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RADIOACTIVE MINERAL OCCURRENCES IN NEVADA

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RADIOACTIVE MINERAL OCCURRENCES IN NEVADA

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ABSTRACT

Four hundred forty-two natural radioactive occurrences of uranium and thorium are known in Nevada. These uranium and thorium occurrences are found in every county, but are concentrated in the west-central part of the State. The distribution pattern somewhat resembles that of metal-mining districts and intrusive rocks. Many occurrences are concentrated in groups or clusters, indicating a possible common genesis within a cluster.

Nevada radioactive occurrences may be classified by mineralogic type and host rock lithology. Several combinations of host rock and mineralogic type contain most of the occurrences, while other combinations contain none. The largest number of occurrences are found in pre-Tertiary rocks associated with base and precious metals. Host rock types are subdivided into: Tertiary volcanic rocks, Tertiary sedimentary rocks, pre-Tertiary rocks, placer deposits, spring deposits and groundwater, and unknown rock types. Four mineralogic types are described: uranium associated with base and precious metals, radioactive pegmatites and plutonic accessory minerals, uranium minerals without associated metals, and anomalous radioactivity only.

At least nine of Nevada's 17 counties are known to have produced uranium from about 28 mines. No production is known before 1951, and about 80 percent of the 137,792 pounds of U_3O_8 produced has come from the Apex mine in Lander County. No production has been reported since 1968; and because of high haulage rates and long shipping distances, Nevada ore grades must be high to make a profit. The A. E. C. estimates Nevada's uranium reserves at 14,000 tons of ore at a grade of 0.33 percent U_3O_8, but this figure is mainly the residue (reserves minus production) from earlier reserve estimates made during periods of higher prices and haulage allowances. A much lower estimate of Nevada reserves is expected following property examinations now in progress by the A. E. C.

Recommendations for exploration include:

(1) Areas of Tertiary sedimentary rocks in the vicinity of known uranium occurrences. Occurrences worthy of further study are located in at least five counties.

(2) Occurrences in or below ash-flow tuffs, especially in Elko and Washoe Counties. Detailed geochemistry, geophysics, and drilling might result in discovery of larger or higher-grade deposits than those presently known.

Exploration interest in vein-type deposits similar to those at the Apex mine, Nevada's major producer, is not expected to be high.

Possible large, low-grade resources of uranium in Nevada may be found in phosphates, black shales, and porphyry copper deposits. Any uranium produced from such deposits would probably be as a byproduct.

INTRODUCTION

PURPOSE AND SCOPE

This report describes all known naturally anomalous radioactive localities in Nevada, and is part of a continuing study of mineral commodities by the Nevada Bureau of Mines and Geology. It attempts to bring together previously collected data from numerous sources that vary widely with respect to availability and reliability, as well as new information gathered by the author in the course of numerous property examinations. The author and the Bureau will appreciate receiving any additions or corrections. Any information acquired after the publication of this report will be placed on file at the Nevada Bureau of Mines and Geology, where it will be available for public inspection.

This report is a compilation of all pertinent data, and prospects and mines are described in varying degrees of completeness. Obviously, not all data could be included. On the basis of those deposits which have been adequately described, the author has also attempted to group and classify the Nevada occurrences, in the hope that this may be of some value in the search for new deposits.

The major emphasis was placed on descriptions of the geology, location, mineralogy, and radioactivity of these deposits; less emphasis was placed on history and detailed development descriptions. All known data on uranium production also was included. Ownership information was usually difficult to obtain or unknown, and is not reported. Claims in many of the areas examined have been allowed to lapse.

Demand for uranium is expected to increase in the future, and the author hopes that this report will stimulate exploration for radioactive minerals in Nevada. Although no Nevada mines are presently producing uranium, the large number and varied types of occurrences indicate a potential for the discovery of economically minable ore deposits.

PREVIOUS INVESTIGATIONS AND SOURCES OF INFORMATION

Uranium in Nevada was first mentioned (Eng. Mining Jour., 1913) in connection with the search for radium-bearing ores. Monazite, which contains thorium, was mentioned even earlier (Day and Richards, 1906). The first specific mention of a uranium mineral occurrence in Nevada was probably by Hill (1916) in the description of the Atlanta mine in Lincoln County.

Most investigations occurred during the uranium boom of the 1950's. At that time the Resource Investigation Division of the U. S. Atomic Energy Commission investigated more than 300 radioactive localities and many other non-radioactive prospects in Nevada. About 600 one-page reports were released concerning Nevada investigations. These preliminary reconnaissance reports were not available to the public at that time, but now can be ordered, either as paper copies or microfiche, from the Clearinghouse for Federal Scientific and Technical Information, U. S. Department of Commerce, Springfield, Va., 22151. (Microfiche are single 4- by 6-inch microfilm negatives which contain an average of 30 reports each.) The reports are available for inspection in the Library of the Mackay School of Mines (microfiche) or in the files of the Nevada Bureau of Mines and Geology (paper copies), both on the Reno campus of the University of Nevada. Additionally, reports on other states are available on microfiche in the Mackay School of Mines Library.

Atomic Energy Commission (A. E. C.) geologists also compiled more detailed data on selected Nevada uranium deposits. Much of this information was published, either by the A. E. C. itself, or in cooperation with the U. S. Geological Survey, but unpublished material also exists. (Published Atomic Energy Commission reports are usually available at official A. E. C. depository libraries, which include the University of Nevada Libraries at Reno and Las Vegas). Many unpublished reports, guidebooks, and maps, including some describing Nevada occurrences, have been placed on open file at the Grand Junction, Colo. office of the A. E. C. Press releases describing this open-file material are available from the Public Information Office in Grand Junction; the open-file documents themselves are available for public inspection in the Technical Library at the Grand Junction office. Copies of all known A. E. C. reports on Nevada uranium also are available in the files of the Nevada Bureau of Mines and Geology.

The U. S. Geological Survey has, of course, published studies on Nevada radioactive occurrences. Trace Element Memorandums and Trace Element Investigations by the Survey contain descriptions of cooperative studies with the A. E. C.; and Bulletins, Professional Papers, and Circulars contain other articles. Professional Paper 300 (Page, Stocking, and Smith, 1956) contains descriptions of Nevada deposits as well as general articles on uranium and thorium. A bibliography by Krusiewski (1970) lists some reports on Nevada and their availability.

Nevada Bureau of Mines Map 19 (Schilling, 1963) shows 104 uranium prospects. Plate 1 of the present report supercedes Map 19. Nevada uranium occurrences are also summarized in the following U. S. Geological Survey articles covering the United States: Butler, Finch, and Twenhofel (1962); Walker, Osterwald, and Adams (1963); and Finch (1967). Olson and Adams (1962) summarize thorium and rare earths for the U. S., and list Nevada occurrences. Most references to specific Nevada properties can be found in the Bibliography of North American Geology or Nuclear Science Abstracts. The bibliography in this report includes all references known by the author to Nevada uranium deposits.

METHODS OF INVESTIGATION

This study was begun by the author in 1968 with an investigation of all known published and unpublished information concerning Nevada radioactive deposits. As a result of this study, a complete bibliography was compiled, and copies were made of all long reports, maps, and other documents. These copies are available for public inspection at the Nevada Bureau of Mines and Geology. From these data, preliminary information sheets were compiled for every known Nevada prospect that contained radioactive minerals, or that indicated radioactivity more than 2 to 3 times background. Some prospects and mines were visited by the author, and this additional data was added to the descriptions. Prospects were selected for field examination for the following reasons: uncertainty in location or geologic data, possible undescribed development, and for general information concerning certain types or clusters of deposits.

During the examination of the deposits, open cuts and underground workings were checked for anomalous radioactivity with a Precision Model 111 scintillator. (Radiation detection is further discussed in the section *Properties and uses).* If extensive undescribed workings were present, geologic maps were drawn. Samples were collected from many properties and later examined in the office. This examination included inspection in short-wave ultraviolet light for fluorescent mineral species as well as inspection under a binocular microscope. Some samples were studied in thin section, and a few minerals were identified by use of X-ray diffraction techniques. The author also made some use of radioactive samples available in Nevada Bureau of Mines and Geology files, and from collections of Bureau personnel. Reported uranium analyses are almost exclusively from other published and unpublished information.

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Additionally, the author would like to take this opportunity to thank his colleagues at the Nevada Bureau of Mines and Geology, especially Harold F. Bonham, Jr., for many useful discussions, and Arthur Baker, III, for critically reading the manuscript. The author is especially indebted to John H. Schilling for many helpful suggestions and critical review of the manuscript. Susan Nichols did an excellent job of preparing the illustrations, and Helen Mossman and Peggy Goldsmith typed the manuscript. Ira Lutsey is responsible for editing the report, and the author gratefully acknowledges his many useful comments.

GEOLOGY OF URANIUM AND THORIUM

PROPERTIES AND USES

Several good reference works describe the physical, chemical, and nuclear properties of uranium and thorium. U. S. Bureau of Mines Bulletin 650, and the report of Bellamy and Hill (1963), probably are detailed enough for most readers. The geochemistry of uranium and thorium is discussed by Wedepohl (1969), who lists numerous review articles.

Uranium

Uranium occurs naturally as a mixture of three isotopes: U^{238} (99.285 percent), U^{235} (0.71 percent), and U^{234} (0.0051 percent). All three are radioactive, but have decay half lives of 10^9, 10^8, and 10^5 years, respectively. U^{238} is the primary source from which the secondary members of the uranium-radium series are derived, since it is the only one long-lived enough to have existed since the formation of the elements. U^{238}, the most common natural isotope, can be converted to Pu^{239} by neutron bombardment. Pu^{239} is a fissionable isotope, and can be used as a fuel in nuclear reactors.[1] Isotopes capable of conversion to fissionable matter are called fertile materials.

U^{235} is the only isotope which is naturally fissionable; that is, capable of splitting to produce energy. The U^{235} present in natural uranium is unrelated to the uranium-radium decay series, and its origin is unknown.

A considerable amount of uranium which has been depleted in U^{235} (enriched in U^{238}) is available in the United States as a result of the production of U^{235} enriched uranium for nuclear reactors. This U^{238} is available for breeder reactors, should they come into general use.

U^{234} is a nonfissionable, nonfertile isotope of no practical use as a nuclear fuel.

Several uranium isotopes can be produced artificially. The most important of these is U^{233}, which can be produced by nuclear bombardment of Th^{232}. Thus, Th^{232} is a fertile material, and could be used in breeder reactors.

The natural radioactive decay series for uranium is quite complex. U^{238} decays through 14 intermediate radioactive nuclides to the stable element Pb^{206}; U^{235} follows the actinium decay series through 10 or 11 stages to the stable isotope Pb^{207}.

Uranium has a density of approximately 19, nearly that of gold, and 65 percent heavier than lead. The silver-grey metal is chemically quite reactive, and surfaces oxidize rapidly at room temperature. It is reasonably ductile and can be fabricated by normal methods. The normal valences of uranium are +3, +4, and +6.

Practically all of the gamma radiation emitted by a uranium mineral and detected by radiometric survey instruments is due to the decay product Bi^{214} although U^{235}, Pb^{214}, Pb^{212}, Ac^{228}, Th^{234}, and Tl^{208} contribute minor amounts. The Bi^{214} is in the decay series of U^{238}, and is a daughter product of radium. If it can be assumed that the radioactive decay products have not been separated from the uranium, then the level of gamma radiation is proportional to the uranium content of the rock. For this, reason, scintillators used in the field do not directly measure uranium content.

It is possible for uranium to be in disequilibrium with its daughter products. For example, Rn^{222}, which is a gas, is quite mobile, and its movement can create a state of disequilibrium. Also, U^{234} and Ra^{226} are quite soluble in water and may be separated through solution from their parents. Small amounts of radium are found in springs, rivers, and sea water for this reason. If any of the above daughters are removed, less Bi^{214} is produced, and a radiometric estimate of the uranium present will be low.

Uranium has been mainly used in the past for atomic weapons, but in the future, its principal use will be as fuel for nuclear reactors. The Atomic Energy Commission has estimated that by 1980 between one-fourth and one-third of the Nation's total installed electrical generating capacity will be nuclear powered. The future demand for uranium has been the subject of much speculation in the past several years. Its production and consumption will continue to increase, but estimates of total demand vary. Projections must be made several years into the future because of the time required to start up new mines, and because of the large amounts of uranium held in various parts of the refining process and in nuclear reactors themselves.

The best sources of information on uranium consumption, uses, and demand, are the most recent U. S. Bureau of Mines Minerals Yearbook, and press-releases and other publications of the U. S. Atomic Energy Commission. Reports by the European Nuclear Energy Agency and the International Atomic Energy Agency have described uranium resources, production, and demand for most of the non-Communist world.

[1] Reactors which produce more nuclear fuel than they consume, by neutron bombardment, are called breeder reactors.

Thorium

Thorium occurs naturally only as Th^{232}, and has a half-life of 1.4 x 10^{10} years. The end product of Th^{232} decay is Pb^{208}. Most gamma radiation from thorium-bearing minerals is from Tl^{208}, an isotope in the Th^{232} decay series.

The most important use for thorium metal is in lightweight and high-temperature strength magnesium alloys for aerospace and military projects. Thorium nitrate is of principal importance in the fabrication of incandescent mantles for outdoor gas lights. Also, small quantities of thorium are used in tungsten incandescent lamp filaments.

Thorium demand for nuclear-energy uses has been very small, and the A. E. C. has filled these demands from a stockpile accumulated mostly before 1962. Thorium has great potential as a source of nuclear fuel, because it can be transmuted to fissionable U^{233} when irradiated by neutrons in a nuclear reactor. Several types of breeder reactors are technically feasible and are currently under development by the Atomic Energy Commission and private industry groups, but it is expected that another 20 years will be required for their complete development, although an unexpected breakthrough could change this.

Over 3.6 million pounds of ThO_2 are presently held in a Government stockpile. About 3 million pounds have been authorized for disposal by Congress, but no further plans have been announced. Also, the A. E. C. holds an additional 3.2 million pounds of thorium metal. Thus, the demand for thorium in the near future will be quite low, but the successful development of an economic breeder reactor could lead to a large future demand.

GEOCHEMISTRY

Uranium constitutes 2 to 4 parts per million of the earth's crust, and thorium is about 3 times as abundant (10-20 ppm). Uranium and thorium are markedly oxyphilic elements (combined with oxygen), and occur as oxides, hydroxides, oxygen salts, and silicates. They do not occur naturally as native elements, sulfides, arsenides, sulfosalts, or tellurides (Heinrich, 1958).

Uranium in nature has two valence states, tetravalent and hexavalent. Tetravalent uranium and thorium behave almost as isotopes of the same element. Uranium and thorium often occur together in igneous rocks and pegmatites. In most other types of uranium deposits, thorium is present only in insignificant amounts. This is explained by the fact that uranium can be oxidized to the hexavalent state and transported, possibly as carbonate or sulfate complexes, while thorium is left behind.

Uranium is present in minor to major amounts in a great variety of geologic environments. Its ubiquitous nature is largely due to three factors (Heinrich, 1958):

1. The isomorphism of uranium, as U^{4+}, with Th, Zr, Ca, Fe^{2+}, and the rare earth elements, so that it appears at least in small amounts in a variety of high-temperature complex oxides, silicates, and phosphates.
2. The wide stability range of uraninite, which may be precipitated in environments ranging from those of high temperatures and pressures (e. g., pegmatitic) to those of room temperature and atmospheric pressure.
3. The oxidation of U^{4+} to U^{6+}, and subsequent formation of the uranyl ion $(UO_2)^{2+}$, which itself may be further complexed (e. g., with CO_3^{2-}), leading, upon precipitation, to varied assemblages of low-temperature uranyl minerals; or decomposition and reduction to reprecipitate in the uranous form.

Uranium in solution is probably in the hexavalent state, but it can be reduced when it encounters carbonaceous matter or hydrogen sulfide derived from sulfide minerals or bacterial action. Uranium in solution is also adsorbed on clay minerals and various colloidal precipitants, and is precipitated by chemical reaction, change in pressure, or evaporation. The uranyl ion of hexavalent uranium readily forms carbonate complexes, and many sandstone-type deposits may be formed by precipitation from such complexes. However, uranyl sulfate and silicate complexes may also be important in uranium transport.

Most of the uranium in solution in surface and ground waters eventually ends up in the ocean, where low concentrations occur in muds and phosphatic sediments. Uranium precipitated in terrestrial sedimentary rocks may be recycled any number of times, resulting in deposits of the sandstone type which have been the source of most of the uranium produced in the United States.

Uranium may be concentrated by igneous, sedimentary (including weathering), and metamorphic processes. Syngenetic deposits in igneous rocks are often of low grade, and occur in late-stage differentiates. Epigenetic deposits in igneous rocks may be high grade but small. Weathering and other sedimentary processes result in resistate (placer) deposits as well as the sandstone type of the Colorado Plateau. Metamorphism may "sweat out" uranium from certain rocks, and concentrate it at favorable sites.

Thorium is concentrated in a lesser variety of geologic environments than uranium. Because of its high charge and large size, the thorium ion is not a constituent of the normal igneous rock minerals, and becomes concentrated in the residual magmatic solutions, a situation similar to that for tetravalent uranium.

Concentrations of thorium minerals are found mainly in pegmatites, certain hydrothermal veins, and detrital deposits. Placers are the most important of the detrital deposits, and contain the largest known reserves of thorium (in monazite).

MINERALOGY

Uranium is an essential constituent in approximately 70 different minerals, and thorium an essential constituent in six. Also, at least 180 minerals contain uranium and thorium in variable amounts as nonessential constituents.

The most common primary uranium minerals are uraninite and coffinite. These are relatively rare in Nevada

NEVADA RADIOACTIVE OCCURRENCES

This report describes 442 radioactive occurrences in Nevada. Figure 1 is a graphic representation of the number of localities in each county. Uranium and thorium occurrences are not evenly distributed throughout the State (pl. 1), but are somewhat concentrated in the west-central and southern areas. The gross distribution of uranium (with a few notable exceptions) resembles the pattern of metal mining districts and, to a lesser extent, the intrusive rocks in Nevada. The non-uniform distribution of uranium and thorium, as well as that of metal deposits and intrusive rocks, may be related to inhomogeneties in the crust or mantle, but the maximum depth of burial and the variation in type of rock exposed at the land surface also have an effect on the pattern of radioactive occurrences in Nevada. A large area in Nye, Lincoln, and Clark Counties comprising the Nellis Air Force Base Bombing and Gunnery Range and the Nevada Test Site is withdrawn from mineral location; no radioactive prospects are reported from this area.

Radioactive occurrences in Nevada are often found in clusters or concentrations within certain limited areas. These radioactive districts or clusters are represented by from three to 40 separate localities, and these individual localities could have a common genesis. Uranium may be found in minor amounts in the veins of some base or precious metal districts, or at prospects zonally adjacent to these districts. Other clusters of uranium and thorium deposits are related to the area of exposure of a certain rock type which may have been enriched in uranium or thorium originally, or which may have provided favorable depositional sites.

Figure 2 demonstrates the classification scheme used in this report, and is an attempt by the author to segregate nearly all of Nevada's radioactive localities into types according to mineralogy and type of host rock. This classification is not comprehensive, and is not adequate for other areas where different kinds of deposits occur. Several more inclusive classification schemes are summarized in table 1. Hopefully, this division of occurrences into types will aid in understanding the variety of Nevada localities, and be of some use in the exploration for commercial deposits.

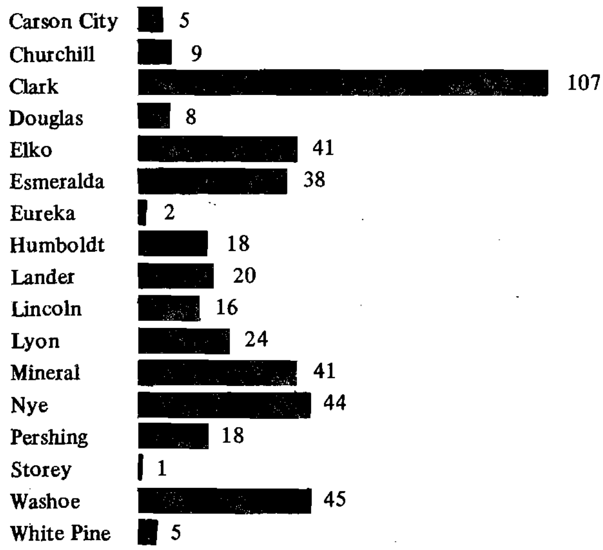


FIGURE 1. Radioactive occurrences in Nevada by county.

The number of each type of occurrence found in Nevada is shown in parentheses in figure 2. The symbols shown are those used on plate 1, which indicates the location and distribution of the occurrences. The discussion which follows does not describe each possible host rock-mineralogic type combination separately. General descriptions are presented for deposits found in each host rock, and sub-headings are reserved for subdivisions of host rocks and the various mineralogic types found in each host rock.

MINERALOGIC TYPE	HOST ROCK TYPE							
	Tertiary volcanic rocks		Tertiary and Quaternary Sedimentary rocks	Pre-Tertiary rocks		Placer deposits	Spring deposits and groundwater	Unknown rock type
	Lava flows and plugs	Ash-flow tuffs		Sedimentary, volcanic, and low-rank metamorphic rocks	Plutonic and high-rank metamorphic rocks			
Uranium associated with base and precious metals.	(4)			(92)	(18)			(8)
Uranium and thorium in pegmatites and plutonic accessory minerals.					(33)	(9)		(2)
Uranium minerals present (mostly secondary). Other mineralization minor or absent.	(12)	(29)	(33)	(30)	(20)			
Anomalous radioactivity with no recognized uranium or thorium minerals. Incl. undescribed types.	(20)	(26)	(46)	(26)	(10)		(7)	(17)

FIGURE 2. Classification of radioactive occurrences in Nevada. The symbols are similar to those used on plate 1. Numbers in parentheses indicate the total number of each type of deposit in Nevada.

URANIUM IN TERTIARY VOLCANIC ROCKS

About 90 uranium occurrences are found in Tertiary volcanic rocks. The majority of them appear to be strata-bound deposits. Uranium mineralization does not usually extend into overlying or underlying rocks, and the uranium was probably derived from and then redeposited in the volcanic rocks. Uranium-bearing epithermal metal deposits in Tertiary volcanic rocks are a possible exception to this generalization, but even in these deposits the hydrothermal fluids might have extracted uranium from the volcanic host rocks.

This report separates volcanic rocks containing uranium prospects into two lithologic sub-types, lava flows and plugs, and ash-flow tuffs. Certain differences exist in the uranium deposits of these two sub-types, and these differences are described below. Following this, the three mineralogic types of uranium deposits in Tertiary volcanic rocks are described.

Occurrence by Host Rock Type

Plugs and Lava Flows

Approximately one-third of all uranium occurrences in Tertiary volcanic rocks are found in flows and plugs. The uranium is quite often concentrated along faults and joints. Iron oxides, manganese oxides, and chalcedony or opal are often found as concentrations along the same radioactive fractures. Anomalous radioactivity without visible uranium minerals is common. Because of the low grade of most of these prospects, only surface exploratory work has usually been done, and little is known about the extent of radioactivity with depth.

Clay minerals, iron oxides, chalcedony, and opal can concentrate uranium from solution. Ground waters may have been important in the transportation of the uranium. Volcanic flows and plugs are often somewhat impervious to the flow of solutions; thus open faults, joints, and flow tops often are loci for uranium deposition. Nearly all of the Tertiary flows and plugs reported to contain uranium, are of silicic to intermediate composition, and more occurrences are found in flows than in plugs. All prospects in volcanic rocks of unspecified lithologic type have been included with those in flows and plugs unless additional information was available. This was done partially for simplicity. However, when ash-flow tuffs are specifically recognized in an area an author will usually mention them, so an unspecified type of volcanic rock is probably a plug or lava flow.

Ash-flow Tuffs

Fifty-five Nevada uranium occurrences are found in Tertiary ash-flow tuffs, mostly in Elko and Washoe Counties. Rhyolitic and dacitic volcanic rocks in the western United States contain up to 30 ppm uranium; ash-flow tuffs of these compositions are fairly common in Nevada. Rosholt and Noble (1969), and Rosholt, Prijana, and Noble (1971), have investigated the loss of uranium from silicic volcanic rocks, and believe that the crystallized portions of many of these rocks have lost from 20 to 60 percent of their original uranium. This loss of uranium is believed due to leaching of the primarily crystallized groundmass by groundwater, mainly shortly after the rocks cooled. Several parts per million of uranium, if leached from the extensive (up to 500 cubic miles estimated) eastern Nevada ash-flow tuffs, would add up to a very considerable tonnage of uranium. Few localities, however, are reported from these extensive ash-flows in eastern Nevada; possibly indicating a province of low-uranium rocks in this area. Certainly enough uranium is available to form large ore deposits.

Uranium is concentrated by several chemical and physical controls in ash-flow tuffs. Non-welded zones at the base and within ash-flow sequences are quite permeable, and uranium can be concentrated by certain controls in these permeable horizons or along faults that cut them. At many properties in the western part of the State, charcoal or carbonized wood at the base of ash-flow tuffs has acted as a precipitant for uranium. Carbon will adsorb and reduce uranium to form organo-uranium complexes. Also, organic matter can provide the energy sources for anaerobic bacteria which generate H_2S, an effective uranium reductant and precipitant.

Clay minerals, formed either along fault gouge zones or from altered volcanic ash, can aid in the precipitation of uranium by adsorbing it onto surfaces of clay particles. Certain minerals which may be precipitated as colloids (silica and iron-oxides) can adsorb uranium. Iron-oxide stained fractures and faults are quite common at uranium occurrences in ash-flow tuffs. Silicification, and the formation of chalcedony and opal, are often the only alteration noted, although some bleaching has been reported. Faults and dikes that cut ash-flow tuffs can act as dams to uraniferous solutions, causing the precipitation of uranium. Heated ground waters may have been the ore-carrying solutions in some districts (see *Pyramid Mining District).* More specific controls are also discussed in the introductions to several for groups or clusters of occurrences (for example, see *Washoe County*).

Occurrence by Mineralogy

Epithermal Metal Deposits

Epithermal mineral deposits in Tertiary volcanic rocks are quite common in Nevada, but anomalous radioactivity or uranium minerals have not been reported in a great majority of them. Although many Nevada mining districts have been investigated by the Atomic Energy Commission and found to be essentially non-radioactive, significant radioactivity has been found at five districts that are associated with epithermal vein mineralization in Tertiary volcanic rocks. In some cases it is not certain that the uranium is related to the same period of mineralization that resulted in deposition of the metals and vein material;

occurrences, possibly because only surface or shallow exploration work has been done on many deposits. The secondary uranium minerals are of the +6 valent type, and include a wide variety of colorful arsenates, carbonates, hydrous oxides, phosphates, silicates, and vanadates. These secondary minerals may form by the alteration, oxidation, solution, and redeposition of uraninite and coffinite, or they may form directly in the zone of oxidation from uranium-bearing solutions. Additionally, uranium is concentrated in certain minerals and mineraloids as very small, discrete uranium minerals in the radioactive species, or in isomorphic substitution for certain ions. Certain radioactive rock samples may not contain recognizable uranium or thorium minerals.

Thorium-bearing minerals are found in igneous and metamorphic rocks and in certain high-temperature veins, and they also occur in placer deposits derived from these sources. The most common of these minerals originally formed as constituents of granitic rocks and pegmatites. Minerals such as monazite, xenotime, allanite, euxenite, and samarskite contain thorium from traces up to 10 percent. Minerals in which thorium is the principal ingredient are not numerous; thorite, thorianite, and huttonite are probably the most well known of these.

The following references contain most of the pertinent information on the mineralogy of uranium- and thorium-bearing minerals: Heinrich (1958); Frondel, Fleischer, and Jones (1967); and George (1949).

Appendix I contains a short description of all uranium and thorium minerals mentioned in this report. Also included are those minerals which contain trace amounts of these elements as nonessential constituents.

GEOLOGIC OCCURRENCE

It is beyond the scope of this report to include a comprehensive description of the world-wide occurrence of uranium and thorium, but it is often useful to have certain background information readily available. The following section is intended only to be a summary.

Many different geologic environments contain deposits of radioactive minerals. The complex and varied classification schemes proposed by several authors (table 1) is an indication of this fact. Deposits of uranium and thorium are reported in rocks of every geologic age and type, and in practically every hydrothermal environment.

Uranium deposits have been classified by many authors according to a variety of criteria, including: wall rock, mineralogy, size and shape (vein, stratiform, etc.), associated elements, relation to structural features, temperature of emplacement, and various other genetic factors. Several authors have attempted rather inclusive classification schemes which utilize a variety of the above criteria; several of these are summarized in table 1. The classification used by Heinrich (1958) is quite complete, and includes thorium as well as uranium. The other schemes listed in table 1 only pertain to uranium, and in one case, only to vein deposits.

Deposits in continental sedimentary rocks are the principal source of uranium mined in the United States. Concentrations of uranium also occur in limestones and coaly carbonaceous rocks. Uranium has been produced from vein and other fracture-controlled deposits, but only in very minor amounts. Uranium is also present in low concentrations in certain black shales and phosphorites, and in accessory minerals of many granitic rocks. Most of the thorium minerals occur sparsely in pegmatites, granites, syenites, carbonatites, schists, and gneisses. Those radioactive minerals which are resistant to weathering may be concentrated in ancient and modern stream and beach placers.

PROSPECTING AND EXPLORATION

Most outcrops of radioactive deposits in the U. S. have probably been found in the course of the very intensive prospecting that took place between 1948 and 1960. For this reason, subsurface prospecting methods will often be required. The following discussion will be mainly concerned with uranium prospecting, because of the very limited present interest in thorium.

The exploration techniques used in the search for uranium may be catagorized into geologic, geophysical, geochemical, and geobotanical methods (Saum and Link, 1969). Blind drilling has also been used extensively as an exploration tool. The geologic methods involve the use of stratigraphy, mineralogy, and field mapping throughout the entire exploration program. Radiometric techniques, both surface and airborne, are the most used geophysical method. The elemental sources of radiation can be determined by the use of gamma-ray spectrometry. This method has possible applications in the search for a variety of mineral deposits other than uranium. Magnetic and electrical methods have limited applications.

Uranium itself is probably the most useful indicator in geochemical prospecting for uranium deposits, but a variety of elements that are often associated with uranium in rocks, soils, and plants have been used. Prospecting by means of measuring the radon concentration in rocks and soils (emanometry) has been used successfully in several areas.

ECONOMICS

Much literature is available on the mining, concentration, processing, and marketing of uranium. Thorium is not so well described, but is often discussed with uranium. Because of the complex and rapidly changing nature of radioactive materials economics, the reader is referred to the following summary references: Bellamy and Hill (1963), Galkin, Maiorov, and Veryatin (1963), and U. S. Bureau of Mines Bulletin 650 (1970). Also, the most recent U. S. Bureau of Mines Minerals Yearbook includes up-to-date discussions of the economics of radioactive minerals.

TABLE 1

Summary of classification schemes used by various authors for uranium deposits.[1]

Heinrich (1958)	Butler and Schnabel (1956)	Stocking and Page (1956)	McKelvey, Everhart, and Garrels (1956)	Stocking and Page (1956), and Everhart (1956)
Syngenetic deposits in igneous rocks *Intrusive rocks* *Extrusive rocks* Radioactive pegmatite deposits *Undifferentiated pegmatites* *Zoned uraninite pegmatites* *Pegmatites with radioactive complex oxide minerals* *Pegmatites with microlite* *Allanite pegmatites* *Miscellaneous types* *Radioactive syenitic pegmatites* *Calcite-fluorite-apatite vein-dikes* *Radioactive nepheline-syenitic pegmatites* *Migmatite deposits* Pyrometasomatic and other high-intensity hydrothermal deposits *Pyrometasomatic deposits* *Hypothermal deposits* Mesothermal deposits *Ni-Co-Ag and allied types* *Pitchblende-pyrite (± Pb, Cu, Ag sulfides) type* *Thorium veins* Epithermal deposits *Siliceous pitchblende-sulfide veins* *Radioactive fluorite deposits* *Uraniferous antimony veins* *Thorite veins and breccia pipes* Epigenetic stratiform deposits in sedimentary rocks Uraniferous phosphorites Uraniferous marine black shales Placer deposits of radioactive minerals Radioactive hydrocarbons *Uranium and daughter elements in petroleum fields* *Uraniferous solid hydrocarbons* Deposits formed by weathering and ground-water action *Radioactive gossans and laterites* *Vein deposits oxidized in place* *Deposits formed by ground-water redistribution*	Uranium in igneous rocks *Intrusive and extrusive rocks* *Pegmatites* Vein and related deposits of uranium *Uranium in fluorite-bearing deposits* *Uranium with sparse or no base metals* *Uranium with ores of base and precious minerals* Uranium in Terrestrial sedimentary rocks *Uranium in sandstone, mudstone, and limestone* *Uranium deposits in coal* *Uranium-bearing placers* *Uranium in evaporites* Uraniferous marine sedimentary rocks *Black shales* *Phosphatic rocks* Uranium in asphaltites Uranium in natural waters	Uranium in igneous rocks Uranium in veins Uranium in terrestrial sedimentary rocks *Clastic rocks* *Chemical precipitates* *Coals* Uranium in marine sedimentary rocks Uranium in petroleum and asphaltites	Uraniferous igneous rocks, pegmatites, and migmatites Uranium in hydrothermal vein and replacement deposits Uranium deposits in sandstone Uraniferous coal and associated carbonaceous shale Uraniferous black shales Uraniferous marine phosphorites	Vein types Type A: Sooty pitchblende, some uraninite and pyrite; quartz and fluorite gangue sparse Type B: Uraninite, iron and copper sulfides, galena, sphalerite, and molybdenite; quartz and fluorite abundant Type C: Uraninite with Co, Ni, and Ag silver minerals in a dominantly carbonate gangue; minor quartz and barite. Type D: Uraninite, gold-bearing pyrite, quartz, and associated Pb, Co, and Ag sulfides TYPE E: Uraniferous hydrocarbons and a variety of metallic sulfides in a calcite-barite gangue

[1]Schemes have been somewhat modified for this report.

the uranium at certain prospects may have been concentrated later during oxidation of the veins by uranium-bearing ground water.

Anomalous radioactivity in the absence of visible uranium minerals is reported from some districts, but autunite, uranophane, torbernite, gummite, and metazeunerite have also been identified. Three occurrences are oxidized iron- and copper-bearing quartz veins, and one has radioactivity associated with a fluorite-cinnabar vein in an ash-flow tuff. Also, metazeunerite is reported associated with copper and tin mineralization in a Tertiary rhyolite plug.

Uranium Minerals Without Associated Metals

At least nine different secondary uranium minerals have been reported from more than 40 occurrences in Tertiary volcanic rocks which contain little or no other introduced minerals. Uraninite and clevite(?) have also been described from a few localities. Most of the common six-valent uranium minerals are known from Nevada deposits, including autunite, phosphuranylite, zeunerite, uranophane, uranospinite, sabugalite, torbernite, meta-autunite, and gummite. Only the vanadates are conspicuously absent.

Minor silicification, bleaching, and kaolinization have been reported but are not common. Iron and manganese oxides are often present, and the mineralogy of the deposits is simple. One to three uranium minerals are usually present; autunite, phosphuranylite, and uranophane are the most common.

Anomalous Radioactivity Only

Radioactivity without visible uranium minerals has been reported from about 50 prospects in Nevada, especially those in rhyolitic flow rocks. Volcanic rocks having fairly widespread radioactivity may be anomalous in contained uranium, and some areas of certain flows have been found to be slightly more radioactive than "normal"; these areas are commonly detected during airborne surveys. Although these rocks will probably never become commercial deposits, they are significant in that they may indicate broad areas of uranium concentration.

Slightly higher than normal radioactivity is often found along faults, joints, and dikes in volcanic rocks. The uranium, perhaps derived from the rocks themselves, could have been concentrated in these places by ground water.

Most prospects having only anomalous radioactivity are very low grade, and concentrations of uranium or radioactivity of only 3 to 5 times background are common. Prospects of this kind are probably of interest mainly as indicators of possible favorable areas for exploration rather than as specific targets.

URANIUM IN TERTIARY SEDIMENTARY ROCKS

Considerable thicknesses of Tertiary fluvatile and lacustrine sedimentary rocks were deposited in Nevada. Correlation over an area of only a few hundred square miles is commonly difficult because of great lateral variation in lithology. The bulk of these sediments accumulated during the Miocene and Pliocene, following a period of volcanic activity which reached a maximum in Oligocene and early Miocene time. The volcanic activity was accompanied or shortly followed by block faulting which produced basins that now contain the sediments. During late Miocene and early Pliocene time these basins were the sites of lakes.

Eruptions from several volcanic centers, especially in southern Nye County, supplied volcanic ash to basins over much of the State, but Tertiary sedimentary rocks were derived mainly from local sources, including volcanic, plutonic, metamorphic, and sedimentary terranes. Eocene conglomerates, limestones, and sandstones are found in Clark, Lincoln, White Pine, Lander, northern Nye, and eastern Mineral Counties. Oligocene through early Miocene rocks are mainly volcanic flows and welded tuffs, with a few intercalated sandstones, shales, and water-laid tuffs, especially in Esmeralda, northwestern Nye, and eastern Mineral Counties. The Miocene and Pliocene fluvatile and lacustrine rocks include tuffs, quartz sandstones, arkosic sandstones, lithic wackes, and conglomerates with lesser amounts of limestone. These deposits are represented by units such as the Truckee, Humboldt, Esmeralda, Panaca, and Muddy Creek Formations. The 79 uranium prospects in Tertiary sedimentary rocks occur in nearly every rock type, but predominate in the shales, sandstones, and tuffs.

Hetland, Sharp, and Warner (1969) described uranium deposits in Oligocene, Miocene, and Pliocene sediments west of the Rocky Mountains, and have divided the deposits into four categories based on environment:

(1) Deposits in lake sediments consisting mainly of water-laid tuffs;
(2) Deposits in lake sediments intruded by volcanic plugs;
(3) Deposits in lake sediments interbedded with arkoses near batholiths;
(4) Deposits in coarse volcanic sediments in local sedimentary basins.

They describe Nevada deposits in the first three of these types.

The source of the uranium in Tertiary sedimentary occurrences is not known with any certainty. Certain constituents of the sediments themselves may have supplied the uranium, which may have been concentrated at favorable sites by ground water. Some possible sources of the uranium are: pyroclastic debris, arkosic sediments derived from plutonic, metamorphic or volcanic terranes, and solutions containing uranium derived from outside the sediments themselves.

A few deposits in Nevada are in very thin ash-fall tuffs or fluvatile sedimentary rocks below or within volcanic flows or welded tuffs. These are often closely related to the volcanic rocks, and the uranium is also often believed to have been derived from them. For these reasons, the localities of the above type are classified with the volcanic and ash-flow tuff occurrences.

Uranium Mineral Occurrences

Highly colored, 6-valent uranium minerals found in Nevada Tertiary sedimentary rocks include carnotite, autunite, uranophane(?), schroeckingerite, sabugalite, and tyuyamunite. Uraninite or other primary uranium minerals may be present at depth in some of the prospects, but have only been reported at one (South Fork No. 1 and 2, Pixley No. 1; Elko County). The minerals often occur as encrustations or disseminated flakes along bedding planes or iron-stained fractures. Water-laid tuffs or tuffaceous shales are common host rocks, although uranium minerals also occur in sandstones and conglomerates. Hydrothermal alteration and typical hydrothermal minerals are almost universally absent, and no known Nevada uranium occurrences are associated with metallic deposits in Tertiary sediments. Uranium has probably been redistributed by the action of recent ground water at many localities, and concentrations in young gravels and caliche are reported. Some secondary uranium minerals, especially schroeckingerite, are known to be water soluble and easily transported. Thirty-three uranium mineral occurrences are reported from Tertiary sedimentary rocks.

Anomalous Radioactivity Only

More than 40 radioactive localities in Nevada Tertiary sedimentary rocks do not contain recognizable uranium minerals. Also, radioactivity at some uranium mineral occurrences indicates that more uranium may be present than can be accounted for in the minerals recognized. Concentration of radioactivity without visible uranium minerals is often found in gouge zones or along iron-stained portions of faults. Clay minerals have been reported to concentrate uranium by adsorption, and the colloidal precipitation of iron oxides may also retain and concentrate uranium. Where fine-grained, tuffaceous shales are found, anomalous surface radioactivity is often more common in them than in contiguous coarser sandstones and conglomerates, which suggests that clay minerals in the shales have concentrated the uranium. Opal, often radioactive and fluorescent, is reported from some deposits, and may be formed from silica derived from devitrifying volcanic ash. Colloidal silica particles can adsorb uranium from ground water because of their negative charge. The devitrifying volcanic ash might also be a source of uranium.

Fossil bones, petrified wood, and lignitic material are also the sites of anomalous radioactivity in Tertiary sedimentary rocks. Carbon in lignite and wood has probably acted to reduce uranium in solution. Stable complexes of uranium and humic acids might form, and thus no uranium minerals would have been recognized. Uranium in bone can replace clacium or be adsorbed on the surface of apatite.

Davis and Hetland (1956) report that uranium in Tertiary clastic rocks of the Basin and Range province is often in disequilibrium, with radiometric assays commonly lower than chemical. This would suggest that uranium in the near-surface environment has been recently redistributed by ground water.

URANIUM AND THORIUM IN PRE-TERTIARY ROCKS

Two hundred twenty-nine radioactive occurrences described in this report are in pre-Tertiary rocks. These prospects occur in diverse host rocks, and represent three of the four mineralogic types of uranium deposits described in this report (fig. 2). Pre-Tertiary host rocks can be subdivided into the following:

(1) sedimentary, volcanic, and low-rank metamorphic rocks (148 occurrences), and

(2) plutonic and high-rank metamorphic rocks (81 occurrences).

Uranium deposits in these two rock types have some differences, probably related to differences in previous depth of burial and the associated variations in temperature and pressure.

Occurrence By Host-rock Type

Sedimentary, Volcanic, and Low-rank Metamorphic Rocks

Uranium and thorium mineralization are reported from Paleozoic and Mesozoic limestones, sandstones, shales, conglomerates, and several types of extrusive volcanic rocks. Some of these, such as the occurrences in the Chinle and Aztec Formations in Clark County, are similar to the sandstone-type deposits in the Colorado Plateau.

Uranium found in several sedimentary units in the Jean-Sloan area (Clark County) is believed to have been derived from a Tertiary tuff, and deposited from moving ground water. Occurrences in sedimentary, volcanic and low-rank metamorphic rocks are found in and around several metal-mining districts in Nevada, and 70 to 80 Nevada prospects are areally associated with plutonic intrusives, but usually concentrated in the surrounding low-rank metamorphic rocks. The presence or absence of recognizable uranium or thorium minerals in sedimentary, volcanic, and low-rank metamorphic rocks is often related to the host rock type as well as the amount of radioactive elements present in a deposit. For example, uranium mineralization in a carbonaceous shale would probably produce no visible uranium minerals because the uranium would be tied up in organic compounds. In a clean sandstone, this same uranium content might result in quite a variety of visible uranium minerals.

Uranium occurrences in rocks near intrusive masses that have been affected by contact metamorphism are included with those in the low-rank metamorphic rocks in this report. This is done because thermal metamorphism around an intrusive mass is commonly areally restricted and of low to intermediate metamorphic grade.

Plutonic and High-rank Metamorphic Rocks

Certain types of radioactive mineralization are commonly associated with plutonic and high-rank metamorphic rocks. Uranium and thorium are common constituents of pegmatites which are often found in rocks formed at elevated temperatures and pressures (see section, *Pegmatites and plutonic accessory minerals*). Anomalous radioactive areas are also reported from Precambrian high-rank metamorphic and plutonic rocks, especially in Clark County; other metals and hydrothermal alteration are usually absent. Radioactive quartz veins with minor base-metal sulfides seem to be more common in plutonic rocks than in any other type. Autunite is probably the most common secondary uranium mineral found in these rocks, and is seen as flakes along gouge zones, iron-stained faults and fractures, breccia zones, quartz veins, and joints. The uranium at these localities may have been removed from the granite by ground water and re-precipitated along permeable zones by iron oxides or clay minerals.

Occurrence By Mineralogy

Base- and Precious-metal Deposits

Uranium occurs in minor amounts in pre-Tertiary rocks at several base-metal districts in Nevada. The Goodsprings and Washington districts are probably the better known, but radioactive occurrences also have been found at many small deposits and single localities throughout the State. About 100 localities associated with base and precious metals are known, but nearly half of these are in the Goodsprings district. Uraninite has been recognized at several prospects, and its presence at depth has been suspected at others. The base-metal occurrences may be in quartz veins in which sulfide minerals are present at the surface or have been oxidized to depths below the level of mining or exploration. When the deposits have been oxidized, 6-valent uranium minerals may be present, or uranium might have been concentrated in secondary copper, zinc, and iron minerals. The mechanism for this concentration is believed to be the adsorption of uranium on colloidal surfaces. Cobalt and nickel minerals are present at some localities, and uraninite has been found in tungsten-bearing tactite zones along intrusive contacts at a few occurrences. Some lead, zinc and copper vein and replacement deposits in sedimentary rocks are also radioactive. Secondary uranium minerals reported from radioactive base- and precious-metal deposits include copper- and lead-bearing varieties (kasolite, torbernite, metatorbernite, and dumontite) and uranophane, phosphuranylite, and gummite.

Uranium has been found in association with iron minerals at some Nevada deposits. Pyrite and magnetite-hematite vein and replacement deposits are common near intrusive contacts in Nevada, but most are not radioactive. In the Atlanta district (Lincoln County), pods of pyrite-uraninite ore containing precious metals occur in jasperized zones of carbonate rocks. Radioactive gossans are found in several mining districts, and may indicate similar pyrite-uranium mineralization at depth. Several Nevada hematite-magnetite deposits are anomalously radioactive, and where the deposits are near intrusive contacts, the iron and uranium mineralization may be related to the plutonic rocks.

The association of uranium with certain oxidized metal deposits results in part from its solubility in acid solution. Uranium in an oxidizing sulfide environment enters ground waters as uranyl sulfate in the presence of ferric sulfate. Where such acid waters are neutralized, colloid ferric-oxide-hydrate forms by hydrolysis of the sulfate, its particles remove uranium from solution by adsorption, and with aging of the colloid and crystallization to goethite, uranium is expelled as exceedingly minute particles of uranyl minerals (Lovering, 1955). Laboratory experiments show that uranyl carbonate, uranyl hydroxide, and uranyl ions are adsorbed both by synthetic colloidal limonite and synthetic hydrozincite (Barton, 1956), and that with crystallization of the absorbents the uranium either forms discrete uranium minerals or is returned to solution. Colloidal chrysocolla and silica are also probably capable of concentrating uranium. The uranium may be derived from weakly to strongly radioactive ore deposits near or underlying a gossan, or from adjacent igneous rock masses.

Uranium Minerals Without Associated Metals

Fifty radioactive prospects in pre-Tertiary rocks contain one or more colored, 6-valent uranium minerals but lack other metallic minerals. Autunite is probably the most commonly reported, and was often discovered in older workings with an ultraviolet light while searching for minerals such as scheelite. Physical controls are important in this type of deposit. Faults in granitic and sedimentary rocks are likely sites for this type of uranium mineralization, as are the margins of plutonic intrusive bodies. Chemical controls such as altered dikes, gouge-zone minerals, and carbonaceous beds; have concentrated the uranium minerals at favorable structural sites. The source of the uranium in these deposits is unknown. For simple occurrences of autunite along fractures in granite, the uranium may have been leached by ground water from the granite and deposited along faults and breccia zones. Quartz veins, dikes, and silicified zones in granite may have acted as dams to uranium-bearing surface and shallow ground water. The uranium found in this environment could have been derived either from pre-existing or surrounding rocks.

Areas of hydrothermal mineralization or alteration which have uranium associated present a greater problem. Where minor primary uranium minerals have been found by exploration at depth, the uranium was probably introduced by hydrothermal fluids. Many uranium occurrences however, have only secondary uranium minerals reported in minor amounts, and the origin of the uranium is in doubt at these prospects. Uranium at a few prospects, such as the carnotite occurrences in the Goodsprings District (Clark County), is believed to have been derived from Tertiary rocks by ground water, and deposited in pre-Tertiary rocks.

Uranium minerals reported from pre-Tertiary rocks include autunite, carnotite, uranophane, zeunerite, torbernite, uraninite, saleeite, novackite, and gummite. The uranium minerals may be accompanied by iron and manganese oxides, but other mineralization and alteration are often absent. Mineral occurrences are reported from sedimentary, plutonic, and metamorphic rocks.

Pegmatites and Plutonic Accessory Minerals

Anomalous radioactivity associated with pegmatite bodies and certain plutonic accessory minerals is quite common in many areas of the world. Many radioactive pegmatites were found by prospectors during the 1950's in Nevada. Although most of them were of limited economic significance, these occurrences may indicate favorable areas for exploration, areas in which plutonic rocks or magmatic fluids may have been enriched in uranium and thorium.

Uranium, thorium, and rare-earth minerals are common accessory minerals in pegmatite deposits. More than 70 uranium minerals are known from pegmatites, and many rare-earth minerals contain small amounts of uranium. Also, certain accessory minerals in plutonic igneous rocks are high in uranium. The mineralogy of radioactive pegmatites has been summarized by Page (1950). Certain granitic rocks contain substantial amounts of uranium and thorium which are chemically bound so lightly that they can be partially extracted from pulverized rock with dilute acid (Brown, Harrison, and Silver, 1956). Table 2 shows the distribution of uranium and thorium in a typical granite.

TABLE 2

Distribution of uranium and thorium in granite from Essonville, Ontario, Canada.[1]

Material	Abundance (wt percent)	Uranium content (ppm)	Thorium content (ppm)
Quartz	24	0.130	----
Plagioclase	20	.204	----
Perthite	52	.218	0.410
Magnetite.	.4	2.57	----
Apatite	.02	90.5	----
Sphene	.4	303	5375
Zircon	.04	2650	2170
Composite rock . . .	----	2.74	41.88
Acid-soluble material:			
Micrograms of element per gram of rock	----	.90	17.55
Percentage of total	----	29	42

[1]From Brown and Silver (1956).

Pegmatites are common in the rocks surrounding most plutons. They also occur within intrusive rocks themselves and in high-rank metamorphic rocks (often Precambrian). Radioactive pegmatites are usually granitic in composition, and the radioactivity may be confined to certain zones or mineral species. The 33 reported radioactive pegmatites in Nevada all occur in plutonic or high-rank metamorphic rocks.

Anomalous Radioactivity Only

Thirty-six radioactive prospects in pre-Tertiary rocks have no reported uranium or thorium minerals, and are not known to be associated with any extensive hydrothermal or pegmatitic mineralization. Included in this type of occurrence are anomalous amounts of uranium and thorium in Precambrian high-rank metamorphic rocks, and radioactive anomalies along fractures, quartz veins and near intrusive contacts in limestones, quartzites, conglomerates, argillites, and other rocks.

RADIOACTIVE PLACER DEPOSITS

The world's most important accumulations of thorium are in heavy mineral concentrations, mostly in fairly young stream and alluvial fan deposits derived from igneous terranes. Uranium is usually present in lesser amounts. Several resistant minerals which may be concentrated in placer deposits contain uranium and thorium as major or minor constituents. Rare-earth metals are also present in these minerals. The bulk of uranium and thorium in placers is in mildly radioactive resistant species that are accessory minerals in igneous and metamorphic rocks. These include monazite, xenotime, apatite, and sphene. Additionally, several primary uranium, thorium, and rare-earth minerals have been reported from placers in various parts of the world. Some of these are: brannerite, samarskite, euxenite, uranothorite, and thorianite. Pegmatites often contain these minerals, and may be the source of many of them in placers.

Monazite and uranothorite(?) have been reported from Nevada radioactive placer deposits. Also reported are the more resistant plutonic accessory minerals which are often slightly radioactive. All of the nine Nevada deposits are alluvial placers. They are of late Tertiary or Quaternary age, and probably result from the erosion of granitic terranes. Radioactive placers are reported from various areas of the State, but their location and mineralogy are not often well described. It is unlikely that any of these deposits will be mined exclusively for their radioactive mineral content in the near future. However, thorium will probably become an important nuclear fuel in breeder reactors, and demand may greatly increase over the next 10 to 20 years.

RADIOACTIVE GROUNDWATER AND SPRING DEPOSITS

Anomalous radioactivity has been reported at a few of Nevada's many hot springs, and several cold springs are also radioactive. Deposits precipitated around these springs, and those from extinct springs, can also be radioactive. Studies of the uranium content in natural waters has led to the conclusion that thermal springs are often lower in uranium content than are cold waters under equivalent conditions (Nininger, 1956, p. 238). However, factors such as pH, oxidation-reduction potential, and chemical composition may affect the ability of thermal waters to retain uranium. Of the many decay products in the uranium series, Ra^{226} (radium), and Rn^{222} (radon gas) are both quite water-soluble and are also capable of emitting gamma rays or decaying within a period of several days or years to gamma-emitting isotopes.

In several Nevada springs, radon gas is believed to be a contributor to the radioactivity that was noted, and radium may also be present. Decay products of both of these isotopes are gamma-emitters, and will give high readings on a scintillation counter.

The quantities of uranium, radium, and radon can be measured in natural waters. Their presence in anomalous amounts may indicate buried uranium deposits or the dispersion halos of favorable environments. However, what constitutes background amounts of these elements is dependent upon many factors, including the rock type present. Several slightly anomalous uranium analyses reported from Nevada well waters are interpreted as indicating the presence of volcanic rocks at depth. Seven occurrences of radioactive ground water or spring deposits are known in Nevada and are shown on plate 1.

The measurement of radon gas in ground waters has been used as a method of locating possible buried uranium deposits. Rn^{222} has a half-life of only 3.8 days, and most of it decays before it can travel a great distance from its source. Except for unusual conditions, the maximum distance at which radon in ground water would signal a buried uranium deposit is about 40 feet. Even in cases of radon measurement in waters from pumped or flowing wells, springs, and hot springs, it has been shown by studies of the radon isotopes and their decay products that the radon had not traveled far.

RADIOACTIVE OCCURRENCES IN UNKNOWN HOST ROCK

This category includes 27 deposits for which only inadequate information is available. Eight of these occur in an unknown host rock in association with base or precious metals, two are radioactive pegmatites in an unknown host rock, and for 17 prospects no geologic information is reported.

NEVADA URANIUM PRODUCTION

At least 9 of Nevada's 18 counties are known to have produced uranium. No production is known before 1951. About 80 percent of Nevada's total production is from Lander County, mostly from the Apex mine. Exact figures for individual mines are not available, but some information can be obtained from U. S. Bureau of Mines Minerals Yearbooks, and from unpublished data in Nevada Bureau of Mines and Geology files. These incomplete figures are summarized in table 3. Production not reported by the A. E. C. (table 3) is believed to be very minor.

Most of the 137,792 pounds of U_3O_8 produced in Nevada was shipped during the 1950's, when the A. E. C. was most active in procuring uranium. Today, because of high haulage rates and long shipping distances, Nevada ore grades must be high to make a profit. The A. E. C.'s uranium procurement program was so successful in the 1950's, that interest in uranium exploration dropped off after 1958, and the A. E. C. limited the amount it would buy to a certain percentage of the reserves discovered prior to 1958. However, uranium exploration has recently increased and this trend will probably continue in the future, with minor fluctuations. Baroch (U. S. Bureau of Mines Mineral Facts and Problems–1965) presents a good description of the history of uranium production in the United States.

No Nevada mines are known to be producing uranium at present. Production was last reported in 1968. A number of properties in Elko, Lander, and Washoe Counties might be able to produce a limited amount of ore if custom processing facilities were nearby. However, any such facilities would have to be built on the basis of larger new discoveries somewhere in the State.

RESOURCES AND AREAS RECOMMENDED FOR EXPLORATION

The U. S. Atomic Energy Commission has estimated that Nevada uranium reserves at the end of 1970 are 14,000 tons of ore at an average grade of 0.33 percent (oral communication, Maurice Hansen). However, this amount is mainly the residue (reserves minus production) from reserve estimates made during periods of higher prices and haulage allowances. Property examinations in progress by the A. E. C. to update reserve estimates are expected to reduce the 14,000-ton figure considerably. Reserve tonnage estimates at lower grades should be larger, but when grades fall much below 0.25 to 0.30 percent U_3O_8, the high unit costs involved in mining small deposits, coupled with considerable haulage distances, make these ores unprofitable. If custom milling facilities were available within reasonable distances, somewhat larger reserve estimates (at a lower grade) might be expected. Obviously, any new mills would have to be on the basis of large new deposits.

Those Nevada mines having known production are listed in table 3. Mines which have reported production in Washoe, Elko, and Lander Counties probably contain most

TABLE 3

Nevada Uranium Production[1]

Mine	Index no. (text and pl. 1)	Ore shipped[2] (short tons)	U_3O_8 contained (lbs.)	Average grade (percent U_3O_8)	Year(s)[3]
CLARK		13	3	0.012	
Golden Glow and Carnotite Lode prospects	31	?	?	?	
Green Monster mine	57	5	109	1.09	1951
Hilltop mine	25	0.015	≤2.8	≤9.56	
South Valley No. 2 claim	17	13	2.6	0.01	
ELKO		4,706	18,624	0.198	
Happy Joe No. 1, etc., claims	142	225	2,259	0.5	
Race Track mine	136	100	?	?	
Rim Rock mine	139	<500	?	?	1960
South Fork and Pixley claims	140	<200	?	?	1960
HUMBOLDT		563	1,451	0.129	
Moonlight mine	216	~500	?	0.07-0.22	1953-1955
LANDER		22,084			
Apex mine	229	~20,000	~100,000	?	1955-1968
Lowboy mine	234	<200	?	0.26	1955(?), 1959
LINCOLN		147	835	0.284	
Blue Bird mine	249	100(?)	600(?)	0.3	1953-1955
White Cloud prospect	253	0.5(?)	?	?	1955, 1956, 1959
LYON		121	663	0.274	
Flyboy claims	283	50	?	?	1961
Glacier King No. 1 claim	278	?	?	?	1957
River Road mine	275	45	?	?	1956, 1957
MINERAL		256	537	0.105	
Blue Boy and Marietta claims	312	?	?	0.09	
Carol R mine	322	?	?	?	1955, 1956
Holiday mine	302	?	?	?	1955
NYE		48	230	0.240	
Black Bonanza claims	358	?	?	?	1956
WASHOE		880	6,018	0.342	
Armstrong claims	403	?	?	?	
Buckhorn mine (Nev. and Calif.)	426	>400	>800	0.2	1955, 1956
DeLongchamps prospects	406	100-500(?)	?	?	1955, 1956
Divide claims	411	?	?	?	
Lost Pardner group	407	< 100(?)	?	?	
Lowary claims	405	?	?	?	1957, 1964, 1966
Red Rock prospect	434	?	?	?	
Tick Canyon group	417	0-100(?)	?	?	
Yellow Jacket (Calif.) claims	420	?	?	?	1968

[1]Based upon figures in U. S. Bureau of Mines Minerals Yearbooks, 1953-1966, and published and unpublished reports for the various properties. County production totals supplied by the A. E. C.

