suggested by Dr. H. D. Holland, and was carried out at Princeton University during 1951 and 1952. Dr. Holland and Dr. H. H. Hess showed a continued interest during the course of the work. The writer is indebted to them for many helpful suggestions and for critically reading the manuscript.

Reference

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URANOTHORITE NEAR FOREST HOME, SAN BERNARDINO COUNTY, CALIFORNIA*

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The intensive search for uranium in southern California during recent years is yielding discoveries of some uncommon uranium and thorium minerals, some of which occur under unusual or unique geologic environments. The presence of uranium minerals near Forest Home, San Bernardino County, was brought to the attention of D. F. Hewett early in 1955 by Pierre George, an amateur collector of minerals, of San Gabriel. After some preliminary tests of the materials collected by Mr. George, the area was visited by D. F. Hewett in April. Laboratory work by Jerome Stone and others of the U. S. Geological Survey has confirmed the presence of uranothorite and several other thorium-bearing minerals at several localities near Forest Home.

Forest Home P. O. is on the south side of Mill Creek, due south of San Bernardino Mountain, in the principal valley that drains the south slopes of San Bernardino Mountain (Fig. 1). Eastward from Forest Home, the successive tributaries of Mill Creek from the north are Lost Creek, Alger Creek, and Falls Creek. The uranothorite locality is an opencut on the east slope of Alger Creek valley about 300 feet above the creek and about 3,000 feet north of the point where Alger Creek joins Mill Creek. A rough road follows Alger Creek to an ore bin, and a chute extends up the slope to the opencut. The opencut is about 30 feet long and it is limited by a vertical wall about 15 feet high. During 1954, a few tons of material, probably less than 10 tons, were sorted and shipped for its content of uranium. The names of the owners or shippers are not known.

At another locality, higher on the ridge west of Alger Creek, several

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prospect pits have yielded similar material but no ore has been shipped; several claims have been located by Mr. Gilliam and associates of Rialto, Calif.

The eastern half of the San Bernardino Mountains is within the San Gorgonio quadrangle, the geologic features of which have been studied and described by Vaughan (1922). According to Vaughan, Mill Creek valley coincides with a large fault, one of the San Andreas fault zone.

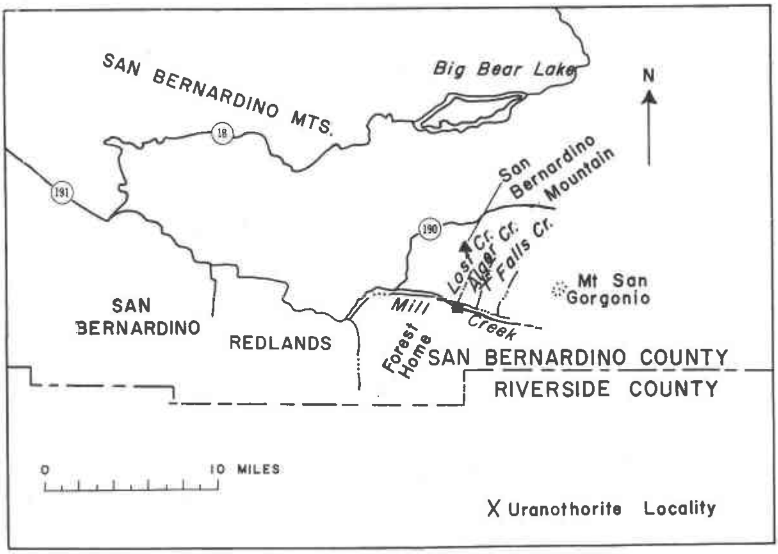

Fig. 1. Index map of Forest Home Area, San Bernardino County, California.

San Bernardino Mountain lies within an area about 4 by 7 miles, north of the fault, underlain by probable Precambrian "undifferentiated schists," which range from thinly laminated biotite schists to fine-grained gray granite gneiss. Along Alger Creek, the lamination trends west to northwest and dips southwest to steeply northeast; at the open-cut east of Alger Creek, the strike of the lamination is N. 30° to 40° W. and the dip is 35° to 40° SW.

The large body of schist and gneiss which includes San Bernardino Mountain is surrounded by and probably underlain by younger "heterogeneous plutonic rocks" of undetermined but probably Mesozoic age. These rocks have not been found along Alger Creek and Lost Creek. Cactus granite (Vaughan, 1922), probably of Jurassic age, underlies large areas on the north slopes of the San Bernardino Mountains, but is not known along Alger Creek.

