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DURING

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PRECIOUS STONES.

By George F. Kunz.

There were fewer diamonds, precious stones, and pearls imported into the United States in 1908 than during any year since 1896. The importations for the year amounted to $4,618,999. The small import in 1908 was due to the effects of the financial disturbance of 1907, up to which time, for a number of years, the imports had increased annually. When the disturbance took place, the retail buyer ceased his purchases and many firms found their business at a standstill, stocks were disposed of to other dealers, and many private individuals sold back the jewels they had previously purchased. Moreover, those dealers who were not so seriously affected by the hard times, initiated a policy of retrenchment. Although the value of the imports only amounted to the low figure I have mentioned, yet this does not indicate the actual sales of jewels to retail purchasers, for probably two or three times the amount of precious stones imported changed hands through the shrinkage and liquidation of certain stocks, and through repurchases made from private individuals. Moreover, the policy of retrenchment to which I have alluded caused the sales to exceed the purchases in the case of many retail dealers. It will, therefore, be seen that the imports for 1909 must exceed those of 1908 by 100 to 200 per cent., even if there be no sharp recovery and conditions remain as they are at present. Already they are rapidly improving.

Diamonds.

Transvaal.—The year 1908 was eventful and critical for the diamond industry of South Africa. The enormous development and production, and the opening of new mines, that had been going on for years, were brought to a sudden stop by the panic in 1907, America being the greatest consumer of the diamond output. Retrenchment at once began; and diamonds ceased to be purchased, and became almost a drug on the market. Prices fell rapidly, and the effect was felt at every African mine. The smaller ones closed at once, and the larger ones had to face grave problems of policy in order to continue operations, with lowered prices and almost no demand.

The two great producers, viz., De Beers and Premier, after ineffectual negotiations, decided upon opposite courses. The De Beers company adopted a policy of reduced production, and the endeavor to uphold prices as far as possible. The Premier company preferred to continue, and even increase, its output, and find its return in large sales at lower prices. The wisdom, and the results of these opposite policies occupied the minds of all concerned, and filled the columns of the press connected with the diamond industry with keen debate. Both companies, however, have weathered the storm, and conditions have now improved. The business crisis has passed; the large stocks of diamonds in the hands of dealers have been gradually reduced; and the mines are resuming some activity, and hoping for a return of the former conditions.

This, however, is not certain. The great and sudden fall in the value of diamonds has shown that they cannot be relied upon, as before was claimed, as a sure investment of capital, available at any time. Moreover, the new discoveries in German Southwest Africa, the development of the great Brazilian diamond region with modern appliances, and the discoveries in Arkansas, small as yet, but possibly important, all tend to cause some question as to the likelihood of the African mines ever regaining the control that they had in the period between the end of the Boer war and the crisis of 1907.

The whole situation is likely to be influenced greatly by the enormous output for which the Premier mine is preparing. Its "No. 4 gear," now being installed, is to raise its washing capacity to 45,000 loads per day of 24 hours. At 300 days in a year, this would yield over 13,000,000 loads per annum, much above the product of all the De Beers company's mines; and at an average of 0.25 carat per load, the annual output of diamonds would exceed 3,000,000 carats. How will this immense production affect the situation? The costs at the Premier are very low, as it is an enormous open mine, and the company can hence afford to sell at low rates and yet make a profit. It has proved this already, in the disastrous period of 1908; and there is a fear freely expressed that the result may be a cheapening of diamonds to such an extent that their traditional value will be impaired. This, however, is not entirely likely to be the case. A great quantity of the Premier material is of very poor quality and will fill a large and new field in which something cheaper than has been sold before can be placed in great quantities throughout such countries as India, Asia Minor, Northern Africa, Spain, Italy, Mexico, and some of the South American countries, as well as the West Indies. On the other hand, it will probably have a tendency to check a much further advance or gradual marking up in the price of diamonds, which it has been the custom of the Syndicate to do every six months, for the last eight or 10 years. The price now is as high as the public will freely take them at, and it is well that the advances should cease.