[2]Production listed is that reported from various sources. Reliability of data for individual mines is variable, and the amounts indicated may only be a fraction of the total. County totals, however, are believed to include nearly all of the production.

[3]Years of known production are listed, but production may have occurred at some properties in years other than those shown.

of Nevada's known reserves; 10 to 20 mines may be represented in the reserve total, and ore grade and mineralogy vary considerably from mine to mine.

Most of the United States uranium production is from continental sedimentary rocks, especially arkosic sandstones with interbedded claystones. The arkose fraction of these units was commonly derived from granitic terranes, and plant debris and other organic matter are often reported.

Uranium deposits in continental clastic rocks are distributed throughout Nevada. Most of these rocks are of late Tertiary age, but a few minor uranium occurrences are reported from Clark County in the Triassic Chinle Formation, a major producer on the Colorado Plateau.

Tertiary sedimentary rocks are distributed throughout the State, and uranium prospects in them are found in nearly every county. Prospects in lake sediments and interbedded arkoses derived from granitic rocks are found in the Peterson Mountain area (Washoe County), Mountain City area (Elko County), and at the River Road mine (Lyon County). These prospects occur in rocks which have certain similarities to the uranium-bearing Tertiary clastic sediments of Wyoming, and are worthy of further study.

Uranium deposits in tuffaceous lake beds and epiclastic volcanic sandstones are known from numerous areas of the State, especially eastern Clark County (in the Horse Spring Formation), Reese River Valley Area (Lander County), near Tonopah (Nye and Esmeralda Counties), Coaldale Area (Esmeralda County), and the Virgin Valley Area (Humboldt County). Further prospecting in these areas might discover larger, more economic deposits.

Ash-flow tuffs in Elko and Washoe Counties seemingly are particularly favorable for uranium deposits, but those discovered to date are small. Similar undiscovered deposits should be present within and below these ash-flow tuffs; probably these have not yet been found because they are not presently exposed. Other than close-spaced drilling, exploration techniques for locating these deposits have not been developed. Detailed stratigraphic, geochemical, and geophysical studies would probably be required to locate areas favorable for larger or higher grade ore bodies. Exploration and drilling for the deposits probably should first be concentrated near known major and minor occurrences. Since these seem to be strata-bound deposits, favorable structural and stratigraphic sites (such as basal sedimentary beds, unwelded zones, faults, and the intersection of dikes with certain faults or beds) might be the loci for uranium deposition.

Possible large, low-grade resources of uranium in Nevada may be found in phosphates, black shales, and porphyry copper deposits. Any uranium produced from such deposits would probably be as a byproduct. Uranium in phosphate-bearing rocks of the Western United States ranges from 0.001 to 0.024 percent U_3O_8 and apparently increases with phosphate content. Permian phosphate-bearing rocks are found in northeastern Nevada, but detailed data on their phosphate and metal content are not available. Large phosphate resources are found in the western phosphate field, which includes parts of Idaho, Wyoming, Utah, and Nevada. Only a small portion of Nevada is in this field, and reserves of ore grade may be small. In certain instances the feasibility of extracting metals such as uranium and vanadium from phosphate rock has been demonstrated. Any phosphate exploration program in Nevada should consider the possibility of byproduct production of uranium and other metals.

Certain black shales in Nevada and elsewhere in the world are known to contain unusually high concentrations of certain minor elements, including uranium. Studies of the uranium content of certain Nevada black shales have not found any very anomalous areas (Duncan, 1952b, 1953b, c; Moore and Stephens, 1954; Gott and others, 1952), but the metal content of many Nevada black shales is not well known. Byproduct or co-product production of uranium might be possible from large-scale mining operations in metal-rich black shales, if any were developed.

Uranium is present in small amounts in granitic rocks, and is anomalous in certain porphyry copper deposits. Uranium occurs in trace amounts in copper ores, and can be recovered from the leach solution and mill water if economic conditions warrant. This is being done at several porphyry copper deposits in the southwestern United States. In Nevada, samples of oxide copper ore from Yerington (locality 280) are known to be anomalous in uranium.

Although most of Nevada's production has been from the vein-type deposit at the Apex mine, exploration interest in deposits of this type is not expected to be high. The high costs of underground mining and the small relative size of most vein deposits precludes interest by major companies for at least as long as successes continue in the discovery of large, sandstone-type deposits. Ore may still remain at the Apex and Lowboy mines (Lander County), and possibly in the Blue Bird mine (Lincoln County), and extensions or similar new deposits may be present in the vicinity of these known mines.

DESCRIPTIONS OF RADIOACTIVE OCCURRENCES BY COUNTY

This section contains descriptions of all known Nevada radioactive occurrences. The deposits are numbered consecutively as described, and may be located on plate 1 (in pocket). Production and type of deposits are also represented by symbols on plate 1.

Occurrences are described by county (Carson City was formerly Ormsby County). Within each county, clusters or groups of deposits are often described together following an area name and a general synopsis of the geology of the prospects and the surrounding area. Prospects not grouped are listed together under *Other Occurrences* in the same county section. Grouping was usually done when several occurrences of a specific type are present in an area. The occurrences may have similar mineralogy, geology, or wall rock, or may be areally or zonally distributed in some recognizable pattern. Deposits in a group may have a common genesis, and this is often discussed, but it is hoped that the grouping of some deposits having uncertain genetic relationships may stimulate further research in this field.

The "best" name of each prospect was determined using all available data; all other known names are also reported to facilitate tracing of these properties in the future. In many cases several prospects were described together. When several names are listed above the same description, these are believed to be separate properties that because of similar location, geology, development, and other factors were described together either by a previous investigator or by the author. These properties are commonly adjoining, but may cover several square miles or be separated by distances of up to 1 mile. The heading *Other names* includes secondary names for properties listed above, including misspellings. All known names for properties described in this report are alphabetically listed in the index, followed by their index number and the page on which their description is located.

Locations are described by section, township, and range except in areas where the Public Land Survey grid is incomplete. In unsurveyed townships, section lines have often been projected by the author; where done, this is so noted. Prospect locations in areas covered only by U. S. 1:250,000-scale topographic maps were projected by means of a transparent section overlay. Also, additional location data are sometimes included. Obviously, the certainty of the locations varies, depending upon the data available. Where location information is queried, the exact position of the deposit is uncertain. "Exact location uncertain" and "exact location unknown" indicate decreasing degrees of certainty. In those prospects not visited by the writer, locations were determined from published and unpublished information, and all available published and preliminary topographic maps as of September, 1970. Some locations are undoubtedly inaccurate, as they are merely a "best guess" by the author. Any additions or corrections will be appreciated by the author and the Bureau.

Uranium production figures are reported whenever known. If no production has been reported, this heading is omitted in the description. Uranium production in the State is also discussed in the section *Nevada's Uranium Production,* and is summarized in table 3. Production other than uranium is not included.

All known workings are described under the heading of development. Prospects not inspected during this study were probably last described in the 1950's. More recent development, if any, is not usually known. When development work was done in search of some commodity other than uranium, this is noted.

The heading *Radioactivity* in the property descriptions includes scintillation counter or geiger counter readings in milliroentgens per hour (mR/hr) or counts per second (cps). The highest reading and the background are reported, and additional readings are sometimes included. Also included with the radioactivity are any uranium analyses, reported as U_3O_8, either analyzed for by chemical (cU_3O_8) or radiometric (eU_3O_8) means. When no method of analysis is reported, the type of assay is unknown. The samples were usually taken from the most radioactive area and are not indicative of ore grades. The type of sample taken is usually described, if known. Any radium analyses of water samples are reported in micromicrocuries per liter ($\mu\mu c$/l).

A general description of the geology and mineralogy includes all available pertinent data not reported elsewhere. The descriptions often result from a synthesis of several sources of material, most of which are mentioned in the references. Unless quoted directly, specific references are not usually cited in the geology section for each deposit. Uranium or thorium mineral names mentioned in the geologic descriptions are in italics, and a brief description of each mineral is given in Appendix A.

The list of references following each property description includes all references used to compile that description. General references such as Schilling (1963); Butler, Finch, and Twenhofel (1962); and Walker, Osterwald, and Adams (1963), were cited only when these reports were specifically used (usually for location information). Reports and maps which do not specifically mention the radioactive locality, but which were used in compiling the geologic descriptions, are also included. Unpublished reports, maps, and other documents were not usually cited, but may be mentioned in the geologic description or elsewhere in this report. All cited publications are listed in the *Bibliography* at the end of this report. Additional references include those publications used for background information, and all reports describing radioactive investigations in Nevada.

CARSON CITY

1. Lucky Strike group (9 claims)

Location: Sec. 20(?), T. 16 N., R. 20 E. Could not be located during this study.
Development: A few small pits.
Radioactivity: Background = 0.03 mR/hr.; High = 0.11 mR/hr. A sample contained 0.038 percent eU_3O_8.
Geology: Anomalous radioactivity is associated with northerly-trending fractures in the Hartford Hill Rhyolite(?). The fractures dip 80° E.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3712, 3717.

2. Sophie group

Location: NW¼SW¼ sec. 23, T. 15 N., R. 19 E.
Development: Two small prospect pits.
Radioactivity: Background = 0.014 mR/hr.; High = 0.06 mR/hr.
Geology: Slight radioactivity was found along a nearly vertical 2- to 5-foot-wide pegmatite dike which trends N. 40° E. A nearby parallel dike is also radioactive. The dikes cut Mesozoic schists and phyllites, and are composed mainly of quartz and feldspar with some magnetite-rich areas. No zoning was noted, but the central portion of the dike is slightly more radioactive. The author visited this locality in 1969.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3719.

3. 8 Spot group (8 claims), Lucky Bird group (nos. 1-17)

Location: Center, N½ sec. 28, T. 15 N., R. 20 E.
Development: Several bulldozer trenches and pits.
Radioactivity: Background = 0.015 mR/hr., High = 0.06 mR/hr.
Geology: Abnormal radioactivity occurs along a N. 80° W. vertical fault in slightly bleached, iron-stained meta-andesite of probable Mesozoic age. A 2-inch-wide gouge zone is the most radioactive. Other less radioactive spots were noted within the surrounding nearby area. *Autunite* was recognized, but does not account for all of the radioactivity. One skarn specimen was quite radioactive, but contained only minor *autunite*. The area lies quite near the contact with a granitic intrusive. This occurrence was visited by the author in 1969.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3714, 3718.

4. "Carson City Monazite-Bearing Placer"

Location: T. 15 N., R. 20 E., exact location unknown.
Geology: Stream placers near Carson City have yielded as much as 12 pounds per ton of heavy concentrates, most of which consisted of magnetite. However, chromite, garnet, zircon, *monazite*, and gold also were present. In two concentrates, *monazite* is reported to make up 5 and 29 pounds per ton, zircon 80 and 21 pounds per ton, and gold $8.78 and $7.44 per ton respectively. The 5-pound-per-ton sample was known to be a concentrate of a 12-pound-per-ton separate, giving known concentrations in the stream placers of 0.03 pounds per ton of *monazite* (0.000015 percent), 0.48 pounds per ton zircon (0.00024 percent), and 0.000025 ounces per ton gold.
References: Lovering, 1954; Carper, 1945; Schrader, Stone, and Sanford, 1917; Staatz, 1964; Day and Richards, 1906.

5. Sally group (10 claims)

Location: Sec. 16, T. 15 N., R. 21 E.
Development: Two trenches.
Radioactivity: Background = 0.03 mR/hr.; High = 0.40 mR/hr. A sample contained 0.03 percent eU_3O_8.
Geology: *Autunite* and limonite reportedly occur in a slightly brecciated and kaolinized area in the Tertiary Hartford Hill Rhyolite. Similar mineralization is reported from the base of the Hartford Hill, where it contains a few feet of sediments and overlies granitic rocks. The author found Sally No. 3 in 1969 in the SW¼SE¼ sec. 16, T. 15 N., R. 21 E., but was unable to find the radioactive area.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3715, 3716.

CHURCHILL COUNTY

Nine radioactive occurrences are known in Churchill County. They are widely separated or of diverse geology, and were not segregated into groups for this study. Five of the deposits are in rhyolitic volcanic or tuffaceous rocks, three are associated with various base metals, and one is in Tertiary lignitic sedimentary rocks.

CHURCHILL COUNTY, *continued*

6. K D group (116 claims)

Location: Sec. 22(?), T. 24 N., R. 34 E.; location uncertain.
Development: Discovery and location pits.
Radioactivity: Background = 0.03 mR/hr.; High = 0.75 mR/hr. A 1-foot chip sample contained 0.04 percent eU_3O_8.
Geology: *Uranophane*(?), and iron and copper oxides reportedly occur in a fault zone cutting rhyolitic volcanic rocks.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3300.

7. Cottonwood claims

Other names: Lovelock and Nickel mines, London and Liverpool mines, Mustang No. 1-4.
Location: Sec. 10, T. 22 N., R. 34 E. (projected). Along Cottonwood Creek.
Development: A shallow shaft, less than 100 feet deep, and numerous small adits and pits. All workings are for nickel.
Radioactivity: Three or more times background. A select sample from a prospect pit contained 0.098 percent eU_3O_8. Other samples were also anomalous in uranium, and contained 3.9 percent nickel and 3 percent cobalt. Chemical and radiometric assays for uranium were nearly equal. Other samples reportedly contained 0.1 to 0.7 percent eU_3O_8.
Geology: Concentrations of nickel and cobalt occur in small veinlets along a sheared contact between fine-grained gabbro and albitized Jurassic arenite. Primary and oxidized nickel, cobalt, and copper minerals have been recognized. The arenite is commonly highly folded and fractured, and often intruded by fine-grained albitites. Albitization and silicification of the arenite is commonplace. Positive sodium fluoride bead tests for uranium were obtained on several distinct minerals from mill slag samples. A sample submitted to the Atomic Energy Commission in 1951 contained 0.335 percent eU_3O_8, and was identified as *pitchblende* in ferromagnesium minerals.
References: Davis, 1954; Ferguson, 1939; U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3738, 3308, 3731; Willden and Speed, 1973.

8. Bluebird property

Other names: Blue Bird
Location: Sec. 13(?) or 24(?), T. 16 N., R. 32 E.; exact location unknown.
Development: Location pits.
Radioactivity: Background = 0.015 mR/hr.; High = 0.15 mR/hr.
Geology: An unidentified yellow uranium mineral occurs in a small quartz vein with iron and copper sulfides. The wallrock is unknown. The author was unable to locate this prospect in 1969.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3297.

9. Johnson group

Location: Sec. 19(?), T. 16 N., R. 33 E.; exact location unknown.
Development: At least one pit.
Radioactivity: Background = 0.025 mR/hr.; High = 0.3 mR/hr. A grab sample and a chip sample from the pit both contained 0.01 percent eU_3O_8.
Geology: Anomalous radioactivity reportedly occurs in rhyolitic flows.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3296.

10. Chalk Mountain mine

Location: Sec. 23, T. 17 N., R. 34 E. (unsurveyed, projected from east). On the southeast flank of Chalk Mountain.
Development: Several levels of underground workings. Mining was done in early 1900's for lead and silver.
Radioactivity: One sample assayed 0.13 percent eU_3O_8, but contained only 0.05 percent cU_3O_8.
Geology: Irregular veins, containing silver and lead minerals, occur in Triassic(?) carbonate rocks. The ore minerals include cerussite, anglesite, cerargyrite, wulfenite, vanadinite, and argentiferous galena. Anomalous radioactivity was noted on the 335-foot level, associated with a gouge zone in a dolomitized limestone.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3301; Willden and Speed, 1973; Thorstenson, 1968.

11. Gamma group (nos. 1 and 2)

Other names: Gamma Lignite prospect
Location: Sec. 35(?), T. 16 N., R. 37 E. (unsurveyed). About 300 yards west of the Gold Trail mine.
Development: A 30-foot 5° inclined adit and a 10-foot-long trench (1950).

CHURCHILL COUNTY, *continued*

Radioactivity: Up to 0.1 percent uranium in the ash (produced by burning lignite).

Geology: Uranium is reported present in a 10-foot interval in Tertiary sedimentary rocks containing 50 percent lignitic units. One bed averages 3.5 feet thick and contains up to 0.06 percent uranium (up to 0.1 percent in the ash). Dips are low in the surrounding poorly indurated sandstones and shales, and exposures of the radioactive units continue for more than a quarter of a mile. The ash content of the lignite ranges from 59 to 75 percent (fig. 3). Selenite is commonly present in the lignites.

References: Staatz and Bauer, 1954a; Davis, 1954; Gott and others, 1952; Duncan, 1952b, p. 118; Staatz and Bauer, 1951a; Willden and Speed, 1973; McKelvey, 1957, p. 36.

12. Martin claims

Location: Sec. 12(?), T. 18 N., R. 34 E. (unsurveyed). About 8 miles north of Chalk Mountain.

Development: Location pits.

Radioactivity: Background = 0.02 mR/hr.; High = 0.15 mR/hr.

Geology: *Torbernite*(?) is present along fractures in a Tertiary rhyolite. The author was unable to locate these claims in 1968.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3293.

13. Mustang group (nos. 1-7)

Location: Sec. 25(?), T. 20 N., R. 39 E.

Development: Several location pits.

Radioactivity: Background = 0.03 mR/hr.; High = 0.15 mR/hr.

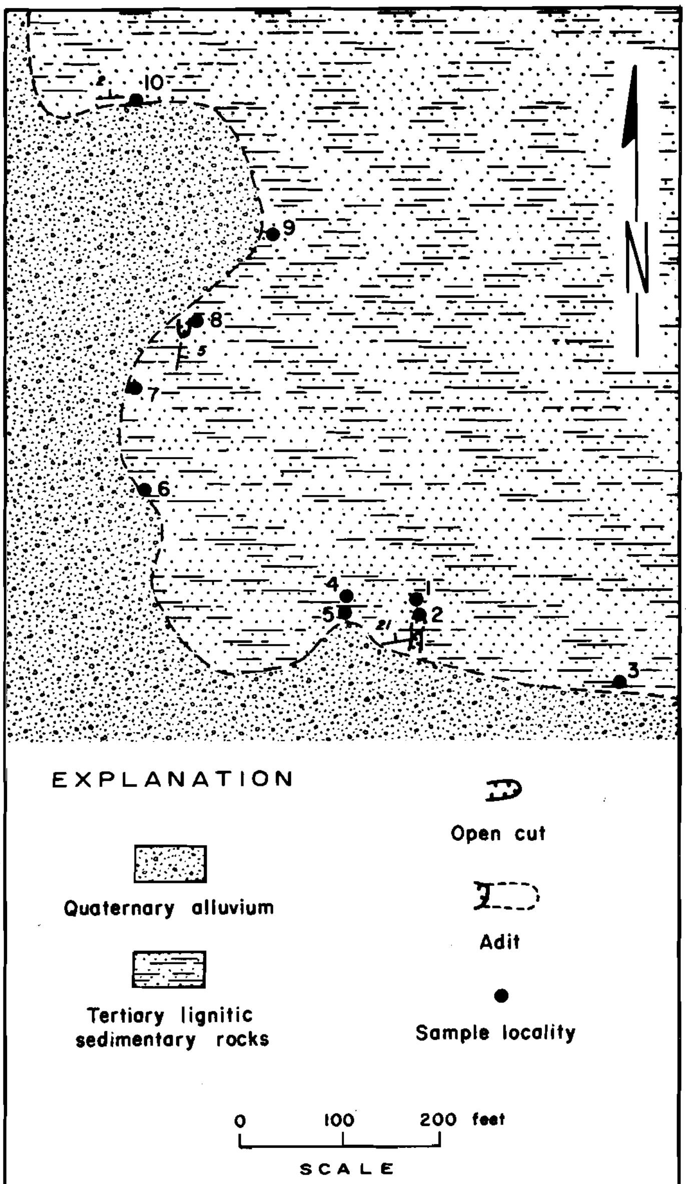
Geology: Anomalous radioactivity is associated with opalized stringers, beds, and fractures in a tuff unit. The tuff is interbedded with volcanic flows. Iron and manganese oxides are also present.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3295.

14. Patriot group (26 claims)

Location: Sec. 6(?), T. 19 N., R. 40 E.

Radioactivity: Background = 0.03 mR/hr.; High = 0.17 mR/hr. A 20-foot horizontal chip sample contained 0.03 eU_3O_8.



Sample Locality	eU_3O_8 (percent)	cU_3O_8 (percent)	Ash (percent)	U_3O_8 in ash (percent)
1	0.048	0.061	71.98	0.100
2	0.027	0.045	71.77	0.061
3	0.004	0.008	58.71	0.018
4	0.045	0.066	59.35	0.118
5	0.004	0.007	74.63	0.009
6	0.021	0.025	63.44	0.042
7	0.004	0.009	73.79	0.014
8	0.037	0.070	64.61	0.108
9	0.019	0.032	71.62	0.047
10	0.012	0.011	61.77	0.020

Adapted from Staatz and Bauer (1951a).

FIGURE 3. Maps showing locations of lignite samples from the Gamma group, Churchill County.

CHURCHILL COUNTY, *continued*

Geology: Minor quantities of *autunite* occur along iron-stained fractures in Tertiary rhyolitic volcanic rocks.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3299.

CLARK COUNTY

Gold Butte District

Pegmatites are found over a large area in the Gold Butte district. Small pegmatites are abundant, and larger types, at least 30 feet thick, are numerous in some areas (Olson and Hinrichs, 1960). A few of the pegmatites contain small quantities of *samarskite, euxenite,* zircon, *allanite,* columbite, *monazite,* fluorite, beryl, magnetite, and stibiotantalite(?) in addition to the more common pegmatite minerals (Olson and Hinrichs, 1960; Volborth, 1962a, b). *Allanite* is also reported as a rare accessory mineral from some Precambrian rapakivi-type granites which intrude older Precambrian gneisses, migmatites, granites, pyroxenites, and hornblendites. This *allanite* occurs as euhedral or corroded brown grains, and is partly metamict (Volborth, 1962b).

Columbite- and *samarskite*-bearing pegmatites as well as *allanite* pegmatites occur along granite-schist contacts. Normally *allanite* has a tendency to occur alone, and then to represent the only abundant rare earth mineral in pegmatites of the Gold Butte area (Volborth, 1962a). *Samarskite*- and columbite-bearing pegmatites do not usually contain *allanite.* Three descriptions of radioactive pegmatite are included in this report.

A second type of uranium occurrence (six localities) is also included in the Gold Butte district. Most of the properties are on or near Tramp Ridge, a few miles north of the Gold Butte mining district. The uranium at these deposits occurs as yellow, 6-valent uranium minerals disseminated in sandstones, limestones, and tuffs of the Miocene Horse Spring Formation. The uranium minerals are often found along joints.

Additionally, one occurrence of *carnotite* and opal in the Chinle(?) Formation has reported hydrothermal alteration.

15. J. V. property

Location: Sec. 10(?), T. 18 S., R. 70 E. Exact location unknown.
Geology: No information is available on this claim.
References: U. S. Atomic Energy Comm. unpublished map.

16. Blue Chip, Frank Robbin, and other prospects (6 claims)

Location: Secs. 13 and 24, T. 18 S., R. 70 E. (unsurveyed). Sections projected from west.
Development: Bulldozer trenches.
Radioactivity: A few times background.
Geology: *Tyuyamunite*(?) occurs as small smears in the gray and white calcareous tuffs and clays of the Tertiary Horse Spring Formation.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3380.

17. South Valley No. 2 claim

Location: Sec. 30, T. 18 S., R. 71 E. (unsurveyed). Projected from the west.
Production: A shipment of 13 tons is reported, but the grade was only 0.01 percent U_3O_8.
Development: Several bulldozer cuts.
Radioactivity: High = 0.6 mR/hr.
Geology: *Tyuyamunite* occurs as disseminated streaks and as fracture coatings in red- and white-mottled, limy, tuffaceous and arkosic sediments of the Tertiary Horse Spring Formation.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3314.

18. First Chance group (20 claims)

Location: Sec. 25, T. 18 S., R. 70 E.
Development: 500 feet of bulldozer road
Radioactivity: Background = 0.02 mR/hr.; High = 0.20 mR/hr. Samples contain up to 0.32 percent cU_3O_8.
Geology: *Carnotite* or *uranophane* occurs as disseminations or coatings in a sandstone of the Tertiary Horse Spring Formation.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3313; Finch, 1967; Longwell and others, 1965, p. 183.

19. Name unknown

Location: Sec. 35(?), T. 18 S., R. 70 E.
Development: Location pits
Radioactivity: 0.5-1.0 mR/hr. above background.
Geology: Anomalous radioactivity is associated with a white, tuffaceous(?) clay bed in the Tertiary Horse Spring Formation.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3343.

20. Long Shot No. 1 claim

Other names: Mutual Uranium Co.
Location: N½ sec. 2, T. 19 S., R. 70 E. (unsurveyed). Projected from the west.
Development: A 35-foot tunnel and several pits.

CLARK COUNTY, *continued*

Radioactivity: Background = 0.03 mR/hr.; High = 0.7 mR/hr. Channel samples containing 0.03 percent U_3O_8 and select samples containing 2.0 percent U_3O_8 have been cut in the tunnel.

Geology: A yellow uranium mineral (either *tyuyamunite* or *uranophane*) occurs scattered in four porous limy beds of the Tertiary Horse Spring Formation.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3323, 3323a; Longwell and others, 1965, p. 132.

21. Lucky Bart prospect (8 claims)

Location: SW¼ sec. 2, T. 19 S., R. 70 E. (unsurveyed). Projected from west.

Development: Unknown

Geology: *Autunite*(?) is disseminated in a conglomeratic sandstone in the Tertiary Horse Spring Formation.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3391(?); Longwell and others, 1965.

22. Horse Springs group (nos. 1 and 2), Green Spot group (nos. 1 and 2)

Other names: Horse Spring.

Location: Sec. 3(?), T. 19 S., R. 70 E. (unsurveyed), projected from the west.

Radioactivity: About twice background. A select grab sample contained only 0.0008 percent U_3O_8.

Geology: *Carnotite* and opal fill joints and fractures in steeply dipping silicic and calcareous sediments of the Triassic Chinle(?) Formation. Hydrothermal alteration is reported.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3366.

23. Uranium No. 1 and Old Dad prospects

Location: Sec. 32, T. 18 S., R. 70 E.

Development: Three prospect pits and several drill holes.

Radioactivity: Select samples contain as much as 0.48 percent eU_3O_8 (0.035 percent cU_3O_8).

Geology: *Monazite* and abnormally radioactive magnetite are present in feldspar-quartz-biotite pegmatite-like bodies that cut a Precambrian gneiss. Beryl(?), azurite, and malachite are also reported. Traces of thorium and uranium have been found in drill holes.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3373; Lovering, 1954, p. 80; Longwell and others, 1965, p. 185; Olson and Adams, 1962; Overstreet, 1967, p. 172.

24. Yellow Queen prospect

Location: W½(?) sec. 12, T. 19 S., R. 69 E.

Development: Bulldozer cuts

Radioactivity: About five times background (0.2 mR/hr.).

Geology: *Tyuyamunite*(?) occurs as scattered smears on fracture surfaces in the Tertiary Horse Spring Formation. Rocks exposed include calcareous green and white clays, red and white tuffaceous sediments, and red sandstone.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3388.

25. Hilltop mine

Location: NW¼ sec. 21, T. 19 S., R. 70 E. (unsurveyed).

Production: Thirty pounds of *samarskite* was produced from a pocket cut by the short adit.

Development: Two small trenches, a short adit, and several shallow bulldozer cuts.

Radioactivity: A sample of pure(?) *samarskite* contained 11.3 percent U_3O_8.

Geology: A lenticular quartz-feldspar pegmatite body that trends north and dips steeply to the east cuts a coarse-grained porphyritic granite. The pegmatite is 30 feet wide and is exposed for more than 180 feet. *Samarskite* (or *euxenite*) occurs as distinct masses which are sparsely and irregularly distributed in the dike. Other minerals include *monazite*(?), purple fluorite, epidote, clinozoisite, muscovite, biotite, magnetite, stibiotantalite(?), and chlorite(?). The quartz and feldspar appear to be of commercial grade.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3368; Longwell and others, 1965, p. 131; Volborth, 1962a; Staatz, 1964.

26. Allanite pegmatites

Location: T. 19 S., R. 70 E.; exact location unknown.

Radioactivity: The type of *allanite* occurrence reported usually contains cerium-earth metals, thorium, and traces of uranium.

CLARK COUNTY, *continued*

Geology: Two small *allanite* pegmatite bodies are known in the Gold Butte area. They are generally small irregular bodies in porphyritic rapakivi-like granite. Volborth (1962a) reports that all known *allanite* pegmatites occur near the contacts between Precambrian granites and schists. *Allanite* is concentrated in poorly developed wall and intermediate pegmatite zones, which are mostly composed of very-coarse-grained microperthite and quartz. Biotite, and in one case magnetite, are abundant associates. *Allanite* does not exceed 1 to 3 percent in these zones of the pegmatites, and only traces of zircon and *samarskite* are present.

References: Volborth, 1962a, p. 214.

Muddy Mountain and Valley of Fire Region

Several prospects in the Muddy Mountains contain *carnotite* or are otherwise anomalously radioactive, and occur in rocks ranging from Triassic to Tertiary in age. Evidence of hydrothermal alteration is either absent or was not reported. The mineralization is often concentrated in carbonaceous trash.

Uranium occurrences are present in the Triassic Chinle Formation in this area but are reportedly insignificant compared to deposits found in this unit on the Colorado Plateau (Barrett and Mallory, 1955). The Shinarump Member in the Muddy Mountains resembles exposures in the Colorado Plateau, and contains fragments of silicified wood throughout.

27. R. A. H. group (nos. 1-6)

Location: NE¼ sec. 8, SE¼ sec. 5, T. 15 S., R. 67 E.

Development: Prospect pits.

Radioactivity: Background = 0.015 mR/hr.; High = 0.05 to 0.06 mR/hr. Anomalous radioactivity is reported in Tertiary sediments, mainly limestones and conglomerates.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3386.

28. Weiser anticline occurrences

Location: T. 15 and 16 S., R. 66 E.; southwest from Glendale along Weiser Ridge.

Development: Unknown

Radioactivity: High background.

Geology: Along the west side of Weiser anticline, carbonaceous trash beds of the Shinarump Member of the Chinle Formation have an unusually high background of radioactivity which is reportedly due to disseminated uranium. No uranium minerals have been recognized.

References: Barrett and Mallory, 1955; Longwell, 1928.

29. Last Chance claim

Location: NW¼(?), T. 16 S., R. 67 E.; exact location unknown. Possibly in the vicinity of the corner of T. 15 S., and T. 16 S., R. 66 E. and R. 67 E.

Development: Numerous prospect pits.

Radioactivity: High = 0.25 mR/hr.; a grab sample gave a reading of 0.03 mR/hr.

Geology: A shaly, jarosite(?) stained sandstone containing abundant carbonaceous trash is abnormally radioactive. The bed is near the top of the Triassic Shinarump Member of the Chinle Formation. The dip is nearly vertical.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3330.

30. Carnotite No. 1 claim

Other names: Perkin Brothers claim

Location: Sec. 20, T. 16 S., R. 67 E.

Development: Several pits and a shallow shaft.

Radioactivity: Background = 0.1 mR/hr.; High = 2.C mR/hr. Samples contain up to 0.07 percent eU_3O_8 (0.075 cU_3O_8).

Geology: Very-fine-grained *carnotite* occurs with carbonaceous trash as well as along a limestone-sandstone contact. The *carnotite* occurs in a zone up to 5 feet thick and 300 feet long. The rocks present at the prospect are part of a 58-foot-thick unnamed unit at the top of the Jurassic(?) Aztec Sandstone, which presumably lies unconformably beneath the Willow Tank Formation of Cretaceous age.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3329; Carper, 1946; Barrett and Mallory, 1955.

31. Golden Glow and Carnotite Lode prospects

Other names: Overton property, Perkin Brothers claims(?).

Location: Sec. 16, T. 16 S., R. 67 E.

Production: Some ore may have been produced.

Development: About 15 prospect pits.

Radioactivity: Samples contain up to 0.045 percent cU_3O_8. Radiometric assays are about 15 percent greater.

CLARK COUNTY, *continued*

Geology:	*Carnotite* occurs with opal and calcite along fractures in clays, conglomerates, and tuffaceous sandstones of the Cretaceous(?) or Tertiary(?) Overton Fanglomerate.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3369; Finch, 1967; Longwell and others, 1965, pl. 2.

32. Valley of Fire State Park

Location:	T. 17 S., R. 67 E.
Geology:	Some of the petrified logs in the Shinarump Member of the Chinle are radioactive. Uranium minerals may possibly be present.
References:	Barrett and Mallory, 1955.

Goodsprings Area

The first published mention of uranium in the Goodsprings district was by Hill (1912). Yellow crystals from the Singer-Tiffin mine were said to be a uranium-bearing mineral, but Hill reported that they proved to be pyromorphite (a green or yellow lead-phosphate and lead-chloride).

Uranium minerals in this district were first described by Hewett (1923). He reported that *carnotite* was present as thin films along fractures at several localities, and suggested that the carnotite was deposited by ground water during recent geologic time.

Barton and Behre (1954) report that interest in these deposits was revived during the Second World War. Hill and Carper of the Union Mines Development Corp. reported at least a trace of *tyuymunite* in every railroad cut between Jean and Arden (fig. 4). They believed that the uranium had been leached from the hills to the west of the occurrences.

During the same period, tests of zinc ores from the Goodsprings mines lead to the discovery of the uranium mineralization at the Green Monster mine. Further investigations in the district indicated the presence of uranium at several other mines.

Barton and Behre (1954) described both areas of uranium mineralization (the base-metal mining district and the Jean-Sloan area). Their detailed report is the basis for much of the data summarized below. Because the two areas of uranium mineralization near Goodsprings differ from each other in mineralogy, geographic distribution, and origin, they are described separately under the general title of the Goodsprings area.

Jean-Sloan Area

Barton and Behre (1954) studied the *carnotite* occurrences near Jean and Sloan (fig. 4), and concluded that they were associated with rocks which mainly underlie or are down dip from the Erie Tuff. The minerals were probably deposited from groundwater, above the water table. The conclusions of Barton and Behre (1954) are quoted below:

1. Small amounts of uranium mineralization occur in widely scattered localities east of the Goodsprings quadrangle and in at least one locality two miles north of Goodsprings (Locality 27).
2. The uranium mineral is universally *carnotite.*
3. All of the deposits are of a common origin. They were deposited from ground water above the water table in recent geologic time, the mode of deposition being similar to that of caliche.
4. Structural control is effective in the localization of the mineralization because joints and minor faults provide channelways for circulating ground water.
5. The known deposits are not of sufficient grade to be of economic significance, and there is little possibility that they are related to large undiscovered deposits of the same type.
6. The source of the uranium and much of the vanadium is the Erie tuff, which contains a high concentration of uranium. A different tuff, probably related to the tuffs of Table Mountain, was the source of the uranium in the occurrence north of Goodsprings (Locality 27).
7. Manganese dioxide and uranium are independent in their occurrence.
8. The Erie tuff is the extruded portion of a residual magmatic fluid in which uranium was concentrated.
9. It is possible that the same magmatic process which produced the tuff gave rise to hydrothermal solutions which could have formed large deposits of uranium. The depth of such deposits, if they do exist, may be excessive for exploration or mining.
10. The vent from which the tuff was erupted is probably located east or southeast of Erie and is probably covered by more recent sediments and volcanic rocks.

33. Locality 3

Location:	NE¼ sec. 12, T. 23 S., R. 60 E.; near the Union Pacific Railroad.
Development:	3 shallow cuts.
Radioactivity:	Background = 5 cps; High = 10 cps.
Geology:	*Carnotite* occurs as pebble coatings and aggregates in earthy white caliche in Quaternary gravels.
References:	Barton and Behre, 1954; Finch, 1967.

34. Locality 1

Location:	NE¼NW¼ sec. 2, T. 23 S., R. 60 E.; along the Union Pacific Railroad.
Development:	Railroad cuts.
Radioactivity:	No areas reported above background (10 cps).
Geology:	A very small amount of *carnotite* occurs sporadically as minute specks along bed-

CLARK COUNTY, *continued*

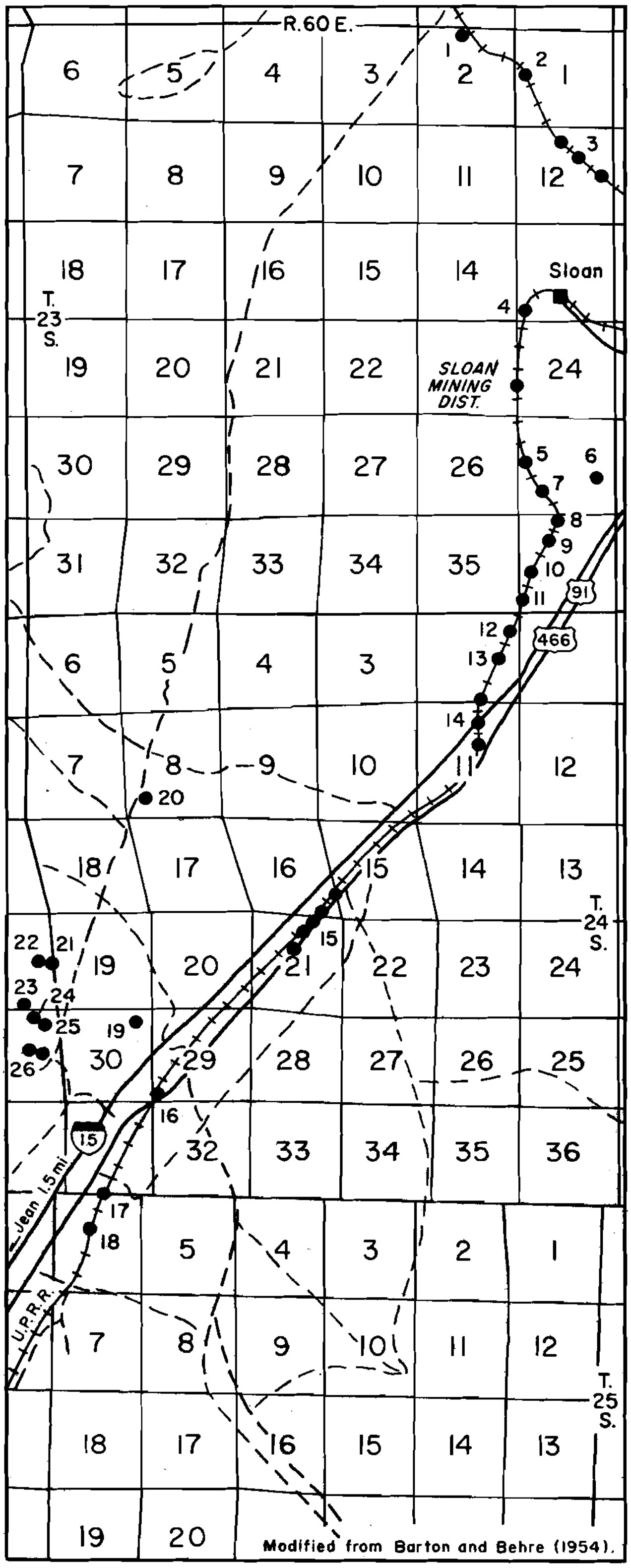


FIGURE 4. Uranium localities in the Jean-Sloan area, Clark County.

ding planes and joint surfaces in limestones, sandstones, and shales of the Mississippian Bird Spring Formation.

References: Barton and Behre, 1954.

35. Locality 2

Location: SW¼NW¼ sec. 1, T. 23 S., R. 60 E.; along the Union Pacific Railroad.
Development: Railroad cuts.
Radioactivity: Background = 5 cps; High = 10 cps.
Geology: Minute specks of *carnotite* occur very sporadically along joints and bedding planes of the Bird Springs Formation.
References: Barton and Behre, 1954.

36. Little Snake, Purple Valentine, etc. claims.

Location: Secs. 4, 15, 16, 28, T. 23 S., R. 60 E.
Development: Several pits and trenches.
Background = 0.015 mR/hr.; High = 0.07 mR/hr. Samples range from 0.014 to 0.15 percent cU_3O_8.
Geology: Uranium occurs in sandy horizons of the Permian Kaibab and underlying Supai Formations. In some prospect pits, *carnotite* is present as joint coatings or associated with faults.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3309; Finch, 1967.

37. Locality 4

Location: SW¼ sec. 13, T. 23 S., R. 60 E.
Development: Railroad cut
Radioactivity: Background = 5 cps; High = 15 cps.
Geology: *Carnotite* is fairly common, though never abundant, in a caliche-cemented Quaternary gravel bed. The pebbles are mainly chert and carbonate rock fragments. An overlying basalt-pebble gravel contains only sparse *carnotite.*
References: U. S. Atomic Energy Comm. RME-3119, Barton and Behre, 1954; Hewett, 1923.

38. "Sloan mining district"

Other names: *Carnotite* deposit.
Location: SW¼ sec. 24, T. 23 S., R. 60 E.; in a railroad cut 1.25 miles south of Sloan.
Geology: *Carnotite,* associated with calcite and manganese oxide, occurs as fracture coatings in the Erie Tuff.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3385; Lovering, 1954; Vanderburg, 1937; McKelvey, 1957.

CLARK COUNTY, *continued*

39. Locality 5

Location: SW¼NW¼ sec. 25, T. 23 S., R. 60 E.
Development: Railroad cut
Radioactivity: Background = 8 cps; High = 15 cps.
Geology: *Carnotite* occurs as minor specks on fractures in a Tertiary sandstone and in the underlying Bird Spring Formation.
References: Barton and Behre, 1954; Hewett, 1923; Finch, 1967.

40. Locality 6

Location: NE¼SE¼ sec. 25, T. 23 S., R. 60 E.
Development: A 6-foot-deep pit
Radioactivity: Background = 20 cps; High = 45 cps.
Geology: Two steeply dipping sets of joints in the Bird Spring Formation contain thin films of *carnotite.* The joint sets trend north-south and east-west. Specks of *carnotite* were also present in the overlying decomposed tuff and caliche.
References: Barton and Behre, 1954.

41. Locality 7

Location: Center, SW¼ sec. 25, T. 23 S., R. 60 E.; in a cut along the railroad.
Development: Railroad cut.
Radioactivity: Background = 30 cps; High = 150 cps. Select samples contained 0.14 to 0.70 percent cU_3O_8.
Geology: *Carnotite* occurs along joints and along a N. 65° W. fault in a maroon welded tuff unit of the Erie Tuff. No hydrothermal alteration was reported present, and little difference in metal content was noted between samples taken here and those from a fresh tuff specimen.
References: Barton and Behre, 1954.

42. Locality 8

Location: NE¼NW¼ sec. 36, T. 23 S., R. 60 E.
Development: Railroad cut.
Radioactivity: Background = 10 cps; High = 45 cps.
Geology: A few specks of *carnotite* are found on outcrops of the Bird Spring Formation.
References: Barton and Behre, 1954.

43. Localities 9, 10, 11, 12, 13

Location: SW¼ sec. 36, T. 23 S., R. 60 E., and NE¼ sec. 2, T. 24 S., R. 60 E. Along the Union Pacific Railroad.
Development: Railroad cut.
Radioactivity: Background = 20 to 25 cps; High = 50 to 90 cps. A select sample from Locality 11 contained 0.008 percent cU_3O_8.
Geology: *Carnotite* occurs as specks and coatings on joints in the Erie Tuff, with caliche coatings, and in sand and gravel beds which are younger than the tuff. The sand and gravel units overlie an unmineralized basalt which overlies the Erie Tuff.
References: Barton and Behre, 1954.

44. Locality 14

Other names: Erie to Arden along Union Pacific Railroad.
Location: NW¼NE¼ sec. 11, T. 24 S., R. 60 E.
Radioactivity: Background = 20 cps; High = 40 cps. A mineralized limestone pebble 2 inches in diameter registered 10 times background. Up to 0.03 percent U_3O_8 reported.
Geology: *Tyuyamunite* occurs as scattered blebs and patches in a caliche-cemented Quaternary gravel. The total uranium content of the gravel is very low. The caliche zone has been estimated to contain approximately 0.03 percent U_3O_8.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3356; Carper, 1954; Barton and Behre, 1954; Finch, 1967.

45. Locality 20

Location: SW¼SE¼ sec. 8, T. 24 S., R. 60 E.
Development: Small prospect pit.
Radioactivity: Background = 10 cps; High = 15 cps.
Geology: Traces of *carnotite* occur along joints and slickensided minor faults in the Supai Formation.
References: Barton and Behre, 1954.

46. Locality 16

Other names: Red Turtle
Location: Center of secs. 29, 30, 31, 32, T. 24 S., R. 60 E.; Jean Underpass.
Development: Prospect pits, highway and railroad cuts.
Geology: *Carnotite* occurs as films and specks in caliche and on pebbles of crystalline rock and limestone. The unit is a gravel which underlies the Erie Tuff.
References: Barton and Behre, 1954; Finch, 1967.

47. Locality 15

Location: N½ sec. 21, and SE¼ sec. 16, T. 24 S. R. 60 E.
Development: Several highway and railroad cuts.

CLARK COUNTY, *continued*

Radioactivity:	Background = 10 cps; High = 15 cps.
Geology:	Extremely small amounts of *carnotite* occur in gravels which are composed of pebbles of Erie Tuff and limestone.
References:	Barton and Behre, 1954.

48. Willabelle claim

Other names:	Locality 19, "Sutor area"
Location:	NE¼ sec. 30, T. 24 S., R. 60 E.
Radioactivity:	Less than 3 times background.
Geology:	*Carnotite* and manganese oxide occur along bedding planes in a red sandstone of the Permian Supai(?) Formation.
References:	Hewett, 1923; Barton and Behre, 1954; Lovering, 1954; Vanderburg, 1937; Finch, 1967.

49. Nunn prospect

Location:	Sec. 19, T. 24 S., R. 60 E.
Geology:	*Carnotite* occurs along bedding and fractures in a red sandstone of the Permian Supai(?) Formation.
References:	Finch, 1967; Hewett, 1923.

50. Humdinger, Lake View, Lake View No. 1 claims

Other names:	Lakeview; Localities 22, 23, 24, 25, 26.
Location:	SE¼ sec. 24, and NE¼ sec. 25, T. 24 S., R. 59 E.
Development:	Several prospect pits.
Radioactivity:	Background = 15 cps; High = 30 cps.
Geology:	*Carnotite* occurs as small patches and films on sandstone and limestone of the Permian Toroweap Formation. Visible *carnotite* is not abundant enough to produce high radioactivity.
References:	Barton and Behre, 1954; Hewett, 1923; Finch, 1967.

51. Sieber claim

Other names:	Locality 21
Location:	NE¼SE¼ sec. 24, T. 24 S., R. 59 E.
Development:	A 12-foot-deep shaft
Radioactivity:	Background = 15 cps; High = 45 cps.
Geology:	*Carnotite,* manganese oxides, gypsum, and calcite are found as specks and thin films along joints and fractures. The minerals occur on surface exposures of a sandstone bed in the upper part of the Permian Supai(?) Formation.
References:	Hewett, 1923; Barton and Behre, 1954.

52. Localities 17 and 18

Location:	N½ sec. 6, T. 25 S., R. 60 E.
Geology:	*Carnotite* reportedly occurs with caliche as coatings and films along joints in the Erie Tuff. The caliche is composed of fine-grained calcite and gypsum.
References:	Barton and Behre, 1954.

53. Locality 27

Other names:	Goodsprings occurrence
Location:	Center, sec. 14, T. 24 S., R. 58 E.
Development:	A prospect pit about 5 feet deep.
Radioactivity:	A chip sample contained 0.006 percent cU_3O_8.
Geology:	A small amount of *carnotite* is found as small specks on fractures in soft, buff sandstone of the Permian Toroweap Formation.
References:	Lovering, 1954; Hewett, 1923; Barton and Behre, 1954; Finch, 1967.

Goodsprings Mining District

Many mines in the Goodsprings district are radioactive in certain areas or contain uranium minerals. The radioactivity was found to be associated with limonite, hydrozincite, ferruginous chert, carbonaceous shale, and secondary copper minerals. These minerals are present in the oxide zone of the sulfide vein deposits of the Goodsprings district. Barton and Behre (1954) believe that the association of uranium with these secondary minerals is due to the adsorption of uranium on colloidal surface particles during oxidation (gossan formation). Lovering (1955) has discussed this mechanism in detail for iron oxides.

In the Goodsprings district ore deposits have been worked primarily for gold; for copper with accessory cobalt, nickel, and silver; for lead and zinc, with accessory silver and vanadium; and for uranium (Longwell and others, 1965). Ore deposits are mainly confined to the Monte Cristo Limestone of Mississippian Age. Hewett (1931) subdivided this unit into five members, which are (from bottom to top, respectively): Dawn Limestone, Anchor Limestone, Bullion Dolomite, Arrowhead Limestone, and Yellowpine Limestone. However, mineralization is also present in the Mississippian Bird Spring Formation, the Devonian Sultan Limestone, and the Cambrian Goodsprings Dolomite. All of the workings in the Goodsprings district are shallow, and oxidation is deep.

Barton and Behre (1954) investigated 85 mines and prospects and found that 45 showed anomalous radioactivity (fig. 5). Their conclusions, after detailed investigations, are quoted below:

1. Anomalous radioactivity attributable to minor amounts of uranium is widespread in the Goodsprings

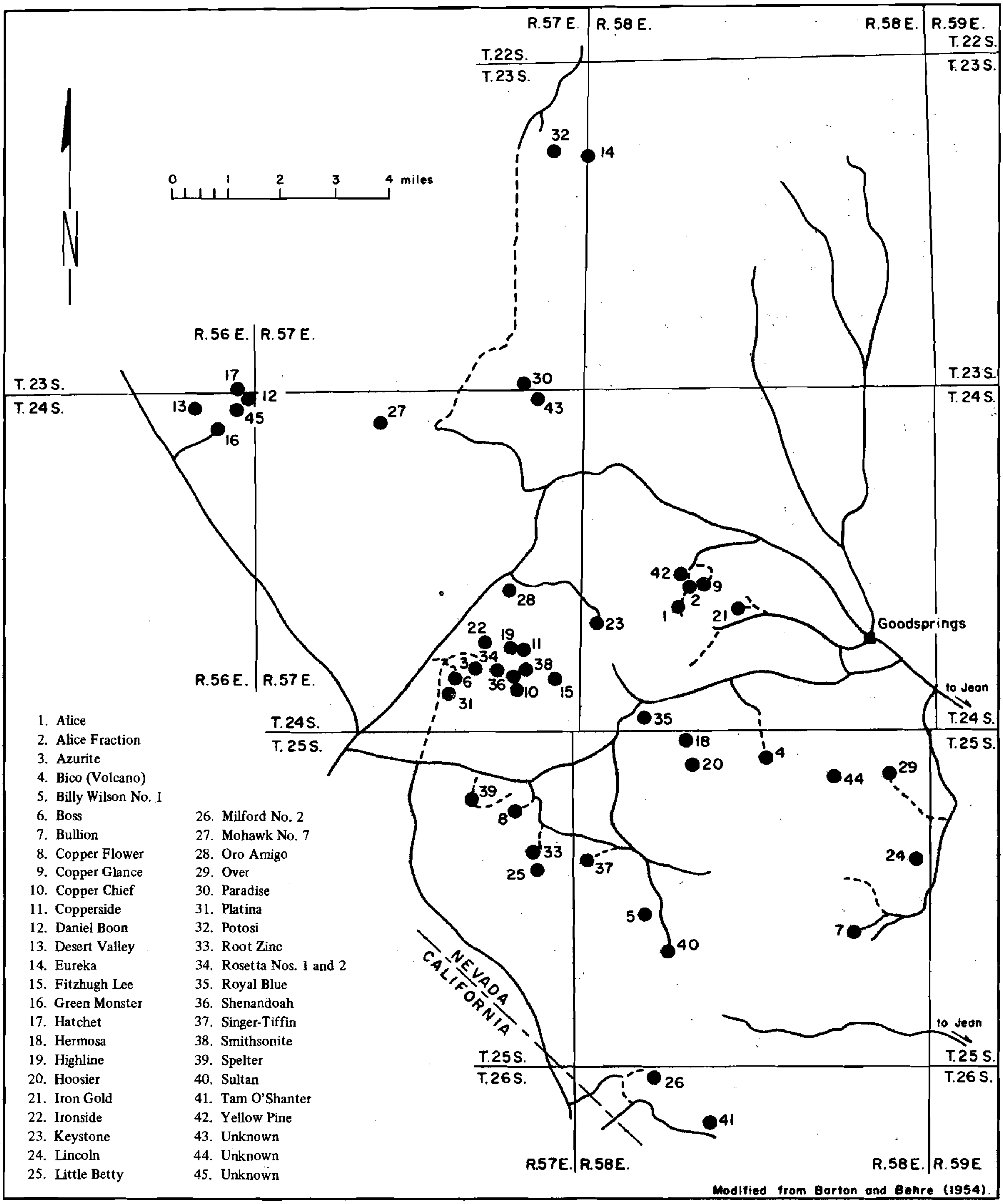


FIGURE 5. Location map of radioactive occurrences at mines in the Goodsprings mining area, Clark County.

CLARK COUNTY, *continued*

district, being found in 46 to 85 mines and prospects examined.

2. All known occurrences are of very low grade; and, with the possible exception of the Green monster mine, there is little possibility of producing uranium ore.
3. It is probable that more trace uranium mineralization can be found throughout the district, but except for the area near the Green Monster mine any additional discoveries are likely to be below ore grade.
4. Uranium minerals in megascopic quantities are rare, being found only at the Green Monster and Singer-Tiffin mines and at the Desert Valley prospect.
5. Radioactivity is concentrated by limonite, hydrozincite, chrysocolla, and ferruginous chert. These materials have passed through a very fine or colloidal state during their formation.
6. The mechanism for the fixation of the uranium is adsorption.
7. The uranyl carbonate complex ion, $UO_2(CO_3)_3^{-4}$, is probably the most important uranium ion, so far as the adsorption by the oxidized ores at Goodsprings is concerned. In environments where the pH is low or where carbonate is absent, the uranyl (UO_2^{+2}) and uranyl hydroxide (UO_2OH^+) ions are probably more important.
8. The adsorption is reversible; and upon crystallization of the adsorbent the uranium is forced to return to solution. If no solution is present secondary uranium minerals will crystallize within the former adsorbent.
9. The best uranium showings are in lead-zinc mines, but are generally confined to the immediate vicinity of copper mineralization.
10. Copper showings are often radioactive, especially those on the west slopes of Shenandoah Mountain (near the Boss mine).
11. Uranium is independent of cobalt, vanadium, gold, silver, and molybdenum mineralization.
12. The more western mines of the Goodsprings area tend to be more radioactive; but no definite limits to uranium mineralization have been defined.
13. The source of the uranium was in large part traces of some primary uranium mineral, presumably pitchblende, which was more closely associated with the copper-iron primary minerals than with those of lead-zinc, cobalt, vanadium, gold, silver, or molybdenum.
14. The only known ore containing what is probably a primary hydrothermal uranium mineral occurs at the Potosi mine where it is localized by black shale. Pyrite, but no copper minerals, accompanies the uranium which is paragenetically later than the sphalerite.
15. The volcanic rocks which once covered much of the area possibly contributed small amounts of uranium to the oxidized base metal ores, but this effect is probably of minor importance.
16. As in the case of the other metals, there is little likelihood of finding mineralization of value in undolomitized limestone.

54. Potosi mine

Other names: Potesi mine
Location: Sec. 12, T. 23 S., R. 57 E.
Development: Several thousand feet of workings on 6 levels.
Radioactivity: (Underground): Background = 10 cps; High = 275 cps. Non-radioactive shale fragments reportedly contain 0.013 percent cU_3O_8.
Geology: Anomalous radioactivity is associated with mineralized areas containing dark brown sphalerite and white calcite in a breccia of gray dolomite and fragments of black, carbonaceous shale. Autoradiograph techniques indicate that an unidentified uranium mineral occurs as irregularly curving subparallel threads in the shale fragments. The shale is believed to have been derived from the base of the Bird Springs Formation. The mine produced considerable quantities of sulfide ore, mainly sphalerite, from ore bodies in the Yellowpine Limestone Member beneath a thrust fault.
References: Barton and Behre, 1954; Longwell and others, 1965.

55. Hatchet mine

Location: Sec. 36(?), T. 23 S., R. 56 E.
Radioactivity: Background = 10 cps; High = 80 cps.
Geology: Anomalous radioactivity is associated with limonite, oxidized copper minerals, and hydrozincite.
References: Barton and Behre, 1954.

56. Unnamed prospect

Location: Center, NW¼ sec. 1, T. 24 S., R. 56 E.
Development: Small prospect pit.
Radioactivity: Background = 10 cps; High = 40 cps.
Geology: Very minor films of *carnotite* and fluorescent chalcedony coat fragments of dark grey, clastic limestone of the basal part of the Bird Spring Formation (Mississippian).
References: Barton and Behre, 1954.

57. Green Monster mine

Location: Center, W½ sec. 1, T. 24 S., R. 56 E.
Production: One shipment of 5 tons containing 1.09 percent U_3O_8 was made in 1951.

CLARK COUNTY, *continued*

Development: Extensive workings consisting of over 2,300 feet of drifts and crosscuts on three levels. Workings (for lead and zinc) extend to a depth of 380 feet.

Radioactivity: (Underground): Background = 20 cps; High = 3,100 cps. Select samples contain up to 10.5 percent cU_3O_8.

Geology: *Kasolite* and *dumontite* occur with secondary copper and lead minerals in a 1- to 2-foot-wide zone on the footwall side of the upper ore shoot of oxidized lead-zinc material. Limonite, crysocolla, and hydrozincite are also radioactive. Hydrozincite is reportedly only radioactive near copper staining. The lead-zinc ore occurs in tabular bodies which plunge 30° to 60° SE. in the Mississippian Monte Cristo Limestone. Ore is localized along brecciated fault intersections. Hydrozincite is the predominant ore mineral, but calamine, smithsonite, galena, cerussite, and anglesite are also present. Primary uranium minerals may be present at depth in the unoxidized ore. This mine has the best uranium shows in the Goodsprings district.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3379, 3381, 3381a, 3381b, 3381c, 3381d; Barton and Behre, 1954; Lovering, 1954; Brokaw, 1944; Longwell and others, 1965; Albritton and others, 1954. Mining Jour., 1945.

