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Issued April 8, 1912.

United States Department of Agriculture,

BUREAU OF SOILS—CIRCULAR No. 62.

MILTON WHITNEY, *Chief of Bureau.*

UNITED STATES DEPARTMENT OF AGRICULTURE,
Washington, D. C., January 27, 1912.

SIR: I have the honor to transmit herewith the manuscript of a report covering investigations of the Lyon nitrate prospect near Queen, N. Mex., by E. E. Free, of this bureau, and to recommend that it be published as Circular No. 62 of the Bureau of Soils.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

REPORT OF A RECONNOISSANCE OF THE LYON NITRATE PROSPECT NEAR QUEEN, N. MEX.

By E. E. FREE.

The prospect is located in Dark Canyon on the eastern slope of the Guadalupe Mountains in Eddy County, N. Mex. It is 4½ miles up the canyon (west) from the ranch of W. E. Thayer, and is about 6 miles due east (no direct road) from the post office of Queen, N. Mex. It is probably in township 24 south, range 23 east, New Mexico principal meridian. but this is not certain, as time was not taken for the finding of corners or the running of accurate surveys. So far as known the prospect is on public land. It has been located and monumented as a placer claim. The prospect is probably a mile or two inside the eastern boundary of the Guadalupe National Forest, though this is uncertain. The elevation, as determined by aneroid from the railway at Carlsbad, is 5,250 feet above sea level.

The prospect is reached by road from Carlsbad, via the main road to Queen, N. Mex., as far as the mail box of W. E. Thayer, 10 miles east of Queen. From here one follows a private road to the Thayer ranch (1¼ miles) and then a private road or trail up Dark Canyon for about 4½ miles. The distance from Carlsbad by road is 39 miles, of which about 30 miles is good road and 3 miles more is fair, while the last 6 miles (after leaving the main road) is very bad. The last half mile must be traveled horseback or afoot. It would be possible, however, to make a fair road at comparatively small expense.

Where the prospect is located Dark Canyon is cut into the extensive series of light-colored limestones and sandstones covering the whole eastern slope of the eastward dipping monocline that forms the Guadalupe Mountains. Even the sandstones of this series are prevailingly calcareous and the series is provisionally called Creta-

FIG. 1.—View of end of point upon which nitrate outcrops occur, showing typical series of strata.

ceous, though this correlation is only tentative. No fossils were found. There are a few meager exposures of a red, indurated argillite, but its relation to the rest of the series was not determined. All strata dip gently toward the east with occasionally a small amount of local folding or faulting. The slope is dissected by many steep-walled canyons, in which perhaps 300 feet of the Cretaceous (?) series are exposed. The general character of the series is shown in figure 1.

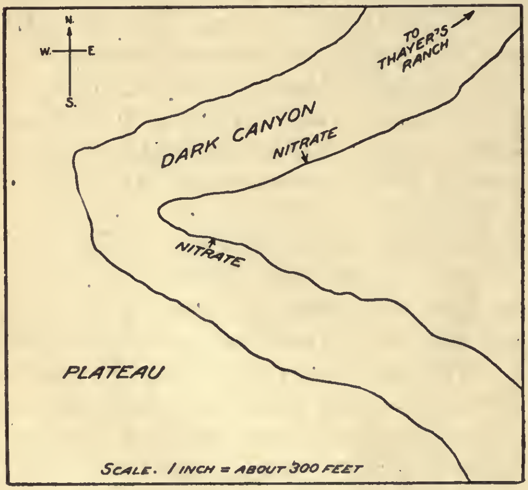

FIG. 2.—Sketch of Dark Canyon, showing location of nitrate deposits.

The nitrate prospect is located at the bottom of the wall of Dark Canyon, on both sides of a small point formed by a bend of the canyon, as is indicated by the rough sketch map, figure 2. At this point the canyon is perhaps 200 feet deep, and is set in rocks which do not seem to differ in any way from those of the mountain slope in general. The section on both sides of the point is essentially the same (the dip being insignificant) and is as follows:

1. Limestones and sandstones of the usual series, not examined in detail—about 200 feet.
2. Hard arenaceous limestone, honeycombed with many small cavities 1 inch to 2 inches in diameter and containing crusts of crystalline calcite—1 to 3 feet.
3. Soft, easily weathered calcareous sandstone—2 to 4 feet.
4. Harder limestone, more calcareous than No. 3—1 to 3 feet.
5. Arenaceous limestone, with soft, easily weathered spots, also showing a few of the cavities characteristic of No 1—5 to 10 feet.
6. Hard oolitic limestone (exposed on the north side of the point only)—4 feet.
7. Talus.

