much as 8, and the wear is so great that resetting becomes necessary about every 10 feet, while in ordinary sandstones and quartzites a drill crown will last through two or three times that distance. In all these matters much depends on the skill of the drill operator, who must be able to judge as to the hardness of the rock, and graduate the rate of speed and the force applied accordingly.

INCREASED VALUE OF CARBON AND BORT.

A marked advance in the price of the diamond carbon used in boring and mining operations is reported during the past year, and is due to several concurrent causes. M. Jacques Baszanger, at the congress of boring engineers held in Frankfort, dealt with this subject, and gave three reasons for the rise in value. These were (1) the fact that the Brazilian carbonado product is controlled and practically "cornered" by a single firm—which condition has led to (2) an effort to replace its use by that of "boort," or bort, the African product, while (3) the Transvaal war had interrupted the operations of the De Beers Company for several months. The consequence has been that the limited amounts of bort obtainable in the market have been sought for with great competition.

[1] Diamond drilling for gold and other minerals, by G. A. Denny, with illustrative diagrams; pp. x, 158, London, 1900.

A striking illustration of the fact just referred to and of its far-reaching results is furnished by the recent statement that prospecting operations in British Columbia have been impeded and almost suspended in consequence of the cost of bort, which has risen from $16 to $70 a carat. The expense of diamond drilling has thus been advanced from $1.50 to $4 per foot, with a very serious effect upon explorations by this process.

CORUNDUM GEMS.

SAPPHIRE.

MONTANA.

Reports from the Fergus County sapphire mines at Yogo indicate active and successful working. The gems occur in a vertical "lead," or "vein," of clay, inclosed between walls of rock—i. e., in a decomposed igneous dike. This material is taken out and washed, and the stones then sorted. The company that is operating the mines has worked down some 50 or 60 feet, but exploration has been made for 200 feet, with the same occurrence of sapphires. Different portions along the dike vary widely in their yield of gems. In September last five "blocks" were reported as worked. One of these yielded 10,000 carats, the other four only 8,000, one of them furnishing but 74.

It is stated that quantities of corundum besides the gem variety are obtained, and that large amounts of it are lying on the dumps, of no present value until railroad transportation is available. The most important gem yet found here was a very deep blue fine stone of over 3½ carats.

CORUNDUM.

NORTH CAROLINA.

New associations.—In studying the genesis of the ruby and the sapphire in recent years it has been found that corundum, long regarded as a somewhat rare species and principally confined to basic igneous rocks, really occurs quite freely in varied associations in syenites, gneisses, and schists. Its abundant occurrence in connection with nepheline-syenites in Canada has been described in the reports of this Survey.[1]

RUBY.

MONTANA.

The Granite County deposits, at Rock Creek, were worked during part of the summer, and an attempt was made to trace some of the gems to their original source in the rock. As to the success of this search no positive results have yet been reported. A large number

[1] Twentieth Ann. Rept. U. S. Geol. Survey, Part VI (cont'd), pp. 570–572; Twenty-first Ann. Rept. U. S. Geol. Survey, Part VI (cont'd), pp. 437–441.

of gems were obtained from the beds and were cut at Helena. The proportion of red ones—rubies—was greater than heretofore, but none were found possessing the deep color of true oriental ruby. They were of light shades of red, beautiful, and extremely brilliant, but not so dark as desired. At least sixty occurrences of rubies were located on several miles of gulches.

At no known locality, however, has there ever been found so great a variety of rich colors in corundum gems as here. At the Paris Exposition of 1900, there was shown a brooch of over 200 of these stones, ranging from 1¼ to 3 carats each, every one of a different tint or shade. Although the deep-red ruby and the "velvet blue" or "cornflower" sapphire were lacking, yet the richness and variety of the other kinds were unequaled; pale rubies, pink, salmon, passing into yellow, pure yellow, yellow brown and deep brown, pale blues and greens, blue-green, etc. Often a single stone would show two or three distinct shades of one color. Many of the colors have never been observed at any other locality. All were of unusual brilliancy, and improve greatly in artificial light. The butterflies and other rich jewels made from these stones possess almost the beauty of natural insects

BURMA.

The Burma Ruby Mines, Limited, the company that was organized after the British occupation of Burma, and from which such fabulous results were anticipated but not realized, has finally succeeded in overcoming the obstacles which for years impeded its endeavors, and has actually begun to pay dividends. This result has been reached by several steps, aided by increased experience and improved methods of working. Three years ago the capital was reduced £120,000 by "writing off" 8s. per share on 300,000 shares. The rent paid to the Government has also been largely reduced; first, by the Government consenting to cancel an accumulated debt of unpaid rental, amounting to 4 lakhs of rupees, or £25,000, and then by a reduction of rent from nearly £20,000 to £12,500, subject to an increase in the Government's share of the net profits from 20 to 30 per cent. The result of these changes was that in 1899 there was for the first time a balance instead of a deficiency, and in 1900 a dividend of 12½ per cent, amounting to £18,687 10s., was announced, leaving a balance of about half that sum to be carried over to the next year's account.

The Burma company is now producing fully one-half of the annual yield of rubies in the world. The original value of the gems as mined is more than doubled by the time that they reach the individual purchaser. The cost of cutting stones so hard as rubies is greater than that of any other gem except the diamond, and adds about 40 per cent to their value, as many are small; while in the course of their passage through various hands, their cost is further enhanced until it is esti-

mated as about two and a half times the value as taken out of the "byon."

The following figures, taken from the company's annual statements, will give an idea of the progress made in the past seven years. They show strikingly the steady reduction in cost of working the "byon" per load, the fluctuations in the royalty received from native workers, and the advance in the balance on ruby production:

Operations at the Burma ruby mines.

Year.	Loads of byon washed.	Gross cost per load.	Rent to government.	Royalty from natives.	Balance on ruby trading account.
		s. d.			
1893–94	20,089	29 2.75	£12,708	£20,585	£4,535
1894–95	61,080	8 10	11,276	21,395	16,744
1895–96	148,740	3 9.75	11,250	28,277	27,204
1896–97	266,739	3 1	18,437	22,534	43,529
1897–98	823,703	1 2.75	20,815	9,976	52,146
1898–99	652,456	12.86	16,674	14,233	51,469
1899–1900	818,135	10.39	14,769	18,468	84,114

EMERALD.

NORTH CAROLINA.

The emerald and hiddenite mine at Stony Point, Alexander County, N. C., formerly much noted, has been involved in litigation for several years past, and during this time nothing has been done there, or at least no discoveries have been reported or published. Few gem emeralds have been found here; but remarkable crystals, very finely formed and richly colored, and as much as 10 inches long, translucent to semiopaque, were taken out when the mine was first worked about twenty years ago.

