PERIDOTITE DIKES IN SCOTT COUNTY, ARKANSAS.

By HUGH D. MISER and CLARENCE S. ROSS.

LOCATION AND HISTORY.

An exposure of peridotite in the bank of Freedom Creek, a tributary of Dutch Creek, in the eastern part of Scott County, Ark., was discovered about 1909 by W. M. Taylor. In 1916 and subsequent years the peridotite was prospected by test pits, known as the Dutch Creek peridotite mines, opened by different firms and companies, including W. M. Taylor & Co., Baggaly & Barnes, and the New Mexico & Arkansas Oil & Diamond Mining Co. The prospectors hoped to find diamonds or other minerals of value. Considerable money has been spent in digging test pits and in making analyses, but no diamonds or anything else of value, so far as the writers know, have been found.

The openings were visited December 14, 1917, by Mr. Miser, who made the accompanying sketch geologic map. Specimens of the peridotite from the openings have been studied by Mr. Ross. An examination of the general geology of the region was made in August, 1911, by A. H. Purdue and Mr. Miser.

The peridotite occurs in secs. 3 and 4, T. 3 N., R. 26 W., about 3 miles west-southwest of Blue Ball post office and the same distance north-northeast of Olio post office. The prospects are near the Danville-Waldron road, 25 miles west-southwest of Danville, Yell County, Ark., on the Chicago, Rock Island & Pacific Railway, and 20 miles east of Waldron, the county seat of Scott County, on a branch of the Kansas City Southern Railway. (See fig. 63.) These two towns are the most convenient railroad points from which the locality may be reached. The peridotite is in the wide stream flats of Dutch Creek and its tributary Freedom Creek. (See fig. 64.) Dutch Creek, a perennial stream, flows east-northeastward and enters Petit Jean Creek, a tributary of Arkansas River, near Danville, Ark. The valley of Dutch Creek near Olio and Blue Ball is nearly 2 miles wide and is straight. The altitude of its stream flat is about 500 feet. The south side of the valley is formed by a straight sharp ridge called Dutch Creek Mountain, attaining an altitude of 1,750 feet; and the north side is formed by Petit Jean Mountain, another

ridge, which attains an altitude of 2,600 feet. The slopes of these mountains are steep, though their lower parts are broken by low straight foothill ridges.

ROCKS ASSOCIATED WITH THE PERIDOTITE.

The valley of Dutch Creek is underlain by a thick bed of black clay shale in the upper part of the Atoka formation, which is of

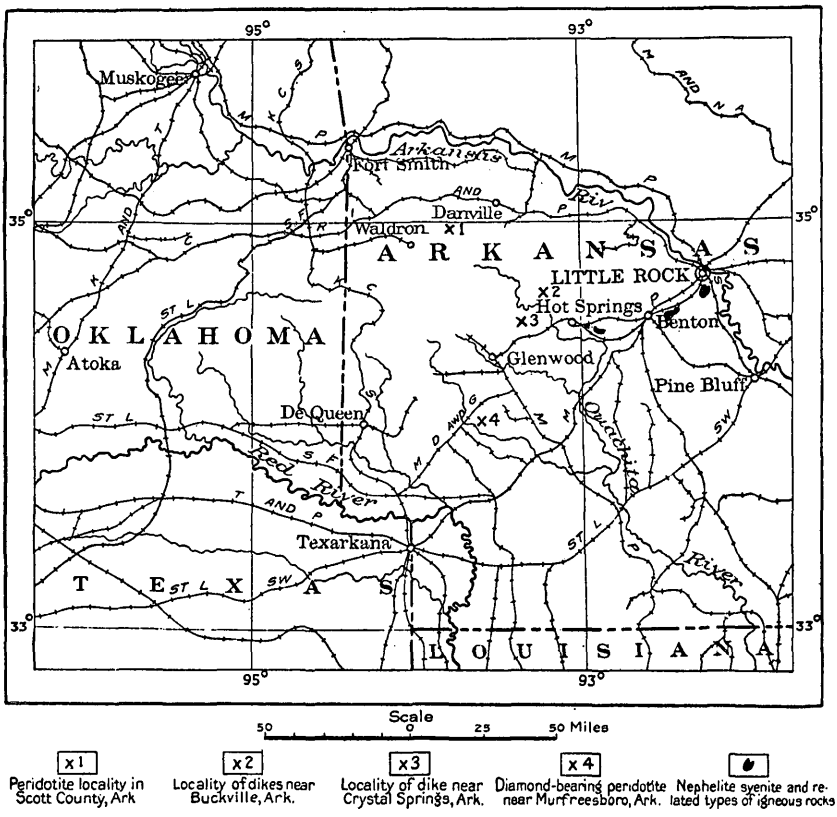

FIGURE 63.—Map showing location of peridotite in Scott County, Ark.