The De Beers mines, and the Jagersfontein, which is closely affiliated with them, produce diamonds of finer quality than the Premier, at greater cost and selling for higher prices. Their policy, therefore, was reduction of output, and it resulted well, even while the Premier declined to coöperate and went on producing lower-grade stones. But it is claimed by competent judges that the course taken by the De Beers and Jagersfontein companies saved the diamond trade from utter collapse and disaster in 1908. The reduction was made under an agreement between the De Beers and some other companies, and aimed to meet the emergency gradually, with as little hardship and strain as possible under the circumstances. Some mines were to be closed, and the others were worked on a reduced scale. The course of the De Beers company at Kimberley was as follows:

In October, 1907, it was operating five mines, six days (of 24 hours each) in the week, and producing some 30,000 tons of "blue" daily. In November, the reduction began by cutting down the working hours to 16 and the hoisting hours to 12, and later to eight, per day; this lowered the output one-half. The next step was to reduce the days to five per week; and in April, 1908, the Dutoitspan mine, which had been yielding one-third of the company's output, was closed entirely. By June, 1908, these steps had reduced the force employed—the whites to one-half, and the natives to two-fifths—as shown by the following figures:

	Whites.	Blacks.	Total.
1907	4106	25,601	29,707
1908	2162	9,889	12,051
Reduction	1944	15,712	17,656

The salaries of all employees had also been reduced one-sixth. The daily output was brought down to about 11,000 tons.

The annual report of the De Beers company presented at the meeting in December, 1908, gives full particulars of the crisis passed through in the year ending June 30, 1908, and shows also the influence of improved conditions in the subsequent half-year. These had been such that the dividend on preferred shares, due in December, was voted as usual. The previous dividends on the same shares had been also paid, although those on the deferred shares had been passed. The company has on hand a stock of diamonds conservatively estimated at £1,500,000, and a supply of "blue" on the floors that is worth £8,000,000 after washing costs are paid. The tone of the report is assuring, and it appears to be well grounded. The dynamite factory owned by the De Beers company is proving an important feature; it is supplying the great demand of the

Rand gold mines, and an agreement has been formed with them, to furnish one-half of their entire supply for nine years to come.

The exceptional conditions of 1908 led the Diamond Syndicate, which has for many years taken the product of the De Beers company for the market, to terminate that arrangement, or at least not to renew it. The syndicate has since been reorganized, however, and some similar agreement will probably be reached ere long.

Since the autumn of 1908, a revival of confidence has taken place, and plans are being formed for resuming and enlarging the diamond production at various mines. The vast preparations at the Premier have already been mentioned. Great activity is developing at the Voorspoed mine, in the Orange River Colony, which will soon be treating 9000 loads per day. The Kimberley mines have returned to six days in the week; and a general spirit of advance is apparent at all points.

In comparing the results of the opposite policies adopted by the two great companies, it would seem that while both have been justified by a measure of success, that of the Premier has proved most advantageous for itself, while that of the De Beers has operated more favorably on the diamond trade as a whole. This last point has already been referred to, and need not be further explained. The total output of all the De Beers mines was reduced, by the methods above described, from 2,061,973 carats in 1906-07, to 1,473,272 carats in 1907-08; while the value fell in a still greater ratio, viz., from £5,652,321 to £2,914,646 respectively. Notwithstanding these facts, however, the De Beers company met its obligations to the Cape government, £110,000, and paid its dividends on the preferred (though not on the deferred) shares,—£800,000,—and closed its last year with a balance of £563,810.

The Premier company in the year ending with October, 1908, produced 2,078,825 carats of diamonds, against 1,889,986 carats in the previous year, and about half as many in the year before that. The value of the diamonds produced, sold and unsold, exceeded the total cost of production and sale by £789,000, and £290,000 was paid to the Transvaal government for colonial taxes. Dividends of £100,000 were paid to shareholders; and much more would have been divided, but for the cost of installing the great new plant already referred to, which is to increase the output to 3,000,000 carats.

Naturally the De Beers company might be inclined to carry on a competition with the Premier, but as the latter can produce diamonds at so much less cost than the De Beers, some more neutral and less dangerous course will probably be pursued. Although the bulk of the material from this mine is not as fine as that from De Beers mines, some of it is finer.

RECORD OF SOUTH AFRICAN DIAMOND COMPANIES IN 1907–08.