Emerald matrix.—A novel and attractive stone has recently been brought forward under the name of "emerald matrix." The emerald deposit at Big Crabtree Mountain, Mitchell County, N. C., described for the first time in this report[1] has been lately worked by a New York company, and, although no transparent gems have yet been obtained, a beautiful ornamental stone has been developed. The crystals vary from one-eighth of an inch to 1¼ inches in diameter, and are rarely over 1 inch in length. They are not transparent, but have rather a fine emerald color, penetrating narrow veins of quartz and feldspar in an irregular manner. This green and white mixture is very pleasing; and as the feldspar has a hardness of 6.5, the quartz of 7, and the emerald of about 8, the whole can be cut and polished together. Pieces are cut en cabochon, showing sections of one or more emerald crystals on the top and sides of the polished stone. The name of "emerald matrix" is given to this ornamental gem material.

[1] Sixteenth Ann. Rep. U. S. Geol. Survey, Part IV, p. 600.

COLOMBIA.

The emerald mines of Colombia, at Muzo and Coscuez, near Bogota, are again to pass under a new management. In 1894 a seven years' lease was granted by the Government to M. Macini, formerly French chargé d'affaires in Colombia, who subsequently transferred it to a British company for $400,000 in cash and an annual payment of $30,000. New proposals are now to be made, the lease being about to expire.

RUSSIA.

P. Zemjatchensky, in a paper on the emerald and beryl of the Uralian Emerald Mines, states,[1] first, that 85 versts northeast of Ekaterinburg, on the headwaters of the Starka, Tokowaja, and other right-fork streams, emerald mines were opened in 1832 in the Pyschma Bolschoi Reft region, two years after the first emerald had been found by a peasant. The developments lasted until 1837. They had decreased in their output until 1852, when the Imperial Cabinet decided that the flow of the river was affected, which, together with the high cost of obtaining the emeralds and consequent unprofitableness of mining, led to the closing of the mine.

Miklachewsky, who in 1861 or 1862 examined the mines, stated that from 1831 to 1862 emerald and beryl weighing 2,332.49 kilograms (5,131 pounds), and phenacite 82.16 kilograms (180¾ pounds), and chrysoberyl 39.95 kilograms (87.9 pounds) had been mined. Later several lessees worked the mine with more or less vigor and more or less financial success, resulting in the entire closing of the mine in 1892. In the two and one-half years of workings they found 360 kilograms (790 pounds) of emerald and beryl and 41 kilograms (90.2 pounds) of alexandrite. Recently the mines have been rented by the New Emerald Mines Company, who have resumed operations.

BERYL.

Beryls of great size, like those of Acworth, N. H., and smaller crystals of gem quality, have been reported in the vicinity of Blandford, Mass. The large crystals were found in a quarry on the land of Mr. E. Boise, where ledges of white quartz were being worked for use in the manufacture of glass and sandpaper. The crystals were very abundant, and many had the diameter of a keg or small barrel, though of rough texture. One of the finest, of uniform light green, with lateral planes nearly perfect, and about 5 feet in length and about 2 feet in diameter, has been secured for the museum of Lehigh University, South Bethlehem, Pa.

The finer crystals, of smaller size, but yielding gem material, have

[1] Travaux Société impériale des naturalistes de St. Pétersbourg, Vol. XXIX, part 5, pp. 1–19, 1900.

been found in bowlders and stone fences. One crystal, 5 inches long and 3 inches in diameter, is said to have yielded its discoverer $150 in New York. Most of the crystals obtained are smaller than those mentioned, however. The source of these beryls is as yet unknown, but there is evidently a valuable locality in the neighborhood, doubtless to the north, whence these specimen pieces have been carried by glacial agency. Associated with the colored tourmaline described further on, at Mesa Grande, San Diego County, Cal., was a remarkable mass of transparent, rose-colored beryl, measuring 65 by 50 millimeters. It is evidently an etched fragment of a very large crystal, the etched faces, with marking and erosions, being visible all over it. Viewed by transmitted light it varies from a delicate rose color to a rich pink, almost that of a Brazilian topaz.

TOPAZ.

A recent article on the mode of occurrence of topaz near Ouro Preto, Brazil, by Prof. Orville A. Derby,[1] gives the results of a study of the associated earths and rocks at the locality where this topaz is found. The crystals occur in a dark-colored earth, which, from its mineralogical character and its geological relations, appears to represent the remains of an igneous dike in which the topaz was an original mineral. What the exact nature of the rock composing this dike was can not be ascertained, on account of its condition of extreme alteration.

GARNET.

OUVAROVITE.

Very interesting is the discovery of the occurrence of richly colored ouvarovite near Carrville, Trinity County, Cal. The mineral occurs in small dodecahedral crystals, from 1 to 3 mm. in diameter, of the richest deep green, coating seams or cavities in chromic iron. These were mistaken for emeralds and announced as such, causing considerable excitement for a time, but their form and association are conclusive as to their being chrome garnet. So far the crystals are small, but as an addition to the gem stones of the United States and as mineralogical specimens they are of great interest.

Mr. George L. Carr, of Carrville, one of the first discoverers, reports that all those found were at the surface, and that no development has yet been made. Further exploration will be awaited with interest.

The suggestion arises that perhaps the mineral described in 1865 by Goldsmith,[2] under the name of trautweinite, from Monterey County, Cal., may be an impure variety of ouvarovite.

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[1] Am. Jour. Sci., January, 1901, 4th series, Vol. XI, pp. 25–34.

[2] Proc. Acad. Nat. Sci. Phila., 1865, pp. 9, 348–365.

TOURMALINE.

In 1898, while prospecting in Mesa Grande Mountain, San Diego County, Cal., for lepidolite, a large ledge was observed that appeared to be a mass of this mineral. This locality is at an altitude of 5,000 feet, in the Mesa Grande Mountain, a region in which no geological work had up to that time been done. The first few blasts showed that lepidolite was present in quantity, and also in larger and more brilliant scales than in the well-known locality at Palo, Cal. Both in the lepidolite and in the associated quartz there are magnificent crystals of tourmaline, and, as at Palo, the rubellite variety predominates. The new locality differs, however, in having the tourmaline in distinct, isolated crystals. Many of these are translucent, or even transparent, and occur as large, separate crystals, with perfect prisms and terminations. They differ in both these respects from the Palo crystals, which are nearly opaque and grouped in radiations almost blending into the matrix 1, which latter is lepidolite, with rarely ever any quartzite. The rubellite seems the predominating variety at Mesa Grande Mountain; but there is also a large proportion of parti-colored crystals—i. e., those made up of three, four, or five distinct sections, as at Haddam Neck, Conn., and Paris, Me.; others present the Brazilian type, in which several different colored tourmalines appear, as though included one within the other. In the Brazilian forms, however, the interior of the crystal is generally red, inclosed in white, and the exterior green. This concentric arrangement is reversed in the crystals from Mesa Grande Mountain, which are generally green in the interior, or yellow green, inclosed in white, with the exterior red. The habit of the crystals is also very interesting, in that many of them, when doubly terminated, end in a flat, basal form of pyramid, and are not hemimorphic, as tourmalines generally are. This, however, is not a constant feature, as one magnificent crystal, nearly 40 millimeters in diameter, is terminated with three low, rhombohedral (?) planes, which, from the peculiar markings upon them, suggest that this crystal may be a trilling. In this instance the termination is green, resting immediately upon white, then green. The largest section of a crystal is a fine pink, translucent rubellite (42 millimeters in diameter and 45 millimeters in height; not flawless). Another is a brilliant, pink crystal, with a basal termination, 56 millimeters in height and 25 millimeters in diameter.

