



**FAC-SIMILE OF THE GOLD MEDAL AWARDED TO THE MINERAL INDUSTRY  
BY THE  
SOCIÉTÉ D'ENCOURAGEMENT POUR L'INDUSTRIE NATIONALE DE FRANCE,  
IN RECOGNITION OF  
ITS SERVICES TO THE WORLD'S INDUSTRY AND COMMERCE.**

# THE MINERAL INDUSTRY,

ITS

STATISTICS, TECHNOLOGY AND TRADE

IN THE

UNITED STATES AND OTHER COUNTRIES

TO THE END OF

1900.

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## GEMS AND PRECIOUS STONES.

THE most important feature in the mining of gems and precious stones in the United States during 1900 was the success attained by the New Sapphire Mining Syndicate, which greatly increased its output of sapphires from the mines at Yogo, Mont. As usual there was a small production of turquoise in New Mexico and California, and of rubies and sapphires in North Carolina. Among foreign countries Persia, Burma, Siam, South Africa, and Colombia continued to be the main source of supply of the most valuable gems.

**DIAMONDS.**—*Africa.*—The report of the De Beers Consolidated Mines, Ltd., for the fiscal year ending June 30, 1900, shows that the total output of diamonds during that period was sold for £2,070,414. The profits, after deducting expenditures amounting to £1,616,217, were £454,196. From the De Beers mine there were hoisted 1,081,115 loads of blue ground, from the Kimberley mine 592,549 loads, and from the Premier mine 980,210 loads. The total quantity of material washed at the De Beers and the Kimberley mines was 1,522,108 loads, which yielded 1,000,964 carats, or an average of 0.67 carats per load, while at the Premier mine 1,662,778 loads were washed, yielding 496,762 carats, or 0.30 carats per load. The diamonds from the Premier mine realized the sum of £567,360, or 22s. 10d. per carat, against 20s. 9d. per carat for the preceding year, and the diamonds from the De Beers and the Kimberley mines £1,794,222, or 35s. 10d. per carat, as against 29s. 7d. in the previous year. A new agreement for the sale of the company's output of stones at an increased price was entered into on the 20th of April, 1899, which covers the period from April 1, 1900, to July 31, 1901. During the year the company purchased the claims, machinery, etc., of the New Bultfontein Mining Co. for the sum of £192,862, which transaction will greatly facilitate the working of the Bultfontein mine. The operations of the company were seriously hampered in consequence of the Transvaal war, and it was thought best to defer the usual dividends. A large sum, however, amounting to £1,493,326, was written off the profit and loss account against the assets of the company. During the siege of Kimberley by the Boers, the pumps in both mines were kept going and no damage was done to the underground or surface plant. New discoveries of diamonds were reported in 1900 from the May district of Cape Colony, and from the Kamemtka River, a tributary of the Sanacka, in the Russian Urals. The Transvaal and Orange Free State mines were inactive, owing to the Boer war.

*Australasia.*—Diamond mining in New South Wales during the latter half of 1899 was greatly hampered by the recurrence of the water famine, which has

annually visited the fields for several years past. The output amounted to 25,874 carats, valued at £10,350, derived almost entirely from the Boggy Camp Field, 11 miles west of Tingha. Owing to the scarcity of water, mining in the Bingara field was confined almost entirely to exploration work. The principal mines operated in the Tingha field are the Invernell Diamond Fields, Ltd., The Soldiers' Hill Co. and the Australian Diamond Fields, Ltd. The first mentioned has a very complete and modern diamond washing and saving plant with a capacity of 300 cu. yd. per eight hours. Water is taken from the Gwyder River over a mile distant.

*South America.*—In Brazil there has been a revival of the diamond mining industry owing to the Transvaal war. It is almost impossible, however, to form an accurate estimate of the present production, as the State places a duty of 16% on the valuation in addition to the 1% tax demanded by the municipal government with the consequence that only a small proportion of the diamonds and carbons are declared. The value of the exports from Minas Geraes during the first half of 1900 were reported at 255,000 milreis (\$140,000). Mr. A. de Jaeger estimates the total production of Brazilian stones at 12,000,000 carats, valued at \$100,000,000. In 1880 the State of Minas Geraes yielded 5,000 carats, but subsequently the output fell off to a few hundred carats. The most noted specimens from the Brazilian mines are the "Southern Star," which weighed 253 carats in the rough, and the "Dresden" of 117 carats, both of which came from Bagagem.