58. Desert Valley mine

Location: NE¼ sec. 2, T. 24 S., R. 56 E.

Development: Several small pits and trenches, and an inclined shaft about 50 feet deep with short drifts at two levels.

Radioactivity: Background = 15 cps; High = 90 cps (dump).

Geology: A very small amount of *dumontite*(?) and anomalously radioactive copper minerals are reported from the dump and the underground workings (fig. 6). Limonite, galena, and oxidized copper, zinc, and lead minerals occur along vertical fractures in a shear zone in dolomitized Bullion Limestone just below the base of the Arrowhead Limestone (Mississippian). The shear zone is nearly parallel to bedding, which here strikes N. 58° W. and dips 65° SW.

References: Barton and Behre, 1954; Longwell and others, 1965, p. 189.

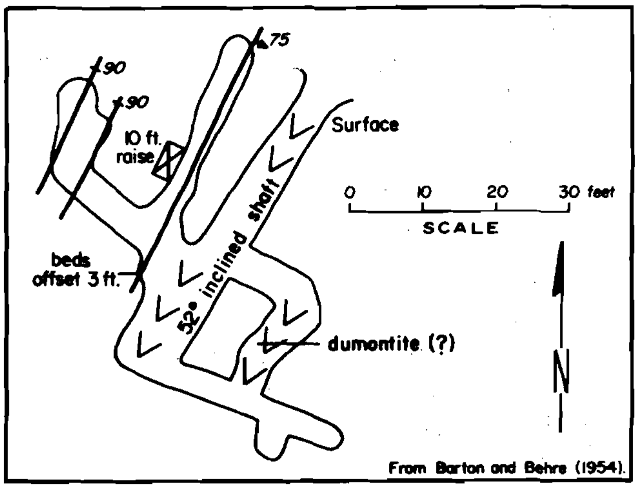


FIGURE 6. Map of the Desert Valley mine, Clark County.

59. Daniel Boon mine

Location: NW¼ sec. 6, T. 24 S., R. 57 E.

Radioactivity: Background = 15 cps; High = 35 cps.

Geology: Workings are reportedly slightly radioactive throughout.

References: Barton and Behre, 1954.

60. Mohawk No. 7 mine

Location: Sec. 4, T. 24 S., R. 57 E.

Development: Prospect pits

Radioactivity: Background = 10 cps; High = 200 cps.

Geology: Limonite and oxidized copper minerals occur along a shear zone parallel to bedding in the Bullion Limestone. Highest radioactivity is associated with goethite surrounded by halos of malachite and minor chrysocolla.

References: Barton and Behre, 1954.

61. Paradise prospect

Location: SE¼ sec. 35, T. 23 S., R. 57 E.

Development: Several small pits and short tunnels.

Radioactivity: Background = 10 cps; High = 50 cps +. A one-foot chip sample contained 0.019 percent cU_3O_8.

Geology: Oxides of copper, zinc, and iron occur along fractures in the steeply dipping beds of dolomitized Monte Cristo Limestone (Mississippian) which are upturned under the Keystone thrust. Copper minerals, mainly malachite, are slightly radioactive, but the highest radioactivity is associated with an earthy white material which is in part hydrozincite. About 2,000 feet to the southeast there are

CLARK COUNTY, *continued*

several similar prospects, two of which have comparable radioactivity associated with small lenses of ferruginous chert, limonite, and copper staining.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3346; Barton and Behre, 1954; Longwell and others, 1965.

62. Name unknown

Location: Center, sec. 1, T. 24 S., R. 57 E.
Radioactivity: Background = 10 cps; High = 50 cps.
Geology: Limonite and oxidized copper minerals are slightly radioactive.
References: Barton and Behre, 1954.

63. Ore Amigo mine

Location: E½ sec. 23, T. 24 S., R. 57 E.
Development: Less than 1,000 feet of workings on two levels.
Radioactivity: Background = 10 cps; High = 60 cps.
Geology: Anomalous radioactivity is associated with limonite, azurite, and malachite in siliceous lenses in the Sultan Limestone.
References: U. S. Atomic Energy Comm., RME-3119; Barton and Behre, 1954; Hewett, 1923.

64. Ironside mine

Location: W½ sec. 26, T. 24 S., R. 57 E.
Development: Two adits.
Radioactivity: Background = 10 cps; High = 60 cps.
Geology: Radioactivity is localized in limonite and oxidized copper minerals. Mineralization is in the Devonian Sultan Limestone.
References: Barton and Behre, 1954; Longwell and others, 1965, p. 191.

65. Smithsonite mine

Location: SE¼ sec. 26, T. 24 S., R. 57 E.
Development: Several adits
Radioactivity: Background = 10 cps; High = 30 cps.
Geology: Slight radioactivity is probably associated with limonite, which is more abundant here than in other lead-zinc mines in the Goodsprings district.
References: Barton and Behre, 1954; Longwell and others, 1965, p. 196.

66. Rosetta No. 1 and 2 claims

Location: S½ sec. 26, T. 24 S., R. 57 E.
Development: Several pits and a short drift.
Radioactivity: Background = 10 cps; High = 250 cps.
Geology: Anomalous radioactivity is associated with irregular lenses of siliceous limonite surrounded by halos of chrysocolla (with minor malachite) up to 3 inches thick. Stainierite is present as irregularly distributed specks on fractures. Limonite without copper minerals is also locally radioactive.
References: Barton and Behre, 1954; Longwell and others, 1965.

67. Highline mine

Location: E½ sec. 26, T. 24 S., R. 57 E.
Development: Several hundred feet of workings on two levels.
Radioactivity: Background = 10 cps; High = 60 cps.
Geology: Anomalous radioactivity is reportedly associated with limonite and oxidized copper minerals. The workings explore a shear zone in the Sultan Limestone which contains oxidized copper and cobalt minerals. A small amount of chalcocite is present, but the most abundant material is a mixture of chrysocolla, tenorite, malachite, and cobalt oxide in a siliceous iron-oxide gangue. Veins and lenses of chalcopyrite and a cobalt sulfide may have made up the original ore.
References: Barton and Behre, 1954; Hewett, 1931.

68. Azurite mine

Location: SW¼ sec. 26, T. 24 S., R. 57 E.
Development: Less than 1,000 feet of underground workings.
Radioactivity: Background = 10 cps; High = 30 cps.
Geology: Chalcocite, bornite, and chalcopyrite ore bodies occur in a dolomitized zone in the Anchor Limestone. Abnormal radioactivity is associated with limonite.
References: Barton and Behre, 1954; Hewett, 1923.

69. Copperside mine

Location: E½ sec. 26, T. 24 S., R. 57 E.
Development: Several hundred feet of underground workings.
Radioactivity: Background = 10 cps; High = 80 cps.
Geology: Lenses of chalcopyrite, bornite, chalcocite, and copper oxides occur parallel to bedding near the base of the Sultan Limestone. Abnormal radioactivity is associated with both oxidized copper minerals and limonite.
References: Barton and Behre, 1954; Hewett, 1923.

CLARK COUNTY, *continued*

70. Boss mine

Location: Secs. 27 and 34, T. 24 S., R. 57 E.
Development: Several levels down to 500 feet deep, with hundreds of feet of drifts and adits, made while mining copper and precious metals.
Radioactivity: Background = 10 cps; High = 100 cps.
Geology: Anomalous radioactivity is present in limonite lenses surrounded by chrysocolla. The ore body occurred along a minor fault zone related to the Keystone thrust fault. This minor fault separates the Monte Cristo Limestone from the Valentine Limestone Member of the Sultan Limestone (Mississippian). The mine is an example of the unique copper-platinum-palladium deposits in the Goodsprings district.
References: Barton and Behre, 1954; Longwell and others, 1965; Hewett, 1931.

71. Platina mine

Location: NE¼ sec. 34, T. 24 S., R. 57 E.
Development: 5 adits with several hundred feet of workings (for copper).
Radioactivity: Background = 10 cps; High = 40 cps.
Geology: Lenses of ferruginous chert, coated with malachite and chrysocolla, parallel the bedding in the Monte Cristo Limestone. Limonite and chrysocolla are radioactive.
References: Barton and Behre, 1954; Hewett, 1931; Longwell and others, 1965.

72. Shenandoah mine

Location: NW¼NE¼ sec. 35; T. 24 S., R. 57 E.
Radioactivity: Background = 10 cps; High = 50 cps.
Geology: Anomalous radioactivity is reported from limonite. Mineralization is in the Monte Cristo Limestone.
References: Barton and Behre, 1954.

73. Copper Chief mine

Location: Center, N½NE¼ sec. 35, T. 24 S., R. 57 E.
Development: Several pits, short tunnels, and shallow shafts.
Radioactivity: Background = 10 cps; High = 10 cps.
Geology: Anomalous radioactivity is associated with siliceous limonite and, to a lesser extent, with chrysocolla. Irregularly mineralized fractures in the Mississippian Bullion Dolomite contain stainierite, malachite, and chrysocolla.
References: Barton and Behre, 1954; Longwell and others, 1965.

74. Fitzhugh Lee mine

Location: N½ sec. 36, T. 24 S., R. 57 E.
Development: Two short tunnels and several trenches.
Radioactivity: Background = 10 cps; High = 35 cps.
Geology: Slightly anomalous radioactivity is associated with limonite and sporadic malachite and chrysocolla in a shear zone in the Monte Cristo Limestone.
References: Barton and Behre, 1954; Hewett, 1931.

75. Keystone mine

Location: NW¼ sec. 30, T. 24 S., R. 58 E.
Development: Three adits and two shafts.
Radioactivity: Background = 10 cps; High = 25 cps.
Geology: Limonite from a dump is very slightly radioactive.
References: Barton and Behre, 1954.

76. Yellow Pine mine

Location: NW¼ sec. 20, T. 24 S., R. 58 E.
Development: Extensive underground workings.
Radioactivity: Background = 10 cps; High = 200 cps. Selected radioactive samples contain 0.01 and 0.02 percent eU_3O_8.
Geology: Radioactivity is closely associated with oxidized copper minerals, although hydrozincite is also radioactive. Maximum radioactivity was noted in a prospect pit southeast of the main workings. The radioactive material is porous, massive, siliceous limonite with small amounts of malachite and chrysocolla. Nickel (annabergite) is reported from the ore bins of this mine (Hewett, 1931). The author briefly visited this mine in 1971.
References: Barton and Behre, 1954; Longwell and others, 1965, p. 109, 110; Hewett, 1931.

77. Alice Fraction prospect

Location: Center, sec. 20, T. 24 S., R. 58 E.
Development: A few small pits and trenches.
Radioactivity: Background = 10 cps; High = 100 cps.
Geology: A 2-foot-thick vein of limonitic chert containing oxidized copper minerals is radioactive. The vein strikes N. 25° E. and dips nearly vertically.
References: Barton and Behre, 1954.

CLARK COUNTY, *continued*

78. Alice mine

Other names: Alice No. 2 claim(?), Yellow Pine Extension, Green Mountain.
Location: S½ sec. 20, T. 24 S., R. 58 E.
Development: Three shafts several hundred feet deep, and numerous drifts and crosscuts (for zinc, lead, copper, and silver).
Radioactivity: Background = 10 cps; High = 40 cps.
Geology: Slightly anomalous radioactivity is associated with limonite. Lead and zinc minerals occur in a nearly continuous ore shoot 900 feet long, up to 40 feet wide, and 2 to 5 feet thick, in basal dolomite of the Bird Spring Formation (Mississippian).
References: Barton and Behre, 1954; Hewett, 1931.

79. Copper Glance mine

Location: SE¼NW¼ sec. 20, T. 24 S., R. 58 E.
Development: Several small pits and stopes.
Radioactivity: Background = 10 cps; High = 30 cps.
Geology: Chrysocolla and malachite occur along a vertical shear zone in dolomite. Radioactivity is associated with copper oxides and limonite.
References: Barton and Behre, 1954; Hewett, 1931.

80. Iron Gold mine

Location: NW¼SW¼ sec. 21, T. 24 S., R. 58 E.
Geology: Water from a pool at the bottom of a 100-foot-deep shaft contained 4.9 micromicrocuries per liter of radium and 110 micrograms per liter of uranium. Shales, limestones, and tuffs of the Triassic Moenkopi Formation cut by a granite porphyry dike are reported present in the shaft. The radium probably indicates the presence of volcanic or intrusive igneous rock.
References: Scott and Barker, 1962.

81. Hoosier mine

Location: Sec. 5, T. 25 S., R. 58 E.
Development: Several stopes accessible by three adits.
Radioactivity: Background = 10 cps; High = 50 cps.
Geology: Slightly anomalous radioactivity is reportedly associated with hydrozincite. Galena (locally altered to cerussite), hydrocite, and other zinc minerals occur in a crushed zone of dolomite near the base of the Bird Spring Formation.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3360; Barton and Behre, 1954; Hewett, 1931; Longwell and others, 1965.

82. Rose mine

Location: Center, sec. 31, T. 24 S., R. 58 E.
Development: A 110-foot adit and a 85-foot inclined shaft.
Radioactivity: Background = 10 cps; High = 25 cps.
Geology: Oxidized copper minerals occur around lenses of ferruginous chert in a shear zone in the Goodsprings Dolomite. The slight radioactivity is associated with limonite.
References: Barton and Behre, 1954; Hewett, 1923.

83. Hermosa mine

Location: SE¼SE¼ sec. 32, T. 24 S., R. 58 E.
Development: Surface pits and a small amount of underground workings.
Radioactivity: Background = 10 cps; High = 50 cps.
Geology: Slightly anomalous radioactivity is associated with limonite. Cerussite, wulfenite, galena, and pyromorphite occur in a breccia zone parallel to the bedding in the Bird Spring Formation (Mississippian).
References: Barton and Behre, 1954; Hewett, 1931; Schilling, 1962.

84. Royal Blue prospect

Location: NW¼SW¼ sec. 32, T. 24 S., R. 58 E.
Development: Prospect pit.
Radioactivity: Background = 10 cps; High = 35 cps.
Geology: Anomalous radioactivity is associated with limonite and oxidized copper minerals in a copper prospect.
References: Barton and Behre, 1954.

85. Over prospect

Location: SW¼ sec. 1, T. 25 S., R. 58 E.
Development: Several pits and adits
Radioactivity: Background = 50(?) cps; High = 110(?) cps.
Geology: Anomalous radioactivity is probably associated with oxidized copper minerals. Lead and zinc minerals are also present.
References: Barton and Behre, 1954.

CLARK COUNTY, *continued*

86. Name unknown

Location: Center, S½ sec. 2, T. 25 S., R. 58 E.
Development: Numerous pits
Radioactivity: Background = 30 cps; High = 60 cps.
Geology: Limonite and oxidized copper minerals are slightly radioactive.
References: Barton and Behre, 1954.

87. Bico property

Other names: Volcano
Location: NW¼ sec. 3 and NE¼ sec. 4, T. 25 S., R. 58 E.
Radioactivity: Background = 10 cps; High = 30 cps.
Geology: Hydrozincite is reportedly radioactive.
References: Barton and Behre, 1954.

88. Bullion mine

Location: Sec. 23, T. 25 S., R. 58 E.
Development: An inclined shaft, and workings on four levels.
Radioactivity: Background = 10 cps; High = 30 cps.
Geology: Galena and hydrozincite occur in tabular bodies along breccia zones in the Anchor Limestone. The radioactivity is associated with hydrozincite.
References: Barton and Behre, 1954; Hewett, 1931.

89. Little Betty claim

Location: SE¼NW¼ sec. 13, T. 25 S., R. 58 E.
Radioactivity: Background = 15 cps; High = 70 cps.
Geology: Anomalous radioactivity is reportedly associated with hydrozincite and iron-rich chert.
References: Barton and Behre, 1954.

90. Lincoln mine

Location: NW¼ sec. 13, T. 25 S., R. 58 E.
Development: A 350-foot-long inclined shaft and several small stopes.
Radioactivity: Background = 10 cps; High = 90 cps.
Geology: Slightly anomalous radioactivity is associated with limonite and oxidized copper minerals. Veins and veinlets of chrysocolla, and probably other copper minerals, occur in dolomite about 800 feet below the top of the Goodsprings Dolomite (Cambrian). Some silver chloride and bromide, and cobalt oxide are reported.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3345; Barton and Behre, 1954; Longwell and others, 1965; Hewett, 1931.

91. Eureka mine

Location: Sec. 27, T. 25 S., R. 58 E.
Development: A few shallow workings.
Radioactivity: Background = 10 cps; High = 50 cps.
Geology: Slightly anomalous radioactivity is associated with limonite and oxidized copper minerals. The ore occurred in brecciated, dolomitized Yellowpine Limestone.
References: Barton and Behre, 1954.

92. Sultan mine

Location: SE¼ sec. 20, T. 25 S., R. 58 E.
Development: Workings over a vertical range of 300 feet that explore a horizontal area of 200 by 700 feet.
Radioactivity: Background = 10 cps; High = 50 cps.
Geology: Slightly anomalous radioactivity is associated with limonite, hydrozincite, and copper oxides. Ore bodies of hydrozincite, cerrussite, calamine, and galena occur in brecciated Mississippian dolomite along the Sultan thrust, and in tabular bodies along high-angle faults which cut the breccia zone.
References: Barton and Behre, 1954; Longwell and others, 1965; Hewett, 1931.

93. Billy Wilson No. 1 claim

Location: NW¼(?) sec. 20, T. 25 S., R. 58 E.; 0.75 miles northwest of the Sultan mine.
Development: An old adit, 20 feet long.
Radioactivity: High = 0.3 mR/hr.
Geology: Radioactivity occurs in the Mississippian Monte Cristo Limestone along a minor fracture near the Sultan fault. Galena and iron and copper oxides are reported present.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3312.

94. Singer mine, Tiffin mine

Other names: Singer-Tiffin mine
Location: NW¼ sec. 18, T. 25 S., R. 58 E.; two mines about 300 feet apart.
Development: The Singer mine consists of about 800 feet of drifts and a 240-foot-deep inclined shaft. The Tiffin mine contains

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many hundreds of feet of irregular drifts. All workings are for copper, lead, zinc, silver, and gold.

Radioactivity: (Underground): Background = 10-20 cps; High = 400-500 cps. Select samples contain up to 0.06 percent U_3O_8.

Geology: Ore occurred in a breccia zone in dolomitized limestones of the Mississippian Anchor Limestone and Bullion Dolomite. Breccia, parallel to bedding, contained galena, oxidized lead minerals, hydrozincite, and calamine. *Kasolite*(?) and a green uranium mineral were found as coatings on joint surfaces and bedding planes in the Singer mine. Elsewhere in both the Singer and Tiffin mines, anomlous radioactivity is associated with limonite, oxidized copper minerals, and hydrozincite. Yellow to yellowish-green *carnotite* is found sparingly along two post-mineral faults in the Tiffin mine.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3370, 3374; Barton and Behre, 1954, Lovering, 1954; Longwell and others, 1965.

95. Spelter mine

Location: NW¼ sec. 11, T. 25 S., R. 57 E.
Development: Several adits
Radioactivity: Background = 10 cps; High = 90 cps.
Geology: Hydrozincite is reportedly radioactive.
References: Barton and Behre, 1954.

96. Copper Flower Quartz mine

Other names: Copper Flower mine, Vanadium Wedge mine, Last Chance mine.
Location: Center, E½ sec. 11, T. 25 S., R. 57 E.
Development: A 120-foot adit and two very small stopes (for copper).
Radioactivity: Background = 15 cps; High = 175 cps. Specimens of chrysocolla from the dump assay 0.116 percent cU_3O_8.
Geology: Anomalous radioactivity is associated with iron and copper oxides along a steeply dipping fracture zone near the base of the dolomitized Anchor Limestone Member of the Mississippian Monte Cristo Limestone. Iron-oxides, chrysocolla, azurite, and malachite occur in seams less than 1 inch thick along brecciated zones.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3372, 3377; Barton and Behre, 1954, p. 57; Lovering, 1954, p. 78; Longwell and others, 1965.

97. Root Zinc mine

Other names: Root mine, Bonanza Hill mine, Root Hill, Root Camp.
Location: NW¼ sec. 13, T. 25 S., R. 57 E.
Development: Several adits, drifts, and crosscuts.
Radioactivity: Background = 10 cps; High = 100 cps.
Geology: Anomalous radioactivity is associated with limonite in a brecciated and dolomitized zone in the upper part of the Mississippian Yellowpine Limestone Member of the Monte Cristo Limestone. Hydrozincite, calamine, cerussite, and residual pods of galena occur in tabular ore bodies.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3363, 3371; Barton and Behre, 1954; Longwell and others, 1965.

98. Milford No. 2 mine, Ingomar mine

Location: NW¼ sec. 5, T. 26 S., R. 58 E. (unsurveyed).
Development: Several tunnels totaling over 1,500 feet (for zinc, lead, copper and silver).
Radioactivity: Background = 10 cps; High = 200 cps.
Geology: Anomalous radioactivity was noted associated with hydrozincite and limonite at several locations in the workings. Lead-zinc ore bodies occurred along faults in dolomitized portions of the Mississippian Yellowpine Limestone Member.
References: Barton and Behre, 1954; Longwell and others, 1965; Hewett, 1931.

99. Tam O'Shanter mine

Location: Sec. 9(?), T. 26 S., R. 58 E. (unsurveyed).
Development: Several hundred feet of drift on a single level, an inclined winze about 200 feet deep, and a stope to the surface above the drift (for lead and zinc).
Radioactivity: (Surface): Background = 10 cps. (underground): Background = 40 cps; High = 225 cps.
Geology: Anomalous radioactivity is associated with copper oxides and to a lesser amount with limonite. Ore occurred in a breccia zone parallel to bedding near the base of the Mississippian Bird Spring Formation.

Cerussite, plumbojarosite, smithsonite, pyromorphite, aurichalcite, and calamine were present.
References: Barton and Behre, 1954; Longwell and others, 1965; Hewett, 1931.

CLARK COUNTY, *continued*

Crescent Peak Area

Several prospects in the vicinity of Crescent Peak contain thorium- and uranium-bearing minerals in pegmatites and other small intrusive bodies. Rare earths are also present at some localities. Some fine-grained *allanite* is reported from the *xenotime-monazite* dikes in this area (Volborth, 1962a, p. 214). Uranium and thorium can occur as impurities and chemical substitutions in *xenotime,* zircon, *monazite,* and *allanite.* At the Crescent Peak occurrences the uranium and thorium may be present in all of the above minerals, but *monazite* and *allanite* probably contain the most. The radioactive dikes from this area are fine grained, partly brecciated, and as much as 5 feet wide (Staatz, 1964).

Malan and Sterling (1969) report that felsic Precambrian metamorphic units in western Arizona, Nevada, and California have anomalously high background radioactivity. These units are inferred to have been high-energy, near-continental clastic sediments. Three samples from Precambrian rocks in the general vicinity of the Crescent Peak area contained anomalous amounts of uranium and thorium (Malan and Sterling, 1969, table 8). The radioactive elements in these samples may occur either in specific minerals or along grain boundaries. These rocks are unlikely to contain deposits of ore-grade material, but they may have been a source of uranium for younger, undiscovered ore bodies.

100. Location No. 16

Other names: Sample E753
Location: Sec. 17, T. 28 S., R. 61 E.
Radioactivity: 5.1 ppm eU_3O_8; 102.3 ppm $eThO_2$.
Geology: A sample of Precambrian mylonitic augen gneiss contained an anomalous amount of thorium.
References: Malan and Sterling, 1969.

101. Location No. 7

Other names: Sample C927
Location: Sec. 21, T. 28 S., R. 61 E.
Radioactivity: 11.9 ppm eU_3O_8, 22.2 ppm $eThO_2$.
Geology: A sample of Precambrian quartz monzonite contained an anomalous amount of uranium.
References: Malan and Sterling, 1969.

102. Location No. 6

Other names: Sample C926
Location: Sec. 22, T. 28 S., R. 61 E.
Radioactivity: 74.7 ppm $eThO_2$, 175.1 ppm eU_3O_8.
Geology: A sample of Precambrian quartz monzonitic gneiss contained an anomalous amount of uranium and thorium.
References: Malan and Sterling, 1969.

103. Nippeno mine area

Other names: Neppeno mine area
Location: Secs. 22 and 27, T. 28 S., R. 61 E.
Radioactivity: Background = 20 cps; High = 50 cps.
Geology: An *allanite*-like mineral has been reported from an aplitic dike that cuts Precambrian rocks near the Neppeno mine northwest of Crescent Peak. Radioactivity reported from this area may be due to the *allanite.*
References: Volborth, 1962a, p. 214; Longwell and others, 1965; U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3319.

104. Surprise group

Location: Sec. 29(?), T. 28 S., R. 61 E.
Radioactivity: Background = 25 cpm; High = 100 cpm.
Geology: An area of Precambrian gneiss with granitic dikes has a slightly anomalous radioactivity. Quartz veins, and iron and manganese oxides were noted. Nearby mines have base-metal quartz veins present.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3357.

105. Thor claims

Other names: Thorium prospect
Location: Sec. 32, T. 28 S., R. 61 E.
Development: None
Radioactivity: The altered area is strongly radioactive.
Geology: A small body of Tertiary or Cretaceous quartz monzonite intrudes Precambrian rocks. The quartz monzonite is altered to a *monazite*-apatite rock in a vertical pipe 75 feet in diameter. The central 25- to 30-foot portion of this pipe is brick red and contains 30 percent *monazite* and 60 percent apatite. Bastnaesite(?) may also be present.
References: Longwell and others, 1965, p. 180; Olson and Adams, 1962, p. 8.

106. Prospectors Uranium claims (nos. 1-20)

Other names: Prospector
Location: Secs. 3, 10, T. 29 S., R. 61 E.
Development: Bulldozer trenches

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Radioactivity:	Background = 0.01 mR/hr.; High = 2.5 mR/hr. One assay reports the following: U_3O_8 = 0.874 percent, ThO_2 = 0.62 percent, and rare earth oxides = 6.81 percent.
Geology:	Radioactivity is associated with a N. 55° W. dike cutting granitic rocks. One sample reportedly contained 30 percent apatite, 20 percent *monazite,* and 5 percent zircon.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3328.

Other Clark County Occurrences

Widely scattered prospects in Clark County not grouped under area descriptions are of a variety of types. However, one type is found in so many separate occurrences that it deserves special mention. Of the 14 properties described below, 10 are in Precambrian rocks. It has been noted elsewhere in this report (see *Crescent Peak Area*) that some felsic Precambrian rocks in southern Nevada contain slightly anomalous amounts of uranium and thorium (Malan and Sterling, 1969). The Precambrian prospects included below are concentrations of these radioactive minerals along faults and contacts, and in pegmatite dikes. One radioactive base-metal breccia pipe in Precambrian rocks is also reported.

107. Fry and Jeffers claim

Location:	Sec. 6 or 7, T. 13 S., R. 64 E. (unsurveyed). Projected from the west.
Radioactivity:	Background = 0.032 mR/hr.; High = 0.05 mR/hr. Samples contain 0.65 percent eU_3O_8 (0.11 cU_3O_8) and 0.23 percent eU_3O_8 (0.009 cU_3O_8).
Geology:	Slight radioactivity is present in a black Paleozoic limestone. No structure was noted.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3331.

108. South Valley No. 4 claim

Location:	Sec. 16(?), T. 15 S., R. 70 E.
Development:	A small pit
Radioactivity:	Background = 40 cps; High = 400 cps. Grab samples contain up to 0.04 percent eU_3O_8.
Geology:	Anomalous radioactivity occurs near the contact of a mica schist and a sandy shale in Precambrian metamorphic rocks.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3326.

109. Sampson and Sampson No. 1 claims

Location:	SE¼NE¼ sec. 24, T. 18 S., R. 61 E.
Development:	A 15-foot vertical shaft and a 75-foot inclined shaft having several drifts and winzes (for precious metals).
Radioactivity:	Background = 0.01 mR/hr.; High = 0.3 mR/hr. A select sample contained 0.068 percent cU_3O_8.
Geology:	Anomalous radioactivity occurs in a 15-foot-deep shaft along a N. 60° W. brecciated zone in dolomite of the Monte Cristo Limestone. Higher readings are associated with pods of malachite, chrysocolla, and iron oxides. An inclined shaft to the northwest contains hydrozincite and hemimorphite in narrow seams in the brecciated dolomite. Small amounts of silver and gold were noted in some assays.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3315, 3315a; Longwell and others, 1965.

110. Little Hal, Steve Nos. 1 and 11 claims

Location:	Sec. 25(?) or 26(?), T. 20 S., R. 62 E.
Development:	Prospect pits.
Radioactivity:	Background = 0.025 mR/hr; High = 0.15 mR/hr.
Geology:	Anomalous radioactivity is associated with pegmatite dikes in Precambrian metamorphic rocks.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3332.

111. Gypsum Cave area

Location:	NE¼ sec. 10, SE¼ sec. 10, W½ sec. 12, and NE¼ sec. 14, T. 20 S., R. 63 E.; locations approximate.
Development:	Unknown
Radioactivity:	Anomalous, but not ore grade.
Geology:	Four airborne radioactive anomalies were reported in the Gypsum Cave area, east of Sunrise Mountain. Anomalous areas are reportedly underlain by a coarsely crystalline granite which may cut Tertiary (Miocene?) lacustrine deposits.
References:	Barrett and Mallory, 1955.

112. Anomalies 4, 5, 6, 7

Other names:	Bitter Spring Valley
Location:	T. 19 S. and 20 S., R. 66 E. (unsurveyed). Three miles north of Bearing Peak, and along a northeast line toward Bitter Spring.
Development:	Unknown

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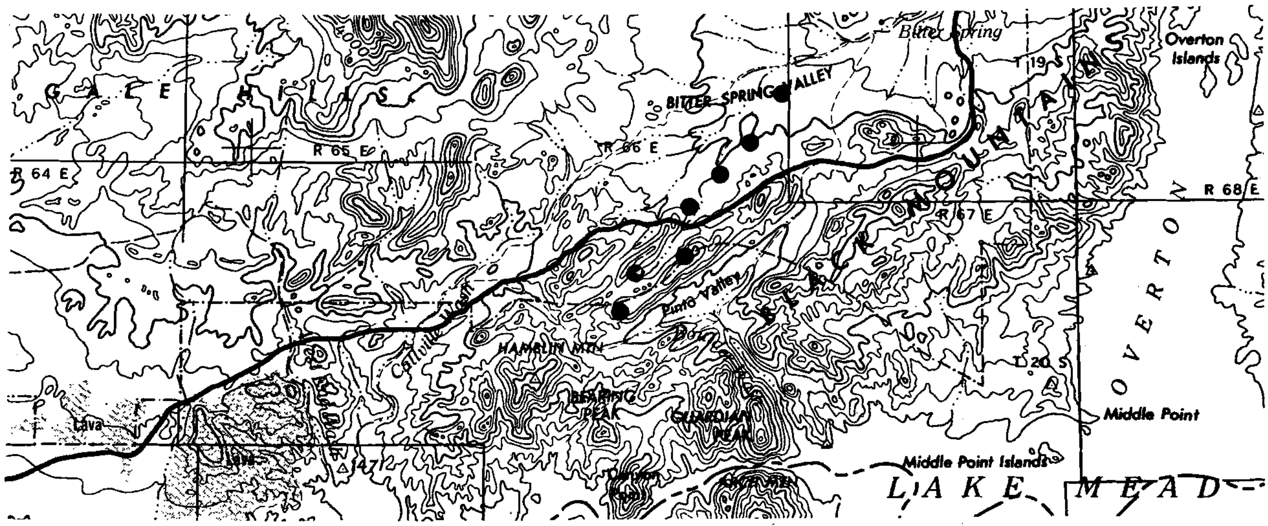

FIGURE 7. Airborne radioactive anomalies in Bitter Spring Valley, Clark County.

Radioactivity: High = 0.11 mR/hr. Grab samples contain 0.01 percent eU_3O_8.

Geology: A 1-foot-thick shale bed near the middle of an 8- to 10-foot-thick limestone unit of the Tertiary Horse Spring Formation(?) is anomalously radioactive at several localities. Longwell and others (1965) map the Horse Spring Formation here as the Gale Hills Formation of Cretaceous or Tertiary age. Seven airborne anomalies were reported from this limestone bed along a 6 to 7 mile line. Figure 7 shows the approximate location of these anomalies.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3325; Barrett and Mallory, 1955; Longwell and others, 1965, pl. 1.

113. 50-50 claim

Location: Sec. 15(?), T. 19 S., R. 67 E.

Development: None

Radioactivity: Background = 0.010 mR/hr.; High = 0.025 mR/hr.

Geology: Very slightly abnormal radioactivity is present at one locality in mudstone of the Pliocene(?) Muddy Creek Formation.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3327; Longwell and others, 1965.

114. Nevada mica mine

Other names: White Cloud(?)

Location: SW¼ sec. 18, T. 20 S., R. 70 E. (unsurveyed).

Development: Several small pits and open cuts.

Radioactivity: Background = 0.03 mR/hr.; High = 0.1 mR/hr.

Geology: Slightly anomalous radioactivity occurs along a 10- to 50-foot-wide granite pegmatite dike in Precambrian gneiss and schist. Muscovite and feldspars are present around a quartz core.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3333; Longwell and others, 1965.

115. M & E Nos. 2 and 12 claims

Location: Sec. 35(?), T. 25 S., R. 63 E.

Development: A 25-foot-deep shaft and several bulldozer cuts.

Radioactivity: Background = 0.015 (approx.) mR/hr.; High = 0.4 mR/hr.

Geology: Anomalous radioactivity occurs in Precambrian gneiss and schist. Thorium-bearing minerals may be present.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3311; Staatz, 1964.

116. Big Horn claims

Location: Sec. 36(?), T. 25 S., R. 64 E.

Development: A 35-foot-long trench

Radioactivity: Background = 0.04 mR/hr.; High (across 2.5 feet) = 0.4 mR/hr. A 1.5-foot channel sample contained 0.07 percent eU_3O_8 and 0.024 percent cU_3O_8.

Geology: Radioactivity is associated with fractures in Precambrian metasedimentary rocks.

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References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3316.

117. Mary Helen and Rose Alice claims

Location: Sec. 14(?), T. 26 S., R. 63 E.
Development: None(?)
Radioactivity: Background = 0.015 mR/hr.; High = 0.5 mR/hr.
Geology: Anomalous radioactivity occurs in a greenstone gneiss band in Precambrian metamorphic rocks.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3310.

118. H & E property

Location: SW¼ sec. 4, T. 27 S., R. 64 E.
Geology: Anomalous radioactivity has been reported in Precambrian rocks.
References: U. S. Atomic Energy Comm., unpublished map.

119. Yellow Jacket group (nos. 1-15)

Location: Sec. 7(?), T. 26 S., R. 60 E.
Development: Several trenches
Radioactivity: Background = 0.03 mR/hr.; Average = 0.08 mR/hr.; High = 0.18 mR/hr. Samples reportedly range from 0.07 to 0.125 percent eU_3O_8.
Geology: A 20-foot-wide shear zone cuts Precambrian rocks, especially a very coarsely crystalline red granite. The zone trends N. 80° W. and dips 80° S. *Autunite* is sparsely disseminated throughout the shear zone.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3387.

120. Lucy Gray mine

Location: SE¼ sec. 32, T. 27 S., R. 60 E.
Development: 3,200 feet of underground workings on 3 levels (for base and precious metals).
Radioactivity: Background = 0.04 mR/hr.; High = 0.10 mR/hr.; Average = 0.06 mR/hr. Select samples contain from 0.03 to 0.25 percent eU_3O_8.
Geology: Anomalous radioactivity is probably associated with iron and copper oxides in an elliptical breccia pipe in Precambrian granite gneiss. Silver, gold, lead, and copper production have been reported.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3390; Longwell and others, 1965.

121. Superfluous No. 1 claim

Location: S½ sec. 3, T. 32 S., R. 64 E.
Development: Several pits
Radioactivity: Background = 0.06 mR/hr.; High = 1.8 mR/hr. A select sample contained 0.25 percent ThO_2.
Geology: Anomalous radioactivity occurs near the contact of Precambrian metasedimentary rocks and a granitic intrusive. Epidote and iron oxides are also present.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3318; Olson and Adams, 1962; Staatz, 1964.

DOUGLAS COUNTY

Kingsbury Grade Area

Three prospects in the vicinity of Kingsbury Grade contain radioactive minerals in pegmatites that cut granitic rocks. Pegmatite and aplite dikes in the Carson Range may often be somewhat more radioactive than the granitic or metamorphic rocks they cut. The Sophie group (Carson City) is probably a similar type of occurrence, and the author noted that pegmatite-aplite dikes 1½ miles west of Steamboat Springs (Washoe County) are also very slightly radioactive (1.5 to 2 times the background in metamorphic rocks).

122. Kingsbury Queen prospect

Location: SW¼ sec. 20, T. 13 N., R. 19 E.; along Nevada Highway 19.
Development: One bulldozer trench.
Radioactivity: Background 0.01 mR/hr.; High = 0.20 mR/hr.
Geology: Anomalous radioactivity is associated with smoky quartz and slightly altered pink orthoclase in a 15-foot-wide, north-trending, quartz-rich pegmatite dike which cuts granitic rocks. Radioactivity occurs in small lenticular patches. Clear quartz is not radioactive. Also reported are *torbernite*, and an unidentified yellow mineral. Acmite (aegirine) crystals are also said to be radioactive. The author examined this prospect in 1969, but did not recognize any uranium minerals. *Allanite* is reported from a nearby prospect (Hunch and Lucky Strike claims) and may have been mistaken for aegirine here.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3393, 3399.

123. Granite group (nos. 1-5)

Location: Center, sec. 20, T. 13 N., R. 19 E.
Development: Prospect pits

DOUGLAS COUNTY, *continued*

Radioactivity:	Background = 0.04 mR/hr.; High = 0.15 mR/hr.
Geology:	Anomalous radioactivity is associated with a pegmatite dike which cuts granitic rocks. Chrysocolla is reportedly present.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3397.

124. Hunch and Lucky Strike claims

Location:	NW¼(?) sec. 33, T. 13 N., R. 19 E.
Development:	Several small prospect pits.
Radioactivity:	Background = 0.03 mR/hr.; High = 0.05 mR/hr.
Geology:	Slightly anomalous radioactivity is associated with thorium-bearing *allanite* in pegmatite dikes which cut a quartz-rich, biotite granite.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3392.

Other Douglas County Occurrences

125. Peek-A-Boo claims

Location:	Sec. 36(?), T. 14 N., R. 20 E.
Development:	Old prospect pits for gold.
Radioactivity:	Background 0.015 mR/hr.; High = 0.20 mR/hr.
Geology:	Anomalous radioactivity occurs along several northwest-trending faults and pyrite-bearing quartz veins in Tertiary rhyolite.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3396.

126. Julietta prospect

Location:	Sec. 20(?), T. 14 N., R. 21 E.
Development:	Shallow pits and cuts.
Radioactivity:	Background = 0.016 mR/hr.; High = 0.60 mR/hr.
Geology:	Anomalous radioactivity, *autunite(?)*, opal(?), and iron and manganese oxides are found in a breccia zone in granitic rock.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3395.

127. Triangle group

Location:	Sec. 12(?), T. 10 N., R. 22 E.
Radioactivity:	Background = 0.02 mR/hr.; High = 7.0 mR/hr. A select sample contained 0.057 percent eU_3O_8.
Geology:	A highly altered area in a metamorphosed conglomerate is radioactive. No uranium minerals reported.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3398.

128. Mountain View group (11 claims)

Location:	Sec. 31(?), T. 11 N., R. 23 E.
Development:	One 10-foot-deep pit.
Radioactivity:	Background = 0.02 mR/hr.; High = 0.075 mR/hr.
Geology:	Anomalous radioactivity is associated with an iron-stained fracture in Jurassic(?) granitic rocks.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3400.

129. Hi-Boy claims

Location:	Secs. 9(?), 16(?), T. 9 N., R. 23 E.
Development:	Several small pits and trenches.
Radioactivity:	Background = 0.009 mR/hr.; High = 0.15 mR/hr. One sample contained 0.07 percent eU_3O_8.
Geology:	Radioactivity is associated with small, low-angle, iron-stained faults in Tertiary lake beds.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3394.

ELKO COUNTY

Mountain City Area

Numerous uranium prospects are located in the vicinity of Mountain City. The location of some of these is shown in figure 8. A number have produced some ore, mainly containing secondary uranium minerals. *Uraninite* is reported from a bentonitic tuff at one claim group (South Fork No. 1 and 2, Pixley No. 1). One type of deposit occurs at the base of an ash-flow tuff section which overlies granitic rocks, or along faults which separate these two units. At one prospect, secondary uranium minerals occur with pyrite and molybdenite in a fracture zone in granite. It is not known whether the uranium at this occurrence (Autunite Nos. 1-16, October Nos. 1-22) is related to the ash-flow tuff described above, or to the molybdenum-pyrite mineralization. The author feels that at this property, uranium minerals may have been formed as a result of ground water redeposition of a pre-existing deposit at the granite-tuff contact.

The origin of uranium deposits at contacts of ash-flow tuffs and tuffaceous sedimentary rocks with granitic rocks, is worthy of some speculation. It seems possible that the uranium may have been derived from either the granitic

ELKO COUNTY, *continued*

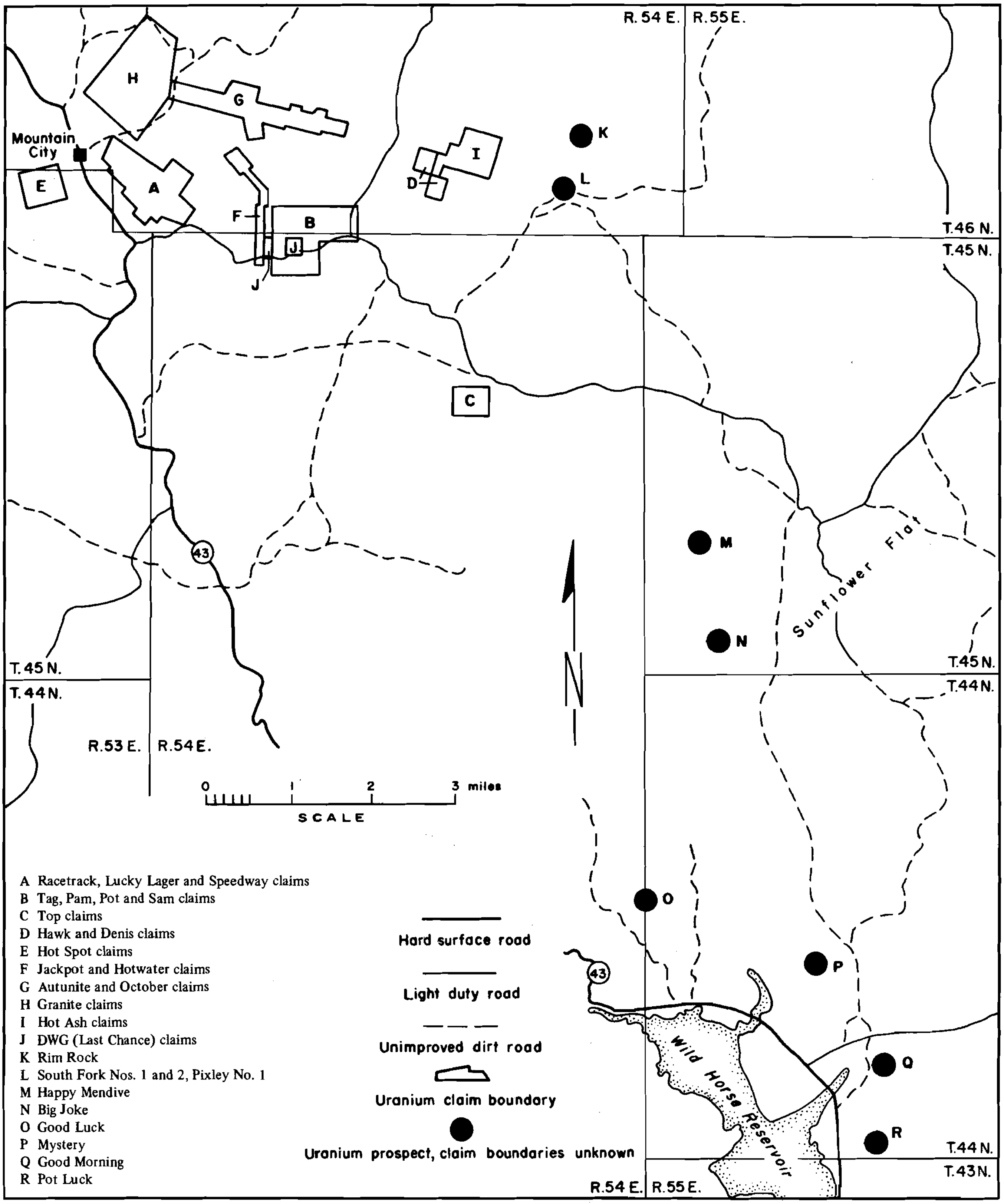

FIGURE 8. Location map of uranium claims in the vicinity of Mountain City, Elko County.

ELKO COUNTY, *continued*

rock or the ash-flow tuffs or both. Under the correct conditions, ground water could have carried the uranium in solution to favorable areas of deposition, possibly areas of high porosity and permeability, such as faults, basal unwelded zones in ash-flow tuffs, or poorly consolidated sedimentary units below the ash-flow tuffs. Ore controls might include carbonaceous matter and clay minerals. This problem is further discussed in the section of this report dealing with uranium deposits in ash-flow tuffs.

A second type of occurrence in the Mountain City area, represented by one deposit, is the Garnet tungsten mine. Here, *uraninite* occurs in a tactite zone.

Additionally, two *monazite*-bearing placers are found in the area, and several unclassified occurrences are also reported.

130. Mountain City district

Location: T. 46 N., R. 53 E.; location uncertain.
Geology: *Monazite*-bearing placer gravels reported.
References: Lovering, 1954.

131. Granite group (nos. 1-18)

Location: Sec. 25 and 36, T. 46 N., R. 53 E., and sec. 19 and 30, T. 46 N., R. 54 E.
Development: Several small trenches.
Geology: Anomalous radioactivity with minor *autunite* occurs in Tertiary volcanic rocks near the contact with underlying quartz monzonite. The volcanic unit is the Cougar Point Welded Tuff.
References: D. L. Hetland, written communication, 1971; Coats, 1968.

132. Autunite group (nos. 1-16) and October group (nos. 1-22)

Location: T. 46 N., R. 54 E. (unsurveyed). On a rounded hill south of Harris gulch, 1.5 miles northeast of Mountain City.
Radioactivity: Background = 0.017 mR/hr.; High = 0.5 mR/hr.
Geology: *Autunite, torbernite,* and *meta-torbernite* are present along an altered and silicified fracture zone in Cretaceous quartz monzonite. The mineralized zone strikes N. 12° W., is nearly vertical, and contains minor amounts of quartz, molybdenum, and iron oxides. A nearby molybdenum prospect contains pyrite and molybdenite in quartz veins and disseminations in the quartz monzonite.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3429; Schilling, 1962.

133. Hot Spot No. 1 claim (1956)

Other names: Eddie No. 1 (1968)
Location: Sec. 2, T. 45 N., R. 53 E.; southwest of Mountain City 0.4 miles on hill north of Russel Gulch, adjoining the rodeo grounds.
Development: Four bulldozer cuts.
Radioactivity: Background = 150 cps; High = 5,000 cps; average along a 25-foot strike length = 1,000 to 1,200 cps.
Geology: *Autunite* occurs along a fault which separates granodiorite from the pyroxene andesite of Russell Gulch (Coats, 1968). The uranium mineralization is in a 2.5-foot-wide zone, and is associated with clay minerals. This locality was examined by the author in 1968.
References: Coats, 1968; U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3427.

134. Race Track mine, Lucky Lager claims, Speedway claims

Location: Sec. 1, T. 45 N., R. 53 E.
Production: Reported 100-ton trial shipment in 1958.
Radioactivity: Background = 120 cps; High = 1200 to 1500 cps. An ore sample reportedly from the Racetrack mine contained 0.755 percent U_3O_8.
Geology: Anomalous radioactivity occurs along a shear zone separating Tertiary volcanic rocks from Cretaceous quartz monzonite. The radioactivity was discernable for more than 200 feet along a 15-foot-wide zone.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3428; U. S. Bur. Mines Minerals Yearbook, 1958; Butler, 1958, p. 127.

135. Tag, Pam, Pat, and Sam claims, DWG (Last Chance) group (nos. 1-3)

Other names: Lucky Strike No. 0, Anomaly No. 2.
Location: Sec. 5, T. 45 N., R. 54 E. (unsurveyed). Turn east on graded road 1¼ miles S. of Mountain City, go 2.5 miles to prospect. Trenches along both sides of the road north of Quartzite Hill.
Development: 2 bulldozer cuts and a 30° inclined shaft filled with water to within 25 feet of the surface.
Radioactivity: Background = 0.03 mR/hr.; High = 1.5 mR/hr.; analyses of up to 0.25 percent cU_3O_8 reported.

ELKO COUNTY, *continued*

Geology: Radioactivity is present along more than 400 feet of exposed contact of the Cretaceous Mountain City quartz monzonite stock with the basal zone of a rhyolitic air-fall tuff below a black, vitrophyric, andesitic welded tuff called the pyroxene andesite of Russell Gulch (Eocene or older). *Autunite* is concentrated in a 2- to 3-inch-thick bentonitic zone just above a thin charcoal layer. Weaker uranium mineralization extends downward to the weathered quartz monzonite 1 foot below, and for over 1 foot above, into the unwelded basal zone of the tuff. A carbonized log with minor *autunite* was reported from 60 feet underground. The author visited this property in 1968, and examined the Lucky Strike No. 0 near the road along California Creek.

References: Coats, 1964; U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3432; Coats, 1968; Peterson, 1956.

136. Jackpot and Hotwater claims

Location: Sec. 5, T. 45 N., R. 54 E. (unsurveyed). Projected from the west.

References: D. L. Hetland, written communication, 1971.

137. Hawk group (nos. 1-3), Denis claims (nos. 1 and 2)

Location: NE¼ sec. 33, T. 46 N., R. 54 E. (unsurveyed).

Development: Minor drilling and trenching.

Geology: *Autunite* occurs in conglomerate and Tertiary volcanic rocks overlying quartz monzonite.

References: D. L. Hetland, written communication, 1971.

138. Hot Ash group (nos. 1-9)

Location: Secs. 27 and 34, T. 46 N., R. 54 E.

Development: Several small trenches.

Geology: Radioactivity and minor *autunite* occur along the contact of volcanic rocks with underlying quartz monzonite.

References: D. L. Hetland, written communication, 1971.

139. Rim Rock mine

Other names: Rimrock mine.

Location: SW¼ sec. 26, T. 46 N., R. 54 E.

Production: Reported production of less than 500 tons of uranium ore in 1960 by the Bogdanich Development Co.

Development: An open pit.

Geology: *Autunite* is reported in Tertiary arkosic sedimentary and volcanic rocks that overlie quartz monzonite.

References: U. S. Bur. Mines Minerals Yearbook, 1960; D. L. Hetland, written communication, 1971.

140. South Fork claims (nos. 1 and 2), Pixley No. 1 claims

Other names: East and South Fork.

Location: Sec. 35, T. 46 N., R. 54 E. (unsurveyed).

Production: Valley Engineering reported production in 1960. Less than 2000 tons of uranium ore produced.

Development: Open pit and 4,000 feet of rotary drilling in 1960. Probably more recent drilling also.

Geology: *Uraninite* and yellow secondary uranium minerals occur in a Tertiary bentonitic tuff which is arkosic and carbonaceous near its base. The unit overlies a quartz monzonite.

References: U. S. Atomic Energy Commission, unpublished map; U. S. Bur. Mines Minerals Yearbook, 1960; D. L. Hetland, written communication, 1971.

141. Top claims

Location: Sec. 15, T. 45 N., R. 54 E. (unsurveyed). Projected from the east.

References: D. L. Hetland, written communication, 1971.

142. Happy Joe No. 1, Happy Mendive (center, sec. 30), and Big Joke (center, sec. 31) claims

Other names: Big Joe No. 1(?)

Location: Secs. 19, 20, 29, 30, 31, T. 45 N., R. 55 E.

Production: Reported 225 tons of ore containing 0.5 percent U_3O_8.

Radioactivity: Background = 0.03 mR/hr.; High = 0.5 mR/hr. A 5-foot chip sample contained 0.08 eU_3O_8 (0.087 cU_3O_8).

Geology: *Autunite* occurs in fault zones in rhyolite. The anomalous radioactivity extends for at least half a mile along the structure and a branching structure.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3431: Walker, Osterwald, and Adams, 1963.

ELKO COUNTY, *continued*

143. Mystery (sec. 21), Good Luck (sec. 18), Good Morning (sec. 28), Pot Luck (sec. 33) claims

Other names:	Mystery John, Mystery-Joker(?).
Location:	Secs. 18, 21, 28, 33, T. 45 N., R. 55 E. See fig. 8 for exact locations.
Development:	Bulldozer trenches and pits.
Geology:	Radioactivity reportedly occurs in Tertiary rhyolites and tuffs. The geology may be similar to that at Happy Joe No. 1, etc.
References:	D. L. Hetland, written communication, 1971.

144. Anomaly No. 3

Location:	Sec. 28(?), T. 46 N., R. 55 E. (approximate location).
Radioactivity:	About 500 cps above background.
Geology:	An airborne radiometric anomaly was noted to the east of Mountain City, but the bedrock there was covered with alluvium, and no evaluation could be made.
References:	Peterson, 1950, p. 7.

145. Anomaly No. 1

Location:	Sec. 20, T. 46 N., R. 56 E. (location approximate). On the Western Shoshone Indian Reservation.
Radioactivity:	About 500 cps above background.
Geology:	An airborne radioactive anomaly is reported from this area.
References:	Peterson, 1956, p. 7.

146. Alder Gulch district

Location:	T. 46 N., R. 56 E.; location uncertain.
Geology:	*Monazite*-bearing placer gravels reported.
References:	Lovering, 1954.

147. Garnet tungsten mine

Other names:	Tennessee Mountain area, Tennell Creek area.
Location:	Secs. 16, 17, T. 45 N., R. 56 E.
Development:	2,600 feet of diamond drilling, 300 feet of upper adit, 400 feet of lower adit.
Radioactivity:	Background = 0.02 mR/hr.; High = 1.00 mR/hr. One sample contained 0.48 percent U_3O_8.
Geology:	*Uraninite* occurs along a fault that strikes N. 75° W. and dips 65° E. in a body of tactite. The uranium occurrence is reported to be 295 feet from the portal of one adit. The tactite has replaced limestone along the contact of a granite stock with the Cambrian or Ordovician Tennessee Mountain Formation. Pyrite, molybdenite, bismuthinite, and minor chalcopyrite occur with finely disseminated scheelite. Exploration work was done for tungsten.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3430; Schilling, 1962; Bushnell, 1967; Coats and McKee, 1972.

148. Semsco property

Location:	Secs. 3, 4, T. 44 N., R. 63 E.
Development:	Old workings for copper and precious metals.
Radioactivity:	Background = 0.01 mR/hr.; High = 0.15 mR/hr.
Geology:	Anomalous radioactivity is associated with oxidized copper-bearing veins in Carboniferous limestone and Cretaceous(?) granodiorite.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3406.

149. Independence claims (nos. 1-10)

Location:	Sec. 35(?), T. 44 N., R. 63 E.
Development:	Old workings for copper and precious metals.
Radioactivity:	Background = 0.015 mR/hr.; High = 0.15 mR/hr.
Geology:	Anomalous radioactivity occurs in oxidized copper-bearing veins which cut a Cretaceous(?) granodiorite.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3407.

Contact Area

Five somewhat dissimilar radioactive occurrences are grouped in the vicinity of Contact. One is a radioactive *allanite* locality, two are associated with copper-bearing veins, one is in Tertiary sedimentary rocks, and one is poorly described.

150. Contact area

Location:	T. 45 N., R. 64 E.(?); exact location uncertain.
Geology:	Radioactive *allanite* is reported from near contacts of granitic intrusive rocks with sedimentary rocks (mostly limestones).
References:	Schrader, 1912; Peterson, 1956.

ELKO COUNTY, *continued*

151. Badger property

Location: Sec. 15(?), T. 44 N., R. 65 E. Exact location unknown.
References: U. S. Atomic Energy Comm., unpublished map.

152. Pink Horse claims

Location: Sec. 32, T. 44 N., R. 66 E.
Radioactivity: Background = 0.03 mR/hr.; High = 0.15 mR/hr. A select sample contained 0.12 percent cU_3O_8.
Geology: Uranium mineralization occurs along bedding in Tertiary tuffaceous lake sediments. Peterson (1956) reports a uranium occurrence east of Contact which may be related to a lineation (fault?) separating Tertiary sedimentary and rhyolitic volcanic rocks.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3405; Peterson, 1956, p. 8.

153. Prince claims

Location: Sec. 22 or 27, T. 44 N., R. 66 E.
Development: None(?)
Radioactivity: Background = 40 cps; High = 5000 cps. Chip samples reportedly contained 1.20 (1.45 cU_3O_8), 0.02, and 0.06 (0.073 cU_3O_8) percent eU_3O_8.
Geology: *Uranophane*(?) has been reported from an area of Paleozoic limestones and Tertiary granites. No other information is available on the prospect.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3417.

Goose Creek Area

This area includes portions of Elko County, Nev., Cassia County, Idaho, and Box Elder County, Utah. A large portion of the area is covered by Pliocene lake beds reported to be the Salt Lake Formation (Mapel and Hail, 1959). Numerous lignite and carbonaceous shale beds in this formation have concentrations of uranium as high as 0.1 percent. The highest reported uranium values occur in Idaho, but two reported localities are in Nevada. Lignite ash values range from 60 to 95 percent. Other rock exposed in the surrounding area include Tertiary(?) rhyolite, sediments of the Tertiary Payette(?) Formation, and Quaternary alluvial deposits.

Seven samples of volcanic ash, welded tuff, and bentonite from T. 47 N., R. 70 E. contained 0.002 to 0.004 percent eU_3O_8. Also, water analysis of Goose Creek and a spring in the Payette(?) Formation contained 2 ppb uranium. The uranium is believed to have been derived from volcanic ash by ground water, and concentrated in the carbonaceous beds.

154. Locality 39

Location: SE¼SW¼SW¼ sec. 7, T. 47 N., R. 70 E.
Radioactivity: Analyses reported are less than 0.03 percent eU_3O_8.
Geology: A measured section in the Tertiary Salt Lake Formation at this locality includes 5 feet of carbonaceous shale which contains slightly anomalous amounts of uranium.
References: Mapel and Hail, 1959; Mapel, 1952.