The gangue of Mesa Grande tourmaline is generally white, opaque quartzite, the crystals penetrating it in all directions. When the crystals occur in lepidolite they are generally opaque, but more distinct than those at Palo, and always much larger. All the material at the Palo locality was taken from the surface, showing the result of more or less water acting on pegmatite rock, resembling in this respect

the locality at Paris Hill, Oxford County, Me. Owing to the great variety of crystals at Mesa Grande, and their size, perfection, and beauty, this locality may prove to be one of the most important yet found in the United States. Remarkable specimens of tourmaline inclusions in quartz, from Jefferson County, Mont., are described further on under the head of quartz inclusions.

The results of the mining at Paris Hill, Oxford County, Me., and at Haddam Neck, Conn., were not as extensive as those of previous years.

QUARTZ.

QUARTZ INCLUSIONS.

A very remarkable occurrence of tourmaline inclusions in quartz is described by Mr. A. P. Pohndorf, of Butte, Mont. About 22 miles southeast of that city, and 16 miles from Silver Star, Jefferson County, on the ridge between Little and Big Pipestone creeks, occurs a ledge—perhaps a dike—of very coarse pegmatite on the edge of the Butte granite area. The rock is much broken up at the point described, and hence its exact relations can not be determined without further development; thus far it has only been excavated about 25 feet.

In this coarse pegmatite are found crystals of orthoclase feldspar, perfect in form, from 8 to 14 inches in diameter; mica in small scales, sometimes filling cavities; black tourmaline, and very remarkable forms of quartz—colorless, smoky, and amethystine—the two former filled with tourmaline inclusions, but the latter free from them. Mr. Pohndorf describes smoky crystals up to 3 feet in length and 8 inches in diameter, more or less filled with acicular tourmaline. Many of the crystals, also, would be nearly colorless were it not for the tourmaline needles inclosed, which make the mass appear black. The amethysts sometimes occur in groups by themselves, at other times upon the smoky quartz arranged in parallel positions, and again as clear purple terminations to smoky crystals, of which the prisms are filled with tourmaline. In one instance Mr. Pohndorf obtained a double-terminated crystal of this kind—a black prism with clear amethystine pyramids. It is very singular that the tourmaline inclusions, so marked in other varieties, are not to be found in the amethyst, even when part of the same composite is crystal.

The tourmalines, which vary from delicate needless up to slender crystals as much as 5½ millimeters in diameter, penetrate the quartz in every direction; but they sometimes present a zonal arrangement, such that the quartz crystals, when cut transversely, show beautifully marked "phantoms" inclosed or defined by the tourmalines. Crystals 4 inches or more in diameter, cut across in this way into polished sections, are very beautiful, and equal to anything of the kind ever obtained.

Some of his finest specimens Mr. Pohndorf got from small pockets filled with scales of mica. These small mica flakes in many cases adhere to the sides of the quartz crystals, forming more or less of a coating, and occasionally they are inclosed in the quartz. The species of this mica has not yet been determined.

Other interesting inclusions are reported by Mr. H. F. Wheaton, of Riverside County, Cal., from the San Bernardino Range, in the county of the same name, in the desert. Those noted are perfect transparent quartz crystals penetrated with beautiful rutile crystals, and associated with orthoclase feldspar and tabular hematite, an alliance recalling Habachthal and Tavetsch in the Tyrol; also colorless quartz crystals with chlorite "phantoms," including "minute grouped masses of a green color," thought to be chrysocolla or epidote.

AMETHYST.

Amethystine quartz has been found by Mr. A. P. Pohndorf, of Butte, Mont., in a very singular association with smoky quartz full of acicular tourmaline. The amethyst is free from the tourmaline, although sometimes forming clear purple terminations to crystals that are so filled with it as to appear black. The particulars of this curious association, near Silver Star, Jefferson County, Mont., are given under the heading "Quartz inclusions."

QUARTZ INCLUSIONS SAGENITIC.

Many of the crystals of quartz found with the amethyst in Silver Creek, Jefferson County, Mont., are almost entirely permeated with tourmaline; others strangely so. Many of these crystals when cut in transverse sections show beautifully marked phantoms, inclosed in delicate prismatic needles of tourmaline, penetrating the quartz in every direction, making this occurrence one of the most remarkable yet found.

MOSS AGATE (MOSS JASPER).

Chalcedony with dendritic markings, in masses from 15 to 18 inches across, and jaspery agate, with mosslike markings of a dark-brown color, are among the minerals collected by Mr. H. F. Johnson in the San Bernardino Mountains, in the county of that name, in the desert region of California, and reported by Mr. Wheaton, of Farm Springs, in the adjacent county of Riverside, Cal.

THE ARIZONA PETRIFIED FOREST.

The celebrated "Petrified Forest" near Holbrook, Ariz., has been recently brought within easier access for tourists by the establishment of the new railroad station named Adamana, whence the forest can be

reached by a drive of 6 miles, although the most remarkable portions of it lie several miles farther southward. Most tourists visit only this nearer part, and the other sections are less known. A recently published account goes quite particularly into the features of the whole area.

At the first deposit, so called, several sections of land are strewn with the fallen and broken trunks, washed out by the erosion of the fine, grayish, sandy material in which they were embedded. Here is the noted Chalcedony Bridge, where one of the finest logs, nearly 4 feet in diameter at its base, spans a deep gully, with its ends resting on the banks and still partly covered up. Much of the wood in this part of the park is broken up and scattered over the ground in small fragments.

The second deposit, lying a few miles to the southeast, covers several hundred acres and presents certain differences in the material. Here many large trunks are found that are simply broken across into cylindrical sections 5 or 6 feet in length. The trunks are not so shattered as in the first deposit. This better state of preservation seems probably due to a more recent washing out of the trunks, with a consequently shorter exposure to atmospheric action.