Parts of the section are shown in figures 3 and 4.

Thin sections from specimens of No. 5 and No. 6 have been prepared and examined by Prof. J. C. Jones, of the Mackay School of

FIG. 3.—View of nitrate-bearing exposure on north side of point, showing weathering into strata Nos. 3 and 5 of the section.

Mines. He reports that No. 5 is an arenaceous limestone with rounded quartz grains 0.1 millimeter in diameter, forming about 25 per cent of the entire rock. Blotches of iron oxide occur irregularly distributed through the specimen and some kaolin is also present. The calcite occurs in part as a microcrystalline cement and in part as crystalline grains of diameters up to 0.3 millimeter. No. 6 is an oolitic limestone with many rather angular quartz fragments usually occurring as nuclei of the oolitic grains. Some of the calcite has been recrystallized and serves as cement. The oolitic grains vary from 0.1 millimeter to 0.2 millimeter in diameter.

The visible nitrate occurs as a very thin efflorescence on the surface of Nos. 3, 4, and 5 of the section. Nitrate can also be detected by taste in parts of the rock on which no efflorescence is visible. Twenty-eight samples were taken, the effort being to have them representative of the rock itself rather than of the film of surface efflorescence which covers it. These samples have been analyzed by Mr. A. R. Merz, of the Cooperative Laboratory of the Mackay

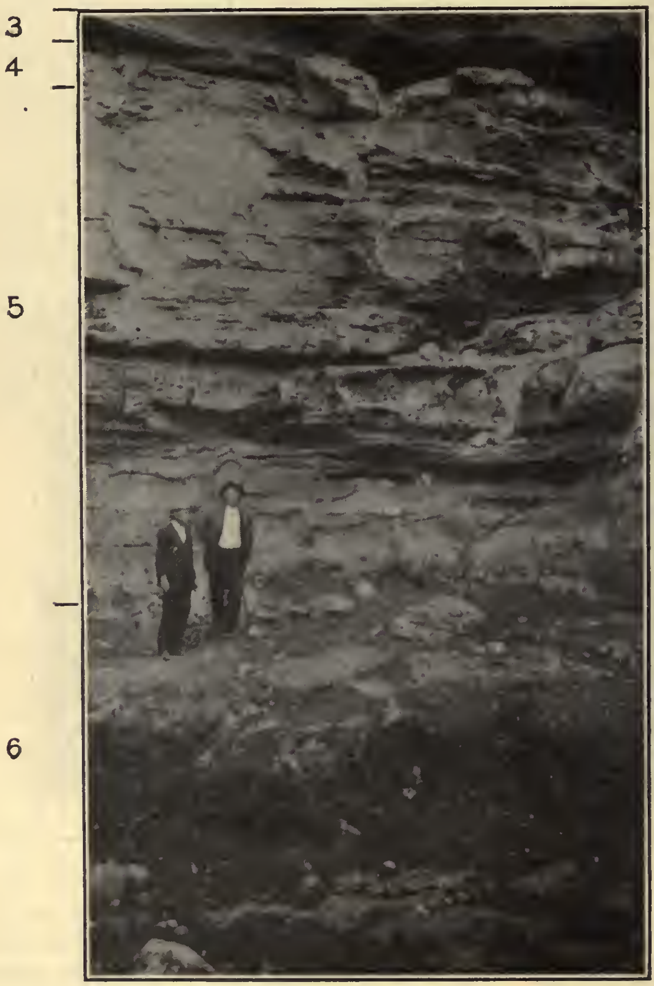

FIG. 4.—View of nitrate exposure on north side of point, showing erosion of stratum No. 5 (below), and No. 3.

School of Mines, United States Bureau of Soils, and Geological Survey, at Reno, and found to contain the following percentages of potassium nitrate:

1. From the exposure on the north side of the point.
   Four specimens from No. 3 of section, 0.67, 0.04, 0.84, and 1.68 per cent.
   Six specimens from No. 4 of section, 0.44, 1.18, 1.30, 1.30, 1.68, and 2.24 per cent.
   Four specimens from No. 5 of section, 0.82, 0.89, 1.44, and 2.12 per cent.

