range from .2 to .4% uranium oxide and Scintillator and Geiger counter readings indicate specimen sample of from .5 to 1% uranium oxide, the present surface exposures are not wide enough to represent minable ore. However, the mineralization is strong enough to class this as a good prospect and further development should be done in depth. The possibilities for finding minable ore appear as follows:

(1) There are indications that ore makes out into the softer tuff beds on the west side of the dike-fault. Present exposures are so poor that the actual nature and amount of the tuff beds are unknown and it is possible that some basalt sills may be present. Uranium ore might be expected to be found in certain tuff horizons next to the dike-fault and not in others of different texture and composition.

(2) Another possibility is that the rhyolite breccia type ore might increase in depth.

This prospect warrants an exploration program which will provide for uncovering and gaining some depth along the mineralized zone to help determine the true nature of the deposit and whether minable ore is present or not.

A second radioactive area on Group 1 claims is about 300 feet east from the main discovery described above. Here another small rhyolite breccia dike from 2 to 4 feet wide is exposed along a fault striking N. 30° W. and dipping 65° E. Only about 15 feet of the dike is exposed under a large talus slide. A small amount of dozer work will determine whether this zone is worth further exploration.

A third area of interest on Group 1 claims is near the east end line of Pike Creek Carnotite claim No. 5 (figure 2). An area about 30 feet in diameter gives scintillator readings up to 0.2 MR. Higher readings are indicated along individual N. 30° E. striking fractures. Mr. Dewey Quier had a specimen sample assayed from one of these fractures, and the results were 4 pounds of mercury per ton. The writer cut a 6 inch wide sample from near the same place and it assayed .01% mercury (0.2 pounds per ton) and .116% uranium oxide.

Group 2, Pike Creek Carnotite claims

Claims in this group are located on the east range front south of the old cabin on Pike Creek as shown on figure 2. A trail up the steep slope leads directly to a cliff of rhyolite in the southwest corner of claim No. 2. Scintillator readings of .1 to .2 MR. along the base of the cliff are apparently caused by minor amounts of autunite along fractures in the rhyolite on the hanging wall side of fine grained basic dike. This dike strikes N. 10° W., dips 45° W., and is exposed over a width of 15' in one place. This dike is almost identical to the dike next to the ore at the Timber Beast mine and might possibly be a southern extension of the same structure. Further prospecting along this dike trend might reveal some area worth trenching.

Alvord Cave Claims

These two claims are located on the east range front about midway between Little Alvord Creek and Alvord Creek. (Figure 3) Fractures in massive rhyolite in a cave contain minor amounts of autunite. No appreciable amount of uranium is indicated from the observed surface exposures.

OTHER PROSPECTS IN DISTRICT

Other prospects in the district are shown on Figure 3 for the purpose of showing the areal extent and trend of the uranium mineralization. A few comments will be made on some of these prospects.

The Timber Beast property has been developed by about 300 feet of tunnel and the operators have recently acquired a DMEA loan for further work. Two areas of autunite have been found in dacite and tuff adjacent to a fine-grained basic dike.

The Rhoades prospect in Little Alvord Creek is probably an extension of the Timber Beast zone. A few tons of low grade ore has been mined from a fault zone in rhyolite next to the basic dike.

The Alex-Ladd property has exploited a 3 to 4-foot wide shear zone in rhyolite containing autunite on fracture surfaces. Assay values as high as 0.34% uranium oxide have been reported.

The Upper Pike Creek property according to Schafer (10) is located on a low count radioactive zone in what is probably a dacite flow. Autunite is said to be visible on fractures and joints but much of the radioactivity is thought to be within the rock minerals.

ORIGIN OF URANIUM DEPOSITS IN STEENS MOUNTAIN

The origin or type of uranium deposits found in Tertiary rhyolite tuffs, flows and related rocks may have considerable bearing on development of the deposits or at least on the attitude of the mining profession toward the area. Briefly the two general modes of origin usually advocated are: (1) the uranium was originally deposited as primary minerals such as pitchblende or uraninite by ascending fluids (hydrothermal) from a deep-seated source, and then oxidation processes converted the primary minerals near the surface to autunite, torbernite and like minerals; (2) the rhyolite and dacite flows and related tuffs contained relatively high amounts of uranium (compared with surrounding rocks such as andesite and basalts) within the rock minerals themselves, and during weathering processes minor amounts of uranium from disintegration of these rock minerals were circulated by ground waters and precipitated along faults and fractures and in certain permeable beds.