The diamondiferous deposits of British Guiana attracted considerable attention in 1900, and efforts were made to find the original matrix of these valuable stones. Early in the spring a shipment of 282 specimens was made to London valued at the high figure of \$12 per carat. Later in the year, 400 small stones, ranging up to 1.5 carat in weight, were brought to Georgetown. The locality of the deposits is about 250 miles up the Mazaruni River, a journey of from 12 to 20 days from Georgetown. The diamonds are found in a formation consisting of sandy pulverulent clay mixed with rounded and subangular pebbles and nodules of ironstone, of pieces of quartz, felsite and ironstone conglomerates with much ilmenite sand, rounded pebbles of schorl, pleonaste, small, white and faintly colored corundum and topaz. Digging has been carried to 7 ft. below the surface, and from 150 cu. yd. over 1,000 small size stones have been extracted of a generally pure color and water and shape, the largest weighing, perhaps, 2 carats. In another part of the diggings 100 cu. yd. yielded over 1,000 stones. The gravels here are remarkable for the large number of transparent quartz crystals free from any trace of erosion. The district is heavily forested and is fairly healthy, though subject to frequent rainfall.

#### DIAMONDIFEROUS DEPOSITS IN THE UNITED STATES.

By WM. H. HOBBS.

THE occurrences of diamonds in the United States seem to be largely confined to three regions, *viz.*: the stretch of country southeast of the Appalachian Mountain system between Virginia and Georgia, the belt west of the Sierra Nevada

and Cascade ranges in California and Oregon, and the region bordering upon the Great Lakes of the Laurentian system.

*Piedmont Region of the Southern Appalachian.*—In the southern portion of the Piedmont plateau 18 diamonds have been found and identified, most of them ranging from a fraction of a carat in weight to a little over 4 carats. One, however, the "Dewey" diamond, found at Manchester, Va., in 1855, weighed before cutting 23.75 carats, and it is the largest diamond that has been found in the United States. In North Carolina diamonds have been found in Burke, Rutherford, Lincoln, Mecklenburg, Franklin and McDowell counties. From South Carolina one diamond has been reported, but upon rather unsatisfactory evidence since the stone has been lost and there is no evidence that it was ever examined by a competent mineralogist. In Georgia, diamonds have been found, it is claimed, in Habersham, White, Banks, Lumpkin, Hall, Forsyth, Gwinnett, Cobb, Clayton, Bartow, Carroll and Haralson counties. Nearly every diamond from this region of which a definite report has been made has an octahedral crystal form, though this is modified in some instances, as in the Dewey diamond, by combination with the trisoctahedron. One hexoctahedron has been reported.

The diamonds are found in loose gravels and there can be little doubt that they are derived from the disintegration of the crystalline rocks in the Appalachian ranges to the northwest. Among the numerous types here represented are included ultrabasic igneous rocks and itacolumite, which latter in Brazil is diamondiferous but here is apparently barren.

*The Pacific Slope Region.*—Like the region just described the California-Oregon region is one of placer gold mining, and it is in connection with this industry that the diamonds have been found. The earliest finds date almost as far back as the discovery of gold, the former State Geologist, J. D. Whitney, and the State Mineralogist, Henry G. Hanks, being the authorities for the determination of the stones as diamonds. Mr. Geo. F. Kunz\* mentions 30 stones which have been found and for which the identification seems tolerably satisfactory. A considerable number of others have been reported whose identity has not been established. The introduction of gravel stamp mills and the use of mercury to recover the gold from the sluices have been alike unfavorable to the discovery of diamonds, but fragments of diamond crystals continue to be reported in the tailings from the stamps.

H. W. Turner, in his paper on "The Occurrence and Origin of Diamonds in California,"† reviews the reports of Whitney and Hanks and on their authority enumerates 12 localities in Eldorado, Amador, Nevada, Butte, Trinity and Del Norte counties, at which diamonds have been found. From one of these localities, Cherokee Flat in Butte County, no fewer than 56 stones were found according to Whitney. Of more recent finds, Turner reports 14 stones from the vicinity of Placerville, Eldorado County, a number from Plumas County, one from Tulare County, five from Oroville in Butte County and five from other localities. Of the recent Placerville finds two stones have been described by Kunz.‡ Each of these stones is nearly a quarter of an inch in diameter, the

\* *Gems and Precious Stones of North America.* New York, 1890. pp. 24-30.

† *American Geologist.* Vol. XXIII, pp. 182-191, March, 1899.

