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A Preliminary Report

ON THE

Arkansas Diamond Field

BY

Philip F. Schneider, M. Ph.

Issued by the

Bureau of Mines, Manufactures and Agriculture

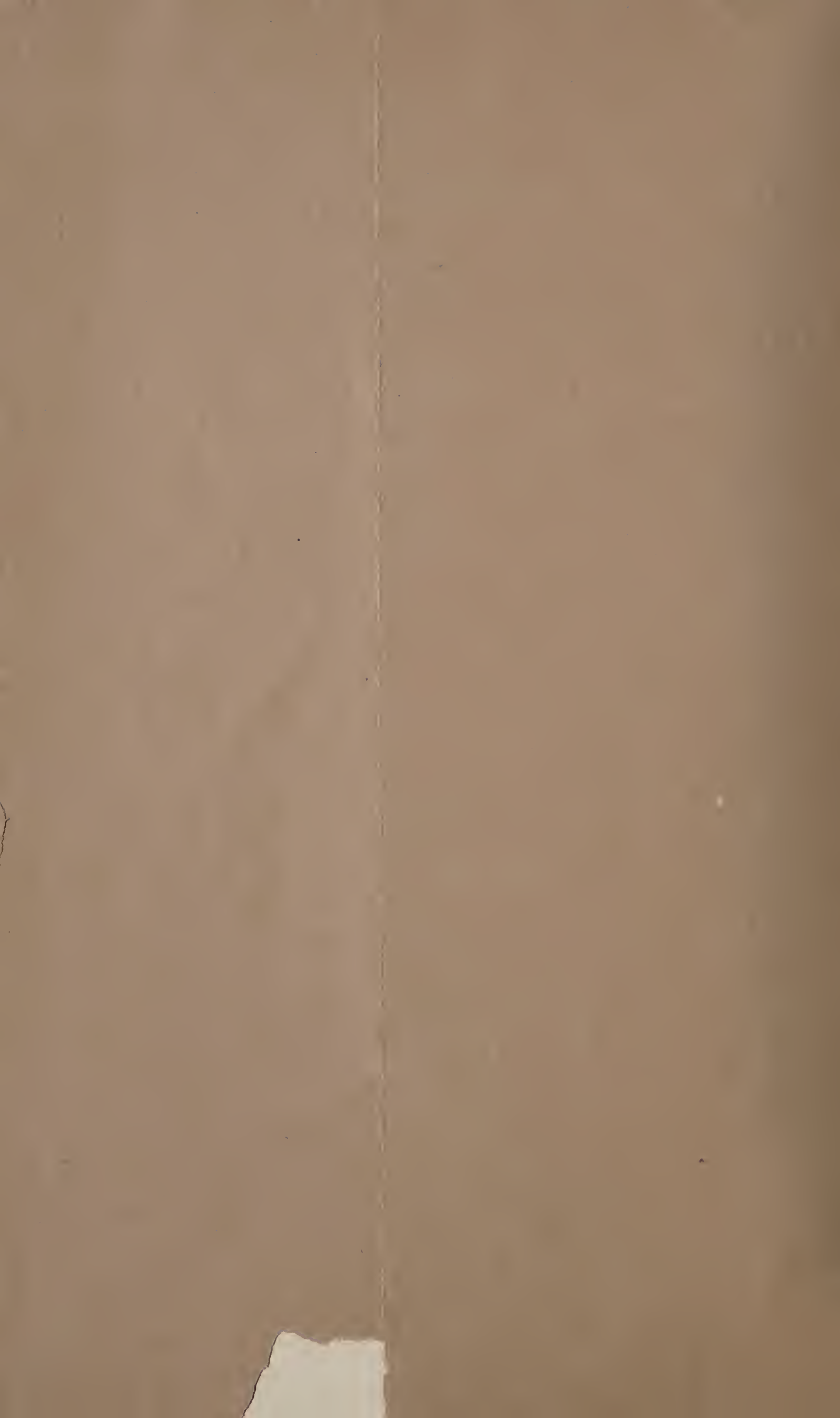
GUY B. TUCKER, *Commissioner*

CENTRAL PRINTING COMPANY

Little Rock, Arkansas

1907

658-415



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Letter of Transmittal.

