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Mineral Resources of the White Mountain
Wilderness and Adjacent Areas,
Lincoln County, New Mexico

By

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With a section on
Aeromagnetic Interpretation, by
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STUDIES RELATED TO WILDERNESS

WILDERNESS AREAS

Under the Wilderness Act (Public Law 88-577, Sept. 3, 1964) certain areas within the National forests previously classified as "wilderness," "wild," or "canoe" were incorporated into the National Wilderness Preservation System as wilderness areas. The act provides that the Geological Survey and the Bureau of Mines survey these wilderness areas to determine the mineral values, if any, that may be present. The act also directs that results of such surveys are to be made available to the public and submitted to the President and Congress. This bulletin reports the results of a mineral survey of the White Mountain Wilderness and adjacent areas, New Mexico.

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Studies Related to Wilderness

Mineral Resources of the White Mountain Wilderness and adjacent areas, Lincoln County, New Mexico

By Kenneth Segerstrom, U.S. Geological Survey, and
R. B. Stotelmeyer and F. E. Williams, U.S. Bureau of Mines

Summary

Studies to evaluate the mineral resource potential of the White Mountain Wilderness, south-central New Mexico, were made by the U.S. Geological Survey and U.S. Bureau of Mines. The study included collection and compilation of geologic, geochemical, geophysical and mining data. A total of 902 samples were taken by the Geological Survey and 813 by the Bureau of Mines in the wilderness and vicinity.

The area, encompassing the most rugged and least developed part of the Lincoln National Forest, has a total relief of about 5,000 ft (1,525 m). Sierra Blanca rises to 12,003 ft (4,201 m) above sea level in the Mescalero Apache Indian Reservation just south of the wilderness boundary. Acreage of the wilderness is 31,170 (126 km²), and proposed additions total 12,880 acres (21 km²) more.

The White Mountains consist of a thick pile of nearly horizontal volcanic rocks of Tertiary age which are intruded by three stocks and their apophyses. The volcanic rocks unconformably overlie sedimentary rocks which have been downwarped in the Sierra Blanca structural basin. The volcanic rocks represent an inversion of topography in a sense, for they form a topographic high over a structural low. The basin is just east of the Tularosa Basin and just west of the Mescalero arch. The White Mountains form part of the Lincoln County porphyry belt. Mineralization that has occurred within the study area is manifested in breccia pipes, disseminations in unbrecciated intrusive rocks, and in fissure veins.

The study area appears to have a good potential for the discovery of a molybdenum-copper deposit in a breccia pipe, possibly with additional gold and silver, or a disseminated molybdenum deposit in relatively unbrecciated intrusive rock. Either type of deposit would be of low grade and to be economic would have to be of large tonnage. Parts of three igneous stocks and a plug occur in the study area. A small part of the Rialto stock, predominantly a monzonite, lies within one of the proposed additions. The Three Rivers stock, primarily a syenite porphyry, underlies a large area in the southwestern part of the study area. Nearly a third of the Bonito Lake stock, a syenite, lies within the southeastern part of the study area. The relatively small plug of rhyolite of Cone Peak is in the wilderness area. These intrusives have undergone hydrothermal alteration and have been mineralized in places. To prove or disprove the existence of ore deposits in these rocks would entail extensive drilling programs and expenditures of great amounts of capital. Target areas are suggested by contoured molybdenum values of 15 ppm or greater. Four of the anomalous areas are underlain by the Three Rivers stock and a fifth is underlain by the Rialto stock. Weakly anomalous molybdenum values in the argillized rhyolite of Cone Peak suggest another target (Thompson, 1974, p. 17).

Beryllium, niobium, rare-earth elements, molybdenum, fluorine and riebeckite taken together are characteristic of alkalic rocks like those of the Three Rivers stock, and although their presence does not in itself indicate a potential ore body, their abnormally high concentrations at or near the head of Indian Creek near the boundary of the Mescalero Apache Indian Reservation, may indicate a potential exploration target for rare-earth elements and beryllium, as well as for molybdenum.

The fissure veins are generally narrow and lenticular. Metals associated with the veins are copper, lead, zinc, silver, and gold. The veins have been intensively prospected in the past. Since 1880, more than 4,000 mining claims have been located in the study area, most of them on fissure-vein deposits in volcanic rocks. Selected samples taken by the Bureau of Mines from mine dumps, ore stock-piles, and veinlets yielded high anomalous results at some places, but none of these samples is believed to be representative of a large deposit.

Nonmetallic mineral resources of the area include fluorite, quartz crystals, corundum, alumina, and coal. Their occurrence is described in this report, but none of these commodities occur in sufficient concentrations or tonnages for profitable exploitation. Sand, gravel, and building stone also occur, but their distance from markets makes them noncompetitive with construction materials from other sources. There is no evidence to indicate a potential for petroleum production, nor for the development of a geothermal resource in the area.

Introduction

Location and accessibility

Rising steeply above the desert to the west, a major southern extension of the Rocky Mountains culminates in the White Mountains massif. The White Mountain Wilderness encompasses a rugged and roadless part of the Lincoln National Forest, in Lincoln County, south-central New Mexico. The White Mountains have been extensively pitted by mine prospects, and the meager water resources have been tapped by pipelines, so that the still undeveloped wilderness area is small (31,171 acres or 126 km²) and of irregular shape. Moreover, the highest part of the range, including Sierra Blanca is in the Mescalero Apache Indian Reservation and hence excluded from designation as a wilderness area.

The town of Ruidoso, with a year-around population of 2,216 in 1970, is a little over 10 miles (16 km) southeast of the White Mountain Wilderness. Nearby Ruidoso Downs is an internationally known race track, a mecca for thousands of devotees during the racing season. There were over 100 motels in and near the town in 1974, and several thousand summer homes. Other attractions of Ruidoso are a cool summer climate, and an adjacent ski area; these, coupled with relative nearness to Texas cities, bring additional thousands of people into the region. Burgeoning land development on the east flank of the mountains contrasts with little or no land development on the west and north sides, where cattle grazing is practically the only use.

Carrizozo, the county seat of Lincoln County, with 1,123 inhabitants in 1970, is 7 or 8 mi northwest of the northern end of the wilderness area. This town, in contrast with booming Ruidoso, has declined in population for the last several decades.

The wilderness area lies within a large triangle formed by U.S. Highways 54, 70, and 380 (fig. 1). State Highway 37 cuts across the

Figure 1.--Near here.

triangle on the east flank of the mountains. From Highway 37, four roads branch west, leading to the edge of the wilderness. From south to north these are:

(1) Forest Road No. 532, narrow and with hairpin curves but black-topped, leads from Alto, 6 1/2 mi (10.5 km) north of Ruidoso, to the Sierra Blanca Ski Area, 19 mi (31 km) by road west of Alto.

(2) Forest Road No. 107, graveled on lower part, unsurfaced on upper part, leads up Bonito Canyon from State Highway 37 westward to the mouth of Argentina Canyon, a distance of 9 mi (14.5 km).

(3) Forest Road No. 400, a good graveled road, leads from the village of Nogal, up Nogal Canyon to the wilderness boundary, a distance of 7 mi (11.3 km). Near the upper end of Forest Road No. 400, a branch (No. 108) leads south, past Parsons Hotel, and connects with Forest Road No. 107.

(4) Forest Road No. 580, a rough jeep trail with several gates, leads from Highway 37 about a mile north of Nogal up Tortolita Canyon to the wilderness boundary, a distance of 7 mi (11.3 km).

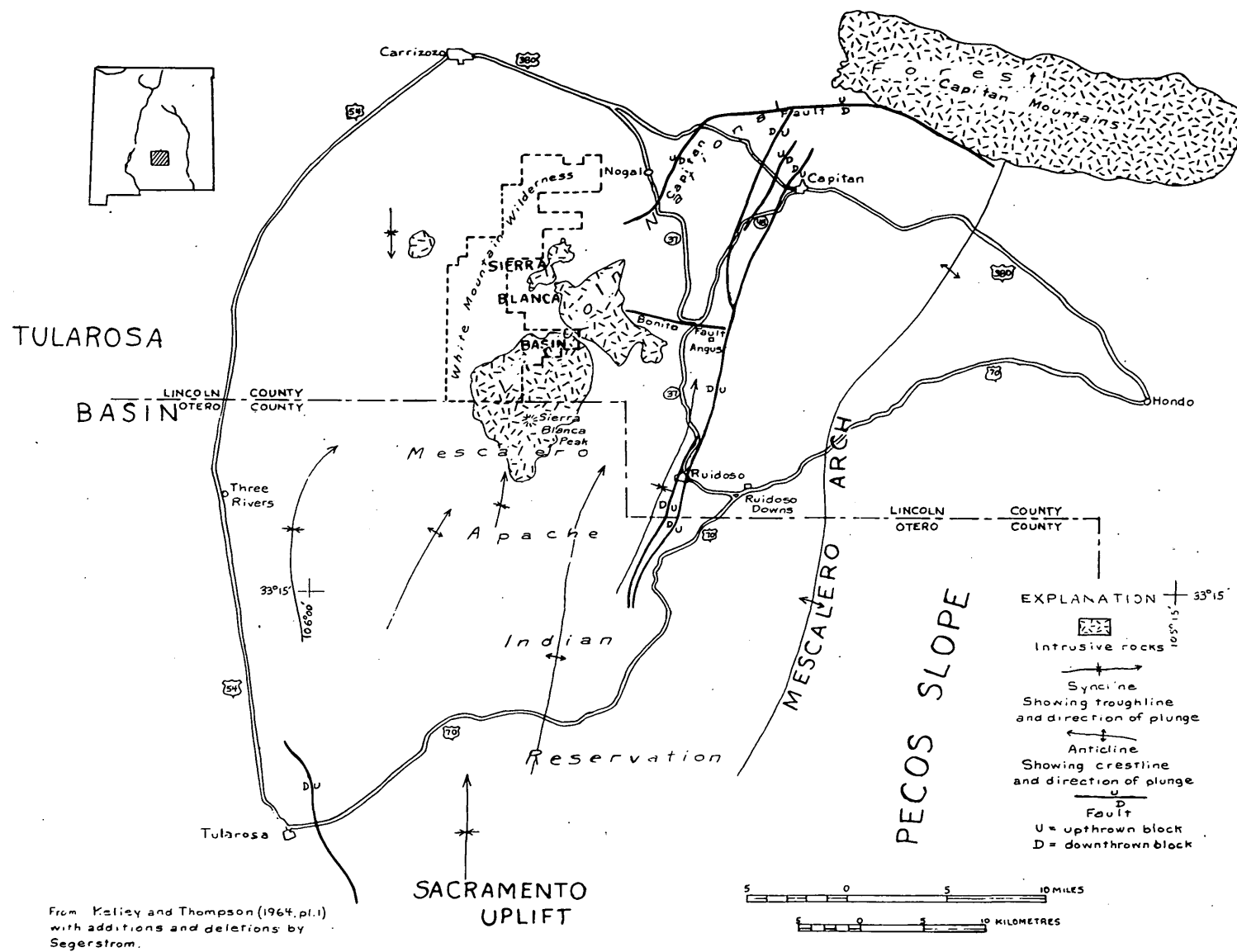


FIGURE 1. - Index map of part of southern New Mexico showing structural setting of the White Mountain Wilderness and vicinity.

Main access to the west side of the White Mountains is via Forest Route No. 579, a good graveled road, which leads from Three Rivers, a tavern on U.S. Highway 54, 16 mi (26 km) southwest of Carrizozo to Three Rivers Campground at the wilderness boundary, a distance of 15 mi (24 km). Various unimproved ranch roads, some of them with locked gates, lead toward the west boundary of the wilderness (fig. 1).

At the ski area an 8,000-ft (2,440 m) long gondola lifts passengers 1,700 ft (518 m) vertically to an elevation of 11,400 ft (3,477 m). This lift is operated not only during the skiing season, but also during the summer tourist season. It provides easy access to the highest part of the White Mountain Wilderness.

Crest Trail passes near the summit house of the ski lift and traverses the wilderness to Nogal Peak, a distance of 12 mi (19.3 km). This seldom used trail provides splendid views of White Sands and the Carrizozo lava flow to the west and has several alternate routes which branch down the canyons to the east and west to provide good access to most parts of the wilderness.

Topography

The White Mountain Wilderness Area includes part of the tremendous west escarpment of the White Mountains; from a point on the crest about 1/2 mile (0.8 km) north of the county line between Lincoln and Otero Counties to Three Rivers Canyon, a distance of 2.4 miles (4 km), there is a drop of 4,500 feet (1,372 m). The ridge between Indian Creek and Three Rivers Canyon, near the south boundary of the wilderness area, is almost unimaginably rugged, dissected as it is by steep gullies with numerous falls 50 to 100 ft (15-30 m) or more high. The wild beauty and enormous height of the west escarpment would be notable in any regional setting; it is even more notable in its proximity to the relatively uninspiring bajada terrain to the west.

The eastern slope of the wilderness is also deeply dissected, but interfluves descend ramplike away from the mountain axis. Indeed, lower parts of the interfluves, outside the wilderness boundary seem to be graded to an extensive high terrace that continues many miles down the Pecos Slope to the east. The poorly defined eastern base of the White Mountains--roughly along State Highway 37 is about 7,000 feet (2,135 m) above sea level--about 1,000 feet (305 m) higher than the well defined western base of the range.

Drainage

Most of the wilderness lies along the watershed divide between the undrained Tularosa Basin, to the west, and the through-going Pecos River valley, to the east. All of the drainage to the east is funnelled through the Rio Hondo, which joins the Pecos at Roswell. The Rio Bonito and the Rio Ruidoso, the principal branches of the Hondo, both head in the White Mountain Wilderness. In their upper reaches these streams and their main tributaries are mostly spring-fed and perennial. On the other hand, collection basins of the streams that drop off the western escarpment are so minuscule that nowhere does perennial flow extend beyond the wilderness boundary there.

Climate and vegetation

The White Mountain Wilderness is one of moderate to heavy precipitation and forest cover as compared with the relatively arid and barren lowlands to the east and west. The summer temperatures average about 20° F. (11° C.) cooler than nearby valley and basin localities and the average annual rainfall, about 25 inches (635 mm), is three times that of lower land to the west and twice that of lower land to the east. Springtime is usually very dry: periods of extreme forest-fire danger are common in April, May, and June.

The climate and vegetation of the White Mountain Wilderness are primarily functions of altitude although they are also affected by ruggedness of terrain and direction of slope. The descent from the crest down the western escarpment is characterized by a sharp increase in temperature and decrease in rainfall and forest cover.

Previous geologic investigations

The earliest published reference to the geology of the area is that of F. A. Jones, who briefly described three mining districts in the White Mountains: the Nogal, the Bonito, or Parsons, and Eagle Creek-Rio Ruidoso (1904, p. 168-172). The Nogal District was described in much more detail by L. C. Graton a few years later (1910) and then briefly again by Lasky and Wootton (1933). The first geologic map and structure section of the area were by N. H. Darton (1922, pl. 40, fig. 28); Intrusive rocks and extrusive rocks are not separated on the map.

During World War II, the U.S. Bureau of Mines made reconnaissance investigations of lead and zinc deposits in the Helen Rae-American mines area near the northeast corner of the wilderness area and at several prospects outside the wilderness in Tanbark and Turkey Canyons. A corundum occurrence at the mouth of Blue Front Canyon (in the southeastern part of the wilderness) and a quartz-crystal deposit on the divide between south Rio Bonito and Three Rivers Canyons were also investigated; but no reports were published.

In 1959, G. B. Griswold's book on the mineral resources of Lincoln County appeared. In this comprehensive study all of the subdistricts mentioned are described as parts of the Nogal Mining District. The investigations of Griswold covered many mines and prospects (1959, p. 41-64). A later study by Griswold and Missaghi was the first one to be published on molybdenum occurrences in the White Mountains (1964). A geochemical survey of the Crow Mine area in Tanbark Canyon was made by Mardirosian (1964).

Weber's geologic map of the Carrizozo quadrangle (1964) represented a departure from earlier investigations, which were largely restricted to descriptions of mineral deposits. The published map covers the northern part of the White Mountain Wilderness and adjacent areas to the west and north, at a scale of about 1:175,000. A year later the geologic map of New Mexico appeared (1965); at a scale of 1:500,000. The State map over-generalizes the geology of the White Mountains with its portrayal of a single large pluton covering most of the wilderness area.

In the early '60's, T. B. Thompson began a series of investigations which have continued to the time the present report was written (1974). These studies have covered virtually all aspects of the geology of the White Mountains. Thompson's studies were of the stratigraphic section of the Sierra Blanca volcanics (1964), the general geology of the area, including a geologic map at 1:62,500 scale (1966), hydrothermal alteration and mineralization of the Rialto stock (1968), petrology and mineralization of the Three Rivers stock (1972a), the Sierra Blanca igneous complex (1972), and the mineral deposits of the Nogal and Bonito mining districts (1973). Thompson also collaborated in a study of petrology and mineralization of the Three Rivers stock (Giles and Thompson, 1972).

Present investigations

The present study is primarily a mineral evaluation made during 1971-73 within the framework of the known geology of the area. Because of time restrictions, no attempt was made to remap the geology. After some checking was done, the published maps by T. B. Thompson were used, thus allowing the present authors to spend practically all of their time in geochemical prospecting, investigations of mineralized outcrops, interpretation of analytical results, and interpretation of the aeromagnetic survey which was made especially for this study. The present work was extended into adjacent mining districts in order to complete our coverage of the mineral potential of the wilderness area itself.

In the field, the greatest effort was devoted to the sampling of stream sediments, for samples of these inherently represent larger volumes of rock than do samples of individual bedrock outcrops.

The entire study area has vertical airphoto coverage in color, at a scale of approximately four inches to the mile (1:15,840). Stereo pairs of these pictures, taken in 1969 for the U.S. Forest Service, were used in the field for plotting sample localities and checking the geology. The localities were transferred to a U.S. Forest Service planimetric base at a scale of two inches to the mile (1:31,680), and in this way plate 2 was compiled.

An aeromagnetic survey of the area (pl. 1), made in 1971 by the U.S. Geological Survey, was interpreted by Lindrith Cordell.

Investigations by U.S. Bureau of Mines personnel included a search of all public records for mining-claim locations (pl. 3), a review of the region's mineral history, and a field examination of mining claims, prospect workings, and mineral showings on and near the mining claims.

Acknowledgments

Our deepest appreciation for help in this study goes to T. B. Thompson, professor of economic geology at Colorado State University, and the person who is the most knowledgeable regarding the local geology. Plate 1 is compiled from Thompson's published and unpublished geology.

Ralph Forsythe, mine operator at Nogal, provided useful information. The services of Arvel Runnels, hotel keeper and horse wrangler at Parsons, were indispensable in locating scores of obscure and overgrown diggings. Geologists of Perry, Knox, and Kaufman, Inc., accompanied Segerstrom in the field and contributed their ideas about molybdenum occurrences. U.S. Forest Service Ranger Wayne White, formerly of the Ruidoso Ranger Station, and now of the Supervisor's office in Alamogordo, and Roy Parker, General Manager of the Sierra Blanca ski development, helped us with access information and the use of the gondola ski-lift. Kelly Stevenson, of Carrizozo, and T. F. Ryan III, of Three Rivers, kindly gave us permission to go through privately owned land on the west side of the wilderness. The authors are also indebted to R. H. Weber, of the New Mexico Institute of Mining and Technology, for identification of many Bureau of Mines rock and mineral specimens.

Geology
Sedimentary and volcanic rocks
Cretaceous sedimentary rocks

The oldest rocks known to be present in the area are assigned to the Mesaverde Group (pl. 1). These rocks do not crop out in the White Mountain Wilderness; their outcrops are restricted to a small area south of Nogal. This unit was first defined by W. H. Holmes (1877), and its type locality is Mesa Verde, Montezuma County, southwestern Colorado. In both southwestern Colorado and south-central New Mexico, the Mesaverde Group is divisible into a lower sandstone member about 200 feet (60 m) thick, a middle shale-coal unit about 200 feet (60 m) thick, and an upper sandstone about 50 feet (15 m) thick. The upper unit has thin conglomerate beds which were once assigned to the overlying McRae Formation (Bodine, 1956, p. 9). However, the well rounded clasts in these beds "could only have been achieved with the type of environment known to exist during Mesaverde time" (Thompson, 1966, p. 16).

