GEOLOGICAL SURVEY CIRCULAR 291

A URANIUM-BEARING RHYOLITIC TUFF DEPOSIT NEAR COALDALE ESMERALDA COUNTY, NEVADA

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UNITED STATES DEPARTMENT OF THE INTERIOR
Douglas McKay, Secretary

GEOLOGICAL SURVEY
W. E. Wrather, Director

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ABSTRACT

A small deposit of uranium-bearing rhyolitic tuff is exposed at the northern end of the Silver Peak Mountains about 4 miles south of Coaldale in Esmeralda County, Nev. The deposit consists of weakly mineralized welded tuff containing veinlets and small irregular pods of higher grade uranium-bearing rock. The conspicuous ore minerals are autunite and phosphuranylite, which coat some fractures and partly fill some feldspar crystal cavities in the tuff. Uranium is also present in small amounts in siliceous material that occurs as scattered veinlets and as matrix of a breccia pipe. Numerous limonite-stained joint surfaces on the welded tuff also contain small amounts of uranium. No identifiable uranium minerals were found in the siliceous vein material or in the limonite-stained fracture coatings. Several samples collected from weathered outcrops contained from 0.002 to 1.86 percent uranium.

INTRODUCTION

In the course of examining lignitic shale deposits about 4 miles south of Coaldale, Nev. (fig. 1), a deposit of uranium-bearing rhyolitic tuff was found and examined in reconnaissance in mid-October 1951 by N. M. Denson and D. C. Duncan. The deposit was found by using a portable gamma scintillation detector to trace slightly radioactive gravels in dry washes to the bedrock sources of the gravel. The locations given in this report were made by compass intersection and by the use of geologic maps of the nearby lignite field which served as general bases. Ten representative samples of the deposit were analysed by the Geological Survey. Specimens collected for mineral identification were examined by Maurice Deul, and the welded tuff was examined petrographically by Clarence Ross, of the Geological Survey.

Location

The uraniferous tuff deposit, accessible by 3 miles of dirt road leading south from the junction of U. S. Highways 6 and 95 (fig. 1), is near the south line of the NE$\frac{1}{4}$ sec. 33, T. 2 N., R. 37 E., Mount Diablo meridian on privately owned patented coal land. No evidence of previous prospecting or development of the uranium deposit was noted during the investigation.

Previous work

The general geology of the Silver Peak quadrangle was mapped and described by Spurr (1906). The Tertiary