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To His Excellency, X. O. Pindall, Acting Governor:

SIR—I have the honor to submit to you for publication by the State, a preliminary report on the Arkansas Diamond Field prepared by Professor Philip F. Schneider, M. Ph.

Much interest has been manifested throughout the country in the Arkansas diamond discovery and this office has been flooded with requests for information by capitalists and scientists from various parts of the world seeking reliable information. This we were unable to supply as the edition of Branner's report has long since been exhausted. It therefore became imperative to have some official report prepared by a competent authority discussing in full the various details of the subject.

This work has been entrusted to Philip F. Schneider, of Syracuse, New York, a geologist of the highest repute and one thoroughly familiar with peridotite rock, who was instructed to visit the field, secure all the information possible, and embody the same with suitable illustrations and a complete discussion of the entire subject in a report to this Bureau for publication by the State. It is expected that this report will be ready for publication by the close of the year.

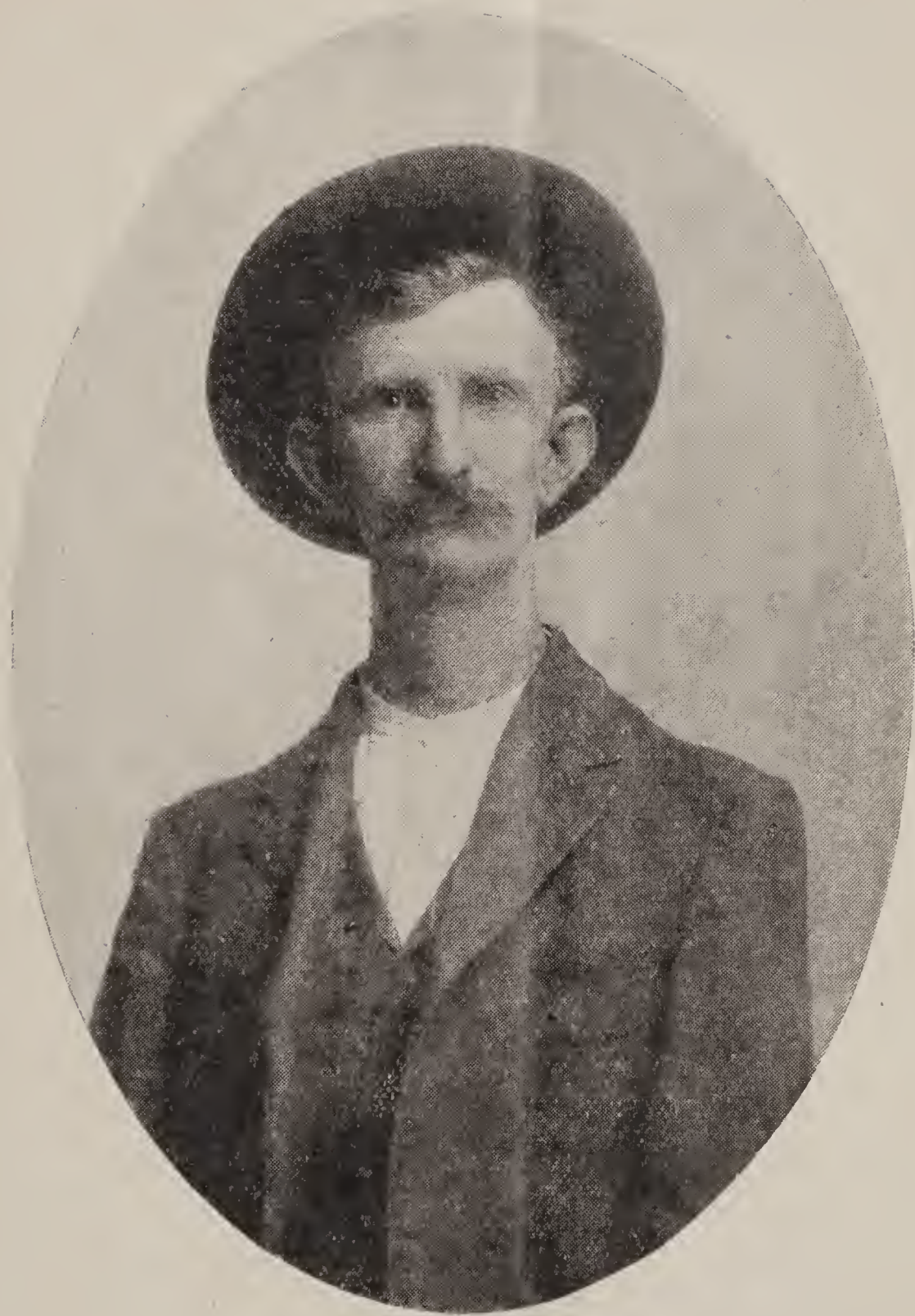
The present bulletin is a preliminary account, which has been prepared to satisfy the immediate demand for accurate information.