‡ *16th Annual Report United States Geological Survey.* Point IV., p. 596.

larger one being of a greenish hue and the smaller one pale yellowish. The diamonds of the Pacific Slope are found in the auriferous gravels, and there can be but little doubt that they are derived from the crystalline rocks in the ranges to the east. All the localities in which diamonds thus far have been discovered are in the vicinity of serpentine masses, a fact which suggests an origin possibly similar to that of the South African diamonds.

*The Great Lakes Region.*—In the region bordering upon the Great Lakes 17 or more diamonds have been found at eight widely separated localities within the States of Wisconsin, Michigan and Ohio. In Wisconsin the diamonds occurred at Plum Creek, Rock Elm township, Pierce County, Oregon in Dane County, Eagle in Waukesha County, Kohlsville in Washington County, Saukville in Ozaukee County and Burlington in Racine County. In the two remaining States diamonds were found at Dowagiac in Cass County, Mich., and at Milford in Clermont County, Ohio. All these localities are included in the drifted area and in or near the "kettle moraines" of the later glacial epochs. It is also worthy of note that all save the Michigan locality are on or near the outermost fringe of these moraines. This is believed to indicate that the diamonds which have been found and those which still lie buried in the drift, have been brought from their earlier home through the agency of the ice mantle at the time of its later invasion of the territory of the United States, and probably also at the time when it occupied its most advanced position. I have given this view in my paper on "The Diamond Field of the Great Lakes,"\* and if it is correct there is much probability that the area in which was the early home of the lake diamonds may be located in the wilderness to the eastward of James Bay in the Dominion of Canada. The evidence for this is derived from a study of the ice scorings on the rock exposures within the glaciated territory and it will be augmented so soon as scientific exploration of the Hudson Bay region supplements the few data now available regarding ice movement in that territory.

Unlike the diamonds from the other areas in the United States those found in the Lake region are large. With the exception of the Plum Creek specimens, which were quite small, they range in weight from 2.0625 to 15.375 and 21.25 carats, the respective weights of the Eagle and Kohlsville diamonds. This larger size is doubtless explained by the fact that placer gold mining has been but little resorted to in the region in question, though the minute Plum Creek specimens were discovered in this way. The other specimens were discovered quite accidentally and stones of less than two carats' weight would therefore be expected to escape detection.

In none of the three diamond producing regions of the United States do the prospects warrant any mining operations carried out solely for the purpose of obtaining diamonds. In the southern Piedmont and in the Pacific Slope regions diamonds will continue to be found in connection with the placer workings for gold, and it is to be expected that diamonds will also occasionally be discovered in the kettle moraines of the Lake region, but workable deposits can only be looked for in the homes from which the stones have been carried. Because of the indications of an abundant source the Canadian locality offers the most

\* *Journal of Geology*, Vol. VII, pp. 375-388, May-June, 1899.

promise of success, but the time is yet hardly ripe for prospecting in the region for diamonds.

In addition to the three regions described above, the State of Idaho should be mentioned in which a number of small diamonds have been found in connection with the gold placers. In this region is perhaps to be included Blackfoot in Deer Lodge County, Mont., from which place Kunz reported the occurrence of an octahedral diamond in 1883.\*

**EMERALDS.**—The lease of the celebrated emerald mines of Muzo and Coscuez, Republic of Colombia, held for the past eight years by Mr. Macini, and transferred by him to an English mining company, expires July 15, 1901. The Government proposes to grant the concession, including rights of exploitation, use of buildings, etc., to the highest bidder for a term of 15 years. The concessioner must pay to the Government a premium not less than \$200,000 gold and an annuity, the amount of which should be named in the bid. The Muzo mines were discovered in 1555 by Lancheros. Mining was begun in 1568 and has been continued ever since. No record exists of the quantity or value of the stones produced, although fortunes have been made for generations of leaseholders. The gems occur in isolated crystals or in lodes with calcite and parisite in a bituminous limestone of the Lower Cretaceous age, lying on a Triassic sandstone. The mine has the form of a tunnel 100 yards wide, with very inclined walls. Near the mouth are several very large reservoirs, the water of which is controlled by a system of gates. The overlying barren rock is cut out in benches and falls to the bottom and when this begins to fill, the water is turned on and the rock swept away. This operation is repeated until the limestone is laid bare, when the gems are carefully broken out.

A large amount of exploration work has been done in the Emerald deposits of New South Wales which are located at Butler's Reef, 10 miles from Emmaville. Some of the gems which were sent to England were highly praised, but the work has not been profitable.