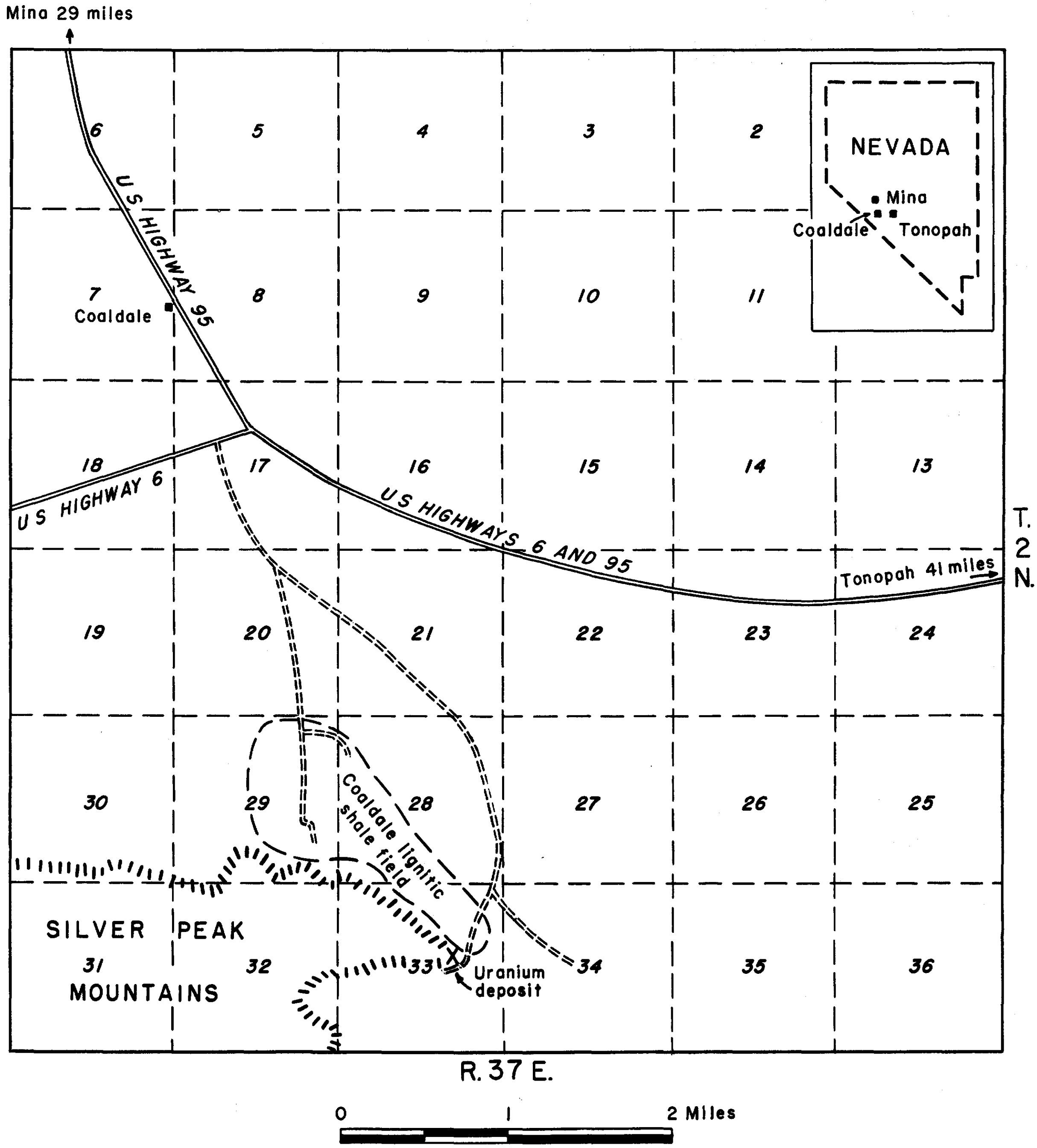

Figure 1. —Map showing location of uranium deposit near Coaldale, Esmeralda County, Nev.

sedimentary rocks of the region were described and assigned to the Esmeralda formation by Turner (1899). Lignitic shale deposits in the Tertiary rocks that crop out north of the uranium deposits were described by Hance (1913) and Toenges and others (1946), and were examined by V. H. Johnson and R. C. Robeck (1944) for the Geological Survey. These earlier reports include considerable data which are useful in interpreting the geology of the area but which do not include direct information on the uranium deposit.

GEOLOGY

Rocks exposed in the northern part of the Silver Peak Mountains are Cambrian and Ordovician marine sedimentary rocks unconformably overlain by Tertiary volcanic rocks and intermontane basin sediments (Spurr, 1906, p. 17-21, and pl. 1). Volcanic rocks, mostly of rhyolitic composition, make up the prominent land forms of the northeastern tip of the mountains (figs. 1 and 3). The Esmeralda formation of Tertiary age is a thick sequence of shale, tuffaceous sandstone, conglomerate, and a few impure lignite beds. The formation is exposed in low foothills along the north flank of the mountains. In this part of the Silver Peak Mountains the Esmeralda formation is in fault contact with the Tertiary volcanic rocks at most places, but near the uranium deposit (fig. 2), the basal part of the formation overlies the volcanic rocks with normal sedimentary contact. Extensive pediment "flats" southeast of the deposit are mostly covered by a thin veneer of alluvium.