155. Locality 32

Location: S½SE¼NW¼ sec. 19, T. 47 N., R. 70 E.; near road approximately half a mile northeast of Goose Creek Ranch.
Radioactivity: Less than 0.03 percent eU_3O_8 reported.
Geology: Two carbonaceous shale beds in the Salt Lake Formation having an aggregate thickness of 9 feet contain slightly anomalous amounts of uranium.
References: Mapel and Hail, 1959.

Southern Ruby Mountains

Several hundred pegmatite-aplite dikes cut the Middle Tertiary (25 to 40 m. y.; see Schilling, 1965) Harrison Pass stock and the surrounding Lower Paleozoic sedimentary rocks. *Autunite* was found in sparse flaky crystals at several places, especially at locality V-14 in Dawley Canyon on the east side of the range. *Uraninite* is reported from Gilbert Canyon on the west side of the range.

156. Gilbert Canyon area

Location: SE¼ sec. 9, T. 29 N., R. 57 E.
Development: A small trench and pit.
Geology: A small piece of *uraninite* and its alteration products was reportedly found near an 8-foot-wide quartz mass forming the core of a larger pegmatite body. Beryl, columbite-tantalite, and garnet were also found.
References: Olson and Hinrichs, 1960; Olson and Adams, 1962.

ELKO COUNTY, *continued*

157. Dawley Canyon area, location V-14

Location: NE¼SW¼SW¼ sec. 16, T. 29 N., R. 58 E.
Geology: *Autunite* is reported along a north-trending vertical fault which forms the west contact of a 2.5- to 3-foot-thick, beryl-bearing pegmatite dike. The dike is one of many pegmatite and opalite dikes cutting the biotite-muscovite granite of the Harrison Pass stock and nearby quartzites and schists. Pegmatites of the Dawley Canyon area contain quartz, albite, oligoclase, microcline, perthite, muscovite, biotite, beryl, garnet, tourmaline, hematite (specularite), apatite, phlogopite, columbite-tantalite, *autunite,* andalusite, sillimanite, adularia, and phenakite.
References: Olson and Hinrichs, 1960; Olson and Adams, 1962.

Other Elko County Occurrences

158. Gold Basin district

Location: T. 47 N., R. 56 E.; location uncertain.
Geology: *Monazite*-bearing placer gravels reported.
References: Lovering, 1954.

159. White Rock Canyon

Location: SW¼ sec. 19, T. 44 N., R. 52 E.
Development: Prospect pits
Radioactivity: Two to three times background.
Geology: Several uranium prospects have been reported along the southwestern border of the White Rock stock and along the arcuate fault separating the Porter Peak Limestone and Prospect Mountain Quartzite south of the intrusive contact (Decker, 1962). Abundant gossan is reported from the radioactive areas, but no uranium minerals were recognized.
References: Decker, 1962, p. 56.

160. Name unknown

Location: Center, T. 40 N., R. 68 E.; west of Montello. Exact location unknown.
Geology: *Autunite* has been reported from a fault zone in limestone(?).

161. Anomaly No. 4

Location: Sec. 23, T. 37 N., R. 67 E.; 2.5 mi. southeast of Cobre.
Radioactivity: Readings of 3,000 to 3,500 cps were noted during an airborne radiometric survey. Normal background would be 1,000 to 2,000 cps.
Geology: An area of rhyolite flows is anomalously radioactive over a considerable area. A locality having five times the background radioactivity was noted during ground reconnaissance.
References Peterson, 1956.

162. Midas area

Other names: Midas mining district.
Location: T. 39 N., R. 46 E.; exact location unknown.
Geology: Uranium mineralization has been reported from opalized volcanic beds. No further information is available.
References: Eng. and Mining Jour., 1950b, p. 106; Davis, 1954.

163. Deerhead group (nos. 1-18)

Location: Sec. 24, T. 32 N., R. 52 E.
Development: A few small bulldozer trenches.
Geology: Anomalous radioactivity occurs in a silicified breccia zone on the Deerhead No. 6 claim. The breccia zone contains fragments of a black shale and waterlain tuff. The tuff overlies the black shale in the surrounding area.
References: D. L. Hetland. written communication, 1971.

164. Black Kettle group (nos. 1-4)

Location: W½ sec. 34, T. 32 N., R. 52 E.
Development: A caved 50-foot-deep shaft.
Geology: Anomalous radioactivity occurs in a semi-consolidated siltstone on the Black Kettle No. 4 claim.
References: D. L. Hetland, written communication, 1971.

165. KEF No. 2 claim

Location: Sec. 24(?), T. 30 N., R. 52 E.; Section 19 is also mentioned.
Development: None(?).
Radioactivity: Background = 0.025 mR/hr.; High = 0.04 mR/hr.
Geology: Very weak radioactivity is reportedly associated with clays, gypsum, and weak iron staining in Tertiary lake sediments.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3468.

ELKO COUNTY, *continued*

166. Asphaltite prospect

Location: N½N½ sec. 1, T. 29 N., R. 52 E.; along Smith Creek(?).

Development: Several trenches and pits, a shallow shaft and several short adits.

Radioactivity: Up to 0.097 percent cU_3O_8 reported.

Geology: An asphaltic pyrobitumen (probably impsonite or grahamite) has been reported from several localities between Trout Creek and Willow Creek, near the Eureka County line. The occurrences are reportedly associated with a north-trending basin-and-range fault. At the best described locality, the impsonite? occurs in lenses, stringers, and sheets along a fractured zone about 3 feet wide. The veins cut Paleozoic sandstone, shale, and conglomerate, and range from pure lenses up to 18 inches wide to asphalt impregnated sandstone. The vein which follows the fracture zone trends N. 60° E. and is nearly vertical. Samples of the impsonite? are said to resemble coal, have a specific gravity of 1.9, pitch-like luster, and conchoidal fracture. Vanadium and uranium are both present in anomalous amounts. The vanadium is present almost exclusively in the impsonite?, as shown by the ash analyses below (Vanderburg, 1938).

	Percent V_2O_5
Original sample	0.16
Ash and impurities	6.4
Minus 20-mesh ash	24.8

Another sample (Vanderburg, 1938, p. 57) gave the following result:

	Percent
Gold	Trace
Silver	None
V_2O_5	0.918
U_3O_8	.097

This property could not be located in 1970.

References: Anderson, 1909; Vanderburg, 1938, p. 56, 57; Gianella, 1945, p. 69; Roberts, Montgomery, and Lehner, 1967, p. 112; Lovering, 1954, p. 96; Lincoln, 1923, p. 261; Hamilton, 1956, p. 73; Tischler and Oesterling, 1964.

167. White Hill No. 1 claim

Location: Sec. 34(?), T. 32 N., R. 56 E.; possible location only. The property is reportedly on a bluff 1 mile north of the Charles Drown ranch, 25 miles southeast of Elko.

Development: Several bulldozer cuts.

Radioactivity: Background = 0.07 mR/hr.; High = 0.12 mR/hr.

Geology: Weak radioactivity occurs in opalized zones containing a little carbon trash. Iron and manganese oxides are present. The rocks are part of the lacustrine and fluvatile late Tertiary Humboldt Formation.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3433.

168. Tumbee property

Location: Sec. 13(?), T. 29 N., R. 61 E.; exact location unknown.

References: U. S. Atomic Energy Comm., unpublished map.

169. Pride and Lost Chance claims

Other names: Southam claims, Dolly Varden district.

Location: T. 29 N., R. 66 E.; exact location unknown.

Radioactivity: About 2.5(?) times background. A sample from a pegmatite dike contained 5.95 percent Th, 1.5 percent eU_3O_8 (0.128 percent cU_3O_8) and 0.35 percent rare earth oxides.

Geology: Slight radioactivity was reportedly found in shear zones in rhyolite flows and in a Cretaceous coarse-grained quartz monzonite stock, and in fractures in several northeast-trending, orthoclase pegmatite dikes. Also, various areas along the contact of the quartz monzonite stock with Carboniferous shales and limestones were radioactive. In one area the uranium mineralization is associated with chrysocolla and iron oxides. Thorium accounts for most of the radioactivity. Snow (1963) did not find any uranium mineralization during detailed mapping of this area.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3418; Snow, 1963; Davis, 1954; Olson and Adams, 1962.

170. B & O claims

Location: NW¼, T. 28 N., R. 66 E.; exact location unknown. Reportedly in low foothills on the east side of Melrose Mountain (this area could not be found on available maps).

ELKO COUNTY, *continued*

Development:	None(?).
Radioactivity:	Background = 30 cps; High = 100 cps.
Geology:	Very slight radioactivity is reported in Tertiary rhyolitic flows, reportedly associated with hematite.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3416.

ESMERALDA COUNTY

Southern Cedar Mountains

Three uranium prospects are reported from an area north of Gilbert at the southern end of the Cedar Mountains. The location of the prospects is not well known. Two of the occurrences are in Mio-Pliocene sedimentary rocks and the third is in an underlying ash-flow tuff.

171. Wildwood group (27 claims)

Other names:	Wild Wind.
Location:	T. 5 N., R. 37 E. or 38 E.; exact location unknown.
Development:	A 25-foot-long trench.
Radioactivity:	Background = 0.04 mR/hr.; High = 0.18 mR/hr. A 0.5-foot chip sample contained 0.11 percent eU_3O_8 and a 1.5-foot chip sample contained 0.03 percent eU_3O_8.
Geology:	A yellow, earthy uranium mineral occurs as coatings along joints and bedding planes in tuffaceous Mio-Pliocene sedimentary rocks. These are usually described as part of the Esmeralda Formation. The uranium mineralization is apparently present near the contact of the sedimentary rocks with an underlying welded tuff and agglomerate.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3436.

172. Cant Miss group (23 claims)

Location:	T. 5 N., R. 38 E.(?); location unknown.
Development:	Three trenches.
Radioactivity:	Background = 0.04 mR/hr.; High = 0.22 mR/hr. A 1.5-foot chip sample contained 0.06 percent eU_3O_8.
Geology:	Abnormal radioactivity occurs over a limited area in Tertiary volcanic agglomerate and welded tuff. These rocks are rhyolitic to andesitic in composition and underlie Mio-Pliocene lacustrine sedimentary rocks.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3435.

173. Anomaly No. 6

Other names:	W. Kohlmoos, et. al.
Location:	Sec. 14(?), T. 5 N., R. 38 E.; (unsurveyed). Projected from the east.
Radioactivity:	Background = 0.02 mR/hr.; High = 3.5 mR/hr.(?).
Geology:	Abnormal radioactivity (reportedly 2 to 3 times background) occurs along vertical, north trending fractures in a Tertiary conglomerate. The conglomerate is well cemented with silica, and is fossiliferous.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3645; Meehan, Sharp, and Mallory, 1956.

Emigrant Peak Area

Several Esmeralda County uranium occurrences are grouped in the northwest part of the county and centered around Emigrant Peak. A number of prospects are in Tertiary sedimentary rocks, although anomalies in Tertiary volcanic rocks and Ordovician limestone and shale are also reported. At two properties anomalous radioactivity is associated with springs. Mineralization is confined to anomalous radioactivity and secondary uranium minerals.

174. Aching Back, Blue Moon, Rosamunda, Topnotch and Happy Day claims

Location:	Sec. 8(?) or sec. 9(?), T. 1 N., R. 35 E.; exact location uncertain.
Development:	None(?)
Radioactivity:	Background = 0.035 mR/hr.; High = 0.085 mR/hr.
Geology:	Slight radioactivity reported from these claims may be associated with petrified wood in Tertiary sandstone and conglomerate.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3463.

175. Bullet Placer No. 1 claim

Location:	SW¼SW¼SW¼ sec. 28, T. 2 N., R. 36 E.
Development:	Numerous bulldozer cuts.
Radioactivity:	Background = 0.015 mR/hr.; High = 0.16 mR/hr.
Geology:	Anomalous radioactivity occurs around a spring. The highest radioactivity was found over the spring itself, and in wind-blown sand nearby. However, areas of alluvium within 100 feet of the spring are up to 2 to 3 times background. Outcrops of Tertiary lacustrine mudstones and calcareous spring deposits

ESMERALDA COUNTY, *continued*

are not radioactive. An older Tertiary quartz latite hypabyssal intrusive crops out in the vicinity, but no anomalous radioactivity was noted in this unit. Radioactivity may possibly be due to gamma-emitting decay products of radon in the spring water. The author examined this locality in 1970.

176. Gap Spring occurrence

Location: SW¼SE¼ sec. 32, T. 2 N., R. 36 E.
Development: A few nearby bulldozer cuts.
Radioactivity: Background = 0.013 mR/hr.; High = 0.07 mR/hr.
Geology: A small spot of several square feet at the outlet of Gap Spring is slightly radioactive. The area surrounding the spring is a lacustrine tufa deposit. The tufa itself is not usually radioactive, but an area of running water has the highest radioactivity. The water may contain radon, but no analysis was made. The author found this locality in 1970.

177. Magma group (5 claims)

Location: Center, sec. 33, T. 2 N., R. 36 E.
Development: Numerous bulldozer pits.
Radioactivity: Background = 0.03 mR/hr.; High = 0.30 mR/hr. A 6-foot chip sample contained 0.06 percent eU_3O_8.
Geology: Radioactivity is reported from along the contact of a rhyolite and a tuff. Iron stained quartz stringers are associated. This prospect could not be found in 1970.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3455.

178. Name unknown

Location: SW¼ sec. 4, T. 1 N., R. 36 E. (unsurveyed). Projected from north.
Development: Bulldozer cuts and several small pits.
Radioactivity: Background = 0.015 mR/hr.; High = 0.06 mR/hr.
Geology: A few small spots in a Tertiary bentonitic conglomerate are slightly radioactive. The conglomerate may be near the base of a Tertiary clastic section, which here overlies the Ordovician Palmetto Formation. The Tertiary sedimentary rocks in this vicinity were apparently deposited on a surface of high relief. No uranium minerals were noted during a visit by the author in 1970.

179. Anniversary claim

Location: Sec. 2 or 3, T. 1 N., R. 36 E.; exact location uncertain.
Development: A small pit.
Radioactivity: Background = 0.013 mR/hr.; High = 0.045 mR/hr. A 3-foot chip sample ran 0.01 percent eU_3O_8.
Geology: Very slight radioactivity has been reported from highly folded and brecciated limestone and shale(?) in the Ordovician Palmetto Formation.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3444.

180. Gap Strike group (21 claims), Sammy group (2 claims), and Wolf group (8 claims)

Location: Secs. 3 and 10(?), T. 1 N., R. 36 E.
Development: A small trench.
Radioactivity: Background = 0.025 mR/hr.; High = 0.40 mR/hr. A 3-foot chip sample contained 0.02 percent eU_3O_8.
Geology: *Autunite* and minor *carnotite*(?) are disseminated in lacustrine tuffs and poorly consolidated ferruginous sandstone.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3456; Finch, 1967.

181. Coaldale prospect, Phillips and Wentland No. 1 claims, Quinseck claim

Location: Center, sec. 33, T. 2 N., R. 37 E.
Development: None
Radioactivity: Background = 0.05 mR/hr.; High = 0.15+ mR/hr.; samples collected from weathered outcrops contained from 0.02 to 2.20 percent cU_3O_8.
Geology: Uranium mineralization occurs in a rhyolitic welded tuff near a fault contact with younger Tertiary fluviatile and lacustrine rocks. A normal sedimentary contact is present just east of the prospect (fig. 9). The area of mineralization is 400 feet long and up to 200 feet wide. Uranium is irregularly disseminated in siliceous veinlets, in a siliceous breccia pipe, along limonite stained joint surfaces, and as incrustations and cavity fillings of *autunite* and *phosphuranylite.* Veinlets and limonite coatings contain up to 0.31 percent cU_3O_8. Except for samples containing visible secondary uranium minerals, chemical assays are about 10 to 20 percent lower than radiometric analyses. Nearby lignite beds in the sedimentary rocks are not uraniferous.

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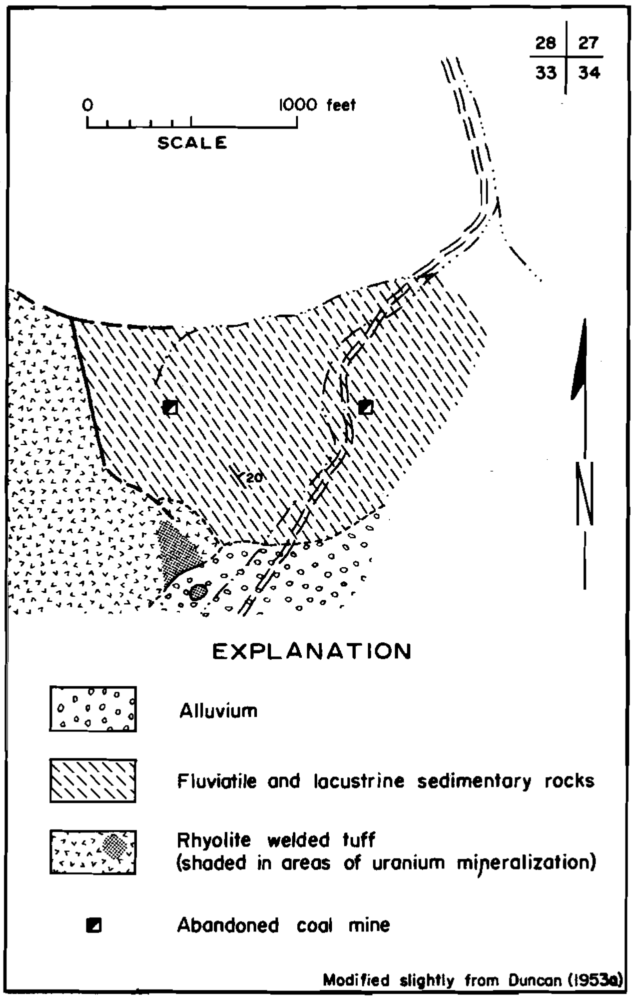

FIGURE 9. Geologic sketch map of the Coaldale prospect, Esmeralda County.

Duncan (1952a) estimated 50 tons of indicated and inferred ore averaging 0.30 percent cU_3O_8, 350 tons averaging 0.03 percent, and perhaps 67,000 tons averaging 0.03 percent, and perhaps 67,000 tons averaging 0.006 percent cU_3O_8. These reserves were calculated to a depth of 50 feet.

This locality was visited by the author in 1969, but the area of mineralization could not be located.

References: Duncan, 1953c; Sharp, 1956; Duncan 1952a; Moore and Stephens, 1954; McKelvey, 1957; U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3453; Davis, 1954, p. 6, 8.

Tonopah Area (Esmeralda County)

During a detailed investigation of uranium occurrences in the vicinity of Tonopah, the author searched for all the known radioactive anomalies. In Esmeralda County, 22 of these localities were found (see fig. 10). Also, descriptions of 13 occurrences located in adjacent parts of Nye County are described elsewhere in this report.

All of the Tonopah occurrences are in the Mio-Pliocene Siebert Tuff, and lie in a north-trending zone about 1 mile wide and 8 miles long. This zone is anomalously radioactive and contains local concentrations of higher radioactivity (Davis and Hetland, 1956). Individual localities have somewhat variable geology, but north-south faults and fractures are often reported. Linear trends of deposits, as shown in figure 10 are often associated with minor faults. The strike of the beds is often north-south, and an alignment of localities might be due to uranium mineralization in a

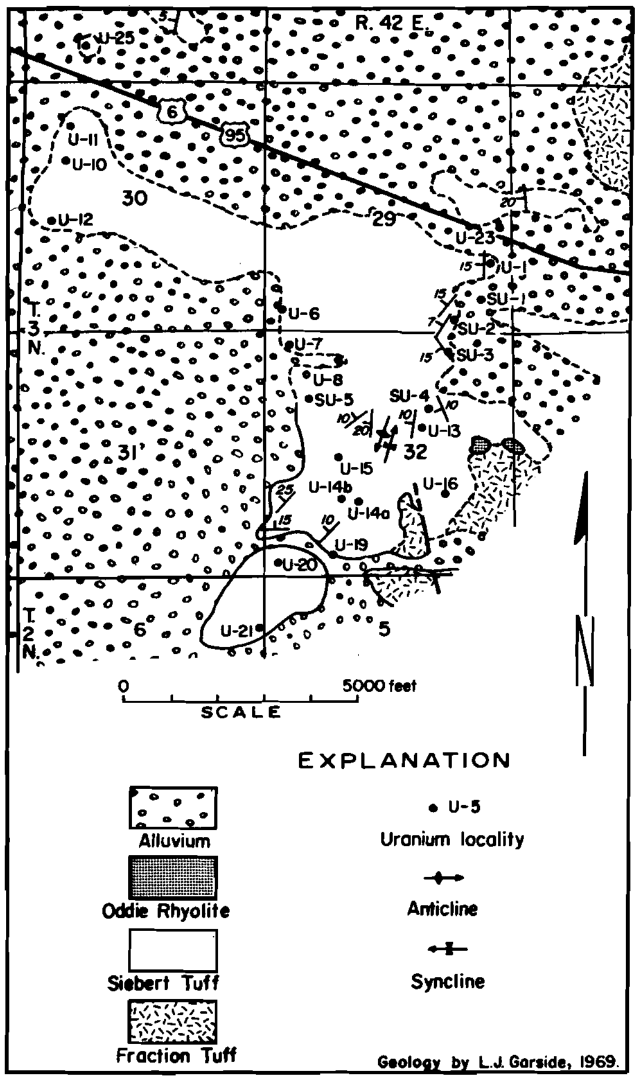

FIGURE 10. Uranium occurrences in the part of Esmeralda County adjacent to Tonopah.

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particular bed or series of beds. However, this explanation is inadequate for the entire 8-mile-long anomaly, as quite dissimilar beds are mineralized at either end of the anomaly. Davis and Hetland (1956) proposed a shear zone in the Siebert tuff along the radioactive anomaly. The mineralized faults and fractures would then be the surface expression of a major structure, which might be older than the Siebert. No definite evidence exists that would either prove or disprove this theory.

The Siebert tuff, at the type locality just south of Tonopah, consists of 600 feet of water-laid lapilli tuffs, tuffs, and tuffaceous shales. However, in the area of the uranium deposits the pyroclastic portion is finer and less conspicuous. White tuffs and tuffaceous shales are the most common rock type, but sandstones and conglomerates are also present. The uranium mineralization at individual prospects is often confined to a single small area in one or more beds. Uranium may be concentrated in the finer shales in preference to sandstones, but this is not universally true. The mineralization at several localities is confined to one bed, but is present in that bed only on one side of a north-trending fault. Stratigraphic relationships are probably more important as ore controls at specific structural sites.

The author was unable to recognize any uranium minerals at prospects in the Tonopah area. Davis and Hetland (1956) report yellow radioactive coatings on collophanite and opal. Samples containing up to 50 percent collophanite are reported, and most of the uranium may be contained in the collophanite (especially at locality SU-3). Also, molybdenum is anomalous in several samples. Iron oxides are probably due to the oxidation of syngenetic pyrite, which can be seen in drill-hole samples from depths below 150 to 200 feet.

The uranium may have been derived from the volcanic ash present in the Siebert Tuff, or it may have been introduced by uranium-bearing hydrothermal fluids. Leaching from the tuffs does not necessarily preclude the presence of thermal waters, but they are probably not necessary. The absence of features and minerals indicative of hydrothermal mineralization tends to favor the ash-leach theory. Ground waters are certainly capable of concentrating the amounts of uranium presently known in the Tonopah area.

182. Localities U-25, U-11, U-10, U-12

Location: NW¼ sec. 30 and SW¼ sec. 19, T. 3 N., R. 42 E.

Development: Several bulldozer trenches, pits, and one drill hole (less than 100(?) feet deep).

Radioactivity:

	Background (mR/hr)	High (mR/hr)
U-10	0.015	0.09
U-11	0.015	0.045
U-12	0.012	0.020
U-25	0.05(?)	0.25

Geology: Abnormal radioactivity at two of the four above localities (U-11 and U-25) is associated with minor faults that trend N. 10-25° E. Additionally, possible north-trending fractures were present at U-12, and the anomaly at U-10 (fig. 11) may also be related to unrecognized fractures. The trend of these four occurrences (fig. 10) is also suggestive of a structure having this direction, but beds of the Siebert Tuff here strike about due north and dip 25° west, and the radioactivity may be related to bedding. Iron oxides occur at both radioactive and non-radioactive localities, in the tuffs and tuffaceous shales. These localities were visited by the author in 1969.

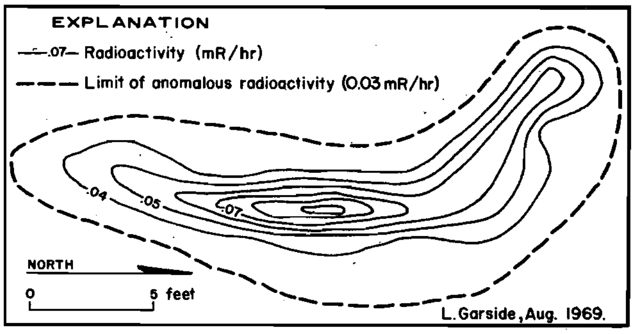

FIGURE 11. Radioactivity isolines at Locality U-10, in Esmeralda County near Tonopah.

183. Rich and Rare claim, Quinseck prospect (2 of 52 claims)

Other names: Rich and Rare, Locality U-23.

Location: NE¼SE¼ sec. 29, T. 3 N., R. 42 E.

Development: Bulldozer cuts and drill holes.

Radioactivity: Background = 0.012 mR/hr.; High = 0.07 mR/hr. Six- and 3-foot chip samples contain 0.06 and 0.02 percent eU_3O_8 respectively.

Geology: An area of 10 to 20 square feet in iron-stained tuffs is radioactive. A fault that strikes N. 17° E., and dips 75° W. was reportedly radioactive at this locality. The author was unable to find this fault in 1969, but this locality is one of several on a N. 25° E. trend of occurrences (fig. 10).

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3441.

184. Localities SU-1, 2, 3, and 4 and U-1 and 13

Other names: Silver Queen, Lambertucci property.

Location: SE¼ sec. 29 and NE¼ sec. 32, T. 3 N., R. 42 E.

Development: Numerous bulldozer cuts, pits, and roads. More than 50 holes, each up to 100 feet deep, were drilled on the Silver Queen claims (SU-3).

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Radioactivity:

	Background (mR/hr)	High (mR/hr)
SU-1	0.03	0.25
SU-2	0.02	0.80
SU-3	0.015	0.12
SU-4	0.015	0.12
U-1	0.010	0.035
U-13	0.025	0.49

Chip samples (2 to 4 feet) contain from 0.12 to 0.18 percent cU_3O_8. Radiometric analyses are both slightly higher and lower than chemical.

Geology: The six radioactive localities described above all fall on a line which trends N. 25° E. Several occurrences are related to north-trending faults, and isoradioactivity anomalies are elongated in a north-south direction. Davis and Hetland (1956) mention that the uranium present is contained in collophanite. Samples containing up to 27 percent P_2O_5 have been reported. Numerous exploration holes were drilled in the 1950's and logged by the Atomic Energy Commission. These holes show anomalous radioactivity to depths of 100 feet, the deepest drilled. However, the larger anomalies were within 40 feet of the surface (fig. 12).

Uranium mineralization may be localized by certain beds, or may occur in several different beds along minor, iron-stained fractures. These fractures nearly always trend north or northeast. Two samples from locality SU-2 contained 374 ppm and 166 ppm of molybdenum, about 20 to 30 times normal. Vanadium is reportedly present only in amounts normal for rocks of this type. These properties were examined by the author in 1969.

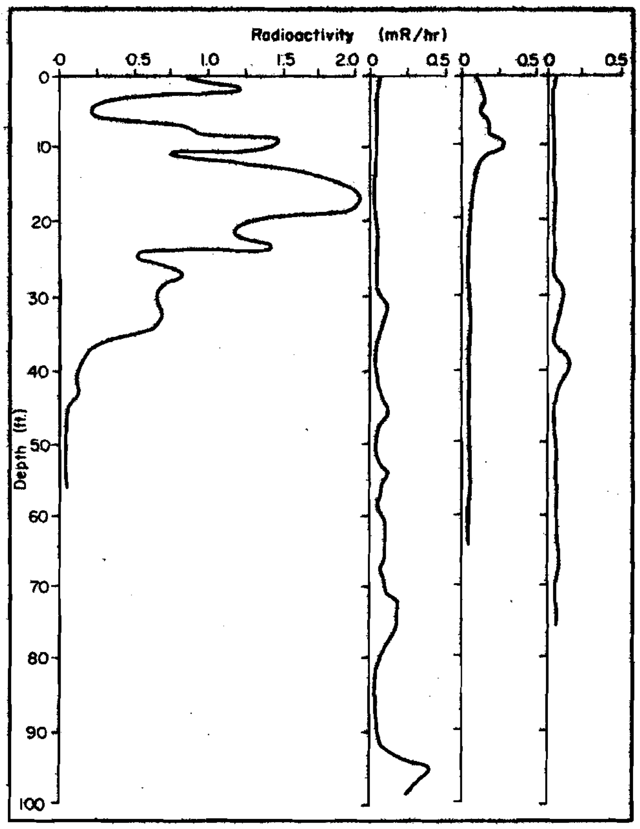

FIGURE 12. Four examples of radiometric well logs from drill holes on the Silver Queen claim (Locality SU-3), Esmeralda County.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3462; Finch, 1967; Davis and Hetland, 1956; Meeham, Sharp, and Mallory, 1956; Powers and Finch, 1955; Hetland, Sharp, and Warner, 1969.

185. Localities U-14a, 14b, 15, and 16

Location: Center, S½ sec. 32, T. 3 N., R. 42 E.

Development: Bulldozer cuts.

Radioactivity:

	Background (mR/hr)	High (mR/hr)
U-14a	0.045	0.15
U-14b	0.04	0.30
U-15	0.040	0.20
U-16	0.030	0.075

Geology: Anomalous radioactivity occurs in tuffaceous shales, sandstones, and conglomerates. Some areas of higher radioactivity are associated with iron-stained fault zones. A N.10°W. fault is present at locality U-15. Some areas of conglomerate exposure have a high background over several thousand square feet. These localities were visited by the writer in 1969.

186. Localities U-19, 20, 21

Location: SW¼SW¼ sec. 32, T. 3 N., R. 42 E., and NE¼NE¼ sec. 6, T. 2 N., R. 42 E.

Development: Bulldozer trenches.

Radioactivity:

	Background (mR/hr)	High (mR/hr)
U-19	0.04	0.12
U-20	0.04	0.07
U-21	0.035	0.07

Geology: Anomalous radioactivity is concentrated in iron-stained tuffaceous shales and conglomeratic, tuffaceous sandstones. At two localities, the uranium seems to be associated with a certain bed or sequence of beds (U-19 and U-20), and at a third (U-21) the radioactivity is concentrated in the footwall of a fault that strikes N.45°E., and dips 60°NW. The author visited these localities in 1969.

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187. Localities SU-5; U-6, 7, and 8

Other names: Garibaldi group
Location: NW¼ sec. 32, T. 3 N., R. 42 E. and SW¼SW¼ sec. 29, T. 3 N., R. 42 E.
Development: Bulldozer cuts.
Radioactivity:

	Background (mR/hr)	High (mR/hr)
SU-5	0.015	0.15
U-6	0.03	0.12
U-7	0.03	0.20
U-8	0.015	0.020

Geology: Four radioactive occurrences lie along a line that trends N. 15° W. At two localities (SU-5 and U-6), a N. 10° W., 55° to 60°W. fault was present. No faults could be identified at U-7 and U-8 but they may be present. At locality U-6, the radioactivity is associated with certain iron-stained tuffs and tuffaceous shales in the footwall of a N. 10° W. fault. A sample from U-7 contained 117 ppm molybdenum. These occurrences were visited by the author in 1969.

Tokop Mining District

Radioactive occurrences in the Tokop mining district are mainly on Gold Mountain and Slate Ridge. Ten occurrences are included under this district description. Except for a locality having unknown wallrock (Old Ingalls mine), all the properties are either in quartz monzonite or in the Precambrian Wyman Formation (the Tule Canyon "placers" were derived from granitic rocks). Radioactivity is usually concentrated along shear zones, pegmatite dikes, or quartz veins, and oxidized copper and iron minerals are often present.

188. Old Ingalls mine

Location: T. 7 S., R. 40 E.; approximate. Tule Canyon area. Exact location unknown.
Geology: The presence of uranium has been reported at this mine. No other information is available.

189. Tule Canyon "placers"

Location: T. 7 S., R. 40 E.
Geology: Reported "estimates" in 1954 of the values per cubic yard in the heavy mineral fraction of 15 million cubic yards of gravel were as follows: gold, 12 cents; tungsten minerals, 6 cents; fluorite, 6 cents; *uranothorite*(?), 3 cents; *monazite* and *xenotime,* 3 cents; columbite and *euxenite* 1.5 cents; zircon and rutile, 1.5 cents. (Total = 33 cents).
References: Unpublished data, Nevada Bur. Mines; Lovering, 1954, p. 96.

190. Tule Royal group (nos. 1-6)

Location: T. 8 S., R. 41 E.; along the east side of Tule Canyon near its mouth.
Development: A small pit.
Radioactivity: Background = 0.15 mR/hr.; High = 0.2 mR/hr. A grab sample contained 0.02 percent eU_3O_8.
Geology: A small area (2 square feet) of anomalous radioactivity is associated with a 2-foot-wide quartz vein. The radioactivity is associated with limonitic patches in the country rock (granite?) adjacent to the vein. Cinnabar(?) also was reported.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3446.

191. Name unknown

Location: SW¼ sec. 23, and NW¼ sec. 26, T. 8 S., R. 40 E.
Development: Several open cuts and prospect pits.
Radioactivity: Background = 0.015 mR/hr.; High = 0.15 mR/hr. over an area of 500 by 800 feet. A small area along a fault gave readings up to 0.20 mR/hr. A grab sample ran 0.08 percent eU_3O_8.
Geology: *Autunite*(?) occurs along a fault exposed in a 15-foot-deep shaft. The wall rock is reportedly shale (Precambrian Wyman Formation).
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3447.

192. Atlas, Moonstone, Moonstone Annex, and Ajax No. 1 claims

Other names: Greens Camp
Location: Sec. 12(?), T. 7 S., R. 41 E.; (Greens Camp is in sec. 13).
Development: Several pits and trenches and an inaccessible shaft.
Radioactivity: Background = 0.025 mR/hr.; High = 0.08 mR/hr.
Geology: Anomalous radioactivity is reported in quartz veins which cut a granitic intrusive. Copper, lead, and zinc minerals are present.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3454.

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193. Checkmate No. 1 claim

Location: 37°18′14″ North latitude, 117°20′50″ West longitude; at pass in Slate Ridge, 3½ miles southeast of Gold Point. Probably at adit symbol on Gold Point 7½ minute sheet.
Development: Old 30-foot adit and caved shaft.
Radioactivity: Background = 0.05 mR/hr.; High = 0.5 mR/hr. Samples contain from 0.013 to 0.136 percent eU_3O_8 (0.144 cU_3O_8).
Geology: An oxidized "iron dike" reportedly cuts limestone, and is radioactive along the footwall side. The limestone is probably in the Precambrian Wyman Formation.

194. Independence group (nos. 1-6)

Location: 37°14′ North latitude, 117°19′ West longitude. Willow Spring area(?), south side of Gold Mountain. Location uncertain. The author could not find this locality in 1970.
Development: Old workings for gold and silver. 750 feet of adit, plus other adits, shafts, and pits.
Radioactivity: Background = 0.04 mR/hr.; High = 0.40 mR/hr.
Geology: Radioactivity is reported from gouge zones along faults in limestone of the precambrian Wyman Formation. Iron oxides and copper carbonates are also present.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3457.

195. Susan group (nos. 1-6)

Location: NW¼, T. 8 S., R. 42 E.; exact location unknown.
Radioactivity: Background = 0.04 mR/hr.; High = 0.10 mR/hr. 1.5 and 2.0 foot chip samples contained 0.02 and 0.09 percent eU_3O_8.
Geology: Abnormal radioactivity occurs in isolated pods and stringers along the contacts of a quartz-rich pegmatite dike which cuts Jurassic(?) granitic rocks. The radioactive pods occur in the country rock along both sides of the dike, but the dike itself is barren. Biotite, lepidolite, quartz, and orthoclase were identified in the dike.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3439.

196. Randolph Mine

Other names: Randolf
Location: T. 8 S., R. 42 E.; location unknown.
Development: A 200-foot shaft and an adit with 300 feet of workings. This is an old gold mine.
Radioactivity: (Underground) Background = 0.02 mR/hr.; High = 0.5 mR/hr.
Geology: A kaolinized shear zone in an adit is abnormally radioactive over a 0.5 to 1 foot width. This radioactive zone parallels the drift for 20 feet, at a distance of about 180 feet from the portal. *Autunite(?)* was reported. The wall rock is quartz monzonite, and workings follow northwesterly trending shear zones.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3434.

197. Red Rock claims (nos. 1 and 2)

Location: Sec. 2(?), T. 8 S., R. 42 E. (unsurveyed). Exact location uncertain.
Development: A 40-foot inclined shaft, two adits, and several prospect pits. Old workings are for gold.
Radioactivity: About 10(?) times background. Select samples contain 0.005 percent cU_3O_8.
Geology: *Autunite,* azurite, malachite, siderite, and iron oxides occur along a highly brecciated shear zone in limestone of the Precambrian Wyman Formation.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3467.

Other Esmeralda County Occurrences

198. Copper Queen group

Location: Sec. 1, T. 4 N., R. 39 E.
Development: An inaccessable 65-foot-deep shaft plus several small pits (workings for copper, lead, and silver).
Radioactivity: Background = 0.05 mR/hr.; High = 0.225 mR/hr. A 6-inch channel sample contained 0.024 percent eU_3O_8.
Geology: Copper, lead, and silver mineralization is reported from quartz veins which cut granitic intrusive rock. The anomalous radioactivity occurs in a pit where a 6-inch quartz vein is exposed.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3451.

ESMERALDA COUNTY, *continued*

199. Iron King group

Location: SE¼SE¼ sec. 7, T. 3 N., R. 36 E.
Development: A 40-foot-deep shaft, a 25-foot adit, and several bulldozer cuts.
Radioactivity: Background = 0.017 mR/hr.; High = 0.11 mR/hr. Select samples contain 0.03 and 0.04 percent eU_3O_8.
Geology: A tabular body of iron oxides (mainly limonite) occurs along the east-trending, high-angle contact fault contact between chert of the Ordovician Palmetto Formation and dolomite of the Permian Diablo Formation. The iron oxide body is up to 100 feet wide and several hundred feet long. A porphyritic quartz monzonite intrudes the chert within a few hundred feet of the prospect. Radioactivity occurs at several spots in the iron oxide body. This body is most likely a gossan produced by the oxidation of pyrite or other sulfides. The above description was compiled following an examination by the author in 1970.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3452.

200. Jet group (nos. 1-25), Taylor claims, Utron group (4 claims)

Location: Sec. 23, T. 1 N., R. 39 E. (unsurveyed). In a canyon 0.5 miles northeast of electric pole 5668 (elevation), Silver Peak 15-minute sheet.
Development: Bulldozer trenches.
Radioactivity: Background = 0.02-0.04 mR/hr.; High = 0.40-1.30 mR/hr. One 5-foot chip sample contained 0.124 eU_3O_8.
Geology: Anomalous radioactivity and iron staining reportedly occur along minor fractures in Tertiary rhyolites and tuffs. Utron No. 3 was examined by the author in 1970, but no radioactivity was found.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3460, 3442.

201. Weepah Uranium group (14 claims)

Location: Secs. 20, 21, T. 1 N., R. 40 E. (unsurveyed). Could not be located in 1969.
Development: Old workings for gold. Three pits, 6 to 8 feet deep.
Radioactivity: Background = 0.04 mR/hr. (surface), 0.15 mR/hr. (pit); High = 0.50 mR/hr. (pit). A 2-foot chip sample contained 0.08 percent eU_3O_8.
Geology: Anomalous radioactivity occurs along a northeast-trending fault in metamorphosed sedimentary rocks. At the prospect the fault strikes N. 70° E., and dips 60° NW. The fault zone is from 6 inches to 2 feet wide.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3437.

202. Mustang, Mustang Nos. 1-7 claims

Location: Sec. 32, T. 1 S., R. 37 E. (unsurveyed). Projected from the west.
Development: Several bulldozer cuts.
Radioactivity: Background = 0.03 mR/hr.; High = 0.20 mR/hr. A select sample contained 0.13 percent eU_3O_8 (0.198 cU_3O_8) and a 3-foot chip sample contained 0.02 percent U_3O_8. Other samples contain 0.093 and 0.426 percent cU_3O_8.
Geology: Uranium mineralization (*carnotite?*) occurs along a shear zone and along bedding planes in Tertiary lacustrine sediments. The sediments consist of partially silicified, carbonaceous mudstone units separated by conglomerates. The uranium occurs in the mudstone units.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3445.

203. 16 to 1 claim

Location: S½ sec. 32, T. 2 S., R. 38 E.
Development: One shaft and several adits.
Radioactivity: Abnormal background readings up to 0.05 mR/hr. were reported.
Geology: Slight radioactivity is reported from one prospect, which is located on a quartz vein cutting an altered tuff.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3448.

204. Mohawk property

Location: Western Esmeralda County
Geology: Radioactive ore with vanadium has been reported from the Mohawk property in western Esmeralda County. Gold and lead were also reported. There is a Mohawk mine in the Argentite mining district (NE¼ sec. 36, T. 2 S., R. 38 E.); it is not known whether this is the property containing the radioactive ore.
References: Eng. and Mining Jour., 1951.

ESMERALDA COUNTY, *continued*

205. Virginia group (17 claims)

Location: SE¼ sec. 15, T. 2 S., R. 39 E.
Development: None
Radioactivity: Background = 0.03 mR/hr.; High = 1.0 mR/hr. One sample contained 0.235 percent eU_3O_8 but only 0.004 percent cU_3O_8. A grab sample ran 0.03 percent cU_3O_8.
Geology: Hot springs along the edge of Clayton Valley dry lake are reportedly radioactive.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3443.

206. Esmeralda Uranium No. 28, Esmeralda No. 15, Uno No. 6, Buckeye No. 1, Eds No. 5, M & R No. 6, Minnis No. 50

Location: SW¼ sec. 25 and NW¼ sec. 36, T. 4 S., R. 38 E.
Development: Prospect pits.
Radioactivity: Background = 0.04 mR/hr.; High = 0.40 mR/hr.
Geology: Radioactivity occurs sporadically along seams up to 6 inches thick in a series of interbedded tuffaceous and sandy lacustrine beds. The most intense radioactivity occurs along a 6 inch band of buff colored tuff in a medium-grained, well cemented sandstone. *Autunite* and an unidentified yellow earthy uranium mineral are scattered throughout the tuff for an exposed distance of 21 feet. The lake beds strike N. 50° E., dip 55° SE., and appear to be interbedded with a series of massive lava flows.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3440; Finch, 1967.

207. Galena claims (nos. 1 and 2)

Location: Sec. 35(?), T. 4 S., R. 40 E.; exact location uncertain.
Development: Two adits, drifts, and surface trenches.
Radioactivity: Background = 0.02 mR/hr.; High = 0.075 mR/hr.
Geology: A prospect on the north slope of the Silver Peak Range is reportedly slightly radioactive. The workings are on a galena-bearing quartz vein. The radioactive area occurs in a gouge zone along the east (hanging wall) side of the vein.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3450.

208. Thunderbird group (nos. 1-12)

Other names: Thunder Bird
Location: Sec. 4, T. 6 S., R. 40 E.
Development: Three pits.
Radioactivity: Background = 0.04 mR/hr.; High = 0.08 mR/hr. A 3-foot vertical chip sample contained 0.02 percent eU_3O_8.
Geology: Very slightly anomalous radioactivity occurs along bedding planes in a series of well-bedded calcareous, lacustrine tuffs(?). The beds strike N. 80° W. and dip 45° SW.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3438.

EUREKA COUNTY

209. Copper King mine

Other names: Maggie Creek prospect
Location: SE¼SE¼ sec. 28, T. 34 N., R. 51 E.
Development: 125 feet or more of surface adit, a 200-foot vertical shaft, 850 feet of connecting drifts and crosscuts, and several pits and trenches. One pit is 85 feet long, 65 feet wide, and 100 feet deep. Workings are for copper.
Radioactivity: Background = 0.015 mR/hr.; High = 0.25 mR/hr. A grab sample contained 0.06 percent U_3O_8.
Geology: Oxidized copper minerals, principally chrysocolla, malachite, azurite, and cuprite, occur along shear zones in chert, shale, and limestone units which are partially equivalent to the Ordovician Vinini Formation. The ore bearing zone strikes N. 60° E. and dips steeply northwest. The radioactivity is reportedly associated with secondary copper minerals along a N. 45° E., 70° W. fracture.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3471; Powers, 1954; Roberts, Montgomery, and Lehner, 1967, p. 98.

210. Lucky Boy (nos. 1-20)

Other names: Hoosac mine
Location: Sec. 12, T. 18 N., R. 53 E. (unsurveyed). Occurrences may be in secs. 13 and 14.
Development: Numerous inaccessible workings developed during the 1870's, for silver.
Radioactivity: Background = 0.015 mR/hr.; High = 0.15 mR/hr. Ore samples contained 0.06 percent eU_3O_8.

EUREKA COUNTY, *continued*

Geology: Ore bodies rich in silver, lead, and arsenic reportedly occurred along a vertical shear zone in the Ordovician Eureka Quartzite. Anomalous radioactivity is found in altered areas, probably associated with the shear zone.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3470; Nolan, 1962, p. 71.

HUMBOLDT COUNTY

Virgin Valley Area

Numerous radioactive prospects are present in the Virgin Valley Formation in northwestern Humboldt County. Most of these have been described as one locality because of their similarity. The radioactivity and colored uranium minerals present are reportedly associated with opalized areas and beds in lacustrine rocks containing tuffaceous material.

The fine volcanic ash and dust present would be good sources of soluble silica. During the formation of the opalized units, the ground water may have also been enriched in uranium. Waters now draining certain tuffaceous terrains in the United States are reported to contain as much as 0.5 ppm uranium, in contrast to ordinary waters, which contain less than 0.001 ppm (McKelvey, 1956, p. 47).

The formation of opal in these beds probably results from the solution of silica from volcanic glass or silicate minerals and its redeposition in an amorphous state. Soluble uranium in ground and surface waters may be adsorbed by this colloidal silica because of the negative charge on colloidal silica particles. Krauskopf (1967) discusses colloids in some detail.

The uranium minerals reported from the opalized Virgin Valley Formation may have formed later than the original uranium concentration. Both *carnotite* and *schroeckingerite* are commonly deposited by surface solutions (*schroeckingerite* is easily soluble in water). These minerals are found in fractures and along layers (bedding planes?) in the opal of the Virgin Valley Formation.

211. Virgin Valley Opal district

Other names: Crane claims, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Wee Wee Marie, September, October, March, 4th of July Nos. 1 and 2, February, April Fool Nos. 1 and 2; January, November, August, December, Tony Jack Group.
Location: Secs. 24, 25, 26, 34, 35, T. 45 N., R. 25 E. (unsurveyed). Along both sides of Virgin Valley just north of Virgin Valley Ranch.
Development: Numerous bulldozer trenches.
Radioactivity: One sample of opal contained 0.14 percent U_3O_8, but most averaged approximately 0.035 percent U_3O_8.
Geology: Anomalous radioactivity and secondary uranium minerals (*carnotite* and *schroeckingertie?)* are reportedly associated with opalized units in a sequence of fine-grained lacustrine tuffs in the middle Miocene (Merriam, 1911, p. 208) Virgin Valley beds (fig. 13). *Carnotite* commonly occurs as fracture coatings or as thin layers in the opal. 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 (Staatz and Bauer, 1954b). More than a third of the opalized beds examined were radioactive. The opal may be grey, brown, tan, black, white, and pale green, and may be banded or variegated. The pale green variety apparently contains the most uranium. Opalized fossil wood was noted in some areas.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3498, 3498a, 3499, 3499a, 3487; Staatz and Bauer, 1951b; Davis, 1954; Davis and Hetland, 1956, p. 358; Finch, 1967; Wyant, Beroni, and Granger, 1952, p. 29; McKelvey, 1957; Staatz and Bauer, 1954b.

212. CC Mines claim

Location: Sec. 18 or 19, T. 45 N., R. 26 E.
Development: Prospect pits.
Radioactivity: Background = 0.007 mR/hr.; High = 0.03 mR/hr. A select sample contained 0.01 percent eU_3O_8.
Geology: Anomalous radioactivity occurs in an opalized tuff bed in the Virgin Valley Formation.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3480.

Soldier Meadow Area

Three uranium prospects are known in this area. The occurrences are poorly described, but probably all are in volcanic rocks. The Blackbird locality probably is typical of this group of occurrences, in being at the base of an ash-flow tuff. Uranium concentration is probably related to ground water movement. Mineralization may be localized in charcoal in clay minerals in gouge zones, and in iron oxide accumulations. The other two prospects may be similar, but no detailed information is available.

HUMBOLDT COUNTY, *continued*

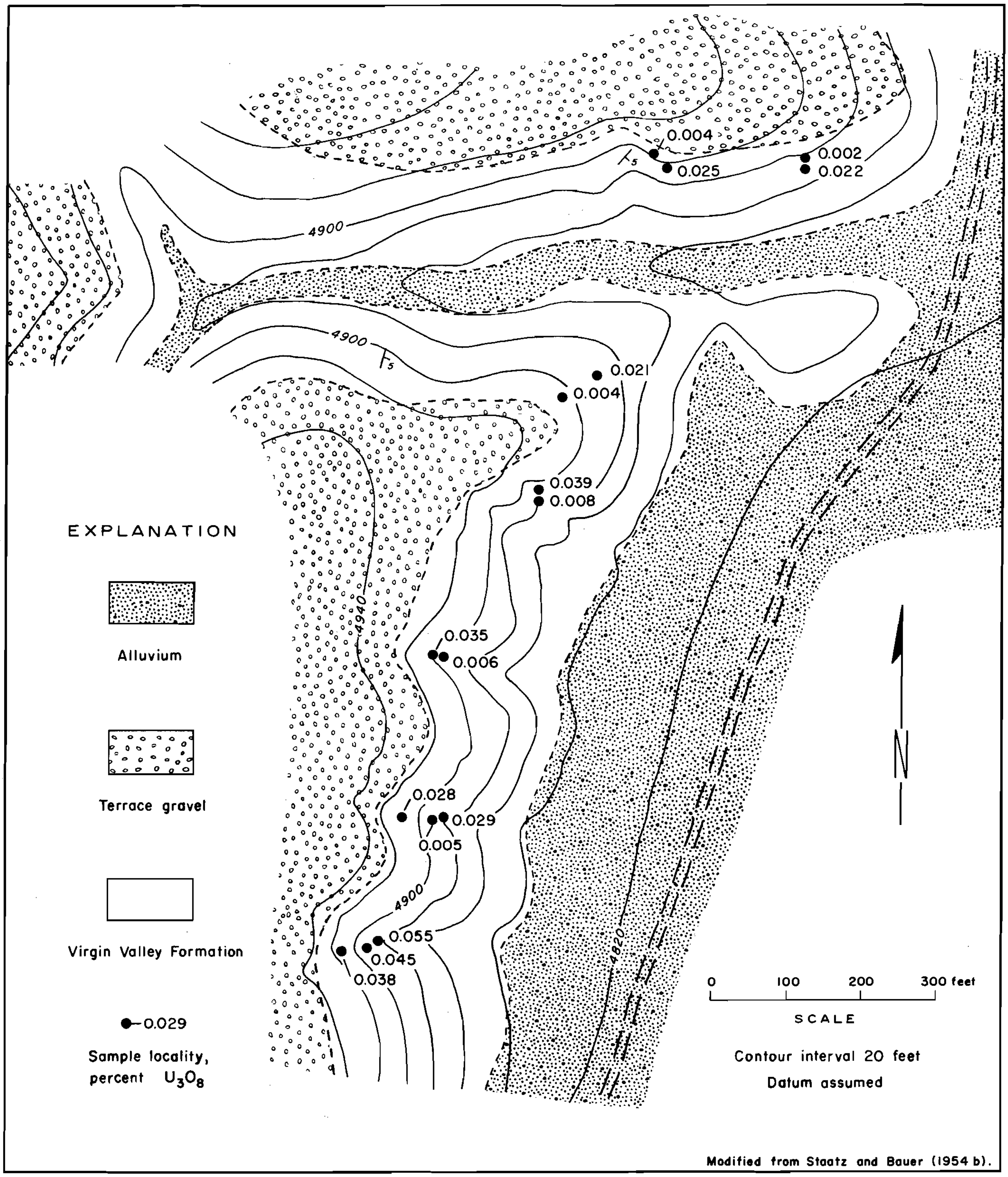

FIGURE 13. Geologic map of the west side of Virgin Valley, Humboldt County, showing sample locations in the Virgin Valley Formation.

HUMBOLDT COUNTY, *continued*

213. Four Leaf Clover group (nos. 1-60)

Location: Sec. 6(?), T. 40 N., R. 25 E.; exact location uncertain. Reportedly on ridge about 1 mile west of C. W. Fick ranch house. The location is also reported as secs. 2, 3, 10, 11, T. 41 N., R. 25 E.
Development: Extensive bulldozer cuts reported.
Radioactivity: Background = 0.015 mR/hr.; High = 0.5 mR/hr.
Geology: Anomalous radioactivity is reported in volcanic rocks.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3483.

214. Unnamed prospect

Location: Sec. 35, T. 41 N., R. 25 E.
Geology: An undescribed prospect is shown on the Vya sheet, 1:250,000 scale topographic map. This locality is in an area of volcanic rocks.
References: U. S. 1:250,000 scale topographic map, Vya sheet; Willden, 1964.

215. Blackbird group (nos. 1-6)

Location: Sec. 14(?), T. 39 N., R. 25 E.
Development: None(?)
Radioactivity: Background = 0.03 mR/hr.; High = 1.0 mR/hr. A sample of charcoal(?) from volcanic rocks contained 0.06 percent eU_3O_8.
Geology: Anomalous radioactivity is reported from a thick sequence of flows, tuffs, and agglomerates. The radioactivity may in part be associated with charcoal material between flows or ash-flow tuffs. Iron and manganese oxides are also reported.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3482.

Moonlight (Kings River) Area

Uranium mineralization has been noted at several localities along the western flank fo the Double H Mountains. The localities all occur on or near the Moonlight fault (fig. 14). One of the younger flows in the area (a rhyolite porphyry?) is anomalously radioactive over a considerable area, and contains up to 0.02 percent U_3O_8. A nearby fluorite-bearing vein contains several secondary uranium minerals. Veins formed by solutions containing uranium and fluorine are commonly considered to be epithermal, and often related to nearby volcanic activity. These veins are seemingly quite common in felsic flows and ash-flow tuffs.

216. Moonlight mine

Other names: Moonlight group, Kings River area, Platora mine.
Location: Sec. 9, T. 45 N., R. 34 E.
Production: Production has probably been about 500 tons of uranium ore. Several cars of ore were shipped by Platora Uranium Corp., but treatment and shipping charges exceeded the value of the ore. Assays ranged from 0.07 to 0.22 percent U_3O_8.
Radioactivity: Background = 30 cps; High = 2600 cps. Assays report up to 0.22 percent cU_3O_8. Radiometric assays are often 10 to 50 percent above chemical, but a few radiometric measurements are slightly less than chemical results.
Geology: Uranium mineralization occurs in a silicified breccia zone in the hanging wall of a north-trending fault which displaces Tertiary rhyolitic ash-flow tuffs. The rhyolitic rocks overlie a Jurassic(?) quartz monzonite or granodiorite, which is present at depth in some of the workings. The mineralized fault dips from 45° to 54° E. near the surface, but the dip steepens to 60° E. in the inclined shaft. Anomalous radioactivity was noted in the hanging wall for 225 feet along the fault (surface measurement). Displacement along this fault is more than 2,000 feet since the late Miocene (Yates, 1942).
Autunite, torbernite, and *gummite*(?) are present with pyrite, iron oxides, clays, quartz, and dark purple fluorite. *Autunite* is reportedly more common near the surface. It has been proposed that *uraninite* may be present at depth.
References: Sharp, 1955; Davis, 1954; Sharp, 1956, p. 80-82; U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3496; Powers, 1954; Willden, 1964, p. 135; Taylor and Powers, 1955; Yates, 1942; McKelvey, 1957; U. S. Bur. Mines Minerals Yearbooks, 1953, 1954, 1955.

217. Granite Point claims

Location: Secs. 4, 5(?), T. 45 N., R. 34 E.
Development: Several thousand feet of bulldozer trenches, and six diamond-drill holes averaging 200 feet in depth and inclined to the east, at the base of the rhyolite cliffs.
Radioactivity: A small area measured as high as 0.30 mR/hr., and this contained 0.024 percent U_3O_8.
Geology: A rhyolitic unit, which contains individual flows up to 150 feet thick, has a background that is 3 to 4 times the

HUMBOLDT COUNTY, *continued*

radioactivity commonly found in basin-and-range rhyolites. Surrounding rocks give readings of 0.035 mR/hr. while the rhyolite averages 0.1 mR/hr.

References: Willden, 1964, p. 132 and 135; Taylor and Powers, 1955.

218. Yellow Star prospect

Location: Secs. 12 and 13, T. 44 N., R. 34 E.

Geology: Two uranium prospects are shown on the Vya sheet, U. S. 1:250,000 scale topographic map. A prospect in this area called the Yellow Star is shown on an unpublished Atomic Energy Commission map of Nevada uranium occurrences. Schilling (1963) also reports a locality here. No other information is available.

References: U. S. Atomic Energy Comm. unpublished map; Schilling, 1963; U. S. 1:250,000 scale topographic map, Vya sheet.

Other Humboldt County Occurrences

219. Cactus group (nos. 1-12)

Location: Sec. 27(?), T. 46 N., R. 25 E. Exact location unknown.

Development: Shallow bulldozer cuts.

Radioactivity: Background = 0.006 mR/hr.; High = 0.015 mR/hr. Two samples contained 0.05 and 0.09 percent eU_3O_8.

Geology: Slight radioactivity is reported from volcanic rocks.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3481.

220. Wedding Ring group (nos. 1-6), Morning Star No. 1, and Copper King No. 1 claims.

Other names: Old Wedding Ring property.

Location: SE¼NE¼ sec. 28, T. 47 N., R. 31 E.

Development: 700 to 1,000 feet of drifts and shafts. Workings are for gold, silver, and copper.