On the ridges east and west of Alger Creek, the prevailing gray granite gneiss is sporadically replaced by reddish-brown feldspar in such a manner that specimens of the resulting rock resemble pegmatite. These bodies of rock, however, do not have the sharply defined boundaries commonly shown by bodies of pegmatite. In the opencut east of Alger Creek, the body of reddish-brown feldspathic rock is roughly lenticular with the larger dimensions parallel to the lamination of the gray granite gneiss; the maximum thickness is about 15 feet. The borders of this lens are not sharp but show gradual transition into the gneiss. All uranothorite thus far found is within the reddish-brown feldspathic rock; at no place nearby is the gneiss radioactive.

The explored body of reddish-brown rock is largely feldspar and quartz, but it contains sporadic poorly defined lenses of dark minerals. The most abundant feldspar is microcline, but a little orthoclase and microperthite are widespread; a little sodic plagioclase also is present. Curved laminae composed of plates of biotite are present in the feldspathic rock. The most abundant dark mineral is magnetite in lenticular aggregates of small grains; ilmenite has not been noted. Intimately associated with the magnetite are small crystals and grains of allanite, uranothorite, and zircon. The quantities of dark minerals in the feldspathic lens vary greatly from place to place. Some layers are wholly magnetite and show no radioactivity; other layers, an inch or more thick contain as much allanite and uranothorite as magnetite.

Allanite was identified by an x-ray diffraction pattern; a spectrographic analysis by K. E. Valentine of the U. S. Geological Survey is as follows:

Over 10 per cent—Si
5–10 per cent—Fe, Ce
1–5 per cent—La, Nd, Al, Ca
0.5–1.0 per cent—Pr, Th
0.1–0.5 per cent—Mn, Y

This mineral has a high magnetic susceptibility and was therefore easily removed from the sample. All of the allanite was concentrated in the magnetic fraction of the Frantz isodynamic separator at vertical and horizontal settings of 10 degrees and 0.3 ampere.

Uranothorite is dark brown and has a greasy to adamantine luster. It has a mean index of refraction of 1.79. The magnetic susceptibility of uranothorite and zircon were about the same, because they were concentrated in the magnetic fractions at the vertical and horizontal settings of 10 degrees and 0.7 ampere. Superficially the two minerals have a similar physical appearance, but uranothorite is dark brown and commonly occurs as anhedral grains and subhedral crystals; zircon is pale brown and occurs as small subhedral to euhedral tetragonal prisms in aggregates of magnetite, allanite, and biotite. The uranothorite was hand-picked and identified by an x-ray pattern. A spectrographic analysis by Helen Worthing of the U. S. Geological Survey is as follows:

Over 10 per cent—Si, Th
5–10 per cent—U
1–5 per cent—Al, Fe, Pb
0.1–1.0 per cent——

Recently, Neuerberg (1954) has described the mineralogy and features of a large pegmatite dike that crops out on the south wall of the South Fork of Pacoima Canyon, Los Angeles County, Calif., about 90 miles west of the Alger Creek deposits. The pegmatite in Pacoima Canyon contains an assemblage of minerals similar to that here described, including very large euhedral crystals of allanite and zircon, and much smaller crystals and grains of uranothorite; it also contains sparse grains of beryl and apatite which are not recognized at Alger Creek. In contrast, however, the pegmatite in Pacoima Canyon presents definite, sharp boundaries to the host rock, norite, which is a border phase of a large mass of anorthosite, whereas the Alger Creek body is much smaller and shows transitional boundaries to the host rock, granite gneiss.

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IDENTIFICATION OF THE 14 Å CLAY MINERAL COMPONENT

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In clay mineral identification an $00l$ spacing of 14 Å which does not expand with glycerol treatment is attributed to chlorite and/or vermiculite. Differentiation is accomplished in several ways; one is based on the collapse of the 14 Å spacing to 10 Å when vermiculite is saturated with potassium. It has been reported that vermiculite found in some soils resists collapse by this method when a salt such as KCl is used. Collapse has been achieved when hot KOH+KCl or NH_4F were used (2, 4). However, both treatments are relatively drastic. Rich (4) reports that NH_4F should be limited to five minutes to minimize clay destruction and that prolonged treatment with KOH+KCl was also found to be destructive.