The third deposit, Chalcedony Park proper, is the largest of all, and lies chiefly in a wide canyon 5 or 6 miles across. Here the silicified logs occur by thousands, still half buried in the soft, sandy deposits, with smaller fragments strewn on every side. Some are long, almost entire trunks; others are broken into cross sections. Very few limbs or branches remain, though many of the logs retain the bark distinctly. Great beauty and variety of color are to be seen in the cross sections of the trees and in the scattered pieces.

Fragments of the same character are found strewn over a wide extent of country, east and west, among the canyons and bad lands of this part of Arizona, and it appears as though the petrified trunks must exist over, or rather under, a large area, but are only exposed where the inclosing material has been removed by erosion.

The establishment of a nearer station, with easier access to these unique localities, will render more important than ever some form of Government protection for these natural treasures of beauty and interest. Such action was urged upon Congress as much as six years ago by the legislature of Arizona,[1] and the bill for the preservation of prehistoric monuments and objects of scientific interest will come none too soon in the case of the Arizona petrified forest.

A very full and careful account of the character and condition of this remarkable locality has been given by Prof. Lester F. Ward, of the National Museum, in a report to the Director of the United States Geological Survey. Dr. Ward visited the region in November, 1900,

[1] Sixteenth Ann. Rept. U. S. Geol. Survey, Part IV, pp. 601-602

and examined it with care, under directions from the General Land Office and the Smithsonian Institution, with a view to some such action as that advocated by the Arizona legislature. He strongly recommends the withdrawal of the area occupied by the petrified forest from private entry and its reservation as a national park.

The relations of the three deposits previously described are made more clear in Dr. Ward's report. The entire region is essentially a worn-down and eroded plain, which had an original altitude of some 5,700 feet above sea level, but of which the upper 700 feet have been cut down and carved out into valleys and gorges separated by ridges, mesas, and buttes. The plain consisted of sandstones and clays of varied and picturesque colors, nearly horizontal, the former constituting the harder capping of the mesas. The age of the beds is regarded as Triassic, and this fact renders the fossil trunks of peculiar interest, as being far more ancient than the petrified forests of California, Wyoming, and the Yellowstone Park, which are largely Tertiary. Nowhere are any of the fossil trunks in their place of growth. Most of them are strewn along the eroded valleys and have been washed out of the sandstone several hundred feet above in the course of its erosion. At a few points they are to be seen in place in the sandstone, but only on reaching a elevation of some 700 feet above the valleys. One of these is on the western border of the largest, or southern, division. The bed is here a coarse, gray, pebbly sandstone, cross-bedded and containing numerous logs and branches, clearly in situ. The same bed, about 20 feet thick, was found at various points at nearly the same elevation, but not always so rich in logs. Another point where the trunks are in place is at the extreme northern end of the area, half a mile northeast of the upper forest, or first deposit of the former account. The bed here has about the same elevation, but is only 400 feet above the forest, the drainage being southward. The sandstone forms the cap of a small solitary mesa, and in it, on its northeastern edge, is the gully spanned by the Chalcedony Bridge, which has, therefore, the especial interest of being in place.

The fact that the trunks are not where they originally grew is evident from several considerations: (1) The character of the bed containing them—a coarse, fragmental deposit; (2) their positions—irregular and prostrate, nowhere erect, and (3) the dismemberment of the trees, with no branches or roots connected with the trunks, though branches are scattered about among the rest of the washed-out deposits.

The original source of the wood, the beds in which the trees grew, must be sought higher up, and perhaps at some distance, in strata which were eroded to form the sandstones into which the trunks were borne, and which was probably covered up by Mesozoic seas and not raised until the great post-Cretaceous elevations began that have lifted this entire region a mile above the present sea level.

The present drainage, as above stated, is southward. About midway of the area lies the arroyo which, says Dr. Ward, "has been mistaken for the famous Lithodendron Creek, so named by Lieutenant Whipple in 1853." It pursues a southward course, winding irregularly among the buttes, and expanding widely toward its southern end, forms there the broad valley of the third deposit above described. It is plain that the sandstone was not uniformly filled with logs. There were centers of accumulation, as Dr. Ward calls them. Fossil wood is abundant all about, but the special deposits that have attracted so much interest are local. The first deposit is found at the northern end, in a valley opening out on the plain reaching to the Rio Puerco, and the second deposit occupies the slope of the eastern border of the area.

The report concludes with several recommendations as to what may wisely be done by the Government. These are made after conference with leading men in Arizona, both in political and business positions. The amount of material is immense, but this fact alone, as experience shows, affords no guaranty against ultimate serious despoilment. Thus far the specimens taken by tourists, and even the logs removed for use as an ornamental stone by the Drake Company, of St. Paul, Minn., have made no impression, but a more serious inroad was threatened by the organization of a company to grind the agatized wood into a substitute for emery. This project fell through, in consequence of the corundum discoveries in Canada, which led to a lower-priced production of emery, and it would not prove of much greater value than plain quartzite. But, sooner or later, in one form or another, the supply will be reduced and the finest specimens removed, unless some kind of protection is given. Dr. Ward recommends prompt withdrawal of the land from entry, careful scientific survey and mapping to ascertain the precise extent and distribution of the fossil forests, or log-deposits, and, based on this last, the creation of a public reservation, under suitable restrictions. Particularly, and immediately, steps are urged for the protection of the chalcedony natural bridge, which shows fissures that may cause it to fall if not ere long supported.

The Drake Company, above referred to, made a fine exhibit of this elegant material at the Paris Exposition of 1900. The large size of the slabs and masses and their unusual richness of coloring unite to produce an ornamental stone of remarkable beauty. The works of the Drake Company are located at Sioux Falls, S. Dak., where the great cutting and polishing machinery is operated by water power, and the polishing of large pieces of hard material is as successfully accomplished as at any establishment in the world.

OPAL.

NEW SOUTH WALES.

The opal production in the White Cliffs district of New South Wales has gone on with good results. The yield for the year was valued at the large amount of $650,000, an increase of about 40 per cent on the output of 1898. The total estimated value of the opal production of the colony to the close of 1899 is given as £376,598, or about $1,875,000, from which it will be seen that the production of the last year exceeds one-third of the whole amount. The popularity of the New South Wales opal continues, and more stones are sold in one year than were sold in an entire century previous to the discovery of the Australian mines. Many are remarkably beautiful, and the price is only one-third to one-tenth of those from the Hungarian mines.

TURQUOISE.