Radioactivity: One sample reportedly contained 0.28 percent U_3O_8. A high of 0.3 mR/hr. was recorded.

Geology: Chalcopyrite-bearing quartz veins cut gneissic granodiorite and associated pegmatite dikes. The anomalous radioactivity is reportedly associated with secondary copper minerals which occur as fracture coatings in the quartz veins.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3479; Willden, 1964, p. 112.

221. Unnamed prospect

Location: NW¼ sec. 28, T. 47 N., R. 37 E.

Development: Several prospect pits.

Radioactivity: Very low in samples examined. Assays of 0.035 percent cU_3O_8 are reported.

Geology: Small flakes of *autunite*(?) were noted on fractures in specimens of a Tertiary tuffaceous shale, but the amount present was too low to produce any anomalous radioactivity in hand samples.

222. Foster property

Location: Secs. 35, 36, T. 43 N., R. 28 E.

Radioactivity: A sample reportedly from this locality contained 5.48 percent eU_3O_8 (2.81 percent cU_3O_8).

Geology: Quartz veins and pegmatite dikes cut granitic intrusive rocks in this area. The radioactive sample may have come from a pegmatite near here.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3485.

223. Blue Jack property

Location: Sec. 15, T. 41 N., R. 27 E.

Development: Two adits.

Radioactivity: As high as 0.3 mR/hr. Assays of 0.14 and 0.185 percent cU_3O_8 reported.

Geology: Anomalous radioactivity (up to 0.3 mR/hr.) reportedly varies directly with secondary copper minerals. Chrysocolla, azurite, chalcocite, malachite, limonite, quartz, and *torbernite*(?) are present along a 3- to 10-foot-wide shear zone between silicified limestone(?) and a diorite.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3488; Willden, 1964, p. 89.

224. Allied group (nos. 1-22)

Location: Secs. 6(?) and 7(?), T. 41 N., R. 30 E.; reported location probably incorrect. Possibly in T. 41 N., R. 28 E.

Development: Location pits(?).

Radioactivity: Background = 0.02 to 0.03 mR/hr.; High = 0.06 to 0.09 mR/hr.

Geology: Slight radioactivity reportedly occurs in tuffs and rhyolites. Iron oxides and opal are also present.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3486.

HUMBOLDT COUNTY, *continued*

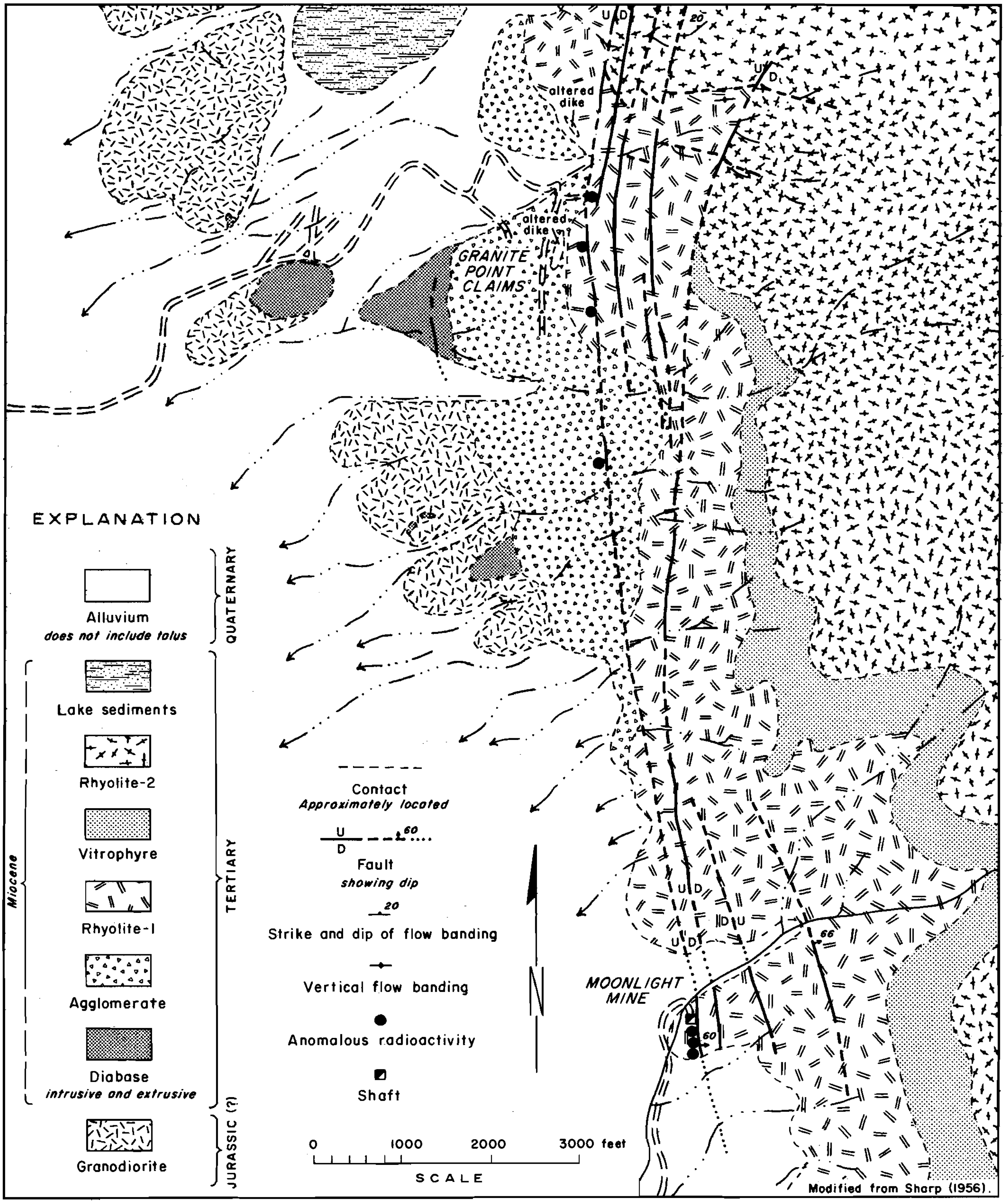

FIGURE 14. Geologic map of the vicinity of the Moonlight mine and Granite Point claims, Kings River area, Humboldt County.

HUMBOLDT COUNTY, *continued*

225. Nevada group (nos. 1-43)

Location: Secs. 3(?), 10(?), T. 40 N., R. 32 E.; west flank of Buff Peak.
Development: Several large bulldozer cuts.
Radioactivity: Background = 0.02 mR/hr.; High = 0.40 mR/hr. A 2-foot chip sample contained 0.02 percent eU_3O_8.
Geology: Anomalous radioactivity occurs along opalized lenses of Tertiary rhyolitic flows.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3484.

226. Margale prospect

Location: Sec. 36, T. 35 N., R. 31 E.; exact location uncertain. This prospect is also reported in sec. 6, T. 34 N., R. 31 E.
Development: An inclined shaft, and an adit about 100 feet long.
Radioactivity: Background = 0.009 mR/hr.; High = 0.02 mR/hr. A grab sample contained only a trace of eU_3O_8.
Geology: Slight radioactivity is present in a highly brecciated shale. Gypsum, quartz, and iron oxides are also present.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3730.

227. Golconda Hot Spring, Harris property

Location: SE¼NE¼ sec. 32, T. 36 N., R. 40 E.; just northwest of town of Golconda.
Radioactivity: Background = 40 cps; High = 450 cps.
Geology: This spring and its deposits are reported to be moderately radioactive. The water reportedly contains a few parts per million of thorium (oral communication, D. I. Segerstrom).
References: Davis, 1954; U. S. Atomic Energy Comm. Prelim. Reconn. Rept. N-SL-17.

228. Getchell mine

Location: Sec. 4, T. 38 N., R. 42 E.
Development: Open pit for gold.
Radioactivity: Anomalies reported range from 75 cps to 400 cps. Assays of 0.021, 0.049, and 0.080 percent eU_3O_8 were reported. A select hand sample was about 10 times background radioactivity.
Geology: Four small anomalies having slight radioactivity were reported at the south end of the main fault, which trends north-south and dips 40° to 60° E. This radioactivity appears to be associated with pyrite or marcasite mineralization in the Cambrian Preble Formation. Sheet-like gold ore bodies with abundant arsenic sulfide are localized along the main fault. A sample of phyllite from the east wall of the south pit contained ilsemannite and *autunite(?)*.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3497, 3497a; Willden, 1964; Erickson and others, 1964.

LANDER COUNTY

Austin Area

Uranium deposits in the vicinity of Austin are often at or near the contact of a Jurassic granitic intrusive with Cambrian and Ordovician rocks. Some prospects also occur along fractures within the intrusive. The contact of the intrusive with the sedimentary rocks normally dips from 45° to 90° in areas near the range fronts, but roof pendants are present at higher elevations in the range, and may indicate a flattening of the contact in these areas (Sharp, 1956).

Mineralized fracture zones occur in the intrusive but often also extend a short distance into the surrounding Paleozoic rocks (fig. 15). These fracture zones resemble dikes, and are composed principally of finely divided sericite with varying amounts of vein quartz. Sharp (1956) believes these fracture zones served as conduits for ascending uraniferous solutions which also contained silver, gold, copper, iron, and silica. The fractures trend east-west, measure 5 to 50 feet wide and up to several thousand feet in length, and dip from 50° N to nearly vertical. It has been proposed that the uranium mineralization may be zonally related to the silver mineralization at Austin (Sharp, 1956).

229. Apex mine

Other names: Early Day claims, Rundberg claims, Apex Minerals Co.
Location: Sec. 1, T. 18 N., R. 43 E.; just north of the mouth of Veatch Canyon.
Production: Nevada's largest producer. Recorded production from 1955 to 1968. The exact production is unknown, but a large proportion of Lander County's 100,000 lbs. total U_3O_8 came from this mine. In 1956 alone, about 9,000 lbs. of U_3O_8 was produced.
Development: Numerous bulldozer cuts, one open pit, and six adits totaling 8,100 feet of underground workings.
Radioactivity: Select samples contain up to 6 percent U_3O_8. Ore bodies range in grade from 0.15 to 0.5 percent U_3O_8.

LANDER COUNTY, *continued*

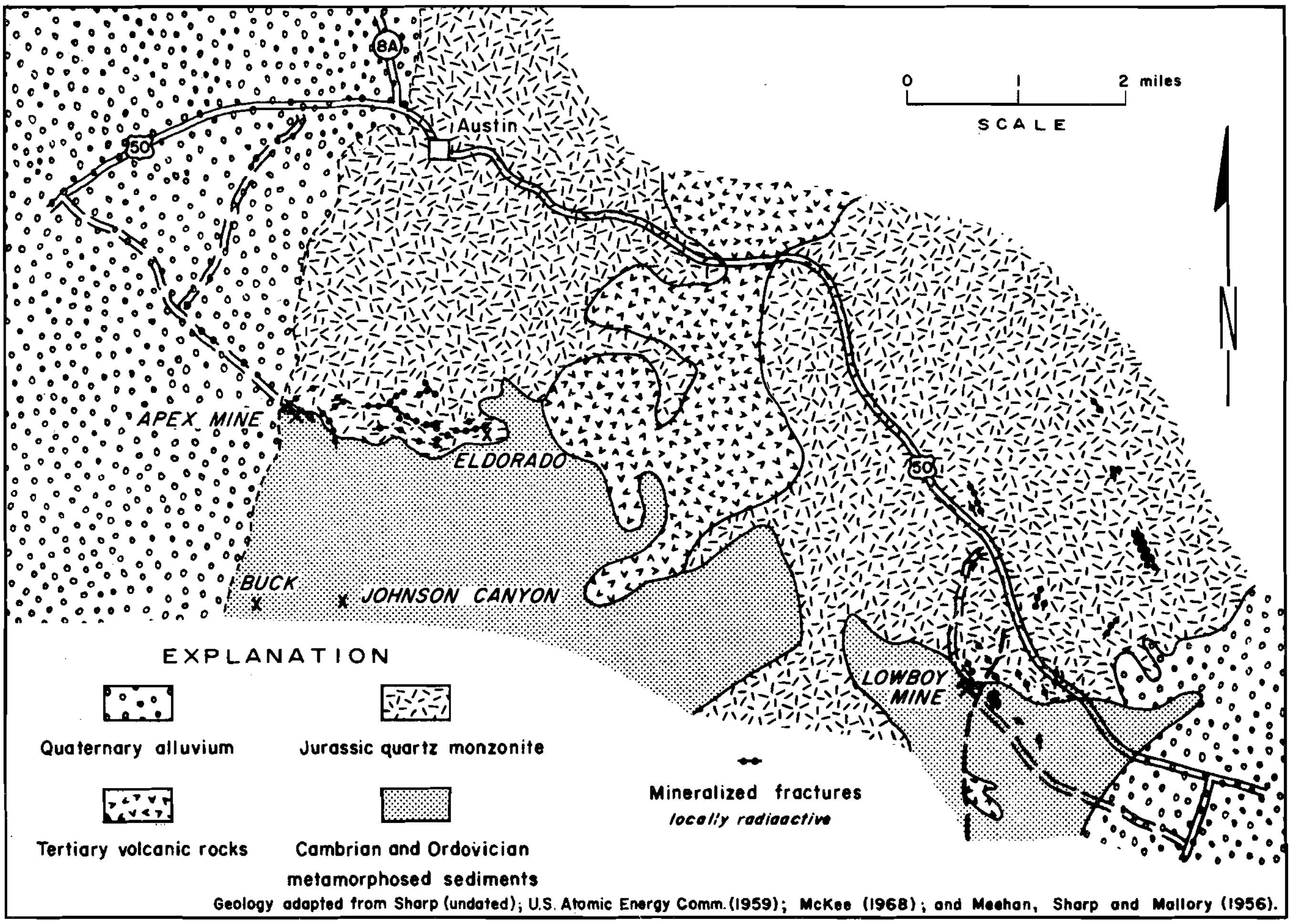

FIGURE 15. Generalized geologic map of a part of the Toiyabe Range south of Austin, Lander County.

Geology: Uranium mineralization occurs in and near the contact of the Jurassic (145-168 m. y.) porphyritic quartz monzonite Austin stock with metamorphosed shales and quartzites of the Cambrian Gold Hill Formation (fig. 16). The intrusive contact is nearly parallel to the bedding in the metasedimentary rocks. Pendants and xenoliths are common. The mineralizing solutions were apparently introduced along silicified fracture zones which occur at the intrusive contact. *Uraninite* and *coffinite* are localized by bedding-plane faults, small folds, transverse fractures, and crushed shaly beds along the sides of east-trending, altered, apatite-bearing aplitic dikes or intrusive contact areas. The aplite dikes are extremely silicified and sericitized. Pyritic and graphitic argillites are the common hosts for the primary ore bodies. Pyrite and sparsely distributed blebs of bornite and chalcopyrite are associated with the primary uranium minerals. Silicification of brecciated areas near the intrusive contact was probably accomplished at a late magmatic stage. Aplitic dikes intruded these zones and acted as dams to the mineralizing solutions. Primary ore bodies, irregular to tabular in shape, were produced in the favorable metasedimentary zones near the intrusive contact.

The majority of the ore is secondary, occurring mainly along faults in the quartzites and shales, but also in aplite dikes and the intrusive itself. *Autunite, meta-autunite, torbernite,* and *metatorbernite* are present, commonly as individual tabular crystals. Some of these crystals reportedly have centers of *uraninite* and *coffinite.* Iron oxides are often present with the secondary ore, bodies of which appear to have been formed by redistribution of uranium by circulating ground

LANDER COUNTY, *continued*

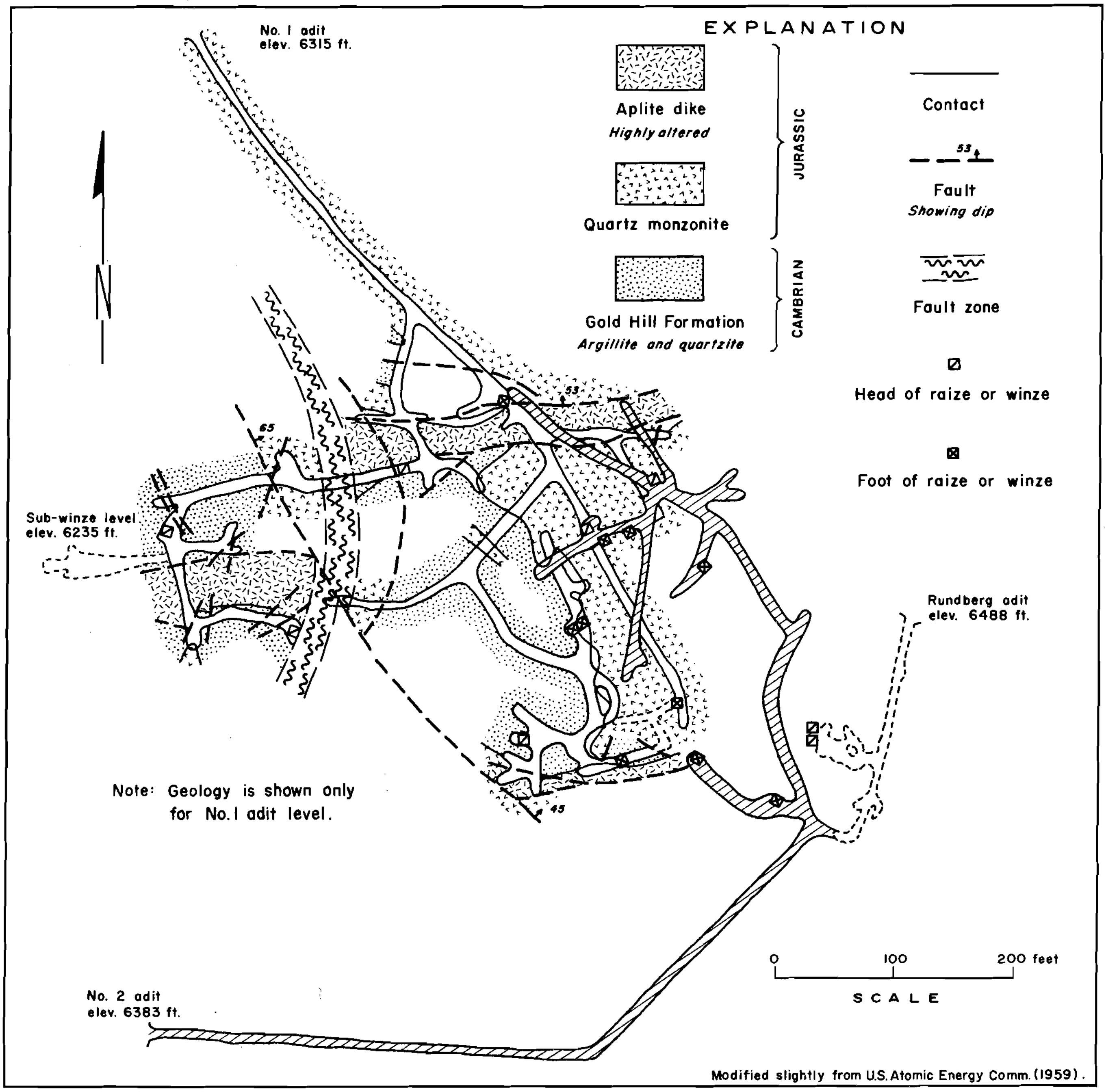

FIGURE 16. Geologic map of the No. 1 adit level of the Apex mine, Lander County.

water. Numerous fracture zones in the quartz monzonite are reported to be radioactive in the vicinity of the mine.

Two major faults displace the ore but have no evident genetic relationship to the uranium deposition. Most of the mining and development was done at or above the present water table. This locality was visited by the author in 1968 and 1970.

References: Sharp and Hetland, 1954; Nye, 1958; U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3518, 3520; Thurlow, 1955; Stewart and McKee, 1967; Taylor, 1953b; Butler, 1958; Sharp, undated; McKelvey, 1957; U. S. Atomic Energy Commission, 1959; U. S. Bur. Mines Minerals Yearbooks, 1955-1960.

LANDER COUNTY, *continued*

230. Eldorado claim

Other names: El Dorado
Location: Center, NW¼ sec. 6, T. 18 N., R. 44 E.; prospect symbol shown on Austin 15-minute topographic map.
Development: Several prospect pits and bulldozer cuts.
Radioactivity: Greater than 4 times background. Select samples average 0.18 percent cU_3O_8 and a 3-foot chip sample contained 0.054 percent cU_3O_8. Chemical analyses average 30 to 60 percent greater than radiometric analyses.
Geology: *Autunite* and anomalous radioactivity occur along a fracture zone in the quartz monzonite. The quartz monzonite is altered to clay minerals, and fractured areas contain limonite veinlets 0.1 to 0.5 inches in width.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3519; Sharp and Hetland, 1954; U. S. Atomic Energy Commission, 1959.

231. Buck claims

Location: SW¼SE¼ sec. 11, T. 18 N., R. 43 E.; south side of small canyon just south of Johnson Canyon.
Development: Four bulldozer cuts.
Radioactivity: Background = 0.01 mR/hr.; High = 0.035 mR/hr. A two-foot chip sample at the most radioactive locality contained 0.02 percent eU_3O_8.
Geology: Slightly anomalous radioactivity occurs in a graphitic, calcareous argillite of the Cambrian Crane Canyon sequence. Highest radioactivity seems to be associated with graphite-rich areas. The radioactive area occurs with Jurassic granitic rocks. This locality was examined by the author in 1968.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3502; Stewart and McKee, 1967.

232. Johnson Canyon claims

Location: Center, S½ sec. 12, T. 18 N., R. 43 E.; at end of road.
Development: Bulldozer cut.
Radioactivity: Background = 0.011, maximum = 0.045. Select samples average 0.03 percent cU_3O_8.
Geology: Slightly anomalous radioactivity occurs along a 5- to 10-foot-wide zone which roughly parallels a 2-foot-wide fault zone in silicified limestones and hornfels of the Cambrian Crane Canyon sequence near the intrusive contact with Jurassic granitic rocks. The author visited this prospect in 1968.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3501; Stewart and McKee, 1967.

233. Graduation, Venus and Jupiter claims

Other names: Tesoro group
Location: NW¼SW¼ sec. 11, T. 17 N., R. 43 E.; on steep slope, north side of valley.
Development: One small pit and several bulldozer trails.
Radioactivity: Background = 0.008-0.010 mR/hr., maximum 0.05 mR/hr. A select sample assayed 0.015 cU_3O_8.
Geology: Anomalous radioactivity occurs in a black, carbonaceous unit of contorted argillites in the Ordovician Valmy(?) Formation. The highest radioactivity is localized in a spot about 1 foot in diameter. Quartz stringers are present locally. The carbonaceous unit was not anomalously radioactive elsewhere in the vicinity. The author examined this property in 1968.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3512; Stewart and McKee, 1967.

234. Lowboy mine

Other names: Anomaly No. 5, Low Boy claims, Valley View.
Location: SW¼SE¼ sec. 13, T. 18 N., R. 44 E.
Production: Four cars of ore (0.26 percent U_3O_8) shipped in 1959 brought $8,957. Three of these were from the northern adits, and the fourth was from the shaft area. Additional ore may have been produced from the southern trench and adit.
Development: Three hundred feet of trench, a partially caved inclined shaft, three adits totaling 150 feet, and overhead stopes and raises in one adit.
Radioactivity: Background = 0.02 mR/hr.; High = 2.0 mR/hr. Chip samples (1, 2, and 3 feet) contained 0.188, 0.292, and 0.421 percent cU_3O_8 respectively (0.19, 0.26 and 0.25 percent eU_3O_8). A sample shipment from the shaft contained 0.55 percent U_3O_8, and a longhole drilled near the northern adits reportedly ran 0.34 percent eU_3O_8 for 36 feet.

LANDER COUNTY, *continued*

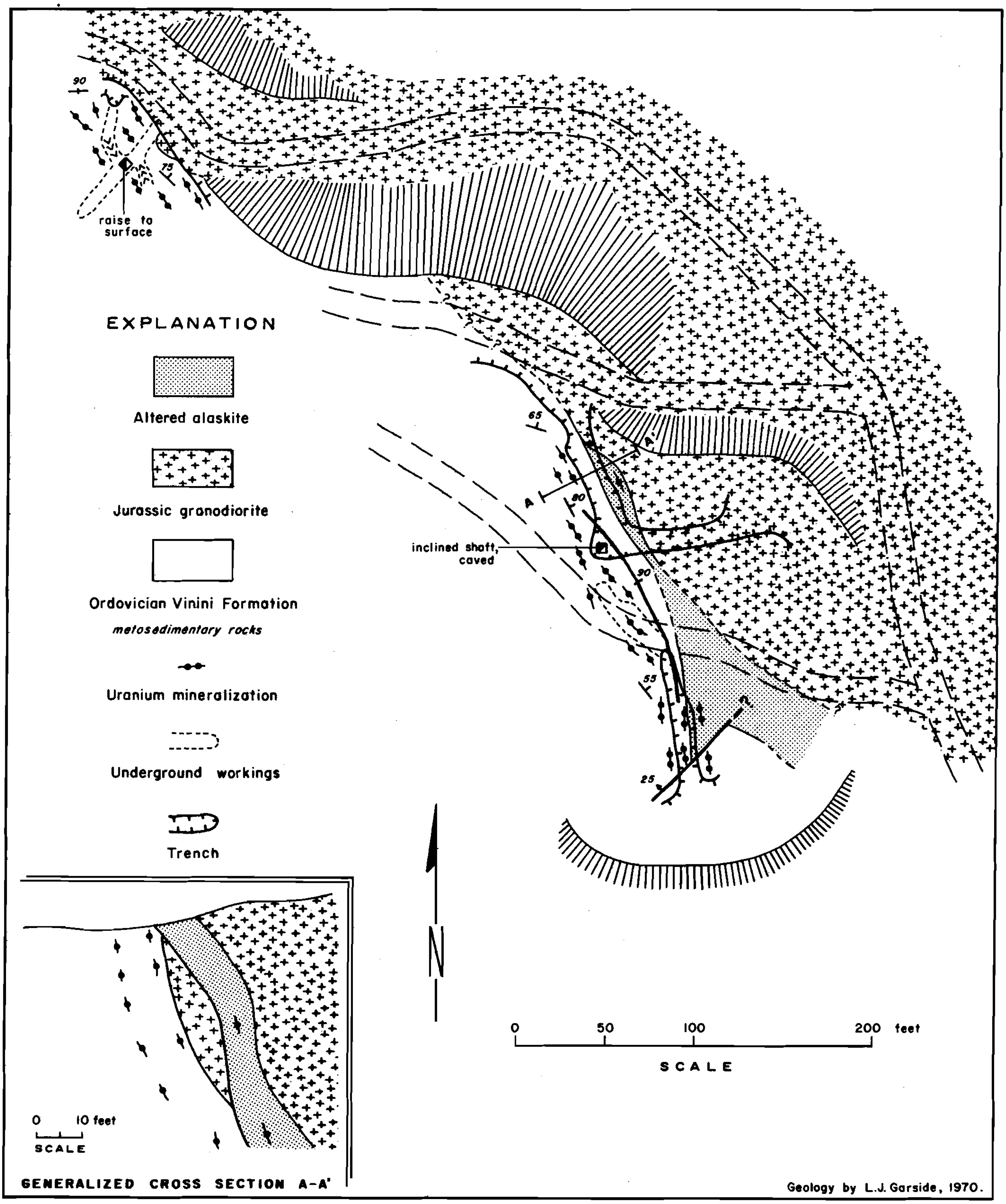

FIGURE 17. Geologic map and generalized cross section of the Lowboy mine, Lander County.

LANDER COUNTY, *continued*

Geology: The Lowboy mine workings are at or near the contact of Jurassic granodiorite and Ordovician Vinini Formation (fig. 17). The intrusive contact nearly parallels bedding in the metasedimentary rocks, trending northwest and dipping steeply northeasterly. The metamorphic rocks are hornfels, phyllites, and minor fine-grained quartzites.

A 5- to 50-foot-wide alaskite dike appears to have been intruded along or near the granodiorite–Vinini contact. This dike has been hydrothermally altered in all areas seen. The alteration does not appear to have extended appreciably into the granodiorite. The feldspar has been altered to kaolinite in the alaskite, and iron oxides are concentrated along its margins. Iron-staining and minor silicification are present in the Vinini Formation as well, mainly along fractures. The abundant iron oxides may have been produced by acid leaching of pyrite.

Most of the ore was produced from overhead stopes which explore certain beds in the Vinini Formation near the granodiorite contact. Mineralization is also present to a lesser extent in the altered alaskite. Secondary yellow and green uranium minerals (including *autunite* and *meta-autunite*) occur as thin fracture coatings. Limonite is commonly associated, and hyaline opal occurs rarely. Primary uranium minerals may be present in unoxidized ore at depth, as reported from the Apex mine 7 miles to the northwest. The author examined this property in 1970.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3504; Sharp, undated map; Meeham, Sharp, and Mallory, 1956; McKee, 1968: U. S. Bur. Mines Minerals Yearbooks 1955, 1959.

235. F. Escobar claims

Other names: Escobar
Location: Center, NE¼ sec. 28, T. 19 N., R. 45 E. (unsurveyed). North side of Simpson Park Canyon along the old Pony Express route.
Development: A 35-foot adit.
Radioactivity: Surface: Background = 0.012 mR/hr., maximum = 0.07 mR/hr.; Underground: Background = 0.02 mR/hr., maximum = 0.04 mR/hr.
Geology: Radioactivity is associated with an iron-oxide-stained fault-breccia zone in contorted argillites and quartzites of the Ordovician Vinini Formation near the intrusive contact with Jurassic granitic rocks. The fault zone and nearby smaller faults are vertical, and trend north-south. The intrusive contact here has been displaced 15 to 20 feet relatively upward on the east side of the fault. *Autunite* and *metatorbernite*(?) have been reported. This occurrence was visited by the author in 1968.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3513; McKee, 1968.

236. Edna prospect

Location: SE¼ sec. 18 or SW¼ sec. 17, T. 19 N., R. 45 E.
Development: Bulldozer pits.
Radioactivity: Background = 0.03 mR/hr.; High = 0.1 mR/hr.
Geology: Slightly anomalous radioactivity is associated with iron staining and quartz stringers in Jurassic granitic rocks.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3506.

237. Arizona property

Location: Sec. 5(?), T. 19 N., R. 44 E. Exact location unknown.
References: U. S. Atomic Energy Comm., unpublished map.

Reese River Valley

Several Lander County radioactive occurrences are present in the Tertiary sedimentary rocks along Reese River Valley to the north of Austin. A number of prospects are concentrated near the Steiner Ranch (sec. 35, T. 24 N., R. 43 E.). More than 200 claims were staked there in the mid 1950's, and some localities were staked again in 1963 and 1968. No surface uranium mineralization is present at most of the claims. Several drill holes noted may be as deep as 200 feet.

Additionally, there are similar scattered localities between the Steiner Ranch area and Austin, and one locality (Dacie Creek) in the Fish Creek Mountains southwest of Battle Mountain.

238. Dacie Creek claims (about 300)

Other names: Dacies Creek claims, Daisy Creek.
Location: Center, sec. 34, T. 28 N., R. 41 E.

LANDER COUNTY, *continued*

Radioactivity: Background = 0.02-0.04 mR/hr.; High = 0.15 mR/hr. Two grab samples contained 0.047 and 0.053 percent eU_3O_8.

Geology: A thin-bedded, water-laid tuff overlain by rhyolite contains areas of anomalous radioactivity. Thin lenses of opal conform with the bedding of the tuff. Both the rhyolite and tuff have reported anomalies, but the highest radioactivity is along minor iron-stained fractures in the nearly horizontal tuffs. No uranium minerals were recognized.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3514; Davis and Hetland, 1956, p. 358.

239. Old Jaw Bone property

Location: Sec. 13(?), T. 26 N., R. 40 E.; exact location unknown.

References: U. S. Atomic Energy Comm., unpublished map.

240. Hart group (nos. 1-27), Pinto group (nos. 1-50)

Location: SW¼ sec. 4, T. 23 N., R. 43 E. (projected).

Development: Numerous bulldozer cuts, and several drill holes possibly as deep as 150 feet.

Radioactivity: Background = 0.015 mR/hr.; High = 0.04 to 0.22 mR/hr. One- to 2.5-foot chip samples reportedly contain 0.037 to 0.08 percent eU_3O_8.

Geology: Radioactivity at the Hart No. 3 claim occurs in irregular areas up to 25 feet in diameter in greenish to cream colored, tuffaceous, slightly calcareous siltstones. The beds strike N. 50° W. and dip approximately 20° SW. The radioactive area is approximately in the middle of the section of Tertiary sediments. Most of the rocks are siltstones. A few sandstone beds were noted in the vicinity. Nearby claims had no radioactive anomalies. The Pinto group claims were not found during the author's examination in 1970.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3508; Finch, 1967.

241. Two-Bit group (nos. 1-6)

Location: Sec. 36(?), T. 24 N., R. 43 E.

Development: Several shallow bulldozer trenches and pits.

Radioactivity: Background = 0.03 mR/hr.; High = 0.15 mR/hr.

Geology: Anomalous radioactivity is reported from tuffaceous lake beds which are interbedded with conglomerates and sandstones. The author was unable to find this locality in 1970. The lake beds surrounding the approximate claim location have been considerably prospected by bulldozer trenching, both in the mid-1950's and in 1963. The highest radioactivity found in these trenches was about twice background. The property was examined by the author in 1970.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3507.

242. Rex Jean claims (nos. 1-11)

Location: Sec. 17(?), T. 23 N., R. 43 E. This group of claims could not be located in 1970, but may be the same locality as the Lee Rene group, which was staked in 1968.

Development: Two bulldozer cuts.

Radioactivity: Background = 0.2 mR/hr.; High = 0.5 mR/hr. Two- and four-foot channel samples contained 0.016 and 0.087 percent eU_3O_8 respectively.

Geology: Anomalous radioactivity is reportedly associated with iron-stained fractures in a rhyolitic, waterlaid tuff.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3511.

243. Lee Rene claims (nos. 1-8)

Location: Center, W½ sec. 17, T. 23 N., R. 43 E. (projected). On the south and west sides of a hill.

Development: Five bulldozer cuts and a 200(?)-foot drill hole.

Radioactivity: Background = 0.015 mR/hr.; High = 0.42 mR/hr.

Geology: Three areas within a quarter of a mile of each other are anomalously radioactive. The highest radioactivity is localized in small spots, but areas of several thousand square feet are 2 to 4 times background. At Lee Rene No. 5 the high radioactivity is associated with a north-trending fault which cuts yellowish-grey tuffaceous siltstones. Gouge and organic(?) matter in the fault zone apparently concentrated the uranium. At Lee Rene No. 8 radioactivity occurs along certain tuffaceous beds. No uranium minerals were detected. This locality may be the same as the Rex Jean claims. The property was examined by the author in 1970.

LANDER COUNTY, *continued*

244. Boon Uranium claims

Other names: Boone prospect.
Location: Secs. 17(?) and 20(?), T. 22 N., R. 44 E.; at the mouth of Boone Creek.
Radioactivity: Background = 0.03 mR/hr.; High = 0.10 mR/hr. Select samples contain 0.01 to 0.045 percent cU_3O_8.
Geology: *Autunite* occurs along fracture planes in a thin chert bed. The chert occurs in a sequence of well bedded, horizontal, water-laid Tertiary tuffs.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3510; Finch, 1967.

245. Willys group (nos. 1-24)

Location: Sec. 11(?), T. 19 N., R. 42 E.; exact location uncertain.
Development: Location pits.
Radioactivity: Background = 0.03 mR/hr.; High = 0.18 mR/hr. A 6-inch chip sample contained 0.06 percent eU_3O_8.
Geology: Anomalous radioactivity occurs in a 6- to 18-inch-thick bed of silicified tuff. Poorly indurated tuffs above and below are not radioactive.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3505.

Other Lander County Occurrences

246. J. H. Vorhees oil wells (nos. 1 and 2)

Location: SE¼SE¼ sec. 27, T. 32 N., R. 45 E.; within 100 feet of U. S. Highway 40.
Geology: Radioactive "black sands" are reported at depths of 58 to 89 feet.
References: J. H. Vorhees in Feb. 17, 1953, letter to J. Lintz, Jr.

247. Cortez Canyon

Location: T. 27 N., R. 47 E.; exact location unknown.
Geology: *Autunite*(?) was reportedly found near the surface in a bulldozer road during the development of the Cortez gold deposit. The rocks present are mainly Silurian and Devonian limestones.

248. Birch Creek area

Location: S½, T. 18 N., R. 44 E.
Geology: A *monazite*-bearing placer is reported in the Birch Creek district.
References: Lovering, 1954.

LINCOLN COUNTY

Atlanta District

According to Tschanz and Pampeyan (1970), Ordovician, Silurian, and Devonian sedimentary rocks crop out in the Atlanta district from beneath the volcanic rocks that cover most of the surrounding area. Limestones of the Pogonip Group, as well as the Ely Springs and Laketown Dolomites, are extensively replaced by jasperoid in certain zones (fig. 18). These zones are partly related to intersecting sets of faults and partly to brecciated areas, although the jasperoid is not entirely confined to such zones. All the ore mined (silver, gold, uranium) came from the jasperoid zones and most of them are anomalously radioactive. *Uraninite* is the main uranium ore mineral reported, but *uranophane* and *autunite* are also present.

Sharp and Myerson (1956) report that no igneous material is present in the breccia zones or pipes. The material was apparently injected from below, as fragments of lower units are contained in them. Other workers (Staatz and Johnson, 1954) believe the breccia zones are related to Tertiary volcanic vents, and report a rhyolite porphyry in some of the underground workings in the Blue Bird mine.

249. Blue Bird mine; Ella, Minnie, and Lucky Dog claims

Other names: Hulse mine
Location: Sec. 22, T. 7 N., R. 68 E. (unsurveyed).
Production: Two carloads of ore containing more than 0.30 percent U_3O_8, about 1 ounce of silver, and 0.03 ounces gold per ton, were shipped between 1954 and 1956. Production is also reported in 1959.
Development: 275 feet of underground workings and 3 diamond drill holes totaling 660 feet.
Radioactivity: Select samples contain 0.1 to 1.28 percent cU_3O_8.
Geology: Pods of pyrite-*uraninite* ore occur in tabular jasperoid zones along gently dipping faults which contain 1- to 4-foot-thick silicified gouge zones (figs. 19 and 20). Mineralization appears to have been controlled by an intrusive breccia zone or pipe which was later cut by many minor faults that strike N. 35-55° W. Yellow secondary uranium minerals (*uranophane?)* occur near the surface. Pyrite reportedly alters to carphosiderite. The Ordovician Ely Springs Dolomite is the mineralized unit in the mine.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3545, 3545A; Butler, Finch and Twenhofel, 1962; Schilling, 1963; Sharp and Myerson, 1950; Walker, Osterwald, and Adams, 1963; Tschanz and Pampeyan, 1970; Powers and Finch, 1955; U. S. Bur. Mines Minerals Yearbooks 1955, 1959.

LINCOLN COUNTY, *continued*

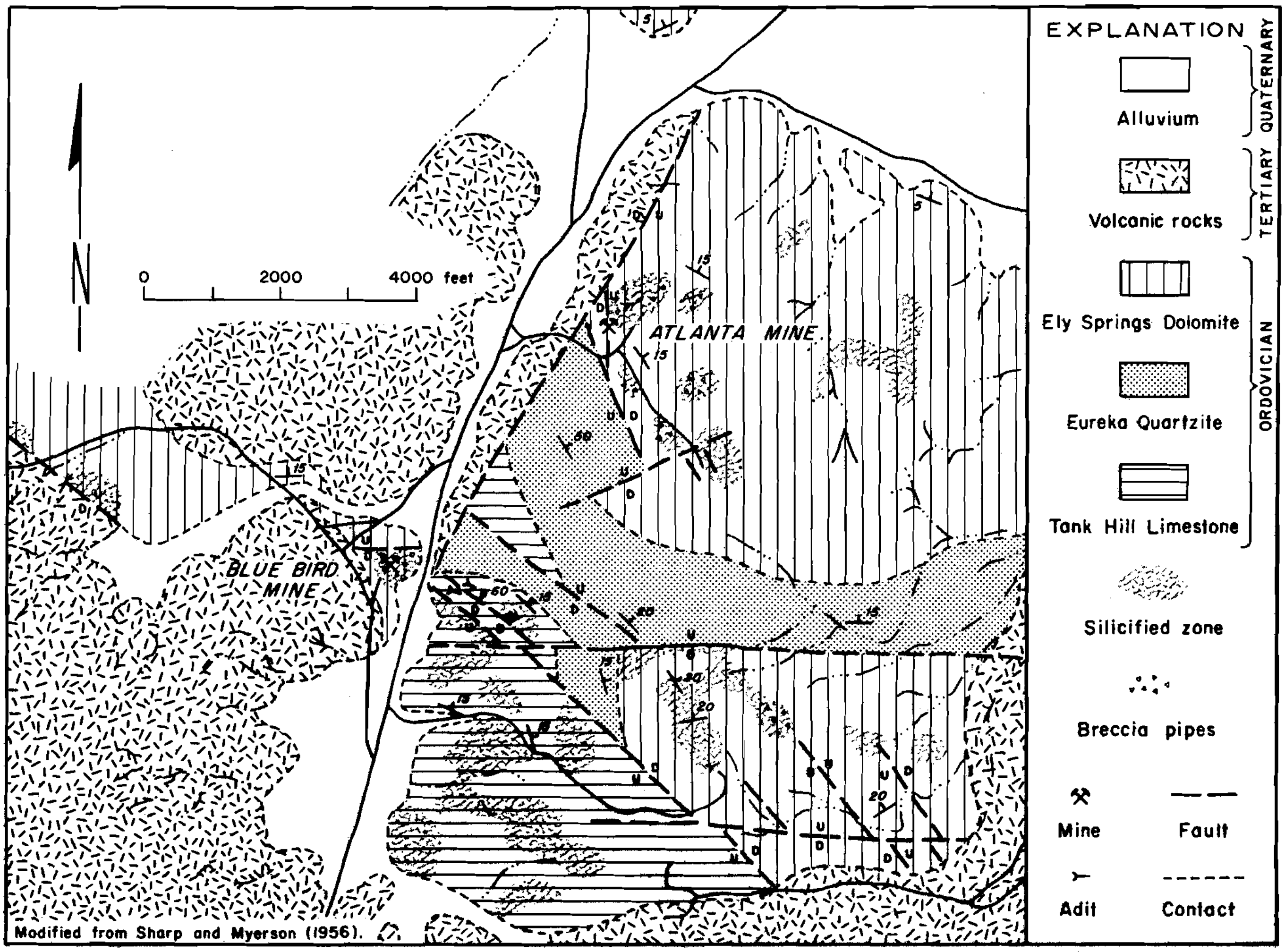

FIGURE 18. Reconnaissance geologic map of the vicinity of the Atlanta and Blue Bird mines, Lincoln County.

250. Atlanta mine

Other names: Atlanta Home, Atlanta Nos. 1-3, Atlanta Strip, Atlanta Strip No. 1, Hillside, Sparrow Hawk, Pactolion Fraction, and Belle.

Location: Sec. 15, T. 7 N., R. 68 E. (unsurveyed).

Production: More than 16,000 tons of low-grade siliceous gold ore was shipped to Kennecott's McGill smelter for use as flux between 1953 and 1955. The ore contained 6 to 12 dollars gold per ton, and about 0.05 percent U_3O_8. The uranium was not recovered.

Development: Two shafts, a raise, a winze, crosscuts, and drifts. Underground development extended to the 400-foot level, and includes at least 2,500 feet of underground workings. An open pit is also present south of the main shaft. Workings are for gold.

Geology: Low-grade gold ore (free-milling) and minor silver and uranium occur in a silicified breccia zone which crops out for 3,000 feet along a fault that strikes N. 30° W. and dips 40° SW. The breccia is mainly limestone, but contains fragments of quartzite and rhyolite tuff. Samples from the 100- and 200-foot levels contain only very minor amounts of uranium (0.01-0.02 percent cU_3O_8). Hewett (1923) reported *carnotite* from this mine.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts., 3554, 3554a, 3554b, 3558, 3558a, 3558b, 3560; Butler, Finch, and Twenhofel, 1962; Schilling, 1963; Staatz and Johnson, 1954; Sharp and Myerson, 1956; Sharp, 1956; Walker, Osterwald, and Adams, 1963; Hill, 1916, p. 117-119; Carper, 1946; McKelvey, 1957; Nevada State Bur. Mines, 1932, p. 51; Smith, 1958.

LINCOLN COUNTY, *continued*

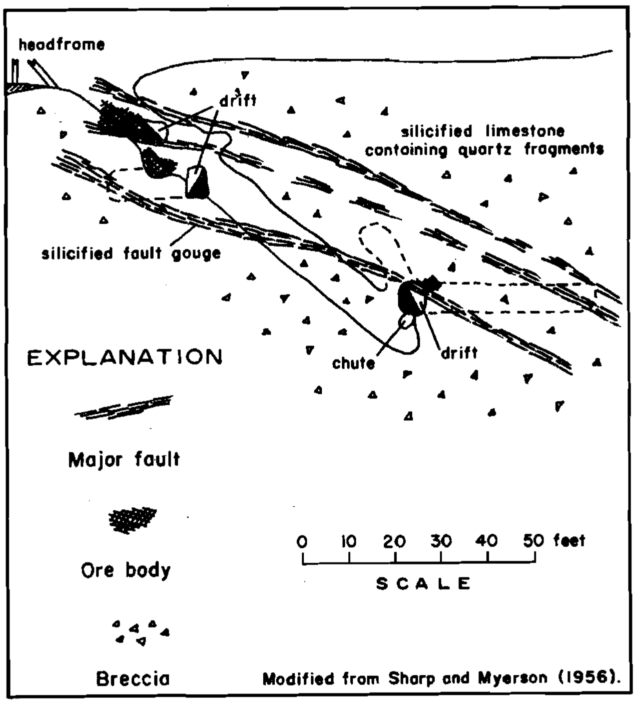

FIGURE 19. Cross section of the Blue Bird mine, Lincoln County.

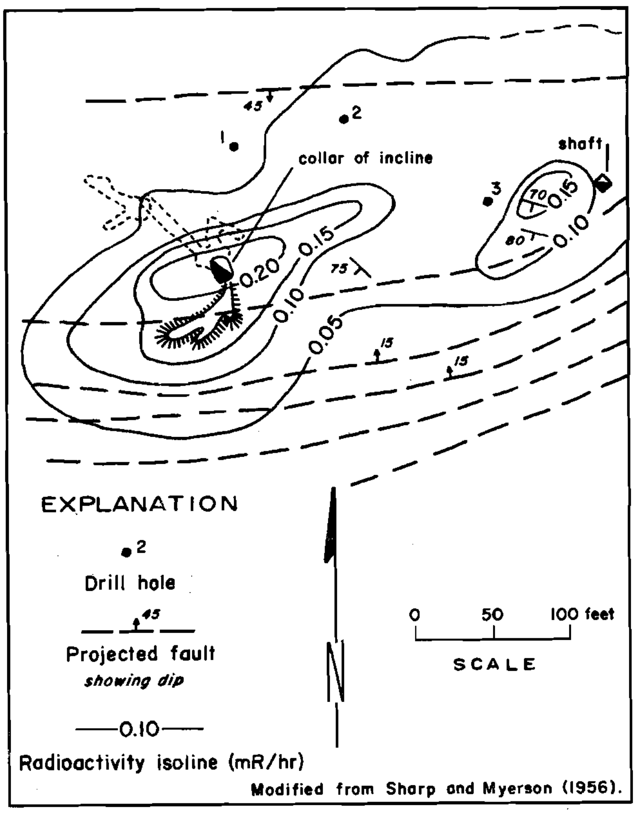

FIGURE 20. Surface radioactivity map of the Blue Bird mine, Lincoln County.

251. Silver Park mine

Other names:	Jesse Knight property.
Location:	Sec. 16, T. 7 N., R. 68 E. (unsurveyed).
Development:	300-foot-deep shaft, caved to within 50 feet of the surface. Workings are for silver.
Radioactivity:	Slightly above background.
Geology:	Dumps and areas near old workings are slightly more radioactive than surrounding unaltered rocks. Calcite, lead and copper carbonates, and cerargyrite are present in siliceous, north- and northeast-trending replacement veins in limestones.
References:	Sharp and Myerson, 1956; U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3564.

252. Nevada Rath claims (nos. 1-13)

Location:	Sec. 19(?), T. 7 N., R. 69 E. (unsurveyed). Half a mile west of Bradshaw Spring; exact location uncertain.
Development:	Several location pits in overburden.
Radioactivity:	Background = 0.10 mR/hr.; High = 3.0 mR/hr. Grab samples of silicified limestone breccia (float) contain 0.69 percent eU_3O_8 (0.613 percent cU_3O_8).
Geology:	*Uranophane*(?) and *uraninite*(?) were reported from a considerable amount of radioactive float on the property, especially in silicified, brecciated limestone.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3537.

Panaca Area

Carnotite is present near Panaca in at least three localities in the tuffaceous lake beds of the Pliocene Panaca Formation. The formation may be up to 1,400 feet thick in some areas. It has been proposed that meteoric or heated waters may have concentrated uranium leached from the tuffaceous material. Outcrops of the formation are light in color, varying from cream to shades of green and tan. The loosely cemented grains in sandstone beds are mostly pyroclastic dust and sand particles, which include angular fragments of feldspar, quartz, biotite, hornblende, and glass. Diatoms, chert nodules, and calcite and opalite lenses are also present (Hetland, Sharp, and Warner, 1969).

253. White Cloud prospect

Other names:	Keg Mining Co. claim
Location:	Center, sec. 3, T. 2 S., R. 68 E.
Production:	A trial shipment of approximately 1,000 lbs. may have been made.
Development:	Three bulldozer cuts on a hillside, and 430 feet of churn drill holes.

LINCOLN COUNTY, *continued*

Radioactivity: (Surface): Background = 0.07 mR/hr., Ave. = 0.05 mR/hr., High = 0.21 mR/hr. (Drill holes, at 30 feet): Background = 0.03 mR/hr.; High = 0.6 mR/hr. Chip samples contain 0.01 to 0.16 percent cU_3O_8; a selected sample ran 0.29 percent cU_3O_8.

Geology: *Carnotite* is present in carbonaceous plant remains, as coatings along joint surfaces and mud cracks, and as irregular disseminations, in lenses 2 inches thick and 1 to 2 feet in length, in a 1.6 foot zone in a 6-foot-thick bed of buff, waterlain tuff of the flat-lying, Pliocene age Panaca Formation (see fig. 21). Nearby these beds are unconformable with the Middle Cambrian Highland Peak Limestone.

Anomalous radioactivity is present for at least several hundred feet along the outcrop. The 1.6-foot zone contains about 0.05 percent U_3O_8 for over 400 feet of exposure. The area of uranium mineralization is believed to represent a paludal facies of the tuff. The author visited this prospect in 1969.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3544; Westgate and Knopf, 1932; Davis and Hetland, 1956; Myerson, 1956; Finch, 1967; Hetland, Sharp, and Warner, 1969.

254. Pay Zone claim

Location: Sec. 9 or 10, T. 2 S., R. 68 E.

Radioactivity: Background = 0.03 mR/hr., High = 0.20 mR/hr. A grab smaple contains 0.013 percent cU_3O_8.

Geology: Anomalous radioactivity occurs in a gray, massive tuff of the Panaca Formation.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3543; Finch, 1967.

255. Dorothy claim

Location: Sec. 4, T. 2 S., R. 68 E.; on a small butte half a mile from the center of Panaca.

Radioactivity: Three times background.

Geology: Slightly anomalous radioactivity is present in a green opalized tuff of the Panaca Foramtion. *Carnotite*(?) is present on fracture surfaces.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3539; Myerson, 1956; Finch, 1967.

Other Lincoln County Occurrences

256. Cave Valley mine

Location: Sec. 16, T. 9 N., R. 64 E.

Development: 120-foot-deep shaft, and drifts and stopes (for silver).

Radioactivity: None(?)

Geology: Five north-trending fissures are present in the mine area. A 1- to 5-foot vein and small bedded replacements in or near the lower limestone in the Pioche shale contain lead, silver, and copper minerals. Uranium minerals were reported in 1930 in this mine. However, Schrader (1931) found no uranium. Psittacinite (a yellow lead-zinc vanadate) has been reported, and may have been mistaken for *carnotite.*

References: Mining Jour., 1930; Tschanz and Pampeyan, 1969; Schrader, 1931.

257. Valley View property

Location: Center, T. 2 N., R. 56 E. Exact location unknown.

References: U. S. Atomic Energy Comm., unpublished map.

258. Lucky Strike claims (nos. 1-9)

Location: T. 2 N., R. 61 E.; exact location unknown.

Development: Eleven drill holes reported, totaling 647 feet.

Radioactivity: Background = 0.02 mR/hr.; High = 0.16 mR/hr. Select smaples contained 0.016 to 0.055 percent eU_3O_8. Samples assaying up to 10 times these values were reportedly submitted to the U. S. Bureau of Mines by an owner of the property.

Geology: Radioactivity is reportedly present in an iron-stained silicified breccia. The wall rock type is not known. No uranium or thorium minerals were recognized.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3536.

259. Walker Unit claims

Location: Sec. 4(?), T. 2 N., R. 67 E.; exact location unknown.

Development: One shallow pit.

Radioactivity: Background = 0.01 mR/hr.; High = 0.07 mR/hr. Two samples contained 0.01 percent eU_3O_8.

LINCOLN COUNTY, *continued*

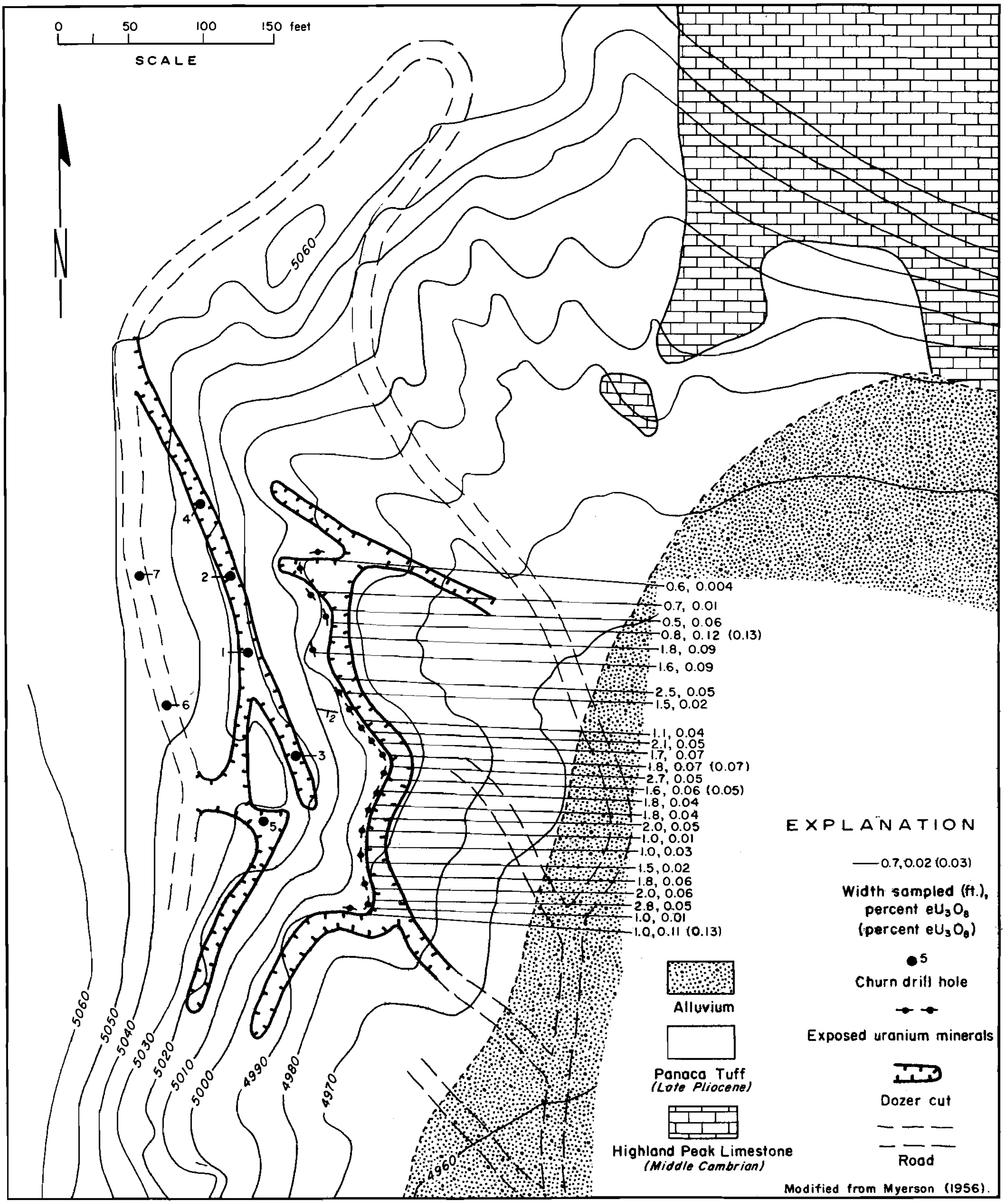

FIGURE 21. Geologic and assay map of the White Cloud prospect, Lincoln County. Widths and grades of the more significant samples are shown.

LINCOLN COUNTY, *continued*

Geology: A bed of opalized tuff 2 to 10 feet thick is radioactive (0.05 mR/hr.) over the entire top of a low hill, some 40 acres. A soft, white, pumaceous tuff underlies the opalized bed. Both units belong to the Pliocene-age Panaca Formation.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3540.

260. Peak claims (nos. 1-12)

Location: T. 1 N., R. 71 E.; near the summit of the high peak at the head of Deer Lodge Canyon.
Development: Bulldozer cuts.
Radioactivity: Background = 0.02 mR/hr.; High = 0.20 mR/hr. One sample contained 0.58 percent cU_3O_8 (but only 0.12 percent eU_3O_8).
Geology: *Autunite* and *torbernite* occur in 1- to 2-inch siliceous stringers in a white to gray rhyolite flow. Some iron-oxide staining is present.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3535; Tschanz and Pampeyan, 1969.

261. White Light No. 9 claim

Location: Sec. 32(?), T. 1 N., R. 68 E.
Development: A 5-foot-deep pit.
Radioactivity: Background = 0.016 mR/hr.; High = 0.05 mR/hr.
Geology: Anomalous radioactivity (probably due to uraniferous opal) is present in a coarse, opalized grey tuff. Minor northeast fracturing is reported. The tuff dips 25° E.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3541.