Several of the uranium prospects appear to be on the northern extension of structures controlling the mercury deposits at the Alexander and nearby mines. Silicification, clay alteration, and minor amounts of mercury are present in some of the uranium prospects. Most of the uranium deposits have been found in fault zones adjacent to either basic dikes or rhyolite breccia dikes. These factors lead the writer to believe that the better uranium prospects in the Steens Mountains are of hydrothermal origin. Some of the minor areas of radioactivity could well be caused by leaching of minor amounts of uranium out of the rock minerals or movement of uranium from original sites of primary deposition.

Williams and Compton (2) observed that the higher temperature sulfide minerals such as schwatzite and chalcopyrite were abundant in the central Pueblo-Steens Mountain district and further north toward the Alexander mine cinnabar is the only sulfide and so this area represents a northern low temperature zone of hydrothermal mineralization. It appears that a low temperature uranium zone might be added to the north of this one where cinnabar diminishes at the expense of uranium.

MILLING

At the present time the Steens Mountain area is isolated so far as an outlet for uranium ores is concerned. The closest uranium mill is located at Salt Lake City, a distance by truck and rail of about 500 miles by a southern route through Winnemucca, Nevada or about 600 miles by a northern route through Idaho. A bright spot in this picture, however, is the recent announcement that the Lakeview Mining Company has signed a contract with AEC for sale of uranium concentrates and will build a 210 ton uranium mill within the next 12 months (see Figure 1 for location). It has been announced that this mill will accept some ore from outside sources.

Ore found to date in the Steens Mountains is a highly siliceous oxidized type containing little or no calcium carbonate. Ore shipped from the Steens Mountains at the present time will have to exceed 0.3% uranium oxide to return a profit under usual operating conditions.

CONCLUSIONS AND RECOMMENDATIONS

Developments within the last two years in Oregon and Nevada have indicated that commercial ore bodies of considerable size exist in Tertiary rhyolite flow and tuff sequences. The Lakeview district in Oregon, about 90 air miles southwest of the Steens Mountains Uranium area is reported to have sizable uranium ore bodies in tuffaceous sediments and mill construction has been approved. Recent developments near Mountain City in northeastern Nevada indicate a good possibility for sizable ore bodies near the surface in tuffaceous sediments. These developments should help develop some optimism towards areas of uranium mineralization in similar environments of acid flows and tuffs.

The writer is impressed with the amount of uranium in surface exposures in the Steens Mountains within an elongated belt about five miles by three-quarters of a mile. These deposits are located along definite fault or dike structures in a rhyolite and dacite flow and tuff sequence. Also impressive is the fact that, with the exception of the Timber Beast mine, these surface exposures have been barely scratched so far as real exploration is concerned. Preliminary exploration designed to test these prospects a few tens of feet in depth should give information necessary to determine whether further expenditures are desirable.

One of the best prospects observed in the Steens Mountains by the writer, which can be explored without excessive costs, is the main showing on the Pike Creek Carnotite claim No. 2 (Group 1) belonging to Solar X Corporation. This prospect should be developed by stages, and each stage should be fully evaluated upon completion so that this information can be incorporated in the next phase of exploration. The geology has been described previously and recommendations are as follows:

(1) Complete the approximate half mile of road up Pike Creek to the prospect as shown on Figure 2. It appears that a route can be chosen in which little or no rock work will have to be done.

(2) Bulldoze the talus cover off the west side of the breccia dike-fault from the creek level up to the high rhyolite cliff. This will expose the nature of the tuff section and prevent talus from sliding into subsequent excavations.

(3) After the dozer work, clean the mineralized zone down to bedrock by hand. Then by using a compressor, drill and powder, trench the mineralized zone about 5 feet wide and from 5 to 10 feet deep from the bottom of the hill up to the base of the rhyolite cliff.

(4) By evaluating the work in Stage 3, a decision can be made as to whether certain beds or the dike-breccia contain enough ore to warrant driving a short adit south into the hill along the mineralized zone and also exactly at what point it should be started.

(5) Should this work above the creek level be successful in discovering ore or at least a strong zone of mineralization, consideration should then be given to drilling in the thick section of tuffs and other rocks along the breccia-fault zone below the creek level.

Other prospects on Solar X Corporation's Pike Creek property should be studied further if the above work is initiated. If Solar X Corporation commences exploration work in the district, it will be possible for the corporation personnel to become acquainted with the local prospectors and their prospects and have some advantage over competitors in acquiring other property when it is deemed advisable.