Along the northern front of the Silver Peak Mountains a zone of normal faults in echelon trends generally northwest and downdrops the sedimentary rocks of the Esmeralda formation on the northeast against the volcanic rocks on the southwest. The faulted zone is about 2 miles long. Its general location is shown on a map by Hance (1913, pl. 23); part of the faulted belt near the uranium deposit is illustrated in greater detail by Toenges (1946, fig. 1). The uranium deposit (fig. 2) is located near the southeast end of the exposed fault zone. Although the earlier maps show a probable fault passing northeast of the deposit, the presence of such a fault was not confirmed in the present brief examination. About 130 feet northeast of the deposit a thin lignitic shale bed at the base of the Esmeralda formation overlies welded tuff in apparently normal sedimentary contact. A narrow zone between the lignitic shale outcrop and the uraniferous tuff is poorly exposed under a rubble of essentially nonuraniferous rhyolitic tuff. Closely spaced joints in the uraniferous tuff deposit suggest that some minor displacement may have occurred, however, in the poorly exposed rocks just northeast of the deposit.

ORE DEPOSIT

Uranium is irregularly disseminated in siliceous veinlets, in a siliceous breccia pipe, along limonite-stained joint surfaces, and as incrustations of autunite and phosphuranylite in welded rhyolitic tuff at the northeastern tip of the Silver Peak Mountains (fig. 1). The principal exposure of the uraniferous tuff forms a knoll that rises about 50 feet above the adjacent flats. A second smaller mass crops out through alluvium to the southeast. These exposures indicate that the deposit occupies a roughly elliptical area about 400 feet long and as much as 200 feet wide (fig. 2). The deposit is elongate approximately parallel to a fault that trends northwest from a point just north of the deposit. The southeastern limit of the radioactive tuff is concealed by alluvium, but the other better exposed boundaries grade into relatively nonradioactive light-gray tuff of apparently similar general composition. The gray tuff interfingers with other flat-lying red-weathering rhyolitic volcanic rocks, presumably both flows and tuffs, west of the radioactive deposit.

The uranium-bearing part of the tuff is closely jointed (fig. 4); some joints contain veinlets a few inches to a few feet long consisting of light- to dark-gray fine-grained siliceous material. Most joint surfaces are coated with a thin brown limonite veneer that is radioactive.

Composition of tuff

Specimens of tuff taken from wall rock adjacent to a siliceous veinlet are light gray flecked with both dark and light phenocrysts as much as three-fourths inch in diameter. In thin section, the tuff contains crystals of unaltered potash feldspar, phenocrysts of another feldspar replaced by a pale yellowish-green claylike mineral that possibly is sericite or alunite, embayed crystals of smoky quartz, and spherulites of cristobolite. The groundmass is mostly altered to claylike minerals, but in places it contains glass shards. The rock is considered by Mr. Ross to be an altered welded tuff of rhyolitic composition.

Siliceous vein material

The siliceous vein material ranges from black to light gray, with gradational color changes observable within individual veinlets. The contacts of the veinlets with the enclosing welded tuff are sharp. The vein material is unbanded and predominantly glassy material containing numerous microscopic inclusions of the tuff. In places the veinlets contain scattered megascopically visible angular inclusions of tuff. A breccia pipe about 10 feet in diameter at locality 42, figure 2, is composed of angular welded tuff fragments cemented with gray to black siliceous matrix. The dark parts of the vein material contain more uranium than the light parts. Samples of dark vein material contained as much as 0. 26 percent uranium, but no uranium minerals were detected in the samples examined under the microscope.

Ore minerals

Bright yellow powdery uranium-bearing minerals coat fractures and joint surfaces at one place (loc. 32, fig. 2) and form encrustations that partly fill some feldspar crystal cavities in the tuff at localities 31 and 32, figure 2. The yellow mineral was tentatively identified as a mixture of autunite (a hydrous-calcium-uranium phosphate) and phosphuranylite (a lead-calcium-uranium phosphate) by microscopic and spectroscopic tests. From the field relationships these minerals seem to be secondary. No other uranium-bearing minerals were detected in the deposit although the limonite stain of some joint surfaces and the black siliceous vein material contained as much as 0. 26 percent uranium.

