# Radioactive Deposits of Nevada

By T. G. Lovering





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UNITED STATES DEPARTMENT OF THE INTERIOR

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# RADIOACTIVE DEPOSITS OF NEVADA*

Compiled by

T. G. Lovering

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Trace Elements Investigations Report 169

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Compiled by

T. G. Lovering

## ABSTRACT

Thirty-five occurrences of radioactive rocks had been reported from Nevada prior to 1952. Twenty-five of these had been investigated by the U. S. Geological Survey and the U. S. Atomic Energy Commission. Of those investigated, uranium minerals were identified in 13; two contained a thorium mineral (monazite); the source of radioactivity on 7 properties was not ascertained; and one showed no abnormal radioactivity. Of the other reported occurrences, one is said to contain uraniferous hydrocarbons and 9 are placers containing thorian monazite.

Pitchblende occurs at two localities, the East Walker River area, and the Stalin's Present prospect, where it is sparsely disseminated in tabular bodies cutting granitic rocks. Other uranium minerals found in the state include: carnotite, tyuyamunite, autunite, torbernite, gummite, uranophane, kasolite, and an unidentified mineral which may be dumontite. Monazite is the only thorium mineral of possible economic importance that has been reported.

From an economic standpoint, only 4 of the properties examined showed reserves of uranium ore in 1952; these are: the Green Monster mine, which shipped 5 tons of ore to Marysvale, Utah, during 1951, the Majuba Hill mine, the Stalin's Present prospect, and the West Willys claim in the Washington district. Reserves of ore grade are small on

all of these properties and probably cannot be developed commercially unless an ore-buying station is set up nearby. No estimate has been made of thorium reserves and no commercial deposits of thorium are known.

## INTRODUCTION

Twenty-five reported occurrences of radioactive material in Nevada had been investigated by the United States Geological Survey prior to 1952 (fig. 1). (Figure 1 shows only 17 localities, because 9 properties in the Washington district are shown as one locality.) Of these, 13 contained uranium minerals and 2 contained thorium minerals. The source of radioactivity on 9 properties was not ascertained and one proved to be barren of radioactivity.

The most promising uranium deposits include: (1) the Majuba Hill deposits in Pershing County, which has large reserves of low grade torbernite-bearing rock, (2) the Green Monster mine in the Goodsprings district, Clark County, which shipped 5 tons of ore containing kasolite (Pb-U silicate) during 1951, (3) the Stalin's Present property, in Pershing County, where a small amount of pitchblende is present, and (4) the West Willys claim in the East Walker River area, Lyon County, where both pitchblende and kasolite have been found.

Thorium has been reported in monazite from placer gravels near Round Mountain in Nye County and from pegmatites on the Old Dad prospect, Gold Butte district, Clark County; in neither of these localities does the mineral occur in sufficient quantities to be of economic interest under conditions prevailing in 1952.

## Scope and purpose of report

A brief summary of the available information on uranium deposits and uranium mining activities in Nevada through 1951 is presented in this report, which is part of a regional compilation of data on uranium deposits in the western United States. Most of the information was obtained during field work by members of the Trace Elements Reconnaissance Group of the United States Geological Survey, and is contained in hitherto unpublished reports. For each locality the location, ownership, development, geology, mode of occurrence, and grade of ore is summarized. The bibliography at the end of the paper lists all references to uranium deposits in Nevada known to the compiler.

All references to township and range refer to the Mount Diablo base and principal meridian.

The terms equivalent uranium (eU) and uranium (U) are used frequently throughout this report. Equivalent uranium is a measure of the radioactivity of a sample. The percentage of equivalent uranium is what the uranium content of the sample would be if all radioactivity were caused by uranium in equilibrium with its disintegration products. Uranium content (U) refers to the actual amount of the element uranium as determined by chemical analysis.

## Acknowledgments

This report was prepared from reports by members of the Trace Elements Reconnaissance Group of the U. S. Geological Survey at the request of L. R. Page, under the helpful supervision of P. K. Sims.

The source reports are largely the work of M. H. Staatz and H. L. Bauer, Jr.; D. H. Johnson assisted Staatz at the Atlanta mine. D. G. Wyant, R. H. Thurston, and A. F. Trites, Jr., prepared the reports on the Majuba Hill area. The information on the Green Monster mine was taken from an unpublished (open-file) report by A. L. Brokaw and a preliminary reconnaissance report by Staatz. Other deposits in Clark County were described by A. F. Carper in Union Mines Development Corporation reports and by D. F. Hewett. R. U. King and W. A. Roberts prepared reports on the Henebergh tunnel and the Yerington mine dump. The Daisy fluorspar mine was discussed briefly in a report by C. W. Chesterman and F. H. Main. Some additional data have been taken from the files of the Trace Elements Reconnaissance Group in Denver. All the unpublished investigations represented in this report, except the Union Mines Development Corporation reports, were done on behalf of the Division of Raw Materials, U. S. Atomic Energy Commission.

## GENERAL DESCRIPTION OF NEVADA

Nevada is almost entirely within the basin-and-range physiographic province which is characterized by numerous long, narrow, northward-trending ranges separated by wide, flat, arid basins. The rivers rise in the higher ranges, flow out into the desert basins, locally called "sinks", and disappear. A few through-flowing tributaries of the Colorado River, such as the Virgin River and the Muddy River, are found in the southeastern part of the state. The highest peak, Mt. Wheeler, 13,047 feet high, is in the Snake Range near the state's eastern border. The lowest elevation, 470 feet above sea level, is on the Colorado River a few miles below Davis Dam.

The geology of the state is varied and complex. Many of the desert ranges expose great thicknesses of Paleozoic sedimentary rocks. In some places these have been invaded by stocks of crystalline igneous rocks; in others, the sedimentary cover has been entirely removed, exposing the ancient pre-Cambrian crystalline and metamorphic rocks. Many other ranges, particularly those in the northern portion of the state, are composed of Tertiary volcanic flows and pyroclastics. Although much complex folding and thrusting has occurred, most of the ranges owe their present pattern and relief to differential uplift along a series of normal faults of Tertiary or Quaternary age.

## RADIOACTIVE DEPOSITS

The radioactive deposits of Nevada are widely distributed. Quite a number of small deposits containing secondary uranium minerals are concentrated in the southern part of Clark County and another concentration occurs in the East Walker River area of southern Lyon County. The remaining known deposits are widely scattered through the state (fig. 1). Careful and systematic exploration, however, probably will reveal other regions containing uranium or thorium deposits.

### Localization

Primary uranium minerals had been found at only two localities in Nevada prior to 1952. These were the West Willys property in the Washington district and the Stalin's Present prospect where primary uranium minerals and their secondary alteration products are erratically distributed through veins or tabular bodies cutting granitic rocks. Uranium minerals in the remainder of the known uranium deposits in the state are all secondary; the primary sources of these minerals are still unknown.

The two localities in the state from which pitchblende has been reported--the Stalin's Present and the West Willys properties--are both tabular deposits in granitic rocks. On the West Willys, pitchblende is closely associated with base-metal sulfides in a quartz vein (fig. 5). At the Stalin's Present, pitchblende occurs as scattered grains in a thin diopside-rich layer in granitic rocks. This layer has been variously interpreted as a metamorphic rock and as an unusual type of vein, but whatever its origin, the uranium is closely associated with it.

On the Old Dad and Uranium No. 1 prospects quartz-feldspar pegmatites cutting pre-Cambrian granites contain small bodies of radioactive magnetite. Chemical analyses of this rock indicate that the thorium-uranium ratio is on the order of 10 to 1. Although no radioactive minerals are visible in the magnetite, it seems probable from the analyses that monazite is finely disseminated in the magnetite.

Most uranium deposits in Nevada consist of secondary uranium minerals disseminated irregularly through fracture zones or along bedding planes. Deposits of this type include the Singer mine, Vanadium Wedge mine, occurrences at Sloan, Goodsprings and Sutor, the Atlanta mine, Henebergh tunnel, Silver Pick mine and Majuba Hill. In all of these places the concentration of radioactive elements appears to have been controlled by ground water circulation along permeable zones. The blanket deposits in caliche in the Erie to Arden area apparently originated from the evaporation of uraniferous ground waters at or near the surface and selective absorption of uranium by the caliche. The lignites on the Gamma Group of claims also appear to have selectively removed uranium from aqueous solution, although the organic matter which forms them may have contained uranium when it was deposited. Whatever the origin, uranium is now somewhat concentrated in these lignites. In the Virgin Valley deposits, uranium is largely restricted to the opalized layers and some of it was apparently deposited syngenetically with the opal (fig. 2). At the Daisy Fluorspar mine, the fluorite is uraniferous, although insufficient information is available on this deposit to indicate whether uranium was deposited contemporaneously with the fluorite or introduced later. The rich uraniferous pockets in the Green Monster mine are close to the surface in a porous, brecciated, contact zone between a limestone and underlying dolomite in the oxidized portion of a lead and zinc sulfide ore body (figs. 3 and 4); the uranium appears to have been derived from circulating ground water.

## Mineralogy

The uranium deposits in Nevada consist of a variety of uranium-bearing minerals, many of which are similar in appearance. Consequently field identifications often are tentative and frequently must be changed after laboratory analyses.

Minerals that seem to have been derived from previously deposited uranium minerals are here called secondary; those that have apparently been deposited directly from hydrothermal solutions are designated as primary. The secondary uranium minerals seldom are sufficiently abundant to be of economic importance; their chief value is as potential indicators of associated primary ore.