Pennsylvanian age. The shale dips at angles of 40° or more toward the north and is estimated to be fully 4,000 feet thick. Heavy beds of brown sandstone interbedded with some black shale, also in the Atoka formation, though at a lower horizon in it, are exposed in Dutch Creek Mountain, but their base does not reach the surface. The beds of sandstone and shale thus exposed in this mountain are at least 3,000 feet thick and have an anticlinal structure; they dip 40°–45° S. on the south slope of the mountain and 60°–70° N. on the north slope.

Sandstones and shales that are younger than the Atoka formation are exposed on the north side of the Dutch Creek valley and on the

south slope and summit of Petit Jean Mountain. The lowest beds, which are exposed farthest south, dip about 40° N., and the youngest beds, which cap the mountain, are horizontal, whereas the beds on the north dip southward. The structure of the rocks in the mountain is therefore synclinal. These shales and sandstones are several thousand feet thick and are of the same age as the Hartshorne, McAlester, and Savanna formations, which have been studied farther north and west in the Arkansas coal field.[1]

A bed of stream gravel and loam, probably of Quaternary age, conceals the shale in the upper part of the Atoka formation in the

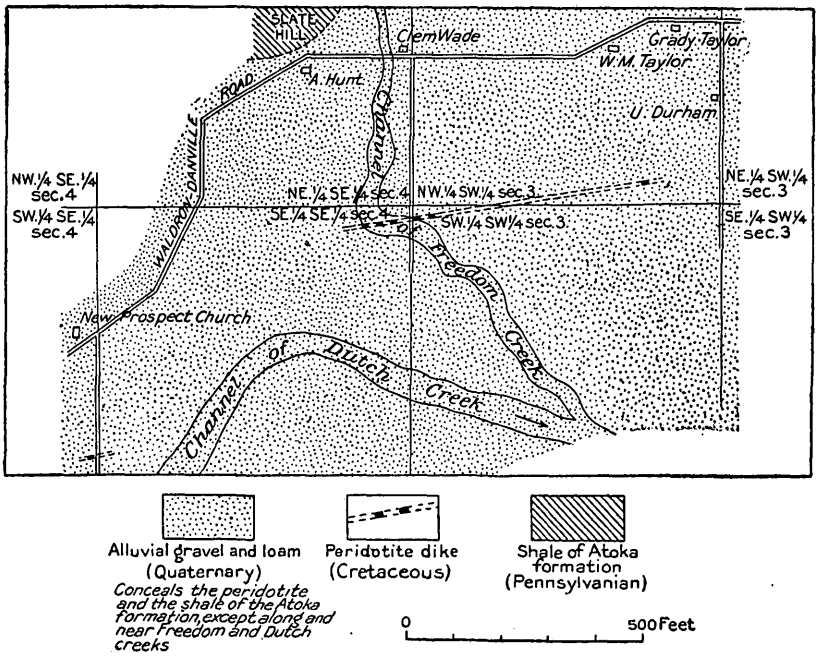

FIGURE 64.—Sketch geologic map of a part of secs. 3 and 4, T. 3 N., R. 26 W., in the valley of Dutch Creek, Scott County, Ark., showing the occurrences of peridotite.

stream flats of Freedom and Dutch creeks near the occurrences of peridotite, but there are a few exposures of shale along and near the channels of these streams, The gravel and loam are as much as 8 feet thick, and the gravel consists of subangular pebbles and cobbles of sandstone.

THE PERIDOTITE.

The peridotite was first discovered in the bank of Freedom Creek. It was later revealed by prospecting at other places in and near the gravelly channel of the creek, in a direction about N. 82° E. of the exposure first discovered. A pit dug at a point almost 1,000 feet farther east in this direction also revealed peridotite. All these

[1] Collier, A. J., The Arkansas coal field: U. S. Geol. Survey Bull. 326, 1907.

openings therefore appear to be on a single dike. The dike was encountered after passing through as much as 8 feet of stream gravel and loam and was then penetrated for a few feet. Where the dike was observed in the openings on Freedom Creek it has a width of 5½ feet, which is said to be the average width, though a maximum width of 6½ feet is reported. The few observed exposures indicate that both the dike and the shale dip 70°–75° N. These observations, together with the apparent trend of the dike, which is the same as the strike of the sandstones on the north and south sides of the valley, indicate that the dike is parallel with the bedding of the shale and that it is therefore in reality a sill. The shale on either side of the dike resembles that at some distance away from the dike and has therefore not been metamorphosed to an appreciable extent. The dike for a depth of 3 to 5 feet below the gravel bed has weathered to a soft yellow-green earth, which contains a very little hard unweathered rock, but at a greater depth there was very little earth mixed with the hard rock.