Respectfully,

GUY B. TUCKER.

Commissioner Mines, Manufactures and Agriculture.

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D. W. M.



JOHN WESLEY HUDDLESTON

The Discoverer of the Arkansas Diamond Fields

The Arkansas Diamond Fields.

Pike County, Arkansas, deserves the distinction of being the first American locality in which diamonds have unquestionably been traced to their rocky matrix of peculiar kimberlite, where they were either formed by nature or at least brought to the surface by the unexplained forces which aided in producing the same. In fact this State has long shared with New York and Kentucky the honor of being one of the three known American localities where this peculiar peridotite, sometimes spoken of as kimberlite, was found.

While this rock was recognized and described¹ as long ago as 1889, it appealed only to a comparatively few persons, mostly scientists, to whom it was of interest because of its rarity as well as to the uncertainty regarding its origin. More than three-fourths of a century before the discovery of the Arkansas diamonds, and nearly half a century before these gems were first recognized in South Africa, Vanuxem², one of the earliest of the American geologists, was puzzled by its peculiar character, and suggested an igneous origin for the New York serpentine (peridotite), which was the only one of its kind then known, nor has the question ceased to puzzle our best scientists since. In fact the formation of serpentine into which this rock changes has ever been one of the vexed questions of geology. It was not until 1887 that Dr. G. H. Williams³ satisfactorily proved the igneous nature of the American varieties, Diller⁴ describing the Kentucky peridotite, and Branner⁵ the Arkansas variety, while the origin of the South African kimberlite is still in doubt.

¹ The Peridotite of Pike Co., Ark., by Branner and Brackett. *Am. Jr. Sci.*, 1889.

² *N. Y. State Geol. Repts.*, 1838-1842.

³ *Science*, March 11, 1887; *Am. Jr. Sci.*, XXXIV, 1887; *Bull. Geol. Soc. Amer.* I, 1890.

⁴ *Bull. Geol. Sur.*, No. 38; *Am. Jr. Sci.*, XXXII, p. 121; *Science*, 1885, p. 65; *Am. Jr. Sci.*, Oct., 1892.

⁵ *Am. Jr. Sci.* XXXVIII, 1889, p. 50; *Ark. Geol. Sur., An. Rept.*, Vol. II, 1890.

It was quite a few years, however, after the discovery of the South African diamonds in the peridotite pipes and dikes before its resemblance to the American rocks was first noted and the remarkable similarity in structure, in inclosures, in eruptive character, and in chemical composition of the rocks of these widely separated localities, fully described.⁶ Naturally this remarkable similarity suggested the possibility of diamonds being found in this rock at all of these localities, but strange to relate, at only one of the localities⁷ was any search made for the gems. At the other two localities, namely in Arkansas and in New York, no one evidently was sufficiently interested to even consider the magnificent possibilities indicated by science along this line, and it was left for Mr. John Wesley Huddleston, a native of Arkansas who knew absolutely nothing of these profound investigations of the scientist, or of the possibilities of the kimberlite as a prospective diamond mine, to find the first unquestioned diamond in this rock in America, thus attracting the attention not only of the scientist but of the ordinary person as well to this subject, and making diamonds, peridotite, kimberlite, Murfreesboro, Pike County, and Arkansas, all household words throughout the country.

LOCALITY.

The locality where this rock occurs is a somewhat restricted area lying about two and one-half miles southeast of Murfreesboro. The rock is first noticed in the hillside about 400 yards east of Prairie Creek, near its junction with the Little Missouri River.