Cretaceous-Tertiary sedimentary rocks

The McRae Formation unconformably overlies the Mesaverde Group. The unit crops out only in the west-central part of the area (pl. 1). The McRae Formation was first defined by V. C. Kelley and C. Silver (1952, p. 115-120) who designated part of the eastern shore of Elephant Butte Reservoir as the type locality. The formation consists largely of interbedded sandstone, shale, and siltstone, with a basal conglomerate member. The sandstone beds are commonly white-to-buff in the lower part and red to maroon in the upper part of the unit (Thompson, 1966, p. 17, 18). The term "Cub Mountain Formation" was used for the same strata by Bodine (1956) and Weber (1964), but the present authors agree with Thompson in assigning the term "McRae Formation" to these beds, on the grounds that the equivalent local name, "Cub Mountain," is unnecessary. A measured section in Sanders Canyon, just outside the wilderness to the west, gave a total thickness of 2,400 feet (732 m) (Weber, 1964, p. 105).

Tertiary volcanic and sedimentary rocks

Sierra Blanca Volcanics

Most of the White Mountain Wilderness is underlain by the Sierra Blanca Volcanics, a group of Oligocene age composed of three formations that are exposed in the study area: Walker Andesite Breccia, Church Mountain Latite, and Nogal Peak Trachyte. Outcrops of the unit are restricted to the area shown in plate 1 and to much smaller areas to the west and south. The Sierra Blanca Volcanics, first defined by Thompson (1964) and Weber (1964), unconformably overlie the McRae Formation and Mesaverde Group and occupy much of the terrain shown as "intrusive" on the State map (1965). The type section extends from Elder Canyon to Nogal Peak, approximately in the center of the wilderness area. There, the measured thickness of the Sierra Blanca Volcanics is 3,340 feet (1,019 m) (Thompson, 1964, p. 76).

Walker Andesite Breccia

The oldest and thickest formation in the Sierra Blanca Volcanics is the Walker Andesite Breccia (2,355 feet or 718 m), named for a ranch on the western side of the White Mountains. As described by Thompson there are 36 flow units in the formation in the vicinity of Nogal Peak, and it consists of a basal flow breccia 703 feet (214 m) thick overlain by alternating flow and flow-breccia units (1972, p. 2342-47). Locally these units are hydrothermally altered and intruded by dikes. Breccia fragments are 2 to 6 inches (5-15 cm) across and constitute more than 50 percent of the rock. Plagioclase (An_{42} to An_{77}) and augite are the most abundant phenocrysts in the lower part of the formation. Hornblende, biotite, and sanidine increase in abundance upward through the section and the plagioclase becomes more sodic (An_{38}) in microlites near the top of the formation. Sample T17, in Elder Canyon, near the bottom of the volcanic section, is 47.4 percent SiO_2 (Thompson, 1972, table 1).

The Spring Canyon Andesite Member is a light-gray erosion-resistant andesite flow which is intercalated between less resistant red-to-maroon andesite breccias.

Nogal Peak Trachyte

A sequence of five volcanic flow units 985 feet (300 m) thick overlies the Walker Andesite Breccia on Nogal Peak, with apparent conformity. Two characteristics distinguish this formation, designated as the Nogal Peak Trachyte by Thompson, from the underlying andesitic formation: (1) composition; (2) a complete absence of hydrothermal alteration and dikes.

The plagioclase is relatively sodic, An_{32} to An_{34} , and the silica content of a sample taken near the middle of the formation is 65.4 percent. Sanidine, glass, and quartz are present in minor amounts (Thompson, 1972). No magmatic activity has taken place in the area of the Nogal Peak Trachyte since its emplacement, consequently it is unmineralized.

Church Mountain Latite

Church Mountain and several smaller summits are capped with latite porphyry and ash flows which directly overlie the Walker Andesite Breccia with apparent concordance. The Church Mountain Latite, so named by Thompson, has a maximum thickness of 750 feet (229 m). Its relationship to the Nogal Peak Trachyte is not known, as the two formations are not in contact.

As the name implies, the formation is more felsic than the underlying rocks. Phenocrysts in the porphyry are in order of abundance, plagioclase, sanidine, hornblende, and biotite. Crystal fragments of the same minerals in a matrix of glass are constituents of the ash flows. A radiometric age determination by the New Mexico State Bureau of Mines and Mineral Resources on a glass sample from near the summit of Church Mountain gave a K-Ar date of 31.8 ± 1.3 million years (Thompson, 1972). This is the only determination which has been made for the age of the Sierra Blanca Volcanics.

Ogallala(?) Formation

A formation which does not crop out in the White Mountain Wilderness but does on the east and west sides (pl. 1) consists of fanglomerate of Pliocene(?) age. This unit, which has been greatly eroded thus distinguishing it from more recently deposited gravels, is somewhat lithified. It overlies the relatively strongly lithified Sierra Blanca Volcanics, McRae Formation, and Mesaverde Group with great unconformity.

The name, Nogal Fanglomerate, has been applied to the formation (Thompson, 1966, p. 19) but the authors feel that this local name is unnecessary. We agree with Thompson that the formation is probably correlative with the Ogallala Formation and hence, may be considered as a fanglomerate facies of the larger unit. The Ogallala Formation extends from western Nebraska well into southern New Mexico, according to Bretz and Horberg (1949, p. 477-480).

Quaternary deposits

Glacial deposits

Bouldery morainal deposits extend from a cirque on Sierra Blanca, one mile (1.6 km) south of the wilderness area, for a distance of about a mile down North Fork of Rio Ruidoso. Both Pinedale and Bull Lake Glaciations are said to be represented by these coarse, unsorted sediments (Richmond, 1964).

Alluvial fill

Valley-fill deposits border the White Mountains on three sides. Coalescing alluvial fans spread out apron-like from the base of the mountains, grading into the well sorted fill deposits of the Tularosa Basin, to the north and west, and the Rio Hondo drainage to the east. The fan materials are typically muds, silts, and sands, locally capped by calichified rock debris.

Intrusive rocks

Intrusive rocks crop out in and immediately adjacent to the study area and include a plug of andesite porphyry, three stocks of intermediate composition with numerous related(?) dikes, and other dikes of varied composition which seem to be unrelated to the stocks. All are of Tertiary age. The stocks and dikes intrude the Walker Andesite Breccia, but they do not intrude upper units of the Sierra Blanca Volcanics (Thompson, 1966, p. 41). The stocks are not in contact with each other at the surface, but relative ages have been determined radiometrically.

Andesite porphyry

A small body of intrusive andesite porphyry about 0.6 mile (1 km) in diameter is exposed in Little Bear Canyon (south-central part of area). The andesite is emplaced in a volcanic vent believed to be the source of porphyry flows of the Walker Andesite Breccia. "The vent rock is similar in mineralogy and pilotaxitic texture to the andesite flow members of the Walker Andesite Breccia" (Thompson, 1972, p. 2348).

Rialto stock

The double-headed Rialto stock, in the central part of the map area and with an outcrop area of about 1.9 sq. mi. (6.9 km²), is the smallest and probably the oldest of the three stocks (pl. 1). The Rialto stock crops out entirely outside the wilderness area but a small part of it lies within one of the proposed additions. The principal rock type of the Rialto stock has been classed as syenodiorite (Griswold and Missaghi, 1964, p. 7) or as hornblende-biotite monzonite (Thompson, 1968, p. 944). Composition is about 90 percent orthoclase and plagioclase. The remainder of the monzonite consists of approximately equal parts of quartz and ferromagnesian minerals, plus sphene, apatite, rutile, and magnetite as accessories (Thompson, 1973, p. 8). Bodies of biotite monzonite, too small to be shown at the map scale of plate 1, cut the hornblende-biotite monzonite in places. Several small zones of brecciated rock appear in the northern "head of the stock, and a breccia pipe of mappable size crops out between the two heads (pl. 1). Hydrothermally altered rock with sulfides of copper and molybdenum is common in the stock, particularly in the northern half.

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Syenite dike

A north-striking, steeply east-dipping syenite dike as much as several hundred feet (about 100 m) wide crops out for about two miles (3.2 km) in the northwestern part of the wilderness area. According to Thompson, the dike is correlative with the Willow Hill sills about five miles (8 km) to the northwest and outside the area of plate 1. A K-Ar age of 34.4 ± 1.2 m.y. (Oligocene) was determined on biotite from a sample of the sill rock (R. H. Weber, 1970, written commun., cited by Thompson, 1972, p. 2350). This is the oldest of three radiometric ages which have been determined for rocks of the area.

Bonito Lake stock

The Bonito Lake stock crops out in the east-central part of the map area and extends well east of the area shown in plate 1; only a small part of it is exposed in the White Mountain Wilderness. Biotite syenite is the dominant rock: it is composed chiefly of orthoclase and plagioclase, although abundant microperthite occurs locally. Magnetite, apatite, zircon and pyroxene are accessory minerals. Hydrothermally altered rock occurs along the northern edge of the stock, where the biotite syenite has been argillized and silicified, and sulfides of iron molybdenum, and copper have been introduced (Thompson, 1972, p. 2351; 1973, p. 8).

A K-Ar age determination was made on biotite from a sample of the syenite taken just southeast of Bonito dam about 1-1/2 miles (2-1/2 km) east of the map area. The resulting date was 26.6 ± 1.3 m.y. or late Oligocene (Thompson, 1966, p. 111).

Three Rivers stock

Most of the southern end of the White Mountain Wilderness and vicinity is underlain by the Three Rivers stock. This intrusion, largest and youngest of the three stocks that are exposed in the area shown in plate 1, extends several miles (about 5 km) south of the map area, well into the Mescalero Apache Indian Reservation. The Three Rivers stock was the subject of a detailed study by Giles and Thompson (1972), who subdivided the intrusive into three lithologic units, and mapped a breccia zone (pl. 1). The units are interpreted by these authors as representing separate intrusive phases (1972, p. 2130-2132, figs. 3 and 4).

Rock of the oldest phase consists primarily of zoned anorthoclase phenocrysts 3-20 mm across in a fine-grained potassium-feldspar ground-mass with interstitial quartz, biotite, and hornblende. The rock is 50-90 percent phenocrysts (Giles and Thompson, 1972, p. 2133).

Rock of the second intrusive phase intrudes the older rock unit along the northern and eastern edges of the stock. The younger rock is classed as "nordmarkite" by Giles and Thompson (1972, p. 2135); it is similar to the syenite porphyry, except that the proportion of phenocrysts, 20-35 percent, is relatively lower.

The youngest phase in the Three Rivers stock is equigranular syenite; it has intruded the syenite porphyry and "nordmarkite" forming very irregular contacts. The equigranular syenite is finer-grained (0.3-0.7 mm), but of similar composition to that of other rocks in the stock (Giles and Thompson, 1972, p. 2135).

Two breccia plugs or brecciated apophyses along or near the northern margin of the Three Rivers stock have been recognized and mapped by Giles and Thompson. These bodies are depicted in plate 1.

The Three Rivers stock has been hydrothermally altered in places, particularly along the northern and eastern margins. The altered rock is silicified and some of it contains fine-grained pyrite and molybdenite (Giles and Thompson, 1972, p. 2137-2139).

A K-Ar age determination was made on anorthoclase feldspar phenocrysts from a sample of the early syenite porphyry taken in the eastern part of the Three Rivers stock. The determined age is 25.8 ± 1.1 m.y., or late Oligocene (Giles and Thompson, 1972, p. 2132).

Rhyolite of Cone Peak

A small rhyolite plug, about 0.3 mile (0.5 km) in diameter, intrudes the Walker Andesite Breccia and intrusive andesite porphyry about one mile (1.6 km) north of the Three Rivers stock. Associated rhyolite dikes extend on either side of the plug, parallel to the northwest edge of the stock, for a total distance of about 2.5 miles (4 km). An unpublished map of the plug and dikes were incorporated in plate 1 of the present report with permission from T. B. Thompson. The rhyolite represents a chemical variation of the source magma of the Oligocene igneous complex of Sierra Blanca. Intrusion of the rhyolite of Cone Peak and its argillization and mineralization probably represent "the final magmatic and hydrothermal event of the igneous complex" (Thompson, 1974, p. 17).

Smaller dikes

The most common dikes in the map area are fine-grained syenite and they are too small and discontinuous to be shown at the map scale. They are difficult to trace, particularly in the stocks to which they were derived. Dikes of greater continuity are shown on plate 1 with a dike symbol rather than as rock units, but these are smaller than the relatively large syenite dike which was mapped as a rock unit and was described in a foregoing paragraph.

The dike swarm about a mile (1.6 km) northwest of the Three Rivers stock is rhyolitic and akin to the Cone Peak plug.

Most dikes shown in the northeastern part of the map area, between Nogal and Nogal Canyon, are diabase and they are members of a prominent north-northeast trending dike swarm which extends from there to the town of Capitan, 7 1/2 miles (12 km) east of Nogal (Elston and Snider, 1964). These dikes intrude the Walker Andesite Breccia and the Bonito Lake stock, and hence are younger than either.

Dikes mapped in the northwestern and western parts of the area radiate outward from the main mountain mass for the most part (pl. 1) and hence would appear to be genetically related to the Rialto or Three Rivers stock. These dikes do not, however, crop out near the stocks, and some of them are of diabasic and gabbroic composition (Weber, 1964, p. 107; Thompson, 1966, p. 60), which is very unlike that of the stocks.

Structure

The White Mountains rise in the Sierra Blanca basin, a structural depression on the west flank of the Mescalero arch, which is bordered here by the Tularosa basin to the west and the Pecos slope to the east (Fig. 1). Structure contours show relief of as much as 5,000 feet (1,525 m) from the floor of the Sierra Blanca basin to the crest of the Mescalero arch in a distance of about four miles (6.4 km), according to Kelley and Thompson (1964, pl. 1). Intrusion of syenitic stocks (Rialto, Bonito Lake, and Three Rivers) into the basin volcanics has been non-deformative, for the lava flows are generally horizontal (Thompson, 1966, p. 73).

Detectable faults, sufficiently large to map, are generally restricted to the northeastern and central parts of the study area (pl. 1). Many small faults, difficult to detect in the igneous complex of Sierra Blanca were not mapped. The only conspicuous joints occur near the northern perimeter of the study area, where radial fractures are generally occupied by dikes.

The large Capitan fault, with a maximum displacement of about 1,300 feet (400 m) at a point northeast of the town of Capitan (Kelley and Thompson, 1964, p. 116), dies out south of the town of Nogal, in the northeastern part of the study area (pl. 1). Faults in the central part of the mapped area represent westward splaying out of the east-trending Bonito fault (fig. 1 and pl. 1), which displaces beds about 1,500 feet (about 460 m) near Angus (fig. 1). The stratigraphic throw along the splays is not over 150 feet (46 m), according to Thompson (1966, p. 75).

Geomorphology

The eastern slope of the White Mountains has deeply weathered interfluves, which descend, ramplike, from the crest to the lower country to the east, where they are overlapped by the fanglomerate facies of the Ogallala Formation. The interfluves are dissected remnants of an old erosion surface where oxidation of sulfide minerals is deep, 60-80 feet (20-25 m). On the western flank, where total relief is much greater than on the east, this surface has been completely destroyed, but the presence of Ogallala(?) fanglomerate farther westward from the base of the mountains suggests that the same surface, or a contemporary one is preserved there by burial.

Aeromagnetic interpretation

By Lindrith Cordell

Aeromagnetic data over the Sierra Blanca area were obtained by the U.S. Geological Survey in 1970, in support of the economic evaluation of the proposed wilderness area. Data were recorded by fluxgate magnetometer flown at an elevation of 12,500 feet (about 1,300 m) along north-south flight lines, spaced about one mile (1.6 km) apart. Total magnetic intensity relative to an arbitrary datum, at a contour interval of 20 gammas, is shown in plate 2. The data are corrected for diurnal variation and traverse ties. The effect of the main geomagnetic field, which contributes a smooth field increasing about nine gammas per mile toward magnetic north, has not been removed.

Magnetic anomalies within the area are related to the intrusive stocks. The gradients along the edges of these anomalies indicate that their sources are at, or fairly near to, the surface.

A magnetic low of about 500 gammas is associated with the Three Rivers stock. Although no magnetic measurements were made on rock samples, the fact that the anomaly is negative can probably be attributed to reversed remanent magnetization. Reversed magnetization is acquired when an intrusive body is emplaced during a period when the polarity of the earth's magnetic field is opposite to the present field direction. It is commonly observed. Alternatively, the magnetic low could indicate that the stock is relatively less magnetic than adjacent rock. This is not likely. The stock is very little altered, and the adjacent rock does not appear to be unusually magnetic, because there is little magnetic expression of topographic ridges in this material. Reversed magnetization of the Three Rivers stock is not particularly significant except that it serves to separate in time the Three Rivers stock from the Bonito Lake and Rialto stocks, which were emplaced during a time of normal polarity.

A positive magnetic anomaly of unknown extent is observed at the southern border of the map area. Inasmuch as this anomaly may contribute a polarization low on its north side to the negative anomaly over the Three Rivers stock, the resulting interference makes it difficult to delimit the subsurface outline of the Three Rivers stock from the magnetic contour pattern. Taken at face value, the trace of the inflection point of the anomaly indicates that the stock is roughly rectangular, with northeast- and northwest-trending sides. This figure does not fit the outcrop pattern very well, but it is aligned with the two main directions observed in the regional structure.

A positive magnetic anomaly (approximately that part of the field contained within the 2200 gamma contour level) circumscribes the area of outcrops of the Bonito Lake and Rialto stocks. The anomaly does not necessarily mean that a homogeneous intrusive mass exists at depth, but it probably does indicate the presence of a more extensive ensemble of intrusions and related rocks than is exposed at the surface. The small positive anomaly (labeled "2543" gammas) may be due to an individual buried intrusive, or a subsurface southward extension of the Rialto monzonite that crops out in Bonito Canyon.

Coalescing of the intrusive bodies at depth and the presence of buried intrusives is not remarkable, and could be predicted on geologic grounds independently of the aeromagnetic data. The aeromagnetic data do, however, serve to delimit the area of intrusive activity.

Based on the position of the inflection point of the anomaly, which generally occurs between the 2200 gamma and the 2300 gamma contour level, the edge of the buried intrusive body (or ensemble of bodies) trends from the molybdenum prospects in Eagle Creek northwest about four miles to an exposure of andesite porphyry in Little Bear Canyon, and from there trends to the north-northeast across upper Bonito Canyon to Nogal Peak. It is possibly significant that this trend, between Eagle Creek and Little Bear Canyon, coincides with three geochemical molybdenum anomalies, the inference being that the molybdenum mineralization occurred in places along the margin of the intrusive stocks. By the same reasoning, however, this trend, based on the aeromagnetic data, does not appear to continue on to the northwest across the proposed wilderness area, but instead shifts to the north-northeast toward Bonito Canyon.

Magnetic expression of altered intrusive border zones, caldera ring dikes, or structural intersections is not observed in these data. Mineralization occurred along the east-west trend of the Bonito fault zone in Bonito Canyon, but there is no magnetic expression of this fault west of the Bonito Canyon prospects, across the border of the hypothetical intrusive body, and into the proposed wilderness area. The Capitan fault, a major regional fault trending northeast from the Sierra Blanca area, is not observed in the surface geology. The northwest edge of the Three Rivers stock anomaly is aligned with the Capitan trend, but there is no basis in the magnetic data for connecting this trend with the end of the Capitan fault on the eastern edge of the geologic map.

Mineral resources

Mineral deposits which were economically exploitable or were believed to be so in the past have been found in the White Mountain Wilderness area. The Nogal mining district, located partly in the wilderness (pl. 2), and the Bonito mining district, outside the area to the east, have together produced about \$1,000,000 at present values for metals (Thompson, 1973, p. 10). Most if not all of this production has been from the parts of the area that are excluded from the wilderness and its proposed additions. The Schelerville mining district, located almost entirely within the northwestern part of the wilderness, has produced small but unrecorded amounts of metals. In addition, several relatively small geochemical anomalous areas in the southern part of the wilderness were found during the present study outside the mining districts. One of them extends into the Mescalero Apache Indian Reservation.

In the Nogal mining district the metalliferous deposits occur in fissure veins, breccia pipes, disseminated "porphyry" bodies, and placers (Thompson, 1973, p. 10). In the Schelerville district the deposits occur in veins, some of them associated with east-striking mafic dikes, and disseminated in andesite breccia flows. In the Nogal district the dominant metal sought was gold; in the Schelerville it was copper. Although no molybdenum has been mined, its occurrence in the syenitic stocks is widespread, and it is believed to be by far the largest potential mineral resource of the White Mountain Wilderness and vicinity.