Mine Year ending June 30.	De Beers-Kimberley.		Wesselton.		Bultfontein.	
	1907	1908	1907	1908	1907	1908
No. loads hoisted	2,103,853	1,208,974	2,104,308	1,524,099	2,320,538	1,319,720
No. loads washed	1,467,456	1,130,673	1,891,461	1,719,737	1,728,047	1,275,858
Carats of diamond found	543,752	414,121	604,915	457,028	547,485	411,386
Value of product	£1,762,080	£822,287	£1,243,360	£775,088	£1,191,551	£704,741
Carats per load	.37	.37	.32	.27	.32	.32
Value per carat	64s. 9.74d.	58s. 0.8 d.	41s. 1.3 d.	38s. 11.4d.	43s. 6.34d.	41s. 4.8 d.
Value per load	24s. 0.2 d.	21s. 5.8 d.	13s. 1.76d.	10s. 6.2d.	13s. 9.49d.	13s. 2.97d.
Cost per load	9s. 0.8 d.	6s. 8.2 d.	5s. 8.87d.	4s. 8.73d.	6s. 2.4 d.	6s. 1.86d.
Loads remaining on floors	3,213,875	3,323,237	2,102,803	1,907,165	1,802,309	1,846,191

Mine Year ending June 30.	Du Toit's Pan.		Premier Year ending Oct. 31.	
	1907	1908	1907	1908
No. loads hoisted	2,481,897	1,444,989	....	8,439,084
No. loads washed	1,539,327	839,075	6,538,669	8,145,794
Carats of diamonds found	365,821	190,737	1,889,937	2,078,825
Value of product	£1,455,330	£612,530	£1,702,630	£1,536,719
Carats per load	.24	.23	.289	.25
Value per carat	79s. 6.78d.	74s. 5.7 d.	18s.	14s. 9d.
Value per load	18s.10.9 d.	17s. 1.4 d.	5s. 2d.	3s. 9d.
Cost per load	6s. 5.84d.	5s. 6.24d.	2s. 4d.	1s. 10d.
Loads remaining on floors	2,272,616	2,878,530	....	....

Points to be noted: The extremely high value of stones from Du Toit's Pan. The steady reduction in cost per load, at all the mines (though little at Bultfontein). The diminution in value per carat, and per load. Du Toit's Pan mine was closed in April, 1908; and the old De Beers mine also, for a part of the last year.

A movement has been started to develop diamond cutting in South Africa. The local market, though relatively small, would employ perhaps one thousand workmen. The cost is greater than in Holland; but this difference is offset by the present tax of 15 per cent. on imported cut stones, and a profit is possible even now. To make the industry important, however, an export tax of like proportions on uncut stones is suggested, but this would involve many complications. All agree that the industry would be advantageous, but many difficulties exist, and are strongly presented by those who fear to unsettle present conditions.

Rhodesia.—Diamonds have been found in two regions in Rhodesia, viz., in the Somabula gravels, and near the Bombesi river in true kimberlite pipes. These may prove to be the source of the Somabula occurrences, as they are within 50 miles of that region. The kimberlite is of the ordinary type, with the usual associated minerals. The gravel beds rest upon a decomposed granite, and at times the separation of the two is not easily traced; but they are distinct, and no diamonds can be found in the decomposed bed-rock. These deposits extend over a wide area, and are sometimes 100 ft. thick.

F. P. Mennell, curator of the Rhodesia Museum at Bulawayo, has published some important notes on the diamantiferous rocks of South

Africa. He accepts the suggestion of the late Prof. Carvill Lewis, attributing the abundant calcite of the blue-ground to alteration from original melilite, and finds it strongly confirmed by recent microscopic studies. The eclogite question assumes a new aspect from observations in the Rhodesian pipes. Here eclogite appears in place, resulting from contact metamorphism, and is therefore neither a segregation nor an older igneous inclusion. Mr. Mennell shows also that it contains metamorphic minerals, and cannot possibly be regarded as the original source of the diamonds.

German Southwest Africa.—The diamond discoveries in German Southwest Africa appear now to be authentic and important. The mode of occurrence is peculiar, among sand-dunes near the coast, where small diamonds abound in a gravelly surface layer, not over a foot deep, and are either picked up by hand or washed in sieves, as at the Vaal River deposits. The central point is Luderitz Bay, a town with now about 1000 white inhabitants and a number of good buildings, situated some 500 miles north of Cape Town. The diamantiferous region is a crescent-shaped belt, curving around Luderitz bay for 300 miles from Elizabeth bay northward, and extending 50 or 60 miles inland. It is perfectly arid, being merely sand reaches among granitic hills. Water for drinking is obtained by an evaporating plant, and for washing, by sinking pits or from the sea. The extent of the diamantiferous sand-layer is yet unknown, as it is irregularly distributed, and much prospecting must be done and a full survey must be made. The diamonds are brilliant octahedral crystals, from $\frac{1}{8}$ to $\frac{1}{4}$ of a carat, although the largest stone found weighed a little over two carats. A "load" of sand (16 cu. ft.) may contain from two to occasionally 15 carats. The average value is about 25s. a carat, and the cost of mining is very small. Since the discovery in June, 1908, to January, 1909, the total production was about 40,000 carats (220,000 stones) valued at £55,000.