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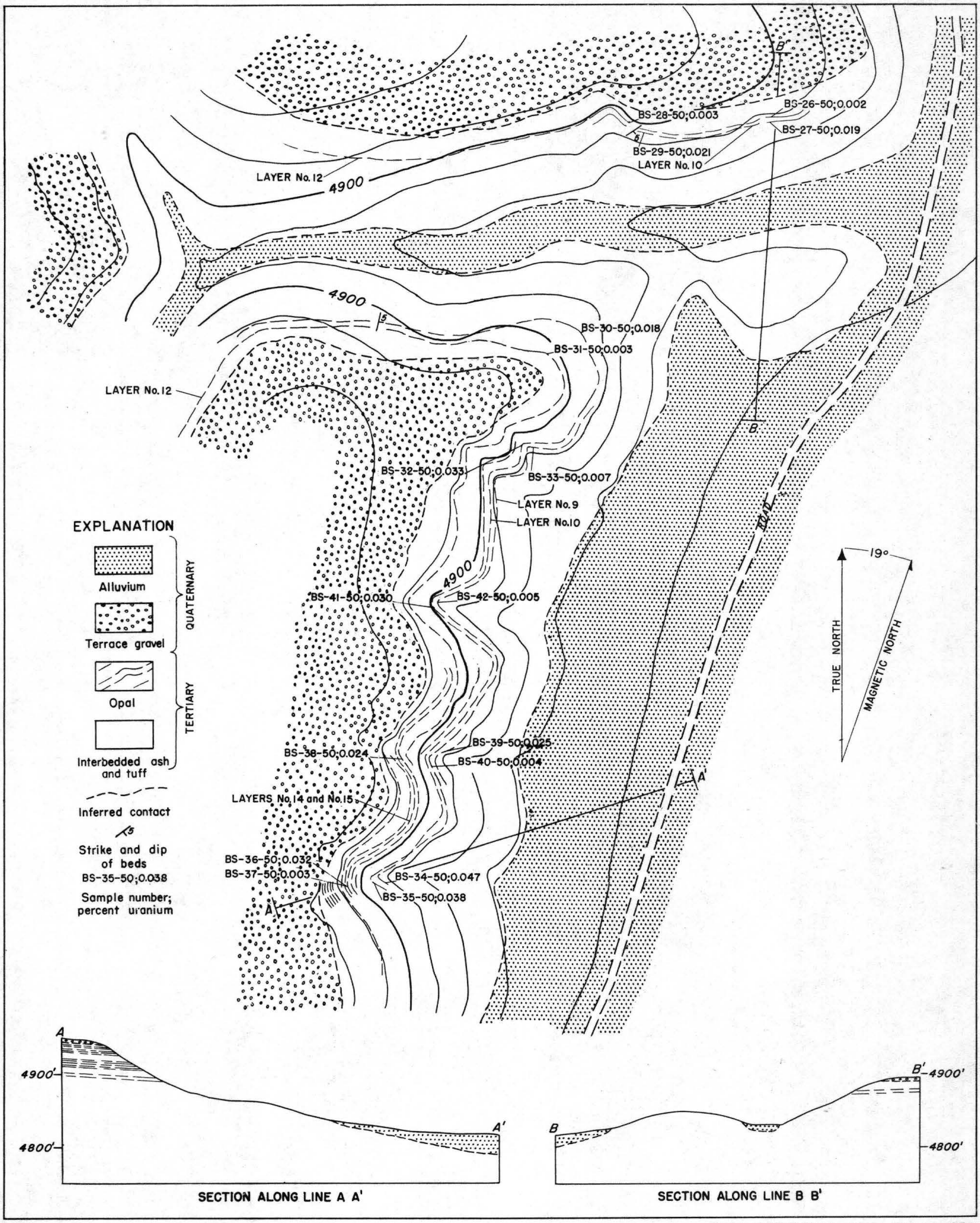


Geology by M.H. Staatz and H.L. Bauer, Jr., 1950.

FIGURE 2.- GEOLOGIC MAP AND SECTIONS, WEST SIDE OF VIRGIN VALLEY, HUMBOLDT COUNTY, NEVADA

100 0 100 200 Feet

Contour interval 20 feet

*Datum is assumed*

GPO 82-8000792

Seven uranium minerals had been identified from various places in Nevada prior to 1952. Table 1 summarizes pertinent information on these minerals.

Pitchblende is the only primary uranium mineral that had been recognized in the state prior to 1952. At the Stalin's Present prospect in Pershing County, pitchblende and gummite are associated with smoky quartz, calcite, and pyrite as replacements in a narrow band of dark green metamorphic rock or vein material enclosed by rhyolitic rock of probable Kaipato age (personal communication, Ralph J. Roberts). In the Washington district, Lyon County, pitchblende is found in quartz veins with copper, lead, silver sulfides, and pyrite in a gangue of quartz, epidote, and barite; the oxidized portions of these veins contain a little torbernite and some kasolite as well as limonite and chrysocolla.

Of the remaining 6 secondary uranium minerals, three (autunite, tyuyamunite and uranophane) are each known from one locality only. Autunite is found as fracture coatings on clay minerals of an altered rhyolite dike and adjacent granite at the Henebergh tunnel; tyuyamunite occurs as small pellets and flakes disseminated through caliche in the Erie to Arden area south of Las Vegas; and uranophane has been tentatively identified from specimens on the dump of the Atlanta mine in Lincoln County, where it is associated with limonite, quartz, barite, and opal. Torbernite at the Silver Pick claim in the Washington district is associated with clay gouge surrounding nodules containing galena, chalcocite, and silver sulfides; whereas at Majuba Hill it coats joints and vugs in rhyolite in association with such complex secondary copper minerals as olivenite and chalcophyllite. Kasolite in West Willys mine

Table 1.--Uranium minerals of Nevada

| Name | Chemical composition 1/ | Uranium (percent) | Megascopic appearance | Locality |
|---|---|---|---|---|
| Autunite | $Ca(UO_2)_2(PO_4)_2 \cdot 10\text{-}12H_2O$<br>$(CaO \cdot 2UO_3 \cdot P_2O_5 \cdot 8H_2O)$ | 45.4-48.2 | Yellow, apple green, small orthorhombic crystals; earthy. | Henebergh tunnel. |
| Carnotite | $K_2(UO_2)_2(VO_4)_2\text{-}3H_2O$<br>$(K_2O \cdot 2UO_3 \cdot V_2O_5 \cdot 8 \pm H_2O)$ | 52.8-55.0 | Canary yellow earthy masses and coatings rarely orthorhombic crystals | Sloan, Goodsprings, Sutor, Virgin Valley |
| Gummite 2/ | - - - - - - - - - - - - -<br>($UO_3$, Pb, Th, R.E., etc.) | - - - - -<br>(40-80) | Yellow, orange, reddish brown-black, massive in crusts | Stalin's Present prospect |
| Kasolite | $Pb(UO_2)SiO_4 \cdot H_2O$<br>$(3PbO \cdot 3UO_3 \cdot 3SiO_2 \cdot 4H_2O)$ | 40.5 | Ochre yellow, monoclinic crystals | West Willys group. Green Monster mine |
| Pitchblende | $UO_2$.<br>($UO_2$ or $U_3O_8$, PbO, etc.) | 56.9-82.9 | Black (greenish, brownish) pitchy luster, massive | West Willys group. Stalin's Present prospect |
| Torbernite | $Cu(UO_2)_2(PO_4)_2 \cdot 8\text{-}12H_2O$<br>$(CuO \cdot 2UO_3 \cdot P_2O_5 \cdot 8H_2O)$ | 47.1-50.8 | Emerald green, apple green monoclinic micaceous, crystalline crusts | Majuba Hill, Silver Pick |
| Tyuyamunite | $Ca(UO_2)_2(VO_4)_2 \cdot nH_2O$<br>$(CaO \cdot 2UO_3 \cdot V_2O_5 \cdot 8 \pm H_2O)$ | 48.1-54.0 | Greenish yellow, coatings, earthy masses, orthorhombic crystals | Erie to Arden area |
| Uranophane(?) | $Ca(UO_2)_2Si_2O_7 \cdot 6H_2O$<br>$(CaO \cdot 2UO_3 \cdot 2SiO_2 \cdot 6H_2O)$ | 56.6 | Yellow, needle-like orthorhombic crystals sometimes massive | Atlanta mine |

1/ Upper formula and uranium content as given by Frondell and Fleischer (1952); lower formula, in parentheses, as given by Smith (1946).

2/ Not a true mineral, approximate composition, according to Smith, is indicated.

in the Washington district is closely associated with pitchblende and base-metal sulfides and their oxidation products; here, this mineral presumably results from the oxidation of galena and pitchblende nearby. At the Green Monster mine, on the other hand, kasolite is associated with limonite, cerussite, malachite and cuprite; no primary uranium minerals are known on this property. Carnotite is found (1) with calcite and manganese oxides coating fractures in rhyolite a few miles south of Sloan; (2) with calcite, manganese oxides, and celestite coating bedding planes and fracture surfaces in Permian sandstones near Sutor and Goodsprings; (3) in opal bands associated with vitric tuff and ash beds in the Virgin Valley, northern Humboldt County.

## Grade

With one exception, the known uranium deposits of Nevada are low in grade. This exception is the Green Monster mine in which small pockets of ore were found, specimens of which assayed as much as 9 percent uranium. The richest samples from other deposits in the state contained less than 0.3 percent uranium. The Virgin Valley opal district, the West Willys and Far West Willys groups of claims in the Washington district, the Majuba Hill mine, and the Stalin's Present property in Pershing County, all have uranium deposits, samples of which contain from 0.1 and 0.3 percent uranium. All other samples have been analyzed from properties in Nevada contain less than 0.1 percent uranium.

## Origin

The known uranium deposits of the state may be separated into three main groups: those associated with sediments; those occurring in igneous rocks; and those found in contact metamorphic zones. These may be further sub-divided into blanket deposits, vein deposits, and disseminated deposits. This classification of Nevada's uranium deposits is indicated in table 2.

Table 2.--Mode of occurrence of uranium deposits in Nevada

| | Country rock | | |
|---|---|---|---|
| Type of deposit | Sedimentary rocks | Igneous rocks | Metamorphic rocks |
| Blanket | Gamma group | Virgin Valley | |
| Tabular (vein or pegmatite) | Singer mine<br>Vanadium Wedge mine<br>Green Monster mine<br>Daisy mine | <br>Washington district<br>Gold Butte district<br>Stalin's Present (?) | |
| Disseminated | Goodsprings<br>Sutor<br>Erie to Arden area | Majuba Hill<br>Sloan<br>Henebergh tunnel | Stalin's Present (?)<br><br>Atlanta mine |

The primary source of most of the secondary uranium minerals found in Nevada remains unknown. Only in the Washington district and at the Stalin's Present prospect is there a close spatial association between primary and secondary uranium minerals.