Three types of mineral occurrences are described by Giles and Thompson (1972, p. 2138-2139) in the Three Rivers stock, where most of the anomalous concentrations of molybdenum were found during the present study: (1) Molybdenite that occurs as coatings on fracture seams and as fine-grained disseminations in quartz veinlets; (2) molybdenite that occurs with silica and pyrite in the matrix of narrow brecciated zones; (3) molybdenum contained within dense, aphanitic, high-silica rock without visible molybdenum-bearing veinlets or incrustations.

Sampling and analytical techniques

Geochemical sampling traverses were run along most streams and some ridges. The distribution of Geological Survey sample localities is given in plate 3. Samples collected from streams were mostly composed of fine-sand size sediments taken in channels, but some of them were of grus, or fine rock debris, taken in tributary gulches. Samples collected from ridges were generally bedrock, although samples of residual soil were collected in saddles. The localities were plotted in the field on stereo pairs of contact prints of airphotos, and later transferred to a planimetric base compiled by the U.S. Forest Service by aerophotogrammetric methods.

In the Denver laboratories of the U.S. Geological Survey the samples were dried and ground to minus 80 mesh, where required; then they were all subjected to semiquantitative spectrographic analysis for 30 elements. These elements are: iron, magnesium, calcium, titanium, manganese, silver, arsenic, gold, boron, barium, beryllium, bismuth, cadmium, cobalt, chromium, copper, lanthanum, molybdenum, niobium, nickel, lead, antimony, scandium, tin, strontium, vanadium, tungsten, yttrium, zinc, and zirconium. Certain rare-earth and associated elements were also sought in most samples.

Additionally, because the detection limit for gold by standard semi-quantitative spectrographic analysis is high, 10 ppm, gold determinations were made on 66 samples by the combination of fire assay and atomic absorption, with a detection limit of 0.05 ppm, and on 19 additional samples solely by atomic absorption, with the same detection limit. Arsenic, an indicator element with poor sensitivity to the standard spectrographic method (detection limit 200 ppm), was determined spectrophotometrically in 68 samples, with a detection limit of 1 ppm, and colorimetrically in 19 additional samples, with the same detection limit.

Evaluation of sample data

Molybdenum

Five significant molybdenum anomalies determined by the sampling and analytical work of the U.S. Geological Survey, and designated as "A", "B", "C", "D", and "E", are shown in plate 2. Four of the anomalies are in the Three Rivers stock, and the fifth is in the Rialto stock. The shape and size of each anomaly is outlined by contours of equal concentrations at 15, 30, 45 ppm, and so on. Lesser anomalies are also shown although they are not discussed individually.

Anomaly "A", on a high ridge at the extreme southeast corner of the White Mountain Wilderness, extends southward into the Mescalero Apache Indian Reservation. The underlying rock is mostly equigranular syenite of the Three Rivers stock (pl. 1). Samples typical of the bulk of exposed rock contained as much as 100 ppm molybdenum, but an atypical sample of gossan float (No. 432) contained 1,500 ppm molybdenum (table 3). The outcrop from which the float came was not found; it is probably buried under colluvial deposits. "Qualitative tests showed that molybdenum is in the limonite of sample 432, as well as in the heavy-mineral concentrate from which limonite had been leached. This concentrate also contains fluorite." (W. R. Griffitts, written commun., March 1974.)

Anomaly "B", centered at the head of Little Bear Canyon, in the south-central part of the wilderness area, lies along the northern margin of the Three Rivers stock, partly in intrusive breccia. The highest molybdenum concentration, 70 ppm, was in sample No. 104.

Anomaly "C", with a maximum of 150 ppm molybdenum on a high ridge east of the wilderness boundary, extends northwestward into the wilderness where it ranges from 15 to more than 45 ppm. Samples with the highest molybdenum content came from rocks of mixed lithofacies in the outer part of the Three Rivers stock. Samples of stream sediments collected in the wilderness area contained lower concentrations of molybdenum than mixed lithofacies samples. The material in the stream sediment samples was probably derived from rocks on the ridge to the southeast rather than from rocks underlying the sampled streams.

Anomaly "D", also with a maximum of 150 ppm molybdenum, is on a high ridge at the head of Eagle Creek, well outside the wilderness, but partly within a proposed addition to the area. Samples constituting the anomaly are from all three lithofacies of the White Mountain stock. The present study did not extend far enough outside the wilderness and the proposed addition to complete mapping of anomaly "D" in the Eagle Creek watershed. Results of intensive geochemical exploration and drilling done by a mining company in that area during the late 1960's were not available to the Geological Survey.

Anomaly "E", outside the wilderness area and its proposed additions, was determined, although incompletely, by sampling along the east branch of Tanbark Canyon, in the east-central part of the study area (pl. 2). The anomalous area, mostly underlain by monzonite of the Rialto stock, had been intensively studied and recognized by several workers prior to the wilderness study. It was sampled by the U.S. Geological Survey as part of the wilderness study only to compare the analytical data derived from stream-sediment samples from this known anomalous area with those data obtained from other areas. Contours are unclosed at the north end of the anomalous area (pl. 2) because of insufficient data. Unpublished results from mining-company drilling undertaken there show molybdenite, most of it low grade, in cores. "Economic concentrations of ore minerals have thus far eluded drilling programs in the Rialto stock" (Thompson, 1968, p. 947), although the last 102 feet (31.1 m) of the Fulmer adit averaged 0.181 percent molybdenite (Griswold and Missaghi, 1964, p. 12).

The following generalizations can be made regarding molybdenum occurrences in samples collected by the U.S. Geological Survey in the White Mountain Wilderness area and vicinity: (1) The mapped anomalies (15 ppm and over) which are contoured on plate 2 are restricted to the Three Rivers and Rialto stocks and the Cone Peak plug, although anomalies too small to be contoured do appear here and there in the volcanic rocks (table 1). (2) Anomalous concentrations of molybdenum in stream sediments are diluted downstream, so that high concentrations are "lost" within a mile or two from their source, although scattered low anomalies are noted in the stream-sediment results (table 2).

Base metals

No high copper anomalies were found as a result of the present wilderness study, although copper deposits are present in the Schelerville mining district along the northwestern edge of the White Mountain Wilderness area. Most copper concentrations of 50 ppm or greater were found in lower beds of the Walker Andesite Breccia, in the Rialto stock, and in stream sediments clearly derived from those rocks. The copper concentration in most stream sediments, soil, and unmineralized rock is <50 ppm and the maximum is 300 ppm (sample 336, T. 9 S., R. 11 E., sec. 8).

No lead anomalies could be reasonably mapped from results obtained from the wilderness study; lead concentrations of 50 or more ppm are clustered in the areas of molybdenum anomalies "A" and "D", with a maximum of 300 ppm (syenite sample 16A, T. 10 S., R. 11 E., sec. 24). Concentrations >50 ppm were found sparingly in the Schelerville mining district and in Nogal and Tortolita Canyons.

Zinc was detected in very few samples; however, the limit of detection in semiquantitative spectrographic analysis is 200 ppm, which is much higher than that for lead or copper. A threshold value of 300 ppm was determined for a small area in Tanbark Canyon (T. 10 S., R. 11 E., sec. 3), outside the wilderness and its proposed additions (Mardirosian, 1964, p. 57). Samples 28A, 30A, and 281A (table 3) from the Schelerville mining district showed high zinc values, but they represent only narrow vein deposits rather than a workable ore body.

Gold and silver

Gold was detected in only four of the 81 U.S. Geological Survey samples collected from the study area (pl. 1) that were analyzed by atomic absorption, or fire assay methods. Samples analyzed for gold were chosen because they contained anomalous concentrations of other metals; the gold concentrations ranged up to only 0.2 ppm.

Gold was also detected in four of ten samples of gravel from a terrace deposit east of Angus (pl. 1). The pan concentrates, representing 1-2 percent by weight of the total sample, assayed as high as 3.6 ppm. The gold was clearly derived from the Rio Bonito drainage to the west, and more probably from the Nogal and Bonito mining districts than from the wilderness area.

Silver was detected in a few samples of syenitic rock, stream sediments, and mineralized rock by the spectrographic method, which is considered to be adequately sensitive for this element. Values range as high as 7 ppm. Anomalous silver concentrations of 5 ppm and 7 ppm were found in stream-sediment samples 781 and 782 (table 2) collected from the Dark Betsy Canyon drainage basin, in one of the proposed additions to the wilderness area. These sediments appear to be derived from mineralized breccia in the vicinity of the Great Western Mine, which is outside the wilderness, and its proposed additions.

Rare-earth and related elements

The 30 elements for which semiquantitative spectrographic analyses were routinely made include lanthanum, which is a rare-earth element, beryllium, scandium, yttrium, zirconium, which are sometimes included with the rare-earth metals, and niobium, which is commonly associated with these elements. Additionally, semiquantitative spectrographic analyses were made of most samples for the rare-earth elements: cerium, erbium, gadolinium, ytterbium, praseodymium, neodymium, and samarium. Giles and Thompson (1972, p. 2139) reported that yttrium, niobium, lanthanum, and cerium are markedly anomalous in unaltered rock of the Three Rivers stock. "Examples of average whole-rock ppm values are: Y-60; Nb-100; Ce-60."

Stream-sediment sample No. 39, from the head of Indian Creek, near the southern edge of the wilderness area, contained exceptionally high concentrations of rare-earth and related elements, except scandium and zirconium (table 2). Study of a heavy-minerals concentrate of this sample by W. R. Griffitts, of the U.S. Geological Survey, shows that hornblende is the dominant component, with several percent of riebeckite, $\text{Na}_2(\text{Fe,Mg})_5\text{Si}_8\text{O}_{22}(\text{OH})_2$, and smaller amounts of xenotime, YPO_4 , which commonly contains erbium, cerium, and other rare earths. Mineral grains resembling pyrochlore, $(\text{Na,Ca})_2(\text{Nb,Ta})_2\text{O}_6(\text{OH,F})$, were also present in this sample and in No. 40, taken nearby (W. R. Griffitts, written commun., March 1974).

Stream-sediment samples, Nos. 39, 49, and several others taken nearby were derived from the Three Rivers stock--specifically from the equigranular syenite of molybdenum anomaly "A" (pl. 3).

Mining claims

The distribution and extent of mining claims in the area are shown in plate 3.

History and production

The oldest mining-claim on record in the vicinity of the White Mountain Wilderness is on file at the Lincoln County courthouse. The claim was recorded in Nogal Precinct No. 1 in 1863. Anderson (1957, p. 92) dates mineral discoveries in the Nogal-Bonito districts from 1865 for placer gold and from 1868 for lode deposits. Records show an Armstrong claim located in Nogal Canyon in 1877 and a Front Quartz Lead and East Bonito Quartz Lead located in 1879, possibly at the junction of Tanbark and Bonito Canyons. That same year J. H. Watts located the Silver King.

Most of the major veins in the White Mountain Wilderness were first discovered and located between 1880 and 1882, soon after the area was separated from the Mescalero Apache Indian Reservation. Many of the early miners had prospected previously in the larger and more famous White Oaks gold camp several miles north of the wilderness.

Although mining claims have been located nearly every year since 1880 in the wilderness area, the most active periods of claim staking were between 1880 and 1882, in 1902, and in 1956, the year before the White Mountain Wild Area was established.

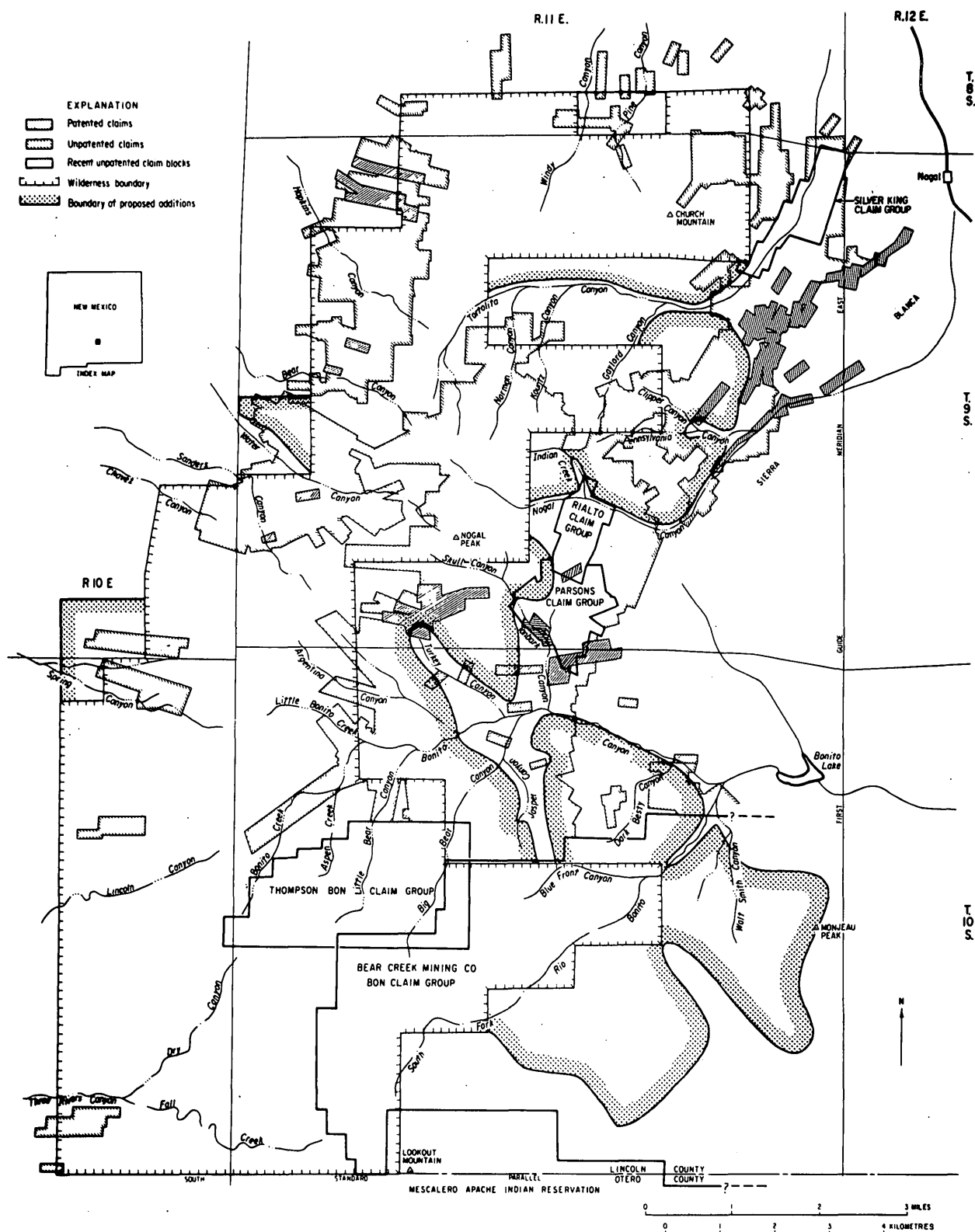


PLATE 3.-Map showing approximate mining-claim coverage in the White Mountain Wilderness, New Mexico.

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Mining claim records refer to the Bonito mining district in 1879; however, no legal mining district existed in the area until the Nogal mining district was organized on July 17, 1880. The southern boundary of the Nogal district was upper Bonito Creek, in the wilderness. Following mineral discoveries in South Fork Rio Bonito, in Big Bear Canyon, and in other areas south of Bonito Creek, the Bonito mining district was formed about mid-1882. Although no district-organization records were found at the courthouse, the Bonito district name is shown on official mineral-survey plats of claims.

Unofficial mining district names in the study area are West Bonito, Tortolita, and White Mountain. Until about 1885, the White Mountain district name was used for some of the claims located near the west boundary of the wilderness. Now it is used for claims located several miles east of the wilderness. The west sides of the Eagle Creek and Cedar Creek mining district adjoin the wilderness, but no prospects or mine workings were found near the boundary.

The Schelerville mining district in the northwest corner of the wilderness has been mentioned in some reports. However, out of the hundreds of claims recorded in the study area, no claims refer to Schelerville as a mining district. The name was adopted from the old mining camp of Schelerville near the northwest corner of the wilderness.

During the active mining period 1902-10, mining claims in the study area along Bonito Creek were consolidated by Parsons Mining Co. Many of the claims shown on an old property map of the company were recorded originally by Carico, Young, and Zumwalt; but the locations shown on the Parsons Mining Co. map are commonly different from those described by the original claimants.

Other major claim consolidations include those of the Iowa & New Mexico Mining and Milling Co., which patented claims on upper Turkey Creek, as well as the Homestake-Grub Stake-Butcher Boy group of claims in the northwest corner of the wilderness. Rolla Wells, who had been a prominent miner in the White Oaks district, was patentee of most of the claims in the Helen Rae-American group at the northeast corner of the wilderness, as well as the Maud, Renowned O.K., and White Swan patents in the Bonito Creek drainage.

The White Mountain Primitive Area, established in 1933, was about 31,170 acres (126 km²), and lay mainly in the upper Bonito watershed, essentially the same land that is now under the jurisdiction of the Bonito Watershed Act of 1939. In 1957, the White Mountain Primitive Area was incorporated and expanded into the White Mountain Wild Area. This expansion involved a major shift in boundaries, including the addition of the mineralized areas north and west of Nogal Peak and the establishment of the White Mountain Recreation Area adjoining the present wilderness on the southeast. Beginning in 1963, nearly all of the lands governed by the Bonito Watershed Act and those in the recreation area are included in the Bon Group of claims located by Bear Creek Mining Co.

Mineral production from the White Mountain Wilderness study area is reported to be about \$1 million (Thompson, 1966). Most of this production was probably from the Helen Rae-American group of patented claims near the northeast corner of the wilderness.

Since 1904, production of gold, silver, copper, lead, and zinc has been recorded by the U.S. Bureau of Mines for at least 22 lode properties and 19 placers in the Nogal and Bonito mining districts. Nearly all of this output has been from mines within a mile (1.6 km) of the wilderness; some production has been recorded from adjoining roadless areas.

Before 1910, mineral production from the study area is valued at \$250,000 (Anderson, 1957, p. 92). The Helen Rae lode, the major mine in the area, produced gold ore from 1933 to 1938. In 1936, the Great Western mine, which adjoins the wilderness, was equipped with a 75-ton-per-day (68 tonnes/day) mill with amalgam plates. During 1937 to 1953, output from this mine, sometimes known as the Pershing mine, was about 914 tons (829 tonnes) of ore. In 1974, the Great Western property was leased by Mr. Arvel Runnels, a local resident, to the Azcon Corporation of St. Louis, Mo. Azcon, a Consolidated Gold Field Group Company, has located other claims in the area. Those claims, as described, probably are within the proposed additions.

Total production from the Patsons (Hopeful) mine, one-fourth mile (about 400 m) from the wilderness, is not known; however, Griswold (1959, p.43) reported that about 75,000 tons (68,000 tonnes) of ore had been removed. The average ore value is said to have been \$3.50 per ton in gold, based on a gold price of \$20 per ounce (Lindgren, et al., 1910).

Most of the mineral production from the White Mountain Wilderness probably occurred before the U.S. Bureau of Mines began recording production data in 1904. As indicated by the small size of accessible workings and the lack of stopes, production must have been limited. Gold, silver, and copper output was probably sold locally to merchants or to larger mining companies at White Oaks.

The only recorded production from the wilderness was a small amount of silver-copper-lead ore from the Cravens property, which probably is the Ace mine in sec. 8, T. 9 S., R. 11 E. Griswold (1959, p. 75) reports output from the Ace mine of about 160 tons of ore.

Sampling and analytical results

Areas that are extensively covered by mining claims and all areas with indications of mineralization were examined. The area investigated included the wilderness, the proposed additions, and adjacent areas where any type of mining activity was thought to have occurred. In this report, the wilderness, together with the proposed additions, is often referred to as the "study area."