The entire diamond region is covered by concessions, under several large companies. Thus far, no machinery is in use, the methods pursued being the simplest. The labor problem is serious, though natives can be had in moderate numbers at very low rates. The white population of the German protectorate is small, and immigration is important, but the region is unattractive. All food must be imported, either from the protectorate or from Cape Colony. The diamonds, however, are quite abundant, and quite recently it has been announced that a pipe or neck has been discovered, which may be looked upon as the source of the diamonds found in the alluvial sands.

Dr. Lotz,[1] who resided in the neighborhood of Luderitz bay from 1903

[1] *Centralblatt f. Mineralogie*, No. 8, April 15, 1909.

to 1906, and made a careful examination of the diamond fields in 1908, states that, so far, diamonds only occur in a narrow strip of territory running from the coast and stretching between Elizabeth bay, to the south, and Gallovidia bay to the north of Luderitz bay. No rocks have been found in the neighborhood of the diamond deposits from which the diamonds, which are certainly a secondary deposit, can be derived. The various diamond fields are not in immediate contact with each other and are also at different levels. The diamonds lie in loose material, 70 to 80 per cent. of which consists of reddish sand and 20 to 30 per cent. of fine gravel from the size of pin-heads to that of lentils. Small, finely-striped agate pebbles, jasper, and ferruginous quartz, as well as greenish stones of considerable weight are characteristic marks of these beds.

In the case of a rather rich deposit belonging to the Colmanskop Diamond Mines, Ltd., the proportion of diamond to the accompanying material was found to be as much as 5.3 carats, or 20 to 25 stones to a cubic meter of material, and a small field, 1250x150 ft., belonging to the same company, and which is being worked, contained, on a low estimate, 38,000 carats, worth 1,140,000 marks, at 30 marks per carat. Although but a small proportion of the fields assigned are now exploited, a daily output of at least 600 carats, or 180,000 carats per year, should be attainable, and as the territory reserved by the Government is not included in the above estimate, a much larger output can eventually be expected.

The average weight of the stones is surprisingly constant, and is from $\frac{1}{4}$ to $\frac{1}{5}$ carat, but stones of a half-carat are frequent. The largest stone found, so far, weighs a little over two carats. The price of exported stones has risen considerably, because of an export duty of 10 marks per carat, so that 60 per cent. of the output brings from 50 to 60 marks per carat. The remainder is kept in the country until an *ad valorem* duty is substituted for the specific one.

Dr. Lotz expresses the opinion that the Luderitz bay diamond deposits represent older coast-formations, in part heaped up and deposited by the wind. The association of the diamond with the accompanying fine gravel, and with the agate pebbles of more recent shore-terraces, might lead us to suppose a connection with the region drained by the Orange river and hence with the Vaal river. This is rendered more probable by the fact that the diamonds of German Southwest Africa have this in common with the "river stones" of the Vaal, that they are more valuable than the diamonds from the blue ground.

To prevent injudicious exploitation, the Government has ordained that, south of 26 deg. south latitude, the fields can only be worked under special conditions.

From an examination of 1762 crystals, mainly from the Colmanskop Diamond Mines, Ltd., Prof. Keiser finds[1] that the predominant form is the rhombododecahedral, although there are many octahedral crystals and twin crystals of the spinel type; perfect octahedral crystals are rarer.

Brazil.—Among the modern methods now being introduced into diamond-mining in Brazil, an important one is that of dredging, which has been applied to portions of the river-bed near Diamantina. An American engineer, G. R. Young, has built and operated very successfully a powerful dredge, which can dig to a depth of 50 ft. The overburden of barren gravel is removed at night, and the "cascalho" layer, 3 to 5 ft. thick, by day, the buckets excavating also several feet down into the soft sandstone bed, to reach the rich cascalho in crevices and hollows. Screening, sizing, and sorting follow; and considerable gold is also recovered.