Respectfully submitted,

/s/ W. P. Johnston

Consulting Mining Geologist
Reno, Nevada
December 7, 1957

APPENDIX I - REFERENCES

(1) Fuller, R.E. (1931), The Geomorphology and volcanic sequence of Steens Mountain in southeastern Oregon - University of Washington Publication in Geology, Vol. 3, No. 1, pp. 1-130.

(2) Williams, H.W., and Compton, R.R. (1953), Quicksilver Deposits of Steens Mountain and Pueblo Mountains, Southeast Oregon - U.S. Geological Survey Bulletin 995-B, pp. 1-76.

(3) Matthews, T.C. (Dec. 1955), Oregon radioactive discoveries in 1954 and 1955 - The Ore.-Bin, State of Oregon Dept. of Geol. and Mineral Industries, Vol. 17, No. 12, pp. 6.

(4) Schafer, Max (Dec. 1955) Preliminary report on the Lakeview uranium occurrences - same publication as (3), pp 2.

(5) Schafer, Max (Dec. 1956) Uranium prospecting in Oregon, 1956 - The Ore.-Bin, State of Oregon Dept. of Geol. and Mineral Industries, Vol. 18, No. 12, pp. 4.

(6) Matthews, T.C. (Dec. 1956) Radioactive occurrences in Oregon, 1956 - Same publication as (5) pp. 3.

(7) Corcoran, R.E. and Wagner, N.S. (1955) Pike Creek Carnotite Group, File Report, Oregon State Dept. of Geol. & Min. Industries, pp. 6.

(8) Wagner, N.S. (Nov. 1955) Progress Report No. 1, supplementing (7) - Oregon State Dept. of Geol. & Min. Industries, pp. 3.

(9) Wagner, N.S. (Dec. 1955) Alex-Ladd claims - File report, Oregon State Dept. of Geol. & Min. Industries, pp 2.

(10) Schafer, Max (1956) Upper Pike Creek radioactive area - File report, Oregon State Dept. of Geol. & Min. Industries, pp. 3.

APPENDIX II - ASSAY DATA

GROUP I PIKE CREEK CARNOTITE CLAIM NO. 2 (Main prospect)
(Assays published by Oregon Dept.of Geol.& Min. Industries)

No.	Width	U_3O_8 Equiv.%	U_3O_8 Chem.%	Fluorescence	Mercury %	Remarks
		.4	.372	None	Trace	Tuff and rhyolite breccia
		.3	.186	None	Trace	" " "
		.47	.373			Material not stated
	3"		.36			Rhyolite (prob. near Upper Cut No. 2)

(PC Samples taken by W.P. Johnston & K.A. Arnold)

No.	Width	U_3O_8 Equiv.%	U_3O_8 Chem.%	Fluorescence	Mercury %	Remarks
PC #2	3'		.024	Minor Y.G.	-	Upper Cut, soft fracture zone in tuff (?)
PC #3	3'		.026	Yell. green	-	Upper Cut #2, soft zone, some autunite
PC #4	6"		.026	Yell.green	-	Upper Cut #2, soft fault gouge, some autunite
PC #5	6"		.35	None	-	Upper Cut #2, W. side rhyolite breccia
PC #6	Grab		.05	None	-	Rhyolite breccia piled at creek level
PC #12	1"		.45	Minor Y.G.	-	Upper Cut #2, Dark rhyolite breccia

OTHER AREAS

No.	Width	U_3O_8 Equiv.%	U_3O_8 Chem.%	Fluorescence	Mercury %	Remarks
PC #1	6"		.116	Minor Y.G.	.01	Group 1, Claim 5, Figure 2, Rhyolite
PC #7	Grab		.013	Rare	-	Group 2, Claim 2, Figure 2, Rhyolite cliff
PC #8	Grab		.012	Rare	-	Group 2, Claim 2, Figure 2, Rhyolite cliff
PC #9	Grab		.003	Rare	-	Alvord Cave claim, soft rhyolite (in cave)
PC #10	Grab		.001	None	-	Alvord Cave claim, hard rhyolite (in cave)
PC #11	Grab		.188	Yell.green	-	Timber Beast claim, S. outcrop, E. of dike

PC #1-12 assayed for uranium by Rare Metals Corp., Murray, Utah.
Mercury assay by Union Assay Office, Salt Lake City, Utah.

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SOLAR X CORPORATION'S PIKE CREEK URANIUM PROPERTY
Steens Mountains Area, Harney County, Oregon

INTRODUCTION

Mr. Kenneth A. Arnold, President of Solar X Corporation, engaged the services of the writer in making an evaluation of the Corporation's Pike Creek Carnotite claims in the Steens Mountains area in Harney County, Southeastern Oregon.