A total of 813 samples was taken by the U.S. Bureau of Mines from veins, mineralized, and altered zones, and mine dumps in 14 localities in and near the study area. At most localities an effort was made to obtain representative samples. At many places, however, selected samples or specimens were obtained to represent the maximum values present in the deposit--on the premise that if assays of the richest material were low, then the deposit had little mineral potential. Based on 1974 spring prices, estimated future metal prices were taken at \$150 per ounce (about \$5/g) for gold, \$6 per ounce (about \$0.20/g) for silver, \$0.80 per pound (about \$0.36/kg) for copper, \$0.22 per pound (about \$0.10/kg) for lead, \$0.35 per pound (about \$0.16/kg) for zinc, and \$3.50 per pound (about \$1.60/kg) for molybdenum. About one-third of the samples had combined metal assay values in excess of \$5.00 per ton (about \$5.50/t). These combined values ignored assays of metals that appeared from assay to be too low-grade for recovery as byproducts. A classification by values of 282 samples containing more than \$5.00 per ton (about \$5.50/t) is as follows:

<u>Range of values</u>	<u>Number of samples</u>	<u>Percentage</u>
\$ 5.00 to \$10.00	135	48
10.00 to 15.00	55	19
15.00 to 20.00	14	5
<u>over \$20.00</u>	<u>78</u>	<u>28</u>
Total	282	100

Many of the high-grade samples were carefully selected; others were taken from ore stockpiles and narrow veinlets.

Most samples were analyzed by the semiquantitative spectrographic method. All samples were fire-assayed for gold and silver; chemical, atomic absorption, or neutron-activation analyses were made of samples that spectrographically showed elements in concentrations above those generally found in igneous rocks. The analyses were made at several laboratories, and the methods of reporting results therefore vary. Thus, the minimum or maximum detection limits differ among the samples, as do the number of decimal places in the analytical results.

All assay and analytical results for gold, silver, and molybdenum are listed for all samples in a table on file with the U.S. Geological Survey. Copper, lead, and zinc values are listed for those samples on which chemical analyses were performed.

Chemical analyses were run for barium and manganese on a number of samples. Eleven samples from a total of 101 contained barium in excess of 10 percent--values ranged from 12.5 to 36.9 percent--but the samples were from relatively narrow showings. Eighty-five samples were analyzed for manganese; 6.5 percent manganese was the highest value obtained.

Chemical analyses made on 106 samples indicated spectrographically a molybdenum content of 100 ppm or more. Invariably the chemical analyses were lower than the spectrograph analyses. The results shown in table 1 are the maximum obtained by the two analytical methods.

Results of the examination of 14 major drainages, or areas, are outlined in figure 2. Each of these areas is described separately in

Figure 2.--Near here.

the text of the report and is covered by an individual map. Sample numbers on the figures in this report depict approximate locations of the mines, prospects, and mineralized areas investigated. In many instances, sample numbers are used to identify the workings examined; results of all sample analyses are in table 1 at the end of this report.

Individual sample values were considered minor or of no economic consequence, interest, or significance when they were equal to or below the following values: 0.01 ounce gold per ton (0.34 g/t), 0.30 ounce silver per ton (about 10 g/t), 0.10 percent copper, 0.40 percent lead, 0.25 percent zinc, and 250 ppm (or 0.025 percent) molybdenum. In the text that follows, sample data are not included for many samples showing lower figures than the values cited above. However, combined values over \$5.00 per ton (\$5.50/tonne) for any one sample are noted in the text of the report. This arbitrarily fixed value was calculated from estimated future metal prices of \$150 per ounce (about \$5/g) for gold, an optimistic \$6.00 per ounce (about \$0.20/g) for silver, \$0.80 per pound (about \$0.36/kg) for copper, \$0.22 per pound (about \$0.10/kg) for lead, \$0.35 per pound (about \$0.16/kg) for zinc, and \$3.50 per pound (about \$1.60/kg) for molybdenum. Prices were based on 1974 spring listings. Metals that could not be economically recovered as byproducts were not considered in the calculations.

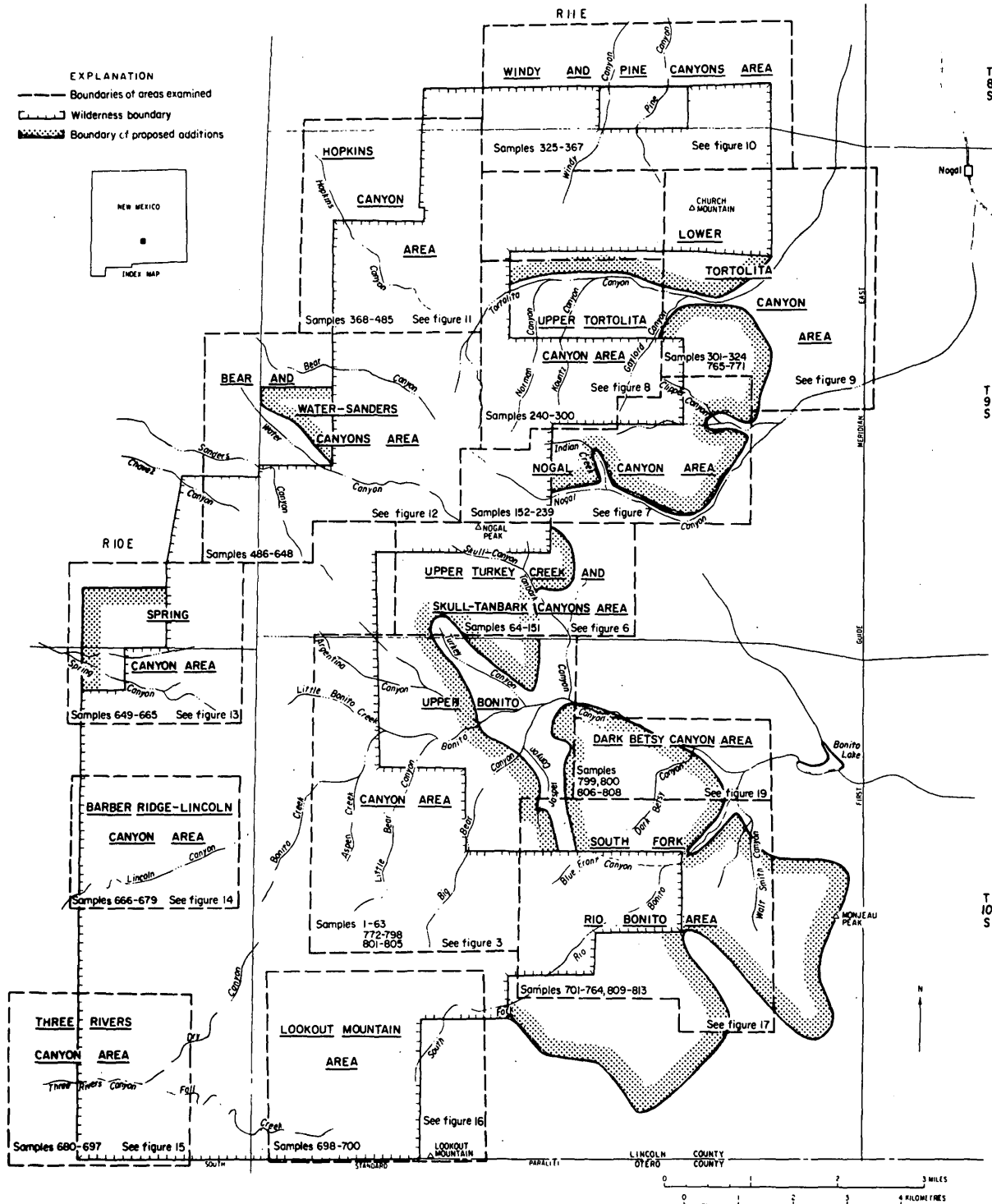


FIGURE 2.-Map showing areas examined by the U.S. Bureau of Mines in and near the White Mountain Wilderness and proposed additions, New Mexico.

Mines, prospects, and mineralized areas

Upper Bonito Canyon area

Hundreds of mining claims were located in Bonito Canyon and its tributaries, Big Bear, Argentina, and Turkey Canyons. Four localities were examined within the upper Bonito drainage area and 94 samples were taken. Sample localities and mining-claim boundaries are shown on figure 3. Generally, assay values were low and sample widths narrow.

Figure 3.--Near here.

Bonito Canyon (samples 1-25)

A total of 25 samples was taken from 10 locations along Bonito Canyon. Assay values were low: only two samples (10 and 14) contained combined metal values of more than \$5.00 per ton. Samples 1-3 were from just east of the proposed-additions boundary; samples 4-15 were from within the area proposed for addition; and samples 16-25 were from within the wilderness.

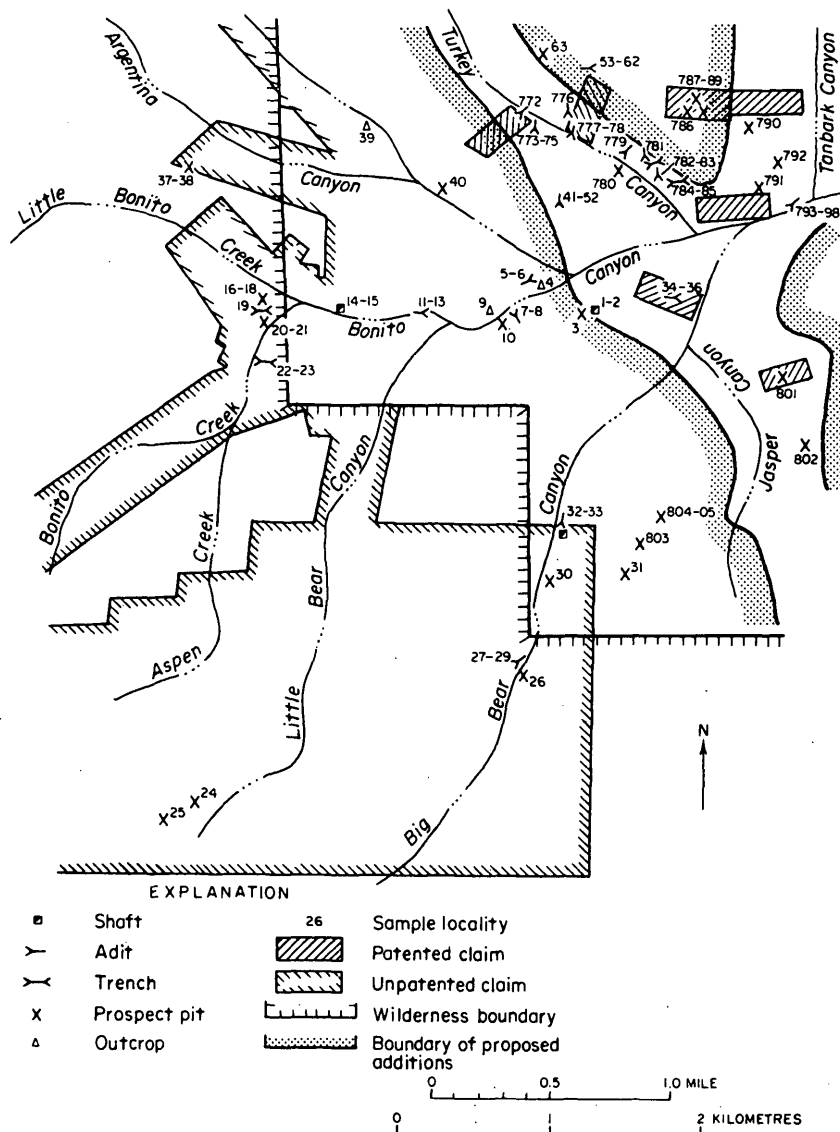


FIGURE 3.—Map of upper Bonito Canyon area.

Samples 1-3

Three samples were taken from a shaft and prospect pit high on the canyon slope on each side of a spur ridge running northerly from the main ridge between Big Bear and Little Bear Creeks. The workings, either on or just east of the study area boundary, were put down on a quartz vein estimated to be 4 feet (1.2 m) in width. The strike of the vein is N. 70° E. The prospect probably was located originally in 1885 as the Hyperion. The shaft, approximately 40 feet (12.2 m) deep, is now debris-filled to within 20 feet (6.1 m) of surface. Two 4-foot (1.2-m) chip samples (1 and 2) across the vein at the shaft both assayed 0.4 ounce silver per ton (about 14 g/t); sample 3, a 4-foot (1.2 m) chip from the pit, contained 0.6 ounce silver per ton (about 25 g/t).

Sample 4

At the mouth of Argentina Canyon, claims have been located on small areas with stringers of magnetite. A 2.9-foot chip sample (87 cm) across an outcrop contained no values of consequence.

Samples 5 and 6

Low values of consequence were assayed in two grab samples taken from the dump of a shallow caved adit a short distance up Argentina Canyon.

Samples 7 and 8

Two samples were taken from an adit (Bonita No. 1) just upstream from the mouth of Argentina Canyon. The adit was driven 37 feet (11.3 m) south, then 13 feet (4.0 m) east from the south bank of Bonito Creek. The working is in a hard, fine-grained, silicified altered zone that contains disseminated pyrite and minor chalcopyrite. A chip sample (7), from a 4 inch (10 cm) zone of gouge along a fracture in the adit, contained 0.01 ounce of gold (0.34 g/t) and 0.4 ounce (14 g/t) of silver per ton; a grab sample (8) from the dump assayed 0.10 percent copper.

Samples 9 and 10

Two samples were taken from a silicified fault zone exposed in an outcrop in a small pit just upstream from the Bonita No. 1 portal.

Sample 9, a 1.5 foot (46 cm) chip sample from the outcrop, contained 0.01 ounce per ton (0.34 g/t) gold and 0.38 ounce per ton (13 g/t) silver; sample 10, a grab sample from the pit dump, yielded 0.02 ounce per ton (0.7 g/t) gold, 0.5 ounce per ton (17 g/t) silver, and 0.5 percent titanium. The combined gold-silver value was calculated to be \$6.00 per ton (\$6.60/tonne) for rock on the pit dump.

Samples 11 to 13

Three samples were taken from a narrow shear zone located on the Bonita No. 2 claim, on the bank of Bonita Creek. The zone was prospected by a 22-foot (6.7 m) drift. The samples, chipped across 3.8, 1.8, and 1.2 feet (1.2 m, 55 cm, and 37 cm) of the shear zone, contained no significant values.

Samples 14 and 15

The samples were chipped from a limonite-stained shear zone under the now delapidated headframe of the sealed Silver Spoon shaft. The shaft, thought to be 150 feet (45.8 m) deep, is just outside the wilderness on the north bank of Bonito Canyon. Sample 14, chipped across a 1-foot (30-cm) width, contained 0.01 ounce per ton (0.34 g/t) gold and 1.54 ounces per ton (53 g/t) silver for a combined value of \$10.74 per ton (\$11.81/t).

Samples 16-21

Six samples were collected from across a fault zone located just inside the wilderness and above the junction of Bonito and Little Bonito Creeks. A claim notice was found for the EPS-1 claim. Workings there include three trench excavations with a combined length of 75 feet (22.9 m) and a 65-foot (19.8-m) bulldozer cut. The fault zone, which bears N.20°W., contains a quartz vein as much as 2.5 feet (74 cm) wide. Analyses of five samples that contain significant but low-grade values are shown below.

<u>Sample No.</u>	<u>Type</u>	<u>Gold Silver</u>		<u>Gold Silver</u>	
		ounce per ton		gram per metric ton	
16	1.3-foot chip		0.38		13
18	10-inch chip		.38		13
19	2.5-foot chip	0.02	.32	0.68	11
20	Dump, quartz	.01	.32	.34	11
21	Dump, grab	.01	.30	.34	10

Samples 22 and 23

A 2-foot (51-cm) chip sample and a sample of rock showing minor copper stain were collected from a steeply inclined 25-foot (7.6 m) trench in the creek bank upstream from the EPS-1 claim. The working is on a deeply weathered shear zone containing quartz stringers. Sample 23, a chip from a quartz fragment in the trench, contained 0.01 ounce gold per ton (34 g/t), 0.44 ounce silver per ton (15 g/t) and 0.08 percent copper.

Although mining claims have been located along upper Bonito Creek, no workings were seen upstream from sample sites 22-23.

Samples 24 and 25

The samples were taken from two pits excavated in an altered zone along the heads of Bonito, Aspen, and Little Bear Canyons. Although the area was carefully examined, only the two pits were found. The altered zone is covered by the Bon Group of 104 claims located in 1969 by T. B. Thompson. The property was later acquired by the Bear Creek Mining Co. Although no drilling has been done, the claims are located in an area that might have mineral potential. Analyses of samples from the two pits showed no mineral concentrations. However, the outcrop at sample site 25 is unusual in that it is composed of silicified wood. The nearest coal deposits are to the west, 2 to 4 miles (3.2 to 6.4 km) outside the wilderness. Thompson (1966, p. 103) reported copper minerals associated with silicified wood and carbonaceous material on Barber Ridge in the wilderness about 2 miles (3.2 km) to the west.

Big Bear Canyon (samples 26-36 and 801-805)

Big Bear Canyon is one of the principal tributaries in upper Bonito Creek; a road extends up the canyon to the wilderness border. Sixteen samples were taken from nine localities along the stream course and its tributaries. One sample is from the wilderness, five are from the proposed addition to the wilderness, and three are from just east of the study area. Of these, four (30 and 34-36) contained combined metal values of more than \$5.00 per ton (\$5.50/t).

Samples 26-29

Four samples were taken from prospect workings just within the wilderness along Big Bear Creek. The workings examined include a 30-foot (9.2-m) cut and a 12-foot (3.7-m) adit, both driven westerly in an altered zone. No mineral potential was indicated from analyses of the samples.

Samples 30 and 31

Two prospect pits were sampled on the east side of Big Bear Creek, less than one-half mile (about 800 m) outside the wilderness but within the study area. A random chip sample (30) of altered material in the pit near the creek assayed 0.02 ounce gold (0.68 g/t) and 0.80 ounce silver per ton (27 g/t) (\$7.80 per ton; \$8.58/t). Assay values for sample 31, grabbed from dump material at a prospect pit on the hillside, were nil for gold and silver.

Samples 32 and 33

Two samples were taken of a dark-brown fine-grained, north-striking, brecciated agglomerate located on the east bank of Big Bear Creek just outside the wilderness, but within the study area. The body has been opened by a 90-foot (27.5-m) bulldozer cut. Probably first located in 1883 as the Capt. Horn, the occurrence is now covered by the Shikeys Shyster claim. A random chip sample (32) across the zone indicated no values of interest; however, sample 33, chipped across 2.3 feet (70 cm) of iron-stained material, assayed 0.52 ounce silver per ton (18 g/t).

Samples 34-36

Three samples were collected from a quartz vein in andesite on the Maud patented claim about one-fourth mile (about 400 m) outside the study area. The claim is presently owned by Dorsey White. According to Thompson (1973, p. 16), the vein trends east-west and dips 75°S. It has been mined on two levels on the west side of Big Bear Creek and has been prospected for but not found on the east side of the creek. Thompson stated that two adits--separated 54 feet (16.5 m) vertically and a shaft sunk to a reported 200 feet (61 m) and later filled with waste--constitute the work done on the property. He added that the vein ranges in width from 1.3 to 6.8 feet (41 cm to 2.1 m) in the lower adit and was reported to be continuous to the bottom of the shaft. The lower adit, excavated in 1963 trends N.70°W. for approximately 250 feet (about 76 m) along a quartz vein in andesite. The upper adit, driven in the 1890's, is now caving and dangerous.

Of the three samples taken one was across 5.5 feet (1.7 m) at the face of the lower adit and two were stockpile grabs. The face is entirely in vein material; sample 34, taken from across the face, assayed 4.34 ounces silver per ton (141 g/t), 1.3 percent lead, 0.42 percent zinc, and 500 ppm molybdenum for a combined value of \$38.40 per ton (\$42.24/t). Thompson obtained a 6.8-ft (2.1 m) chip sample also across this face. His sample assayed 0.32 ounce gold (11 g/t) and 1.28 ounces silver per ton (44 g/t), 7.1 percent lead, 0.39 percent zinc, and 0.017 percent molybdenum. Based on early 1974 prices, this assay indicates a combined gold-silver-lead content value of \$86.92 per ton (\$95.61/t). The two random samples (35 and 36) were from stockpiles of vein rock on a 900-ton (816-t) dump at the lower adit, as estimated by Thompson. Assays were 0.62 and 1.08 ounces of silver per ton (21 and 27 g/t), 0.47 and 0.94 percent lead, and 0.15 and 0.49 percent zinc, respectively. Total metal values were \$5.79 per ton (\$6.37/t) and \$14.05 per ton (\$15.46/t) for these two samples.

Samples 801-805

Five samples were taken from the Greenville patented claim and the area south and southwest of it. The claim, located about one mile (1.6 km) north of the Great Western mine, and straddling the boundary of the proposed addition, was only cursorily examined. A 10- by 10- by 128-foot (3.1- by 3.1- by 39.0-m)-deep, steeply inclined shaft that is inaccessible lies outside the addition. A sample (801) was taken from the dump which is estimated to contain 300 tons (272 t) of material. The sample assayed nil for gold and silver.