262. White Light claim

Location: Sec. 33(?), T. 1 N., R. 68 E.
Development: A 12-foot-deep shaft.
Radioactivity: Background = 0.004 mR/hr.; High = 0.03 mR/hr.
Geology: Anomalous radioactivity occurs along an east-west fissure in the Cambrian Highland Peak Limestone. Hematite staining is prominent, and minor amounts of manganese oxides are present. The outcrop of Highland Peak is an inlier, surrounded by Tertiary volcanic rocks.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3542; Tschanz and Pampeyan, 1970.

263. Old Democrat mine

Location: NW¼NE¼ sec. 18, T. 3 S., R. 67 E.
Development: Several hundred feet of inaccessible workings for gold and silver.
Radioactivity: Background = 0.01 mR/hr.; High = 0.03 mR/hr.
Geology: Slightly anomalous radioactivity occurs along an oxidized copper-gold vein in the Cambrian Prospect Mountain Quartzite. Lead and silver were also produced from the property. The slight radioactivity may be related to a lens of porphyritic diorite which reportedly parallels the vein.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3653; Callaghan, 1936.

264. Tem Piute mine

Location: Sec. 36, T. 3 S., R. 56 E.
Development: Several thousand feet of underground workings and an open pit. The workings were developed for tungsten.
Radioactivity: A chip sample was anomalously radioactive.
Geology: *Autunite* was recognized along a fault in diopside-garnet tactite. The *autunite* occurred as small flakes coating rock surfaces over a short distance along the fault. The intrusive contact with quartz monzonite is nearby. The occurrence is on the 600-foot level in the Moody ore zone, where scheelite occurs in the tactite zone with calcite, fluorite, chlorite, diopside, garnet, quartz, pyrite, pyrrhotite, and minor chalcopyrite and molybdenite.

This locality was found by the author in 1970.
References: Tschanz and Pampeyan, 1970.

LYON COUNTY

Washington Mining District

The Washington district was organized in 1861, and small properties were worked for silver chloride, gold, and copper ores. Uranium minerals were discovered in the district in 1950 (Moore, 1969, p. 29).

Ten prospects described in the Washington mining district are known to be radioactive (see Staatz and Bauer, 1953, for maps of some of these). Primary(?) and secondary uranium minerals are reported from many of them. The deposits are of three closely related types. One type comprises quartz veins in a quartz monzonite. The veins contain silver, lead, copper, and iron sulfides and their oxidation products. *Uraninite* has been reported, and

LYON COUNTY, *continued*

various secondary uranium minerals are common. A second type of occurrence consists of fault gouge zones that contain secondary uranium minerals. These sites of mineralization may contain unrecognized base-metal-bearing quartz veins or may be the result of redistribution of uranium by meteoric waters or hydrothermal solutions. The third type of occurrence, represented by one locality, is a radioactive hot spring. Solutions similar to those issuing from this hot spring may have mineralized the uranium-bearing fault zones described above.

265. Teddy claims (nos. 1-24)

Location: Sec. 5(?), T. 8 N., R. 27 E.
Development: Three bulldozer cuts.
Radioactivity: Background = 0.02 mR/hr.; High = 0.16 mR/hr. Samples reportedly range from 0.108 to 0.58 percent cU_3O_8.
Geology: *Uraninite, uranophane,* chrysocolla, malachite, and limonite are reported from a milky quartz vein 2 to 4 feet wide. The vein cuts a coarsely crystalline quartz monzonite, and strikes N. 70° W. and dips 70° S.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3583(?).

266. Northwest Willys group (2 claims)

Location: Sec. 29, T. 8 N., R. 27 E.
Development: Two bulldozer cuts and two prospect pits.
Radioactivity: A sulfide-bearing pod contains 0.03 percent U_3O_8.
Geology: Two steeply dipping quartz veins trend east-northeast and cut granite. A pod of pyrite, chalcopyrite, galena, limonite and secondary copper minerals has the highest radioactivity.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3588, 3591; Staatz and Bauer, 1953, 1954c.

267. West Willys group (7 claims)

Other names: Old Washington claim.
Location: Secs. 32, 33, T. 8 N., R. 27 E.
Development: Seven adits ranging from 31 to 367 feet in length (Old Washington claim), and several shallow shafts, pits, and other workings (for silver).
Radioactivity: Background = 0.02 mR/hr.; High (copper oxides on dumps) = 0.08 mR/hr. Samples from veins contain from 0.002 to 0.165 percent U_3O_8.
Geology: Radioactivity is associated with pods or thin layers of sulfide minerals in quartz veins which cut a porphyritic quartz monzonite. Four zones of these veins are present on this group of claims. Minerals reported include epidote, barite, galena, chalcopyrite, *pitchblende,* argentite(?), chrysocolla, chalcocite, *torbernite,* and *kasolite.* Individual quartz veins range from 1 inch to 1½ feet thick. Anomalous radioactivity may be in part associated with copper oxides.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3592; Staatz and Bauer, 1953, 1954c; Walker, Osterwald, and Adams, 1963.

268. Quartz mine group (7 claims)

Location: T. 8 N., R. 27 E.; exact location unknown. This prospect may be in the vicinity of the Washington district.
Development: Several bulldozer cuts.
Radioactivity: Background = 0.03 mR/hr.; High = 0.52 mR/hr. A 1.5 foot chip sample contained 0.07 percent eU_3O_8.
Geology: *Autunite* is sparsely disseminated in decomposed granitic rock. A copper-bearing quartz vein is reportedly present in the vicinity of the prospect.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3569.

269. Halloween mine

Location: Sec. 3(?), T. 7 N., R. 27 E.; exact location uncertain.
Development: One prospect pit.
Radioactivity: Background = 0.04 mR/hr.; High = 0.40 mR/hr. A select sample contained 0.15 percent eU_3O_8 and a 5.5-foot chip sample contained 0.07 percent eU_3O_8.
Geology: Uranium minerals are reported from a highly weathered fault zone in granitic rock. Clay and iron oxides are present along the zone, which trends N. 65° E. and dips 80° NW. *Autunite, uranophane* and *carnotite*(?) are reported.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3570.

270. Far West Willys group

Other name: Bonanza
Location: Secs. 5, 6, T. 7 N., R. 27 E.
Development: Bulldozer cuts, two 40-foot shafts, and two adits totaling 200 feet.

LYON COUNTY, *continued*

Radioactivity: Samples from a selected ore pile contained up to 0.165 percent U_3O_8.

Geology: Nine quartz veins, 2 inches to 1 foot in width, which strike east, dip steeply, and are surrounded by envelopes of silicified and argillized quartz monzonite, crop out on the claims. Only four of these have yielded samples that contain more than 0.01 percent uranium. These veins contain thin lenses and aggregates of epidote, chrysocolla, tenorite, chalcocite, chalcopyrite, galena, and argentite. No uranium minerals were recognized.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3593, 3594, 3574; Staatz and Bauer, 1953, 1954c.

271. Kateydid claim

Location: Sec. 4(?), T. 7 N., R. 27 E.; may be in section 3.

Development: Bulldozer trench, 6-foot-deep pit, and diamond drilling(?).

Radioactivity: Background = 0.02 to 0.03 mR/hr., High = 1.5 mR/hr. A sample contained 0.17 percent eU_3O_8.

Geology: *Uranophane*(?) and *zeunerite* occur in a shear zone that strikes N. 80° W. in granodiorite. Higher radioactivity is present at the intersection of this shear zone with a south-trending fault.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3568.

272. Silver Pick property

Location: Sec. 36, T. 8 N., R. 27 E.

Development: Several pits and bulldozer cuts, a 30-foot-deep shaft, a 37-foot incline, a 16-foot adit, and nearly 40 feet of drift (1953).

Radioactivity: 0.015 percent U_3O_8 was found in one sample.

Geology: *Autunite*(?) and *torbernite* occur locally along a shear zone in quartz monzonite. The zone strikes N. 30° E. and dips 50° NW. Scattered small nodules of quartz containing galena, chalcocite, and silver minerals are found in gouge along the altered zone.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3586, 3590; Staatz and Bauer, 1953, 1954c.

273. Grant View Hot Spring

Location: Sec. 8, T. 7 N., R. 27 E.; 300 feet east of the East Walker River.

Radioactivity: Moderate

Geology: Anomalous radioactivity is associated with a hot spring which has a water temperature of about 110° F. Samples of water analysed some time after collection contained only 0.002 percent uranium. The radioactivity of the spring is believed due to radon in the water.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3589; Staatz and Bauer, 1953, 1954c; Davis, 1954.

274. Boerlin Ranch property

Location: Sec. 18, T. 7 N., R. 27 E.; one-quarter mile west of the East Walker River on a ridge top.

Radioactivity: A sample contained 0.009 percent cU_3O_8.

Geology: Slightly anomalous radioactivity is associated with an altered, iron-stained fault zone in granodiorite. The zone is at least 80 feet long, up to 25 feet wide, and trends N. 65° E.

References: Staatz and Bauer, 1953, 1954c.

Other Lyon County Occurrences

275. River Road mine

Location: NW¼ sec. 12, T. 7 N., R. 27 E.

Production: A test shipment of 45 tons of uranium ore was shipped in 1956. Some production was reported in 1957.

Radioactivity: Background = 0.02 mR/hr.; High = 0.40 mR/hr. A 2.5-foot chip sample contained 0.02 percent eU_3O_8, and another 1.7-foot chip sample contained 0.03 percent eU_3O_8.

Geology: Tertiary sedimentary rocks (tuffs, sandstones, shales, etc.) overlie a coarsely crystalline quartz monzonite. Radioactivity is probably localized in the tuffs, but little information is available.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3573; U. S. Bur. Mines Minerals Yearbook 1957.

276. Ramsey prospects

Location: Sec. 10(?) or 14(?), T. 18 N., R. 23 E.

Geology: Radioactive prospects are reported in the Hartford Hill Rhyolite from the area south of Ramsey. None of these localities could be found in 1969 by the author.

References: Schilling, 1963; Rose, 1969, p. 27.

LYON COUNTY, *continued*

277. Lava Cap group (7 claims)

Location: Center, sec. 23, T. 17 N., R. 22 E.
Development: Three bulldozer cuts.
Radioactivity: Background = 0.15 mR/hr.; High = 0.30 mR/hr. A 2-foot vertical chip sample contained 0.40 percent U_3O_8.
Geology: Anomalous radioactivity occurs along a north-south trending fault in Cretaceous(?) granitic rocks just below a disconformable contact with the overlying Hartford Hill Rhyolite. The highest radioactivity is in the gouge zone of the fault, where a very minor amount of *autunite*(?) was noted. Slightly anomalous radioactivity is present over an area of a few hundred square feet.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3571.

278. Glacier King No. 1 claim

Location: Sec. 24, T. 16 N., R. 20 E.
Production: Some ore reportedly was shipped in 1957.
Development: A trench 25 feet long, 3 feet wide, and 4 feet deep.
Radioactivity: Background = 0.03 mR/hr.; High = 1.2 mR/hr. Samples contain as much as 0.34 percent eU_3O_8.
Geology: *Autunite*(?) and iron oxides occur along a minor fault in the Hartford Hill Rhyolite.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3578; U. S. Bur. Mines Minerals Yearbook, 1957.

279. Little Red Head group

Other names: Little Red Head No. 1
Location: Sec. 12(?), T. 14 N., R. 26 E.; exact location unknown.
Radioactivity: Background = 0.05 mR/hr.; High = 3.0 mR/hr.
Geology: Yellow, crystalline uranium minerals occur along a silicified fault(?) zone in Tertiary rhyolite and tuff. The writer could not find this prospect in 1970.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3579; Finch, 1967.

280. Yerington property

Location: Secs. 16, 17, 20, 21, T. 13 N., R. 25 E.
Development: Open-pit copper mine.
Radioactivity: Up to 4 times background. Select samples contained 0.05 percent cU_3O_8 (about 10 times the average for felsic igneous rocks).
Geology: Slightly anomalous amounts of uranium were found in select dump samples from Anaconda Copper Co.'s property. The highest radioactivity was associated with heavy coatings of azurite on slightly mineralized porphyry.
References: King and Roberts, 1954b.

281. Noonday claims(nos. 1-4)

Other names: Noon Day
Location: SE¼ sec. 15, T. 13 N., R. 24 E.
Development: Trenches and pits.
Radioactivity: Background = 0.03 to 0.04 mR/hr.; High = 0.5 mR/hr.; 1-foot chip samples contained 0.016 and 0.003 percent eU_3O_8.
Geology: Anomalous radioactivity occurs near the base of the Hartford Hill Rhyolite.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3577.

282. Well 13/23-25 cbl

Location: NE¼SW¼ sec. 25, T. 13 N., R. 23 E.
Geology: A water sample from this well contained amounts of radium (2.5 micromicrocuries per liter) which are slightly anomalous for this region. This 540-foot-deep well may penetrate Tertiary sediments and volcanics below the alluvium, and possibly reflects the radioelement content of the volcanic rocks.
References: Scott and Barker, 1962.

283. Flyboy claims (nos. 1-11)

Other names: Fly Boy, McCoy prospect, Stronsnider's Ranch.
Location: NE¼ sec. 16, T. 11 N., R. 26 E.
Production: Fifty tons of uranium ore were reportedly shipped in 1961.
Development: 170 feet of adit, 15 feet of drift. Workings were made in search of copper.
Radioactivity: Background = 0.02 mR/hr.; High = 0.19 mR/hr. An 8-foot chip sample contained 0.06 eU_3O_8, and samples containing up to 0.26 percent U_3O_8 and 2.8 percent copper have been reported.
Geology: Uranium, copper, and molybdenum mineralization is present in granite. Chalcopyrite and molybdenite are sparsely disseminated in the granite, and secondary copper and uranium minerals occur along

LYON COUNTY, *continued*

several fractures and sheared areas, especially near aplite dikes. *Torbernite* occurs as small rosettes in cavities, while *autunite* is present as encrustations and colloform masses. *Phosphuranylite* also reportedly occurs in the ore.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3576; Schilling, 1962; Butler, 1958, p. 127; U. S. Bur. Mines Minerals Yearbook, 1961.

284. Eagle Feather group

Location: Secs. 3, 4, 9, 10, T. 10 N., R. 25 E.
Development: None(?)
Radioactivity: Background = 0.05 mR/hr.; High = 2.0 mR/hr. A fossil bone assayed 0.158 percent U_3O_8.
Geology: Fossil bones which occur in Tertiary sandstone and conglomerate are moderately radioactive.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3572.

285. White Rose & White Rose No. 1 claims

Location: Sec. 16(?), T. 10 N., R. 26 E.
Development: Prospect pit. Plans to drill reported.
Radioactivity: Background = 0.05 mR/hr.; High = 0.70 mR/hr. Five-foot and 3.5-foot channel samples contain 0.02 and 0.015 percent eU_3O_8 respectively. Select samples are considerably higher. Chemical assays are usually higher than radiometric.
Geology: *Carnotite*, gypsum, and sulfur(?) are reported as coatings along fractures and joints in diatomaceous beds of Miocene or Pliocene age.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3580; Finch, 1967; Powers and Finch, 1955.

286. Cambridge district

Other names: Pine Grove district
Location: Sec. 31(?), T. 10 N., R. 27 E.
Geology: Gold ore from a claim south of the Cambridge mine is reportedly radioactive. The wall rock is granite.
References: Mining Jour., 1942.

287. Pitch claims

Location: N½ sec. 9, T. 8 N., R. 25 E.
Development: One 32-foot inclined shaft (caved), a 6-foot adit, and a bulldozer bench.
Radioactivity: Background = 0.02 mR/hr.; High = 0.04 mR/hr. A chip sample from the shear zone contained 0.01 percent eU_3O_8.
Geology: Very slightly anomalous radioactivity is present along an iron-stained, westerly trending fracture in a light grey to buff fragmental tuff. The fracture dips 80° N.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3567.

288. Snowball No. 1 prospect

Location: Sec. 22(?), T. 7 N., R. 27 E.; exact location uncertain.
Development: Prospect pit.
Radioactivity: Background = 0.02 mR/hr.; High = 0.6 mR/hr. A 2-foot chip sample contained 0.04 percent eU_3O_8.
Geology: An unidentified yellow radioactive mineral is reported from a highly altered, varicolored, rhyolitic volcanic rock. The author identified *zeunerite* from a sample reportedly from this claim.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3575.

MINERAL COUNTY

Red Ridge Area

Two groups of claims on the Walker River Indian Reservation contain *carnotite* in a rhyolitic tuff. Possibly the concentration of uranium is due to the leaching of tuffs by ground and surface waters.

289. Robinson claims

Other names: Ribonson
Location: Secs. 21, 23, T. 14 N., R. 30 E.
Development: Several prospect pits.
Radioactivity: About four times background. A select sample contained 0.45 percent cU_3O_8, and a channel sample 0.02 percent cU_3O_8.
Geology: A uranium vanadate, probably *carnotite,* occurs in opalized plant material (including an opalized log) in a 1- to 3-foot tuffaceous bed. This bed lies at the base of a quartz latite welded tuff(?). Radioactivity is present over a distance of 1,000 feet along this bed. Another nearby tuff bed is also radioactive.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3634; Finch, 1967.

290. Bubbles claims

Location: Secs. 27, 28, 29, T. 14 N., R. 30 E.
Development: Several small pits.

MINERAL COUNTY, *continued*

Radioactivity: Background = 0.05 mR/hr.; High = 1.5 mR/hr.

Geology: *Carnotite* is present in abundant opalized wood and along altered zones in a rhyolitic tuff. Anomalous radioactivity was noted for about 500 feet along the base of a small hill. This radioactivity may be related to an old lake shoreline.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3628.

291. Blue Bottle, Blue Bottle Nos. 2 and 3 claims

Location: W½ sec. 16, T. 9 N., R. 31 E.

Development: Several prospect pits and shallow shafts. Workings are an old copper prospect.

Radioactivity: Background = 0.02 mR/hr.; High = 0.25 mR/hr.

Geology: Radioactivity occurs with iron and copper oxides in a fissure vein in granite.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3616.

292. Black Hawk claims

Other names: B & P claim, Last Chance prospect.

Location: NW¼ sec. 15, T. 9 N., R. 32 E. (unsurveyed).

Development: One bulldozer cut.

Radioactivity: Background = 0.03 mR/hr.; High = 1.5 mR/hr. Select samples range from 0.08 to 0.41 percent eU_3O_8 (0.052 to 0.383 percent cU_3O_8). A 3-foot chip sample contained 0.06 percent eU_3O_8.

Geology: An iron deposit, mainly magnetite, occurs in a long, narrow roof pendant of Triassic Luning Formation in a granitic intrusive. The roof pendant is nearly a mile long and from a few feet to several hundred feet wide. Small veinlets and lenses of magnetite have replaced limestone. The anomalous radioactivity occurs as patches and lenses in the magnetite. The largest magnetite body occurs on the Black Hawk claim, near the northeast end of the pendant. Zinc and copper minerals are also reported.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3604, 3620; Reeves, Shaw, and Kral, p. 76.

293. William Johnson claims (nos. 1-11)

Other names: Black Horse prospect

Location: Sec. 18, T. 9 N., R. 33 E.

Development: Considerable bulldozer scraping.

Radioactivity: Background = 0.01 mR/hr.; High = 0.18 mR/hr. A sample contained 0.87 percent eU_3O_8 and 1.08 percent cU_3O_8.

Geology: Anomalous radioactivity, and small amounts of *autunite* and *uranophane,* are reported from a ferruginous zone near the contact of the Triassic Luning Formation with granitic intrusive rocks. Uranium mineralization is found along fractures. A small amount of marginal grade (about 40 percent Fe) iron ore is present, plus the usual suite of skarn minerals.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3609; Reeves, Shaw, and Kral, 1958, p. 63 and 64.

Gillis and Gabbs Valley Ranges

Ten radioactive localities have been reported in the Gillis and Gabbs Valley Ranges east of Walker Lake. Three somewhat dissimilar types of deposits are included in this group. The first type are occurrences having copper or copper-uranium minerals. A second kind of prospect, possibly having some similarities to the first, includes several iron oxide bodies which are radioactive. In some cases uranium may have been concentrated during gossan formation. Copper mineralization is also commonly associated. The third type includes two radioactive occurrences in volcanic rocks.

294. Dixie group (nos. 1-26)

Location: Sec. 16(?), T. 9 N., R. 33 E.; exact location uncertain.

Development: A 400-foot adit and an inclined shaft (Silver Queen mine).

Radioactivity: Background = 0.11 mR/hr.; High = 0.22 mR/hr. A select sample contained 0.01 percent eU_3O_8.

Geology: Radioactivity is reported along a major southeast-trending fault and occasionally along joint planes in a black porphyritic andesite(?). *Autunite* is present, as well as copper sulfate, limonite, hematite, and argentiferous galena.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3602.

295. Lucky Ann, Nos. 1 and 2

Location: SE¼(?) T. 9 N., R. 33 E.; exact location unknown.

Development: Two prospect pits and a 20-foot inclined shaft.

Radioactivity: Background = 0.04 mR/hr. (surface) to 0.10 mR/hr. (underground); High = 0.10 mR/hr. (surface) to 0.20 mR/hr. (underground). A 6-foot chip sample contained 0.02 percent eU_3O_8.

MINERAL COUNTY, *continued*

Geology: Radioactivity was detected in veins of calcite, opal(?) and silica (sinter) which cut a dolomite. Mineralization is also present in an underlying black basaltic andesite(?). Copper silicates, calcite, siderite, and *uranophane*(?) are reported.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3601.

296. Lost Sheep claims

Location: Sec. 13(?), T. 10 N., R. 33 E.; near the head of Wildhorse Canyon.

Development: One small pit.

Radioactivity: Background = 0.04 mR/hr.; High = 0.09 mR/hr. A 3-foot vertical chip sample contained only a trace of uranium.

Geology: A dark rhyolite was very slightly radioactive at one spot. Pyrite was also reported.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3600.

297. Broken Bow and Broken Bow King groups

Location: Probably in T. 9 N., R. 34 E. The exact location is unknown, and it may be in T. 9 N., R. 33 E.

Development: Three small pits.

Radioactivity: Background = 0.04 mR/hr.; High = 1.5 mR/hr. Two-foot chip samples range from 0.05 to 0.20 percent eU_3O_8.

Geology: Uranium minerals occur as surface coatings and disseminations throughout a well indurated sandstone at or very near the contact with a granitic intrusive. *Torbernite(?), saleeite,* and *novacekite* are present with iron staining and clays.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3596; Finch, 1967.

298. Lunning Mining Co. claims

Other names: Luning Mining Co. claims

Location: Sec. 36(?), T. 9 N., R. 34 E. (unsurveyed). Eight miles north of Luning, 100 yards to the north of the highway.

Development: Old workings for silver and copper.

Radioactivity: Background = 40 cps; High = 170 cps. A select sample contained 0.01 percent U_3O_8.

Geology: Slightly anomalous radioactivity has been reported from the Luning (Sante Fe) district. The radioactivity is probably associated with iron-stained fractures in Tertiary volcanic rocks. The area of radioactivity could not be located in 1970.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3631; Davis, 1954, p. 21.

299. King David group

Location: Sec. 21(?), T. 7 N., R. 33 E. (unsurveyed).

Development: Old cuts, adits, and shafts developed in search of copper.

Radioactivity: Background = 0.05 mR/hr.; High = 0.30 mR/hr. A select sample contained 0.019 percent eU_3O_8.

Geology: Radioactivity is associated with magnetite, hematite, and copper minerals which occur sporadically in limestone of the Triassic(?) Excelsior Formation. Jaspery gossan, associated with copper ores, has been prospected for iron.

References: U. S. Atomic Energy Comm. Prelim. Reconn Rept. 3619; Ross, 1961, table 6.3; Reeves, Shaw, and Kral, 1958, p. 75, 76.

300. Buff property

Location: Sec. 34(?), T. 7 N., R. 34 E. Exact location unknown.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. N-SL-113 (not available).

301. Iron Gate group

Location: Sec. 35(?), T. 7 N., R. 34 E.; exact location unknown.

Geology: Butler, Finch, and Twenhofel (1962) report a uranium occurrence at the location given above. It is reportedly of a type which includes veins, breccia zones, stockworks, and related deposits. An iron mine of the same name (Iron Gate mine) is located in sec. 33, T. 8 N., R. 35 E. It is not known whether this is the same occurrence.

References: Butler, Finch, and Twenhofel, 1962.

Fitting District

Anomalous radioactivity and uranium-thorium minerals are found on four properties in the Fitting district. These are probably all pegmatite or pegmatite-like occurrences. Late stage magmatic segregations such as these commonly contain both uranium and thorium.

302. Holiday mine

Other names: Holiday and Falcon claims, Holly Daze and Jiminy Cricket mine.

MINERAL COUNTY, *continued*

Location: Sec. 10, T. 8 N., R. 33 E.
Production: Possibly a small amount of production in 1955.
Development: About 170 feet of underground workings.
Radioactivity: Background: (quartz monzonite) = 0.02 mR/hr., (near mine) = 0.04 mR/hr.; High = 5 mR/hr. Selected samples assay as high as 0.22 percent U_3O_8 and 0.85 percent ThO_2.
Geology: Anomalous radioactivity, and yellow, brown, and black uranium and thorium minerals, occur in elongate bodies up to several feet in length. The radioactive minerals have been identified as *thorite, huttonite,* and *uranothorite* (Ross, 1961). Very smoky (nearly black) concentrations of radioactive quartz are often present in or near the radioactive bodies. Plagioclase is somewhat altered in the mineralized areas. The radioactive areas occur in an irregular-shaped dike of sodic plagioclase (albitite) in the hanging wall of a fault which separates the dike from the quartz monzonite which it intrudes. Quartz segregations occur in the albitite, but quartz is not present as individual grains in the dike material (fig. 22, inset). The dike rock resembles rocks that have been called Helsinkites in Finland. It consists of sodic plagioclase, with minor epidote and accessory biotite, muscovite, and apatite. Uranium- and thorium-rich areas and radioactive quartz bodies occur as local segregations, both underground and at the surface. The dike is nearly vertical, trends approximately N. 50° W., and has been displaced by faults in several places. It can be found 66 feet from the portal of the adit (fig. 22) but occurs in only the floor and a 15-foot-deep winze. The author visited this deposit in 1969.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3598; Ross, 1961, p. 76, pl. 1, and table 6.2; Olson and Adams, 1962; U. S. Bur. Mines Minerals Yearbook, 1955.

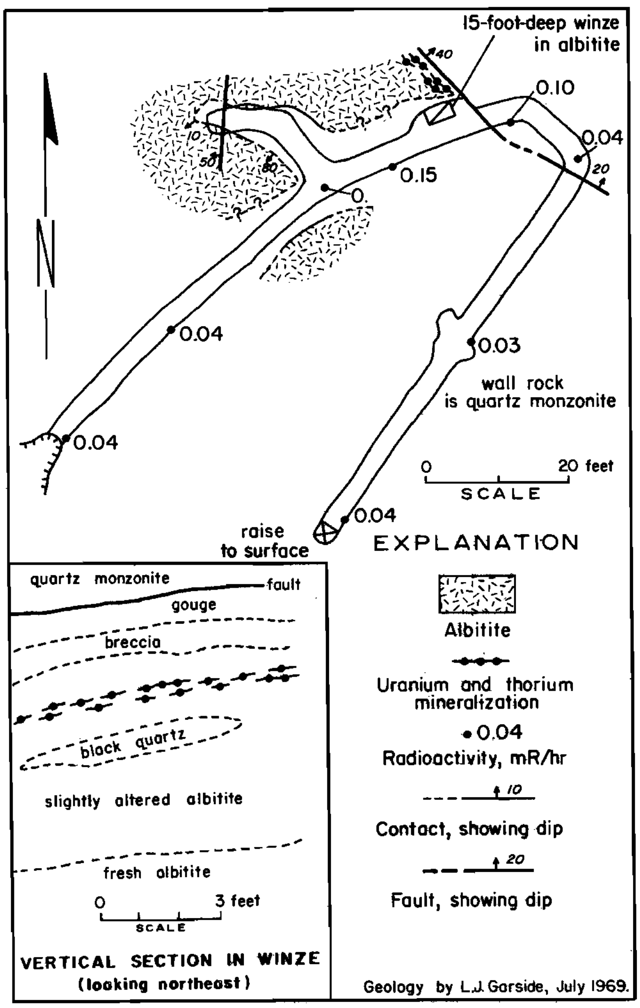

FIGURE 22. Geologic map of the Holiday mine, Mineral County.

303. Elna claims

Location: Sec. 2(?), T. 8 N., R. 33 E.
Development: Several pits.
Radioactivity: Background = 0.015 mR/hr.; High = 1.0 mR/hr. A sample from a stockpile contains 0.12 percent eU_3O_8, but only 0.038 percent cU_3O_8.
Geology: *Uranothorite* and wernerite (scapolite) reportedly occur in a fault breccia zone.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3608.

304. Name unknown

Location: Corner of secs. 3, 4, 9, and 10, T. 8 N., R. 33 E. (unsurveyed).
Development: A 100-foot adit and a small pit.
Geology: A radioactive anomaly is reported in altered granitic rocks.
References: Ross, 1961, p. 76 and pl. 1.

305. Blue Ox prospect

Location: Sec. 9, T. 9 N., R. 33 E.
Development: Unknown.
Radioactivity: Hand samples are anomalously radioactive. The sample reportedly contains 0.5 percent ThO_2.

MINERAL COUNTY, *continued*

Geology: Metamict *thorite* is reported from scapolite. This prospect may be similar to or the same prospect as the Elna claims.

Powell Mountain Area

Two mines in granitic rock contain silver, gold and copper mineralization, and are anomalously radioactive.

306. Silver Star mine

Location: NE¼ sec. 30(?), T. 6 N., R. 30 E.
Development: One 97-foot-long drift (for gold).
Radioactivity: Background = 0.009 mR/hr.; High = 0.70 mR/hr. An analysis of 0.08 cU_3O_8 was reported from one sample.
Geology: Anomalous radioactivity is associated with silver, gold, and copper mineralization along a 4- to 12-inch-thick vein in granite. Galena, malachite, chalcanthite, chrysocolla, and azurite are reported.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3607.

307. Old Virginia City mines

Location: Secs. 7, 8(?), T. 5 N., R. 30 E.
Development: Several pits, adits, and shafts as a result of copper-silver exploration.
Radioactivity: Background = 0.04 mR/hr.; High = 0.2 mR/hr. A channel sample contained 0.015 percent eU_3O_8.
Geology: Mineralized fractures in a granitic intrusive contain chrysocolla, silver(?), and other copper oxides. These fractures are radioactive. The wall rock is granite.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3618.

Marietta Area

Nine prospects near Marietta occur in granitic rock, and one is located in andesite which directly overlies the intrusive. The occurrences in the granite are of two types: (1) those in which radioactivity or secondary uranium minerals and iron oxides occur along shear zones, and (2) prospects in which uranium mineralization is associated with quartz veins containing base and precious metals.

This area was the site of extensive prospecting in the mid-1950's. Several of the properties are reported to extend along one or more northeast-trending faults. All of the prospects described in this section may be genetically related, although some have probably been redistributed later by ground water. These deposits are probably either due to ground water leaching of uranium from weathered granitic rock and concentration in pre-existing fault zones and along impermeable quartz veins, or to the action of hydrothermal fluids (either metal-rich, only uranium-bearing, or both).

308. Pink Lady group (nos. 1-6); Yellow Sky and Horseshoe claims

Other names: Corosey(?)
Location: S½(?), T. 5 N., R. 32 E.; exact location unknown.
Development: Prospect and discovery pits.
Radioactivity: Background = 0.01 mR/hr.; High = 0.35 mR/hr. A select sample reportedly contained 1.3 percent eU_3O_8.
Geology: Radioactivity is associated with minor faults in granitic rock, where *torbernite* occurs as fracture coatings. On the Pink Lady claims, radioactive pegmatites are reported, and possibly contain *samarskite(?)*.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3622.

309. Lucky Horseshoe claim

Location: Sec. 27(?) or 21(?), T. 5 N., R. 32 E.; also possibly in sec. 16.
Development: Several open cuts and trenches.
Radioactivity: Background = 0.04 mR/hr.; High = 0.2 mR/hr. A 1.5-foot chip sample contained 0.061 percent U_3O_8.
Geology: An altered shear zone up to 100 feet wide strikes N. 80° W. in granitic rock. *Autunite, kasolite(?), torbernite(?)* and iron oxides are present in subsidiary fractures within this zone.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3615.

310. Red Stone group (nos. 1-6?)

Other names: Neva-Cal Mining Enterprise
Location: Sec. 31, T. 5 N., R. 32 E.
Development: Open cuts
Geology: *Metatorbernite(?)* occurs in north(?) trending stringers in granitic rock.
References: Ross, 1961, pl. 1 and table 6.7.

311. Sunday Mining Co. group

Other name: Sunday prospect
Location: Sec. 32(?), T. 5 N., R. 32 E. (unsurveyed). Projected from west.

MINERAL COUNTY, *continued*

Development: Several small pits.
Radioactivity: Background = 0.04 mR/hr.; High = 1.20 mR/hr. Several 3-foot horizontal chip samples range from 0.01 to 0.04 percent eU_3O_8.
Geology: Numerous iron-stained seams in a Tertiary andesite breccia locally contain euhedral *metatorbernite* crystals. The andesite disconformably overlies Jurassic(?) granitic rocks. *Zeunerite*(?) and *cuprosklodowskite* have also been reported.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3597; Ross, 1961, pl. 1, table 6.7, and p. 76.

312. Blue Boy and Marietta claims

Location: N½(?), T. 4 N., R. 32 E.; exact location unknown.
Production: One test shipment was reportedly made (average = 0.09 percent cU_3O_8) from the Blue Boy.
Development: Several open cuts.
Radioactivity: Background = 0.03 mR/hr.; High = 0.3 to 0.4 mR/hr.
Geology: *Autunite* and *uranophane* reportedly occur in shear zones, probably in granitic rock. One northerly-trending shear zone on the Marietta claims displays anomalous radioactivity over its entire length, and can be traced to the Yellow Sky claims (see no. 308) to the north.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3635.

313. 4 D claims (nos. 1 and 2)

Other names: Cinderella claim, 4-0
Location: Sec. 11(?), T. 4 N., R. 32 E. (unsurveyed). Projected from west.
Development: Older caved incline shaft (gold-silver prospect). More recent workings include several open cuts; a gentle, 100-foot-long incline shaft; and a 50-foot-deep vertical shaft.
Radioactivity: Reports vary from 20 to 25 times background. Samples contain 0.12 and 0.56 percent eU_3O_8 (0.115 and 0.540 percent cU_3O_8.
Geology: Colored uranium oxide minerals (*kasolite?, gummite?* and *uranophane?*) occur with galena, copper stain, and gold and silver values in several small quartz veins. The quartz veins occur in granitic rocks, and strike N. 30° to 40° W.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3611, 3626, 3625; Ross, 1961, pl. 1 and table 6.7.

314. Silver Moon prospect (36 claims)

Location: Sec. 15, T. 4 N., R. 32 E. (unsurveyed). Projected from west.
Development: Several small cuts and one adit.
Radioactivity: Background = 0.03 mR/hr.; High = 0.7 mR/hr.
Geology: Radioactive material occurs in thin, limonite-stained quartz veins in granitic rock. The veins are less than 1 inch thick, and several inches to 2 feet long.
References: Ross, 1961, pl. 1 and table 6.7.

315. Silver Bell group (57 claims)

Location: Secs. 15, 16, 21, T. 4 N., R. 32 E. (unsurveyed). Projected from the west.
Development: Several pits and tunnels.
Radioactivity: Underground: Background = 0.05 mR/hr.; High = 7.0 mR/hr. Select samples range from 0.16 to 1.23 percent cU_3O_8 (up to 1.41 percent eU_3O_8).
Geology: *Uranophane*(?) and possibly other radioactive minerals occur in small pockets in brecciated quartz veins which also contain lead, copper, gold, and silver. The veins cut a granodiorite intrusive of probable Jurassic age. The radioactive pockets are 1.5 to 2 feet in length, and are found mainly along the footwall of the quartz veins.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3624.

316. Silver State claim

Other names: Wild Horse
Location: Sec. 15(?), T. 4 N., R. 32 E. (unsurveyed). Projected from west.
Development: One bulldozer cut.
Radioactivity: Background = 0.03 mR/hr.; High = 1.20 mR/hr. One grab sample contained 0.12 percent eU_3O_8 and a 2-foot horizontal chip sample contained 0.073 percent eU_3O_8.
Geology: Altered shear zones in a granitic intrusive contain iron-stained quartz and radioactive minerals. *Kasolite*(?) has been reported.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3614.

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317. Mineral Jackpot prospect

Location: Sec. 21, T. 4 N., R. 32 E. (unsurveyed). Projected from west.
Development: Two prospect pits.
Radioactivity: Background = 0.04 mR/hr.; High = 0.4 mR/hr. A chip sample across one vein contained 0.09 percent eU_3O_8.
Geology: Anomalous radioactivity occurs sporadically along several 6-inch quartz veins which cut a quartz monzonite. The vein system trends N. 80° W., and continues for 100 feet. Tourmaline, magnetite, pyrite, molybdenite, limonite, and lepidolite are reportedly present. Gold and silver values have also been noted.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3599.

Other Mineral County Occurrences

318. Guranium group (10 claims)

Location: SW¼ sec. 24, T. 14 N., R. 29 E.
Development: A 150-foot-deep shaft and 300 feet of drifts. Workings for silver.
Radioactivity: Background = 0.04 mR/hr.; High = 0.11 mR/hr. One chip sample assayed 0.025 eU_3O_8.
Geology: Radioactivity occurs along a N. 42° W. vertical fault zone in Tertiary rhyolite. The fault zone averages 3 feet in width and can be traced for 500 feet. Associated copper and silver mineralization are reported.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3606.

319. Happy Return mine

Other names: Rechel
Location: Sec. 28(?), T. 14 N., R. 32 E.
Development: 54 feet of inclined shafts, 40 feet of vertical shaft, 95 feet of drifts, and several other short adits. Work was done for antimony.
Radioactivity: Background = 0.04 mR/hr.; High = 0.10 mR/hr. (surface), 0.40 mR/hr. (underground).
Geology: Radioactivity, generally associated with antimony oxides, occurs along minor faults in a granodiorite. The main antimony ore vein strikes N. 80° E., and dips 65° N. Stibnite, galena, antimony oxides, and limonite are reported.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3603; Lawrence, 1963, p. 126, 127.

320. Contact group (7 claims)

Location: Sec. 27(?), T. 13 N., R. 33 E.
Development: Bulldozer cuts, trenches, and a shallow shaft.
Radioactivity: Background = 0.04 mR/hr.; High = 0.60 mR/hr.; a 2-foot chip sample contained 0.06 percent eU_3O_8.
Geology: Anomalous radioactivity occurs along the brecciated portion of a contact between granitic rocks and a silicified limestone. Opalized portions of this zone seem to be the most radioactive. The limestone is probably part of the Triassic(?) Excelsior Formation.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3637.

321. Eureka claims (nos. 1-3)

Location: Sec. 9(?), T. 7 N., R. 36 E. (unsurveyed). Location uncertain; possibly in section 7.
Development: Several small prospect pits.
Radioactivity: Background = 0.04 mR/hr: High = 0.20 mR/hr. Two samples contained 0.083 and 0.012 percent eU_3O_8.
Geology: Anomalous radioactivity occurs in fossilized wood in a siltstone lens interbedded with a series of volcanic flows.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3636.

322. Carol R mine

Other names: Hawthorne prospect, Wespac group, Amalgamated Uranium Co.
Location: Sec. 31, T. 8 N., R. 32 E.
Production: Some production was reported in 1955 and 1956.
Development: One small open pit and several bulldozer cuts. Recent drilling reported (1972).
Radioactivity: Background = 0.02 mR/hr.; High = 3.0 mR/hr. A select sample contained 0.94 percent cU_3O_8.
Geology: *Carnotite* occurs between grains and disseminated along bedding and fractures in Tertiary basaltic, water-laid tuffs and tuffaceous sandstones. The sediments overlie granite, and lie beneath a basalt flow, and are intruded by a small, perlitic rhyolite neck. They are only a few tens of feet thick. The tuffaceous sandstones consist

MINERAL COUNTY, *continued*

of alternating thin beds of coarse- and fine-grained material, with a 10-foot-thick bentonitic clay unit at the base, above granodiorite. The uranium mineralization occurs along the margin of the perlitic intrusive in the sedimentary rocks. Some radioactivity was also noted in the basalt. The rhyolite neck appears to be younger than the basalts. Conglomerates and boulder beds are interbedded with the basalts higher in the section, but only very minor uranium mineralization was noted in these units.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3621; Davis and Hetland, 1956; Finch, 1967; Ross, 1961, p. 76 and pl. 1; Powers and Finch, 1955; U. S. Bur. Mines Minerals Yearbooks 1955, 1956.

323. Jeep prospect

Location: Sec. 6(?), T. 7 N., R. 28 E.; exact location unknown.
Development: One shallow pit.
Radioactivity: Background = 0.025 mR/hr.; High = 0.05 mR/hr.
Geology: Very slight radioactivity occurs in a diatomaceous bed capped by rhyolite.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3623.

324. Denny D claims (nos. 1-9)

Location: S½ sec. 32, T. 7 N., R. 29 E.
Radioactivity: Background = 0.03-0.04 mR/hr.; High = 1.0 mR/hr. Two- and 3-foot chip samples contained 0.10 and 0.022 percent eU_3O_8 respectively.
Geology: Brecciated portions of a large quartz dike are anomalously radioactive. Iron staining and black (smoky) quartz are reported. The quartz dike cuts a granitic intrusive.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3617.

325. Sunrise claims

Location: Sec. 2(?), T. 6 N., R. 29 E.; exact location unknown.
Development: Several small pits, a 10-foot shaft, and a 10-foot drift.
Radioactivity: Background = 0.015 mR/hr.; High = 1.7 mR/hr. Samples contain as much as 0.80 percent eU_3O_8.
Geology: *Autunite* and an unidentified yellow-green uranium mineral are associated with small horses of carbonaceous shale which occur along a highly brecciated and altered zone between coarsely crystalline granite and rhyolitic volcanics.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3610.

326. Nevada Uranium No. 1 claim

Location: T. 6 N., R. 29 E.; exact location unknown.
Development: None(?).
Radioactivity: Background = 0.05 mR/hr.; High = 0.15 mR/hr.
Geology: A silicified rhyolite is slightly radioactive at this locality.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3627.

327. Relich prospect

Location: Sec. 26, T. 5 N., R. 27 E.; along Bodie-Aurora road where it crosses the Nevada-California boundary.
Radioactivity: Background = 0.03 mR/hr.; High = 0.11 mR/hr.
Geology: Radioactivity is apparently uniformly distributed in certain areas of rhyolite and rhyolitic tuff. No structures were reported.
References: Walker, Lovering, and Stephens, 1956, p. 34.

328. Northern Belle mine

Other names: Argentum mine
Location: Center, sec. 33, T. 4 N., R. 35 E. Projected from the east.
Development: A 1,365-foot-deep shaft and several miles of workings developed in mining of silver.
Radioactivity: (Underground): Background = 0.025 mR/hr.; High = 0.15 mR/hr.
Geology: Anomalous radioactivity was noted along an iron-stained seam on the 1,700-foot level. Highly oxidized manganiferous silver veins occur in shales of the Triassic Candelaria Formation throughout the workings.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3612; Ross, 1961, p. 81, table 6.2.

329. Lucky Susan No. 1 claim

Location: Sec. 35(?), T. 1 N., R. 32 E.
Development: Small pits and trenches.

MINERAL COUNTY, *continued*

Radioactivity: Background = 0.02 mR/hr.; High = 1.2 mR/hr.

Geology: *Samarskite* and *euxinite(?)* are present in pegmatite dikes which cut granitic rocks and older hornblende schist and gneiss.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3605; Ross, 1961, p. 76 and pl. 1; Olson and Adams, 1962; Staatz, 1964.

NYE COUNTY

Southern Shoshone Mountains

Three prospects in the general vicinity of Ione are slightly radioactive. Two are known to occur in the Bonita Canyon Formation (Bonham, 1970), and may be related to volcanic processes. The presence of fluorite and cinnabar at the Dottie Lee claim is especially suggestive of low-temperature mineralization, possibly due to sulfataric or fumarolic processes.

330. Idle Wild claims

Other names: Idlewild

Location: 3(?) or 4(?), T. 14 N., R. 39 E. (unsurveyed). Projected from west; exact location unknown.

Development: Reportedly, several prospect pits.

Radioactivity: Background = 0.04 mR/hr.; High = 0.11 mR/hr. A 6-foot horizontal chip sample contained 0.01 percent eU_3O_8.

Geology: Abnormal radioactivity reportedly occurs at the base of a welded tuff(?), near a 2-foot clay bed. The author was unable to find the locality in 1969.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3647.

331. Dottie Lee claim

Other names: Dotty Lee mines, Bonita Canyon prospect.

Location: Sec. 24, T. 14 N., R. 39 E. (unsurveyed). Located at the prospect symbol at the end of the Bonita Canyon road, South Shoshone Peak 15-minute topographic sheet.

Development: A 45-foot trench, several bulldozer cuts, and a 55-foot adit.

Radioactivity: Background = 0.017 mR/hr.; High = 0.25 mR/hr. Select samples reportedly contain up to 0.08 percent cU_3O_8.

Geology: Anomalous radioactivity is associated with purple fluorite in a crystal-poor, lithic, iron-stained ash-flow tuff of the Bonita Canyon Formation. The fluorite occurs in stringers, veins, and pods (fig. 23) up to 3 inches wide in the hanging wall of a fault that strikes N. 75° W. and dips 85° S. Fluorite comprises up to 3 percent of the rock near the fault. Cinnabar is present with the fluorite in some specimens, but is rare in the wall-rock. One sample contained 0.035 percent mercury. A nearby mercury (cinnabar) prospect occurs in the same ash-flow tuff, but no fluorite was noted. The purple coloration in the fluorite is apparently due to radiation damage, and disappears upon heating to 350° C. The writer inspected this property in 1969.

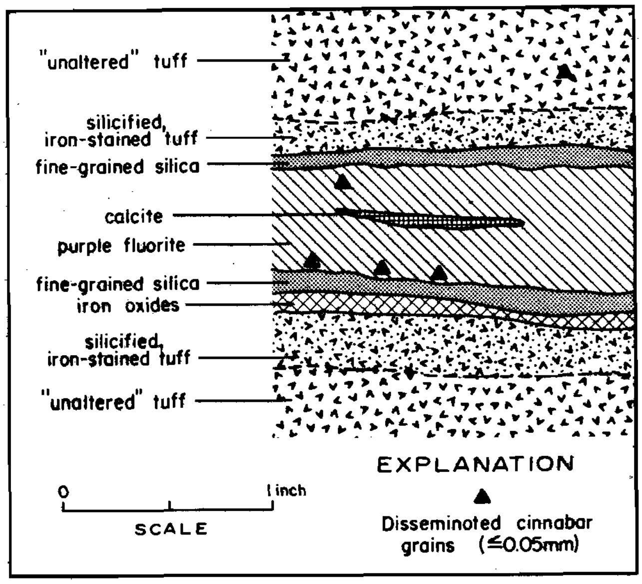

FIGURE 23. Generalized cross section of a fluorite vein at the Dottie Lee mine, Nye County.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3678; Bonham, 1970.

332. Hazel E prospect

Other names: Hazele

Location: Center, sec. 3, T. 13 N., R. 39 E. (unsurveyed). Located at approximately 8,100 feet elevation on a ridge northeast of the north fork of Idlewild Creek.

Development: Two small bulldozer cuts and more than half a mile of bulldozer road.

Radioactivity: Background = 0.025 mR/hr.; High = 0.1 mR/hr.

Geology: Radioactivity occurs across a 10-foot zone in a bleached rhyolitic welded tuff (The Bonita Canyon Formation) along a gouge and breccia zone associated with a

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fault that strikes N. 55° W., and dips 60° SW. A slight amount of iron-oxide staining is present. Bleaching and slight radioactivity (1.5 times background) extend along the fault for 100 feet.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3652; Bonham, 1970.

Lodi Mining District

Four radioactive occurrences have been reported in this mining district. The radioactivity is associated with precious and base metals in quartz veins, in shear zones in granodiorite, and along an intrusive contact with shales and limestones.

333. Smuggler mine

Location: Sec. 13(?), T. 13 N., R. 36 E.; 500 feet west of the Illinois mine.

Development: About 2,000 feet of adits and shafts.

Radioactivity: Background = 0.015 mR/hr.; High = 0.08 mR/hr.

Geology: Anomalous radioactivity is confined to dump material reportedly from a 90-foot shaft. The workings are along the contact between limestone and a granodiorite intrusive. Scattered lead, silver, and gold mineralization occurs along the contact. A trace of scheelite is also reported.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3679, 3699; Taylor, 1953b, p. 219; Kral, 1951, p. 95, 96.

334. Illinois mine

Location: Sec. 13(?), T. 13 N., R. 36 E. (unsurveyed). Projected from the east.

Development: A 1,000-foot shaft and numerous drifts.

Radioactivity: About four times background. Samples contain 0.01 percent eU_3O_8.

Geology: Very slightly anomalous radioactivity is reported from this property. The mine is on a northwesterly bearing vein system in limestone and shale of the Triassic Excelsior(?) Formation near and east of a granodiorite contact. Lead and silver minerals occur in the veins. Lamprophyre dikes of andesitic composition are often associated with the ore zones.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3686; Taylor, 1953b, p. 219; Kral, 1951, p. 95, 96.

335. Wonder Girl prospect

Location: Sec. 13(?), T. 13 N., R. 36 E. (unsurveyed). Projected from the east.

Development: Two small pits.

Radioactivity: Background = 0.02 mR/hr.; High = 0.08 mR/hr. A grab sample from a dump contained 0.03 percent uranium.

Geology: Anomalous radioactivity occurs in granodiorite along a quartz vein which strikes N. 69° W. and dips 64° SW. The vein is tabular, up to 3 feet wide, and can be traced for 150 feet. Galena, chalcopyrite(?), pyrite, and secondary lead, copper, and iron minerals are present in small amounts.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3680, 3701; Taylor, 1953b, p. 219.

336. "66" claim

Location: Sec. 13(?), T. 13 N., R. 36 E. (unsurveyed). Projected from the east.

Development: A 50-foot adit and a 15-foot winze.

Radioactivity: Background = 0.15 mR/hr.; High = 0.5 mR/hr.

Geology: *Pitchblende(?)* and an unidentified yellow uranium mineral occur in an argillized and sericitized shear zone in granodiorite. Pyrite and galena are also reported. The zone strikes N. 2° E., dips 63° E., and is 0.5 to 1 foot wide.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3702; Taylor, 1953b, p. 219.

Northumberland Area

Two uranium prospects are present in Paleozoic shales south of the Northumberland gold mine. No direct relationship with the gold mineralization is known, but the uranium deposits may have a zonal distribution with respect to the Northumberland mine.

337. Rainbow claims (nos. 1-20)

Other names: Air Anomaly No. 3, Valley View.

Location: Sec. 1(?), T. 12 N., R. 45 E. (unsurveyed). Projected from the west. Three miles S. 45° W. from the Northumberland mine.

Development: A 20-foot-deep shaft and several pits.

Radioactivity: Background = 0.05 mR/hr.; High = 0.5 mR/hr. Samples range from 0.047 to 0.388 percent cU_3O_8. Chemical assays are consistently from 10 to 30 percent

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higher than radiometric. Several spots of 5 times background radioactivity were found.

Geology: *Autunite* is concentrated along fractures and bedding-plane slips in a black, highly fractured, silicified Ordovician shale. Radioactivity persists to a depth of 17 feet, where it abruptly terminates at a low-angle, southward-dipping fault. The mineralized zone, which varies in thickness from 2 to 5 feet, dips about 45° S. and strikes eastward. The Rainbow claims, which are in the area of Air Anomaly No. 3, are reportedly 600 feet from the Valley View shaft.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3653; Meeham, Sharp, and Mallory, 1956.

338. Hazel No. 6 claim

Other names: Hazle

Location: T. 12 N., R. 45 E.; exact location unknown.

Development: Discovery and location pits.

Radioactivity: Background = 0.03 mR/hr.; High = 0.60 mR/hr. A chip sample contained 0.09 percent eU_3O_8 and a select(?) sample reportedly contained 0.12 percent eU_3O_8.

Geology: Minor amounts of *torbernite* and *autunite* occur along a fracture zone in steeply dipping, metamorphosed grey shales (Silurian?).

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3641.

Round Mountain-Belmont Area

Two main types of uranium occurrences are found in this area. *Autunite* or *torbernite* are commonly present. Occurrences are either in volcanic rocks or along linear features in granitic rock (faults, aplite dikes, quartz veins, etc.). Also, one *monazite*-bearing placer deposit is described. It is not known whether or not these deposits are genetically related. It may be significant that a variety of igneous rocks of varying ages contain occurrences of radioactive minerals. The source of some of the uranium is probably the intrusive rock. Possibly a higher than normal amount of uranium is present in the granitic rock especially along crystal boundaries. This uranium is easily removed by various types of fluids, and may be concentrated along fractures, dikes, etc. Meeham, Sharp, and Mallory (1956) report that the uranium mineralization in the Round Mountain and Belmont area is present along north-trending fissures in the quartz monzonite intrusive. They also note that these fissures are

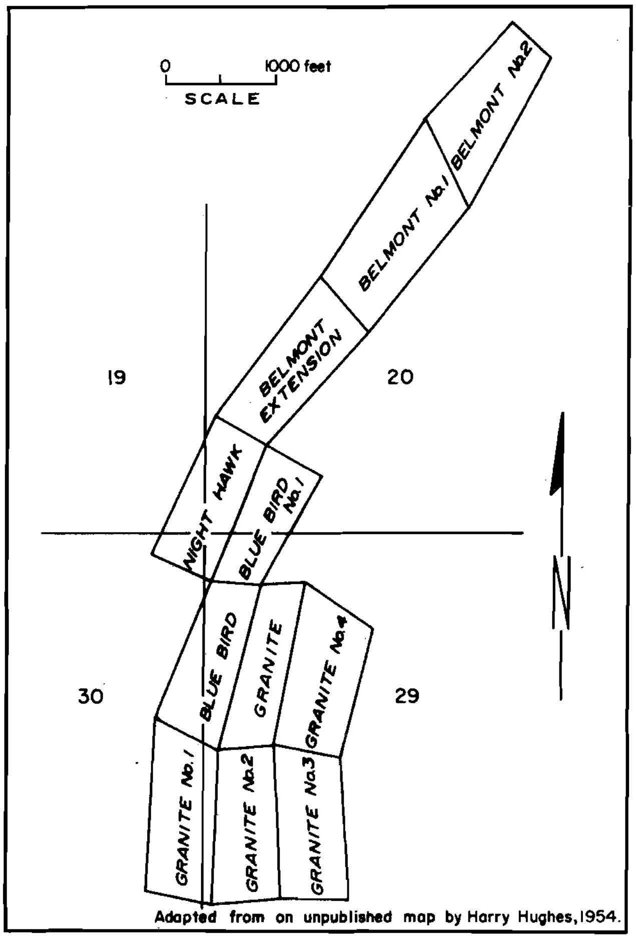

FIGURE 24. Map of uranium claims in the Belmont area, Nye County.

parallel to major joint systems, and can be distinguished by anomalous radioactivity, silica, and altered wall rock. Figure 24 shows the location of several claims in the Belmont area.

339. Air Anomaly No. 4

Other names: Hard Scrabble.

Location: Sec. ?, T. 11 N., R. 45 E. (unsurveyed). One mile south of Moore Creek road, 0.5 mile north of the head of Red Rock Canyon.

Development: Blasting of mineralized vertical exposure.

Radioactivity: Background unknown; High = 3.0 mR/hr. Samples range from 0.04 to 0.13 percent eU_3O_8 (0.05 to 0.18 percent cU_3O_8).

Geology: *Autunite* and radioactive fluorescent opal occur along a vertical breccia zone in Tertiary ash-flow tuffs. The breccia zone trends northeast.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3654; Meeham, Sharp, and Mallory, 1956.

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340. Round Meadow Canyon area

Other names: Western Uranium Corp.
Location: Sec. 15(?), T. 10 N., R. 45 E.
Geology: Anomalous radioactivity has been reported in ash flow tuffs from this area.
References: Unpublished report by Harry H. Hughes.

341. Pine goup (5 claims)

Location: Sec. 16(?), T. 10 N., R. 44 E.; exact location uncertain.
Development: A 30-foot-deep shaft.
Radioactivity: Background = 0.05 mR/hr.; High = 0.5 mR/hr.
Geology: *Torbernite* coats fractures in an altered rhyolite at the bottom of the shaft.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3677.

342. Bey group (27 claims)

Location: Sec. 21(?) or 22(?), T. 10 N., R. 44 E.; 1.5 miles east of Round Mountain, 0.1 mile north of the road.
Development: Bulldozer cuts and an 8-foot-deep pit.
Radioactivity: Background = 0.025 mR/hr.; High = 0.20 mR/hr. A select sample contained 0.03 percent eU_3O_8.
Geology: *Autunite* occurs along fracture planes in a granitic intrusive.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3663.

343. N & H group

Location: Sec. 27(?), T. 10 N., R. 44 E. (unsurveyed). Prospect may be in section 23.
Development: North adit, 703 feet of workings; east adit, 105 feet of workings. Previously worked for tungsten.
Radioactivity: Background = 0.03 mR/hr.; High = 0.15 mR/hr. (east adit). Select samples contain 0.005 and 0.01 percent eU_3O_8.
Geology: *Autunite* occurs as coatings on fracture planes in Jurassic(?) granitic rock. Wolframite and hubnerite are present in quartz veinlets.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3662.

344. 4 Aces and Joker claims

Other names: Joker and Ace claims(?).
Location: Sec. 27(?), T. 10 N., R. 44 E.; exact location uncertain.
Development: A 15-foot shaft.
Radioactivity: Background = 0.02 mR/hr.; High = 0.35 mR/hr. Three- to 4-foot chip samples contain 0.01 to 0.03 percent eU_3O_8.
Geology: *Autunite* occurs along fracture planes and disseminated in quartz monzonite. Radioactivity has also been noted in nearby rhyolite dikes and in shear zones in Tertiary volcanic rocks.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3660, 3685; King and Roberts, 1954a.

345. "Round Mountain area"

Other names: Red Top claim.
Location: Sec. 29(?), T. 10 N., R. 44 E.; location uncertain.
Geology: Placer gravels in a wash reportedly contain rhyolite fragments and granite wash with a little hubnerite and *monazite*, together with rare specks of native copper.
References: Lovering, 1954; Kral, 1951.