Mr. Arnold and the writer spent the 3 days from November 20 to 22, 1957 in the Steens Mountains examining, sampling, and mapping uranium showings on the Pike Creek Carnotite and Alvord Cave claims. We also examined several other uranium prospects in the area in order to obtain a general picture of uranium occurrences. Mr. Dewey Quier, original discoverer of uranium in the Steens Mountains, accompanied Mr. Arnold and the writer in this examination and was helpful in many ways.

The writer was impressed by the number of uranium prospects present in a series of rhyolite and dacite flows and tuffs of Pliocene age within a belt 5 miles long and 3/4 of a mile wide near the east front of the Steens Mountains. Most of these prospects have not been developed beyond location pits, dozer cuts, and access roads. Recommendations are made for an initial exploration program on one of Solar X Corporation's Pike Creek Carnotite claims, one of the best looking prospects observed in the area.

OWNERSHIP AND PROPERTY

Solar X Corporation recently acquired full ownership of 10 unpatented mining claims from Dewey Quier and associates of Burns, Oregon. These 10 claims are as follows:

Group 1 - Pike Creek Carnotite claims Nos. 1, 2, 3, and 5, and the Sunset Claim (Figure 2)

Group 2 - Pike Creek Carnotite claims Nos. 2 and 4, and the Hot Potato claim (Figure 2)

Alvord Cave claims Nos. 1 and 2 (General location on Figure 3)

Group 1 claims are on Pike Creek about three-quarters of a mile west from the east front of the Steens Mountains in Sections 17 and 20, T. 34 S., R. 34 E.

Group 2 claims are located on the steep east front of the Steens Mountains in Section 20, T. 34 S., R. 34 E., about a half mile south of the old cabin on Pike Creek.

The Alvord Cave claims are located on the east front of the Steens Mountains about midway between Little Alvord Creek and Alvord Creek in Section 4, T. 34 S., R. 34 E.

These are all unsurveyed claims and Figure 2 is only a sketch of relative and approximate locations.

ACCESS AND FACILITIES

Location and access roads are indicated on Figure 1 and 2. The property can be reached from Burns, Oregon by taking State Highway 78 southeast 65 miles to Folly Farm and then turning south on an improved graded road for 38 miles to a mine road which branches to the west for 0.6 of a mile to an old cabin on Pike Creek near the east front of the Steens Mountains. This cabin is about 3 miles south of the Alvord ranch. The property can also be reached from Boise, Idaho by taking U.S. Highway 95 southwest to its junction with Oregon State Highway 78 and then continuing on the latter northwest 30 miles to Folly Farm. Denio, Nevada, is 42 miles south of the property and Fields, Oregon, is 24 miles to the south.

An air field suitable for small planes is located near the Alvord Ranch.

Nearest rail facilities are 78 miles to the north at Crane, Oregon or 145 miles south at Winnemucca, Nevada.

Water is abundant in Pike Creek and other nearby creeks. Power is lacking in the area.

PREVIOUS TECHNICAL WORK

The writer made full use of previous published data on the district and Appendix I is a list of publications which were available. Publications by Williams and Compton (2) and Fuller (1) describe the regional geology and give details on the rock units which are important in an evaluation of the uranium deposits. Reports by members of the Oregon State Department of Geology and Mineral Industries concerning the uranium discoveries in the Steens Mountain area (Appendix I) were most useful and this organization should be commended for the real service they give the prospector and mining industry.

HISTORY AND PRODUCTION

Prior to 1900 the Pueblo and Steens Mountains were prospected for gold and copper. The production from these ores has been very small. Mercury was discovered about 1900 and the total production to date has been less than 60 flasks.

Uranium was discovered first on Pike Creek in 1955 by Dewey Quier and since that time has been found in a belt about 5 miles long paralleling the east front of the Steens Mountains and extending about 3/4 of a mile west into the range. This belt commences at Indian Creek on the south and extends north to Alvord Creek (Figure 3). Some development work including roads, dozer cuts, pits and short tunnels has been done on several prospects. There has been no production to date.

GENERAL GEOLOGY

All of the uranium prospects examined by the writer or described in the literature occur in the Pike Creek series of Pliocene age. This series consists of tuffs of variable texture and composition, rhyolite flows and vent material, biotite dacite flows, and beds of volcanic glass. Fine grained basic dikes and sills, and rhyolite breccia dikes have intruded this section. The following stratigraphic section and approximate thicknesses are modified from Williams and Compton, pages 25 and 26 (2).