The occurrence of this peculiar mass of igneous rock, which differs so materially from the sands and gravels of the river valley through which it rises, could scarcely fail to attract the attention of even the most casual observer. It was mentioned by Powell⁸ as far back as 1842, as well as by several other of the early scientific writers, and as already stated has been described in detail by Branner and Brackett in 1889.

⁶ "The Genesis and Matrix of the Diamond," H. C. Lewis, 1887.

⁷ The surface conditions in Kentucky were regarded as so favorable for the formation of diamonds by the action of heated rock upon the Carbonaceous shales through which it passed that there has been some search for diamonds in that locality ever since the theory was suggested, about twenty years ago. While two diamonds are known to have been found in Kentucky, they cannot positively be referred to the peridotite.

⁸ Geol. Rept. on Fourche Cove, 1842. p. 6. (See Branner.)

THE IGNEOUS AREA.

The igneous area composed of the rock is roughly elliptical in form and is given by Branner as 2,400 by 1,600 feet in extreme dimensions, and extending in a general northeast and southwest direction. It is quite probable, however, that a minute examination of the locality would prove that it is even more restricted than this, as the southwest hill contains but little peridotite upon the surface, being composed of a greenish colored quartzite and drab sandrock which have heretofore been referred to the Carboniferous age.

The two remaining hills which form a large part of the igneous area are locally known as the east and west hills, but in order to avoid any confusion as to whether the west hill, composed of the Carboniferous quartzite, or the locally named west hill, which is composed of the peridotite, is meant, the latter will be spoken of as the central hill.

These hills, which rise from sixty to eighty feet above the level of the valley, form a ridge which slopes steeply to the north and west but inclines more gently toward the Little Missouri on the south. The northern slopes of the hills are largely made up of the harder masses of the peridotite which has weathered out into boulders of various sizes.

The east hill has a cap of Carboniferous sandrock, which covers nearly all of the top. On the north and especially upon the west side it has a talus of the smaller boulders which are slowly decomposing, together with more or less of the decayed and disintegrated yellow earth, which is merely the decomposition product of the peridotite.

A spur of the hard peridotite extends slightly west of north from this east hill, and is exposed for a distance of about twenty feet in the south bank as well as in the bed of the Poorhouse Branch. In appearance this spur of the peridotite is not greatly different from the slightly decomposed peridotite of the other localities, its interest lying in the fact that it has not previously been reported as occurring in this branch. In fact all the known references to the branch distinctly state that it contains no exposures of the peridotite.

It will also be of interest to note that the decayed earth and sand at this particular locality show many

beautiful bright green crystals of olivene. Some of them are exceedingly clear and brilliant and should a careful examination of the soil and rock prove that equally well preserved crystals of this same brilliant shade and of a size suitable for cutting occur, they will make especially fine marketable gems.

The central hill contained none of the Carboniferous sandrock so prominent upon the other two hills, but appeared to be made up entirely of a compact, dark-colored, massive peridotite, showing little alteration by the weather. The rock, however, has broken and split up into large blocks and boulders, a few of which have rolled down the slope toward the bottom. The fact that so few of these blocks have been displaced suggests that these cracks and breaks are really the fractures produced by the cooling of the heated mass, subsequently effected by the various atmospheric agencies.

Toward the south, except in the very midst of the hill slope, the surface inclines almost imperceptibly toward the river. That portion of this area which lies nearest the ridge is composed of a much decomposed peridotite. This condition is very clearly shown in the beds of the two small wet-weather streamlets, which have their source in the diamondiferous area, and flow southward across and through the sands and gravels of the river valley and empty into the Little Missouri. In the channels of these streamlets the decayed peridotite is covered by a thin layer of black gumbo-like soil, averaging not more than a foot in thickness together with some pebbles undoubtedly obtained from the adjoining conglomerate. Beyond the observed igneous area these streams show that the river flat is made up of about four feet of yellowish sand over a cemented gravel showing about three feet thick but which other excavations prove to be from ten to twenty feet thick.

METAMORPHISM.

The adjoining sandstones show only slight traces of metamorphism due to the intrusion of this heated mass. In fact the dip of the rocks on the west hill, and the capping of Carboniferous rocks on the east, together with the structure of the peridotite itself seems to indicate that the entire mass was covered at least in

large part by the Carboniferous rocks, and then subsequently eroded, although it would be difficult, if at all possible, to prove this contention, even by considerable excavation.