346. Violet Blue prospect

Location: Sec. 29(?) or 28(?), T. 10 N., R. 44 E.; one mile northeast of the Henebergh Tunnel, just off Shoshone Canyon.
Development: A 160-foot adit (in search of tungsten).
Radioactivity: Select samples reportedly contain up to 0.2 percent U_3O_8.
Geology: Old workings for tungsten (as huebnerite) followed a shear zone in the granite. *Autunite* is reportedly present.
References: Kral, 1951, p. 154, 155.

347. Henebergh Tunnel

Other names: Heneberg Tunnel, Rainbow claims (nos. 1-7), Round Mountain area, Henebergn Tunnel, Hendenberg Tunnel.
Location: Secs. 31, 32, T. 10 N., R. 44 E.
Development: Six open cuts, a 320-foot adit, a 40-foot raise, and a 200-foot winze.
Radioactivity: (Underground): Background = 0.02 mR/hr.; High = 1.5 mR/hr. Select samples here reportedly assayed up to 0.16 percent U_3O_8, but chip and grab samples do not contain more than 0.05 percent U_3O_8.

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Geology: *Autunite* occurs in an altered aplite dike that can be traced for approximately 2,000 feet along a N. 55° E. fault zone in Cretaceous granite (73 to 107 million years). The dike is 5 to 6 feet wide and dips vertically or steeply southeast (fig. 25). The aplite is almost completely altered to clay minerals, and contains iron oxides and *autunite* along fracture surfaces.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3655, 3710; Davis, 1954; King and Roberts, 1954a; Mining Jour., 1946; Kral, 1951, p. 154; Mining and Ind. News, 1948a; Eng. and Mining Jour., 1946, 1950c.

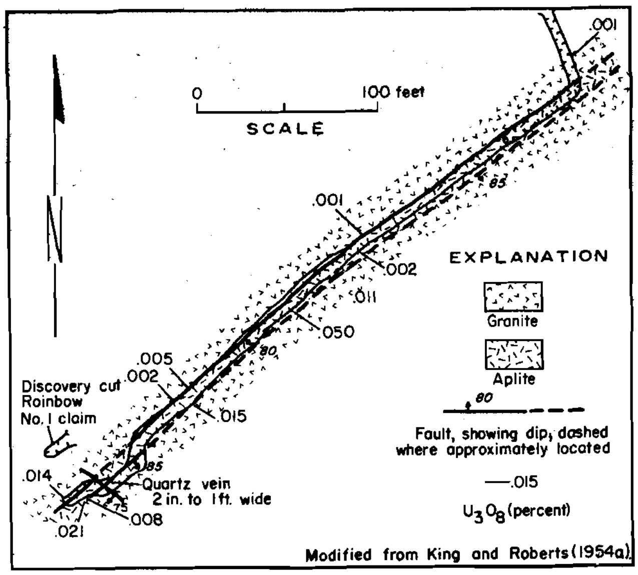

FIGURE 25. Geologic map of the Henebergh tunnel, Nye County.

348. Green Top claim

Location: Sec. 6(?), T. 9 N., R. 44 E.; about 1 mile southwest of the Henebergh Tunnel.

Development: One shallow shaft.

Radioactivity: A grab sample contained 0.014 percent U_3O_8, 87 ounces per ton silver, and 0.66 percent copper.

Geology: Anomalous radioactivity is associated with a 1- to 2-foot-wide quartz vein which strikes N. 50° E. and dips 50° SE. Copper oxides and silver mineralization are present. The wall rock is granite.

References: King and Roberts, 1954a.

349. Blue Bird No. 1, Granite, and Nighthawk claims

Other names: Red Hill claim, Granate, Night Hawk.

Location: Secs. 20, 29, T. 9 N., R. 45 E.

Development: Several pits, a 155-foot adit, and a shaft.

Radioactivity: Background = 0.015 mR/hr.; High = 1.2 mR/hr. A 3.2-foot channel sample contained 0.05 percent eU_3O_8 (0.058 percent cU_3O_8). Select samples contain up to 0.3 percent eU_3O_8.

Geology: Anomalous radioactivity, *autunite,* and *torbernite* occur along north- and northeast-trending altered fracture zones in a quartz monzonite intrusive. The radioactive minerals are found along fracture planes and disseminated in the altered wallrock.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3661, 3638, 3639.

Troy Mining District

Anomalous radioactivity is reported to be associated with precious and base metal mineralization in quartzite at two mines in this district.

350. Shoe-Shoe mine

Other names: Shoe

Location: Sec. 33, T. 6 N., R. 57 E. (unsurveyed). Projected from the west.

Development: Extensive underground workings for gold and silver in the late 1800's.

Radioactivity: Background = 0.02 mR/hr.; High = 3.5 mR/hr. A chip sample contained 0.19 percent cU_3O_8.

Geology: Anomalous radioactivity is associated with heavy iron-oxide coatings along a vein in a fault zone in quartzite near the contact with a quartz monzonite intrusive. Minor amounts of lead, zinc, silver, and gold are reported.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3644.

351. First Strike prospect

Location: Sec. 33, T. 6 N., R. 57 E. (unsurveyed). Projected from the west. Old workings 2,000 feet south of Troy site.

Development: Numerous caved workings for silver and gold.

Radioactivity: Background = 0.035 mR/hr.; High = 2.5 mR/hr. (underground). One-foot and 2-foot chip samples contained 0.062 and 0.288 percent eU_3O_8. Gold and silver values were also reported.

NYE COUNTY, *continued*

Geology: Anomalous radioactivity is reported from an inclined shaft which explores a fault zone separating quartzite from altered quartz monzonite. Iron and manganese oxides, quartz, and gypsum are present.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3649.

Tonopah Area (Nye County)

Thirteen separate radioactive localities in the Siebert Tuff(?) are known in Nye County near Tonopah (fig. 26). A greater number of similar occurrences are present just to the south, in Esmeralda County. These are described in the section *Esmeralda County.*

The following radioactive localities were grouped together into five descriptions because of their distribution and similarity. All occur in shales or sandstones of the Siebert Tuff(?), and uranium minerals are very rare or absent. Many prospects are in some manner related to north-trending faults. However, beds in this area often strike north-south, and the distinctive alignment obvious in figure 26 may be in part due to occurrences within the same stratigraphic interval.

352. Bobby-Jack, Jeep, and Lincoln groups

Other names: Roan group, La Salle claims, Uranium claims; Localities U-26, 27, 28, 31, 36.

Location: N½ sec. 6, R. 3 N., R. 42 E., and W½ sec. 31, T. 4 N., R. 42 E.

Development: Numerous trenches and bulldozer cuts.

Radioactivity: Background = 0.010 to 0.012 mR/hr.; Maximum = 0.13 mR/hr. One sample contains 0.13 percent cU_3O_8.

Geology: At least five anomalous radioactive areas a few tens to a few hundreds of square feet in area are present in Mio-Pliocene tuffaceous lake beds of the Siebert Tuff(?). These areas are aligned along a 1-mile north-south trend which is probably a fault. Anomalies are usually to the east of this fault or within it (in the footwall side). However, at individual prospects, radioactivity is apparently associated with irregular areas in certain tuffaceous sandstones and shales. Iron-oxide staining was noted in some areas. Samples of calcareous tuff reportedly from one locality contained minor amounts of *autunite,* occurring as small, disseminated flakes. The author did not find any uranium minerals during a 1969 visit.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3666, 3668; Finch, 1967; Davis and Hetland, 1956, p. 352.

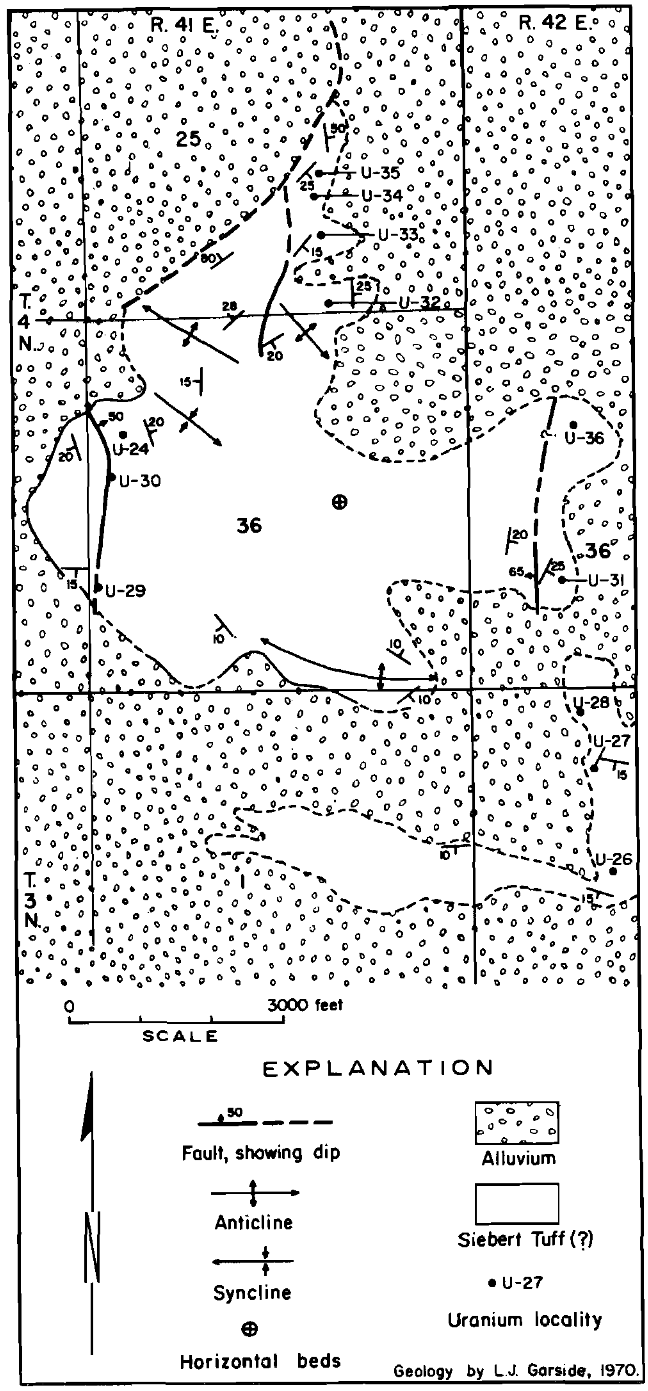

FIGURE 26. Uranium occurrences in the Tonopah area, Nye County.

353. Foster group

Other names: Localities U-24, U-29, U-30; Atlas group.

Location: W½ sec. 36, T. 4 N., R. 41 E.

Development: Several shallow pits, extensive bulldozer scraping, and several shallow drill holes.

NYE COUNTY, *continued*

Radioactivity: Background = 0.015 to 0.025 mR/hr.; High = 0.17 to 0.21 mR/hr. Surface samples reportedly contain 0.021 and 0.028 percent eU_3O_8.

Geology: Three radioactive anomalies (U-24, 29, and 30) lie in or just to the west of a near vertical fault that strikes N. 15° E. in Mio-Pliocene lacustrine sedimentary rocks (Siebert Tuff?). This fault separates sandstones on the east from shales on the west. On the Atlas group (U-24) the radioactivity is localized in the foot wall of the fault (fig. 27), for a distance of 300 to 400 feet. Radioactivity at the other two anomalies is localized by minor east-west or northwest faults. Most radioactive areas are in fine-grained paper shales and siltstones, but at U-29 a few occur in sandstone units. The author visited this locality in 1969.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3669.

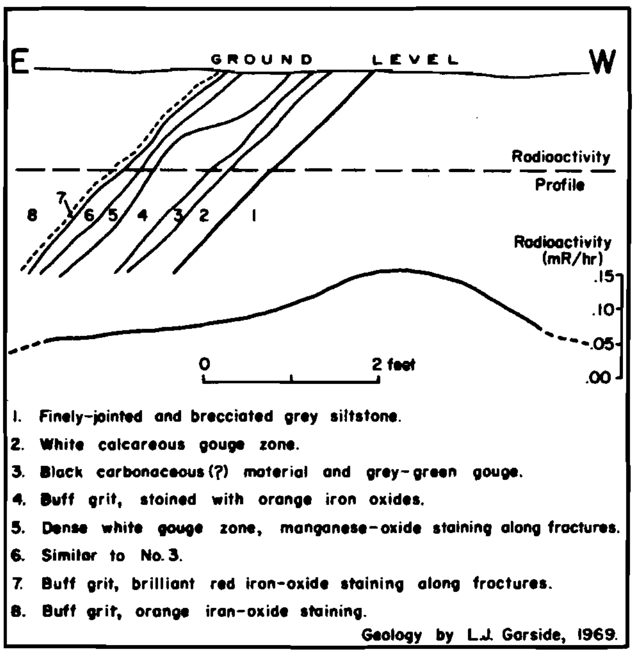

FIGURE 27. Cross section of a fault zone exposed in a prospect pit at Locality U-24, Nye County.

354. Localities U-32, 33, 34, 35

Location: SE¼ sec. 25, T. 4 N., R. 41 E.

Development: Several bulldozer trenches.

Radioactivity: Background = 0.02 mR/hr.; High = 0.09 to 0.17 mR/hr.

Geology: Four radioactive localities occur in a north-south line about half a mile long. No single structure was noted connecting these prospects. Two occurrences (U-32, U-33) are in light colored shales and siltstones. Sandstone beds present are not radioactive. The other two localities are in buff sandstone, and in one case the radioactivity is associated with calcareously cemented concretions. All four prospects may be in the same stratigraphic interval in lacustrine and fluvatile Mio-Pliocene sedimentary rocks (Siebert Tuff?). This locality was described by the author in 1969.

355. Locality U-37

Location: NE¼SE¼ sec. 16, T. 3 N., R. 42 E.

Development: A bulldozer cut.

Radioactivity: Background = 0.035 mR/hr.; High = 0.11 mR/hr.

Geology: A very small area of radioactivity was noted in a tuffaceous shale bed by the author in 1969.

356. Bernice Anderson property

Location: Sec. 3(?), T. 2 N., R. 42 E.; exact location unknown.

Development: None(?)

Radioactivity: Background = 0.07 mR/hr.; High = 0.27 mR/hr. An area of about 100 square feet registered 0.15 mR/hr.

Geology: Anomalous radioactivity is reported from tuffaceous lake beds of the Siebert Tuff. The author was unable to find this locality in 1969 and 1970.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3646.

Bullfrog Mining District

Four uranium prospects in the Bullfrog mining district occur in Tertiary rhyolitic volcanic rocks (probably welded tuffs). Gold-silver veins are also present in these rocks, but the relationship of the uranium occurrences to the precious metal mineralization is not known.

357. Red Dog No. 3 prospect

Location: Sec. 26, T. 11 S., R. 46 E.; 1,000 feet north of the Black Bonanza claims.

Development: Old prospect pits.

Radioactivity: Background = 0.013 mR/hr.; High = 0.3 mR/hr.

Geology: Anomalous radioactivity and iron oxide occur along a fracture in tuff and rhyolite. The fracture trends N. 10° W. and dips 60° W.

NYE COUNTY, *continued*

References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3659.

358. Black Bart Extension claim; Black Bonanza claims (nos. 1-27)

Location:	Sec. 26, T. 11 S., R. 46 E.
Production:	An experimental shipment of ore was reported from the Black Bonanza claims in 1956.
Development:	One prospect pit, and an 85-foot adit.
Radioactivity:	Background = 0.025 mR/hr.; High = 1.0 mR/hr. A grab sample contained 0.024 percent cU_3O_8.
Geology:	Radioactivity is associated with silicified fault breccias along north-trending faults in a Tertiary rhyolite(?). *Uranophane* and *autunite* have been reported.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3650, 3667, 3676.

359. National Bank group

Location:	NW¼NW¼ sec. 15, T. 12 S., R. 46 E.; 500 feet south of the National Bank gold mine.
Development:	One bulldozer trench.
Radioactivity:	Background = 0.01 mR/hr.; High = 0.25 mR/hr. A select sample contained 0.021 percent cU_3O_8.
Geology:	Anomalous radioactivity occurs along a fault cutting a Tertiary rhyolitic ash-flow tuff.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3648; Cornwall, 1972.

360. Virginia Lode claim (patent no. 2487)

Other names:	Gilbralter mine.
Location:	Center, N½ sec. 16, T. 12 S., R. 46 E.
Development:	Nearby gold-silver workings.
Radioactivity:	Background = 0.015 mR/hr.; High = 0.15 mR/hr.
Geology:	Anomalous radioactivity occurs along a fracture zone in a rhyolitic ash-flow tuff. The zone trends N. 25° E. and dips 80° SE. Surface radioactivity is confined to an area 1 foot long and 3 in. wide.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3658.

Fluorine Mining District

Radioactivity was noted at two fluorite mines in this district. The fluorite mineralization is probably related to Tertiary volcanic activity.

361. Daisy fluorspar mine

Other names:	Beatty fluorspar mine, Crowell mine.
Location:	Sec. 23, T. 12 S., R. 47 E.
Development:	Extensive underground developments by shafts, crosscuts and drifts to a depth of over 400 feet (for fluorite).
Radioactivity:	(Underground): Background = 0.015 mR/hr.; High = 0.07 mR/hr. Purple fluorite samples contain up to 0.02 percent eU_3O_8.
Geology:	Slightly anomalous radioactivity occurs with purple earthy fluorite in a series of pipes, irregular bodies, and veins with pipe-like shoots, in a zone of chaotic structure associated with a large thrust fault. The pipes are localized in crackled zones in dolomite of the Cambrian Nopah Formation. Some tabular bodies are as much as 350 feet long and 250 feet high. Fine crystals of cinnabar in calcite vugs are locally abundant. Ore solutions are believed to have been derived from a nearby chamber of Tertiary rhyolite magma that also erupted a considerable volume of flows, ash flows, and tuffs.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3671, 3681, 3703, 3704; Chesterman and Main, 1954; Taylor, 1953b, p. 220; Thurston, 1949; Horton, 1961; Cornwall, 1972.

362. Butler prospect

Location:	Sec. 22, T. 12 S., R. 47 E.
Development:	A 20° inclined shaft about 100 feet long (for fluorite).
Radioactivity:	Background = 0.06 mR/hr.; High = 0.25 mR/hr.
Geology:	Anomalous radioactivity occurs with fluorite in a Cambrian limestone. The limestone has been cut by fractures which trend N. 70° W. and dip 80° SW. Silicification and iron staining are also present.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3711.

Other Nye County Occurrences

363. Ultra Mining Co. group (nos. 1-16)

Location:	SE¼ sec. 10, T. 15 N., R. 48 E. (unsurveyed). Projected from the west.
Development:	Location pits.
Radioactivity:	Background = 0.03 mR/hr.; High = 0.08 mR/hr.
Geology:	Very slightly anomalous radioactivity is associated with altered zones, joints, and fractures in extrusive volcanic rocks. Iron

NYE COUNTY, *continued*

and manganese oxides are reported.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3469.

364. Nyemin claims (nos. 1 and 2)

Location: Sec. 8, T. 12 N., R. 34 E.
Development: One trench and two small pits.
Radioactivity: Background = .04 mR/hr.; High = 1.00 mR/hr. A chip sample assayed 0.33 percent eU_3O_8.
Geology: *Autunite* and an unidentified canary-yellow, earthy uranium mineral occur along a silicified fracture zone in a rhyolitic tuff. The structure strikes N. 80° E. and dips 60° S. The uranium minerals are present in veinlets and along fracture planes.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3643.

365. Thor claims (nos. 1-3)

Other names: Roberts group, Currant area claims.
Location: Sec. 12(?), T. 10 N., R. 57 E.
Development: One pit and a 75-foot inclined shaft.
Radioactivity: Background = 0.01 mR/hr.; High = 0.1 mR/hr. A 3-foot channel sample contained 0.11 percent cU_3O_8.
Geology: Anomalous radioactivity is present along a N. 19° E., 65° W. fault zone in a Tertiary rhyolite. The highest radioactivity is found near the surface, and is associated with limonite coatings on fracture surfaces. *Autunite* was reported from one locality.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3683, 3689, 3690, 3709; Davis, 1954.

366. Lime Ridge group (nos. 1-50)

Location: NW¼ sec. 25, T. 10 N., R. 51 E.; about 0.8 mile north of Moore's Station.
Development: A 30-foot shaft.
Radioactivity: Background = 0.02 mR/hr.; High = 0.20 mR/hr. Samples contain up to 0.02 percent U_3O_8. Assays up to 0.13 percent eU_3O_8 (0.144 percent cU_3O_8) are reported.
Geology: *Autunite* and iron oxides are reported from Tertiary ash-flow tuffs and sediments, probably the Shingle Pass Tuff.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3642.

367. 6-Mile claims (nos. 1-11)

Location: NE¼(?) sec. 28, T. 10 N., R. 51 E.
Development: Bulldozer trenches.
Radioactivity: Background = 0.02 mR/hr.; High = 0.20 mR/hr. Samples contained 0.02 percent U_3O_8. Higher assays are reported.
Geology: *Torbernite* and *autunite* are reported from Paleozoic shales.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3642.

368. Manhattan mining district

Location: Center, T. 8 N., R. 43 E.
Geology: A *monazite*-bearing placer has been reported in the district.
References: Lovering, 1954.

369. Unnamed occurrence

Location: NW¼, T. 8 N., R. 42 E.
Geology: An air anomaly is reported from this area.

370. Williams property

Location: Sec. 24(?), T. 8 N., R. 40 E. Exact location unknown.
References: U. S. Atomic Energy Comm. unpublished map.

371. Pilot group, U-O Dome claims (nos. 1-10)

Location: Sec. 12(?), T. 4 N., R. 44 E.; exact location unknown.
Development: Several pits and trenches.
Radioactivity: Background = 0.015 mR/hr.; High = 0.06 mR/hr.
Geology: Fractured rhyolitic flows reportedly contain anomalous radioactivity. The author was unable to find this locality in 1969.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3664.

372. Rex No. 33 claim

Location: S½ sec. 1, T. 3 S., R. 43 E.
Radioactivity: Background = 0.015 mR/hr.; High = 0.075 mR/hr.
Geology: Anomalous radioactivity occurs in a crush zone in a dacite(?).
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3656.

NYE COUNTY, *continued*

373. Bunker-Stone No. 1 claim

Location: Sec. 18(?), T. 17 S., R. 54 E.
Development: Old prospect pits on copper shows.
Radioactivity: Background = 0.02 mR/hr.; High = 2.0 mR/hr.
Geology: Abnormal radioactivity occurs at one location, in a 1 square foot area near intersecting fractures in the Cambrian Sterling Quartzite. Copper and iron oxides are present, as well as visible yellow uranium minerals.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3651.

PERSHING COUNTY

Several of the occurrences here reported in Pershing County have only very slight radioactivity. These were described in the interest of completeness, and because of their possible relationship to other, more radioactive properties.

Nightingale Mountains and Selenite Range

The nine prospects included in this group all occur in the Nightingale Mountains or the southern end of the Selenite Range. Although they are of more than one type and are located over a large area, they have certain characteristics in common. Many contain colored, secondary uranium minerals, and all occur in sedimentary rocks near granitic or pegmatitic bodies or within these intrusive rocks themselves.

374. Two Chuckers group (nos. 1-3)

Other names: Two chukkars
Location: Sec. 18(?), T. 25 N., R. 25 E.
Development: None(?).
Radioactivity: Background = 0.02 mR/hr.; High = 0.5 mR/hr. Select samples contain 0.23 percent eU_3O_8 (0.279 cU_3O_8).
Geology: A yellow uranium mineral occurs as fracture coatings in a basalt(?) dike which cuts granite.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3723.

375. Sage Hen Springs, Uranium Lode claims

Location: Secs. 6, 7, T. 25 N., R. 25 E.
Development: One 6-foot-deep pit.
Radioactivity: Background = 0.02 mR/hr.; High = 1.5 mR/hr. A sample contained 0.26 percent cU_3O_8.
Geology: *Uranophane(?)* and uraniferous hyaline opal are associated with intricate and complex, limonite-filled, easterly trending fractures in a quartzite. High radioactivity is present along a 2- to 3-foot zone. A pegmatite dike crops out a few feet away.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3720.

376. Four Jacks claims and Pennies claims (about 70 claims), Maybeso prospect

Other names: Dart mine(?).
Location: S½ sec. 10, T. 26 N., R. 24 E.
Development: Numerous bulldozer trenches and prospect pits.
Radioactivity: Background = 0.038 mR/hr.; High = 1.7 mR/hr.
Geology: *Autunite* and *phosphuranylite(?)* are found in grey schists and quartzites along and within several pegmatite dikes. The metamorphic rocks occur as scattered roof pendants in a Cretaceous(?) granitic intrusive. Uranium minerals occur along joints and fractures, mainly in the metamorphic rocks. Mineralization usually extends 4 to 6 feet outward from the dikes, with slightly anomalous radioactivity extending somewhat further. Radioactivity was noted for over 50 feet along the strike of one dike. Many of the pegmatite dikes are bleached and partially altered to clay minerals. The writer visited this area in 1969.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3729.

377. Poncho group (2 claims), Butch group (7 claims), Doris claim

Location: N½ sec. 10(?), T. 26 N., R. 24 E.
Development: Several pits and trenches.
Radioactivity: Background = 0.03 mR/hr.; High = 0.5 mR/hr. A select sample contained 0.055 percent eU_3O_8.
Geology: *Autunite* is present along fractures and bedding planes in shales, phyllites, and schists which occur as roof pendants in a Cretaceous(?) granitic intrusive.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3728.

PERSHING COUNTY, *continued*

378. Big Question claim

Location: Sec. 3, T. 26 N., R. 24 E.
Radioactivity: Background = 0.02 mR/hr.; High = 0.045. A sample reportedly from this property contained 0.154 percent cU_3O_8.
Geology: Slightly anomalous radioactivity is reportedly associated with pegmatites and altered granitic rock.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3733.

379. Jack group (18 claims)

Location: Sec. 1(?), T. 27 N., R. 24 E.
Development: Location pits.
Radioactivity: Background = 0.03 mR/hr.; High = 0.15 mR/hr. Two select samples contain 0.1 percent U_3O_8.
Geology: A yellow, powdery uranium mineral reportedly occurs in association with a highly altered pegmatite dike.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3725.

380. Kimbo group

Other names: Limbo
Location: SW¼ sec. 9, T. 28 N., R. 24 E.
Development: Three shallow pits.
Radioactivity: Background = 0.03 mR/hr.; High = 0.20 mR/hr.
Geology: Pegmatite and quartz dikes cut granitic rocks. The anomalous radioactivity is probably associated with the pegmatites.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3727.

381. Black Granite group (nos. 1-12), Willow group (nos. 1-19)

Location: SW¼ sec. 4, T. 28 N., R. 24 E.
Development: Several cuts.
Radioactivity: Background = 0.03 mR/hr.; High = 0.05 mR/hr.
Geology: Very slight radioactivity is associated with pegmatite and rhyolite dikes in granite.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3726.

382. Unnamed airborne anomaly

Location: Sec. 21 or 28, T. 30 N., R. 24 E.
Radioactivity: Background = 0.01 mR/hr.; High = 0.03 mR/hr.
Geology: Granite is very slightly radioactive at this locality. The anomaly can probably be attributed to normally higher background over igneous terrain.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3724.

Other Pershing County Occurrences

383. Scossa mining district

Location: Sec. 10(?), T. 33 N., R. 30 E.; exact location uncertain.
Radioactivity: Background = 0.02 mR/hr.; High = 0.05 mR/hr.
Geology: Very minor radioactivity has been reported in sandstone from the Scossa mining district.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3735.

384. Majuba Hill mine

Other names: Majuba Hills mine.
Location: Sec. 2, T. 32 N., R. 31 E.
Development: Three adit levels including over 5,000 feet of interconnected workings. Most of the development work resulted from the exploration for copper and tin.
Radioactivity: A 3-foot-wide vein is estimated to average 0.3 percent U_3O_8, and the adjacent 15 feet of wall rock averages 0.1 percent U_3O_8.
Geology: Majuba Hill is a complex Tertiary rhyolite dome which intrudes Triassic(?) argillites, quartzites, and impure limestones. Three types of rhyolitic intrusive rocks are present, and dikelike bodies of chaotic breccias occur throughout the plug. These breccias contain fragments of the surrounding sedimentary rocks as well as the two older types of rhyolite. Both the rhyolites and older rocks have been locally tourmalinized, sericitized, and silicified. *Metazeunerite* occurs in a copper- and tin-bearing vein, in the rhyolite porphyry adjacent to the vein, in fault gouge, in tourmalinized intrusion breccia, and in rhyolite and rhyolite porphyry adjacent to the breccia. The vein, which contains the highest grade uranium, is 3 feet wide and contains chalcocite, pyrite, arsenopyrite, and cassiterite. Elsewhere, the *metazeunerite* occurs with numerous secondary copper minerals, cassiterite, tourmaline, and iron oxides. Fluorite is reported present in some tin-bearing veins.

PERSHING COUNTY, *continued*

Trites and Thurston (1958) include a composite level and assay map of the mine.

References: Thurston and Trites, 1954; Stugard, Wyant, and Gude, 1952; Trites and Thurston, 1958; Thurston and Trites, 1952; McKelvey, 1957; Smith and Gianella, 1942; Matson, 1948.

385. Stalin's Present prospect

Other names: Rocky Canyon prospect.
Location: Sec. 6, T. 29 N., R. 34 E.
Development: A small pit and trench, a 63-foot adit, and a 47-foot winze.
Radioactivity: Select samples contain up to 0.7 percent eU_3O_8, and a channel sample across the "vein" contained 0.07 percent cU_3O_8.
Geology: Radioactivity occurs in and along a 4- to 10-inch-wide zone in a light-grey granitic rock. The mineralized structure trends north and dips steeply to the east. This zone is a dark green "vein-like" body composed of hornblende, diopside, chlorite, biotite, epidote, quartz, dark calcite, *pitchblende,* and *gummite(?).* An intrusive contact with metasedimentary rocks is nearby, and the mineralized body may be a metamorphosed calcareous zenolith. Underground workings are shown in figure 28.

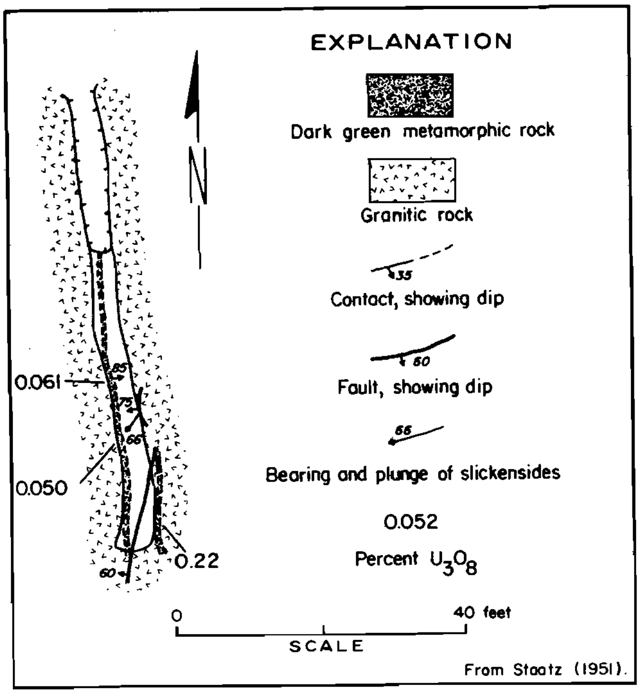

FIGURE 28. Geologic map of the adit, Stalin's Present prospect, Pershing County.

References: Staatz, 1954; Anderson and others, 1952; King, Moore, and Hinrichs, 1952; Taylor, 1952, p. 236; McKelvey, 1957; Staatz, 1951.

386. Vernon and Snowstorm claims

Location: Sec. 2, T. 29 N., R. 28 E.
Development: Prospect pit and a 60- to 70-foot inclined shaft.
Radioactivity: Background = 0.02 mR/hr.; High = 0.04 mR/hr. A sample reportedly from this prospect submitted to the Atomic Energy Commission contained 1.026 percent cU_3O_8 and 2.6 percent WO_3.
Geology: Radioactivity is reportedly present along an east-west shear zone which dips 75° N. The shear is in limestone near a granite contact. Scheelite, quartz, iron-oxides, and molybdenite are reported.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3722.

387. Jackpot claims (nos. 1-8)

Location: Sec. 10(?), T. 28 N., R. 29 E.; exact location uncertain.
Development: Location pits.
Radioactivity: Background = 0.015 mR/hr.; High = 0.030 mR/hr.
Geology: Very slight radioactivity is reported from volcanic flows and tuffs.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3721.

388. Teacup claims (nos. 1-32)

Location: Sec. 24(?), T. 28 N., R. 29 E.; exact location uncertain.
Development: Location pits.
Radioactivity: Background = 0.015 mR/hr.; High = 0.030 mR/hr.
Geology: Very slight radioactivity is reported in volcanic rocks.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3721.

389. Lincoln Hill mine

Other names: Fairhauen, Fairhaven.
Location: Sec. 18, T. 28 N., R. 34 E.
Development: Extensive old workings for precious metals.
Radioactivity: Background = 0.07 mR/hr.; High = 1.0 mR/hr.

PERSHING COUNTY, *continued*

Geology: Anomalous radioactivity occurs along a fault zone in rhyolite. Several nearby faults are slightly radioactive.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3736.

390. C. L. Point group (nos. 1-32)

Location: Secs. 10, 11, T. 28 N., R. 37 E.

Radioactivity: Background = 0.015 mR/hr.; High = 0.04 mR/hr.

Geology: Very slight radioactivity noted in a granitic intrusive near the contact with shales.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3722.

391. Long Lease

Other names: Long Tungsten mine.

Location: Sec. 33, T. 26 N., R. 32 E.

Development: Surface cuts and pits, and 620 feet of drifts and adits. Workings are for tungsten.

Radioactivity: Background = 100(?) cps; high = 900 cps. The best sample assayed 0.11 percent U_3O_8, but many samples contained only 0.01 to 0.05 percent eU_3O_8. Chemical analyses were slightly higher than radiometric.

Geology: In the mine area, Triassic limestones and shales have been intruded by a quartz monzonite stock (fig. 29). The limestones have been recrystallized to marble, and the argillaceous beds changed to hornfels and blocky argillites. Scheelite-bearing bodies occur along the intrusive contact. *Uraninite* and *allanite* are associated with pyrite and molybdenite in small zones of silicification within the tactite. *Uraninite* is the main radioactive mineral, but *allanite* reportedly occurs intergrown in a zonal arrangement with epidote.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3737, 3737a; Davis, 1954.

STOREY COUNTY

392. Hill and Burgner prospect

Location: Sec. 33, T. 19 N., R. 21 E.

Development: About 400 feet of bulldozer cuts.

Radioactivity: Background = 0.02 mR/hr.; High = 0.7 mR/hr.

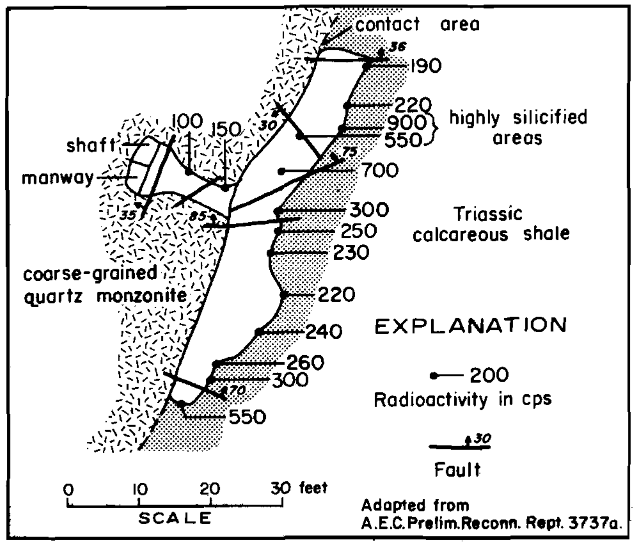

FIGURE 29. Geologic map and radiometric survey of the lower level, south adit of the Long Lease mine, Pershing County.

Geology: Anomalous radioactivity occurs along nearly vertical fractures which trend N. 10° E. The radioactivity occurs over a wide area in an opalized tuff. Cinnabar and iron oxides were noted. This locality is north of the Washington Hill mercury mine.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3756.

WASHOE COUNTY

Northern Washoe County

Only four radioactive prospects are reported from the northern part of Washoe County. Three of these occur in Tertiary sedimentary rocks, and one is poorly described. Other areas of uranium mineralization may be present near the described localities, but the author is unaware of any.

393. Hog Ranch occurrence

Other names: Locality No. 6.

Location: Sec. 7, T. 38 N., R. 23 E.; sections projected from the north. Prospect is along Hog Ranch Creek.

Geology: Slightly anomalous radioactivity has been reported from petrified wood in late Miocene sedimentary rocks (oral communication, H. F. Bonham).

References: Bonham, 1969.

WASHOE COUNTY, *continued*

394. Locality No. 7

Location: Sec. 33(?), T. 38 N., R. 23 E. Projected from the north. Occurrence is south of Nevada Highway 34.
Geology: Abnormal radioactivity occurs in a large amount of petrified wood in late Miocene sedimentary rocks (oral communication, H. F. Bonham).
References: Bonham, 1969.

395. Happy Day property

Location: Sec. 36(?), T. 37 N., R. 22 E. Exact location unknown.
Geology: The prospect may be in the Oligocene South Willow Formation.
References: U. S. Atomic Energy Comm. unpublished map; Bonham, 1969, pl. 1.

396. Locality No. 10

Location: Sec. 7, T. 35 N., R. 23 E.
Geology: Uranium mineralization occurs in sedimentary beds in the Oligocene South Willow Formation. The occurrences appear to be spatially related to a rhyolite plug (oral communication, H. F. Bonham).
References: Bonham, 1969.

Coyote Canyon Area

Uranium is reported from several types of deposits in an area centered around Coyote Canyon. Two prospects are in the Hartford Hill Rhyolite, one is in the Chloropagas Formation, and one is in Mesozoic metamorphic rocks.

397. Lucky Day group

Location: NE¼SE¼ sec. 33, T. 25 N., R. 24 E.
Development: Several small prospect pits.
Radioactivity: Background = 0.035 mR/hr.; High = 0.25 mR/hr. Select samples contain from 0.02 to 0.75 percent eU_3O_8.
Geology: Anomalous radioactivity occurs at one locality in a small prospect pit along a 6-inch-thick, iron-stained volcanic ash bed. The radioactive bed lies directly below the first massive, red ash-flow tuff of the Hartford Hill Rhyolite, and above about 20 feet of slightly bentonitic ash. The Hartford Hill here lies with angular unconformity over steeply dipping black Triassic(?) limestones. Radioactivity is not continuous along the bed in outcrop. The author visited this locality in 1969.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3734; Bonham, 1969.

398. Name unknown

Location: W½ sec. 2, T. 24 N., R. 24 E.
Developments: Prospect pits.
Geology: Anomalous radioactivity is reported from tuffaceous sediments in the Tertiary Chloropagas Formation.
References: Schilling, 1962; Bonham, 1961.

399. Name unknown

Location: SE¼ sec. 3, and SW¼ sec. 4, T. 24 N., R. 24 E.
Development: Several prospect pits.
Geology: Anomalous radioactivity is present in the Hartford Hill Rhyolite.
References: Schilling, 1963; Bonham, 1961.

400. Lizard claims (nos. 1-5)

Location: Sec. 21(?) or 22(?), T. 24 N., R. 24 E.; location unknown.
Development: Numerous pits and adits, one of which is 250 feet long. Workings are for gold and tungsten.
Radioactivity: Background = 0.006 mR/hr.; High = 0.15 mR/hr. A sample contained 0.52 percent eU_3O_8, but only 0.183 cU_3O_8.
Geology: Uranium minerals reportedly occur in small pockets, and are apparently associated with gold. The host rock is a highly fractured, lime-silicate rock containing actinolite and calcite. *Uraninite(?), allanite,* feldspar, pyrite, limonite, and gold are also reported. This property could not be located by the author in 1969. A pegmatite is present in the NE¼ sec. 21 (personal communication, H. F. Bonham), but was not investigated during this study.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3766.

Pyramid Mining District

Copper-lead-zinc-silver deposits in the Hartford Hill Rhyolite are present in the Pyramid mining district (T. 23 N., R. 21 E.). Uranium prospects, also in the Hartford Hill and in younger diabase dikes, are present around the periphery of the district (Bonham, 1969, p. 82, 83).

WASHOE COUNTY, *continued*

Bonham (1969) characterizes the Hartford Hill Rhyolite as a sequence of over 1,500 feet of rhyolitic ash-flow tuffs. He reports that:

"Individual ash flows range from approximately 50 feet thick to over 300 feet thick. The ash-flow tuffs range from slightly welded to moderately welded and are gray, greenish, yellow, brown, or red. The color variation reflects chiefly the oxidation state of the iron present in the tuffs. Ferrous iron is present in the gray and greenish tuffs while ferric iron predominates in the yellow, brown, and red tuffs."

A number of different 6-valent uranium minerals are present, mainly in the Hartford Hill, but also in the diabase dikes. *Pitchblende(?)* or *uraninite* have been reported, but their presence has not been confirmed by later investigations. Because of the simple mineralogy and lack of sulfides and other hydrothermal minerals, Brooks (1956), believes that the uranium occurrences resulted from the groundwater leaching of ash-flow tuffs.

Uranium mineralization in the Pyramid district is often present along northeast-trending faults in the Hartford Hill Rhyolite or along faulted contacts of younger diabase dikes with the Hartford Hill. The rhyolitic ash-flow tuffs have been bleached and locally silicified for widths of up to 20 feet along the faults or diabase dikes. Hematite, manganese oxides, calcite, opal, and chalcedony occur as veinlets and stringers. Opal, chalcedony, hematite, and manganese oxides may contain uranium. The colored uranium minerals present occur as disseminations and encrustations along fractures (Bonham, 1969).

The rhyolitic ash-flow tuffs in bleached zones are partially altered to montmorillonitic clays. The diabase dikes are thoroughly propylitized, either by deuteric alteration or by solutions associated with the uranium mineralization (Bonham, 1969). Gouge zones containing clay minerals are also sites of uranium mineralization. Clay minerals, especially montmorillonite and kaolinite, have been reported to concentrate uranium by adsorption. The amount of UO_2^{++} adsorbed is related to the cation-exchange capacity of the clay mineral. For montmorillonite the amount of uranyl ion fixed increases with the pH (Heinrich, 1958, p. 445).

The presence of uranium mineralization in the Hartford Hill Rhyolite at all radioactive localities in the Pyramid district is suggestive of a genetic link between the uranium and the rhyolite. Bonham (1969) mentions that the elements concentrated at the uranium deposits (uranium, iron, manganese, silica, phosphorous, and calcium) are present in the ash-flow tuffs of the Hartford Hill Rhyolite and could readily have been leached from the tuffs.

A plausible mode of formation for these uranium deposits has been suggested by Bonham (1969), who suggests that the uranium occurrences are zonally related to dacitic plugs which are concentrated in the center of the Pyramid district. The uranium may have been leached from the tuffs by groundwater which had been heated by the intrusion of the dacite plugs, the heated groundwater being a more efficient solvent than unheated groundwater. The uranium and other dissolved elements would have migrated to the periphery of the district, and concentration of uranium would occur because of a decrease in the temperature, and probably pressure, of the uranium-bearing solutions. Fault-gouge zones and diabase dikes probably acted as dams to the mineralizing solutions, provided areas of decreased pressure and temperature, and contained clay minerals which acted as precipitants.

Other areas of uranium mineralization in the Hartford Hill Rhyolite (Dogskin Mountain, Peterson Mountain and elsewhere) do not appear to be spatially related to mining districts or Tertiary intrusive rocks. In these other areas, at least, the heating of groundwater may not have been necessary to produce the uranium deposits.

401. Hopeless prospect (7 claims)

Location:	SW¼ sec. 9, T. 24 N., R. 20 E.
Development:	Shallow pits and trenches.
Radioactivity:	Background = 0.03 mR/hr.; High = 0.45 mR/hr. Assays range from 0.01 to 0.03 percent eU_3O_8.
Geology:	Fluorescent uranium minerals occur along a fault zone in tuff beds of the Hartford Hill Rhyolite. Abnormal radioactivity was detected for 100 feet along the fault.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3783; Finch, 1967; Bonham, 1969.

402. Unnamed prospect

Location:	Sec. 29, T. 24 N., R. 21 E.
Geology:	A uranium prospect is present in the Hartford Hill Rhyolite.
References:	Bonham, 1969.

403. Armstrong claims

Other names:	Penney No. 6 and No. 10 claims.
Location:	Sec. 31, 32, T. 24 N., R. 21 E.
Production:	Production of an unknown amount reported.
Development:	Bulldozer trenching, a 30- to 40-foot shaft, and about 250 feet of underground workings.
Radioactivity:	Background = 0.013 mR/hr.; High = 4.2 mR/hr. Assays of over 2.7 percent U_3O_8 are reported from mineralized fractures up to 6 inches wide. Assays across 5- to 6-foot widths seldom contain over 0.03 percent U_3O_8.
Geology:	Uranium mineralization occurs in and adjacent to a diabase dike cutting a rhyolitic ash-flow tuff of the Hartford Hill

WASHOE COUNTY, *continued*

Rhyolite. The diabase dike strikes N. 30° E. and has a vertical dip. Secondary yellow uranium minerals *(uranophane)* occur in the diabase dike and in fractures in the welded tuff adjacent to the dike. The tuff is normally brick red but it has been locally bleached to a greenish-white along fractures. Quartz crystals in the tuff are very black in mineralized areas, probably due to radiation damage. The highest surface radioactivity usually occurs about 3 feet north of the dike. The author visited this property in 1969.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3777; Bonham, 1969.

404. Garrett prospect

Location: SW¼SE¼ sec. 36, T. 24 N., R. 20 E.; about 1,500 feet northeast of the DeLongchamps prospects.

Development: Several trenches.

Geology: A zone of high radioactivity occurs along the foot wall of a diabase dike which intrudes a tuff of the Hartford Hill Rhyolite.

References: Brooks, 1956.

405. Lowary claims

Other names: Maue-McCray mine, Lowery group, Lowary mine.

Location: SE¼ sec. 36, T. 24 N., R. 20 E.; and SW¼ sec. 31, T. 24 N., R. 21 E.

Production: A small tonnage of ore has been produced, but the amount and grade are unknown.

Development: An open cut 100 feet long, 70 feet wide, and 10 to 20 feet deep, and several smaller pits and trenches.

Radioactivity: Background = 0.025 mR/hr.; High = 1.4 mR/hr. Select samples contain over 9 percent cU_3O_8.

Geology: Uranium mineralization occurs in and adjacent to a N. 10°-20° E. fault zone in welded rhyolite ash-flow tuff of the Hartford Hill. Anomalous radioactivity extends along the fault for about 200 feet in a zone up to 10 feet wide.

U. S. Atomic Energy Commission geologists (A.E.C. PRR-3775) who examined the property in 1955 reported *uraninite, autunite, uranospinite,* uraniferous opal, and barite. However, Bonham (1969) recognized only *autunite* and a yellow secondary uranium mineral (probably *uranophane).* Brooks (1956) also reports the presence of radioactive manganese oxide.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3775; Bonham, 1969; McJannet, 1957; Brooks, 1956; U. S. Bur. Mines Minerals Yearbooks, 1957, 1964.

406. DeLongchamps prospects

Other names: Red Bluff Nos. 1-7, 10 and 11; Rainbow No. 8 Fraction, Red Bluff mine.

Location: N½ sec. 1, T. 23 N., R. 20 E.

Production: Small tonnages of ore shipped since 1955. Two carloads of uranium ore were shipped in 1966.

Development: Numerous pits and trenches, and over 300 feet of underground workings.

Radioactivity: Background = 0.04 mR/hr.; High = 5.0 mR/hr. Assays as high as 15 percent U_3O_8 were obtained on ore high in hematite.

Geology: Uranium mineralization occurs in and adjacent to a diabase dike which intrudes a welded ash-flow tuff of the Hartford Hill Rhyolite. A fault is present at one side of the dike, and both the dike and fault trend N. 35° to 70° E. and dip 65° to 70° NW. The uranium minerals occur in pods, stringers, and encrustations

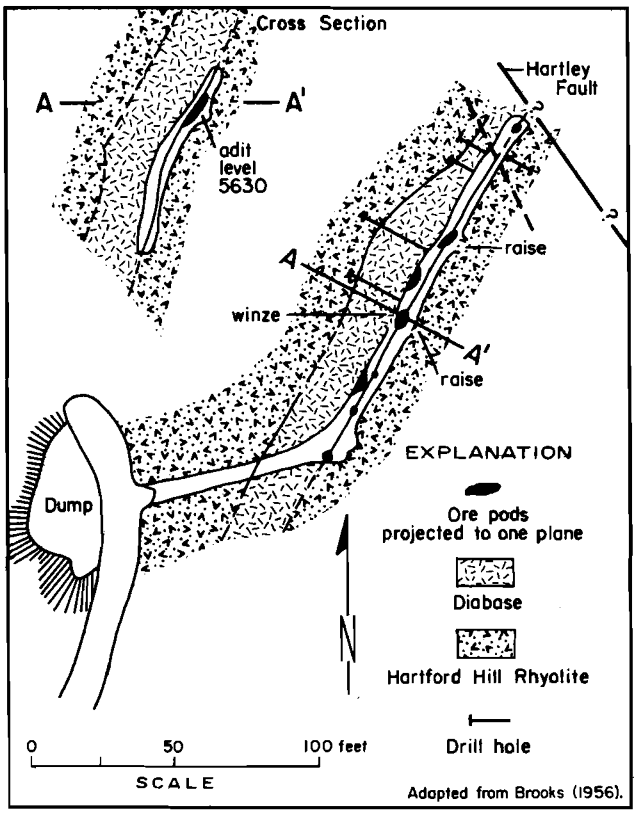

FIGURE 30. Geology and underground workings of the DeLongchamps prospect, Washoe County.

WASHOE COUNTY, *continued*

along fractures in both the dike rock and the welded tuff (fig. 30). Radioactivity can be detected for up to 500 feet along the structure.

According to Brooks (1956) the uranium occurs as *autunite, sabugalite, phosphuranylite, clevite(?),* and as uraniferous hematite and opal. The higher grade ore occurs in lenticular shoots up to 12 feet long and 4 feet wide within the welded tuff in the footwall of the fault between the dike and the welded tuff. Bleaching and local silicification of the welded tuff are associated with these shoots. Hematite, manganese oxides, and minor opal are present with the ore. Quartz crystals in the welded tuff are very smoky, probably due to radiation damage.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3780; Bonham, 1970; Brooks, 1956; Smith, 1956; Butler, 1958, p. 123; McJannet, 1957; U. S. Bur. Mines Minerals Yearbooks 1956, 1959, 1966; Holmes, 1972.

407. Lost Partner group

Other names: Lost Pardner mine, Lost Partners.

Location: W½ sec. 24, T. 23 N., R. 21 E.; near the head of Perry Canyon.

Production: An unknown amount of ore, probably less than 100 tons, has been produced.

Radioactivity: Background = 0.02 to 0.03 mR/hr.; High = 1.4 mR/hr. A 1.9-foot-wide chip sample contained 0.51 percent eU_3O_8.

Geology: Several uranium minerals, including *autunite, torbernite(?),* and *pitchblende(?),* have been reported from this locality (U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3768). The uranium mineralization is found in a fault breccia in Hartford Hill Rhyolite which also contains iron oxides. The fault trends N. 85° W. and dips 85° S. Bonham (1969) saw no uranium minerals during a visit in 1966.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3768; Bonham, 1969.

408. Bing group (nos. 1-11)

Location: Sec. 28, T. 23 N., R. 21 E.; in area now owned by North American Rockwell Corp.

Development: Several prospect pits.

Radioactivity: Background = 0.05 mR/hr.; High = 15.0 mR/hr. Samples contain 0.016 to 2.13 percent eU_3O_8.

Geology: Iron-oxides, *autunite(?), torbernite(?)* and unidentified secondary uranium minerals occur in a northwesterly-trending brecciated shear zone in a welded ash-flow tuff of the Hartford Hill Rhyolite. The contact of the Hartford Hill with Mesozoic granodiorite is nearby.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3779; Bonham, 1969.

409. Snap property

Location: Sec. 2(?), T. 22 N., R. 21 E.; Exact location unknown.

References: U. S. Atomic Energy Commission unpublished map.

410. Thunder Bird group (nos. 1-15)

Other names: Thunderbird claims, Flagg Section, Flagg Station.

Location: W½ sec. 35, T. 23 N., R. 21 E.; in an area now owned by North American Rockwell Corp.

Development: Several shallow pits and a caved adit.

Radioactivity: Background = 0.05 mR/hr.; High = 5.0 mR/hr. Chip samples contained only 0.01 to 0.02 percent eU_3O_8.

Geology: *Autunite, uranophane(?),* and *gummite(?)* reportedly occur as coatings on joints and fractures in the Hartford Hill Rhyolite. The adit was driven on a gouge and breccia zone which trends N. 55° E. and is vertical.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3784; Bonham, 1969.

Dogskin Mountain

Uranium prospects on Dogskin Mountain are all in the Hartford Hill Rhyolite, either near its base or along faults.

The Hartford Hill Rhyolite unconformably overlies Mesozoic granitic rock on Dogskin Mountain. Several feet of carbonaceous to lignitic shale and sandstone occur locally at the base of the formation (Bonham, 1969, p. 98). Small smounts of rhyolitic air-fall tuff may also be present. This volcanic ash is often altered to montmorillonite clay. The carbonaceous to lignitic material reported is often charcoal, formed from plant matter burned in an oxygen-poor environment at the base of the first ash flow.

Uranium and other metals form complexes with naturally occurring organic compounds. The concentration of trace elements, including uranium, may often be explained by the formation of stable complexes between the metals and humic acids (Manskaya and Drozdova, 1968). Charcoal material often controls the deposition of uranium at the Dogskin Mountain properties. It is also commonly present

WASHOE COUNTY, *continued*

at a structurally favorable site–the porous and permeable unwelded base of the ash-flow tuff. Uranium-bearing solutions (probably ground water) could have moved along the base of the Hartford as well as other permeable areas, including faults and other non-welded units. Favorable depositional environments would include carbon-rich areas and concentrations of clays. Fault gouge zones and bentonitic volcanic ash beds would be logical sites of uranium mineralization. Iron and manganese oxides are also often present in the Dogskin Mountain occurrences, and their colloidal deposition may have assisted the uranium deposition.

411. Divide claims (nos. 0-9)

Location: SW¼ sec. 26, T. 24 N., R. 19 E. (projected). On the crest of a ridge about 1 mile west of Peak 7464 on Dogskin Mountain.

Production: A small amount of ore may have been produced.

Development: A large cut and numerous bulldozer trenches.

Radioactivity: Background = 0.017 mR/hr.; High = 0.43 mR/hr. Assays ran as high as 0.30 percent cU_3O_8 for the charcoal material.

Geology: *Autunite* and *torbernite(?)* occur as specks and fine disseminations in charcoal and bentonitic ash at the base of the Hartford Hill Rhyolite. The area of uranium mineralization is about 700 by 300 feet, and is present along one edge of an erosional remnant of the Hartford, which here overlies weathered granodiorite. The mineralized zone is up to 20 feet thick, as exposed in a large cut, and includes volcanic ash with charcoal stringers, and granodiorite boulders up to 15 feet in diameter. The deposit was examined by the author in 1969.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3767; Bonham, 1969; Holmes, 1972.

412. Golden Eagle, Red Eagle claims

Location: NE¼SE¼ sec. 22, T. 24 N., R. 19 E. (projected). Along a jeep road.

Development: One bulldozer cut.

Radioactivity: Background = 0.033 mR/hr.; High = 0.06 mR/hr.

Geology: Very slightly anomalous radioactivity is concentrated in small faults and in fractures in the Hartford Hill Rhyolite. The higher radioactivity is associated with heavy coatings of iron and manganese oxides along the fractures. The author visited this prospect in 1969.

413. Sunnyside claims(nos. 1 and 2)

Location: Sec. 20, T. 24 N., R. 19 E.

Development: Several bulldozer cuts.

Radioactivity: Background = 0.04 mR/hr.; High = 0.15 mR/hr. A 1-foot horizontal chip sample contained 0.03 percent eU_3O_8.

Geology: Radioactivity occurs along an altered fault zone in the Hartford Hill Rhyolite and underlying tuffaceous deposits. Hot spring deposits are reported.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3764.

414. Go-Getter and Pup claims

Location: Sec. 28, T. 24 N., R. 19 E. (projected).

Development: Several bulldozer cuts.

Radioactivity: Background = 0.02 mR/hr.; High = 0.045 mR/hr. Chip samples along the mineralized bed contain 0.038 to 0.081 percent eU_3O_8.

Geology: Uranium mineralization occurs at the base of the Hartford Hill Rhyolite for a distance of 75 feet along the strike. *Autunite(?)* is reported. A zone of intercalated clays, tuffs, decomposed granodiorite, and carbonaceous material lies below the Hartford Hill and above the granodiorite. This zone may be up to 10 feet thick, and contains most of the uranium mineralization.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3776; Bonham, 1969.

415. Lara No. 9 claim

Location: Sec. 29(?), T. 24 N., R. 19 E. (projected).

Development: Prospect pits.

Radioactivity: Background = 0.01 mR/hr.; High = 0.2 mR/hr. A 1-foot chip sample contained 0.06 percent eU_3O_8.

Geology: A yellow, non-fluorescent uranium mineral occurs along east-west fractures in the Hartford Hill Rhyolite. The fractures dip 20° N.

References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3771; Bonham, 1969.

416. Laura(?) claim

Location: Center, sec. 29, T. 24 N., R. 19 E.; along Red Rock Canyon.

Development: One prospect pit.

Radioactivity: Background = 0.015 mR/hr.; High = 0.05 mR/hr.

WASHOE COUNTY, *continued*

Geology: Slightly abnormal radioactivity is present along a north-trending fault zone in the Hartford Hill Rhyolite. This prospect was visited by the author in 1969.

417. Tick Canyon group (nos. 1-16)

Location: Sec. 32, T. 24 N., R. 19 E. Prospect is located in Tick Canyon ¼ miles beyond the end of the road. Shown at shaft symbol on Dogskin Mountain 15-minute topographic sheet.
Production: Unknown, but probably less than 100 tons.
Development: Several prospect pits, trenches; and a short inclined shaft.
Radioactivity: Background = 0.015 mR/hr.; Carbonaceous beds = 0.03 mR/hr.; High (fault) = 0.5 mR/hr.
Geology: A yellow-green, fluorescent, uranium mineral *(meta-autunite?)* and iron-oxides are present in thin carbonaceous charcoal bands and in the gouge zone of a fault. The fault strikes N. 50° W., dips 45° SW., and brings a boulder bed into coincidence with rhyolitic ash-flow tuffs of the Hartford Hill Rhyolite. The property was examined in 1968 by the author.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3785; Bonham, 1969.