A grab sample (802) was from the dump of a 4- by 8- by 17-foot (1.2- by 2.4- by 5.2-m)-deep pit located about one-fourth mile (about 400 m) south of the Greenville claim and outside the proposed addition. The pit was sunk on a porphyritic zone in weathered diorite. The sample showed nil values for gold and silver.

About one-half mile (about 800 m) southwest of sample site 802, three samples were collected from two prospect workings and an outcrop near the bottom of a tributary of Big Bear Creek. Sample 803, chipped across a 2.5-foot (76 cm) limonite zone in weathered porphyritic diorite, contained 0.1 ounce silver per ton (3.4 g/t). Sample 804, collected from a dump estimated to contain 150 tons (136 t) of material. The material in the dump came from a caved adit driven in weathered diorite on a N.12°E. trend. Also a grab sample (805) from a small pit 30 feet (9.2 m) away showed no precious metal values.

Argentina Canyon (samples 37-52)

Sixteen samples were taken from four places in the Argentina Canyon area. One sample site is in the wilderness; two are in the proposed addition. Eight of the samples (38, 41-43, and 45-48) assayed in excess of \$5.00 per ton (\$5.50/t) in metal values; all of these samples, except sample 38, were from the Argentine mine just outside the study area.

Samples 37 and 38

The samples were taken from within the wilderness near the head of Argentina Canyon. There, a prospect pit exposes a 3.5-foot (1.1-m) silicified zone. Sample 37, taken across the zone, contained no significant values; however, a grab sample (38) from the dump yielded 0.01 ounce gold per ton (0.34 g/t), 0.17 percent lead, 0.43 percent zinc, and 700 ppm molybdenum for a combined metal value of \$9.41 per ton (\$10.35/mt).

Sample 39

The sample was taken from the outcrop of a 1-foot (31-cm) wide quartz vein located in the north fork of Argentina Creek. The analysis showed nothing of interest.

Sample 40

The sample was chipped across a 10-inch (25-cm) quartz vein on the north bank below the forks of Argentina Creek. It contained 300 ppm molybdenum. A caved adit, or trench, at this site might be on a claim filed in 1888 (Junction or Tenderfoot claim).

Sample 41-52

Twelve samples were taken from the workings of the Argentine mine. The mine, first located as the Cricket claim in 1881 and then relocated as the Argentine in 1887, is between Argentina and Turkey Canyons north of Bonito Creek (fig. 4).

Figure 4.--Near here.

Early development at the Argentine mine consisted of a 350-foot (107-m) shaft and a drift said to have been driven 400 feet (122 m) long at the 250-foot (76.3-m) level (fig. 4). In 1948, an adit driven to intersect the shaft at the 250 level was about 6 feet (1.8 m) too low. According to Mr. Arvel Runnels, who owns the property, there is a very good showing of copper at the face of the drift, but it could not be examined because of bad air behind a caved section at sample location 41. A winze, 20-feet (6.1-m) deep, was also inaccessible. The extension of the shaft below the 250-foot (76.3 m) level, could not be verified because it had caved. Thompson (1973, p. 17) reported that the shaft was sunk on the intersection of two veins: one, a wide quartz vein striking east-west and containing stringers of lead and zinc sulfides, and the other, a quartz vein striking N.10°W. in a copper- and iron-stained shear zone.

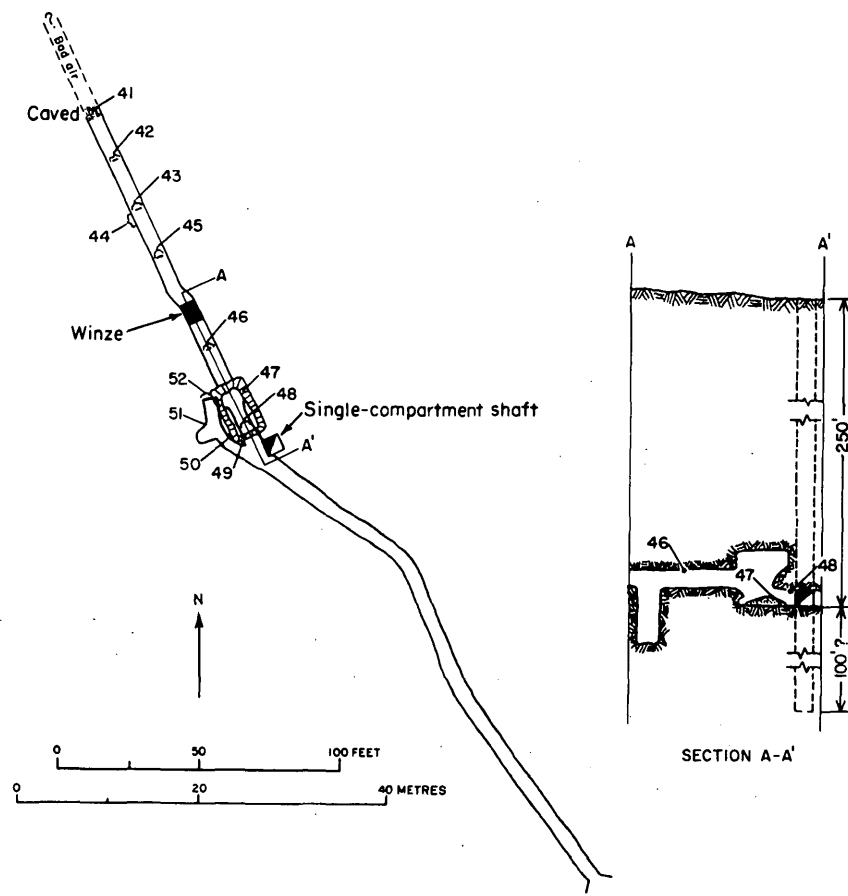


FIGURE 4.- Plan and partial longitudinal section of Argentine mine.

The samples were taken from the northwest-striking vein, cross veins, fracture zones, and muck piles on the floor of the drift. Based on early 1974 prices, seven of the samples assayed dollar values greater than \$5.00 per ton (\$5.50/t). Analyses are given in the table that follows:

Sample No.	Type	Silver		Copper	Lead	Zinc	Molybdenum (ppm)	Calculated Value	
		(ounce per ton)	(g/t)		(percent)			(\$/ton)	(\$/t)
41	Muck pile, grab	0.10	3.4	0.23	0.35	0.53	300	11.03	12.13
42	2.6-foot chip	.40	14	-	.17	.18	500	7.40	8.14
43	3.3-foot chip	2.48	85	.29	.96	3.40	200	47.54	52.29
44	4.0-foot chip	.42	14	-	.09	-	200	-	-
45	3.9-foot chip	.58	20	.15	.30	1.20	-	15.78	17.36
46	3.8-foot chip	3.72	128	.61	1.50	.62	100	43.82	48.20
47	Muck pile, grab	.30	11	-	-	.29	-	6.83	7.51
48	2.6-foot chip	.82	28	-	-	.31	200	7.09	7.80
49	5.3-foot chip	.18	6	-	-	-	-	-	-
50	1.2-foot chip	.22	8	.08	.26	.21	100	-	-
51	2.4-foot chip	.14	5	-	-	-	140	-	-
52	Muck pile, grab	.14	5	-	-	.20	-	-	-

The above samples were taken along the vein that strikes N.10°W.
and which more or less parallels but lies outside the proposed addition.
The east-west striking vein reported by Thompson is not exposed, but
it may extend into the proposed addition.

Lower Tanbark Canyon (samples 791-798)

A working on the ridge just west of lower Tanbark Canyon was examined because it exposes several veins that trend westward into the proposed additions. The working consists of a main crosscut adit, a caved inclined shaft, and several prospect pits. The main adit bears N.35°E. for 83 feet (25 m), then N.20°E. for 92 feet (28 m), then N.18°W. for 11 feet (3 m) to the face. Four major veins are exposed. The first, 98 feet (30 m) from the portal, is 2.5 feet (76 cm) wide, strikes N.72°E. and dips 80°N. A chip sample (798) across the vein assayed a trace of gold and 0.3 ounce silver per ton (9 g/t). A sample (797) taken from a 1.9-foot- (58 cm) wide bleb of mineralized rock 123 feet (37.5 m) from the portal assayed only 0.2 ounce silver per ton (7 g/t). The second vein, 147 ft (44.8) from the portal, is 1.1 foot (33 cm) wide, strikes N. 77° W., and is vertical; a chip sample (796) assayed 0.3 ounce silver per ton (10 g/t). The third vein, 166 feet (50.6 m) from the portal is 2 feet (61 cm) wide, strikes N.45°W. and dips 82°NE. A 2-foot (61-cm) chip sample (795) across the vein assayed 0.6 ounce silver per ton (20 g/t). The fourth vein, exposed 1 foot (31 cm) from the face, is 11 inches (28 cm) wide, strikes N.75°E. and dips 84°N. A chip sample (793) across the vein assayed 0.8 ounce silver per ton (27 g/t) and 0.71 percent lead (\$7.92 per ton; \$8.71/t). In addition, a minor vein (sample 494) 2 inches (5 cm) wide, located 170 feet (51.9 m) from the portal contained 0.1 ounce silver per ton (3 g/t), and a body of mineralized rock, 1.9 foot (58 cm) wide, located 123 feet (37.5 m) from the portal contained 0.2 ounce silver per ton (6 g/t).

Sample 792 was taken across a 2.7-foot (82-cm) vein in a pit about 100 feet (30.5 m) northwest of the main adit portal and assayed 1.0 ounce silver per ton (3 g/t) and 0.71 percent lead for a total metal value of \$9.12 per ton (\$10.03/t). The vein strikes east-west and dips 78°N.; it may be a continuation of one of the veins exposed in the main adit.

At the northeast corner of the White Swan patent, a 5-foot (1.5 m) chip sample (791) taken across a steeply dipping, east-west striking vein contained 0.3 ounce silver per ton (10 g/t). The claim borders but is not within the newly proposed addition to the wilderness.

Lower Turkey Canyon (samples 53-63 and 772-798)

Samples 53-62

Ten samples were collected from an adit located on a small tributary of Turkey Creek. The property on which the adit is located probably is the Jester mine, although the Frank Willis group and the Grand Prize claim, located in 1889, plot in the vicinity. The adit bears N.74°W. for 145 feet (44.2 m) and turns nearly due north for 90 feet (27.5 m). The samples, the analytical results of which are shown in figure 5, were taken from altered porphyritic andesite,

Figure 5.--Near here.

fracture zones, and quartz veins as much as 2.5 feet (76 cm) wide. Sample 55 was from a 2-inch (5 cm) quartz veinlet, and sample 56 was from a 3-foot- (91-cm)-wide shear zone crossing the drift.

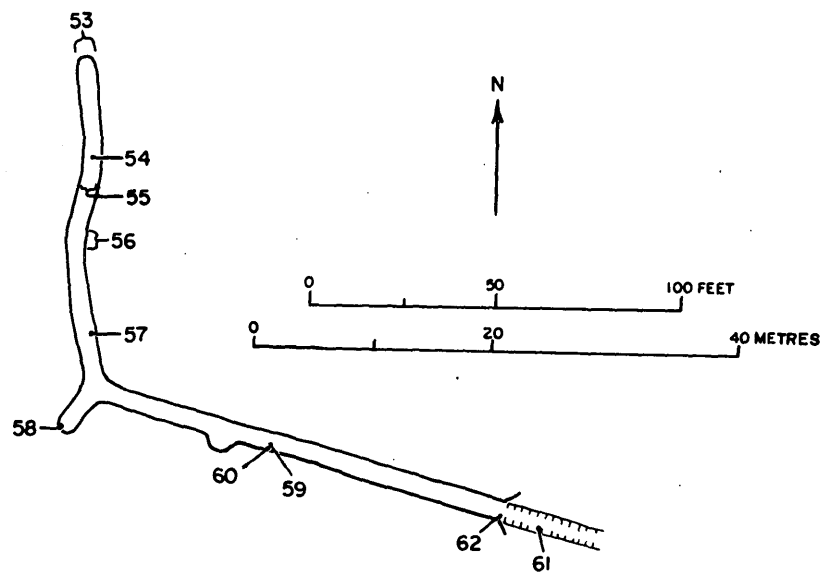


FIGURE 5.-Plan of Jester (?) mine.

The sample values shown below are submarginal; dollar values range from \$4.92 to \$11.11 per ton (\$5.41 to \$12.22/t) for the 10 samples.

Sample	Type	Gold		Silver		Copper (percent)	Lead	Zinc
		(ounce per ton)	(g/t)	(ounce per ton)	(g/t)			
53	2.5-foot chip	0.02	0.7	0.40	14			
54	Muck pile, grab	.02	.7	.56	19			
55	2-inch chip	.02	.7	.36	12	0.27		
56	3.1-foot chip	.04	1.4	.42	14	.04		0.37
57	11-inch chip	.02	.7	.38	13			
58	2.7-foot chip	.02	.7	.32	11			
59	2.5-foot chip	.03	2.1	.44	15			
60	5.8-foot chip	.02	.7	.38	13			
61	1.2-foot chip	.02	.7	.48	16			
62	2.1-foot chip	.03	2.1	.78	27		0.18	

Sample 63

A random chip sample of quartz exposed in a shallow prospect pit on a ridge west of the Jester(?) adit contained 0.02 ounce gold per ton (0.7 g/t), 0.56 ounce silver per ton (19 g/t), and 500 ppm molybdenum (\$9.86 per ton; \$10.85/t).

Samples 772-785

Fourteen samples were taken at nine excavations along the bottom of Turkey Canyon. All the workings are near the study area.

The westernmost excavation is a caved adit trending northeast. Selected material from the dump (sample 772) showing minor pyrite and barite assayed 0.92 ounce gold (32 g/t) and 3.0 ounces silver per ton (103 g/t) for a total dollar value of \$21.00 per ton (\$23.10/t).

Three samples were taken from the area of an adit about 200 yards (about 183 m) east-southeast of sample site 772. The adit, 210-feet (64.1-m) long was driven northwest in diorite. A chip sample (774) taken across a 3.5-foot- (1.1-m)-wide quartz vein bearing N.28°W. and dipping vertically assayed a trace gold and 0.1 ounce silver per ton (3 g/t). A 4-foot (1.2 m) chip sample (775) taken across the back 20 feet (6.1 m) from the face showed slightly higher values: 0.04 ounce gold per ton (1.4 g/t) and 0.9 ounce silver per ton (31 g/t) or \$11.40 per ton (\$12.54/t). A selected sample (773) of quartz on the dump contained 0.63 percent zinc.

Sample 776 was an 8-inch (20-cm) chip sample taken across a northeast-bearing fracture zone in quartz diorite about 250 yards (229 m) northeast of sample site 773 and is exposed in a short adit that bears N.41°E. for 56 feet (17.1 m) and then N.65°E. for 16 feet (4.9 m). The zone strikes N.55°E. and dips 80°SE. at the face. The sample assayed only 0.1 ounce silver per ton (3.4 g/t) and no gold.

Two samples were taken from a short adit 200 yards (183 m) south of sample site 776. The adit was driven northeast in quartz diorite, and the innermost 10 feet (3.1 m) is along a 3-foot (91 cm), quartz-filled fracture zone bearing N.86°E. and dipping 72°N. A chip sample (778) taken across this zone at the face contained only 0.1 ounce silver per ton (3.4 g/t). A second quartz-filled fracture zone 5 feet (1.5 m) from the portal bears N.67°E. and dips 61°NW. A 1.5-foot (46 cm) chip sample (777) taken across the full width of the zone showed 0.02 ounce gold (0.7 g/t) and 0.2 ounce silver per ton (7 g/t).

Sample 779 came from a 20-foot (6.1-m) adit bearing S.37°E. and driven in altered diorite. The adit is about 350 yards (320 m) downstream on the north side of the creek from sample sites 777-778. The sample, a 5-inch (13-cm) chip sample taken from gouge at the face yielded no values.

Across the creek from sample site 779 an adit with two short forks was driven a total of 35 feet (10.7 m) on a shear zone exposed on a cliff face. The left fork bears N.70°W., the right N.25°E. A chip sample (780) taken across the face of the right fork was barren. The shear zone was not exposed in the left face.

Sample 781 was collected about 200 yards (183 m) downstream (east) of sample site 780. There, the largest excavation is an adit on the north bank of the creek. This is probably the old Bailey adit described by Thompson (1973, p. 17) as being several hundred feet long and driven on a sulfide-bearing shear zone that is traceable for at least 800 feet (244 m) on the surface. Griswold (1964, p. 1) shows the prospect to be in a zone of unaltered monzonite. At the time of this study, the adit was completely waterfilled. The sample was selected from vein material on the dump and showed only a trace of silver and 0.63 percent zinc.

Sample 782 was collected from a 30-foot (9.2-m) adit bearing N.12°E. and driven along a nearly vertical shear zone in quartz diorite. The working is located 200 feet (61 m) east of the old Bailey(?) adit. The sample, chipped across a 1-foot (31-cm) interval of the adit face, assayed a trace of silver. A selected sample (783) of kaolinized wall rock from the dump assayed 0.02 ounce gold (0.7 g/t) and 0.4 ounce silver per ton (14 g/t) for a combined metal value of \$5.40 per ton (\$5.94/t).

Two samples were taken from the easternmost working in lower Turkey Canyon, a single excavation composed of a trench and adit driven on a shear zone in quartz diorite. The zone bears N.68°W. and dips 66°SW. An 11-foot (3.4-m) adit extends from the east end of a 30-foot (9.2-m) long trench. A 1.2-foot (37 cm) chip sample (784) from a gouge zone in the adit face showed a trace of gold and 0.2 ounce silver per ton (7 g/t); a 9.5-foot (2.9-m) chip sample (785) across the top of the portal was barren. The portal exposes a well developed fracture zone containing highly kaolinized material with streaks of limonite.

Old Abe Claim (samples 786-789)

Workings of the Old Abe claim are within the proposed addition about one-fourth mile (about 403 m) northeast of the sample sites on lower Turkey Creek. The claim was patented in 1908. The main working here, somewhat deteriorated, is a combination of an adit, shaft, and winze. The adit bears N.88°W. at least 67 feet (20.4 m) along a 2- to 12-inch (5- to 30-cm) quartz vein that dips 80°S. Beyond this point, the adit is filled with muck and debris to within 1 foot (31 cm) of the back. At 40 feet (12.2 m) from the portal, a 30-foot (9.2-m) raise extends to the surface; at 45 feet (13.7 m) is a winze filled to within 5 feet (1.5 m) of the adit floor; at 67 feet (20.4 m) is a stub drift that extends 8 feet (2.4 m) to the north. Two samples of vein rock and one sample across the full width were taken in the adit. A 3-inch (8-cm) veinlet sample (787) taken on the south wall 50 feet (15.3 m) from the portal assayed 0.03 ounce gold (1 g/t) and 18.3 ounces silver per ton (628 g/t) for a total metal value of \$114.30 per ton (\$125.73/t). Sample 788 was taken from the same locality. It was chipped across a 3.2-foot (98 cm) width of the back and included both the vein and adjacent wall rock; it showed a trace gold and 3.3 ounces silver per ton (113 g/t) (\$34.06 per ton; \$37.47/t). Sample 789 was taken 5 feet (1.5 m) from the portal. It was chipped across 1.3 feet (40 cm) of vein and wall rock. It assayed 0.03 ounce gold per ton (1 g/t), 2.5 ounces silver per ton (86 g/t), and 7.04 percent lead (\$50.48 per ton; \$55.53/t). On the basis of these limited sample data and known working dimensions, it is estimated that 1,250 tons (1,134 t) of inferred ore might

conceivably be obtained from this working; the value of this tonnage would approximate \$40,000 at current metal prices. Additional ore might be found by exploration, but the property has little potential except for a very small-scale operation.

An apparent continuation of the Old Abe vein is exposed in a prospect pit on a ridgeline about 100 yards (91.5 m) away from the Old Abe working. The vein there strikes N.78°W. and dips 67°S. A 7-foot (2.1-m) wide chip sample (786) across the east wall of the pit assayed a trace of gold and 1.0 ounce silver per ton (34 g/t).

Sample 790

Sample 790 was about one-fourth mile (about 400 m) east from the Old Abe workings, near the Renowned OK patented claim, a 2.3-foot (70 cm) vein striking N.78°E. and dipping 80°S. is exposed in two prospect pits and a caved adit. The sample was chipped across the vein where the vein is exposed in the western prospect pit. The analysis showed a trace of gold, 1.0 ounce silver per ton (34 g/t) and 1.44 percent lead for a total value of \$12.34 per ton (\$13.57/t).