The very slight amount of metamorphic change is further shown by the contact of the peridotite dike at the mouth of Prairie Creek with the soft Cretaceous sandstone. Outside of a slight darkening of the color of the adjoining sandstone for about an inch on either side of the dike there is practically no metamorphic change. It is true that this adjoining material is somewhat softer than the remainder of the Cretaceous formation, but this is readily explained by the ease with which the atmospheric agents would penetrate the fissure and attack the rock.

THE PERIDOTITE.

The Arkansas peridotite, or diamond bearing rock, in unweathered specimens is a dark green, almost a black rock, of dense texture, and containing numerous sparkling particles of black mica (biotite). Freshly broken pieces also show what seem to be jet black crystals imbedded in the mass of the peridotite, but in thin sections these crystals appear to be of a dark green color. These crystals and grains of olivene make up the greater portion of the mass.

Specimens of the peridotite which are somewhat decomposed, however, become a dark yellowish brown color, the olivenes changing to decidedly yellow colored masses which show very prominently in the darker ground mass. The mica apparently is but slightly affected by the weathering agencies.

Where decomposition has gone on to a considerable extent the rock breaks up into a mass of more or less angular fragments, which in the later stages change to a soft friable more or less earthy mass of a decidedly yellowish or greenish yellow color. As already stated this greenish yellow earth covers the greater portion of the igneous area south of the ridge of hard peridotite, and is of special interest because it comprises that portion of the igneous mass in which the diamonds have all been found. Whether this badly decomposed mass of the peridotite is merely a part of the same which breaks up more readily than does the harder

material of the ridge of hills to the north, the writer is not prepared to state, not having examined this part of the field, but there is little question but it is. However, it must be borne in mind that a part of this decayed material may have been washed down there from the hillsides, which partly surrounded it, to the north and west.

MINING THE GEMS.

A large number of the gems discovered up to the present time have been picked up by the workmen upon the surface, usually after a rain. About a week ago, during the writer's sojourn at the field, a handsome canary diamond of about two carats weight, a perfectly formed hexoctahedron, was thus picked up by one of the guards⁹ outside of the inclosure. He was not searching for gems particularly at the time but happened to notice a gleam of light flashing from the ground about twelve feet ahead of him, he went to the spot, and picked up the diamond.

Shortly before this another guard, Mr. Jim Key, while sitting upon a mass of the rock eating his lunch, happened to glance down and noticing a bright sparkle in the rock, took out his jack-knife and began to pick and cut away the rock, and presently had picked out from its matrix a half carat diamond. It was unfortunate that this gem was taken out from its resting place. However, the owner of the mine told me of another stone which was found and only partly separated from the inclosing rock, thus proving beyond a doubt the existence of the diamond in the peridotite. This interesting specimen was not in the possession of the owners at the time of my visit, and could not be seen, although a photograph of the same was shown.

However, some of the gems are obtained by washing the rock, after the manner of the South African diamond companies. In brief the method employed is as follows:

The peridotite, because much of it is already in the decomposed disintegrated state, does not need at present to be exposed in order to permit it to break up as in South Africa, although about six acres has been plowed up and is virtually being reëxposed to the at-

⁹ Mr. Lee Wagner.

mosphere. This material is next taken to the concentrator, or washing machine, where it is mixed with water and agitated by rapidly revolving arms fitted with iron teeth for the purpose of carrying off the earth and lighter material, while the diamonds with the heavier stones and pebbles settle at the bottom. From time to time these are drawn off and screened through one-half and one-quarter inch mesh sieves which separate the larger rocks and fragments from the rest. These concentrates are then spread out upon a table and carefully sorted over to obtain the diamonds which they contain.

The grease separator which has proved so valuable an adjunct to the African mining companies for obtaining the gems from the other concentrates has not as yet been tried by the local company, although Mr. John Peay, the manager, has been experimenting along that line with some success. The great lack of the company at the present time is water. However, a pumping plant, with a capacity of 97,000 gallons will shortly be installed upon the banks of the Little Missouri, which should give them a plentiful supply of water.