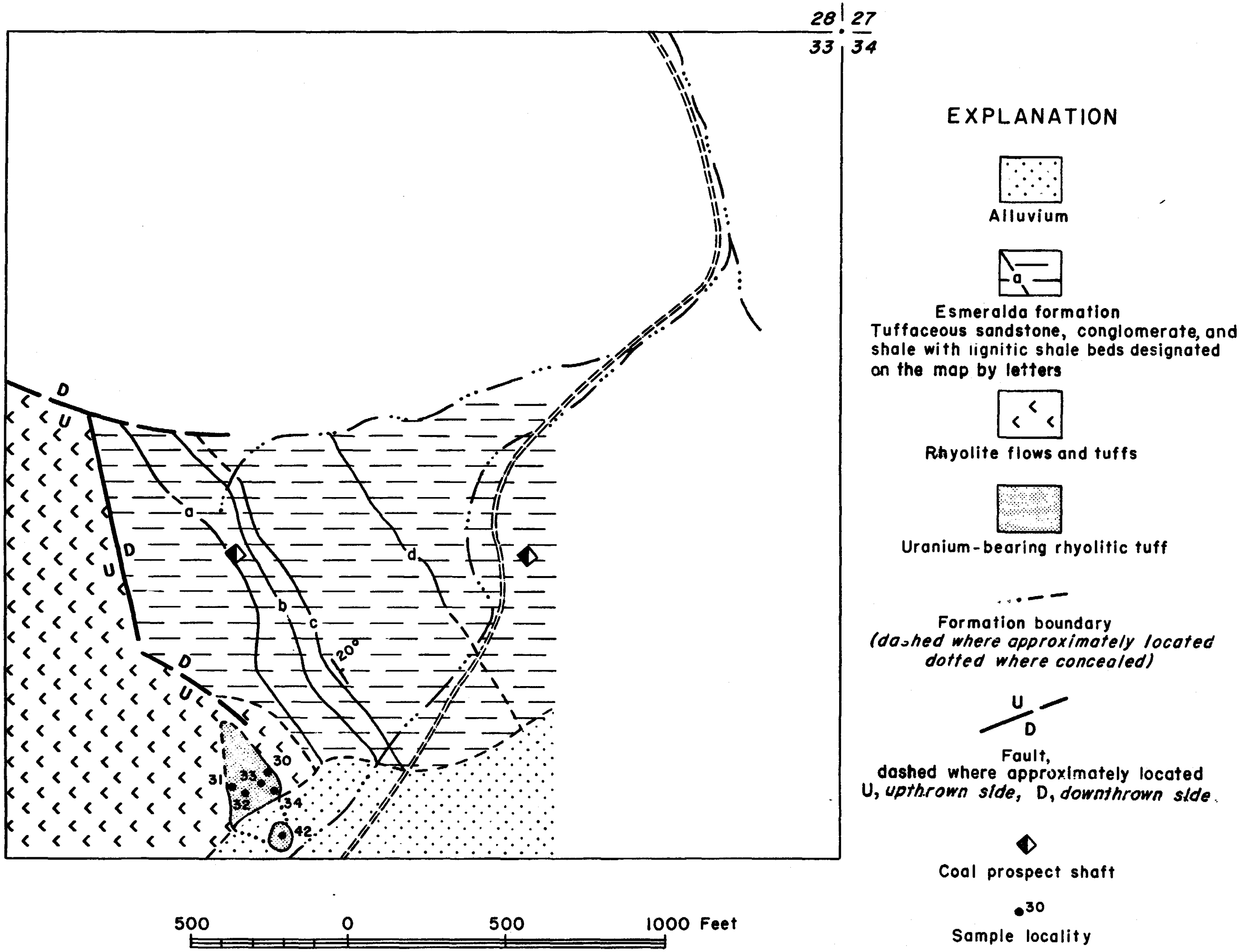

Figure 2.—Geologic sketch map of uranium-bearing tuff deposit NE¼, sec. 33, T. 2 N., R. 37 E., near Coaldale, Esmeralda County, Nev.