2. From the exposure on the south side of the point:
   Three specimens from No. 2 of the section, 0.33, 0.95, and 1.30 per cent.
   Two specimens from No. 3 of the section, 1.01 and 1.12 per cent.
   Four specimens from No. 4 of the section, 0.67, 1.30, 1.78, and 3.20 per cent. (The last two specimens showed surface efflorescence and can not be considered as representative of the rock.)
   Five specimens from No. 5 of the section, 0.23, 0.39, 0.78, 0.95, and 1.13 per cent.

The average of all analyses is 1.16 per cent potassium nitrate. Excluding the two samples which carried visible surface efflorescence, as noted above, the average is 1.04 per cent potassium nitrate.

It is not possible to be certain as to the origin of the nitrate, but it seems very probable that it is derived, either directly or through bacterial alteration from the excrement of animals (including, perhaps, birds and bats), which have occupied the cavities in stratum 2 of the section, or the more or less sheltered holes and ledges weath-

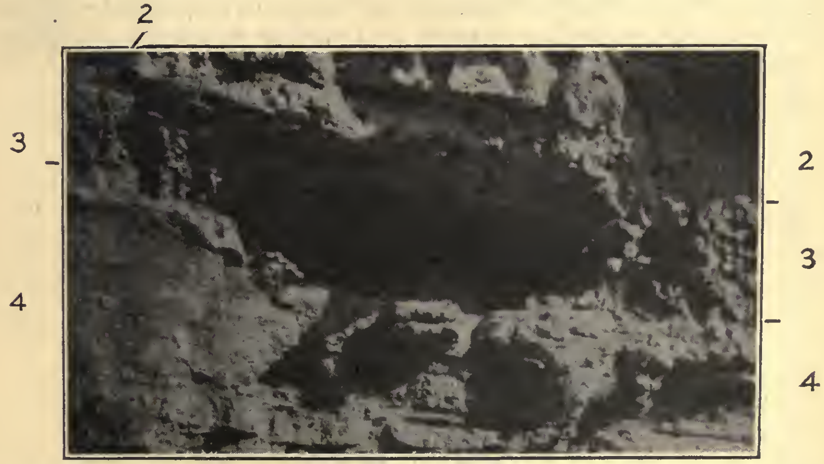

FIG. 5.—View of hole eroded into stratum 3 at nitrate exposure on south side of point. Also shows calcite-lined cavities in stratum 2.

ered into strata 3 and 5, as shown in figures 3 and 5. No guano is visible in these cavities, but partially eaten nuts prove the presence of squirrels or similar rodents. It is possible also that caves containing larger quantities of animal refuse may exist in the superimposed limestones, and that nitrate therefrom may have leached downward and impregnated the strata in which it is now found. A superficial inspection failed to disclose any such caves, but no careful search was made. The hypothesis of animal origin is strongly favored by the fact that the nitrate is entirely of potassium rather than of sodium. So far as the writer is aware, potassium nitrate has never been discovered in nature otherwise than as the product of the alteration of animal excrement and remains.[1] Furthermore, any other

[1] It should be noted that Ochsenius regards the potassium nitrate deposits of Hungary as formed by reaction between organic matter and mother liquors residual from the evaporation of sea water, but this theory has never gained general acceptance.

hypothesis is negatived by the nature of the rock in which the material is found. This rock is almost certainly of marine origin, and largely the result of chemical precipitation under water. It is nearly inconceivable that primary nitrate would be associated with it, and there is no known reaction or process by which nitrate could have been formed secondarily within its mass.

But whatever may be the source of the nitrate, it is obvious that there is not enough of it to have any important commercial value. The surface rocks as sampled contain too little material to be profitably worked by any known method or any method likely to be discovered, and there is no reason to believe that the rock would increase in grade as one penetrated within it. Indeed I am of the opinion that the reverse would be the case, and that the portions at and near the surface contain more nitrate than the rock within. This follows from the tendency of percolating waters to concentrate all soluble materials, including nitrates, at a surface where they undergo evaporation.

Approved.

JAMES WILSON,

Secretary of Agriculture.

WASHINGTON, D. C., *January 29, 1912.*

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