D. A. MacAlister† describes what are known as the emerald mines of Cleopatra which lie in the mountain range extending a long distance parallel to the Red Sea within a few miles west of its coast, in a latitude a little south of Eofu, on the Nile. The mines of the Northern Etabi seem to have remained untouched since their desertion after the fall of Rome. The workings are small passages burrowed in the emerald bearing schists, sometimes extending for a long distance. Many scattered ruins are there in which no doubt the mining population lived and the differences in style among them suggest they were occupied for a long time.

**GARNET.**—The garnetiferous deposits of Bohemia from which for years the world's supply of garnet was produced occur in the hilly Cretaceous district in the northeastern part. Of late the industry has been subject to many changes and the South African pyropes or "Cape rubies" have been in such greater demand that nearly all of the Bohemian workings have been abandoned except the extensive open pits at Podseditz. The South African garnet is obtained in the washing of the blue ground in the diamond district. It is possible that the

\* *America*, pp. 30-31.

† *Geographical Journal*, November, 1900.



Bohemian industry will be revived, particularly if started on a large scale with improved mechanical methods, as the deposits cover an area of 27 sq. miles and a portion of it only has been worked. According to Hans Oehmichen a tenth of this district is exceedingly rich. The Bohemian garnet is of a fine, rich dark-red color sometimes passing into jacinth-red and occurs exclusively in grains of various sizes. It is classified as a magnesian alumina garnet containing lime, iron, manganese and chromium oxides. Distinct crystals are rarely found. The specific gravity ranges from 3.69 to 3.72, and the larger grains average 0.44 g. in weight as a rule, although some have been recorded 1.5 in. in diameter.

**OPAL.**—The White Cliffs Opal Mining Co., Ltd., operating the opal fields in the Albert mining district of New South Wales is practically the largest producer of noble opal. This field has increased its production and the value of the output for 1899 has been estimated at £135,000 as compared with £80,000 in 1898. During the middle of 1899 the number of miners was increased to over 1,000, with the result that an augmented quantity of opal was produced, causing a temporary glut on the market. During the last quarter of the year many miners left the field owing to the fall in prices, and the number was reduced to 750 by the end of 1899. The White Cliffs Opal Mining Co., Ltd., which had 350 tributors working in their district in August, dismissed 300 of them, and other lessees followed the same course. It was expected that in 1900 the present surplus stock would be absorbed and higher values restored, particularly as the demand for the finer qualities is increasing. The nature of the product and the uncertain and at times limited demand for it must always render the market liable to be overstocked. The water supply, ever a source of great anxiety, will be greatly improved by the government tank which is being constructed a mile south of White Cliffs on the Wilcanna Road. The great difference in price between the various classes of opal, together with the fact that opal buyers do not as a rule record the weight of the purchase, renders the estimate of production very difficult. The weight of the output in 1899, however, from the post-office returns of opal parcels that passed through the mail, was 2,795 lb. avoirdupois. As to the outlying portions of the White Cliffs opal field, three-fourths of the miners employed on the Bunker Creek diggings, 12 miles from White Cliffs, have ceased operations and practically no attempt has been made during the year to extend the mining beyond the central field.

The value of the production in Queensland in 1899 was £9,000, an increase of £355 above the value of the previous year's output. This advance is rather remarkable as the district was parched for a great part of the time and the price of the stone had decreased.

**RUBY.**—The Burma Ruby Co., Ltd., has declared a dividend for the year ending February 28, 1900, of 12.5%. After payment of rent and £9,943 to the Government there remains £25,050 available for the shareholders. During the year 818,135 loads of earth have been washed as compared with 652,456 loads in the previous year and £84,000 was received from the sale of stones. The company apparently controls all of the known ruby ground in Burma, and the mines are estimated to produce more than one-half of the world's output. A part of the ground included in the concession is worked by natives, from 1,000

to 2,000 of whom are licensed to dig for rubies; each native paying a royalty of 20 rupees (about \$6) per month. The income derived from this source is large, being usually more than enough to cover the rent paid to the Indian Government for the concession. The rubies are obtained from the alluvial ruby earth (*byon*) of the Mogok Valley. For a time the company was unable to work this earth at a profit, and an attempt was made to reach the source of the rubies by tunnelling into Pingutoung Hill. This hill is said to be of volcanic origin with an extinct crater at the summit. The rubies were supposed to occur in the volcanic pipe, similar to the occurrence of diamonds in the Kimberley mines, but the work proved unsuccessful and operations upon the hill were abandoned. Work is now being directed to the alluvial deposits, which the company is able to treat successfully owing to the use of powerful pumps for the removal of the water. The natives have in the past treated most of the surface *byon*, and the company is now treating those portions of the deposit which are below the original surface. About 6 ft. of the surface material is removed and the ruby bearing earth extracted by open cuttings. None of the excavations is as yet more than 40 ft. deep, but with improved machinery the depth will probably be extended even to bed rock, where it is supposed the largest and best rubies will be found. Formerly the richer material only in small quantities was treated, but experience has shown it is better to wash the whole of the *byon*. The productive area of the valley contains approximately 20,000,000 loads of ruby-bearing ground. Estimating on the 11-months' work ending January 31, 1900, the average value per load was 50c., and the cost per load 27c., leaving a profit of 23c. per load. Although large stones are rare, several of fairly large size have been found by the Burma Ruby Co., Ltd., during the past few years. One weighing 28 carats in its natural state and 18.5 carats after cutting, was recently sold for a large sum. Other large stones are now being cut. In the trade rubies are divided into eight classes, according to their size and color.