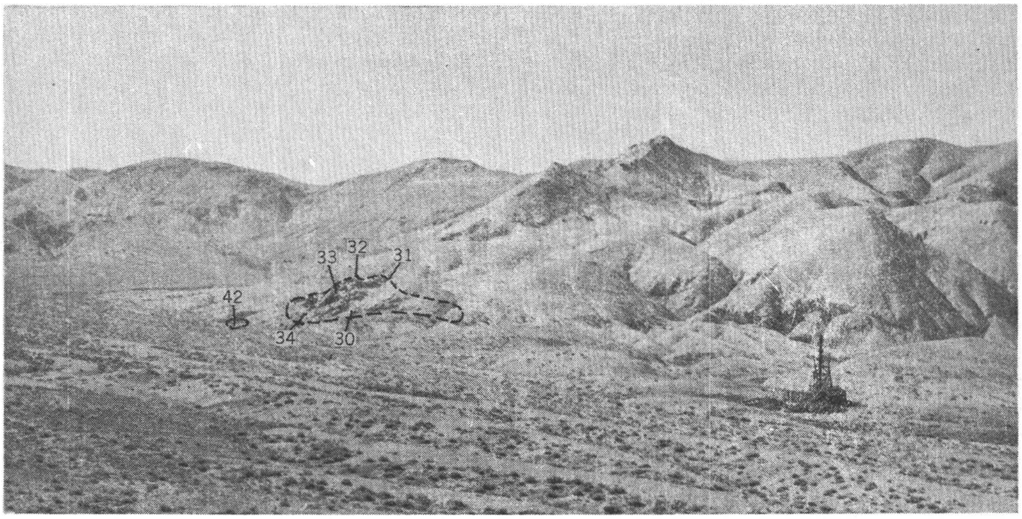

Figure 3. —View of northeastern part of the Silver Peak Mountains, showing the location of uranium-bearing tuff deposit, Esmeralda County, Nev. (outlined). Numbers show locations of samples referred to in text. An abandoned coal prospect is in right foreground. Photographed from ridge about 1 mile northeast of deposit.

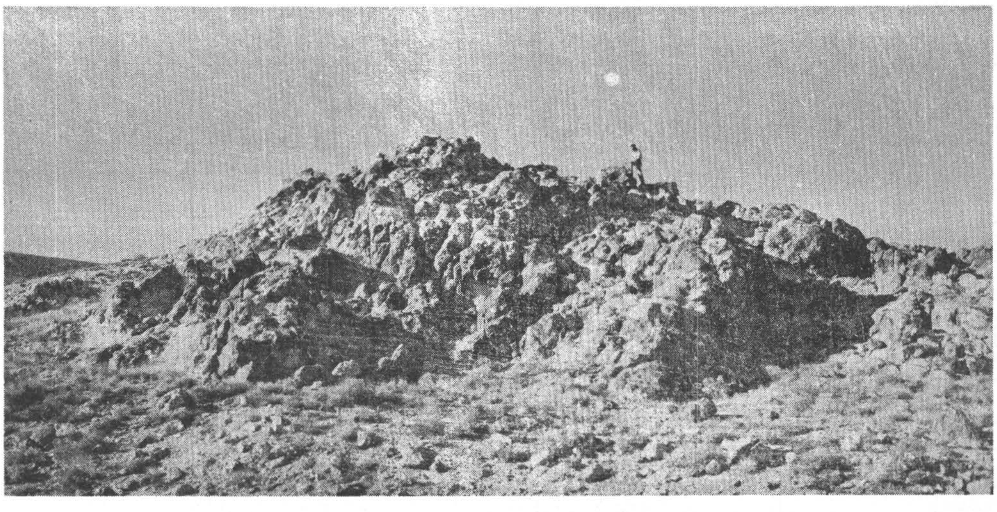

Figure 4. —View of east side of uranium-bearing tuff deposit. Welded rhyolitic tuff exposed on the knoll is closely jointed. Note the iron-stained joint surfaces (dark) that are strongly radioactive and areas of white tuff (light) that are weakly radioactive.

Origin of uranium

The concentrations of uranium in siliceous vein materials and along limonite-stained joint surfaces within the deposit suggest that primary uranium mineralization took place at the time of introduction of siliceous vein material that spread along joint surfaces during or after faulting. The conspicuous uranium minerals, autunite and phosphuranylite, are probably secondary alteration products of other uranium-bearing compounds. The source of the uranium is conjectural. Possibly it was originally disseminated in minute amounts in the volcanic rocks in which the deposit occurs, or possibly it was introduced from another source by hydrothermal solutions.