In the annual report to the Secretary of the Interior on the progress and development of the Territory of New Mexico for the year ending June 30, 1900, made by the governor, Hon. Miguel A. Otero, are contained numerous references to the wealth of New Mexico in precious stones, particularly turquoise. The statement is made that this Territory has become already the chief source of the supply of turquoise to the world, and that its color and quality are unsurpassed. The great mine long spoken of as at Los Cerrillos is really a few miles north of that point, and the locality is named Turquesa. Here is the principal source, now known as the Tiffany mine. The output since 1890 is estimated, according to official reports, at a total value of $2,000,000, but the former owner claims that this is much below the reality, and that since 1893 the annual output has approached $1,500,000. This, on the other hand, may be overestimated.

NEPHRITE.

SIBERIA.

The occurrence of nephrite in Siberia has only attracted attention within a comparatively recent period. Its existence at some localities in northern Asia was, indeed, quite certain, from the fact of its being so long known and so highly prized in China; but it was not discovered in place until 1850, when the noted Siberian explorer and prospector, Mr. J. P. Alibert, while seeking for the graphite mines that have since become so celebrated, had the good fortune to discover a locality of fine nephrite in the bed of the stream known as the Onot in eastern Siberia.

JADE.

BRITISH COLUMBIA.

Mr. Harlan I. Smith has described[1] a series of observations conducted by the Jesup North Pacific Exploring Expedition, upon prehistoric village and burial sites at and near Lytton, in British Columbia, at the junction of the Fraser and Thompson rivers. Mr. Smith collected much interesting material, and notes among other stone implements, the occasional occurrence of a light-green, translucent mineral, apparently nephrite, wrought into thin, delicate celts. These range from 4 inches in length, 1½ inches in width, and only one-quarter inch in thickness, down to 1 inch in length, with the other dimensions proportionate. The grooves made in cutting them are visible in some examples, while in others they have been polished out. Those collected show all the stages of manufacture from bowlders on the river bank that had been grooved by grinding or rubbing with thin slabs of siliceous sandstone, to selvage pieces thus produced and then broken off, and celts still showing the break line, and finally those completely polished. Sandstone pieces or saws were obtained that fitted the grooves in the green stone. The whole account—bowlders, sandstone, and all the steps—recalls with singular minuteness the New Zealand jade occurrence and use. No analyses of the mineral are given, so that it is not certain what the nephrite may prove to be here. The bowlders, of course, indicate its occurrence in place somewhere higher up in the course of the river. Mr. Smith says that the coast Indians are accustomed to use the celts, mounted as adzes, to smooth and finish boards that have been split out with wedges. Many wedges, made of the antlers of elk, were among the implements associated with these specimens, and it is fairly presumable that the celts were used in the manner described.

THOMSONITE (MESOLITE).

The local gem stone from Grand Marais, Minn., usually designated thomsonite, is not really that species, but the closely allied mineral, mesolite, according to Prof. N. H. Winchell.[2]

Analyses of Grand Marais mineral.

SiO_2.	Al_2O_3.	CaO.	Na_2O.	K_2O.	Fe_2O_3.	H_2O.
Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
40.45	29.50	10.75	4.76	0.36	0.23	13.93
46.02	26.72	9.40	3.76	.39	.81	12.80
40.45	29.37	10.43	4.28	.42	.88	13.23

[1] Mem. Am. Mus. Nat. Hist., Vol. II, part 3, May, 1899.
[2] Twentieth Ann. Rept. U. S. Geol. Surv., Pt. VI (cont'd), 1899, pp. 591–592.

SODALITE.

The Canadian section at the Paris Exposition of 1900 had specimens of a fine blue massive sodalite from Dungannon Township, Hastings County, Ontario. The color is very rich, closely resembling lapis lazuli, and the deposit could be easily opened and developed if any demand should arise for the mineral as an ornamental stone. It is beautifully adapted for mosaic, inlaying, etc., and was exhibited in the hope of bringing it into notice for such purposes.

CHIASTOLITE MACLE.

This mineral, a variety of andalusite, sold generally under the name of cross-stone (German Kreuzstein), has been found in Madera County, Cal., of fine quality and remarkable size. Fragments of crystals belonging to Mr. W. W. Jefferis are over 3 inches long and measure $1\frac{3}{4}$ by $1\frac{1}{4}$ inches in diameter on the ends, the section being a rhombic prism. When polished these show the peculiar cross pattern that has given its name to the mineral, in rich black upon a white or fine salmon-colored ground, and sometimes with a black square or lozenge at the center from which the arms of the cross extend.

OBSIDIAN.

An interesting account has been given recently of the great obsidian mines in the State of Hidalgo, Mexico, by Prof. W. H. Holmes, of the United States National Museum.[1] These are among the most remarkable and important of the prehistoric mines that are found in various parts of North America, and furnished a large part of the obsidian that is so widely distributed throughout the whole Southwest. In Mexico and Central America implements and fragments abound everywhere, indicating extensive traffic, and at points like Tenochtitlan (the modern City of Mexico) and San Juan Teotihuacan the refuse deposits are black with thousands of pieces.

PYRITE.

The use of iron pyrites in jewelry is not frequent, but it has recently come to be somewhat in vogue in a peculiar form. Old specimens are occasionally seen in which pyrite has been cut and polished as a faceted stone, very brilliant in luster, but, of course, perfectly opaque. The new form in which this mineral is used in jewelry is that of a coating of small bright crystals, nearly uniform in size, forming a sparkling surface of even height. These coatings occur upon the sides of cavities or crevices in anthracite coal, more especially on the slate, and are used for jewelry and ornamental work to some extent just as

[1] Amer. Anthropologist, Vol. II, No. 3 (July-Sept., 1900), pp. 405–416.

they occur, the only cutting being that involved in smoothing the back and making the pieces of suitable size and shape for mounting. One firm, which claims to control the entire output of the pyrites which occurs in this form, made an exhibit of it at the Paris Exposition of 1900, with the object of making it known as a novelty to European jewelers.

Pyrite has recently been obtained in a rather novel form, which yields beautiful specimens for cabinets. The mineral appears in flattened lenticular disks, composed of radiating crystals, often accurately circular in outline and brilliant in luster, between the layers of coal shale or "slate," from Marzon Creek, Illinois.

Radiated spherical nodules of pyrite are familiar, and these are in fact only the same thing; but this highly flattened form is a novelty. The specimens measure 1 or 2 inches in diameter, and are known as "pyrite sans." They are especially handsome when seen on the black ground of the shale.

THE TIFFANY-MORGAN COLLECTION.

In the American section of the Paris Exposition of 1900 was the Tiffany collection of precious and ornamental stones of the United States, and in the Diversified Industries section the Tiffany collection of foreign gems. In both collections were the finest obtainable examples of the most perfect natural crystals, the choicest broken fragments, and rolled pebbles, as well as the largest and finest obtainable gems. These were all purchased to be combined with the collection of gems that constituted the central figure of the Paris Exposition of 1889, and were presented to the American Museum of Natural History, New York, by the donor of the Bement collection, Mr. J. Pierpont Morgan, whose generous gift makes this collection of gems now in the American Museum of Natural History the first in existence. The collection is now being arranged in a special building—Morgan Hall. Both these collections were formed by the writer.