Upper Turkey Creek and Skull-Tanbark Canyons Area

Two drainages, Upper Turkey Creek and Skull-Tanbark Canyons, and their connecting ridges were examined. Eighty-eight samples were taken from numerous prospect workings; the sampling was confined to secs. 27, 28, 33, and 34, T. 9 S., R. 11 E. (fig. 6). Assay values were

Figure 6.--Near here.

generally low; the samples were from narrow showings.

Upper Turkey Creek (samples 64-104)

Forty-one samples were taken from 18 places in the upper Turkey Creek drainage. Although 22 samples showed combined metal values in excess of \$5.00 per ton (\$5.50/t), values generally were low.

Samples 64-102

Thirty-eight samples were taken from 15 workings and three outcrops on the 11 patented claims in upper Turkey Canyon. These claims constitute the Turkey Creek group.

The southernmost working is a caved adit trending N.35°E. at the fork of Turkey Creek in SW 1/4 sec. 33, T. 9 S., R. 11 E. Sample 64 was taken from a dump estimated to contain 200 tons (181 t) of country rock mostly andesite; assay results showed no unusual mineral content.

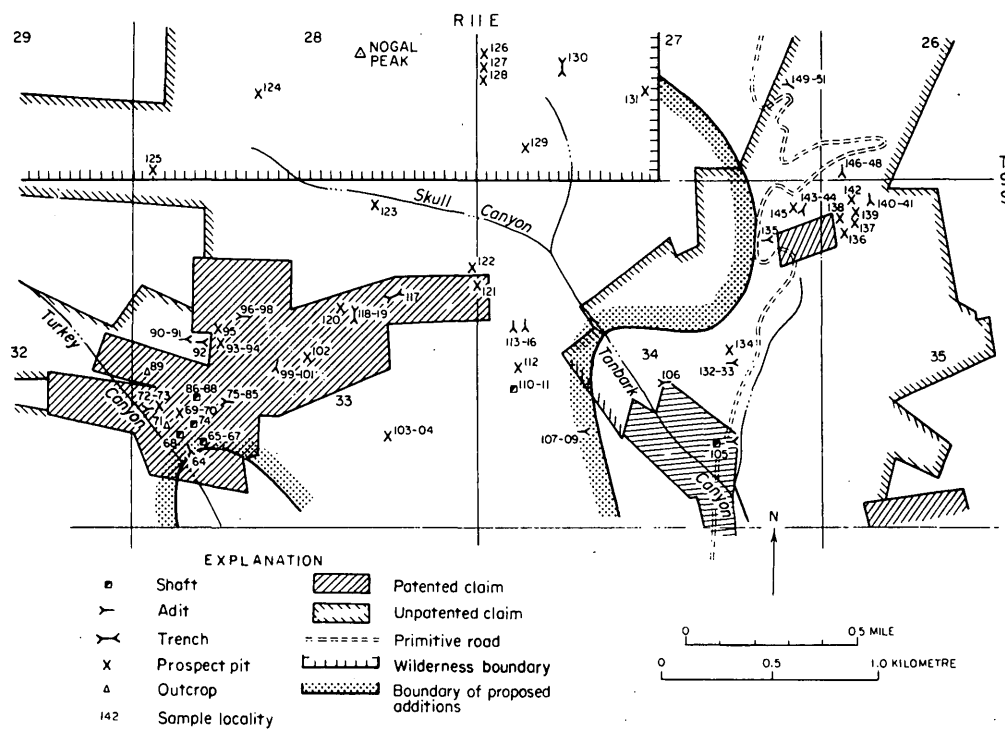


FIGURE 6.—Map of upper Turkey Creek and Skull-Tanbark Canyon area.

Samples 65-67 were taken from a shallow shaft on the Montezuma claim that was probably 25 feet (7.6 m) deep originally but is now filled with caved material to within 7 feet (2.1 m) of the collar. Although copper stain was seen on a boulder size fragment of quartz on the dump, assay results of all three samples were not important.

Sample 68 was taken from a 6-inch (15.2-cm) quartz vein on a lode known either as the Monte Carlo or Monte Cristo. The vein was explored by a shaft, now caved, that was originally about 20 feet (6.1 m) deep. The sample contained no significant values. Sample 69 was taken from a prospect pit 30 feet (9.2 m) upslope and put down on a 2-foot-(61-cm)-wide zone in andesite containing copper minerals. The sample, taken across the zone, assayed 0.20 percent copper. A copper-bearing specular hematite veinlet 2 inches (5 cm) wide was sampled in the pit. The sample (70) contained 0.03 ounce gold per ton (1 g/t), 0.50 ounce silver per ton (17 g/t), and 1.47 percent copper for a combined metal content of \$31.02 per ton (\$34.12/t). About 50 feet (15.3 m) west, sample 71 was taken across a 1-foot (31-cm)-wide exposure of malachite-stained hematite that contained less than 0.1 percent copper.

The samples were taken from workings located on the hillside, several hundred feet above the bottom of the west fork of Turkey Creek. A dump at a prospect pit in a siliceous zone was sampled (72); the assay showed no important metal content. Thirty feet (9.2 m) southwest of the pit, sample 73 was taken across a 3.5-foot (1.1-m) quartz vein that apparently parallels the siliceous zone exposed in the pit. No significant mineral concentration was detected in the sample.

A 1-foot (31 cm), east-striking quartz vein was sampled (74) at the collar of a shallow shaft that was filled with caved material to within 3 feet (92 cm) of the collar. Assay results were insignificant.

The Richard Carver adit, on the opposite side of the canyon, is the most extensive working accessible in the area of the Turkey Creek group. The adit was driven for 522 feet (159 m) on bearings varying from S.83°E. at the portal to S.75°E. at the face. A 13-foot (4.1 m) crosscut is in the south wall 129 feet (39.3 m) from the face; a narrow stope, 10 feet (3.1 m) high and 25 feet (7.6 m) long, is about 225 feet (68.6 m) from the face. Most of the adit was driven on a quartz vein as much as 7 feet (2.1 m) wide; 11 samples (75-85) were taken at intervals across the vein and structures along the adit. All assayed submarginal values, but all showed dollar values exceeding \$5.00 per ton (\$5.50/t) as shown below.

<u>Sample No.</u> ^{1/}	<u>Type</u>	<u>Gold</u>		<u>Silver</u>		<u>Zinc</u> (percent)	<u>Value</u>	
		(ounce per ton)	(g/t)	(ounce per ton)	(g/t)		(\$/ton)	(\$/t)
75	2.7-foot chip	0.06	2.1	0.36	12		11.16	12.30
76	4.3-foot chip	.02	0.7	.56	19	0.29	8.39	9.23
77	5.0-foot chip	.04	1.4	.20	7	.67	10.69	11.76
78	3.5-foot chip	.03	1.0	.30	10	.31	8.47	9.32
79	4.7-foot chip	.02	0.7	.36	12	.32	7.40	8.14
80	1.9-foot chip	.02	.7	.38	13		5.28	5.81
81	10-inch chip	.08	2.7	.32	11		13.92	15.31
82	7.0-foot chip	.06	2.1	.12	4		9.00	9.90
83	1.4-foot chip	.04	1.4	.08	2.7		6.00	6.60
84	3.0-foot chip	.08	2.7	.20	7		12.00	13.20
85	5.5-foot chip	.06	2.1	.50	17		12.00	13.20

^{1/} Copper, lead, and molybdenum insignificant.

A shaft, believed to be the King Rex, was sunk on a 3.5-foot (1.1-m) quartz vein, across the gulch from the Richard Carver adit. This shaft is believed to have been sunk on the same vein as that in the Richard Carver. The workings are estimated to have totaled several hundred feet, judged from the size of the dump, but the shaft has caved or has been filled with debris to within 33 feet (10.1 m) of the surface. Two samples (86 and 87) from the dump and a chip sample (88) across an outcrop of the vein 50 feet (15.3 m) west of the dump showed no significant mineral values.

The outcrop is about 1,000 feet (305 m) northwest of the King Rex shaft. A random chip sample (89) taken across a 13- to 16-foot (4.0- to 4.9-m) width of green-stained andesite showed no significant mineral values. The outcrop is about 1,000 feet (305 m) northwest of the King Rex shaft.

Several caved workings are located near the upper east fork of Turkey Creek. The samples were collected from the westernmost working. The working is a trench, or a caved adit, excavated along two iron-stained quartz veins that strike N.75°E. and measure 1.3 feet (40 cm) and 6 inches (15 cm) wide. The veins contain bornite and chalcopyrite but very minor copper values were detected in the two samples (90 and 91).

Just east from where samples 90-91 were collected is another caved working of undeterminable length; most of the dump has been washed away. A selected sample (92) of scattered rock contained 0.08 ounce gold per ton (2.7 g/t) and 0.52 ounce silver per ton (18 g/t), 0.02 percent copper, 0.10 percent lead, and 0.27 percent zinc for a total gross value of \$17.01 per ton (\$18.71/t). A random chip sample (94) from a breccia occurring in the area assayed 0.01 ounce gold per ton (0.3 g/t) and 0.50 ounce silver per ton (17 g/t).

A chip sample (95) was taken across a 3-foot (91 cm) quartz vein at a debris-filled prospect pit between the forks of a creek just north of sample site 93-94. The sample assayed 0.03 ounce gold per ton (1 g/t) and 0.48 ounce silver per ton (16 g/t).

Three samples were taken from a working that consists of a trench and adit. The trench, 30 feet (9.2 m) long, is connected to an adit that bears N.80°E. for 12 feet (3.7 m) and S.55°E. for 14 feet (4.3 m). The working is the northernmost examined in upper Turkey Creek. The samples (96-98), were taken across quartz stringers, and a quartz-filled fracture zone 3.5 feet (1.1 m) wide. Sample widths were 10 inches (25 cm), 3 inches (7.6 cm), and 3.5 feet (1.1 m), respectively. Gold assays ranged from 0.04 to 0.06 ounce per ton (1.4-2.1 g/t), and silver assays ranged from 0.10 to 0.90 ounce per ton (3.4-31 g/t). Total metal values ranged from \$6.00 to \$14.00 per ton (\$6.60 to \$15.84/t). The 3.5 foot (1.1 m) sample (98) had a value of \$9.12 per ton (\$10.03/t).

Two samples were taken from an adit about one-quarter mile (about 400 m) southeast of sites 96-98. It is believed to be on the Stonewall Jackson patent. The adit, driven into a ridge, bears N.25°E. for 39 feet (11.9 m). A 5-foot (1.5-m) chip sample (99) across the face assayed 0.06 ounce gold and 0.82 ounce silver per ton for a gross value of \$13.92 per ton (\$15.31/t). A sample (100), 2-inches (5 cm) wide, from a structure filled with quartz and fault gouge that crosses the drift 15 feet (4.6 m) from the face showed 0.04 ounce gold per ton (1.4 g/t) and 0.30 ounce of silver per ton (10 g/t). Sample 101, of a 2-inch (5 cm) fracture filling near the portal, yielded only minor gold and silver values.

A grab sample (102) of quartz from a prospect pit near the center of sec. 33 on the ridge crest above the Stonewall Jackson adit contained 0.02 ounce gold per ton (0.7 g/t) and 0.42 ounce silver per ton (14 g/t).

Samples 103 and 104

Gold and silver were detected in a 6-inch (15 cm), east-west striking vein in a small prospect pit on the divide between Turkey and Devil's Canyons in SE 1/4 sec. 33. Sample 103 from the east face of the pit assayed 0.06 ounce gold per ton (2.1 g/t) and 2.44 ounces silver per ton (84 g/t), but sample 104 from the same vein in the west face of the pit assayed extremely low values in gold and silver.

Skull-Tanbark Canyons Area (samples 105-151)

The greatest concentration of mining activity in the Bonito mining district has been in Tanbark Canyon (fig. 6), mainly in sec. 3, T. 10 S., R. 11 E., and secs. 33 and 34, T. 9 S., R. 11 E. Eleven lode claims and two mill sites are patented; the entire drainage has been covered by unpatented claims. The latter include the Parsons group and part of the Rialto group. Except for part of the Old Abe (sample sites 786-789), all of the patented claims lie outside the study area (pl. 1).

At the time of the first phase of this investigation, drilling for molybdenum was underway in NE 1/4 sec. 34. At the same time(?) the Etta-Emma molybdenum prospect was being reopened in the extreme SW 1/4 sec. 26, T. 9 S., R. 11 E. Both sites are outside the study area.

The wilderness investigation was limited to the area upstream from the site of the Parsons Hotel in sec. 34, T. 9 S., R. 11 E. The Renowned O.K. claim, patented in 1891, is west of the road in the main part of Tanbark Canyon and outside the proposed addition. Griswold (1959, p. 53-54) and Thompson (1966, p. 90-91) described the Renowned O.K. lead-zinc-silver mine in detail. The workings shown on their maps were examined by the U.S. Bureau of Mines in 1943 and described in an unpublished War Minerals report. That report, however, shows the mine to be on a group of unpatented claims called the Petty mine consisting of the Handy and Surprise groups.

Griswold (1959) reported that an adit approximately 400 feet (112 m) long, a raise of 40 feet (12.2 m), and a shallow winze constitute the main working at the Renowned O.K. Galena, sphalerite, and minor chalcopyrite comprise the ore minerals; minor silver is contained in galena. The minerals are in an east-west-trending quartz vein in pyritized andesite. The vein averages 1 foot (31 cm) in width. Griswold stated that 25 tons (22.7 t) of lead-silver ore was treated in 1957 at the owner's mill in Carrizozo. Minor production of gold, silver, copper, lead, and zinc ores was reported in 1936 and 1938.

The Crow group of six patented claims is on the east side of Tanbark Canyon opposite the Renowned O.K. Located in the early 1880's, the lodes were not patented until 1908. The mine and surrounding area are described in great detail by Mardirosian (1964) and briefly by Thompson (1966, p. 91).

Forty-seven samples were taken at 19 locations in the Skull-Tanbark Canyons area; their analyses are listed in table 1. Assay values were negligible except for the 17 samples listed below.

Sample No.	Type	Gold		Silver		Copper (percent)	Lead (percent)	Zinc	Molyb- denum (ppm)	Value	
		(ounce per ton)	(g/t)	(ounce per ton)	(g/t)					(\$/ton)	(\$/t)
105	Dump, quartz	0.03	1.0	3.20	110		2.42	1.17		42.54	46.80
107	1.2-foot chip	Tr	Tr	.8	27		.67			7.75	8.53
108	1.4-foot chip	N	N	Tr	Tr		.63		1,000	9.77	10.74
112	Dump, quartz	.03	1.0	.84	29					9.54	10.49
113	1.9-foot chip						.87	.19	<1,000	10.61	11.67
114	2.0-foot chip	.01	0.3	.38	13	0.07	.60	.72		11.46	12.61
115	1.2-foot chip	.01	0.3	2.20	75	.08	3.10	.83	<1,000	41.15	45.27
124	Random chip	.01	0.3	1.10	38					8.10	8.91
128	5.0-foot chip	.02	0.7	.40	14					5.40	5.94
130	Dump, grab	.02	0.7	.40	14					5.40	5.94
136	3.7-foot chip	.01	0.3	3.60	123				300	25.20	27.72
145	1.0-foot chip	.07	2.4	Tr	Tr					10.50	11.55
146	Selected	Tr	Tr	Tr	Tr				13,000	91.00	100.10
147	8-inch chip	Tr	Tr	N	N				13,500	94.50	103.95
148	Selected	N	N	Tr	Tr				1,700	11.90	13.09
149	3.0-foot chip	Tr	Tr	.10	3.4				1,200	8.40	9.24
150	3.0-foot chip	.005	0.2	Tr	Tr				990	6.93	7.62

All the above samples were from deposits outside the wilderness, except for 124, 128, and 130. Samples 107, 108, and 112-115 were taken from workings in the proposed wilderness addition.

Sample 105

Sample 105 was taken from one of a group of properties located near the site of the Parsons Hotel. The properties include the Ironsides claim patented in 1892, the Silver King claim patented in 1891, and the Thrifty and Hopeful patented millsite claims. The sample, was a grab sample of quartz from a 100-ton (91-t) dump at the inaccessible Silver King shaft. The sample assayed 0.03 ounce gold per ton (1.03 g/t), 3.2 ounces silver per ton (110 g/t), 2.42 percent lead, and 1.17 percent zinc for a total metal value of \$42.54 per ton (\$46.79/t). An adit, now caved, is reported to have connected the shaft and the east fork of Tanbark Canyon. The workings appear to be very old; the dump is deeply weathered and overgrown.

Sample 106

A sample of leached rock was taken from the dump at a caved working in Skull Canyon just west of the Silver King property. Nothing of value was indicated in the sample analysis.

Samples 107-109

Three samples were collected from the Grey Goose adit about one-half mile (about 800 m) west of the Silver King shaft and probably within the proposed wilderness addition. The adit is 150 feet (45.8 m) long and trends westerly. A 66-foot (20.1-m) long crosscut about 26 feet (7.9 m) from the portal was driven north in a highly altered zone containing clay and stringers of quartz. Samples 107 and 108, taken at the face of the crosscut and 27 feet (8.2 m) from the main drift, assayed 0.67 and 0.63 percent lead, over widths of 1.2 feet (37 cm) and 1.4 feet (43 cm), respectively. Sample 107 also contained 0.8 ounce silver per ton (27 g/t) and sample 108 contained 1,000 ppm molybdenum. Values of these two samples were \$7.75 and \$9.77 per ton (\$8.52 and \$10.75/t), respectively. Sample 109, taken across a 1.6-foot (49-cm) limonite-quartz zone 100 feet (30.5 m) from the face of the main drift, contained no significant values.

Samples 110 and 111

Two chip samples were taken across widths of 5.0 and 1.8 feet (1.5 m and 55 cm) from a deeply weathered zone cropping out on a knoll northwest of the Grey Goose. A shaft, originally about 30 feet (9.2 m) deep, but now caved and nearly filled with debris, was sunk on the zones. The samples showed nothing of significance on assay.

Sample 112

A massive quartz outcrop is exposed by several pits north of the shaft. The 8-foot (2.4-m) wide body was insufficiently exposed to obtain a strike and dip. A grab sample assayed 0.03 ounce gold per ton (1.03 g/t) and 0.84 ounce silver per ton (29 g/t).

Samples 113-116

Four samples were taken from a working on the north side of Devil's Canyon, an unmapped tributary of Skull Canyon in NW 1/4 sec. 34, T. 9 S., R. 11 E. (fig. 6). The working may have been located as the Emmart in 1892 and was relocated as the Red Fox in 1897. It is now claimed as the Old Red Fox by Homer Collins of Carrizozo, N. Mex. Thompson (1973) reported that 16 tons of lead-zinc ore of uncertain grade was shipped in 1965. The working, near the bottom of the canyon, is within the study area. It consists of a trench, 135 feet (41.2 m) long and as much as 25 feet (7.6 m) deep that connects with an adit 258 feet (78.7 m) long driven generally N.24°W. on a quartz vein. About 45 feet (13.7 m) in from the portal is a 25-foot (7.6 m) opening to the surface. A narrow stope 10 feet (3.1 m) long and 15 feet (4.6 m) high is 92 feet (28.1 m) from the face. Sample 113, taken across 1.9 feet (58 cm) at the adit face, contained 0.87 percent lead and nearly 1,000 ppm molybdenum for a calculated worth of \$10.61 per ton (\$11.67/t). Sample 114, chipped across 2.0 feet of vein at a point 23 feet (7.0 m) from the face, assayed 0.01 ounce gold per ton (0.3 g/t), 0.38 ounce silver per ton (13 g/t), 0.60 percent lead, and 0.72 percent zinc. The total metal value of this sampled material was calculated at \$11.46 per ton (\$12.61/t). A sample (115) chipped across a 1.2-foot (37 cm) vein exposed 19 feet (5.8 m) from the west end of the stope showed high assay results: 0.01 ounce gold per ton (0.3 g/t), 2.20 ounces silver per ton (75 g/t), 3.10 percent lead, 0.83 percent zinc, about 1,000 ppm molybdenum, and minor copper for a worth of \$41.15 per ton (\$45.27/t). Sample 116, taken across 2 feet (61 cm) at the east brow of the stope, contained insignificant metal values.