United States. (By John T. Fuller.)—It is now nearly two years since the first rumors of the discovery of diamonds in their original matrix in Pike county, Arkansas, began to reach the East. This discovery has since been verified by competent engineers and geologists, and active peparations are being made to develop the field on an extensive scale. The exact location of this Arkansas discovery is Pike county, Sections 21 and 28, Township 8 South, Range 25 West. The diamond-bearing area lies on the east bank of the Little Missouri river near the junction of that stream with Prairie creek. The nearest town is Murfreesboro, the county seat, which is about 2½ miles to the northwest. Direct rail communication to Murfreesboro will be established in the near future by a branch line which will connect with the main line of the Kansas City Southern at Ashdown, Arkansas. At present the easiest way to reach the property is by rail from Little Rock to Cooley's Crossing, via Prescott, which is about 6½ miles from Murfreesboro, the latter distance being covered by wagon.

The history of this Arkansas discovery presents several interesting features. First mention of this locality was made as early as 1842, but no report of any accuracy was made until 1890, when the region, including the volcanic area, was mapped and reported on by John C. Branner, who at that time was State geologist.[2] In this report Branner mentions that the rock resembled closely the diamond-bearing rocks of South Africa. No more notice was taken of this area until 1906, when John M. Huddleston, who had in the meantime purchased the property on which the greater part of the diamond area lies, found the first

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[1] *Centralblatt f. Mineralogie*, No. 8, April 15, 1909, pp. 251–254.
[2] Geological Survey of Arkansas, Annual Report for 1890.

diamond on Aug. 1, 1906.[1] This was a white stone of 4½ carats. On the afternoon of the same day a second diamond was found by Mr. Huddleston, who, suspecting that he had found something valuable, although he did not know just what, sent the stones to C. S. Stifft, a jeweler of Little Rock, who pronounced them to be true diamonds. Mr. Stifft, with several friends, secured options on the Huddleston tract and on considerable other land adjoining, thus gaining control of by far the greater part of the igneous area. The company thus provisionally formed, secured competent professional advice, and on the strength of the reports that were made, the Arkansas Diamond Company was incorporated.

The matrix of the diamond is a rock which has been described by the late Prof. Henry Carvill Lewis as "a porphyritic volcanic peridotite of basaltic structure," which is named kimberlite.[2] This peridotite, or kimberlite, is more popularly known in South Africa as "blue ground." The use of the term "blue ground" in connection with this rock is misleading. Many people are deceived by this term and take it for granted that the diamonds occur in a soft clay soil, or ground which presents little difficulty or expense to wash and concentrate. This is not the case. The origin of the term "blue ground" is interesting. Like most peridotites, the greater number of the "diamond-bearing peridotites" show marked changes on exposure to the atmosphere and "weather in place" to considerable depth. The fresh peridotite is as a rule of a bluish green color, which changes on weathering to a dull grayish green or yellowish green. During the process of weathering, the rock disintegrates to a great degree and can easily be pulverized between the fingers. It is then, properly speaking, when in this condition, a "ground" and not a rock. This yellow disintegrated peridotite being naturally the top portion of the mass, was the rock in which the diamonds were first found and became known as "yellow ground." In time the "yellow ground" was mined out exposing the hard undecomposed blue peridotite beneath, which was called in contra-distinction by the early miners "blue ground."

The diamond-bearing peridotites of South Africa occur in what is there locally known as a "pipe," which is the neck, vent, or stock, of an old volcano, or dike, filled up solid with the diamond-bearing rock and extending to unknown depth. The Arkansas peridotite has been demonstrated to be in every essential similar to the diamond-bearing peridotites of South Africa, and the most essential characteristic, the actual finding of diamonds within its mass, is fulfilled.

I have heard it said, and seen it written, that this Arkansas peridotite

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[1] *Am. Journ. of Science*, G. F. Kunz and H. S. Washington, Vol. XXIV, Sept. 1907, pp. 275-276. *Trans.* A. I. M. E. Feb meeting, 1908, Kunz and Washington, pages 187-194.

[2] Eighteenth Annual Report, De Beers Consolidated Mines.