Analysis of Tertiary volcanic rocks from the Raton area of New Mexico has shown that they contain as much as 0.004 percent uranium, probably as a primary constituent. If this material were leached and reconcentrated at a ratio of 25 to 1, it would fall within the lower limit of commercial deposits and well within the limits of many of the secondary deposits discussed in this paper. No such analyses of the volcanic rocks of Nevada are known to the author; however, the carnotite-bearing opal interbedded with volcanic tuff in the Virgin Valley deposits and the uranium-bearing lignites of the Gamma group are permissive of such a source. The concentration and redeposition at both localities could have been accomplished by leaching the volcanics with slightly acid ground waters. If such processes of concentration have been effective, the primary uranium in these areas is probably diffused through the volcanic rocks instead of being concentrated in pitchblende in veins.

The primary source of the remaining secondary deposits in Nevada is probably either (1) quartz fissure veins containing pitchblende associated with base-metal sulfides, or (2) such minerals as uraninite, samarskite, and allanite disseminated in minute quantities through granitic intrusive rocks. Most of the deposits in the Washington district are probably derived from veins carrying pitchblende. Those at Majuba Hill, the Atlanta mine, the Henebergh Tunnel, and in Clark County, might be derived from either source. The uraniferous fluorspar at the Daisy mine might be a primary deposit from hydrothermal solutions or the uranium might have been introduced at a later date from a distant source by ground waters. The data available on this property are insufficient to support a theory of genesis of uranium.

The thorium-bearing magnetite on the Old Dad and Uranium No. 1 claims in the Gold Butte district appears to be genetically related to the quartz-feldspar pegmatites in which it occurs and may thus be classified as primary.

## MINE DESCRIPTIONS

### Churchill County

Radioactive lignites have been found at the Gamma property (fig. 1) on the western side of the Desatoya Range in southeastern Churchill County. Five lignite beds, ranging in thickness from less than a foot to about four feet occur in a series of interbedded, poorly consolidated, clays and sandstones of Tertiary age, several hundred feet thick, and overlain by volcanic rocks. The areal extent of the lignite beds was not determined and no uranium minerals have been identified in them.

#### Gamma property

by M. H. Staatz and H. L. Bauer, Jr.

The Gamma property consists of two claims--the Gamma No. 1 and the Gamma No. 2--in the Buffalo mining district in T. 16 N., R. 30 E., Mt. Diablo principal meridian (No. 4, fig. 1). The claims were located on November 30, 1948, by Fred F. Erb and Cleo Erb of Fallon, Nevada (Staatz and Bauer, 1951).

The property is in a group of low hills, about 300 yards west of the Gold Trail mine. It may be reached from Fallon by taking U. S. Highway 50 for 63 miles east, turning right on a dirt road for five miles, and left on a narrow dirt road for 2.5 miles to the Erb residence. The Gamma property is two miles from the Erb residence on a small private road.

In 1950 the mine workings consisted of a tunnel 30 feet long inclined at 5 degrees and a trench 10 feet long, 380 feet northwest of the tunnel.

The rocks on the Gamma property consist of gently dipping, poorly indurated, friable sandstones and clays of late Tertiary age, that contain five thin, clayey lignite beds. The thickest of these beds are about 3-1/2 feet in thickness. These rocks are overlain by dark red volcanic rocks, some of which appear to be rhyolite flows. The sedimentary strata, on the average, strike east and dip north at angles ranging from 2° to 21°; at places, however, some of the beds strike north and dip at low angles to the east. Most of the lignite beds are underlain by light to dark clay seams. The sandstones are friable, unconsolidated rocks with a bluish-gray cast produced by grains of dark bluish volcanic rocks. The lignite beds are composed of light brown to black carbonaceous material intermediate in character between peat and lignite. Most beds are underlain by light to dark gray clay. It is soft, porous, shows many imprints of leaves and bark, and has greenish yellow-stained clay along some of the partings. Selenite is common on bedding planes in the lignite but is not found in the surrounding sediments. The ash content of the lignite ranges from 59 to 75 percent. Five lignite beds were found in a section of sediments 10 feet thick. The No. 1, No. 2, and No. 4 beds are less than 0.3 feet thick, clayey, and of little economic interest. Bed No. 3 averages 0.6 feet thick and the one sample taken contained 0.052 percent uranium in the lignite and 0.095 percent in the ash. Bed No. 5 averages 3.5 feet thick and the uranium content ranges from 0.006 to 0.059 percent in the lignite and from 0.008 to 0.100 percent in the ash.

The lignite beds are exposed almost continuously for 1,285 feet. Both north and east of the exposed area the lignite is covered by slope wash.

## Clark County

Eight radioactive deposits in Clark County have been investigated. At the Green Monster mine (figs. 1 and 3), in western Clark County, a vein deposit contains kasolite (lead uranium silicate) and an unidentified yellow uranium mineral associated with cerussite, calamine, and the secondary copper minerals malachite, azurite, and cuprite. Undetermined minerals give positive tests for uranium at the Singer and Vanadium Wedge mines in the same vicinity. Carnotite that is associated with calcite and manganese oxide, coating fractures in rhyolite, is exposed in a railroad cut a few miles south of Sloan. In the Gold Butte district, undetermined minerals cause radioactive anomalies in pegmatite dikes cutting pre-Cambrian granite. Hewett (1923) mentions two occurrences of carnotite, coating fractures in Permian sandstones and shales. One of these is 2 miles west of the town of Sutor; the other 2 miles north of Goodsprings; both in the Goodsprings mining district. Tyuyamunite coats caliche over a large area of valley fill south of Las Vegas; this may be the same as some of the carnotite reported by Hewett.

### Goodsprings district

Most of the known uranium occurrences are in the Goodsprings district in the southern part of the county (No. 12, fig. 1). The geology and ore deposits of this area have been thoroughly described in U. S. Geological Survey Professional Paper 162 (Hewett, D. F., 1931).

Stratified rocks ranging in age from upper Cambrian to Recent are exposed in the Goodsprings area; these rocks have an aggregate thickness of approximately 13,000 feet. The lower 8,500 feet is made up of Paleozoic rocks in which limestones and dolomites predominate; above these are 4,000 feet of Triassic and Jurassic rocks consisting largely of sandstones, shales and conglomerates with 600 feet of limestone near the base. These rocks are overlain unconformably by Tertiary stratified gravels and pyroclastics and by Quaternary valley fill; the total thickness of these younger rocks reaches 500 feet in some places. Large masses of granite porphyry and a few small lamprophyre dikes were intruded near the center of the district in late Cretaceous or early Tertiary time. During middle Tertiary time a series of pyroclastics and flows of varying composition was erupted from several centers in the southern part of the area. At some time prior to the granitic intrusion the area was subjected to compressive forces which resulted in open folding in the older Paleozoic rocks, close folding in the younger Paleozoic rocks, and culminated in a series of thrust faults. This intense deformation was followed by the development of northerly trending block faults, which occurred at intervals during middle and late Tertiary time.

Deposits of gold, copper, lead, zinc and silver were deposited in fractures and breccia zones around the intrusives; these deposits show a crude zoning with gold nearest the intrusives, copper is in an intermediate position, and the lead-zinc-silver deposits most remote. All of these deposits are in rocks of pre-Permian age. Three of the uranium occurrences are associated with base-metal sulfides in Mississippian limestones and dolomites; two are associated with manganese minerals in Permian sandstones and shales; one is a fracture coating in Tertiary rhyolite; and one coats caliche capping Quaternary valley fill. All appear to be late deposits formed by ground water.

Green Monster mine.--The Green Monster mine (No. 11, fig. 1), in sec. 1, T. 24 S., R. 56 E., near the California line (Staatz, 1951) is leased by Fred Smith of Las Vegas.

The mine was the source of considerable tonnage of zinc and lead ore, and the mine workings are extensive. The workings explore a steeply dipping, mineralized breccia zone and consist of more than 2,300 feet of drifts and crosscuts in three main levels, extensive stopes on 3 separate ore shoots, and several shafts, winzes, and raises (G.W. Walker, written communication). The deposit has been worked for lead, zinc, and copper minerals to a depth of 380 feet.

The ore deposit is irregular in thickness and is localized by a shear zone in the Bullion dolomite of Mississippian age. Secondary uranium minerals occur in a zone 1 to 2 feet thick on the footwall side of the ore body. Kasolite and an unidentified uranium mineral are associated with malachite, azurite, cuprite, cerussite, calamine, and limonite in a yellow, earthy ore as replacement deposits in the upper stope. Selected specimens assayed as high as 9 percent uranium.

Most of the uranium is in the upper stope and the grade decreases rapidly with depth; 0.057 percent uranium is the highest value obtained 80 feet below the upper stope. Reserves are evidently small and only one shipment of 5 tons containing 1.09 percent $U_3O_8$ had been made by the end of 1951.

Singer and Vanadium Wedge mines.--Two other mines--the Singer and the Vanadium Wedge--in the vicinity exploit base-metal deposits in Mississippian limestones and contain some uranium minerals.

The Singer mine, (No. 17, fig. 1) in sec. 18, T. 25 S., R. 58 E., Mt. Diablo principal meridian, has yielded 1,200 tons of lead-zinc ore. It was owned in 1944 by Charles Beck of Las Vegas, Nev. The mine workings consist of several short adits, pits, and shafts, in a shattered block of Bullion limestone of Mississippian age, which has been thrust over the Birdsprings formation of Permo-Pennsylvanian age. Coatings of secondary green and yellow uranium minerals were observed on joint surfaces and bedding planes in the limestone. Samples assayed from 0.04 to 0.051 percent uranium (G. W. Walker, oral communication).

The Vanadium Wedge mine, (No. 16, fig. 1) 7 miles southwest of Goodsprings in T. 25 S., R. 57 E., has yielded one carload of copper ore which was reported to have contained 20 percent copper. In 1944 the mine was owned by Frank Williams of Goodsprings. The workings consisted of a short adit and a small side drift in the Monte Cristo limestone of Mississippian age. The ore is in an iron-stained fault zone and consists largely of malachite and azurite. No uranium minerals were visible in the mine workings, but the copper ores gave positive fluorescent bead tests for uranium. No assay data are available.

Sloan.--Carnotite, associated with calcite and manganese oxide, has been reported by Hewett (1923) as fracture coatings in small veinlets cutting rhyolite porphyry a few miles south of the town of Sloan (No. 14, fig. 1). The exposures of carnotite are in a railroad cut along the Union Pacific right-of-way and no attempt has been made to determine the extent of the occurrence. A sample submitted by E. M. Thompson of Rope Hill, Va., to the Atomic Energy Commission, contained 0.017 percent equivalent uranium.