THE DIAMONDS.

Up to the present writing, October 14, 1907, over one hundred and sixty diamonds have been found. More than fifty of these gems, all that were in the possession of the owners at the time of the writer's visit, were shown to him and drawings and descriptions of the same made. These will be given in full in the final report. The remainder of the stones, which are said to represent by far the better part of the material, were sent to Mr. George F. Kunz, the most distinguished gem expert in America, for examination and description. In his report,¹⁰ he says:

“About 130 diamonds have thus far been found, the weight varying from $\frac{1}{2}$ of a carat to $6\frac{1}{2}$ carats. The first stone found by Mr. Huddleston is white and weighs $4\frac{1}{2}$ carats; the second, also white, weighs three carats; the third is yellow and weighs $\frac{1}{2}$ carat. The majority of the stones are flattened octahedrons; some

¹⁰ “The Arkansas Diamond Field,” Kunz & Washington. Special Rept. in U. S. Mineral Resources for 1906. Section on Precious Stones.

are flattened and triangular, and a few are almost perfect octahedrons. No cubes have been found. Most of the stones are white, a large proportion being of good water, and the white of exceptional purity, finer than most African stones. A smaller number are brown, some are yellow, and several small individuals are bort."

The stones examined by the writer could scarcely be designated as representative material from the mine, and were interesting scientifically rather than economically, the following facts being especially noteworthy.

(1) The tendency of the crystals toward the canary shade of color, although some very good white crystals were seen.

(2) Crystals triangular, much flattened or elongated, and a preponderance of the hextetrahedral form.

(3) The peculiar markings, or corrosion, of the surface of quite a number of the crystals. In fact some of them appeared as though they had been immersed after formation in some substance capable of dissolving or corroding the carbon. One of the crystals, probably a rhombic dodecahedron, was so acted upon in this way that its sharp edges were entirely destroyed and eaten away, making the determination of the crystal form almost impossible. These forms were suggestive of Herr Luzi's ¹¹ experiments and indicate the possibility of more than one eruption.

(4) One slightly distorted octahedron appeared somewhat milky, and when examined carefully with the glass showed that its entire surface was studded with numerous hexagonal pittings, in much the same way that the inverted triangles appear on many African stones.

These facts, together with others indicating a possibility of carbonado occurring in the workings, will be taken up more fully in the final paper.

OTHER GEMS.

The pyrope garnet, or "Cape Ruby," which occurs so abundantly in the Kentucky peridotite, and more sparingly in the New York and South African rocks, is quite small and very rare in the Arkansas

¹¹ "Artificial Figures of Corrosion on Rough Diamonds," *Berichte der Deutschen Chemischen Gesellschaft*, 1892.

peridotite. Mr. Huddleston is authority for the statement that about sixty were found among the heavier concentrates from the material washed at the river. One round garnet, of the usual red color, was shown to the writer with one of the packages of diamonds.

As to the ilmenite, it has been said that this mineral has not been found in the Arkansas peridotite, but several pieces were shown to the writer by one of the members of the company to whom they were sent in the belief that they might prove of value.

The clear-green crystals of olivene have been described.

GENUINENESS OF THE FIELD.

Because of the uncertainty connected with the entire subject, caused in part at least by the reports of certain so-called experts, who were denied admission to the field, and therefore had no hesitancy about pronouncing the find a "fake" and a "salt," as well as to the suspicion with which capital naturally regards any new mining enterprise, we were instructed to lay special stress upon the subject of the genuineness of the field. While the writer was shown many of the little courtesies by the company which scientific men are so accustomed to receive that they have come to regard them as their right, nevertheless he was refused permission for the present to visit the six acres of productive diamond ground. However, he is convinced from innumerable facts, no one of which is conclusive, but which taken together are too strong to be refuted, of the absolute genuineness of the find. Here are a few of the reasons:

(1) The occurrence here of the kimberlite, or diamond-bearing rock, which is the most natural place for the diamond to be found.

(2) The 165 unquestioned diamonds, which can actually be shown, and said to come from this place.