Samples 117-120

Four prospects were examined in the central part of sec. 33 (fig. 6). No values of economic significance were found. Sample 117 was taken from the dump of a pit near a canyon bottom; samples 118-119 were grabs of loose material from a 20-foot (6.1 m) trench on the ridge; sample 120 was chipped across a 7-inch (18 cm) quartz vein in a pit 150 feet (45.8 m) from the trench.

Samples 121-123

At this site about 2,000 feet (610 m) south of Skull Canyon, three prospect pits were examined. Assay values were negligible.

Sample 124

Sample 124 was taken from a prospect pit in the saddle at the head of Skull Creek about one-fourth mile (about 400 m) southwest of Nogal Peak. The locality is in the wilderness in SW 1/4 sec. 28, T. 9 S., R. 11 E. A notice at the pit identified the property as the T-claim. A random chip sample taken across the south face assayed 0.01 ounce gold per ton (0.3 g/t) and 1.10 ounces silver per ton (38 g/t).

Sample 125

The sample was taken from a deposit sparsely mineralized with amethystine quartz. The deposit is about one-fourth mile (about 400 m) southwest of sample site 124 and probably within the wilderness. The claim was first located in 1903 and subsequently relocated several times; a notice was found for the T-2 claim. The exposure in a small pit has been picked over; blasting would be required to determine if any specimens remain. The deposit is too small for development by other than mineral collectors. Assay of the sample showed gold and silver values to be very low.

Samples 126-129

The samples were collected from four pits near the top of the ridge running east from Nogal Peak on the north slope of Skull Canyon. The pits were sunk in volcanic rock containing crystals and fracture coatings of specular hematite. No metalliferous concentrations were detected in samples except for one (128) that contained 0.02 ounce gold per ton (0.7 g/t) and 0.40 ounce silver per ton (14 g/t) (\$5.40 per ton; \$5.94/t).

Samples 130 and 131

Sample 130 was taken from altered rock near the contact of intensely altered rocks of the Rialto-Parsons molybdenum deposit with unaltered volcanic rocks. The contact is a short distance down the Nogal ridge and in the wilderness. The sample, a grab, came from a 62-foot (18.9-m) trench and showed a value of \$5.40 per ton (\$5.94/t) in gold-silver but not molybdenum values. Sample 131, taken from the dump at a 9-foot (2.8-m) pit sunk in pyritized and altered rock about one-half mile east of sample site 130, showed only insignificant values.

Samples 132-134

Two samples (132 and 133) were taken in an adit located in E 1/2 sec. 34, T. 9 S., R. 11 E., just west of Parsons Road. The adit is 40 feet (12.2 m) long and bears N.60°W. Another sample (134) was from a pit 20 feet (6.1 m) north of the adit portal. All were chip samples with widths from 3.0 to 3.5 feet (91 cm to 1.1 m); no metalliferous concentrations were detected in the sample analyses. The area is now part of the Parsons group of claims.

Sample 135

The sample came from an adit on the Jennie Lind claim in the ruins of the old townsite of Parsons City in NE 1/4 sec. 34. This old claim which dates to the 1800's was part of the Parsons Mining Company's Hopeful group in 1911 and is now part of the new Parsons group of claims. The adit extends 43 feet (13.1 m) on a N.80°W. bearing and 21 feet (6.4 m) on a N.40°W. bearing. The sample was chipped across 3 feet (91 cm) of altered igneous rock 9 feet (2.8 m) from the face and assayed 0.8 ounce silver per ton (27 g/t).

Just east of the Jennie Lind adit is the Hopeful patented claim, more commonly known as the Parson's mine. Mining was done by gloryhole and underground stoping methods. The mine is described as being in what may be a breccia pipe in altered igneous rock (Griswold, 1959, p. 43-44, Thompson, 1966, p. 99-100).

The breccia is auriferous, and recent drilling has shown the presence of copper and molybdenum at depth; drilling data are, however, not available. The U.S. Bureau of Mines took no samples at the mine, but turquoise was noted in thin fracture fillings. One of the owners, Edward Penfield of Carrizozo, N. Mex., has old maps of the mine, including gold-assay maps of the gloryhole, and a map of tailings ponds below the old mill, the ruins of which still remain.

The Parsons group of claims is outside the study area.

Samples 136-142

Seven samples were taken from a number of prospects that lie just east of the Parsons mine on what was originally the Bismark claim but what is now is believed to be the Molly 2E claim of the Rialto group. An adit and five pits were examined and were found to be in breccia similar to that at the Parsons mine. The adit is ninety-three feet (28.4 m) long and has a plan like a question mark: the adit from the portal bears N.5°E. for 19 feet (5.8 m) and gradually changes to N.55°E. for about 50 feet (15.3 m), and turns to N.85°W. for the last 24 feet (7.3 m). It declines at about 10° from the portal. A 3.7-foot chip sample (136) contained 0.01 ounce gold per ton (0.3 g/t), 3.6 ounces silver per ton (123 g/t), and 300 ppm molybdenum, for a combined worth of \$25.20 per ton (\$27.72/t); all other samples contained very low metal values.

Samples 143 and 144

The samples came from a 322-foot (98-m) adit, called the Buckshot Tunnel which is a short distance north of the Parsons mine. The adit was driven N.10°E. in pyritized, altered igneous rock. Both samples were taken across the back 25 feet (7.6 m) and 75 feet (22.9 m) from the face and showed no appreciable mineral values. The working is now on the Molly claim of the Rialto group.

Sample 145

The sample was collected from a quartz vein at least 1 foot (31 cm) wide that occurs in a 50 foot (15.3 m) caved working about 200 feet (61 m) west of the Buckshot Tunnel. It was chipped across the vein and contained 0.07 ounce gold per ton (2.4 g/t), or \$10.50 per ton, 11.55/t.

Samples 146-148

The samples were collected from the old Etta-Emma prospects which lie in the SW 1/4 SW 1/4 sec. 26 and outside the proposed addition to the wilderness. These prospects are now covered by the Rialto claim. Sample 146 was hand picked from rock in an old trench that was being cleaned out at the time and showed 13,000 ppm molybdenum worth \$91.00 per ton (\$100.10/t). Sample 147 was chipped across 8 inches (20 cm) of a fault plane that forms the trench wall; the sample contained 13,500 ppm molybdenum worth \$94.50 per ton (\$103.95/t). Sample 148 was selected from freshly blasted rock in the footwall of the trench and showed 1,700 ppm molybdenum (\$11.90 per ton, or \$13.09/t). These samples show unusually high values of molybdenum and were obtained on the Rialto claim group in the vicinity of where a drill-exploration program was being conducted for molybdenum.

Rialto Deposit

A group of claims, referred to as the Rialto deposit, covers an area of hydrothermally altered igneous rock containing molybdenum, copper, gold, and silver in secs. 26, 27, 34, and 35, T. 9 S., R. 11 E. The area is just east of the study area. The first claims were located in the vicinity probably as early as the 1870's. During the 1880's, the area was staked for gold occurrences. Molybdenum, although probably recognized by the early prospectors, was not actively sought until the 1950's.

According to Griswold (1959, p. 57), the principal occurrence of molybdenum is in the area of the Fulmer Tunnel in SE 1/4 sec. 27, about 2,000 feet (610 m) from the wilderness and along the new Parsons Road from Nogal Canyon to the Parsons mine. The Fulmer Tunnel is a 384-foot (117-m) adit high on the south slope of Nogal Canyon.

In 1957 Climax Molybdenum Co. drilled four diamond drill holes in the vicinity of the Fulmer Tunnel. Griswold reported that total drilling amounted to 2,319 feet (707 m), the longest hole being 734 feet (224 m). All holes were drilled easterly and inclined 30° to 60° from horizontal.

In 1963 Griswold examined the molybdenum deposit in detail under the sponsorship of the New Mexico Bureau of Mines and Mineral Resources and the results were published as Circular 67 (1964). Griswold, in addition to reporting the sampling he did there, reported details of the exploration conducted by Climax. He concluded that the Fulmer Tunnel area averaged about 0.20 percent molybdenite too low to be mined economically.

Samples 149-151

Sampling was limited in the vicinity of the Fulmer Tunnel because most of the surface exposures of molybdenum are outside the wilderness. More than 40 prospect openings were observed in the area, mainly in W 1/2 sec. 26 and E 1/2 sec. 27; however, the only samples were taken from the Fulmer Tunnel. A 3-foot (91-cm) chip sample (149) taken across the back 6 feet (1.8 m) from the face showed 1,200 ppm (0.12 percent) molybdenum (\$8.40 per ton; \$9.24/t); another 3-foot (91-cm) chip sample (150) 25 feet (7.6 m) from the face assayed 990 ppm molybdenum (\$6.93 per ton; \$7.62/t); and a 4.6-foot (1.4-m) chip sample (151) 250 feet (76.3 m) from the portal contained 360 ppm (0.04 percent) molybdenum.

Nogal Canyon area

There are numerous workings and extensive mining-claim coverage in the Nogal Canyon area in secs. 21-28, T. 9 S., R. 11 E. For description the area was subdivided into two parts--Nogal Canyon and Pennsylvania-Clipper Canyons. Sample localities and claim boundaries are shown on figure 7.

Figure 7.--Near here.

Nogal Canyon (samples 152-201)

Of the hundreds of claims, both patented and unpatented, located along Nogal Canyon from the headwaters to the town of Nogal, only those in or near the wilderness study area were examined.

Fifty samples were taken from 19 locations in the Nogal Canyon area. All were from within the study area; 14 were from within the wilderness. Combined assay values in excess of \$5.00 per ton (\$5.50/t) are listed for eight samples:

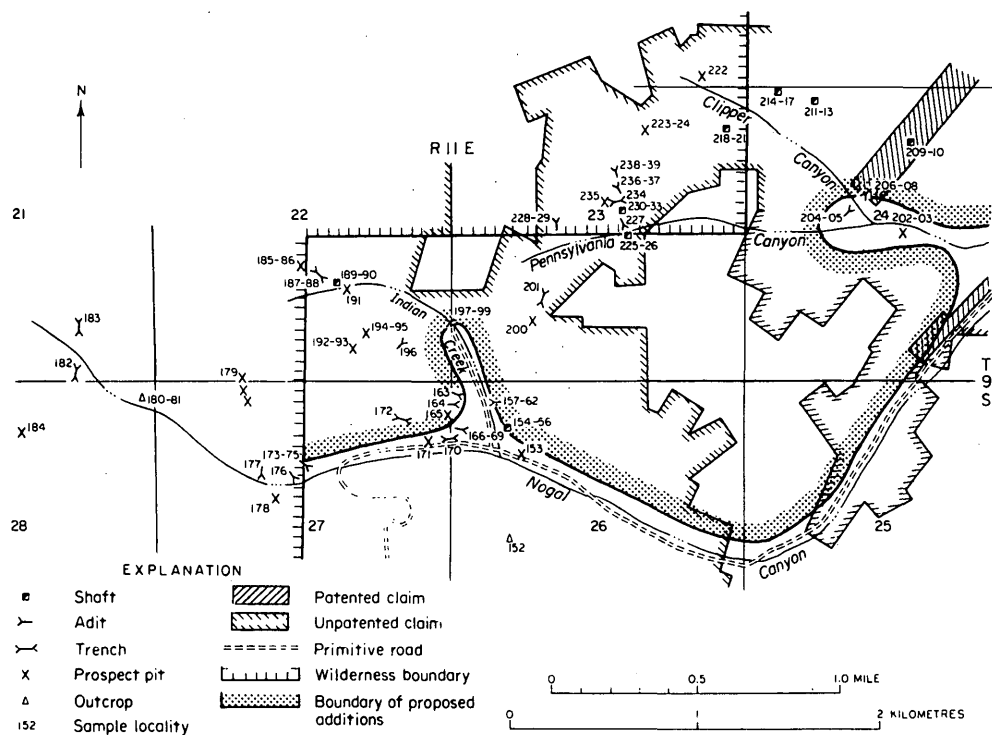


FIGURE 7.—Map of Nogal Canyon area.

<u>Sample No.</u>	<u>Type</u>	<u>Gold</u>		<u>Silver</u>		<u>Lead</u> <u>(percent)</u>	<u>Zinc</u>	<u>Molybdenum</u> <u>(ppm)</u>	<u>Value</u>	
		<u>(ounce</u> <u>per ton)</u>	<u>(g/t)</u>	<u>(ounce</u> <u>per ton)</u>	<u>(g/t)</u>				<u>(\$/ton)</u>	<u>(\$/t)</u>
175	3.2-foot chip	0.02	0.7	1.7	58				13.20	14.52
183	Trench, grab	.05	1.7	Tr	Tr				7.50	8.25
188	Selected	.01	0.3	4.28	150	0.29	0.55		32.91	36.20
191	Dump, grab	.04	1.4	.52	18				9.12	10.03
192	Selected	.02	0.7	.04	1.4			900	9.30	10.23
193	Selected	.02	0.7	.10	3.4			300	5.10	5.61
196	Dump, grab	.02	0.7	.52	18				6.12	6.73
197	3.7-foot chip	.005	0.2	1.06	35				6.36	7.00

Sample 152

The sample was a piece of float, apparently from an iron-bearing vein that is reported to trend northwest from the NW 1/4 sec. 26, to the NE 1/4 sec. 27, T. 9 S., R. 11 E. No exposures of the vein were found. The sample showed an iron content of 47.3 percent.

Sample 153

The sample came from the easternmost working examined in the main part of Nogal Canyon, a prospect pit a short distance downstream from the mouth of Indian Creek. The sample is from a 2-inch (5 cm) quartz stringer and showed no significant mineral content.

Samples 154-156

Three samples were taken from the vicinity of a caved shaft with a weathered dump near the mouth of a small tributary of Indian Creek. The ground, originally claimed as the Trader in 1880 is now part of the Rialto group. No important metal values were detected on analysis.

Samples 157-162

Six samples were collected from an adit located on the hillside about 1,000 feet (about 300 m) north of the shaft just described. The adit which, might be the old Mart or Klondike prospect, was driven N.85°E. for 50 feet (15.3 m) S.58°E. for 36 feet (11.0 m), and S.33°E. for 23 feet (7.0 m). The samples were taken at various points along a quartz vein as much as 1.5 feet (46 cm) wide and contained only minor metal values. The highest assay was 0.03 ounce gold per ton (1.03 g/t) from an 11-inch (28-cm) chip sample (162).

Samples 163-165

Samples 163 and 164 were taken from two caved workings near each of which are dumps of about 25 tons (about 23 t). Silver was reported at 0.50 ounce per ton (17 g/t) for sample 163 and 0.40 ounce per ton (14 g/t) for sample 164. Sample 165 came from the dump of a shallow caved pit on the ridge behind the workings and contained no significant values.

Samples 166-169

The samples were from a caved 10-foot (3.1-m) adit on the west side near the mouth of Indian Creek. Three of the samples (166-168) were chipped from altered zones at the portal. They contained silver values of 0.40, 0.40, and 0.36 ounce per ton (12-14 g/t), but other metal values were of no consequence.

Samples 170 and 171

A sample was taken from the end of a bulldozer cut on the north bank of Nogal Creek just upstream from the mouth of Indian Creek. Another sample was taken across a 2.5-foot (76-cm) exposure of conglomerate in a prospect pit. Assay values were negligible except for 0.03 ounce gold per ton (1.0 g/t) in sample 171.

Sample 172

The sample was taken from a 50-foot (15.3-m) trench on the hillside northwest of the pit in the conglomerate. No significant metals were detected on assay.

Samples 173-176

Four samples were taken from two workings just above the junction of Parsons Road and the Nogal Canyon road. One of the workings, a 29-foot (8.8-m) adit bearing N.57°W., is located at the wilderness boundary.

It was driven in a zone of highly pyritized rock that is part of a locally altered area present around the workings. A chip sample (173) from near the face was of no consequence.

A sample (174) taken across 3.6 feet (1.1 m) of the back at a point 17 feet (5.2 m) from the face, however, yielded 0.54 ounce silver per ton (19 g/t), and a chip sample (175) taken across 3.2 feet (98 cm) of the back 5 feet (1.5 m) from the portal assayed 0.02 ounce gold per ton (0.7 g/t) and 1.70 ounces silver per ton (58 g/t) or \$13.20 per ton (\$14.50/t) in metal value.

Sample 176 was from the dump of the second working, a caved adit or trench about 25 feet (7.6 m) long just inside the wilderness. The sample showed no significant metal values.

Samples 177 and 178

Sample 177 came from a caved adit on the north wall of Nogal Canyon about 1,000 feet (about 300 m) upstream from the wilderness boundary. No metal values were detected in it. A claim notice was found for the R & L claim. Sample 178 taken from a prospect pit across the canyon likewise showed no important values.

Sample 179

A random chip sample from one of three pits near the crest of a ridge north of the R & L adit contained no important metal values.

Samples 180 and 181

Two samples of gravel cemented by black minerals, probably oxides of iron and manganese, were taken in the extreme northeast corner of sec. 28. Sample analyses indicated no mineral potential.

Samples 182 and 183

The samples were taken from the dump of a caved working and a 125-ft (38.1-m) trench in altered rock near the head of Nogal Canyon. Sample 183 was of leached rock in the trench and contained 0.05 ounce gold per ton (1.7 g/t) and a trace of silver (\$7.50 per ton; \$8.25/t of gold).

Sample 184

The sample came from a prospect pit in altered rock on the divide between Nogal and Water Canyons; it assayed 0.34 ounce silver per ton (12 g/t).

Samples 185-191

Seven samples were taken from two pits, a trench, and a shaft near the divide between the upper forks of Indian Creek. The upper pit is on the wilderness boundary. A 2.5-foot (76 cm) chip sample (185) was taken across a quartz vein in the north face of the pit, and assayed 0.50 ounce silver per ton (13.7 g/t) and 0.41 percent lead. A 1.2-foot (37-cm) chip sample (186) was taken from the same vein in the south face and assayed 0.62 percent lead.

Sample 187 was taken from a fracture zone in the trench and showed no significant metal values. A selected sample (188) of pyrite-bearing quartz on the dump, however, assayed 0.04 ounce gold per ton (1.4 g/t), 4.38 ounces silver per ton (150 g/t) 0.29 percent lead, and 0.55 percent zinc (total metal worth of \$32.91 per ton; \$36.20/t).

Two samples (189 and 190), one from a fracture zone and the other from an estimated 100-ton (90.7 t) dump at the shaft did not show significant assay values.

A grab sample (191) from the dump at a prospect pit down the hill from the shaft assayed 0.04 ounce gold per ton (1.4 g/t) and 0.52 ounce silver per ton (18 g/t).

Samples 192-196

Sample 192 was of rock from a prospect pit on the ridge west of Indian Creek. It contained a mineral identified as ferrimolybdate, an oxide of molybdenum. This material yielded 0.02 ounce gold per ton (0.7 g/t) and 900 ppm (0.09 percent) molybdenum for a net worth of \$9.10 per ton (\$10.01/t). A grab sample (193) from the dump assayed 0.02 ounce gold per ton (0.7 g/t) and 300 ppm (0.03 percent) molybdenum for a net worth of \$5.10 per ton (\$5.61/t).

Samples 194 and 195 were collected from a badly caved prospect on the slope below the pit just described. No metals of importance were detected in assays. Sample 196 came from a dump near a small adjacent caved adit and contained 0.02 ounce gold (0.7 g/t) and 0.52 ounce silver per ton (18 g/t) about \$6.12 per ton (\$6.73/t).

Samples 197-199

Three samples were taken from the Cougar adit located at the south quarter-corner between secs. 22 and 23. The adit, driven on an apparently barren fracture zone, extends in an arc varying from N.35°E. at the portal to N.85°E. at the face, for a total distance of 83 feet (25.3 m). A 12-foot (3.7-m) crosscut was driven northerly 38 feet (11.6 m) from the face of the main adit. Sample 197 chipped from the face across 3.7 feet (1.2 m) of the fracture zone assayed 1.06 ounces silver per ton (36 g/t), about \$6.00 per ton (\$6.60/t). Sample 198, a 1.9-foot (58-cm) chip, yielded 0.44 ounce silver per ton (15 g/t) and a 4-foot (1.2-m) chip (199) yielded 0.40 ounce silver per ton (14 g/t).

Samples 200 and 201

One sample was taken from the vicinity of a working on the ridge between Indian Creek and Pennsylvania Canyon. The working is a pit or shaft completely filled with debris; no estimate could be made of the original depth, but it was probably less than 50 feet (15.3 m). No metal concentration was detected in the analysis of a dump sample (200). A grab sample (201) was taken in a 20-foot (6.1 m) trench that was excavated in iron-stained, altered rock on the hill slope north of the filled pit or shaft; nothing of value was detected.