Sutor.--Hewett (1923) describes carnotite showings in secs. 29 and 30, T. 24 S., R. 60 E., west of Sutor, (No. 15, fig. 1) and in sec. 14, T. 23 S., R. 58 E., a few miles north of Goodsprings. The carnotite at both localities forms joint and fracture coatings associated with manganese oxide, calcite, and celestite, in sandstones of Permian age. Near Sutor the carnotite is stratigraphically below a prominent limestone; near Goodsprings it is stratigraphically above it. At both places several small pits have been excavated, but no production is recorded.

## Erie to Arden area

by A. F. Carper

Low-grade secondary uranium minerals in caliche occur in alluvium of Quaternary age between the railroad stations of Erie and Arden (No. 13, fig. 1) in the same general region as the carnotite deposits discussed above. Alluvium occupies an area roughly 12 miles long by 4 miles wide in the valley and near the surface it is cemented by caliche. Pits and railroad cuts in the alluvium expose a layer of caliche, 1 to 5 feet thick, which contains scattered small blebs and patches of tyuyamunite. The caliche is estimated to contain approximately 0.025 percent uranium.

## Old Dad and Uranium No. 1 claims

The Old Dad and Uranium No. 1 claims, in T. 18 S., R. 70 E., Mt. Diablo principal meridian, Gold Butte mining district, (No. 10, fig. 1) are owned by R. F. Perkins and Fay Perkins of Overton, Nev. The discovery pits in feldspar-quartz-biotite pegmatite-like bodies of pre-Cambrian (?) age contain monazite (?) associated with magnetite, that is abnormally radioactive. Samples from the pits contain as much as 0.41 percent equivalent uranium, 0.03 percent uranium (G. W. Walker, oral communication).

## Humboldt County

Uraniferous opal, and locally carnotite, occur in the Virgin Valley opal district, near the Oregon state line. The uraniferous opal constitutes discontinuous layers as much as 6 feet thick and half a mile long in vitric tuff and ash beds of Tertiary age. The tuff and ash contain sparse uranium minerals.

### Virgin Valley opal district

by M. H. Staatz and H. L. Bauer, Jr.

The Virgin Valley opal district is on the Virgin Valley ranch in T. 45 N., R. 26 E., Mt. Diablo principal meridian, in the Sheldon Game Refuge (No. 1, fig. 1). The district is 88 miles east of Cedarville, Calif., and 41 miles west of Denio, Nev., which is 102 miles northwest of Winnemucca (Staatz and Bauer, 1951d). Uraniferous opal deposits have been found on 19 claims, located by Jack Crane and Toni Crane of Oswego, Oregon, during July and August of 1950, along both the east and west sides of the Virgin Valley. Before the discovery of uranium minerals, about 20 small pits had been dug on the east side of the Virgin Valley in prospecting for opal. During the summer of 1950, a 315-foot bulldozer trench and 12 small pits were dug on the east side of the valley.

Gently dipping tuff and ash beds, at least 300 feet thick, which are capped by a basalt flow and coarse gravel, crop out in Virgin Valley. Greenish-gray vitric tuff beds, consisting largely of glass fragments from 0.5 mm to 30 mm in diameter, predominate. On the east side of the valley fine-grained chalk-white ash beds are composed partly of clay minerals interbedded with the tuffs. These beds are probably altered feldspathic tuffs.

The uraniferous opal is in discontinuous layers, as much as 6 feet thick and half a mile long, that are parallel to the bedding of the ash and tuff. Four of seven opal layers on the eastern side of the valley are abnormally radioactive, and four of fifteen opal layers on the western side are abnormally radioactive. The opal in most places is in tuff beds but on the east side of Virgin Valley some layers, especially the more translucent varieties, are in the ash beds. Uranium is the radioactive element in the opal. Powdery yellow carnotite commonly occurs as fine coatings on parting planes and fractures in the opal, and at one locality it forms thin laminae in the opal. Some of the opal that shows abnormal radioactivity contains no visible carnotite. Samples of uraniferous opal taken on the eastern side of the valley contain from 0.002 to 0.12 percent uranium, and samples from the western side contain from 0.002 and 0.047 percent uranium.

Because of the low grade of these deposits, they were not considered to be of economic importance in 1951.

## Lincoln County

Uranium has been reported from only one locality in Lincoln County, the old Atlanta mine, in T. 6 N., R. 68 E., Mt. Diablo principal meridian. Areas of abnormal radioactivity occur in a silicified breccia zone between limy dolomite and an intrusive rhyolite porphyry. An unidentified canary yellow uranium mineral (uranophane ?) was noted at one place. The gangue consists largely of clay minerals, hematite, limonite, quartz, calcite, opal, and barite. Material from the dump contains about 0.2 ounces to the ton in gold.

## Atlanta mine

by M. H. Staatz and D. H. Johnson

Introduction.--The Atlanta mine is on the west side of a hill several hundred feet high at the northwestern end of the Wilson Creek Range in Lincoln County, Nevada. This mine is in the Silver Park mining district in T. 6 N., R. 68 E., Mt. Diablo principal meridian, 52 miles by road from Pioche (No. 8, fig. 1).

The Atlanta property was patented on July 8, 1912, by Elmer Bray. It consists of the following 10 claims: Atlanta Home, Atlanta No. 1, Atlanta No. 2, Atlanta No. 3, Atlanta Strip, Atlanta Strip No. 1, Hillside, Sparrow Hawk, Pactolian Fraction, and Belle. In 1950, it was owned by the Richmond Chemical Corporation of 1201 North Nevada Street, Carson City, Nev.

The property was visited during the winter of 1949 and 1950 by Charles Towle of the U. S. Atomic Energy Commission and part of the dump was sampled.

The present owner reports no production from the mine prior to 1948. In that year 1200 tons of dump material was shipped to the Kennecott Copper Company's smelter in McGill, Nevada, to be used as siliceous flux. According to L. D. Gordon of the Reconstruction Finance Corporation, this material averaged about 0.2 ounces in gold per ton. This material was sampled by the Kennecott Copper Company and was reported to average about 0.2 percent uranium. The Reconstruction Finance Corporation took 192 samples on the surface and in the workings down to the 200-foot level. Results of radioactivity and chemical analyses for uranium of 30 of these samples are given in table 3. The dump of shaft No. 2 and the 100- and 200-foot levels were sampled by the authors and traverses for radioactivity were made across the dumps and on the 100-foot level. Mine workings consist of two shafts, a raise, a winze, crosscuts, and drifts. Three small levels have been driven from the first shaft above the 100-foot level. A vertical shaft (No. 2) is 240 feet northwest of the first shaft. Three levels, the 100-, 200- and 400-foot, take off from the second shaft. The 100-foot level has 583 feet of workings. On a crosscut 80 feet from the shaft, a winze extends downward for about 80 feet and a raise extends from this level up to one of the sub-levels driven from the old shaft (No. 1). At the far end of the 100-foot level the workings on the old shaft were reached by a 16-foot raise. The 200-foot level has 1200 feet of workings. The 400-foot level was not visited. A large dump containing an estimated 10,000 tons of material, surrounds the vertical shaft (No. 2) and a small one of about 2,000 tons surrounds the old shaft (No. 1).

Geology.-- A zone of silicified breccia at least 150 feet wide lies between a limy dolomite on the east and a porphyry on the west. This breccia has been mineralized and contains gold, silver, and uranium. The dolomite is a gray rock containing some chert and horn corals. To the west of the dolomite is a porphyry that is not exposed in the immediate vicinity of the mine but appears at the ends of some of the western crosscuts. This rock is a fine-grained, light-gray porphyry with occasional quartz phenocrysts. Between these two rocks is a silicified breccia at least 150 feet thick with a curved north trend. From the underground workings, it appears to dip westerly at about 45°. The partly silicified fragments indicate that

Table 3.--Sample data, Atlanta mine, Lincoln County, Nevada

| Type of sample | Field No. | Material sampled | Equivalent uranium (percent) | Uranium (percent) |
|---|---|---|---|---|
| C* | SJ-6-50 | High grade, dump | 0.054 | 0.041 |
| C | SJ-7-50 | Dump | 0.004 | 0.004 |
| C | SJ-8-50 | Dump | 0.007 | 0.004 |
| C | SJ-9-50 | Dump | 0.008 | 0.007 |
| C | SJ-10-50 | Dump | 0.003 | 0.003 |
| A | SJ-11-50 | 100' level, replaced breccia | 0.010 | 0.010 |
| B | SJ-12-50 | 100' level, replaced breccia | 0.012 | 0.011 |
| B | SJ-13-50 | 200' level, replaced breccia | 0.013 | 0.010 |
| B | SJ-14-50 | 200' level, replaced breccia | 0.008 | 0.005 |
| B | SJ-15-50 | 200' level, replaced breccia | 0.002 | 0.002 |
| B | SJ-16-50 | 200' level, replaced breccia | 0.004 | 0.004 |
| B | SJ-17-50 | 200' level, replaced breccia | 0.007 | 0.008 |
| B | SJ-18-50 | 200' level, replaced breccia | 0.010 | 0.006 |
| B | SJ-19-50 | 200' level, replaced breccia | 0.007 | 0.003 |
| B | SJ-20-50 | 200' level, replaced breccia | 0.003 | 0.003 |
| B | SJ-21-50 | 200' level, replaced breccia | 0.005 | 0.003 |
| A | SJ-22-50 | Composite R.F.C., surface | 0.001 | 0.002 |
| A | SJ-23-50 | Composite R.F.C., surface | 0.001 | 0.002 |
| A | SJ-24-50 | Composite R.F.C., surface | 0.001 | 0.002 |
| A | SJ-25-50 | Composite R.F.C., surface | 0.001 | 0.002 |
| A | SJ-26-50 | Composite R.F.C., 100' level | 0.001 | 0.002 |
| A | SJ-27-50 | Composite R.F.C., 100' level | 0.002 | 0.003 |
| A | SJ-28-50 | Composite R.F.C., 100' level | 0.003 | 0.006 |
| A | SJ-29-50 | Composite R.F.C., 100' level | 0.005 | 0.002 |
| A | SJ-30-50 | Composite R.F.C., 200' level | 0.002 | 0.004 |
| A | SJ-31-50 | Composite R.F.C., 200' level | 0.005 | 0.006 |
| A | SJ-32-50 | Composite R.F.C., 200' level | 0.007 | 0.003 |
| A | SJ-33-50 | Composite R.F.C., 200' level | 0.002 | 0.004 |
| A | SJ-34-50 | Composite R.F.C., 200' level | 0.003 | 0.002 |
| A | SJ-35-50 | Composite R.F.C., 200' level | 0.001 | 0.001 |
| A | SJ-36-50 | Composite R.F.C., 22' level | 0.001 | 0.001 |

* "R.F.C." samples were taken when mine was being considered for a Reconstruction Finance Corporation loan. A= Channel sample. B= Chip sample. C= Grab sample.

the breccia contains both dolomite and porphyry. Charles C. Towle, Jr. of the Atomic Energy Commission states that the structure is interpreted as the edge of a Tertiary volcanic vent, piercing Paleozoic sediments. The vent represents an explosion pipe, filled with lava, and the zone of breccia is a ring-like remnant of explosion breccia lying between a dolomite wall of the original pipe and the porphyry which constitutes the central lava column of the vent.