(3) The probability that they did come from this field, as they possess peculiarities both of crystal form and color, showing a marked family resemblance which would hardly be true for a collection of rough stones bought in open market, and which might have come from several mines. In fact, these family traits in the gems are such that only a speculator of exceptional ability and knowledge of the occurrence of diamonds

would understand and have the prudence to search for, in purchasing a parcel of gems for "salting" purposes.

(4) The straight-forward story told by Mr. Huddleston, the discoverer of the diamonds, which is so simple and unvarnished a tale, and so convincing in its completeness, that it will be given verbatim in the final report.

(5) The comments of the people of that vicinity and of former workmen of the company all favor the finding of the diamond. None of these people doubt, or even question, the finding of the gems.

(6) The character and reputation of the men composing the company, men who could not afford to jeopardize their standing in the community by association with any questionable concern.

(7) The finding of the gem in the matrix, where it still remains as vouched for by Dr. Kunz, who is far too experienced a hand to be misled in such a matter.

(8) The methods employed by the company to develop the mine. They are not "selling stock on a mere speculation," or "get rich quick" plan, but doing the most reasonable thing under the circumstances—cautiously developing the property until such time as they are convinced that the yield of gems will pay for mining on a large scale.

However, enough reasons have been enumerated to prove conclusively the occurrence of the diamonds.

PRODUCTION.

Are the conditions such that Arkansas will become an important factor in the diamond production?

About 160 diamonds have been obtained during the past year from about six acres by a few workmen with crude machinery, working only a small portion of the time because of lack of water. This would seem to indicate an extremely productive field, but is it? Situated as they are, the six acres have for centuries received the wash of the three hills to the north, acting as a natural concentrator, and the gems which are apparently found in such abundance may be the accumulations of a thousand years in this particular spot. However, I do not wish to be understood as belittling the possibilities of the field, but merely suggest a rea-

son for its surprising surface productiveness, and one which must be taken into consideration in determining its true value.

To properly do this, enough of the rock, say a few thousand loads, should be carefully washed, screened, and sorted, and an accurate account kept of the number and weight of the diamonds found therein, for determining the actual percentage per load. With this as a basis it will not be difficult to determine the actual cost of production and to discover whether the gems can be profitably mined.

Another and a very serious factor will enter into the problem, namely, the depth of the yellow disintegrated peridotite, and whether the harder blue ground beneath will become decomposed in a reasonable length of time, thus permitting the diamond to be won. Should this not result, some economical way must be devised for treating the rock, causing it to disintegrate, otherwise the very richest diamond-bearing ground would be valueless.

OTHER FIELDS.

The question naturally arises, Is this the only diamond field in the State? While it is possible that there are other occurrences of the diamond-bearing peridotite in Arkansas, it is quite unlikely, otherwise with the interest manifested, the search now being carried on, and the survey work already performed, they would doubtless have been brought to light. However, this supposition may be proven fallacious any day by a second Huddleston actually bringing in some diamonds from a new locality. At present none such is known, certainly not in close proximity to the mine.

The Little Rock Diamond Mining Company was sufficiently farsighted to acquire practically all of the known peridotite outcrop, only a small portion of the same being in other hands. Should any diamonds be found (not in the peridotite) on the adjoining property, they will be mere floaters and will not occur in quantity sufficient to pay for searching. The river gravels below the igneous outcrop are more likely to contain a few stones but even here they probably do not exist in quantities sufficient to pay for carrying on a continuous search for the same.

Does the peridotite occur in the immediate vicinity of the outcrop, but hidden by the overlying Tertiary gravel? This it is impossible to state without sinking innumerable pits, or drilling through the overlying sands and gravel everywhere. Then it would be proven only for the places actually tested. With one exception none of the wells which penetrate the gravel show the peridotite, although several cut into a greenish marl and quartzite. The exception is a well sunk near the cabin standing just north of the place where the Poorhouse Branch crosses the Washington road. This is about 650 yards northwest of the central hill. The few pieces of the peridotite lying near this well are just as likely to have been brought there from the neighboring hill by some former inhabitant of the now vacant cabin, as to have come from the excavation.

In conclusion we can merely repeat that Pike County has a genuine diamond mine, but its probable value cannot even be estimated until after hundreds of tons more of the rock have been thoroughly screened and sorted, the actual percentage value of diamond per ton ascertained, and the decomposing factor of the harder "blue ground" actually determined.

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