Pike Creek Series (below)

Upper biotite dacite flow - 300 feet thick
Lower biotite dacite flow - 500 feet thick

Upper tuff - 40 feet thick on Pike Creek, 80 feet on Indian Creek, white to greenish siliceous tuff.
Upper laminated rhyolite - 250 feet on Pike Creek, siliceous platy flow of pinkish rhyolite. Numerous vent areas at this horizon.

Middle tuff - about 300 feet on Pike Creek, siliceous tuff and lapilli tuff.

Lower laminated rhyolite - as much as 200 feet thick. Platy, pink to light colored, rhyolite.

Lower tuff - as much as 200 feet thick, siliceous tuffs; locally cut by many sills of basalt.

UNCONFORMITY

Alvord Series

Exposed thickness 500 feet, acid tuffs, tuffaceous sediments, clays, opaline cherts, and conglomerate. Early Pliocene.

In general the strike of bedding and flow lines is north to northwest and dips range from 5 to 20° in a westerly direction, but there are radical departures near vent areas and near the east range front where many east dips were observed.

The steep east front of the Steens Mountains represents an eroded fault scarp from a concealed regional fault along the alluvial covered base. The range front has been elevated along this fault in relation to the Alvord Valley to the east. Elevations range from about 4500 feet in the valley next to the fault to 9,990 feet at the top of Steens Mountain. A series of subsidiary faults having relatively minor displacements traverse the area west of the range fault for at least three-quarters of a mile. The two faults on Figure 4 represent two directions of faulting which are prevalent in Pike Creek. Some of the uranium deposits may be fairly near the concealed range front fault but most of them appear to be in or adjacent to the subsidiary faults or next to dikes occupying these faults. Fractures roughly at right angles to these faults may have helped control ore in some prospects.

Contact zones between flows, tuffs, and dikes along with fractures and the different permeability characteristics of the different rocks are all factors important in controlling the mineralization.

SOLAR X CORPORATION PROPERTY

Group 1, Pike Creek Carnotite Claims

Claims of this group are located in the canyon of Pike Creek. The main prospect, the original uranium discovery in the Steens Mountains, is exposed on the south wall of the canyon adjacent to Pike Creek about 3/4 of a mile by trail above the old cabin near the range front. (Figure 2)

Uranium mineralization occurs along a rhyolite breccia dike and accompanying fault which strike N. 25° E. and dips 65° E. as shown in the figure 4 sketch. Referring to the stratigraphic section given earlier in the report, the lower laminated rhyolite has been displaced vertically at least 75 feet along the dike and fault; thus from the creek level south up the hill to the vertical cliff face there is a wall of rhyolite on the east side of the dike-fault zone and a talus slope on the west side. The talus slope appears to be underlain by the Lower tuff unit and the contact with the overlying Lower Laminated rhyolite is probably near the base of the west-trending cliff wall at the top of the slope; thus the structure is a normal fault having the east wall moved down at least 75 feet relative to the west wall.

The rhyolite dike is comprised of fragments of platy rhyolite, ranging from pea size to 2 inches in long dimension, set in a matrix of fine-grained to almost glassy rhyolite. The breccia dike filled a fracture or fault zone and then subsequent faulting occurred along the same break after solidification of the dike. This later faulting has formed a 3 to 5 foot shear zone along the footwall or west side of the rhyolite breccia dike.

Uranium mineralization has been found along the dike-fault zone for a slope distance of about 75 feet. At the time of the writer's visit talus had filled in the three cuts and exposures were poor (figure 4). However, by scintillator readings, black light work on samples and assay results, it was determined that the three following types of uranium mineralization occur here:

(1) In places the footwall side of the rhyolite breccia is highly radioactive over at least 6 inches and some radioactivity was observed over a 6 foot zone including rhyolite breccia dike and platy rhyolite. No uranium minerals have been identified although dark spots appear in the matrix of the breccia in samples with high count. Corcoran and Wagner (7) give a chemical assay of 0.36% U_3O_8 from a sample of this material. A sample PC#5 representing a 6 inch width of rhyolite breccia at Upper Cut No. 2 taken during this examination assayed .35% U_3O_8. This material did not fluoresce; another specimen sample PC#12 assayed .45% U_3O_8.

(2) A 3 to 6 inch thick fault gouge (clay seam) adjacent to the hard footwall of the rhyolite breccia dike contains tiny streaks of black sooty material which is highly radioactive in one place and not in another. Part of this material is probably iron or manganese oxides but some must contain a dark colored uranium mineral of one kind or another. This material does not fluoresce.