THE BEMENT COLLECTION.

The mineral collection formed by Mr. Clarence S. Bement, of Philadelphia, has been known for years past as the finest private cabinet in America, and perhaps in the world. This last statement was made emphatically by no less an authority than Prof. Gerhard Vom Rath, of the University of Bonn, who published a series of notes upon it in the Verhandlungen der Naturh. Vereins d. preuss. Rheinl. und Westf., in 1884.[1] At that time the collection numbered some 9,000 specimens. It has since been increased to 10,500. Professor Vom Rath then said that it ought to become public property and should find its

[1] Translated by the writer in 1886.

way into the United States National Museum. During the last year this unequaled collection has been purchased for the American Museum of Natural History at New York, through the munificent liberality of Mr. J. Pierpont Morgan.

MINERALS AT THE PARIS EXPOSITION OF 1900.

The mineralogical and metallurgical exhibits at the Paris Exposition of 1900 exceeded in beauty and scientific interest those of any previous exposition. Only a few leading points can be noted, but these will give some idea of the mineralogical and geological treasures assembled.

In the exhibit made by the Alpine Club, of France, M. Demarty, well known as a specialist and a writer concerning the minerals of the Auvergne district, displayed a most interesting collection of the rocks and minerals of that remarkable region of central France. Prominent among these were the Auvergne amethysts, both in polished form and in small, dark, richly colored crystals, with jasper and other siliceous minerals found in association with them.

In section 63 the Norwegian Government exhibited some of the most remarkable specimens of crytallized native silver ever found from the mines of Kongsberg—"the mines of the pauper and the King," as they are called—comprising many types of crystals, groups of cubes and cubo-octahedrons measuring as much as an inch on the face, also wires and ropes of silver nearly a foot in length, in masses weighing up to 1 pound each, besides isolated crystals, and masses of silver on the gangue. There was also a superb collection of thorites and organzites; and columns of polished labradorite and gabbro 12 to 15 inches in diameter and over 20 feet in height. The labradorite is very dark in color, almost black, and the reflections are small and silvery blue.

Another interesting exhibit was that of the soapstone from the quarry of Gudbrandsdalen, used in the interior decoration of the cathedral at Trondjhelm.

In the Finland pavilion was shown the meteorite of the Bjurbo fall, a chondrite that fell on March 12, 1899. The 800-pound mass, broken into many pieces, but with the crust unusually fresh and interesting, was well shown in a cylindrical glass case.

The Russian section contained a magnificent collection of minerals from the Ural Mountains, splendid crystals of beryl, rubellite, topaz, etc., and a wonderful display of vases of rhodonite, malachite, lapis lazuli, and other characteristic Russian minerals; a single bowl of jasper from Kolyvan, Siberia, measured 8 feet in height and 6 in diameter. There was also a superb collection of cut objects of jade and aventurine from the Imperial Lapidary works at Peterhoff.

Among the most remarkable, one might say sensational, exhibits in the whole exposition, was the jeweled map of France, presented by the Czar Nicholas II to President Loubet. This map is about one meter square, and is made entirely of Russian semiprecious stones, set as a mosaic, for the several departments and inlaid with gem stones for the cities. Each department is represented by one special stone—jade, onyx, agate, carnelian, malachite, etc., and a great variety of colored jaspers, for which Russia is noted. For the principal cities, Paris is represented by a ruby, Marseille by an emerald, Lyon by a diamond, Bordeaux by an opal, Lille by a turquoise, etc. The size of each stone is in proportion to the importance of the city or town. The value of this unique map is estimated at two million francs. The emerald alone that represents Marseille is valued at 900 rubles. During the exposition it was displayed in the Russian section of the Art Industry Building. It is now in the museum of the Louvre, having been turned over to the Government of the French Republic by President Loubet as properly national rather than private property.

The only object comparable to this map is probably the jeweled globe belonging to the Shah of Persia, at Teheran, which has rarely been seen by Western eyes.

Denmark appeared especially in her colony of Iceland, whence were displayed hundreds of pounds of Iceland spar, the crystals being of "irreproachable transparency," as the French express it. One crystal, nearly a foot in diameter, had its faces coated with magnificent zeolites—stilbite, epistilbite, heulandite, etc.

The Baltic amber was shown in one of the most comprehensive collections ever made, prepared by Dr. Klebs, of Konigsberg, Prussia, the celebrated amber expert. This collection comprised all the various forms in which amber occurs and all the very interesting inclusions, as of woody matter, insects, spiders, moving bubbles, etc., all accompanied with full explanatory labels and a good catalogue.

In the Austrian and Hungarian sections there was a magnificent collection of minerals, conspicuous among which were crystals of salt from the mines at Wielicza, which have been worked for hundreds of years; from Transylvania, realgar and orpiment, and a great variety of the occurrences of native gold from the mines at Vöröspatak. The Dubnik mines were represented by a fine collection of noble opals and hydrophanes. These mines are now worked under Government patronage, but the recently developed Australian opal fields are outstripping them many-fold in production.

The Servian pavilion contained some fine copper minerals, as well as magnificent crystals of cinnabar, the white chloride, and other mercury compounds.

Passing from Europe to America, in the United States section there was shown a complete metallurgical exhibit of this country, prepared

by the chief of the department of mines, Mr. F. J. V. Skiff. Among American mineral dealers only one had an exhibit—Mr. Warren M. Foote, of Philadelphia—who showed a fine collection of both American and foreign minerals. A very complete exhibit of the mineralogy of the United States was for the first time prepared and shown under a cooperative arrangement between the Bureau of Mining Industry and a number of our leading universities, including Cornell, Princeton, Chicago, Michigan, and others. Some 4,000 specimens in all were displayed, the collection being made as complete as possible. It was arranged according to Dana's Mineralogy, each institution taking one section of it.

The Canadian exhibit, in charge of Mr. Fairbault, contained a noble collection of the minerals of the Dominion, notable among which were great crystals of apatite, polished slabs of labradorite, large masses of sodalite, and a great variety of gold and other precious minerals.

In the Mexican section, in addition to the large variety of silver minerals usually shown, was a collection of beautiful specimens of crystallized boleite, cumengite, azurite, and other species from the famous mines at Boleo, in Lower California.

The Australian and Japanese exhibits were especially notable. Among the gems of the entire collection were the extraordinary twin crystals of quartz from Japan. One of these were crystals from 9 to 12 inches long at an angle of 45°. Superb groups of crystallized stibnite and an entire collection of the minerals of Japan, gathered by Mr. Tsunashirō Wada, and many specimens of remarkable beauty from a collection by Mr. Takudzi Ogawa, all are worthy of special mention.