Ore deposits.--The ore deposit was formed by replacement of the silicified breccia. Some areas were completely replaced by soft clayey material high in hematite and limonite. Vugs are common in vein material and frequently contain crystals of calcite, quartz, opal and barite. No copper minerals are visible on the dump or in the ore zone of the mine but small amounts of chalcanthite have formed on the walls of the 200-foot level in some places. Uranium occurs sporadically within the mineralized area. In three places on the 100-foot level readings of 20 on the 0.2 scale of a Geiger counter were obtained. One of these areas at the bottom of the No. 2 shaft had an exposed length of 16 feet. On the 200-foot level, areas adjacent to the shaft are uraniferous but the remainder of this level is filled with radon gas so that readings on the Geiger counter were not reliable. No uranium minerals were positively identified, but a canary-yellow, non-fluorescing, pulverulant mineral associated with calcite has been tentatively identified as uranophane. The large dump surrounding shaft No. 2 showed some abnormal radioactivity, representing about 0.05 percent equivalent uranium.

## Lyon County

In the eastern part of Lyon County, within an area of about 20 square miles along East Walker River, uranium-bearing quartz fissure veins are known on the claims in the Far West Willys group, the Northwest Willys group, the West Willys group, the Silver Pick property, and the Boerlin Ranch area; and radioactivity is known in the Grant View hot spring. The uranium-bearing minerals--pitchblende, kasolite, and torbernite--are associated with copper-silver-lead minerals. The radioactivity of the hot springs probably results from radon gas. A reported radioactive occurrence near Yerington was investigated with negative results.

### Washington district

by M. H. Staatz and H. L. Bauer, Jr.

The deposits are in Tps. 7 and 8 N., R. 27 E., Mt. Diablo principal meridian (No. 7, fig. 1), in a region of rugged topography at altitudes between 5,000 and 6,400 feet. They can be reached from Yerington on the north by paved State Highway 3 and 30 miles of dirt road (Staatz and Bauer, 1953e). The area is underlain by a porphyritic granite of probably Jurassic age which is cut by aplite and perthite-quartz pegmatite dikes. To the east, the granite is overlain by coal-bearing shales and sandstones of Tertiary age.

Far West Willys group.--The Far West Willys group of claims is about a mile west of the East Walker River in secs. 5 and 6, T. 7 N., R. 27 E. It was located in 1949 and 1950 by Warren Loose, O. A. Kerlee, J. R. Ford, and L. O. Kerlee. The area was prospected for silver in the 1880's and the old workings include two 40-foot shafts, two adits totaling 200 feet, and several small trenches. Nine quartz veins, more than 2 inches wide, that strike east and dip steeply and are surrounded by envelopes of silicified and argillized granite, crop out on the claims. The ore shoots are thin lenses and aggregates of epidote, chrysocolla, tenorite, chalcocite, chalcopyrite, galena, and argentite. Uranium minerals have not been identified, but samples from a selected ore pile contain as much as 0.14 percent uranium. Only four of the veins yielded material containing over 0.01 percent uranium.

Northwest Willys group.--The Northwest Willys group is in sec. 29, T. 8 N., R. 27 E., Mt. Diablo principal meridian, and consists of two claims that were located in 1950 by Warren Loose, A. O. Kerlee, J. R. Ford, and L. O. Kerlee. The claims have been developed by two short bulldozer cuts and two small prospect pits.

Two quartz veins that trend east-northeast and dip steeply are exposed on the property. One of the veins contains a pod of pyrite, chalcopyrite, galena, secondary copper minerals, limonite, and quartz that is 8 feet long and 0.7 foot wide. This pod shows the highest radioactivity on the property. A channel sample across the pod contained 0.33 percent uranium.

West Willys group.--The West Willys group consists of seven claims on both sides of a tributary canyon about a mile west of the East Walker River, in secs. 32 and 33, T. 8 N., R. 27 E., Mt. Diablo principal meridian. The group is owned by Warren Loose, L. O. and O. A. Kerlee and J. R. Ford. Four zones of quartz veins were found in the area covered by West Willys, West Willys No. 2, West Willys No. 4 and the West Willys No. 7 claims.

The West Willys claim, on the north side of the canyon, is the most promising prospect in the area. Two quartz veins with an average trend of N. 67° W. and steep dips are exposed for a distance of 250-300 feet; their thickness ranges from a few inches to 3 feet. The veins consist of gray or milky quartz cut by fine veinlets of sericite and contain a few small drusy cavities. Chrysocolla, chalcocite, chalcopyrite, galena, and manganese oxides are sporadically distributed along the hanging wall of the veins. The radioactive material consists largely of a few grains of a dull black mineral, probably pitchblende, that occurs with the copper-lead minerals. An orange-yellow alteration product of the pitchblende in the central part of the western vein has been identified as kasolite. Geiger counter readings as high as 6 divisions on the 2.0 scale were obtained on the property. Channel samples scattered along the two veins contained from 0.001 to 0.087 percent uranium; two select grab samples from the dump contained 0.11 and 0.072 percent uranium, respectively.

The West Willys No. 2 claim is near the top of a ridge 1,500 feet north of the main canyon. The old workings consist of a shaft 30 feet deep, near the center of the vein, and several small pits. A quartz vein 500 feet long and less than a foot wide strikes N. 40-65° E. across the property, and dips 75° NW. The vein, which is bordered by zones of silicified granite, contains a little barite, galena, chrysocolla, chalcopyrite, and chalcocite. A channel sample across the vein assayed 0.002 percent uranium and a selected dump sample contained 0.022 percent uranium.

The West Willys No. 4 claim, on the south side of the canyon, has been developed by a small shaft, three open cuts and three small prospect pits. A 200-foot shear zone on the claim, trending N. 49° E., contains a number of quartz veins less than a foot wide. These veins consist of white quartz, containing chrysocolla, sericite, chalcocite, chalcopyrite, and galena, which occur either in thin layers along the footwall or as scattered pods. The parts of the veins that contain the sulfides are the most radioactive. Two channel samples across the vein assayed 0.003 percent uranium.

The West Willys No. 7, or Old Washington claim, 900 feet north of the main canyon, was mined for silver between 1880 and 1900, and the old workings include seven adits and three small open cuts. Two narrow shear zones that contain gouge and quartz veins cross the claim én echelon. One zone strikes N. 77° W. and dips 80° S., the other strikes N. 51° E. and dips 73° NW. Several small, east-trending silicified zones also crop out. The individual veins range from less than 1 inch to 1-1/2 ft. in width. Pockets and streaks consisting largely of epidote, chrysocolla, barite, chalcopyrite, galena, chalcocite, and argentite (?) occur sporadically in the veins. Specks of a dull black radioactive mineral, probably pitchblende, were found with the sulfides in one place. Analyses of 17 channel and grab samples contained from 0.002 percent to 0.018 percent uranium; only two of the samples contained more than 0.01 percent uranium.

Silver Pick property.--The Silver Pick property in sec. 35, T. 8 N., R. 27 E., is owned by L. W. Osborne and Art Baseman of Yerington, Nev. The original location was made in 1935 for silver. Uranium minerals were not discovered until 1950. The workings consist of two shafts about 30 feet deep, small adits, and trenches. A northeast-trending shear zone contains gouge and scattered blebs of quartz in a granitic country rock. Some of the quartz nodules contain galena, chalcocite, and silver sulfides. The gouge contains local concentrations of a platy light green mineral, which has been tentatively identified as torbernite. The most radioactive sample that was analyzed contained 0.013 percent uranium and came from altered granite adjacent to the shear zone.

Boerlin ranch area.--A radioactive fault zone trending northeast in granite was noted 2 miles north of the old Boerlin ranch in sec. 18, T. 7 N., R. 27 E. The highest radioactivity noted occurs in an area about 1 foot square and a sample taken from this area contains 0.009 percent uranium.

Grant View hot spring.--The Grant View hot spring is in a bend of the East Walker River Valley in sec. 8, T. 7 N., R. 27 E., Mt. Diablo principal meridian; the spring is covered by the Grant View No. 1 claim belonging to Warren Loose, O. A. Kerlee, J. R. Ford, and L. O. Kerlee. The water near the source was slightly radioactive when collected but when analyzed a few weeks later, this water contained only 0.020 parts per million of uranium. The abnormal radioactivity is probably caused by radon gas. A sample of sand from near the spring contained 0.002 percent uranium.

## Yerington property

by R. U. King and W. A. Roberts

The Yerington property, owned by the Anaconda Copper Mining Company, is in Mason Valley 1-3/4 miles west of Yerington, the county seat of Lyon County. The property includes parts of secs. 16, 17, 20 and 21, T. 13 N., R. 25 E., Mt. Diablo base and meridian (No. 5, fig. 1). The Singatse Range, which is composed of volcanic and sedimentary rocks of Triassic or Tertiary age, rises abruptly to an elevation of about 7,000 feet, 5 miles to the west of the property. Mining activity in the area dates from about 1865 when attempts were made to mine copper and precious metals from rocks of Tertiary age on the eastern slopes of the range. The geology and ore deposits of the Yerington district have been described in detail in Professional Paper 114 (Knopf, Adolf, 1918). No production is recorded on the Yerington property because development has not proceeded beyond the exploratory stage. Exploratory development consists of numerous churn and diamond drill holes placed on a 200-foot grid, a 400-foot shaft, and an estimated 5,000 feet of drifts and raises. Sixteen thousand tons of low-grade copper ore is estimated to be present on the dumps of this property. Access to the mine workings was not possible at the time of examination because of flooding.