(3) In the Upper Cut and Upper Cut No. 2 there is a soft zone about 3 feet wide next to and west of the gouge zone described above. The first 18 inches of this material next to the gouge contains rather abundant autunite along fracture surfaces and the next 18 inches noticeably less.

Different types of uranium mineralization, traces of mercury, accompanying silicification and other rock alteration suggest to the writer that the deposit was formed by ascending solutions and did not result from the leaching of small amounts of uranium from the surrounding rocks. If this assumption is true, the mineralized area represents a channelway in which the solutions rose up along the breccia dike and fault from depth. Although assays of interest

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(Private report - not for public distribution)

See letter from Ken Renolds 12-11-57 in Uranium File

GEOLOGIC REPORT

SOLAR X CORPORATION'S PIKE CREEK URANIUM PROPERTY

Steens Mountains Area, Harney County, Oregon

By

W. P. Johnston

Consulting Mining Geologist

Reno, Nevada
December 7, 1957

PIKE CREEK CARNOTITE GROUP — Harney County

Owners: Dewey M. and Alma M. Quier, Burns, Oregon: C. P. and Gladys M. Woodle, Corbett, Oregon; Beulah Rhoads, Burns, Oregon.

Location: Secs. 17 and 20, T. 34 S., R. 34 E., Harney County. The claims are confined mostly to a narrow zone along Pike Creek approximately 3 miles south of Alvord Ranch.

General geology: The general stratigraphic sequence in this area of Steens Mountain consists of a series of northwesterly dipping Tertiary volcanics. These are best exposed on the east face of the range and were first named and described by Fuller (1931) and later by Williams (1953). On the basis of their investigations this series has been divided into four major formations as follows (oldest to youngest): (1) Alvord Creek formation, acidic tuffs and tuffaceous sediments with some leaves; (2) Pike Creek volcanic series, rhyolitic and dacitic flows and tuffs; (3) Steens Mountain volcanic series, basalts and andesites with subordinate dacites and rhyolites; and (4) Steens basalt, cliff-forming flows of olivine basalt.

The age of the volcanics is based largely on the fossil floras found within the Alvord Creek beds near the base of the exposed section and these have been variously dated from upper Miocene to lower Pliocene (Fuller, 1931 and Axelrod, 1944). Unfortunately fossil leaf dating has not reached the accuracy or dependability of vertebrate dating, but the apparent stratigraphic similarity of the Steens Mountain section to the Owyhee section to the northeast (Porter, 1953) would tend to show the age of the Alvord Creek beds to be Mascall-Payette equivalent (upper Miocene). Farther to the south in the Pueblo Mountains area Fuller shows that the Steens basalts dip conformably beneath the Thousand Creek beds which contain a large mammalian fauna of middle Pliocene age (Wood, et al, 1941). This places the age of the Steens Mountain volcanics, therefore, between upper Miocene and middle Pliocene.

The elevation of the range began after the eruption of the Steens basalts and probably even after the Thousand Creek beds were laid down. This would place the time of uplift in the middle or late Pliocene or earliest Pleistocene. The east face of Steens Mountain is much steeper than the west side and shows the typical geomorphic features identified with basin and range fault-block mountains (faceted spurs and hot springs, etc.). Smith (1927) considered the major uplift along the east side of the range to be due to large-scale thrust faulting by compressional forces, but a rebuttal by Fuller and Waters (1929) clearly showed that these are normal faults produced by tensional stresses.

Geology and mineralogy of the deposit: The area showing the greatest radioactive anomaly is confined to a fairly narrow shear zone in acid lavas of the Pike Creek volcanic series and is exposed in a narrow canyon approximately one-half mile upstream from where Pike Creek debouches onto its alluvial fan on the west side of Alvord basin. Williams divides the Pike Creek series into five members based on the dominant lithology of each, and the mineralized fault zone appears to be within his "lower laminated rhyolite" where it is exposed in the creek bed. The fracture zone is approximately 6-10 feet wide, strikes N. 30° E. and dips about 60° E. The country rock is a hydrothermally(?) altered pinkish-gray brecciated and silicified rhyolite made up predominantly of a "mat" of very poorly sorted angular fragments of felsitic rhyolite up to 1 inch (most of which show well-developed flow banding) in a dense siliceous aphanitic groundmass. The radioactive mineralization is confined almost entirely to a fairly narrow "selvage" bordering the fracture surfaces of the rock within the fault zone and is especially concentrated along the footwall side. These surfaces have been stained a deep dull red color which grades imperceptibly downward into the unaltered rock within a distance of one-half to three-quarters of an inch. A slab of the rhyolite approximately three inches wide and one-half inch thick was cut from the rock normal to the plane of the mineralized fracture surface. This in turn was split into equal portions; each approximately 1½ inches wide; one from the upper half of the slab which included the "high count" mineralized zone and one from the lower half which showed a much lower count. Chemical analyses from these two portions showed 0.36 percent U_3O_8 from the upper half and 0.04 percent U_3O_8 from the lower half.