Seven Lakes Mountain

Two uranium prospects are known on Seven Lakes Mountain. The Crescent claims are in Hartford Hill Rhyolite. Mineralization may be due to the damming of groundwater by a glass dike, and the resulting uranium precipitation. The Independence group occurs in carbonaceous material at the base of the Hartford Hill Rhyolite.

418. Independence group (nos. 1-12)

Location: Sec. 16(?), T. 24 N., R. 18 E.
Development: Several pits.
Radioactivity: Background = 0.03 mR/hr.; High = 4.0 mR/hr. Three 4-foot chip samples contained 0.10 and 0.092 percent eU_3O_8 respectively. A select sample of carbonaceous material contained 0.32 percent cU_3O_8.
Geology: *Autunite(?)* and an unidentified yellow uranium mineral occur with carbonaceous material at the base of the Hartford Hill Rhyolite. The carbonaceous material is discontinuous, and thickness varies from a few inches to over 6 feet. Mineralization in the bed can be traced for about a quarter of a mile. The beds dip 30° to 35° SW.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3787; Holmes, 1972.

419. Crescent claims

Other names: Seven Lakes prospect, Red Rock prospect.
Location: Sec. 27, T. 24 N., R. 18 E.
Development: Several pits and trenches.
Radioactivity: Background = 0.01 mR/hr.; High = 0.4 mR/hr. A select sample ran 0.35 percent eU_3O_8 and a 5-inch horizontal chip contained 0.06 eU_3O_8.
Geology: An unidentified yellow uranium mineral is associated with a glass dike which follows a fault. The dike is about 2 inches wide, strikes N. 72° E., and dips 60° NW., in the Hartford Hill Rhyolite. Nearby mineralization occurs as coatings on joints and fracture surfaces.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3772, 3791; Bonham, 1969.

Peterson Mountain

Three types of radioactive occurrences are represented in this group. Four properties are located in Tertiary sedimentary deposits, three are in the Hartford Hill Rhyolite, and one is a pegmatite occurrence.

Several prospects in Tertiary sedimentary rocks are just on the Nevada-California boundary. For the sake of completeness, several occurrences which are a few hundred feet over the state line into California, were included. Uranium mineralization in water-laid tuffs, arkosic sandstones, claystones, conglomerates, and other rock types is often associated with carbonaceous or humic material. Specific beds are often the locus of uranium deposition, but mineralization may be quite spotty. The uranium minerals reported are hydrated uranyl phosphates, and may result from groundwater redistribution of elements present in the rocks. Exploratory drilling for uranium in the Tertiary sedimentary rocks (in California) was reported in 1969.

Uranium mineralization in the Hartford Hill Rhyolite is either in iron-stained, silicified veinlets along faults, or is associated with carbonized wood.

Nine cars of ore containing more than 0.25 percent U_3O_8 were reportedly shipped in 1968(?) from the Peterson Mountain area. This production was probably from a property in Tertiary sedimentary rocks. The production was probably from California, very near the Nevada border.

WASHOE COUNTY, *continued*

420. Yellow Jacket claims

Location: Sec. 5, T. 23 N., R. 18 E.
Production: Unknown.
Development: Three bulldozer cuts.
Radioactivity: Background = 0.02 mR/hr.; High = 0.1 mR/hr. A select sample contained 0.06 percent eU_3O_8.
Geology: Slightly anomalous radioactivity occurs in a sequence of upper Tertiary sandstones and siltstones. Sporadic humic-rich areas in a cream-colored claystone are somewhat radioactive. The prospect is in beds which are only a few feet above the nonconformable contact with granitic rocks. The writer visited this prospect in 1969.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3786; Finch, 1967.

421. Jeanne K claim

Other names: Cornelia C
Location: Sec. 7(?), T. 23 N., R. 18 E.; near the California-Nevada border.
Development: Several bulldozer trenches.
Radioactivity: Background 0.03 mR/hr.; High = 1.25 mR/hr. A 1-foot vertical chip sample averaged 0.80 percent cU_3O_8 and a 2.5 foot vertical chip sample ran 0.153 percent cU_3O_8.
Geology: *Sabugalite* is disseminated in a 1-foot-thick Tertiary clay bed and an underlying 2-inch carbonaceous bed. The mineralized unit overlies water-deposited tuffs which disconformably overlie granitic rocks. Sparse uranium mineralization extends a short distance into the underlying tuffs. The clay bed was found to contain uranium for over 100 feet along the strike.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 1151 (California).

422. Barbara L. claim

Other names: Barbarel
Location: SW¼ sec. 7, T. 23 N., R. 18 E.; (in California, near the state line).
Radioactivity: Background = 0.015 mR/hr.; High = 0.32 mR/hr.; average = 0.07 mR/hr.
Geology: *Autunite* and possibly other secondary uranium minerals occur in upper Tertiary arkosic sandstones, conglomerates, claystones and tuffs. The highest radioactivity is associated with disseminated *autunite* in and below a discontinuous humic-rich bed. This bed is probably a buried soil. Anomalous radioactivity extends over an area of several thousand square feet in both the Tertiary fluvatile and lacustrine sediments and the soil presently forming from them.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3778; Finch, 1967.

423. Herbal claims (4 claims)

Location: Sec. 18(?), T. 23 N., R. 18 E.; near the California-Nevada boundary.
Development: Several prospect pits.
Radioactivity: Background = 0.03 mR/hr.; High = 1.5 mR/hr. Areas of highest radioactivity contained 0.06 percent eU_3O_8.
Geology: *Autunite(?)* occurs as discontinuous lenses in micaceous sandstone and claystone beds in Tertiary sedimentary rocks. The mineralization is associated with iron oxides and is apparently related to bedding.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 1143.

424. Bastain prospects

Location: Sec. 19, T. 23 N., R. 18 E.; 1 mile north of the Buckhorn mine on the California-Nevada boundary (fig. 31).
Development: A 25-foot drill hole.
Geology: *Autunite* is associated with carbonized wood in a rhyolite tuff of the Hartford Hill Rhyolite. Some of the wood is completely encircled or partially replaced by *autunite.*
References: McJannet, 1957; Van Couvering, 1962.

425. Lucky Day and Valley View prospects

Location: Sec. 19(?), T. 23 N., R. 18 E.; on the California-Nevada boundary.
Development: Several prospect pits.
Radioactivity: Background = 0.05 mR/hr.; High = 1.0 mR/hr. Select samples contain up to 0.2 percent cU_3O_8.
Geology: *Autunite* and an unidentified yellow, crystalline uranium mineral occur in welded and non-welded tuffs of the Hartford Hill Rhyolite.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 1153 (California).

WASHOE COUNTY, *continued*

426. Buckhorn mine

Other names: Antelope Range (Peterson Mountain) area; Hallelujah Junction area.

Location: Sec. 29, 30, T. 23 N., R. 18 E.; northeast of Hallelujah Junction on the California-Nevada boundary (fig. 31).

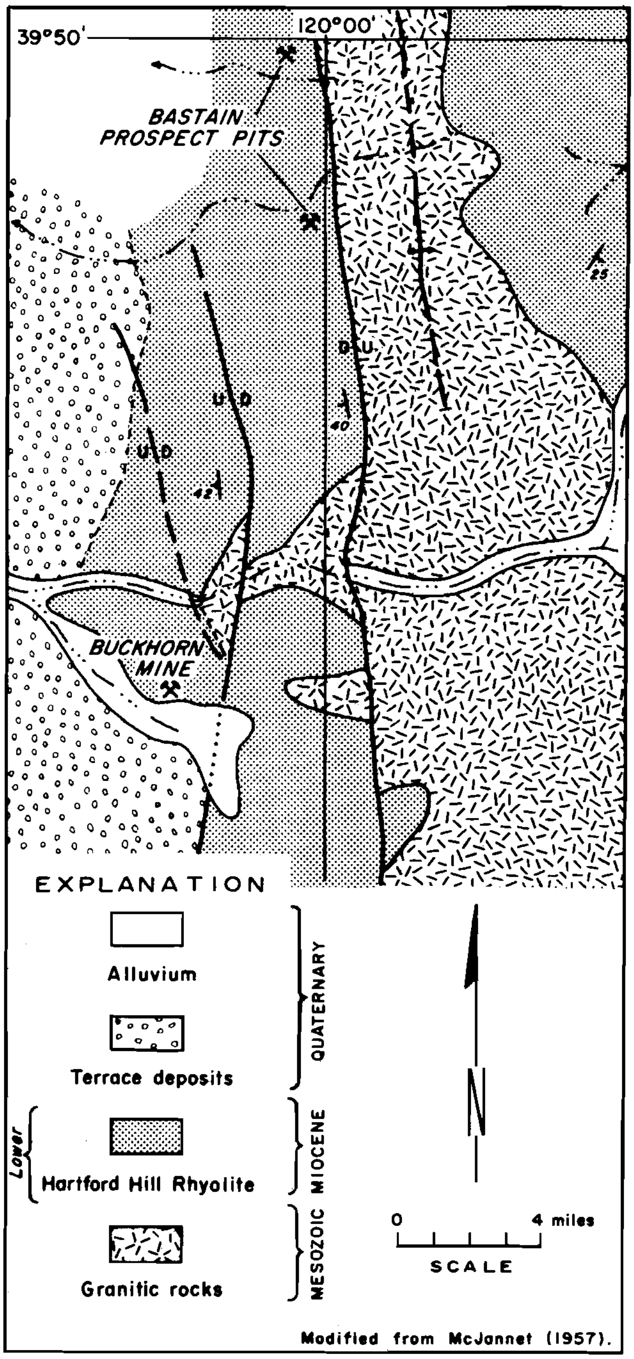

FIGURE 31. Geologic map of the Buckhorn mine area, Washoe County.

Production: Total production has been in excess of 400 tons of ore. The grade exceeded 0.2 percent U_3O_8.

Development: Numerous pits and trenches.

Radioactivity: Background = 0.01 mR/hr.; High = 0.50 mR/hr. Grab samples contained up to 0.51 percent eU_3O_8. The highest grade select sample contained 2.35 percent eU_3O_8.

Geology: *Gummite, uranophane,* and *autunite* occur as small disseminated grains in ash-flow tuffs of the Hartford Hill Rhyolite, which here overlies tuffaceous lacustrine sedimentary rocks. *Gummite* is the chief uranium mineral present. Mineralization is apparently associated with narrow, iron-stained, silicified veinlets. The principal zone of mineralization is at least 140 feet long and 90 feet wide, and uranium minerals occur in northeast-trending fractures. A second mineralized zone trends northwest and is about 120 feet long by 20 feet wide. Inability of the mine operators to keep the ore grade at or above 0.2 percent U_3O_8 is reported to be the reason for the cessation of mining at the property. Apparently a moderate tonnage of material averaging somewhat less than 0.2 percent U_3O_8 is still present at the Buckhorn mine. An examination of this property was made in 1968.

References: Hetland, 1955; Sharp, 1956; Walker, Lovering, and Stephens, 1956, p. 34; Bonham, 1969; Troxel, Stinson, and Chesterman, 1957, p. 671 and 672; McJannet, 1957; Van Couvering, 1962; U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 1152 (California).

427. Granite Mountain prospect

Other names: Granite Peak.

Location: Sec. 27(?), T. 23 N., R. 18 E.; exact location unknown.

Geology: A uranium- and thorium-bearing pegmatite is reported from this area. The prospect could not be located in 1970.

References: Schilling, 1963; Bonham, 1969.

Spanish Springs Valley and Hungry Valley

Four prospects are reported from this area. Two are in Hartford Hill Rhyolite, one is in a tuff, and one is in pegmatite-quartz veins. At the Good Luck claims, uranium is localized along a fault in silicified Hartford Hill Rhyolite. The Petrified Tree prospect contains uranium associated with silicified and carbonized plant material at the base of the Hartford.

WASHOE COUNTY, *continued*

428. Petrified Tree group (nos. 1-17)

Location: NE¼SW¼ sec. 12, T. 21 N., R. 20 E.; northern end of Spanish Springs Valley.
Development: Two bulldozer benches, prospect pits, and a bulldozer road.
Radioactivity: Background = 0.013 mR/hr.; High = 0.10 mR/hr. Carbonized wood contains 0.025 percent U_3O_8.
Geology: Anomalous radioactivity is associated with silicified and carbonized logs and other plant material at the base of the Hartford Hill Rhyolite. The Hartford Hill is densely welded here, and overlies a roof pendant of biotite-rich gneissic rock in a granodiorite intrusive which crops out nearby. The metamorphic rocks have been cut by aplitic dikes and apophyses of granodiorite. The Hartford Hill was apparently deposited here against a hill of the older rocks. The logs and other material are found below the perlitic base of the Hartford in an ash-rich bentonitic unit, which apparently occurs at the base of the buried hill. Several small faults and fractures are present, but the radioactivity does not seem to be localized along them. *Sabugalite* and *autunite* occur along fractures and layers in the wood, and disseminated in the weathered metamorphic rocks. The uranium minerals are more abundant in the silicified portions of the logs. This property was visited by the author in 1968.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3773, 3760; Bonham, 1969; Holmes, 1972.

429. Daisy Mae claims

Location: Sec. 17(?), T. 21 N., R. 20 E.
Development: A 44-foot adit, several cuts and trenches.
Radioactivity: Background = 0.04 mR/hr.; High = 0.15 mR/hr. A 10-foot chip sample contained 0.04 percent eU_3O_8.
Geology: *Autunite(?)* has been reported from a light green band in a tuff. This property could not be located in 1968.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3765.

430. Mandy's prospect

Location: Sec. 18(?), T. 21 N., R. 21 E.; on land now owned by North American Rockwell Corp. Location uncertain.
Development: One 15-foot inclined shaft.
Radioactivity: Background = 0.03 mR/hr.; High = 0.4 mR/hr. A select sample contained 0.57 percent eU_3O_8.
Geology: Anomalous radioactivity has been reported from pegmatite-quartz veins.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3782.

431. Good Luck claims (nos. 1-8)

Location: Sec. 20(?), T. 21 N., R. 20 E.
Development: Two small pits.
Radioactivity: Background = 0.035 mR/hr.; High = 0.13 mR/hr. Selected samples contain up to 0.31 percent eU_3O_8 (0.353 cU_3O_8). One-foot channel samples assayed 0.01 percent eU_3O_8.
Geology: Abnormal radioactivity and a non-fluorescent yellow uranium mineral are present sporadically over an area 300 feet by 1,000 feet. The uranium mineralization is localized along north-trending, steeply dipping breccia zones, fractures, and altered areas in the Hartford Hill Rhyolite, which is highly silicified and iron-stained adjacent to the mineralized fractures. High radioactivity is also associated with fibrous volcanic glass.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3763; Finch, 1967; Bonham, 1969.

Other Washoe County Occurrences

432. Black Hawk claims (nos. 1-9)

Other names: Blackhawk.
Location: Sec. 8 or 16, T. 25 N., R. 18 E.; exact location uncertain.
Development: Bulldozer cuts, pits, and trenches.
Radioactivity: Background = 0.05 mR/hr.; High = 0.50 mR/hr.
Geology: *Torbernite, autunite,* and *carnotite(?)* occur in a fault that strikes N. 65° W., and dips 80° NE, and which cuts pre-Jurassic metamorphic rocks, near a contact with a granitic intrusive. Ilmenite(?) may be present. This area is reportedly barely detectable by airborne scintillometer. Several magnetite bodies along veins in metavolcanic rocks are reportedly nearby.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3769; Bonham, 1969, p. 99; Shaw, Reeves, and Kral, 1962, p. 118.

WASHOE COUNTY, *continued*

433. Name unknown

Location: Center of boundary between sec. 19 and 30, T. 23 N., R. 23 E.; on Pyramid Lake Indian Reservation.
Development: None.
Radioactivity: Background = 0.015 mR/hr.; High = 0.10 mR/hr.
Geology: Lacustrine sediments of Pleistocene Lake Lahontan are radioactive in an area of a few tens of square feet. The rocks are cobble conglomerates and cross-bedded sandstones which are cemented by and interbedded with calcareous tufa. The clastic debris is mainly from older volcanic rocks. No uranium minerals were noted, and radioactivity does not appear to be restricted to particular beds or other structural features. The author visited this occurrence in 1969.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3781.

434. Red Rock prospect

Other names: Red Rock Road area, Kollman prospect, Deer Lodge claims, O'Blarney claims.
Location: NE¼SW¼ sec. 27, T. 22 N., R. 18 E.
Production: None?
Development: Two bulldozer benches.
Radioactivity: Background = 0.012 mR/hr.; High = 0.13 mR/hr. *Allanite* is radioactive and contains some thorium. Large hand specimens run about 10 times background.
Geology: A large granitic aplite-pegmatite dike (150 feet by 500 feet) which cuts a Jurassic(?) quartz diorite intrusive contains several small segregations of allanite pegmatite. The dike strikes east-west and is nearly vertical. Eight *allanite* pegmatite bodies are reported in the dike. The *allanite* occurs as euhedral to subhedral crystals as much as 6 cm. long and 1 cm. wide in an aplitic matrix of quartz, albite, and microcline. *Allanite* content varies from 5 to 30 percent. The large aplite-pegmatite dike is probably related to a pluton of quartz monzonite which intrudes the quartz diorite about 1 mile east of the prospect. *Tscheffkinite* (a rare earth titanate-silicate) has been reported from the Deer Lodge claims. This property was examined by the writer in 1969.
References: Olson and Hinrichs, 1960, p. 180; Staatz, 1964; Volborth, 1962; Bonham, 1969; Davis, 1954; U. S. Atomic Energy Comm. Prelim. Repts. 3797, 3774.

435. Sundown claim, Wadsworth Uranium group (18? claims)

Location: NW¼ sec. 14, T. 20 N., R. 23 E.; on the south and west sides of a butte.
Development: Several bulldozer roads, numerous prospect pits, two 10-foot adits.
Radioactivity: Background = 0.017 mR/hr.; High = 0.17 mR/hr. A 1.5-foot chip sample contained 0.03 percent eU_3O_8.
Geology: Radioactivity occurs in a cream-colored, partially welded ash flow of the Hartford Hill Rhyolite just below the densely welded base of the next ash-flow unit. Carbonized wood fragments are present in the mineralized unit, and are the most radioactive. Slight radioactivity (up to 2 times background) was noted near a diabase dike which cuts the Hartford, and along minor fractures. The author described this property during a 1969 visit.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3788; Rose, 1969, p. 27.

436. Verdi lignite-uranium prospect

Location: SE¼ sec. 4, T. 19 N., R. 18 E.
Development: None.
Radioactivity: Less than 0.001 percent equivalent uranium has been reported.
Geology: One sample of lignite from the Tertiary Truckee Formation was very slightly radioactive. Nearby lignitic beds were not radioactive.
References: Moore and Stephens, 1954.

437. Neuebaumer and Kelley claims

Location: Sec. 3(?), T. 18 N., R. 20 E. exact location unknown.
Development: None(?).
Radioactivity: About 10 to 20(?) times background.
Geology: Anomalous radioactivity is reported in partially silicified sand and diatomite beds. This property could not be located in 1970.
References: U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3790.

WHITE PINE COUNTY

438. Cherry Creek Hot Spring

Location:	Sec. 2(?), T. 23 N., R. 63 E.; one-quarter mile southeast of the Cherry Creek railroad station.
Geology:	This spring is reported to be slightly radioactive.
References:	Davis, 1954.

439. Ruggles Leader claims

Location:	S½(?), T. 22 N., R. 62 E.; exact location unknown.
Development:	A 22-foot-deep shaft.
Radioactivity:	Background = 0.012 mR/hr.; High = 0.20 mR/hr.
Geology:	Scattered *autunite* crystals occur in vugs and along fractures in a Tertiary latite(?).
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Rept. 3799.

440. U_3O_8 claims (nos. 1-12)

Other names:	Ely Uranium, Birch mine.
Location:	Center, S½ sec. 32, T. 21 N., R. 62 E.
Development:	A 35-foot-deep vertical shaft, an open cut, and an unknown amount of drilling (1954).
Radioactivity:	About 2.5 times background. Samples contain 0.07 and 0.10 percent eU_3O_8 (0.082 and 0.11 percent cU_3O_8).
Geology:	Anomalous radioactivity occurs along fractures in metamorphosed Paleozoic limestones. The locality is reportedly a silver prospect, and is located about 1 mile southwest of the Hunter mine, a lead-copper-silver mine.
References:	U. S. Atomic Energy Comm. Prelim. Reconn. Repts. 3800, 3801a.

441. Mount Wheeler area

Location:	Center, T. 13 N., R. 69 E.; the area drained by Snake Creek.
Geology:	A 5-square-mile area of quartz monzonite contains accessory minerals which include *allanite, monazite,* sphene, apatite, zircon, garnet, and epidote. *Allanite* and *monazite* are present in amounts from 0.04 to 0.12 weight percent, and vary with CaO content of the quartz monzonite. The intrusive has been dated as 145 million years (± 20 m.y.) at this locality. The ThO_2 content of the *allanite* ranges from 1 to 2 percent, and from 6 to 14 percent in the *monazite.* Rare-earth oxides are present in the *allanite* and *monazite* in amounts from 20 to 75 weight percent.
References:	Staatz, 1964; Lee and Bastron, 1962; Lee and Bastron, 1967; Schilling, 1965; Whitebread and Lee, 1961; Whitebread and others, 1962; Drewes, 1958; Whitebread, 1969.

442. Grand Prize and Mayflower claims

Location:	Sec. 7(?) or 8(?), T. 12 N., R. 63 E.; in Sawmill Canyon, about 6 miles northeast of Lund. Exact location uncertain.
Development:	A 30-foot adit.
Radioactivity:	Readings of up to 2 mR/hr. (underground). An 18-foot section of an adit gives a reading of 1 mR/hr. Samples contain up to 0.15 percent U_3O_8.
Geology:	Anomalous radioactivity reportedly occurs near an intrusive contact of granitic rocks with quartzite. A 5-foot-thick brecciated quartzite band trends north-south and is radioactive along its 125-foot length. A fluorite prospect is reported from this vicinity (Horton, 1961).
References:	U. S. Atomic Energy Comm. unpublished map; Horton, 1961, p. 24.

APPENDIX A

Brief descriptive mineralogy of radioactive minerals mentioned in this report.

Sources for the following descriptions include Frondel, Fleischer, and Jones (1967); Frondel (1958); and Dana (1932).

Allanite (Ca, Ce, Th)$_2$ (Al, Fe, Mg)$_3$ Si_3O_{12} (OH). May contain up to 2.95 percent uranium, but usually contains a few hundredths of a percent. May also contain thorium in amounts up to 4.35 percent. Brown to black mineral similar to epidote; crystals tabular or long and slender. May be metamict due to radiation damage. Most commonly found as an accessory mineral in plutonic rocks and pegmatites.

Apatite $Ca_5(PO_4)_3$ (F, OH, Cl). May contain up to 0.08 percent uranium when found in igneous rocks, but usually less than 0.01 percent. May contain up to 0.003 percent thorium. Apatite crystals common in igneous and metamorphic rocks.

Autunite $Ca(UO_2)_2(PO_4)_2 \cdot 10\text{-}12\ H_2O$. Thin to thick tabular crystals with rectangular or, less commonly, an octagonal outline. Hardness 2-2½. Luster vitreous to pearly. Color lemon yellow to sulfur yellow; sometimes greenish yellow to pale yellow. Streak pale yellow. Strong fluorescence to yellowish green in ultraviolet light (brighter fluorescence on fractured surfaces than on weathered ones). Meta-autunite and autunite may be mistaken for each other in the field. Very common secondary uranium mineral.

Brannerite AB_2O_6; A is mainly U but also Ca, Fe, Th, Y; B is mainly Ti and Fe. Contains 26.5 to 43.6 percent uranium and 0.26 to 11.3 percent thorium. Color black, brown, and yellowish brown. Found in granitic rocks, pegmatites, and placers.

Carnotite $K_2(UO_2)_2(VO_4)_2 \cdot 1\text{-}3\ H_2O$. Occurs as powder, disseminated, in crusts or aggregates, or as coatings. Soft. Dull and earthy to pearly. Color bright yellow to lemon yellow, also greenish yellow. Not fluorescent. Common secondary uranium mineral. May be deposited by the action of meteoric waters.

Chevkinite (or Tscheffkinite) (C, Y, Ca, U, Th)$_2$ (Ti, Fe, Mg)$_2$(Si, Al)$_2$$O_{11}$(?). Contains up to 2.3 percent uranium and 18.4 percent thorium. Color black, in orthorhombic or monclinic crystals. Occurs in certain plutonic rocks and pegmatites.

Clevite A variety of uraninite containing rare earths.

Coffinite $U(SiO_4)_{1-X}(OH)_{4X}$. Color black; luster dull to adamantine. Pulverulent to friable or brittle. Hardness 5-6. Often occurs as very fine particles. Occurs in many deposits in sandstones and hydrothermal veins.

Cuprosklodowskite $Cu(UO_2)_2(SiO_3)_2(OH)_2 \cdot 5\ H_2O$. Isostructural with uranophane. Often found as thin films or crusts, or as minute acicular crystals, often radiating from a center. Color yellowish green to grass green and greenish yellow. Luster of aggregates dull to silky. Has a superficial resemblance to chrysocolla and malachite. A secondary mineral, often formed by the alteration of earlier formed uranium minerals, or deposited from solution in the oxidized zone of uranium deposits.

Dumontite $Pb_2(UO_2)_3(PO_4)_2(OH)_4 \cdot 3H_2O$. Occurs as small elongated crystals, striated parallel to the c-axis. Color and streak yellow to ocher yellow. Translucent. Fluoresces weakly green in ultraviolet light. Rare.

Euxenite (Y, Ca, Ce, U, Th) (Nb, Ta, Ti)$_2$ O_6. Part of the euxenite-polycrase series. Pseudo-orthorhombic. Crystals rare; commonly massive. Hardness 6.5. Color brownish black. Found in certain granite pegmatites, commonly with other rare-earth minerals.

Gummite Vague term used to designate fine-grained, dense uranium minerals, usually alteration products of uraninite; whose true identity is unknown. Minerals are usually highly colored, often in shades of yellow or orange. Often associated with uranophane. The term has been used for any colored, earthy, secondary uranium minerals which could not be readily identified.

Huttonite $ThSiO_4$. A dimorph of thorite; isostructural with monazite. It can be distinguished from thorite by X-ray diffraction if the mineral is not metamict. Colorless to pale cream. Rare mineral from granitic pegmatites, alaskite granite, and placers.

Kasolite $Pb(UO_2)(SiO_3)(OH)_2$. An ochre-yellow to brown secondary mineral. Occurs in compact granular masses and crusts as well as small groups of lathlike crystals or radial fibrous aggregates. Not fluorescent. Lustre dull to earthy. Occurs in oxidized uranium-bearing veins, especially in the presence of base metals.

Meta-Autunite $Ca(UO_2)_2(PO_4)_2 \cdot nH_2O$. A dehydration product of autunite, the value of n ranges from 2½ to 6½ and possibly up to 8. Crystal morphology is that of autunite. Color lemon yellow to greenish yellow and yellowish green. Luster pearly to dull. Fluoresces yellowish green in ultraviolet light, but less strongly than autunite. Autunite rapidly dehydrates to meta-autunite at or near ordinary conditions of temperature and humidity. The change is reversable. Differences between autunite and meta-autunite are not often discernable in the field.

Metatorbernite $Cu(UO_2)_2(PO_4)_2 \cdot nH_2O$. A dehydrated form of torbernite. Found in thin tablets as sheaflike aggregates, also as rosettes. Color pale green to dark green. Hardness 2½. Luster vitreous to subadamantine. Not fluorescent. A secondary mineral with the same general occurrence and association as torbernite.

Metazeunerite $Cu(UO_2)_2(AsO_4)_2 \cdot 8\ H_2O$. Found as distinct crystals closely resembling those of torbernite and metatorbernite. Usually in rectangular flattened tablets; also as aggregates of platy crystals. Hardness 2-2½. Luster vitreous. Color grass green to emerald green. Fluoresces weakly in yellow green in both long- and short-wave ultraviolet light.

Monazite (Ce, La, Nd)PO_4, with Th substituting for (Ce, La) and Si for P. Thorium content normally from a few percent to 10.6 percent, but possibly up to 26.4 percent. Usually contains less than 0.1 percent uranium. Principal ore mineral of thorium (from placers). Commonly found in small euhedral crystals, but sometimes found in pegmatites as large crystals weighing several pounds. Common detrital mineral. Hardness 5-5½. Luster usually resinous or waxy, but inclining to vitreous or subadamantine. Color yellowish or reddish brown to brown; also shades of yellow, greenish, and nearly white. Not fluorescent. Widely disseminated as an accessory mineral in granites, gneisses, and pegmatites. In placer deposits and rarely in veins.

Novacekite $Mg(UO_2)_2(AsO_4)_2 \cdot 8\text{-}10\ H_2O$. Arsenate end of the saleeite-novacekite series. Isostructural with autunite and torbernite. Single crystals occur as rectangular plates. Also as crusts and scales. Color yellow. A rare secondary mineral, known chiefly from oxidized zones of veins containing primary uranium minerals as well as nickel, arsenic, and cobalt. See saleeite.

Phosphuranylite $Ca(UO_2)_4(PO_4)_2 \cdot (OH)_4 \cdot 7\ H_2O$. Found as thin coatings or aggregates that appear dense, earthy, or minutely scaly to the eye. Hardness 2½. Color deep golden yellow to rich yellow. No fluorescence in ultraviolet light. Has the same chemical composition as autunite or meta-autunite, but displays a more intense and more golden yellow color. A widespread secondary mineral but found in very small amounts. Occurs as an alteration product of primary uranium minerals and of autunite, and in some sandstone-type deposits on the Colorado Plateau.

Pitchblende A variety of uraninite which forms microcrystalline masses that, when developed as crusts, often show concentric banding and form botryoidal surfaces. The particle size of pitchblende is small. The relation between the names uraninite and pitchblende is similar to that between quartz and chalcedony.

Sabugalite $HAl(UO_2)_4(PO_4)_4 \cdot 16\ H_2O$. Isostructural with fully hydrated autunite. Single crystals are very thin plates, but the mineral typically occurs as densely aggregated crusts. Hardness 2½. Color bright yellow to lemon yellow, closely resembling that of autunite. Fluoresces bright lemon yellow in ultraviolet light. Resembles autunite, metaautunite, and saleeite in color, habit and occurrence. A rare secondary mineral which occurs in oxidized uranium-bearing veins and sandstone-type deposits.

Saleeite $Mg(UO_2)_2(PO_4)_2 \cdot 8\text{-}10\ H_2O$. The phosphate end-member of the saleeite-novacekite series. Single crystals are rectangular flattened plates. Saleeite often occurs as crusts or interlocking aggregates of plates or scales. Color, pale yellow to straw yellow; also lemon yellow. Luster weak to waxy. Saleeite fluoresces a bright lemon yellow in long-wave and less brightly in short-wave ultraviolet radiation. In hand specimen, closely resembles autunite, meta-autunite, sabugalite, and uranospinite. Saleeite resembles autunite in occurrence and association, and is commonly associated with many of the phosphates, particularly autunite, torbernite, sabugalite, and phosphuranylite.

Samarskite (Y, Ce, U, Ca, Fe, Pb, Th) (Nb, Te, Ti, Sn)$_2O_6$. Contains 8.4 to 16.6 percent uranium, and up to 3.7 percent thorium. Commonly massive and in flattened, embedded grains. Hardness 5-6. Luster vitreous to resinous. Color velvet black. Streak dark reddish brown. From granite pegmatites.

Schroeckingerite $NaCa_3(UO_2)(CO_3)_3(SO_4)F \cdot 10\ H_2O$. Crystals rare; ordinarily found as crusts, clusters, rosettes or aggregates. Hardness 2½. Luster weakly vitreous. Color greenish yellow. Brightly fluorescent in yellowish green in ultraviolet light. Soluble in water. Somewhat resembles the various green members of the torbernite and metatorbernite groups. A secondary mineral. May be deposited in near-surface environment by meteoric waters. Found as a post-mine mineral at some localities.

Sphene $CaTiSiO_5$. May contain very minor amounts of uranium and thorium. Color brown, gray, yellow, green, rose red, and black. Luster adamantine to resinous. Common rock-forming mineral, especially in intermediate plutonic rocks.

Thorianite (Th, U)O_2. Forms a complete series with uraninite. The division between thorianite (ThO_2) and uraninite (UO_2) is at 1:1 atomic ratio. Crystals are simple cubes. Hardness 6½-7. Luster submetallic when fresh, changing to resinous or hornlike. Color black, brownish black, and dark reddish brown. Not fluorescent. Occurs as primary mineral in pegmatites. Widespread as a detrital mineral. Usually found in placer deposits.

Thorite $ThSiO_4$. Contains up to 10.1 percent uranium and 25.2 to 64.1 percent thorium. Crystals closely resemble those of zircon, and thorite is isostructural with zircon. Often metamict. Hardness 4½. Luster vitreous to resinous, sometimes greasy. Color brownish yellow, yellow to orange yellow, also brownish black to dark brown to reddish brown. Very closely resembles zircon and huttonite. Occurs in pegmatites and placers.

Torbernite $Cu(UO_2)_2(PO_4)_2 \cdot 12\,H_2O$. Crystals commonly thin to thick tabular, with a rectangular or octagonal shape. Also as scaly or granular masses. Luster vitreous to subadamantine. Color emerald green to grass green, less commonly leek green, apple green, or siskin green. Contradictory reports on fluorescence: apparently not fluorescent or very weakly fluorescent in green in ultraviolet light. Cannot be distinguished at sight from metatorbernite, zeunerite, or metazeunerite. Usually occurs as an alteration product of uranium-bearing veins; also present in oxidized zones of some sulfide vein deposits.

Tscheffkinite See chevkinite.

Tyuyamunite $Ca(UO_2)_2(VO_4)_2 \cdot 5\text{-}8\,H_2O$. Crystals are tiny scales. Commonly massive, compact to microcrystalline, also pulverulent, and as thin films and coatings. Usually more coarsely crystallized than carnotite, which it resembles in hand specimen. Hardness 2. Luster of crystals adamantine to waxy, massive material may be dull to waxy. Color yellow to canary yellow or lemon yellow. Color usually appears somewhat greenish as compared to carnotite. Either not fluorescent or very weakly fluorescent in yellow green in ultraviolet light. Widespread occurrence, but less abundant than carnotite. Common in the oxidized zone of sandstone-type deposits on the Colorado Plateau.

Uraninite Ideally UO_2 but better expressed as $(U^{+4}_{1-x}, U^{+6}_{x})O_{2+x}$. Forms a complete series with thorianite. See also pitchblende and cleveite. Uraninite crystals are commonly cubes. Hardness 5½-6. Luster submetallic and ironlike in unaltered crystals, usually pitchlike to greasy. Color dark gray to black; also dark brown or brownish black in altered crystals. Occurs in granite and syenite pegmatites (crystals); in hydrothermal sulfide veins (pitchblende); and in sandstone-type deposits.

Uranophane $Ca(UO_2)_2(SiO_3)_2 \cdot 5\,H_2O$. Probable structure of an inosilicate, as suggested by its acicular crystal habit. Crystals are minute needles, occurring as stellate tufted aggregates or crusts. Also massive or microcrystalline. Hardness 2½. Luster vitreous; massive material may appear dull or earthy to waxy. Color lemon yellow to pale straw yellow and honey brown; also greenish yellow to yellowish green and orange yellow. Crystals are weakly fluorescent in green in ultraviolet light; massive material usually is not fluorescent. Uranophane is of supergene origin; often deposited from meteoric waters or formed as an oxidation product of uraninite, especially in pegmatites. A common secondary uranium mineral.

Uranospinite $Cu(UO_2)_2(AsO_4, PO_4)_2 \cdot 11\,H_2O$(?). Belongs to the torbernite or metatorbernite groups. Easily confused with novacekite and meta-autunite. Hardness 2-3. Luster pearly. Color lemon yellow to siskin green. Fluoresces bright lemon yellow in ultraviolet light. A rare secondary mineral, often derived from the alteration of uraninite and primary arsenides in hydrothermal veins.

Uranothorite A variety of thorite containing up to about 12 percent uranium. Uranoan thorite.

Xenotime YPO_4. May contain up to 3.6 percent uranium, and 2.2 percent thorium. Crystals resemble zircon in habit. Hardness 4-5. Luster resinous to vitreous. Color yellowish brown, reddish brown, red, grayish white, wine yellow or pale yellow. Occurs as an accessory mineral in pegmatites, and sometimes distributed in granitic and gneissoid rocks. Also found in placers.

Zeunerite $Cu(UO_2)_2(AsO_4)_2 \cdot 10\text{-}16\,H_2O$. Found as distinct crystals closely resembling those of torbernite and metatorbernite. Hardness 2½. Luster weakly vitreous. Color green to emerald green. Fully hydrated zeunerite does not fluoresce in ultraviolet light. May dehydrate in air to metazeunerite. Almost all reported specimens of zeunerite have proved to be metazeunerite.

Zircon $ZrSiO_4$. May contain small amounts of uranium, thorium, and rare earths. Crystals commonly in square prisms, sometimes pyramidal. Hardness 7½. Luster adamantine. Colorless, pale yellowish, grayish, yellowish green, brownish yellow, reddish brown. A common constituent of igneous rocks, especially granites and pegmatites. Also found in placers.

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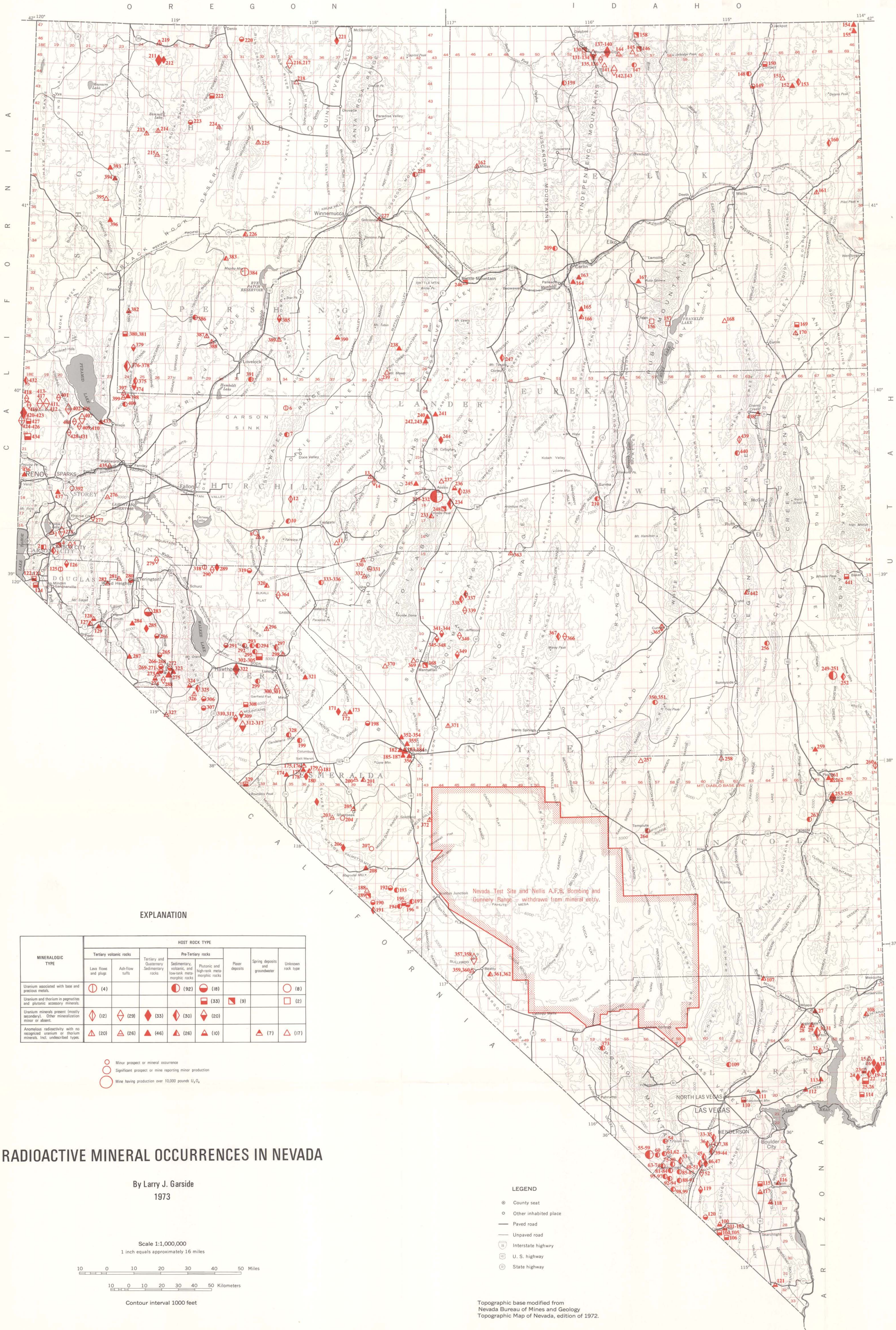
INDEX

Index numbers in parentheses are keyed to consecutively numbered occurrence descriptions in text and on plate 1.



RADIOACTIVE MINERAL OCCURRENCES IN NEVADA

By Larry J. Garside

1973

EXPLANATION

MINERALOGIC TYPE	HOST ROCK TYPE							
	Tertiary volcanic rocks		Tertiary and Quaternary Sedimentary rocks	Pre-Tertiary rocks		Placer deposits	Spring deposits and groundwater	Unknown rock type
	Lava flows and plugs	Ash-flow tuffs		Sedimentary, volcanic, and low-rank meta-morphic rocks	Plutonic and high-rank meta-morphic rocks			
Uranium associated with base and precious metals.	(4)			(92)	(18)			(8)
Uranium and thorium in pegmatites and plutonic accessory minerals.					(33)	(9)		(2)
Uranium minerals present (mostly secondary). Other mineralization minor or absent.	(12)	(29)	(33)	(30)	(20)			
Anomalous radioactivity with no recognized uranium or thorium minerals. Incl. undescribed types.	(20)	(26)	(46)	(26)	(10)		(7)	(17)

Minor prospect or mineral occurrence

Significant prospect or mine reporting minor production

Mine having production over 10,000 pounds U_3O_8

Scale 1:1,000,000

1 inch equals approximately 16 miles

10 0 10 20 30 40 50 Miles

10 0 10 20 30 40 50 Kilometers

Contour interval 1000 feet

LEGEND

County seat

Other inhabited place

Paved road

Unpaved road

Interstate highway

U. S. highway

State highway

Topographic base modified from Nevada Bureau of Mines and Geology Topographic Map of Nevada, edition of 1972.

LIST OF MINES, PROSPECTS, AND OCCURRENCES

CARSON CITY

1. Lucky Strike group (9 claims)
2. Sophie group
3. 8 Spot group (8 claims), Lucky Bird group (nos. 1-17)
4. "Carson City Monazite-bearing Placer"
5. Sally group (10 claims)

CHURCHILL COUNTY

6. K D group (116 claims)
7. Cottonwood claims
8. Bluebird property
9. Johnson group
10. Chalk Mountain mine
11. Gamma group (nos. 1 and 2)
12. Martin claims
13. Mustang group (nos. 1-7)
14. Patriot group (26 claims)

CLARK COUNTY

15. J. V. property
16. Blue Chip, Frank Robbin, *and other prospects (6 claims)*
17. South Valley No. 2 claim
18. First Chance group (20 claims)
19. Name unknown
20. Long Shot No. 1 claim
21. Lucky Bart prospect (8 claims)
22. Horse Springs group (nos. 1 and 2), Green Spot group (nos. 1 and 2)
23. Uranium No. 1 and Old Dad prospects
24. Yellow Queen prospect
25. Hilltop mine
26. Allanite pegmatites
27. R.A.H. group (nos. 1-6)
28. Weiser anticline occurrences
29. Last Chance claim
30. Carnotite No. 1 claim
31. Golden Glow and Carnotite Lode prospects
32. Valley of Fire State Park
33. Locality 3
34. Locality 1
35. Locality 2
36. Little Snake, Purple Valentine, etc. claims
37. Locality 4
38. "Sloan mining district"
39. Locality 5
40. Locality 6
41. Locality 7
42. Locality 8
43. Localities 9, 10, 11, 12, 13
44. Locality 14
45. Locality 20
46. Locality 16
47. Locality 15
48. Willabelle claim
49. Nunn prospect
50. Humdinger, Lake View, *Lake View No. 1 claims*
51. Sieber claim
52. Localities 17 and 18
53. Locality 27
54. Potosi mine
55. Hatchet mine
56. Unnamed prospect
57. Green Monster mine
58. Desert Valley mine
59. Daniel Boon mine
60. Mohawk No. 7 mine
61. Paradise prospect
62. Name unknown
63. Ore Amigo mine
64. Ironside mine
65. Smithsonite mine
66. Rosetta No. 1 and 2 claims
67. Highline mine
68. Azurite mine
69. Copperside mine
70. Boss mine
71. Platina mine
72. Shenandoah mine
73. Copper Chief mine
74. Fitzhugh Lee mine
75. Keystone mine
76. Yellow Pine mine
77. Alice Fraction prospect
78. Alice mine
79. Copper Glance mine
80. Iron Gold mine
81. Hoosier mine
82. Rose mine
83. Hermosa mine
84. Royal Blue prospect
85. Over prospect
86. Name unknown
87. Bico property
88. Bullion mine
89. Little Betty claim
90. Lincoln mine
91. Eureka mine
92. Sultan mine
93. Billy Wilson No. 1
94. Singer mine, Tiffin mine
95. Spelter mine
96. Copper Flower Quartz mine
97. Root Zinc mine
98. Milford No. 2 mine, Ingomar mine
99. Tam O'Shanter mine
100. Location No. 16
101. Location No. 7
102. Location No. 6
103. Nippeno mine area
104. Surprise group
105. Thor claims
106. Prospectors Uranium claims (nos. 1-20)
107. Fry and Jeffers claim
108. South Valley No. 4 claim
109. Sampson and Sampson No. 1 claims
110. Little Hal, Steve Nos. 1 and 11 claims
111. Gypsum Cave area
112. Anomalies 4, 5, 6, 7
113. 50-50 claim
114. Nevada mica mine
115. M & E Nos. 2 and 12 claims
116. Big Horn claims
117. Mary Helen and Rose Alice claims
118. H & E property
119. Yellow Jacket group (nos. 1-15)
120. Lucy Gray mine
121. Superfluous No. 1 claim

DOUGLAS COUNTY

122. Kingsbury Queen prospect
123. Granite group (nos. 1-5)
124. Hunch and Lucky Strike claims
125. Peek-A-Boo claims
126. Julietta prospect
127. Triangle group
128. Mountain View group (11 claims)
129. Hi-Boy claims

ELKO COUNTY

130. Mountain City district
131. Granite group (nos. 1-18)
132. Autunite group (nos. 1-16), and October group (nos. 1-22)
133. Hot Spot No. 1 claim
134. Race Track mine, Lucky Lager claims, Speedway claims
135. Tag, Pam, Pat, and Sam claims; DWG (Last Chance) group (nos. 1-3)
136. Jackpot and Hotwater claims
137. Hawk group (nos. 1-3), Denis claims (nos. 1 and 2)
138. Hot Ash group (nos. 1-9)
139. Rim Rock mine
140. South Fork claims (nos. 1 and 2), Pixley No. 1 claims
141. Top claims
142. Happy Joe No. 1, Happy Mendive, and Big Joke claims
143. Mystery, Good Luck, Good Morning, and Pot Luck claims
144. Anomaly No. 3
145. Anomaly No. 1
146. Alder Gulch district
147. Garnet tungsten mine
148. Semsco property
149. Independence claims (nos. 1-10)
150. Contact area
151. Badger property
152. Pink Horse claims
153. Prince claims
154. Locality 39
155. Locality 32
156. Gilbert Canyon area
157. Dawley Canyon area, loc. V-14
158. Gold Basin district
159. White Rock Canyon
160. Name unknown
161. Anomaly No. 4
162. Midas area
163. Deerhead group (nos. 1-18)
164. Black Kettle group (nos. 1-4)
165. KEF No. 2 claim
166. Asphaltite prospect
167. White Hill No. 1 claim
168. Tumbee property
169. Pride and Last Chance claims
170. B & O claims

ESMERALDA COUNTY

171. Wildwood group (27 claims)
172. Cant Miss group (23 claims)
173. Anomaly No. 6
174. Aching Back, Blue Moon, Rosamunda, Topnotch and Happy Day claims
175. Bullet Placer No. 1 claim
176. Gap Spring occurrence
177. Magma group (5 claims)
178. Name unknown
179. Anniversary claim
180. Gap Strike group (21 claims), Sammy group (2 claims), and Wolf group (8 claims)
181. Coaldale prospect, Phillips and Wentland No. 1 claims, Quinseck claim
182. Localities U-25, U-11, U-10, U-12
183. Rich and Rare claim, Quinseck prospect (2 of 52 claims)
184. Localities SU-1, 2, 3, and 4 and U-1 and 13
185. Localities U-14a, 14b, 15, and 16
186. Localities U-19, 20, 21
187. Localities SU-5; U-6, 7, and 8
188. Old Ingalls mine
189. Tule Canyon "placers"
190. Tule Royal group (nos. 1-6)
191. Name unknown
192. Atlas, Moonstone, Moonstone Annex, and Ajax No. 1 claims
193. Checkmate No. 1 claim
194. Independence group (nos. 1-6)
195. Susan group (nos. 1-6)
196. Randolph mine
197. Red Rock claims (nos. 1 and 2)
198. Copper Queen group
199. *Iron King group*
200. Jet group (nos. 1-25), Taylor claims, Utron group (4 claims)
201. Weepah Uranium group (14 claims)
202. Mustang, Mustang Nos. 1-7 claims
203. 16 to 1 claim
204. Mohawk property
205. Virginia group (17 claims)
206. Esmeralda Uranium No. 28, Esmeralda No. 15, Uno No. 6, Buckeye No. 1, Eds No. 5, M & R No. 6, and Minnis No. 50 claims
207. Galena claims (nos. 1 and 2)
208. Thunderbird group (nos. 1-12)

EUREKA COUNTY

209. Copper King mine
210. Lucky Boy group (nos. 1-20)

HUMBOLDT COUNTY

211. Virgin Valley Opal district
212. CC Mines claim
213. Four Leaf Clover group (nos. 1-60)
214. Unnamed prospect
215. Blackbird group (nos. 1-6)
216. Moonlight mine
217. Granite Point claims
218. Yellow Star prospect
219. Cactus group (nos. 1-12)
220. Wedding Ring group (nos. 1-6), Morning Star No. 1, and Copper King No. 1 claims
221. Unnamed prospect
222. Foster property
223. Blue Jack property
224. Allied group (nos. 1-22)
225. Nevada group (nos. 1-43)
226. Margale prospect
227. Golconda Hot Spring, Harris property
228. Getchell mine

LANDER COUNTY

229. Apex mine
230. Eldorado claim
231. Buck claims
232. Johnson Canyon claims
233. Graduation, Venus, and Jupiter claims
234. Lowboy mine
235. F. Escobar claims
236. Edna prospect
237. Arizona property
238. Dacie Creek claims (about 300)
239. Old Jaw Bone property
240. Hart group (nos. 1-27), Pinto group (nos. 1-50)
241. Two-Bit group (nos. 1-6)
242. Rex Jean claims (nos. 1-11)
243. Lee Rene claims (nos. 1-8)
244. Boon Uranium claims
245. Willys group (nos. 1-24)
246. J. H. Vorhees oil wells (nos. 1 and 2)
247. Cortez Canyon
248. Birch Creek area

LINCOLN COUNTY

249. Blue Bird mine; Ella, Minnie, and Lucky Dog claims
250. Atlanta mine
251. Silver Park mine
252. Nevada Rath claims (nos. 1-13)
253. White Cloud prospect
254. Pay Zone claim
255. Dorothy claim
256. Cave Valley mine
257. Valley View property
258. Lucky Strike claims (nos. 1-9)
259. Walker Unit claims
260. Peak claims (nos. 1-12)
261. White Light No. 9 claim
262. White Light claim
263. Old Democrat mine
264. Tem Piute mine

LYON COUNTY

265. Teddy claims (nos. 1-24)
266. Northwest Willys group (2 claims)
267. West Willys group (7 claims)
268. Quartz mine group (7 claims)
269. Halloween mine
270. Far West Willys group
271. Kateydid claim
272. Silver Pick property
273. Grant View Hot Spring
274. Boerlin Ranch property
275. River Road mine
276. Ramsey prospects
277. Lava Cap group (7 claims)
278. Glacier King No. 1 claim
279. Little Red Head group
280. Yerington property
281. Noonday claims (nos. 1-4)
282. Well 13/23-25 cb1
283. Flyboy claims (nos. 1-11)
284. Eagle Feather group
285. White Rose & White Rose No. 1 claims
286. Cambridge district
287. Pitch claims
288. Snowball No. 1 prospect

MINERAL COUNTY

289. Robinson claims
290. Bubbles claims
291. Blue Bottle, Blue Bottle Nos. 2 and 3 claims
292. Black Hawk claims
293. William Johnson claims (nos. 1-11)
294. Dixie group (nos. 1-26)
295. Lucky Ann claims (nos. 1 and 2)
296. Lost Sheep claims
297. Broken Bow and Broken Bow King groups
298. Lunning Mining Co. claims
299. King David group
300. Buff property
301. Iron Gate group
302. Holiday mine
303. Elna claims
304. Name unknown
305. Blue Ox prospect
306. Silver Star mine
307. Old Virginia City mine
308. Pink Lady group (nos. 1-6), Yellow Sky and Horseshoe claims
309. Lucky Horseshoe claim
310. Red Stone group (nos. 1-6?)
311. *Sunday Mining Co. group*
312. Blue Boy and Marietta claims
313. 4D claims (nos. 1 and 2)
314. Silver Moon prospect (36 claims)
315. Silver Bell group (57 claims)
316. Silver State claim
317. Mineral Jackpot prospect
318. Guranium group (10 claims)
319. Happy Return mine
320. Contact group (7 claims)
321. Eureka claims (nos. 1-3)
322. Carol R mine
323. Jeep claim
324. Denny D claims (nos. 1-9)
325. Sunrise claims
326. Nevada Uranium No. 1 claim
327. Relich prospect
328. Northern Belle mine
329. Lucky Susan No. 1 claim

NYE COUNTY

330. Idle Wild claims
331. Dottie Lee claim
332. Hazel E prospect
333. Smuggler mine
334. Illinois mine
335. Wonder Girl prospect
336. "66" claim
337. Rainbow claims (nos. 1-20)
338. Hazel No. 6 claim
339. Air Anomaly No. 4
340. Round Meadow Canyon area
341. Pine group (5 claims)
342. Bey group (27 claims)
343. N & H group
344. 4 Aces and Joker claims
345. "Round Mountain area"
346. Violet Blue prospect
347. Henebergh Tunnel
348. Green Top claim
349. Blue Bird No. 1, Granite, and *Nighthawk claims*
350. Shoe-Shoe mine
351. First Strike prospect
352. Bobby-Jack, Jeep, and Lincoln groups
353. Foster group
354. Localities U-32, 33, 34, 35
355. Locality U-37
356. Bernice Anderson property
357. Red Dog No. 3 prospect
358. Black Bart Extension claim; Black Bonanza claims (nos. 1-27)
359. National Bank group
360. Virginia Lode claim
361. Daisy fluorspar mine
362. Butler prospect
363. Ultra Mining Co. group (nos. 1-16)
364. Nyemin claims (nos. 1 and 2)
365. Thor claims (nos. 1-3)
366. Lime Ridge group (nos. 1-50)
367. 6-Mile claims (nos. 1-11)
368. Manhattan mining district
369. Unnamed occurrence
370. Williams property
371. Pilot group, U-O Dome claims (nos. 1-10)
372. Rex No. 33 claim
373. Bunker-Stone No. 1 claim

PERSHING COUNTY

374. Two Chuckers group (nos. 1-3)
375. Sage Hen Springs, Uranium Lode claims
376. Four Jacks claims and Pennies claims (about 70 claims), Maybeso prospect
377. Poncho group (2 claims), Butch group (7 claims), Doris claim
378. Big Question claim
379. Jack group (18 claims)
380. Kinbo group
381. Black Granite group (nos. 1-12), Willow group (nos. 1-19)
382. Unnamed airborne anomaly
383. Scossa mining district
384. Majuba Hill mine
385. Stalin's Present prospect
386. Vernon and Snowstorm claims
387. Jackpot claims (nos. 1-8)
388. Teacup claims (nos. 1-32)
389. Lincoln Hill mine
390. C. L. Point group (nos. 1-32)
391. Long Lease

STOREY COUNTY

392. Hill and Burgner prospect

WASHOE COUNTY

393. Hog Ranch occurrence
394. Locality No. 7
395. Happy Day property
396. Locality No. 10
397. Lucky Day group
398. Name unknown
399. Name unknown
400. Lizard claims (nos. 1-5)
401. Hopeless prospect (7 claims)
402. Unnamed prospect
403. Armstrong claims
404. Garrett prospect
405. Lowary claims
406. DeLongchamps prospects
407. Lost Partner group
408. Bing group (nos. 1-11)
409. Snap property
410. Thunder Bird group (nos. 1-15)
411. Divide claims (nos. 0-9)
412. Golden Eagle and Red Eagle claims
413. Sunnyside claims (nos. 1 and 2)
414. Go-Getter and Pup claims
415. Lara No. 9 claim
416. Laura(?) claim
417. Tick Canyon group (nos. 1-16)
418. Independence group (nos. 1-12)
419. Crescent claims
420. Yellow Jacket claims
421. Jeanne K claim
422. Barbara L. claim
423. Herbal claims (4 claims)
424. Bastain prospects
425. Lucky Day and Valley View prospects
426. Buckhorn mine
427. Granite Mountain prospect
428. Petrified Tree group (nos. 1-17)
429. Daisy Mae claims
430. Mandy's prospect
431. Good Luck claims (nos. 1-8)
432. Black Hawk claims (nos. 1-9)
433. Name unknown
434. Red Rock prospect
435. Sundown claim, Wadsworth Uranium group (18? claims)
436. Verdi lignite-uranium prospect
437. Neuebaumer and Kelley claims

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438. Cherry Creek Hot Spring
439. Ruggles Leader claims
440. U_3O_8 claims (nos. 1-12)
441. Mount Wheeler area
442. Grand Prize and Mayflower claims