The purpose of this examination was to investigate the deposit from which a sample collected from a dump had been submitted that contained 0.03 percent $U_3O_8$. The examination was made during the period from October 15 to October 19, 1948. At about 75 stations on the dump, Geiger counts ranged from background to about 4 times background with an average slightly over background. The sample of rock exhibiting the greatest radioactivity assayed 0.005 percent U. A reconnaissance for radioactivity with carborne equipment covering the Yerington mining district was made in conjunction with examination of the property and included approximately 15 square miles on the eastern flank of the range. Two samples of rhyolite of Tertiary age were taken where increases in radioactivity were noted. The results are shown in table 4.

The Anaconda Copper Company has developed a low-grade disseminated copper deposit within a quartz monzonite porphyry stock. Over the entire dump there is little variation in the character of this porphyry except in the degree of mineralization and oxidation. Most of the dump is appreciably oxidized but a few small portions show very little oxidation of the primary copper minerals which consist chiefly of disseminated chalcopyrite.

Table 4.--Sample data, Yerington property, Lyon County, Nevada

| Sample No. | Description | Cu (percent) | $U_3O_8$ (percent) |
|---|---|---|---|
| RUK-8-48 | Weakly mineralized quartz monzonite porphyry, highly iron stained. Dump No. 3 | 0.60 | 0.005 |
| RUK-9-48 | Weakly mineralized quartz monzonite porphyry, little oxidation, relatively fresh grey rock. Dump No. 4 | 2.25 | .001 |
| RUK-10-48 | Quartz monzonite porphyry with heavy coatings of malachite and azurite. Dump No. 8 | 11.64 | .004 |
| RUK-11-48 | Selected pieces showing highest radioactivity, otherwise same as RUK-10-48 | 12.42 | .006 |
| RUK-12-48 | Copper and iron stained quartz monzonite porphyry. Dump No. 12 | 1.39 | .004 |
| RUK-13-48 | Copper and iron stained quartz monzonite porphyry. Dump No. 14 | 5.90 | .004 |
| RUK-14-48 | Miscellaneous station 7,500 ft. west of Yerington property. Unmineralized Tertiary rhyolite | .11 | .004 |
| RUK-15-48 | Miscellaneous station 2-1/2 miles SSW. of Yerington property. Unmineralized Tertiary rhyolite. | .04 | .001 |

Where oxidation has been intense the alteration of the copper minerals produces stains and coatings of malachite and azurite, and rarely a dark reddish-brown copper oxide on fracture surfaces and joint planes. No radioactive minerals were identified, but the highest radioactivity was associated with heavy coatings of azurite on slightly mineralized porphyry at one spot on the dump. Selected specimens of this rock assayed 12.42 percent copper and 0.006 percent $U_3O_8$. A grab sample from the same area assayed 11.64 percent copper and 0.004 percent $U_3O_8$.

## Nye County

### Henebergh tunnel area

by R. U. King and W. A. Roberts

A reconnaissance examination was made of the property of the Henebergh Brothers at Round Mountain, (No. 6, fig. 1) Nye County by the authors during the period from October 19 to October 23, 1948 for the purpose of verifying the presence of uranium ore in the Henebergh tunnel reported in the Mining Press, Reno, Nevada, July 1948. Traverses for radioactivity were made of the tunnel and surrounding areas including abandoned mines on Round Mountain and the Green Top claim, the Four Aces claim and other prospects east of Round Mountain. The geology and ore deposits of Round Mountain have been described in some detail by Ferguson (Ferguson, H. G., 1922). Seven chip samples and three grab samples were taken from radioactive rock in the Henebergh tunnel. One grab sample was collected adjacent to the portal of the tunnel and one grab sample was taken from radioactive material on the dump of a shallow shaft on the Green Top claim. The Henebergh tunnel was mapped in detail (fig. 6) and reconnaissance examinations were made of prospects in the surrounding areas. The tunnel is in secs. 31 and 32, T. 10 N., R. 44 E., Mt. Diablo base and meridan. The property at the time of the examination was owned by John A. and Perry A. Henebergh of Round Mountain and was under lease and option to the Nevada Uranium Production Company of Tonopah. The property consists of seven continguous lode claims named the Rainbow Nos. 1 to 7. Development on the property consists of 320-foot adit running approximately S. 55° W. into a low ridge. Six shallow cuts are strung out on a line extending N. 55° E. from the portal of the adit following a rhyolite dike for a total distance of 1,500 feet. No production has been recorded from this property.

Mesozoic granite makes up the country rock in the vicinity of the Henebergh claims. Locally this rock varies slightly in composition and texture and may be classed as quartz monzonite or granodiorite. It is a light gray to pink, medium-grained rock, composed chiefly of quartz, orthoclase, and subordinate biotite. Scattered thin dikes of aplite and small masses of pegmatite cut the granite but show no apparent structural control. A highly altered rhyolite dike crops out in the area. It is almost completely altered to a soft, friable clay-like material with a chalky or creamy white color. The Henebergh tunnel was driven along this dike for 320 feet and exposes fault contacts on either side of it. The dike has an average strike of N. 55° E. and dips vertically or steeply SE. It ranges in width from 5 to 6 feet where both walls are exposed in the tunnel. On the surface the dike is traceable only by scattered pits and trenches for approximately 2,000 feet and probably pinches out to the northeast and southwest of the tunnel. Megascopically visible uranium minerals are confined to coatings of fracture and fault surfaces. Small flakes 1 to 2 mm in diamter and aggregates of yellowish-green, tabular, fluorescent secondary uranium minerals are tentatively identified as autunite. Considerable iron staining was noted in these fractures and fault surfaces in the rhyolite and along its contacts with the granite.

About 1 mile southwest of the Henebergh tunnel, a copper-bearing quartz vein is exposed in a shallow shaft on the Green Top claim. This vein is from 1 to 2 feet wide, strikes N. 50° E. and dips 50° to the SE. It consists chiefly of banded and vuggy quartz and some quartz crystals. Green copper stains are common and a few dull yellow stains are also present. The quartz vein material on the dump is abnormally radioactive.

The association of small amounts of secondary uranium minerals with highly altered rhyolite on the Henebergh property gives little promise of a commercial deposit. The lack of alteration of wall rocks and the absence of replacement of the dike by uranium minerals indicates a very weak source of mineralization. The secondary uranium mineral present is confined to coatings on joint and fracture surfaces. Assays of samples from the Henebergh tunnel are given in table 5.

## Daisy fluorspar mine

by C. W. Chesterman and F. H. Main.

The Daisy fluorspar mine is in sec. 7, T. 12 S., R. 47 E., about 5 miles east of Beatty (No. 9, fig. 1). The ore mineral, an earthy purple fluorspar, occurs in veins and pipe-like bodies which have been mined to a vertical depth of 400 feet. The country rock is a silicified dolomitic limestone. Samples of fluorspar (table 6) contained from 0.002 to 0.015 percent equivalent uranium. Figure 7 shows the workings and geology of the mine. A more recent report by Thurston (Thurston, W. R., 1949) describes the fluorspar deposits of the Daisy mine in detail.

Table 5.--Sample data, Henebergh tunnel area, Round Mountain district, Nye County, Nevada

| Number | Description | $U_3O_8$ (percent) |
|---|---|---|
| RUK-16-48 | Henebergh tunnel, portal + 100 ft. Chip sample 15 ft. up east rib and across back of tunnel. Altered rhyolite. | 0.002 |
| RUK-17-48 | Henebergh tunnel, portal + 100 ft. 5 ft.-vertical chip sample, west rib, granite | .001 |
| RUK-18-48 | Henebergh tunnel, portal + 225 ft. 6 ft.-vertical chip sample, east rib, granite | .015 |
| RUK-19-48 | Henebergh tunnel, portal + 225 ft. 6 ft.-chip sample across back rhyolite | .005 |
| RUK-20-48 | Henebergh tunnel, portal + 225 ft. 4 ft.-vertical chip sample, west rib, granite | .002 |
| RUK-21-48 | Henebergh tunnel, portal + 150 ft. Grab sample of broken rhyolite showing maximum concentration of fluorescent mineral and highest radioactivity, east rib at floor | .050 |
| RUK-22-48 | Henebergh tunnel, portal + 300 ft. 3 ft.-vertical chip sample, east rib, rhyolite | .021 |
| RUK-23-48 | Henebergh tunnel, portal + 300 ft. 6ft.-horizontal chip sample along east rib, rhyolite | .008 |
| RUK-24-48 | Henebergh tunnel, portal + 315 ft. Grab sample from west rib near floor. Mostly granite | .014 |
| RUK-25-48 | Henebergh tunnel, portal + 119 ft. Grab sample at floor, east rib | .011 |
| RUK-26-48 | Henebergh tunnel, grab sample of gravel from open cut 70 ft. outside of portal | .001 |
| RUK-27-48 | Grab sample of vein quartz from dump of discovery shaft on Green Top claim<br>Silver assay 87 oz./ton<br>Copper assay 0.66 percent | .014 |

## Pershing County

A brecciated stock of rhyolite porphyry has intruded slates and phyllites of probable Triassic age at Majuba Hill in the Antelope district. Both the stock and the rocks that it intrudes have been extensively tourmalinized. Cassiterite and secondary copper minerals are scattered in web-like masses through the rhyolite. The hydrous uranium phosphates, torbernite and metatorbernite, occur erratically along fractures and vugs within the rhyolite and on bedding and fracture surfaces in slates and phyllites.

Table 6.--Sample data, Daisy fluorspar mine, Nye County, Nevada

| Sample No. | Thickness in feet | Description of sample | Equivalent uranium (percent) |
|---|---|---|---|
| C-32-122 | 5.5 | Fluorspar, earthy, purple, soft | 0.007 |
| C-32-123 | 6.0 | Fluorspar, earthy, purple, soft | .007 |
| C-32-124 | 4.0 | Fluorspar, earthy, purple, soft, some clayey gouge in seams | .013 |
| C-32-125 | 4.0 | Fluorspar, earthy, purple, soft | .015 |
| C-32-126 | 4.0 | Fluorspar, earthy, purple, soft | .011 |
| C-32-127 | 6.0 | Fluorspar, earthy, purple, soft | .008 |
| C-32-128 | - | Fluorspar, mill concentrate, 80 percent $CaF_2$. | .002 |

The Stalin's Present prospect is in Rocky Canyon in the Humboldt Range about 11 miles northeast of the railroad town of Oreana. The uraniferous deposit is in a thin layer of a dark green metamorphic rock or vein material, enclosed in granite. The layer has been partly replaced by smoky quartz, calcite, pyrite, pitchblende, and gummite.