An attempt was made to concentrate the radioactive material along the fracture zones by crushing and panning but with little success, since all of the material seemed to have almost the same specific gravity. A check on the Geiger counter showed that, if anything, the "lights," after panning, were slightly more radioactive than the "heavies." It is interesting to note that the water in which the material was panned also showed a trace of radioactivity (approximately 0.015 percent U_3O_8 on the radioassayer) even after standing overnight. Under the microscope both the "lights" and the "heavies" were found to be composed almost entirely of chalcedony with a minor amount of very finely disseminated magnetite. No minerals of high relief could be discerned and no radioactive opaques could be identified with certainty.

Conclusions: The last visit by anyone from the Department (Dole and Wagner, 8/12/55) showed that no pitting or development work of any kind has been done on the shear zone. A trail, however, was bulldozed up one of the spurs on the north side of Pike Creek to an elevation approximately 300 feet above the stream bed. None of the rhyolitic material examined along this trail showed any abnormal count and no development work was in evidence at the top where the trail ended. In the shear zone itself no more than 50-60 feet of mineralized rock is visible and even this is exposed only on the south side of the creek.

The very dense nature of the rhyolite would seem to preclude the possibility of the mineralising fluids being able to impregnate the country rock for any appreciable distance. This is strikingly shown in the rapid drop in U_3O_8 content with distance from the mineralised fracture surface. It is very likely that the U_3O_8 content of the outermost one-fourth inch of rock nearest the mineralized surface may in some cases be as high as .5 to 1.0 percent U_3O_8 (or perhaps even higher on the basis of some scintillator readings taken on the best looking material!), but the far greater volume of very low-grade material with which the "high grade" is intimately associated and which must be mined along with it would almost certainly result in an overall average U_3O_8 content considerably less than the minimum acceptable.

If, however, the fracture system became more closely spaced with depth (although there does not appear to be any surface indication to this effect) it is possible that a larger volume of rock might become sufficiently mineralised to be accepted as commercial grade ore. Another avenue that may be worth investigating is the possible presence of mineralised tuffaceous interbeds which are known to exist both above and below the rhyolite member. Because of their greater relative porosity and permeability, the chances of their being more completely impregnated by the ore solutions are much greater than with the much denser rhyolites except in those areas where the latter have become brecciated due to movement along a fault zone.

The extent to which the tuffs could be impregnated by the ore solutions would depend largely on whether the silicification of the country rock occurred before, during, or after deposition of the radioactive material. Since the radioactive minerals in the brecciated rhyolite cannot be discerned it is impossible to determine the relationships in this rock between the time of silicification and uranitisation. If the silicification of the country rock was prior to the precipitation of the radioactive material, then the type of host rock would have little, if any, bearing on the mode of deposition of the uranium. On the other hand, if silicification of the host rock was contemporaneous with or after uranitization then the porosity and permeability of the host rock might become a critical factor in determining the possible volume of ore deposition. The evidence at the Pike Creek locality would indicate that silicification of the breccia occurred before very much uranium had a chance to be deposited. This is based on the observation that the zone of uranitization is very narrow compared to the zone of silicification. If introduced silica had not rendered the breccia relatively impermeable to later solutions working up along the fault fractures, then the uranium-bearing material would have had a chance to become more widely disseminated throughout the entire shear zone. If this reasoning with respect to the origin of the uranium in the rhyolite breccia is valid, then it is reasonable to assume that the tuffs in this vicinity would, where intersected by the mineralized fault zone, also be highly silicified and therefore relatively impervious.

Report by: R. E. Corcoran and N. S. Wagner

Visited: July 15, 1955 by N. S. Wagner; July 27, 1955 by R. E. Corcoran; August 12, 1955 by N. S. Wagner and H. M. Dole.

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State Department of Geology and Mineral Industries

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PIKE CREEK CARNOTITE GROUP   Harney County

Location: Pike Creek, Harney County; Secs. 17-20, T. 34 S., R. 34 E.

Progress Report No. 1, supplementing the file report written under the above title by Corcoran and Wagner, September, 1955.