**SAPPHIRE.**—Of the Eastern countries, Siam furnishes the finest sapphires, the gems approaching closely to the cornflower blue that is so highly prized. The most important mine is in Battembong district of Pailin. The sapphire-bearing stratum consists of clay and gravel and has a thickness of about 2 ft. The material is mined by pits, washed and the sapphires picked out by hand. Dark sapphires are found in Upper Burma associated with rubies, while Ceylon and Cashmere furnish paler crystals that are brilliant and effective as gems. In Victoria, Queensland and New South Wales large sapphires are frequently found in the auriferous gravels, but they possess usually a very dark color. Recently the "New Mine" sapphires from Montana have acquired recognition in the gem markets, and are by far the most valuable of the precious stones mined in the United States. The mines are located in Fergus County, Mont., 13 miles west of the town of Utica. Their discovery was made in 1895 by a placer mining company while engaged in working the bench gravels of Yogo Creek. It was believed at first that the gems came from the gravel, but it is now known that they occur in a dike of trap rock cutting limestones, which extends for a distance of 5 miles from the canyon of Yogo Creek. The material of the dike varies from the hard igneous rock to a soft yellow clay which is its decomposition

product. The soft material is washed into sluice boxes and the gems caught upon riffles, while the harder rock is first exposed to the weather for a year or more before washing. Owing to the severity of the climate surface operations can only be carried on during the summer months. The gems are brilliant in luster, range in color from steel blue to cornflower blue and are quite free from cloudiness. It is stated that as much as \$75 per carat is obtained for the finest stones. The New Sapphire Mining Syndicate which operates the mines had a very successful season, the yield of gems far exceeding that of previous years. A tunnel and double compartment shaft which will greatly facilitate operations were among the year's improvements.

**TURQUOISE.**—The turquoise mines of Persia which yield the finest gems are located about 35 miles from Nishapour, in the Khorassan. The region is mountainous and the mines are from 5,000 to 6,000 ft. above sea level, lying on the southern slope of the summit of the range. They are controlled by a local firm which pays an annual rental of \$14,000 to the government. At present only one mine is in full operation, with a weekly output of gems valued at about \$400. The manner of working is very primitive. The miners reach the shaft through an inclined tunnel and from this point have to clamber down as best they can. The rock is broken by picks or by blasting and is then hoisted in a goatskin bag attached to a wooden wheel which is turned by two men. At the surface the rock is crushed by small hammers and the stones picked out by hand. Besides the underground mines there are surface diggings (khaki) extending a mile or more over the plain at the foot of the mountain. Work here is carried on by women and children who simply dig up and look over the earth. Not many first water stones are found at present; such as are discovered are immediately bought up by the wealthy Russians and Persians.

New discoveries of turquoise were made at Weckersdorf, Thuringia, and near La Barranea, Sonora, Mexico.

S. L. Penfield\* discusses the probable composition of turquoise, this mineral being regarded by some mineralogists as made up of an aluminum phosphate colored by a copper salt. Mr. Penfield regards turquoise as a derivative of orthophosphoric acid in which the hydrogen atoms are replaced to a large extent by a univalent radical, the small amounts of copper and iron being regarded as constituents rather than impurities; therefore the composition of the mineral may be expressed by the formula  $[Al(OH)_2, Fe(OH)_2, Cu(OH), H]_3PO_4$ .

**TOURMALINE.**—Some work was done during the year in a tourmaline mine in San Diego County, Cal. It is stated that the gems obtained were of excellent color and of sufficient size to command a good price. They are found in a dike of granite 50 ft. or more in width, made up of lepidolite, spodumene, feldspar and quartz. The tourmalines range in color from water white to dark pink and some also show varying shades of green.

\* *American Journal of Science*, November, 1900.