## Majuba Hill mine

by R. H. Thurston and A. F. Trites, Jr.

The Majuba Hill mine, (No. 2, fig. 1) 20 miles by graded dirt road west of Imlay in sec. 2, T. 18 N., R. 31 E., Mt. Diablo principal meridian, is owned by Mr. E. J. Myler of Imlay and is under option to the Getchell Mines, Inc. The mine was originally worked for copper about 1907 and between 1916 and 1918 it yielded about 4,000 tons of ore that averaged 12 percent copper. The mine remained idle from 1918 until 1941, when it was re-opened by the Freeport Copper Company and worked for both copper and tin. The tin deposits are described in U. S. Geological Survey Bulletin 931-C (Smith, W. C., and Gianella, V. P., 1942). In 1942 the present owner, E. J. Myler, acquired the property and mined it for copper. Sometime between 1942 and 1945 the principal uranium deposit was discovered, but there has been no uranium shipped from the mine (1951). The mine workings are extensive and include 3 adit levels and more than 5,000 feet of interconnecting workings. A comprehensive report on the Majuba Hill mine is being prepared for publication (Thurston and Trites) and accordingly only a brief summary of the geology and uranium deposits is given here.

Majuba Hill is a complex rhyolite plug of Tertiary age. Five types of intrusion breccias and several fault breccias are associated with the plug. The igneous complex intrudes and has slightly metamorphosed the surrounding argillites, quartzites, and impure limestones of Triassic (?) age. Both the igneous and metamorphic rocks near the plug have been partly sericitized, silicified, and tourmalinized.

The uranium deposits at Majuba Hill mine occur in a copper- and tin-bearing vein, in the rhyolite and quartz porphyry adjacent to the uraniferous vein, in fault gouge, in tourmalinized intrusion breccia, and in rhyolite and quartz porphyry adjacent to uraniferous breccia. Except for the uraniferous vein, a three-foot vein that contains an average of almost 0.30 percent uranium, the deposits are low in grade. Zeunerite, torbernite, and metatorbernite are the most abundant uranium-bearing minerals; autunite and gummite also have been reported. Primary uranium minerals have not been found. The secondary uranium-bearing minerals are associated with sooty chalcocite, pyrite, and arsenopyrite in the uraniferous vein in the Copper stope; with chalcocite, malachite, and pyrite in the rhyolite and quartz porphyry adjacent to the uraniferous vein; with copper minerals in the intrusion breccia; and with iron oxides in the fault gouge.

Radon, that may be indicative of buried uraniferous deposits, was found locally in the mine.

### Stalin's Present uranium prospect

by M. H. Staatz

The Stalin's Present uranium prospect, (No. 3, fig. 1), is 11 miles northeast of the railroad town of Oreana and about 5 miles above the mouth of Rocky Canyon in the Humboldt Range (Staatz, 1951a). It was located in sec. 6, T. 29 N., R. 34 E., by E. J. Bottomley and A. V. Smith of Lovelock, Nev., in December 1948. The prospect is owned (1951) by E. J. Bottomley and Felix Turillas of Lovelock. In 1951, the workings consisted of a small pit and 25-foot trench connected with a 63-foot adit.

A detailed description of the geology of the prospect is given by Staatz (1951a).

The Stalin's Present uranium prospect is underlain by a light gray granite near the contact with metasediments.

The uranium at the Stalin's Present prospect is in a layer, less than a foot thick, of a dark green metamorphic rock composed of diopside, epidote and chlorite that has been partly replaced by stringers of smokey calcite and quartz. This layer trends northward and dips steeply eastward in a light gray granitic country rock. At places the granite adjacent to the diopside rock is radioactive.

R. F. Johnson and G. W. Walker of the U. S. Geological Survey, who visited this property in connection with the Defense Minerals Administration program, interpret the geology somewhat differently than Staatz.

They say . . . . "Rocks exposed in the vicinity of the workings are metasediments intruded by a dike or tongue of quartz porphyry. The metasediments, which according to Jenney _/ are probably Triassic in

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_/ Jenney, C. P., Geology of the central Humboldt Range, Nevada: Univ. Nevada Bull., v. 29, no. 6, p. 17-18, 1935.

---

age, consist of silicified grit beds and shales. Alteration along north striking shear zones locally has caused the development of white mica in both the metasediments and the quartz porphyry. The quartz porphyry dike is about 75 feet wide, and strikes nearly north. It was not mapped north or south of the workings so it may be related either to a granite porphyry mass to the southeast or to a granitic intrusive exposed about 600 feet southwest of the workings and reported by Jenney to intrude both the metasediments and the granitic porphyry.

Narrow, discontinuous, north-trending veins of diopside-rich rock transgress the quartz porphyry. The owner (Mr. Bottomley) believes there are 3 such veins on the property, but exposures are not good enough to rule out the possibility of some repetition by faulting."

Samples analyzed in the Trace Elements Section Washington Laboratory of the U. S. Geological Survey contained pitchblende and gummite. The pitchblende occurs as scattered grains in the diopside rock and the gummite forms thin coatings on fracture surfaces in the adjoining granite. Three channel samples taken across the layer of diopside rock contained from 0.042 to 0.060 percent uranium. One chip sample contained 0.18 percent uranium.

## Other reported occurrences

The following reported occurrences of uranium and thorium in Nevada have not yet been investigated by the U. S. Geological Survey: (1) the Pinon Range, 15 miles south of Palisade in Eureka County where a uranium-vanadium-bearing asphaltite has been reported (Gianella, 1945); (2) monazite-bearing placer gravels in the Genou, Alder Gulch, Gold Basin and Mountain City districts of Clark County, the Tule Canyon district of Esmeralda County, the Birch Creek district of Lander County, the Carson City district of Ormsby County, and the Manhattan and Round Mountain districts of Nye County (Carper, 1945). Following is a list of analyses of samples submitted by citizens of Nevada to the U. S. Geological Survey (table 7).

## CONCLUSIONS

Commercial exploitation has not yet been made of the uranium on any uranium prospects in Nevada (table 8), with the exception of the Green Monster mine which shipped a few tons of ore to Marysvale, Utah in 1951. Adverse factors affecting exploitation include: low-grade and small reserves, complex nature of the ore, and great distance to markets. If a commercial plant for milling and concentrating the secondary uranium phosphates were established in the region, the torbernite at Majuba Hill

Table 7.--Samples submitted to the U. S. Geological Survey for analysis

| Sample Number | Locality | Submitted by | Type | Uranium minerals | Equivalent uranium (eU or uranium (U) (percent) |
|---|---|---|---|---|---|
| Churchill County | | | | | |
| | Gamma group | F. J. Erb | Lignite | | 0.042 U |
| Clark County | | | | | |
| AEC1255 | Goodsprings district | E. M. Thompson | Conglomerate | | .017 eU |
| W2242 | Gold Butte | R. F. and Fay Perkins | Magnetite, siderite, biotite, hematite | | .41 eU<br>.03 U |
| W2662 | Green Monster mine | F. D. Smith | Yellow earthy ore, cerussite, calamine | Kasolite | 6.0 eU |
| 56064 | Lake Meade area | J. M. Kloff | Pegmatite ? | | .19 eU<br>.02 U |
| 56097 | ? | E. K. Judd | | | .008 eU |
| 56098 | ? | do. | | | .002 eU |
| 56099 | ? | do. | | | .001 eU |
| RW3535 | | H. E. Maus | Carbonaceous soil | | .14 eU<br>.000 U |
| RW3535 | | do. | do. | | .87 eU<br>.000 U |
| Lincoln County | | | | | |
| WZ2946 | Alamo | Elizabeth DeBronwer | Gypsiferous claystone | | <.001 eU |
| WZ2946 | do. | do. | Altered igneous rock | | .006 eU |

Table 7.--Samples submitted to the U. S. Geological Survey for analysis.--Continued

| Sample Number | Locality | Submitted by | Type | Uranium minerals | Equivalent uranium (eU or uranium (U) (percent) |
|---|---|---|---|---|---|
| WZ2946 | Alamo | Elizabeth DeBronwer | Carbonaceous siltstone | | 0.003 eU |
| WZ2946 | do. | do. | Gypsiferous sandstone | | .001 eU |
| WZ2946 | do. | do. | do. | | .03 U |
| Lyon County | | | | | |
| 48396 | Silver Pick property | Art Bassman Leo Osborne | Altered granite | Torbernite | .064 U |
| 48397 | do. | do. | Gouge | Yellow fluorescent | .32 U |
| 48937 | ? | do. | Iron-stained vein, quartz | | .003 eU<br>.004 U |
| 47551 | ? | L. W. Osborne | Altered granite | Autunite | .017 U |
| Pershing County | | | | | |
| W1672 | ? | G. L. Curry | V and secondary Cu mineral and MnO stain | | .021 eU |
| Washoe County | | | | | |
| W2914 | Peterson Range | Darneille and Byler | Quartz diorite, granite, quartz | | .005 eU |
| White Pine County | | | | | |
| 26824 | Near Ely | Walter Edens | Altered granite | Carnotite | .32 U<br>.24 eU |

Table 7.--Samples submitted to the U. S. Geological Survey for analysis.--Continued

| Sample Number | Locality | Submitted by | Type | Uranium minerals | Equivalent uranium (eU or uranium (U) (percent) |
|---|---|---|---|---|---|
| Locality unknown | | | | | |
| W1377 | | G. A. McGinnes | Rhyolite | Torbernite | .03 U |
| W1377 | | do. | Weathered granite | | <.001 U |
| RW2186 | | Owen Walker | Metamorphic rock | | .06 U<br>.16 eU |
| W139 | | E. A. Walker | Granite gneiss and hematite | | .30 eU |