Forward: Whereas this report is designed to supplement the information presented in the above mentioned file report, a very brief summary of the pre-existing geologic setting is given here for the sake of providing the perspective needed to properly visualize the enlarged picture described below. This is simply that the original discovery consists of a radioactively mineralized zone located on the contact of a rhyolite breccia and rhyolite flow. Radioactivity is most intense on the contact wall proper but is also present to a lesser extent in the body of the breccia for a distance of some six or more feet from the contact. The rhyolite contains little, if any, of the radioactive mineralization.

While the possible presence of autunite is indicated by the green fluorescence of some minute crystals sparsely developed in the breccia, the greatest radioactivity always occurs at random places on the contact where the breccia is stained a deep brick red and is covered by a thin encrustation of a sooty, black mineral substance of obscure identity. The contact is sharp, conspicuous, steeply dipping to the east and essentially at right angles to Pike Creek in trend. It is exposed in the form of a natural outcrop situated on the near vertical south wall of the canyon and at the crest of a steep and locally well developed talus slope.

Ownership: This is the same as is shown in the original report, but the property is now held under lease by the United Uranium Corporation. Peter Relos, Postal Building, 518 S. W. Third Avenue, Portland 4, Oregon, is corporation president.

Development: The lessees have exposed the mineralized zone in shallow cuts dug through the talus and into bedrock at three points located directly below the discovery occurrence described in the original report. These cuts were examined on November 5, 1955, and the following is written for the purpose of describing the factors of geologic import that have been revealed by this work.

Geology: First and formost of the newly disclosed data is that the cuts have served to demonstrate the presence of a bedded tuffaceous clay horizon situated approximately 30 feet below the level of the original natural exposure. This tuff was previously obscured behind the talus.

Where exposed, the tuff dips moderately to the west, and the indications are that it continues to underlie the rhyolite flow rimrock of the canyon wall for an indefinite distance in that direction. The tuff is bounded on the east, however, by a wall of the same rhyolite breccia found in contact with the overlying rhyolite flows observed in the discovery pit.

Only short sections of the breccia were disclosed for study on the breccia side of the contact as the cuts were located for their most part in the tuff. Whereas this condition served to restrict examination of the breccia somewhat, various observations which can now be made nevertheless serve to suggest that the breccia may be an intrusive breccia rather than a fault breccia as originally postulated.

Radioactive mineralization is still represented in this breccia-tuff contact horizon by occurrences on the wall of the breccia of the same black, sooty looking radioactive material found on the original breccia-rhyolite contact surface. In addition, crystals of autunite are also present in a state of abundance much greater than in the original exposure. These crystals occur in the tuff for a distance of 12 to 15 inches from the contact. They are best developed on bedding and fracture surfaces where interlocking clusters of crystals are sometimes quite prominent, but examination under a black light show that autunite is also present in the body of the tuff in the form of tiny disseminated specks.

Field measurements of radioactivity indicate that the exposed contact zone as a whole emits about the same level of radiation as in the instance of the natural outcrop. Such measurements also indicate that the body of the breccia continues to be mineralized to about the same extent as previously manifest.

Conclusions: The indication that radioactive mineralization is consistently present to at least a limited extent in the body of the breccia permits the inference that at least part of the radioactive mineralization may have been introduced concurrently with the breccia at the time when a greater number of voids and minute fractures could conceivably have existed along the wall of the intrusion. The encrustation of greater enrichment found on the breccia surface proper shows, however, that the mineralization continued after this time, as does also the autunite development present in the more permeable portions of the tuff.

How significant this mineralization will prove to be at depth from the standpoint of mineable widths of mineable grade ore is a currently unpredictable factor, and much more data will be required in order to fully establish the geologic picture. The very fadt that a tuff horizon has been demonstrated to exist in contact with the breccia is nevertheless encouraging. So also is the fact that autunite is found to be present in greater abundance in the permeable portions of the tuff thus far exposed. Since tuffs of this kind can, and frequently do, contain interbeds which show a wide range of lithologic and textural characteristics, there is therefore some justification for hoping that a more permeable horizon may exist at depth mineralized to an even greater extent than the horizon disclosed by the present development pits.

Proposed development: For the reason of further exploring the foregoing possibility, the lessees plan to drive a prospect tunnel along the contact at a point situated just above creek level and well below the lowest of the prospect pits just described. Such a tunnel at this location will certainly provide additional data which may help clarify some of the existing points which need to be clarified before any far reaching appraisal of the prospect can be made. It will also serve to prospect the tuff at a new horizon.

This work will be done on a contract basis, and is scheduled for immediate commencement.

Report by: N. S. Wagner

Date of Examination: November 5, 1955

Date of Report: November 25, 1955