shows marked differences from the peridotite of Africa. When it is realized that from the same pipe in Africa a dozen or more different hand specimens of peridotite can be taken, no two of which resemble each other either in inclusions or physical appearance, the folly of attempting to find differences in this Arkansas pipe from hand specimens brought from the African pipes, is evident. The only way they can be compared is to compare the masses as a whole, and by this method of comparison I can see no radical difference either in formation, occurrence or in the character of this peridotite from those of South Africa. That the Arkansas peridotite occurs in a pipe similar to its occurrences in South Africa has also been sufficiently demonstrated, by means of bore holes, to be accepted as a fact. The peridotite of the Arkansas pipe, as is also true of the South African pipes, varies considerably in hardness over different parts of the pipe. In most cases the rock will disintegrate readily after a few months' exposure to the atmosphere. The softer varieties, which are comparable in hardness when fresh with ordinary sandstones, "weather in place" to depths varying from 20 to 60 ft. and form the famous "yellow ground" of the South African mines. The harder varieties of the peridotite, which may and do occur in the same pipe with the softer variety and which are known as "hardibank," are of an entirely different nature. No amount of exposure to the atmosphere will have any practical effect on this rock. In hardness it is equal to the hardest quartzites, and to be concentrated at all, it must first be crushed by powerful crushers. This variety does not weather in place to any extent, and forms the hard outcrop which first drew the attention of geologists to the Arkansas pipe.

A roughly elliptical area represents approximately the peridotite pipe, as known at present. The major axis which lies in the northeast-southwest direction, is about 2400 ft., while the minor axis is about 1800 ft. The area covered is approximately 60 acres. On a line which lies practically through three hills, known as the West, Middle and East hills, are the outcroppings of the hard peridotite referred to as hardibank. To the south of these hills the ground falls away gradually to the Little Missouri river. This south slope on the volcanic area is composed of a much softer peridotite than that of the hills. It has here weathered in place to a depth which may reach 60 ft., and is known to be weathered for at least 20 ft. This portion of the area which is also the largest portion, being at least 35 acres in extent, can be excavated easily without or with a minimum use of explosives to a depth of at least 20 ft. I estimate that there is at least 1,500,000 cu.yd. of this material that can be easily and cheaply mined. Overlying the greater part of the whole area to a depth which does not exceed 1 ft., is a black vegetable soil locally known as "gumbo." This soil contains some peridotite and a mixture of other rocks and soils brought in by the surface waters. A number of diamonds have been found in this soil which were undoubtedly derived from the underlying peridotite.

The operations to date have consisted chiefly of haphazard experimental tests of the peridotite from various places on the pipe. These tests were roughly made with inadequate washing machines, and the chances are that as many diamonds were lost in the tailings as were recovered. Considerable work has been done in the way of clearing up the area of stumps and gumbo and plowing loose the weathered peridotite. During these operations a large number of diamonds were picked up by chance by the workmen. The number of diamonds found in this way is remarkable and is an indication of considerable richness. Three bore holes have been put down with a diamond drill on the pipe area to depths of 79, 184 and 205 ft. These holes are in the peridotite for the entire distance sunk.

Toward the end of 1908 all work on the property was suspended until such time as a complete mining, washing and concentrating plant can be designed and erected, when mining on a large scale will be undertaken. The total number of diamonds recovered from this area up to the end of 1908 by chance finds or concentration is 540. Of these 540 stones 505 weighed 217 carats, or an average of nearly ½ carat per stone. The largest stone so far found weighs 6½ carats. Most of the stones found are white, while a few are yellow or brown. A large number of these stones are of good water and of remarkable purity, many being of finer quality than African stones. Three of those found have been cut and have yielded beautiful gems which have been valued at from $60 to $175 per carat, with an average value for the three of $104 per carat. Taking a parcel of rough, unsorted stones from this pipe it will easily average $10 or more per carat in value at the present prices of diamonds. This average equals that of several of the large producing mines of Africa.

The engineer who is called upon to report on an undeveloped diamond mine has the serious obstacle to confront that he can make no definite statements or figures as to what average may be expected from the working. It is impossible to make assays of a diamond mine. Bore holes give only indication of the nature of the peridotite and tell nothing of its richness. The only way that a definite statement of values can be made is actually to mine, wash and concentrate at least 50,000 cu.yd. of the rock. The greater the amount the more accurate will be the result. Test runs from certain parts of the Arkansas pipe indicate at least 0.21 carat per load of 16 cu.ft., which may be considered an excellent average if it can be maintained. In many ways the Arkansas pipe has decided advantages over the South African mines. There is an abundant and nearby supply of water and timber. Fuel and mining supplies are comparatively cheap. Mining should be done here at a cost which would be unattainable in Africa.