Peridotite has also been found a quarter of a mile to the southwest in a pit 10 feet deep. At this place the peridotite forms a dike 1 foot wide, which dips 80°–85° N., parallel with the bedding of the shale, and which is overlain by 3 to 4 feet of gravel and loam. It has weathered to a brown earth in which no fragments of hard rock were visible at the time of examination, but such fragments are said to have been found. The trend and location of the dike at this exposure indicate that it is not a part of the dike that lies farther to the northeast but is a separate dike. The character of the weathered rock indicates that it is similar to the rock that is exposed in and near Freedom Creek.

All the specimens of peridotite obtained by Mr. Miser are from the openings in and near Freedom Creek, and presumably all the specimens sent to him by James H. Baggaly are from the same locality. A description of the specimens is given in the following paragraphs.

The rock, as represented by the specimens, is nearly black and contains black aggregates of serpentine reaching 8 millimeters in length and grains of phlogopite averaging 1 millimeter in diameter. Between the grains of phlogopite is a very fine-grained black groundmass. The rock is dense and compact when fresh and has a dull dark-greenish color when slightly weathered. A few angular inclusions of black shale, as much as 2 inches in their longest dimension, are present in some of the specimens.

Microscopic examination of thin sections of the rock shows that it is composed essentially of serpentine derived from olivine in a groundmass of poikilitic phlogopite, with accessory calcite and magnetite. (See Pl. VII.)

PLATE VII.

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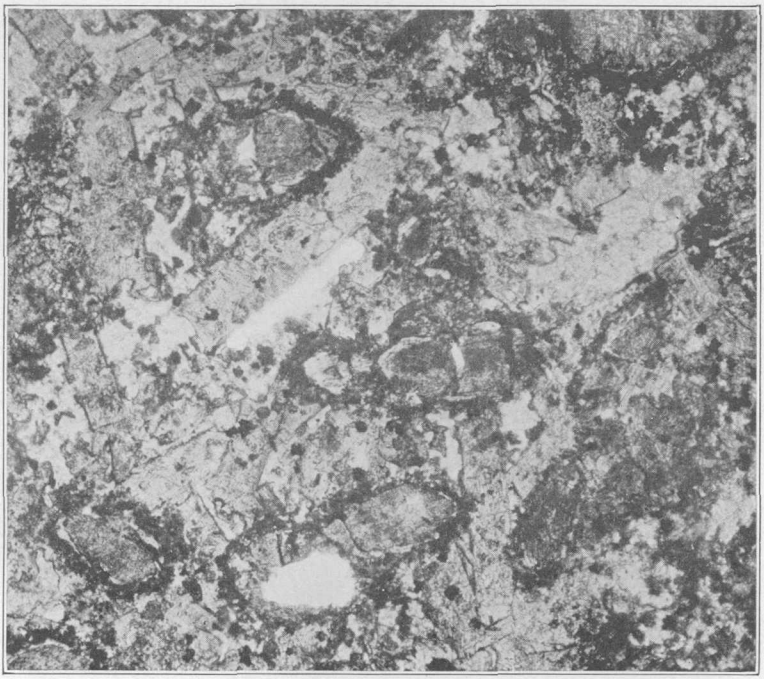
A, Photomicrograph of peridotite dike near Olio, Scott County, Ark. Dark-gray phenocrysts are olivine surrounded by rims of phlogopite with abnormal absorption. Light-gray rectangular phenocrysts are normal phlogopite. The phenocryst near left-hand margin is normal phlogopite with a narrow, sharp outer margin of darker phlogopite with abnormal absorption. Light-colored areas between phenocrysts are calcite. Enlarged 25 times.

B, Photomicrograph of peridotite dike near Olio, Scott County, Ark. Large phenocryst of olivine entirely altered to serpentine. The dark borders around phenocrysts are reaction rims composed of phlogopite with abnormal absorption. Rectangular crystal between large and small phenocryst near lower border is normal phlogopite. Very light colored areas are calcite. Black grains magnetite. Enlarged 15 times.