Unquestionably the finest collection shown by any government was that from West Australia, prepared by Mr. Holroyd, who with indefatigable energy and great intelligence induced the many mine owners of that country to make an exhibit of gold and tellurium minerals such as never before has been seen. This collection is valued at not less than $200,000. In some cases several thousand dollars are represented in a single specimen. Every important mine in every district of West Australia was represented by masses of the rock, with free gold, generally associated with tellurides; and besides the products of each mine, there were fine photographs or superb enlarged transparencies. The specimens were all freshly broken and unrubbed, and such large rich masses of free gold, associated with either petzite, calaverite, hessite, or other tellurium minerals, have never been seen together before. At other times the gold is in spongy and wire forms, or in fine dust, which Mr. Holroyd calls "mustard gold."

The French colony of New Caledonia showed magnificent examples of noumeite, garnerite, and associated species.

The richest mineral specimen at the exposition, however, one in which art has added to the work of nature, was the immense diamond from South Africa found in 1893 at Jagersfontein. It was then a crystal of 961 carats in weight, but has been cut into a brilliant of 239 carats—a superb and faultless gem, blue-white in color, now known as the "Imperial" diamond, and valued at $2,000,000.

Several valuable handbooks were prepared for the Paris Exposition, dealing with mineralogy and mining, especially in Russia and Japan. Among these, reference should be made to the following:

Catalogue des Objets exposées par les Usines de Taguil et de Lounia (Oural) appartenant aux héritiers de M. Paul Demidoff, Prince de San-Donato.

This little pamphlet gave a carefully classified list of the extensive mineral exhibit from this famous mining region.

Mines et Usines Metallurgiques du District de Lysva (Oural), Domain du Compto P. P. Schonvaloff.

This handbook contained a large amount of valuable information as to the gold and platinum workings and the numerous metallurgical establishments of this portion of the Ural region, and has already been cited in regard to the occurrence of diamonds.

Catalogue des Minéraux du Japon (collection de M. Tsunashirō Wada), pour l'Exposition Universelle de 1900, à Paris. Service Géologique Impérial du Japon; Tokyo.

This pamphlet gives a list of some 350 numbers, comprising a fine selection of Japanese minerals, partly described above.

An interesting paper on the pleochroism and polychroism of the historical locality of the island of Elba, by Prof. Giovanni D'Archiardi.[1]

Dr. D'Achiardi dwells particularly on the coexistence of achroite, rubelite, indicolite, afrizite, and their variations of perpendicular and horizontal arrangements of color.

JET.

Mr. A. Bibbins, of Baltimore, reports two localities in the Arundel formation in Maryland, where lignite occurs of a quality sufficiently compact and fine-grained to take a high polish and be capable of being worked into ornaments; in other words, a true jet. One of these localities is at the iron mine at Loper Hall, the other at Fort Dorsey, both in Anne Arundel County, Md. The lignite is in both cases coniferous in structure, and at the second locality is described as "limonitized."

[1] Pleocroismo e policromismo delle tormaline elbane, Pisa, 1900, pp. 1-7.

ARIZONA "MEXICAN ONYX" (ORIENTAL ALABASTER).

The report of the governor of Arizona for the fiscal year ending June 30, 1899, shows great advances in the mining interests of the Territory, its remarkable mineral resources becoming better known and attracting capital from year to year, especially with the increase of transportation facilities. The turquoise mines and the Chalcedony Park have been elsewhere referred to in this and previous reports. But an interesting ornamental stone is the onyx marble, or Mexican onyx, found at Cave Creek, 45 miles northeast of Phoenix. Here a large deposit, covering 20 acres, has lately been opened by the Phoenix Onyx Company. The stone occurs in masses, or "bowlders," ranging from 2 or 3 cubic feet to 25, and even larger, but the latter are of inferior beauty. Its geological occurrence is not described, but in quality it is reported by experts to be the finest ever produced in the United States, and superior to any now obtained at the Mexican locality. It is taken to Phoenix in the rough, and there cut by saws and afterwards polished. The coloring is said to be very beautiful and very varied.

Another onyx marble, in black and white zigzag bands, has been discovered at Kirtland Valley, and also near Greaterville, Ariz. Both of these are beautiful ornamental stones, and are beginning to be developed.

CORAL.

Coral, which has not been fashionable in jewelry for some years, is again coming into favor. The preference, however, is now given not to the deep red color, but to lighter shades; and these pale varieties are reported to have trebled in price within two years past. The *Corallium rubrum* is gathered from numerous banks off the coast of Sardinia, Sicily, northern Africa, and the Adriatic. It forms the basis of an important industry, as the annual yield of the Mediterranean is estimated to be from 150,000 to 200,000 kilograms, valued at about $1,500,000. Prices range widely, from $4 up to $600 per kilogram, according to color and quality, the average being perhaps $75. The pale pink varieties are at present the most valuable and expensive. Naples and Paris are the chief coral markets, and in the former most of the sorting and preparing of the material is done, affording employment to a large number of people.

CONCHITE, A NEW FORM OF CALCIUM CARBONATE.

A novel and important contribution to mineralogy, in its relation particularly to such gem materials as coral and pearls, appeared in the Mineralogical Magazine (London) for November, 1900, under the title "Conchite, a new form of calcium carbonate," by Agnes Kelly. The point brought out in this article and clearly determined by extensive and accurate studies and tests is that the carbonate of lime structures secreted by marine animals, besides some inorganic deposits, frequently consist, not of calcite, nor in any case of aragonite, as heretofore supposed, but of a new isomeric substance for which the name of conchite (from *concha*, a shell) is proposed.

Numerous analyses of shells showed them to consist of carbonate of lime almost chemically pure, with about 3 per cent of organic matter. The carbonite, however, often differs in several important respects from calcite, and is never aragonite, as Rose, Sorley, and others generally, following them, had believed from its superior hardness. This newly recognized form is very frequent in organic structures of various kinds, and also in deposits from certain springs, as at Carlsbad, and in boiler and kettle incrustations, when it is apt to contain traces of iron. It is not, however, universal in organic structures, some of them being calcite entirely and some containing both calcite and conchite in different parts of the same structure. Thus in *Mytilus* and *Pinna*, the outer layers of the shell are of calcite and the inner of conchite, and in *Teredo* the valves are of conchite and tube of calcite, etc.

A point of much geological interest is developed in the fact that conchite, being much less stable than calcite, is very rarely preserved in fossils; and that hence the question whether the shell remains or is represented only by a cast is determined by its composition as calcite in the former case or conchite in the latter.