Table 8.--Uranium deposits in Nevada arranged alphabetically by county and by district 1/

| | Location | | | Reference Number (fig. 1) | Character of deposits | | | Development | Maximum equivalent uranium (eU) or uranium (U) (percent) | Production |
|---|---|---|---|---|---|---|---|---|---|---|
| | Township | Range | Section | | Type | Country rock | Minerals | | | |
| Churchill Co. | | | | | | | | | | |
| Gamma group | 16 N. | 30 E. | --- | 4 | Radioactive lignite | Sandstones and clays | Carbonaceous material | 30-ft. adit; 10-ft. trench | 0.059 U | ---- |
| Clark Co. | | | | | | | | | | |
| Goodsprings district | | | | | | | | | | |
| Erie to Arden area | --- | --- | --- | 13 | Disseminated | Quaternary caliche | Tyuyamunite | ---- | ---- | ---- |
| Green Monster mine | 24 S. | 56 E. | 1 - 2 | 11 | Vein | Dolomite of Mississippian age | Dumontite(?), kasolite, malachite, cuprite, cerussite, limonite | Shaft, drifts, and stopes; 4 levels | 9.0 U | U, Zn, and Pb |
| Goodsprings | 23 S. | 58 E. | 14 | 12 | Disseminated | Permian sandstone | Carnotite calcite, Mn oxides | Prospect pits | | ---- |
| Singer mine | 25 S. | 58 E. | 18 | 17 | Fracture coatings | Mississippian dolomite | Secondary U, Pb, Zn, Ag, and Cu minerals | Small adits and pits | | Pb, Zn, Cu, Ag |
| Sloan | 23 S. | 60 E. | 32 | 14 | Fracture zone | Rhyolite porphyry | Carnotite calcite, Mn oxides | ---- | .017 eU | ---- |
| Sutor | 24 S. | 60 E. | 29 - 30 | 15 | Disseminated | Permian sandstone | do. | Prospect pits | | ---- |
| Vanadium Wedge mine | 25 S. | 59 E. | | 16 | Fault gouge | Mississippian limestone | Malachite, azurite | Small adit | | Cu |

1/ Location of deposits shown on figure 1.

Table 8.--Uranium deposits in Nevada arranged alphabetically by county and by district 1/--Continued

| | Location | | | Reference Number | Character of deposits | | | | Maximum equivalent uranium (eU) or uranium (U) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Township | Range | Section | (fig. 1) | Type | Country rock | Minerals | Development | (percent) | Productio |
| Clark Co.-Continued | | | | | | | | | | |
| Gold Butte district | | | | | | | | | | |
| Old Dad and Uranium No. 1 | 18 S. | 70 E | | 10 | Pegmatite | Granite of pre-Cambrian age | Monazite(?), magnetite | Prospect pits | .41 eU, .03 U | ---- |
| Humboldt Co. | | | | | | | | | | |
| Virgin Valley Opal district | 45 N. | 26 E. | | 1 | Deposited in opal | Opalized tuff and ash | Carnotite, opal | 315-ft. trench 15 small pits | 0.12 U | Opal |
| Lincoln Co. | | | | | | | | | | |
| Silver Park district | | | | | | | | | | |
| Atlanta mine | 6 N. | 68 E. | | 8 | Breccia zone | Silicified dolomite and porphyry | Uranophane(?), limonite, calcite, quartz, barite, opal | Two shafts, workings on 3 levels | .11 U | Six dollar gold per ton |
| Lyon Co. | | | | | | | | | | |
| Washington district | | | | | | | | | | |
| Northwest Willys group (2 claims) | 8 N. | 27 E. | 29 | 7 | Veins | Porphyritic granite | Galena, pyrite, chalcopyrite, Cu oxides, quartz | Two bulldozer cuts, 2 small pits | .003 U | ---- |
| West Willys group (7 claims) | 8 N. | 27 E. | 32 - 33 | 7 | do. | do. | Pitchblende(?), kasolite, galena, chalcocite, Cu oxides, quartz | Shafts, adits, cuts, and pits | .11 U | ---- |
| Silver Pick claim | 8 N. | 27 E. | 35 | 7 | Shear zone | do. | Torbernite(?), galena, chalcocite, quartz | Shaft, cut, and pits | .013 U | ---- |

Table 8.--Uranium deposits in Nevada arranged alphabetically by county and by district[1]/--Continued

| | Location | | | Reference Number (fig. 1) | Character of deposits | | | Development | Maximum equivalent uranium (eU) or uranium (U) (percent) | Production |
|---|---|---|---|---|---|---|---|---|---|---|
| | Township | Range | Section | | Type | Country rock | Minerals | | | |
| yon Co.-Continued | | | | | | | | | | |
| Washington district | | | | | | | | | | |
| Grant View hot spring | 7 N. | 27 E. | 8 | 7 | Hot spring | Sand | | ---- | .008 eU<br>.002 U | ----<br>---- |
| Boerlin Ranch | 7 N. | 27 E. | 18 | 7 | Veins | Porphyritic granite | Clay minerals, quartz | ---- | .009 U | ---- |
| Yerington Anaconda Copper property | 13 N. | 25 E. | ? | 5 | Tailings dump | ---- | ---- | ---- | .006 U | ---- |
| ye Co. | | | | | | | | | | |
| Round Mountain district | | | | | | | | | | |
| Henebergh tunnel | 10 N. | 44 E. | 31 - 32 | 6 | Fracture coatings | Rhyolite dike cutting granite | Autunite(?), kaolin | 35-ft. adit, 6 shallow cuts | .04 U | ---- |
| Beatty district | | | | | | | | | | |
| Daisy mine | 12 S. | 47 E. | 7 | 9 | Veins and pipes | Silicified, dolomitic limestone | Fluorite | | .015 eU | Fluorite |
| ershing Co. | | | | | | | | | | |
| Majuba Hill mine | 32 N. | 31 E. | | 2 | Breccia zone | Slate, quartzite, porphyry | Torbernite, cassiterite, secondary Cu and Ag minerals | Adits on 3 levels | .15 U | Cu, Sn, Ag and Au |
| Stalin's Present claim | 29 N. | 34 E. | 6 | 3 | Metamorphic zone | Greenstone, granite | Pitchblende, gummite, diopside, chlorite, calcite, quartz | 63-ft. adit and small pit | .18 U | ---- |

might constitute a valuable byproduct from the mining of the copper and tin ore.

It should be emphasized that relatively little of Nevada has been adequately prospected for uranium. The wide distribution of known occurrences within the state encourages the hope that further and more detailed exploration will reveal uranium deposits of economic value under current market conditions.

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CONTENTS

# RADIOACTIVE DEPOSITS OF NEVADA

Compiled by

T. G. Lovering

## ABSTRACT

Reconnaissance for uranium in Nevada prior to January 1, 1952, resulted in finding at seven localities, approximately ten million tons of rock, with a uranium content ranging from 0.011 to 0.15 percent; the average is 0.025 percent. The highest grade deposit, the Stalin's Present prospect, has reserves of about 200 tons of rock containing 0.15 percent or 0.3 ton of uranium. The other deposits are too low in grade to be mined at a profit under the economic conditions existing in 1952. The most promising of these low-grade deposits is at Majuba Hill where it is estimated that the inferred reserves are 20,000 tons containing 0.08 percent uranium. The Survey's program of regional reconnaissance will be continued in Nevada in an attempt to delimit areas suitable for district mapping and to find additional deposits. Compilation of existing data indicates that the two most favorable areas are the Stalin's Present prospect area in Pershing County, and the southern portion of Clark County.

## RESERVES

Reconnaissance for uranium at seven localities in Nevada prior to January 1952, resulted in finding 10,000,000 tons of radioactive material with a grade ranging from 0.011 to 0.15 and averaging about 0.025 percent uranium. The inferred tonnage and grade estimated for each locality follows:

| Property and county | Average grade (percent uranium) | Inferred ore (tons) | Tons of uranium |
|---|---|---|---|
| Gamma group, Churchill County | 0.025 | 48,500 | 12.1 |
| Green Monster mine, Clark County | .02 | 1,000 | 0.2 |
| Virgin Valley Humboldt County | .02 | 400,000 | 80.0 |
| Washington district, Lyon County | .011 | 7,000 | 0.7 |
| Stalin's Present prospect, Pershing County | .15 | 200 | 0.3 |
| Majuba Hill, Pershing County | .08 | 20,000 | 16.0 |
| Erie to Arden, Clark County | .025 | 9,500,000 | 2,375.0 |
| Total (rounded) | .025 | 10,000,000 | 2,500 |

The sixteen other radioactive occurrences investigated were considered too small or too low grade to warrant estimates of tonnage and grade. None of the localities in the state was considered to have sufficient uraniferous material of ore grade to be minable under market conditions existing in 1952. The uraniferous lignites on the Gamma group, the uraniferous opal deposits in the Virgin Valley, and deposits in the Erie to Arden area are too low grade to be minable. The tenor of uranium in deposits at the Green Monster mine and in the Washington district varies widely, therefore, although the average grade of any large tonnage is low, it may be possible to produce a small quantity of ore containing more than 0.2 percent uranium by careful hand sorting. The average grade--0.15 percent uranium--of the Stalin's Present property is nearly the maximum grade obtainable without milling. The tonnage available at this property is small--about 200 tons. The deposit at Majuba Hill is the deposit most likely to be mined profitably because of the presence of other metals, but the available tonnage, containing more than 0.2 percent uranium, is too small to be mined for uranium alone at prices existing in 1952.

## METHODS OF CALCULATING RESERVES

The described deposits were sampled by different individuals, at different times, and under varying conditions, therefore, there is no uniformity of sampling techniques and methods of reserve estimation. Most of the reserve estimates are based largely on geologic inference and a relatively small number of samples; consequently the results represent only an order of magnitude and would have to be supplemented by a considerable amount of detailed sampling before any accurate reserve estimates could be made.

## PLANS

The areal distribution of uranium occurrences in Nevada, as shown in this compilation, indicates three areas which may be of interest as potential sources of uranium. These are (1) Majuba Hill in Pershing County, (2) the Stalin's Present mine area in Pershing County, and (3) the southern part of Clark County. The first of these areas, Majuba Hill, has been studied in detail by Thurston and Trites; their final report and recommendations are contained in Trace Elements Investigations Report 171.

The current program of regional reconnaissance in Nevada, being carried out by the U. S. Geological Survey, will be continued to delimit areas for future district studies and to find additional deposits.