Radioactivity

The uraniferous tuff deposit was found by use of a portable gamma scintillation detector which showed a higher radioactivity for stream gravels (35 to 60 mr/hr) down drainage from the radioactive tuff as contrasted with the less radioactive lignite-bearing sedimentary rocks of the Esmeralda formation (10 to 20 mr/hr). The more radioactive stream gravels were followed upstream to their source. Measurements of radioactivity with a Geiger counter on the deposit ranged from 5 on the 0.2 scale to 10 on the 20 scale. The light-gray rhyolitic tuff that makes up the bulk of the deposit averaged an estimated 0.008 to 0.009 percent equivalent uranium readings of approximately 10 or 11 divisions on the 0.2 scale of the counter. The limonite-stained joint surfaces, siliceous vein material, and small masses of tuff showing the yellow uranium minerals produced radioactivity estimated to range from about 0.015 to 1 percent equivalent uranium reading of 17 on the 0.2 scale to 10 on the 20 scale of the counter.

Sample data

Chip samples of the rhyolitic tuff taken at four places, away from visible joint or vein surfaces and considered representative of large parts of the deposit, yielded the following analyses:

Locality no.	Denver Laboratory no.	Kind of material	Equivalent uranium (percent)	Uranium (percent)
31b	54303	Tuff, white, rhyolitic; chips from several faces near southwest margin of deposit.	0.008	0.002
32	54304	Tuff, white, rhyolitic; chips from several faces near central part of deposit.	.029	.026
33	54306	Tuff, white, rhyolitic; chips from several places from central part of deposit.	.013	.008
34	54308	Tuff, white, rhyolitic; chips from several faces along northeast margin of deposit.	.009	.003

Selected samples of the siliceous vein material, yellow-flecked rhyolite adjacent to joints, and rock adjacent to brown-stained joint surfaces yielded the following analyses:

Locality no.	Denver Laboratory no.	Kind of material	Equivalent uranium (percent)	Uranium (percent)
30	54300	Tuff adjacent to limonite-stained joint surface; sample taken from 2-inch wide zone, about 1 ft long, adjacent to joint surface.	0.046	0.044
31	54301	Vein material, dark-gray, siliceous; sample taken from 3-inch wide veinlet along about 1½ ft of outcrop.	.041	.039
31a	54302	Tuff flecked with yellow uranium mineral filling feldspar crystal cavities; chips from weathered surface.	.14	.12
32a	54305	Tuff adjacent to joint surface stained with yellow uranium mineral and flecked with same mineral filling feldspar crystal cavities; chips from 10-inch wide zone, about 4 or 5 ft long.	1.6	1.86
33a	54307	Veinlet, dark-gray, siliceous, and adjacent tuff; sample taken from 2-inch wide zone about 2 ft long.	.24	.26
42	54309	Vein material, gray, siliceous, in breccia pipe about 10 ft in diameter; chips from several parts of exposure.	.031	.024

These higher grade samples represent only a small amount of material sporadically distributed through the deposit.

Potentialities of the deposit

During the brief examination of the deposit no reliable geologic guides for determining the extent and grade of the mineralized rock below surface were recognized; more thorough physical exploration, including penetrations by drilling or prospect pits, will be required to appraise accurately the uranium content.

The samples collected from weathered surfaces on the deposit contained from 0.002 to 1.86 percent uranium. Although they may not reflect correctly the uranium content at depth, from available data the grade of the deposit as a whole is interpreted to average between 0.005 and 0.01 percent uranium. Smaller parts of the deposit, including a breccia pipe filled with siliceous vein material (loc. 42, fig. 2) and a mass of tuff (loc. 32, fig. 2), each of which is about 10 feet in diameter, contain about 0.025 percent uranium. Thin veinlets and smaller masses of adjacent wall rock containing 0.1 to 1.86 percent uranium are sporadically distributed through the deposit and apparently aggregate only a small tonnage of ore. Although the deposit is presumably too small to be considered an important source of uranium, it is of interest as a new locality at which a small amount of commercial-grade uranium ore is found, in a region that may contain other similar deposits.

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