WEIGHT IN CARATS AND COLOR OF THE FIRST 75 DIAMONDS FOUND IN THE ARKANSAS FIELD

No.	Weight.	Color.	No.	Weight.	Color.
1	2 [illegible]	White	39	[illegible]	Brown
2	2 [illegible]	Light brown	40	[illegible]	Brown
3	2 [illegible]	White	41	[illegible]	Green yellow
4	1 [illegible]	White	42	[illegible]	Brown, found in screen wash
5	1 [illegible]	Crystal white	43	[illegible]	White, found in dry wash
6	[illegible]	White	44	Diamond in rock	
7	[illegible]	White	45	4 [illegible]	Perfect blue
8	[illegible]	White	46	2 [illegible]	Crystal
9	[illegible]	White	47	2 [illegible]	Brown
10	[illegible]	Light brown	48	[illegible]	White
11	[illegible]	Yellow	49	[illegible]	White
12	[illegible]	Yellow	50	[illegible]	White
13	[illegible]	Cloudy brown	51	[illegible]	White
14	[illegible]	Cloudy white	52	[illegible]	White
15	[illegible]	Dark brown	53	[illegible]	White
16	[illegible]	Bort	54	[illegible]	White
17	[illegible]	Light yellow	55	[illegible]	White
18	[illegible]	White	56	[illegible]	White
19	[illegible]	Crystal	57	[illegible]	White
20	[illegible]	Light brown	58	[illegible]	Yellow
21	[illegible]	Light brown	59	[illegible]	Yellow
22	About ½	Yellow	60	[illegible]	Yellow
23	2 [illegible]	White	61	[illegible]	Brown
24	2 [illegible]	Silver cape	62	[illegible]	Brown
25	[illegible]	Crystal	63	[illegible]	Brown
26	[illegible]	Crystal	64	[illegible]	Brown
27	[illegible]	Yellow	65	[illegible]	Brown
28	[illegible]	Light yellow	66	[illegible]	Brown
29	[illegible]	Yellow	67	3 [illegible] } are diamonds found in two pieces.	Brown
30	[illegible]	White	68	1 [illegible]	
31	[illegible]	White	69	[illegible]	Brown
32	[illegible]	White	70 to 75	6 pieces bort. Total weight 2½ carats.	
33	[illegible]	White			
34	[illegible]	White			
35	[illegible]	White			
36	[illegible]	White			
37	[illegible]	White			
38	[illegible]	White			

RUBIES.

The reports of the Burma Ruby Mines for the year ending Feb. 29, 1908, show a total output of 2,033,666 truckloads of ruby earth,—considerably more than in any previous year—at a cost of 7.6d. per load; the net profits were $18,906,—both somewhat less than in 1907, though more than in 1906. The company pays the government a rent of 200,000 rupees (£13,400), plus 30 per cent. on all further profits, both from regular working and from royalties in excess of 200,000 rupees paid by native miners.

Owing to the depression in the gem-market, and with a view to restrict the output, the company had entirely stopped night work, from the first of February, 1908, and the wages of the coolie laborers, as well as all other expenses, were reduced as much as possible. As precautionary measures, the payment of the semi-annual rent due the government on Feb. 29, 1908, was with official consent, deferred for the present, and the usual dividend was postponed until trade conditions should improve, although the output for the past year had increased, and the cost somewhat diminished. An important work in connection with the mining operations, the Mogok Valley drainage tunnel, is reported as nearing completion.

OTHER STONES.

Turquoise.—Edward R. Zalinski has published in *Eng. and Min. Journ.*, Oct. 31, 1908, a description of the turquoise occurrences in Grant county, N.. M., and particularly of the Azure mine, thus far the most important. The rock of the immediate region is biotite-granite, intruded by masses of andesite-porphyry, and both traversed by dikes of mica-andesite. The granitic uplift, which formed the Burro mountains, was post-Cretaceous, but earlier than the great volcanic activity of the Tertiary, to which period may belong the later andesite dikes. The granite is much altered and kaolinized near the andesite masses, and it is in this altered portion that the turquoise mainly occurs. The Azure mine itself is in a well-defined vein or zone of alteration, about 50 ft. wide, with distinct walls; and the turquoise appears in two forms, as nodules or concretions in kaolin, and as veins filling cracks in the altered granite. Its quality varies much, and only the best is shipped away; but some of this is equal to the best Persian material, and the total output has reached a greater amount than that from any other group of mines.