PRODUCTION.

In the following table is given a statement of the production of precious stones in the United States from 1896 to 1900:

Value of product of precious stones in the United States from 1896 to 1900.

Stone.	1896.	1897.	1898.	1899.	1900.
Diamond	None.	None.	None.	$300	$150
Sapphire	$10,000	$25,000	$55,000	68,000	75,000
Ruby	1,000	None.	2,000	3,000	3,000
Topaz	200	None.	100	None.	None.
Beryl (aquamarine, etc.)	700	1,500	2,200	4,000	11,000
Emerald	None.	25	50	50	4,000
Phenacite	None.	None.	None.	None.	None.
Tourmaline	3,000	9,125	4,000	2,000	2,500
Peridot	500	500	500	500	500
Quartz, crystal	7,000	12,000	17,000	12,000	10,000
Smoky quartz	2,500	1,000	1,000	None.	1,000
Rose quartz	500	None.	100	100	100
Amethyst	500	200	250	250	500
Prase	100	None.	None.	None.	None.
Gold quartz	10,000	5,000	5,000	500	2,000
Rutilated quartz	500	None.	100	50	50
Dumortierite in quartz	50	None.	None.	None.	None.
Agate	1,000	1,000	1,000	1,000	1,000
Moss agate	1,000	1,000	1,000	1,000	1,000
Chrysoprase	600	None.	100	100	100
Silicified wood (silicified and opalized)	4,000	2,000	2,000	3,000	6,000
Opal	200	200	200	None.	None.
Garnet (almandite)	500	7,000	5,000	5,000	500
Rhodolite	None.	None.	None.	None.	20,000
Garnet (pyrope)	2,000	2,000	2,000	2,000	1,000
Topazolite	100	None.	None.	None.	None.
Amazon stone	1,000	500	500	250	250
Oligoclase	500	25	10	20	20
Moonstone	250	None.	None.	None.	None.
Turquoise	40,000	55,000	50,000	72,000	82,000
Utahlite (compact variscite)	500	100	100	100	100
Chlorastrolite	500	500	5,000	3,000	3,000
Mesolite (thomsonite, so called)	500	500	1,000	1,000	1,000
Prehnite	100	100	100	50	50
Diopside	200	100	None.	None.	None.
Epidote	250	None.	None.	None.	None.
Pyrite	1,000	1,000	1,000	1,000	2,000
Malachite	None.	None.	None.	250	200
Rutile	100	800	110	200	100
Anthracite	2,000	1,000	1,000	2,000	2,000
Catlinite (pipestone)	3,000	2,000	2,000	2,000	2,000
Fossil coral	1,000	500	500	50	50
Arrow points	1,000	1,000	1,000	1,000	1,000
Total	97,850	130,675	160,920	185,770	233,170

IMPORTS.

The following table shows the value of the diamonds and other precious stones imported into the United States from 1867 to 1900:

Value of diamonds and other precious stones imported and entered for consumption in the United States, 1867 to 1900, inclusive.

Year ending—	Diamonds.					Diamonds and other stones not set.	Set in gold or other metal.	Total.
	Glaziers'.	Dust.	Rough or uncut.	Set.	Unset.			
June 30—								
1867	$906	.....	.....	.....	.....	$1,317,420	$291	$1,318,617
1868	484	.....	.....	.....	.....	1,060,544	1,465	1,062,493
1869	445	$140	.....	.....	.....	1,997,282	23	1,997,890
1870	9,372	71	.....	.....	.....	1,768,324	1,504	1,779,271
1871	976	17	.....	.....	.....	2,349,482	256	2,350,731
1872	2,386	89,707	.....	.....	.....	2,939,155	2,400	3,033,648
1873	.....	40,424	$176,426	.....	.....	2,917,216	326	3,134,392
1874	.....	68,621	144,629	.....	.....	2,158,172	114	2,371,536
1875	.....	32,518	211,920	.....	.....	3,234,319	.....	3,478,757
1876	.....	20,678	186,404	.....	.....	2,409,516	45	2,616,643
1877	.....	45,264	78,033	.....	.....	2,110,215	1,734	2,235,246
1878	.....	36,409	63,270	.....	.....	2,970,469	1,025	3,071,173
1879	.....	18,889	104,158	.....	.....	3,841,335	538	3,964,920
1880	.....	49,360	129,207	.....	.....	6,690,912	765	6,870,244
1881	.....	51,409	233,596	.....	.....	8,320,315	1,307	8,606,627
1882	.....	92,853	449,513	.....	.....	8,377,200	3,205	8,922,771
1883	.....	82,628	443,996	.....	.....	7,598,176	*g* 2,801	8,126,881
1884	22,208	37,121	367,816	.....	.....	8,712,315	.....	9,139,460
1885	11,526	30,426	371,679	.....	.....	5,628,916	.....	6,042,547
Dec. 31—								
1886	8,949	32,316	302,822	.....	.....	7,915,660	.....	8,259,747
1887	9,027	33,498	262,357	.....	.....	10,526,998	.....	10,831,880
1888	10,025	29,127	244,876	.....	.....	10,223,630	.....	10,507,658
1889	8,156	68,746	196,294	.....	.....	11,704,808	.....	11,978,004
1890	147,227	179,154	340,915	.....	.....	*e* 12,429,395	.....	13,105,691
1891	*a* 565,623	125,688	(*c*)	.....	.....	*f* 12,065,277	.....	12,756,588
1892	532,246	144,487	.....	.....	.....	*f* 13,845,118	.....	14,521,851
1893	357,939	74,255	.....	.....	.....	*f* 9,765,311	.....	10,197,505
1894	82,081	53,691	.....	.....	.....	*f* 7,291,342	.....	7,427,214
1895	107,463	135,558	.....	.....	.....	*f* 6,330,834	.....	6,573,855
1896	78,990	65,690	.....	(*d*)	(*d*)	*f* 4,474,311	.....	4,618,991
1897	*b* 29,576	167,118	1,386,726	$330	$2,789,924	1,903,055	.....	6,276,729
1898	8,058	240,665	2,513,800	6,622	5,743,026	1,650,770	.....	10,162,941
1899	2,428	618,354	4,896,324	13,388	8,795,541	2,882,496	.....	17,208,531
1900	8,333	605,495	3,658,645	10,721	7,803,066	1,472,328	.....	13,561,588

a Including also engravers', not set, and jewels to be used in the manufacture of watches, from 1891 to 1894; from 1894 to 1896 miners' diamonds are also included.

b Including also miners' and engravers', not set.

c Included with diamonds and other stones from 1891 to 1896.

d Not specified prior to 1897.

e Includes stones set and not specially provided for since 1890

f Including rough or uncut diamonds.

g Not specified since 1883.