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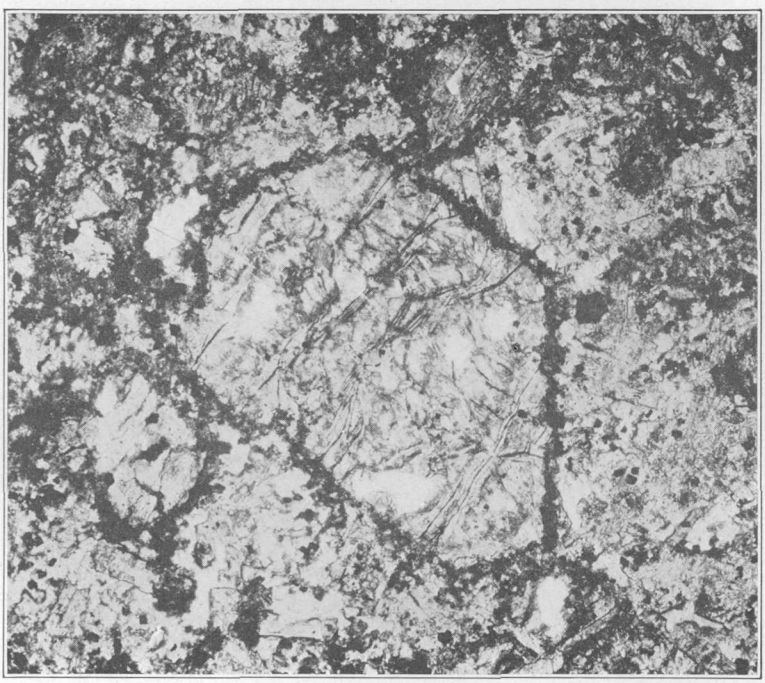

B.

PHOTOMICROGRAPHS OF PERIDOTITE DIKE NEAR OLIO, SCOTT COUNTY, ARK.

Most of the phlogopite occurs in large subhedral to euhedral plates, which have a maximum length of 1.5 millimeters and a thickness of 0.2 to 0.25 millimeter. It is poikilitic and incloses crystals of magnetite, a few very small needles of rutile, and irregular areas of calcite. The mineral is strongly pleochroic, with the absorption Y and Z<X (ordinary micas have Y and Z>X); X, light reddish brown; Y and Z, very light green. A later mica forms narrow zones around the phlogopite phenocrysts and small grains in the groundmass. This later mica has the same unusual absorption but is much darker. X is light olive-green; Y and Z are bright reddish brown.

Olivine is almost completely altered to serpentine, and only a few small areas of fresh olivine remain. Most of the olivine was partly resorbed, as the serpentine areas are distinctly rounded. A distinct reaction rim of the later deeply colored phlogopite surrounds the serpentine.

Magnetite occurs in small euhedral grains, most of them included in phlogopite, and as minute grains which have resulted from the alteration of olivine to serpentine.

Angular areas between euhedral crystals of phlogopite are filled with calcite. The only mineral inclosed in the calcite is the dark mica grains, and small areas of calcite also occur in the larger crystals of phlogopite. The relations do not give any evidence as to the origin of this calcite.

The serpentine is coarsely crystalline, and many small veinlets of fibrous serpentine (chrysolite) occur. Light-colored veins in the rock are composed of calcite with a fibrous habit. Smaller veins are composed of zones in which crushed phlogopite and flakes of calcite are the principal components.

Another specimen from the same locality but from a different part of the dike has essentially the same composition, except that there is a small proportion of nephelite. The nephelite occurs in partly altered euhedral crystals that reach a maximum diameter of 0.5 millimeter.

The peridotite in Scott County is very similar to the diamond-bearing peridotite near Murfreesboro, in Pike County, Ark.,[2] which is 63 miles to the south. It is also similar to the biotite monchiquite that occurs as dikes associated with the nephelite syenites and related types near the center of the State.[3] Four dikes of syenitic rock (tinguaite) lie near Buckville, Garland County, 33 miles southeast of the Scott County peridotite, and a dike of biotite monchiquite

[2] Miser, H. D., and Ross, C. S., Diamond-bearing peridotite in Pike County, Ark.: U. S. Geol. Survey Bull. 735–I, 1922.

[3] Williams, J. F., and Kemp, J. F., The igneous rocks of Arkansas: Arkansas Geol. Survey Ann. Rept. for 1890, vol. 2, 1891.

near Crystal Springs, Garland County, is 36 miles southeast of the Scott County peridotite,[4] and these are the nearest known occurrences of these rocks.

ECONOMIC FEATURES.

The similarity of the peridotite to the diamond-bearing peridotite in Pike County, Ark., suggests at once the possibility that diamonds may also be found in Scott County. Search has been made for them there, but no diamonds or other minerals of value have been found. Should diamonds be found they could not be recovered economically on account of the narrowness of the dikes and the great hardness of the peridotite found after a few feet of the soft weathered material is passed through. Dikes of soft, decomposed peridotite are diamond-bearing at some places in South Africa, and attempts have been made there to recover the diamonds, but the mining of the diamond-bearing peridotite in such dikes was not profitable.

[4] Williams, J. F., and Kemp, J. F., op. cit., pp. 409–410.