Burmese Jade.—A full and very valuable account of the occurrence of jadeite in Upper Burma has been given by A. G. W. Bleeck, presenting an interesting theory of the origin of this mineral.[1] He visited three localities where it occurs, in the Myitkyina district, but dwells chiefly on that at Tammaw, about 50 miles northwest from the Burma railway, where the jadeite is quarried in place, and not obtained (as elsewhere) from boulders. The rocks are described in detail, and their relations strikingly presented. The jadeite occurs in a great dike, plainly igneous, traversing a ridge of serpentine, flanked by "crystalline schists," altered from igneous rocks. The dike gives evidence of some remarkable modes of differentiation in the magma from which it was formed, and of subsequent alteration. It now consists mainly of jadeite and albite, the latter flanking the former on both sides, and passing into it by mixture. Actinolite and some other minerals are also present, and their relations are carefully studied; but the mineral of prime importance is the albite,

[1] "Jadeite in the Kachin Hills." *Records*, Geol. Survey of India, Vol. XXXVI, part 4, 1908, pp. 254–285.

which is also known elsewhere in association with jadeite, and is the only feldspar so associated. Some occurrence of nephelite is also noted.

The genesis of the jadeite is then taken up, forming the most interesting part of this important paper. Mr. Bleeck reviews previous theories as to the jadeite-albite rock, and gives his own conclusions very clearly and forcibly. With Noething, the only other geologist who had studied the actual occurrence, he considers it clearly an igneous intrusion, and refers to the penetration of small veins from the main dike into the country-rock. After much discussion of the magma, whence the dike and, in his judgment, some of the adjacent rocks were derived, Mr. Bleeck presents the view that the dike originally developed as a mixture of albite and nephelite, and that a subsequent intrusion of granite, which altered the basic rocks into the "crystalline schists," caused a change also of the nephelite-albite to a jadeite-albite. From comparison of a series of analyses, the striking fact is shown, that "one molecule of nephelite plus one of albite are equal to two of jadeite ($Na\ Al\ Si\ O_4 + Na\ Al\ Si_3\ O_8 = 2\ Na\ Al\ Si_2\ O_6$), and that such an alteration, affecting the mineralogical, but not the chemical, constitution of the dike, is perfectly possible. The microscopic structure of the rock shows that it has undergone intense pressure since its original development; and jadeite is a mineral of high density (3.2) in the pyroxene group. The general conclusion, based upon a great array of observations and data, is expressed as follows: "That the jadeite-albite dike . . . originally developed under normal conditions as a nephelite-albite rock. As neither albite nor nephelite possesses heteromorphic equivalents which could crystallize under anomalous conditions, metamorphism cannot alter either of these two minerals . . . independently of the other." But the combination of one part albite and one part nephelite, yields jadeite, which could thus be produced by metamorphism under great pressure.

The other Burman occurrences of jadeite are as boulders, some in the beds of streams, and some in a conglomerate of Tertiary age, as shown by associated beds containing Miocene plant-remains. Whether these boulders came from the dike at Tammaw or from other unknown outcrops, has not been fully determined, although the former is probable.

Opal.—Australia, that land of surprises in the domain of natural history, as well as in that of mineralogy, has given us many forms of opal during recent years. First, the wonderful specimens that are found in the brecciated ironstone which was filled with large, wonderful white, blue, and blue-green opals. Then again, there are the opals found in the Wilcannia White Cliffs, New South Wales district, where the most beautiful white noble opals frequently reproduce the vertebrae and other bones of animals, markings in wood, marine shells, etc.; here a mineral resembling gypsum or gaylussite, is also found. The pineapple opal, as it is termed, sometimes occurs in nodules the size of a man's fist.

Until within the past few years, black opal was exceedingly rare. It was supposed to bring "good luck" to its wearer and for this reason, as well as for its beauty, it has always been highly prized. During 1906-08, however, a quantity of black opal, of a velvet-black in general effect, but permeated with a rich display of red, green, blue and purple, was discovered at the Lightning Ridge mine in New South Wales. Gems weighing 100 carats were taken from there, and a quantity of material has been obtained and formed into specimens which have found their way to the gem markets of the world. The opal field is situated in close proximity to the Queensland border and is said to have an extent of 25 miles.

Formerly the name "black opal" was often erroneously bestowed upon matrix opal, a material consisting mainly of veins of opal in the matrix rock; but the true black opal, such as is found at Lightning Ridge, is composed entirely of opal. The material occurs as nodules in the rock and varies much in quality. It frequently happens that fine specimens cannot be utilized for gem purposes because of extensive flaws, or "sand spots" as they are called, which traverse the stone in different directions.

In 1906, opals to the value of £8000 were secured from the Lightning Ridge fields and the worth of the total output there is nearly £50,000. Cut stones have sold for from $5 to 50 and more per carat, the higher prices being for very choice pieces owing to their novelty and present rarity.