Pennsylvania and Clipper Canyons (samples 202-239)

Numerous prospects and mine workings were examined in the north forks of Pennsylvania and Clipper Canyons in secs. 23 and 24, T. 9 S., R. 11 E. (fig. 7). Thirty-eight samples were taken from 16 locations within the area. Twenty-two of the samples were from showings within the wilderness; 12 were from the proposed additions; and 4 were from outside the study area. Assay values were low for all samples.

Samples 202 and 203

Two samples were taken from the easternmost working examined in Pennsylvania Canyon. The working is a 5-foot (1.5-m) adit near the center of sec. 24. Driven in altered latite(?), the samples contained no significant mineral concentrations.

Samples 204 and 205

Two samples were taken from a weathered and overgrown dump adjoining a caved adit of undeterminable length located on the south side of Clipper Canyon. The samples showed no metal concentrations.

Samples 206-210

Five samples were taken from the south ends of the Clipper and Rochford patented claims. The claims are in the bottom of Clipper Canyon and adjoining area, and are within the proposed wilderness addition. The claims, located in 1881 by Minor Gaylord, were patented in 1890.

Investigation was limited to an adit in Clipper Canyon, and a shaft on the steep hillside above it, near the common boundary of the two claims. Several large workings were noted, however, to the northeast. An old map of the area lists 510 feet (156 m) of shafts, drifts, and tunnels on the Rochford, and 110 feet (33.6 m) of workings on the Clipper (R. Forsythe, personal commun., 1971). Ore sold from the claims is recorded at \$15,000, but it is not known in what years it was produced.

Three samples (206-208) were taken from the only working put down on the south end of the Clipper claim. The working is a caved adit driven N.70°E. for 55 feet (16.8 m). There is little evidence of mineralization, and it is possible the adit was started to undercut veins that crop out on the hillside; the samples showed no significant metal values.

Two samples (209 and 210) were taken from a dump adjoining the shaft on the hillside. The shaft, which is inaccessible, is vertical for 50 feet (15.3 m), and then possibly inclines with depth. Sample 209 assayed 0.04 ounce gold per ton and 0.76 ounce silver per ton; and sample 210 assayed 0.03 ounce gold per ton and 0.46 ounce silver per ton (\$10.56 and \$7.26 per ton).

Samples 211-217

Seven samples were taken from the caved remains of two shafts in the saddle between Clipper Canyon and a tributary of Tortolita Canyon. The shafts are near the boundary between secs. 13 and 24, a short distance east of the wilderness and in the proposed addition. The eastern shaft was probably less than 20 feet (6.1 m) deep originally and was sunk on a shear zone. The western shaft is filled with debris to within about 4 feet (1.2 m) of the surface; caving has broadened the collar so that the diameter is now nearly 20 feet (6.1 m). Numerous claims were located in the area beginning in 1882, but none were recorded after 1903.

Samples 211 and 212 were chipped from a shear zone in the eastern shaft. The zone is about 7 inches (18 cm) wide and contains stringers of quartz. Sample 213 was taken from the dump. Sample 214 was collected from the west side of the north face of the collar of the eastern shaft. The sample was chipped across a 1-foot (31-cm) quartz-bearing fracture zone. Sample 215 was chipped across a 3-inch (8-cm) rose-quartz vein in the east side of the north face. A selected sample (216) was taken from the dump; a specimen (217) of ferrimolybdate-stained rock contained only 200 ppm molybdenum. Assay data and calculated metal values are shown below.

Sample No.	Type	Gold		Silver		Copper (percent)	Lead	Zinc	Value	
		(ounce per ton)	(g/t)	(ounce per ton)	(g/t)				(\$/ton)	(\$/t)
211	7-inch chip	0.03	1.0	0.42	14				7.02	7.72
212	2-inch chip	.04	1.4	.62	21				9.72	10.69
213	Dump, grab	.03	1.0	.26	9				-	-
214	1.0-foot chip	.04	1.4	.44	15				8.64	9.50
215	3-inch chip	.04	1.4	.54	19	0.16		0.16	11.80	12.98
216	Dump, grab	.03	1.0	.46	16		0.73	.41	13.34	14.67
217	Dump, selected	.03	1.0	.96	33	.13	3.20		26.42	29.06

Sample 218-222

Five samples were taken from the site of a caved shaft on the other side of the gulch, southwest of the two shafts (sample sites 211-217) just described. The site is just inside the wilderness. Three samples were chipped from a fracture zone as much as 5 feet (1.5 m) wide on which the shaft was sunk. Sample 218, a 2.5-foot (76 cm) chip sample, assayed 0.02 ounce gold per ton (0.7 g/t) and 0.76 ounce silver per ton (26 g/t), and 420 ppm (0.042 percent) molybdenum (\$10.50 per ton; \$11.55/t). Sample 219, a 2.5-foot (76 cm) chip sample, contained 0.04 ounce gold per ton (14 g/t) and 0.54 ounce silver per ton (19 g/t) about \$9.24 per ton (\$10.16/t); sample 220, a 1.8-foot (55 cm) chip sample, yielded 0.03 ounce gold per ton (1.0 g/t) and 0.52 ounce silver per ton (18 g/t), about \$7.62 per ton (\$8.38/t). Sample 221, a grab sample from the 100 ton (91 t) dump assayed 0.03 ounce gold per ton (1.0 g/t).

Sample 222 was quartz fragments from the dump of a small prospect pit located at the crest of the divide north of the shaft. The sample assayed 0.04 ounce gold per ton (14 g/t) and 0.48 ounce silver per ton (16 g/t) for a total value of \$6.88 per ton (\$7.56/t).

Samples 223 and 224

Samples 223 and 224 were collected from a pit about one-fourth mile (about 400 m) southeast of sample location 222 (fig. 6). A random chip sample (223) of quartz, altered igneous rock, and gossan assayed 0.03 ounce gold per ton (1.0 g/t) and 0.60 ounce silver per ton (21 g/t) about \$8.10 per ton (\$8.91/t). The gossan is limonite with thin-walled, cellular boxworks that probably resulted from leaching of base-metal sulfide minerals. Tourmaline rosettes in the rock contain pyrite. A sample (224) from the dump, assayed 0.02 ounce gold per ton (0.7 g/t) and 0.58 ounce silver per ton (20 g/t) about \$6.48 per ton (\$7.13/t).

Samples 225-239

Fifteen samples were taken from eight prospect workings on the divide between Pennsylvania and Gaylord Canyons located in the wilderness. These workings are thought to be along the contact between iron-manganese carbonate veins in intrusive rock cropping out in Pennsylvania Canyon and an auriferous breccia cropping out in Gaylord Canyon.

Two samples were taken from the lowest working on the Pennsylvania Canyon side of the divide. The working, a shaft sunk on a vein, is located at the wilderness boundary. A notice was found for the C&M No. 2 claim; the ground was probably first located as the Caledonia or Nogal Queen in 1887. The samples were from the dump. Sample 225 was of jet black, iron-manganese gossan and sample 226 was a dump sample. Both samples assayed only insignificant values. Sample 227 was a 2.6 foot (79 cm) chip sample taken across the face of a short adit driven in an altered zone. The working is located on the hillside above the shaft just described. Two samples were taken from the vicinity of a prospect pit west of the adit, near the top of Pennsylvania Canyon. A notice was found for the C&M No. 1 claim. Sample 228 was from a 2 inch (5 cm) fissure filled with brecciated quartz; it contained 0.02 ounce gold per ton (0.7 g/t) and 0.78 ounce silver per ton (27 g/t), about \$7.68 per ton (\$8.45/t). A selected chip sample (229) of iron-manganese gossan from rocks on the dump assayed 0.03 ounce gold per ton (1.0 g/t), 0.66 ounce silver per ton (23 g/t), and 290 ppm (0.029 percent) molybdenum, about \$10.49 per ton (\$11.54/t).

Four samples (230-233) were taken from the southernmost of a group of five workings put down on the southern edge of the exposed part of a pipe-like body of breccia. The body extends from the crest of the divide to the bottom of Gaylord Canyon. The sampled excavation is a partly timbered, shallow shaft sunk on a 4-inch (10 cm) seam of white clay, probably kaolinite, adjoining a fracture zone of altered and leached igneous rock. No valuable metal concentrations were detected in four samples (230-233), three chip and one grab.

A random chip sample (234) was taken along a shallow trench 94 feet (28.7 m) long excavated at the crest of the divide. The sample contained only negligible metal values. Another sample (235), however, selected from limonitic box work and quartz scattered on the dump of a debris-filled prospect pit about 100 feet (30.5 m) to the west, yielded 0.01 ounce gold per ton (0.3 g/t) and 0.70 ounce silver per ton (24 g/t), about \$5.40 per ton (\$5.94/t).

Sample 236 was collected from workings on the Gaylord Canyon side of the divide just below the long trench. The workings include a 36-foot (11.0 m) cut and 14-foot (4.3-m) adit that bears S.65°E. The sample, a 3-foot (91-cm) chip sample was taken from across the face of the adit. It assayed 0.02 ounce gold and 0.96 ounce silver per ton (\$8.76 per ton). Sample 237, taken from three narrow clay seams in the southwest wall of the adit, assayed 0.04 ounce gold per ton (14 g/t) and 0.82 ounce silver per ton (28 g/t), about \$10.92 per ton (\$12.01/t).

Sample 238 was collected from a caved working, probably an adit, located in the dense brush below the adit just described. The working probably once was 100 feet (30.5 m) long. The sample was taken across 2 feet (61 cm) of brecciated rock and assayed 0.02 ounce gold per ton (0.7 g/t), 1.02 ounces silver per ton (35 g/t), and 0.69 percent lead per ton, about \$12.16 per ton (\$13.38/t). A sample (239) from the dump contained 0.03 ounce gold per ton (1.0 g/t) and 0.4 ounce silver per ton (14 g/t), about \$6.90 per ton (\$7.59/t).

Upper Tortolita Canyon area

Sixty-one samples were taken in upper Tortolita Canyon and three of its tributaries--Gaylord, Kountz, and Norman Canyons (fig. 8).

Figure 8.--Near here.

Fifty-nine of the samples were taken from 29 sites within the wilderness. Although metal values were generally low, 24 samples had calculated values exceeding \$5.00 per ton (\$5.50/t).

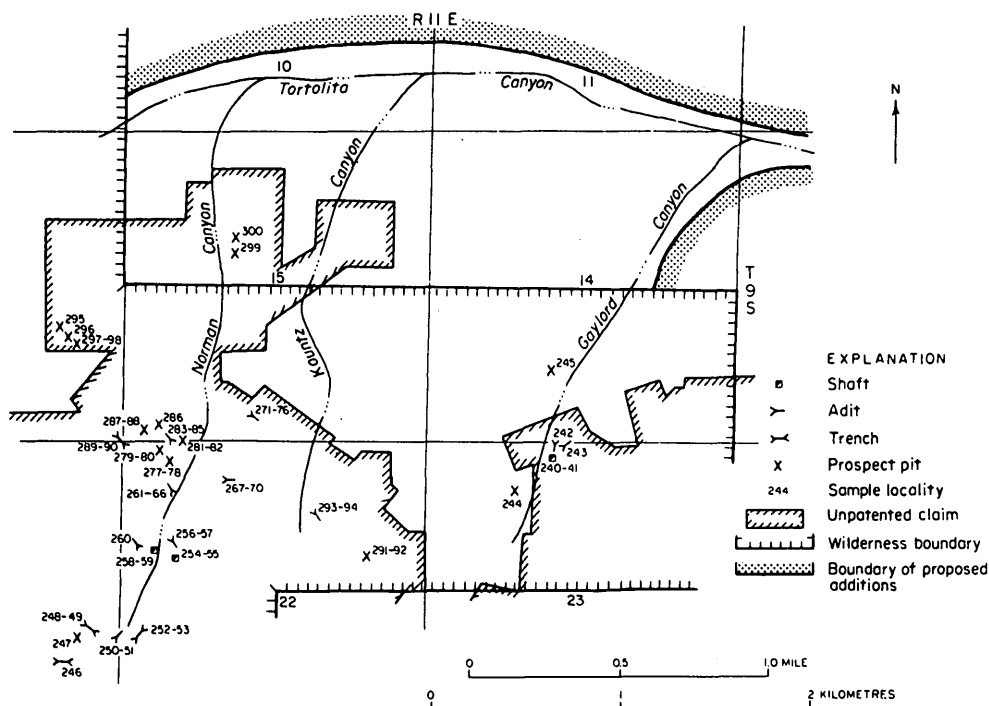


FIGURE B. - Map of upper Tortolita Canyon area.

Gaylord Canyon (samples 240-245)

Three samples were collected from the uppermost of a group of workings at the bottom of Gaylord Canyon. The uppermost working is a 14-foot (4.3-m) shaft sunk in hard, altered breccia. The breccia extends from the bottom of Gaylord Canyon southward to the adjoining ridge. A selected sample (240) of broken rock on the dump yielded values of 0.04 ounce gold per ton (1.4 g/t) and 0.69 ounce silver per ton (24 g/t), and 0.59 percent lead, about \$12.74 per ton (\$14.01/t). Another sample (241) from the dump assayed 0.02 ounce gold (0.7 g/t) and 0.58 ounce silver per ton (20 g/t), about \$6.48 per ton (\$7.13/t). A sample (242) was taken from a caved adit located at the bottom of the canyon. The working may be the D & B tunnel, or the Iron King, last operated by Amos L. Gaylord in 1938. The prospect is estimated to have from 300 to 500 feet (92 to 153 m) of workings judged from the size of the badly eroded and overgrown dump. The sample was composed of chips from a few pieces of brecciated rock scattered on the dump; it assayed 0.02 ounce gold per ton (0.7 g/t) and 0.82 ounce silver per ton (28 g/t), about \$7.92 per ton (\$8.71/t).

Sample 243, a grab sample, came from the vicinity of a caved adit near the bottom of a tributary to Gaylord Canyon, a short distance east of the adit just described. The extent of workings could not be estimated because almost all of the dump had been washed away. A small amount of material in the dump was sampled and assayed 0.02 ounce gold per ton (0.7 g/t) and 0.74 ounce silver per ton (25 g/t), about \$7.44 per ton (\$8.18/t).

Sample 244, a grab sample from a dump at a prospect pit on the ridge southwest of the adits just described contained only a trace of gold and 20 ppm molybdenum.

Sample 245 was from a prospect trench cut in altered rock and located in a small meadow downstream from sample sites 240-243. The sample (245) was chipped across 2.5 feet (76 cm) of fault gouge in the face of the trench and showed no significant metal values.

Upper Tortolita, Norman, and Kountz Canyons

(samples 245-300)

Mining claims were located as early as 1880 in a tributary of upper Tortolita Canyon, now known as Norman Canyon. The location given in claim notices filed during the early days of the district refer to the canyon as Tortolita Canyon. Mining claims in the canyon were consolidated as the Nogal Peak Mining and Milling Co., A. R. Forsythe, president, after the turn of the century (circa 1906).

The Nogal Peak Company claims were known as the Ball (Bald) Hornet group. Most of the exploration and mine development work probably was done in the early 1900's, as indicated by the weathered dumps and deteriorated workings. Over the years the claims in Norman and Kountz Canyons have been relocated under different names.

Claims in the area were again consolidated in the mid-1950's. Prospect trenches, aggregating several hundred feet, and an access road, were bulldozed in secs. 21 and 22, T. 9 S., R. 11 E. around 1956.

Samples 246-253

Eight samples were taken from four trenches and a pit bulldozed in altered igneous rock at the head of Norman Canyon. The trenches total 540 feet (165 m) in length. Only one of the samples contained noteworthy metal values; sample 248 assayed 0.02 ounce gold per ton (0.7 g/t) and 0.1 ounce silver per ton (3 g/t),

Samples 254-260

Seven samples were taken from the vicinity of four workings on the ridges and in the tributaries near the head of Norman Canyon. The most extensive working is an inaccessible shaft, at least 75 feet (22.9 m) deep, on the ridge between two forks in the upper part of the canyon. A selected sample (254) from scattered quartz on the dump assayed 0.03 ounce gold per ton (1.0 g/t); a grab sample (255) from the dump yielded 0.02 ounce gold per ton (0.7 g/t) and 0.10 ounce silver per ton (3 g/t).

A selected sample (256) of quartz from the dump of an adit located on the slope below the shaft yielded the highest gold assay obtained in the course of the wilderness investigation: 0.50 ounce gold per ton (17 g/t), about \$75.00 per ton (\$82.50/t). The adit, although caved, was judged from the size of the dump, to have totaled more than 200 feet (61.0 m) and it may have connected with the shaft. A sample (257) from the dump yielded 0.02 ounce gold (0.7 g/t) and 0.06 ounce silver per ton (2.1 g/t). A notice was found for the Last Chance claim dated 1957.

Two samples were collected from a shallow shaft on the nose of a ridge west of the adit. The shaft, about 30 feet (9.0 m) deep originally and now filled with debris to within 15 feet (4.6 m) of the collar was sunk on a 1.2-foot (37 cm) quartz vein. The vein strikes N.25°W. A chip sample (258) taken across the vein and a 3-foot (91 cm) channel sample (259) taken across an adjoining clay zone showed no significant metal values.

Sample 260 was taken from a caved adit located northwest of the shaft. The working, originally about 15 feet (4.6 m) long, was driven on a 4-inch (10 cm) pyrite-bearing quartz vein. The sample (260) was chipped across the vein and contained nothing of value.

Samples 261-266

Six samples were taken from the workings known as the Norman mine which is situated at the upper end of a road that traverses Norman Canyon. The workings include a 47-foot (14.3 m) adit driven N.45°W., a 9- by 10-foot (2.8- by 3.1-m) stope at the face, and a water-filled winze located 20 feet (6.1 m) from the portal. The adit had been driven along a fault zone rich in manganese and barium and along which was emplaced a quartz vein as much as 3.5 feet (1.1 m) wide. Five samples (261-265) were taken across the zone where it is exposed in the stope and one sample (266) was taken from the zone near the winze. Assay data are shown in the following table:

<u>Sample No.</u>	<u>Type</u>	<u>Gold</u>		<u>Silver</u>		<u>Value</u>	
		(ounce per ton)	(g/t)	(ounce per ton)	(g/t)	(\$/ton)	(\$/t)
261	1.1-foot chip	0.03	1.0	0.46	16	7.26	7.99
262	7-inch chip	.02	0.7	.44	15	5.64	6.20
263	2.8-foot chip	.04	1.4	.60	21	9.60	10.56
264	2.5-foot chip	.02	0.7	.58	20	6.48	7.13
265	3.5-foot chip	.02	0.7	.56	19	6.36	7.00
266	1.0-foot chip	.02	0.7	.48	16	5.88	6.47

Samples 267-270

Four samples were from a working near the top of the ridge adjacent to the east fork of Norman Canyon. The working is an 8-foot (2.4-m) adit driven N.80°E. in a siliceous zone. Sample 267 was taken from a 3-inch (8-cm) quartz vein in the face and assayed 0.02 ounce gold per ton (0.7 g/t) and 0.38 ounce silver per ton (13 g/t), about \$5.28 per ton (\$5.81/t). Sample 268, a 3.4-foot (1.0-m) chip sample taken across part of the east wall of a connecting 20-foot (6.1-m) cut, yielded 0.02 ounce gold per ton (0.7 g/t) and 1.26 ounces silver per ton (43 g/t), about \$10.56 per ton (\$11.62/t); sample 269, taken across a 4-foot (1.2-m) siliceous zone in the west wall, contained 0.02 ounce gold per ton (0.7 g/t) and 0.06 ounce silver per ton (2.1 g/t); and sample 270, taken from a 2-foot (61 cm) transverse siliceous zone, was relatively barren.

Samples 271-276

Six samples were collected from a short adit about 400 yards (366 m) north of the same ridge slope as that just described. The adit which follows a gouge-bearing fracture zone was driven for 50 feet (15.3 m) on a S.72°E. bearing. Near the face, a stub drift was driven another 28 feet (8.5 m) on bearings varying from S.28°E. to S.55°E. The samples were taken along the fracture zone on which the adit had been driven. Gold and silver values for the samples are listed below.

<u>Sample No.</u>	<u>Type</u>	Gold		Silver		Value	
		(ounce per ton)	(g/t)	(ounce per ton)	(g/t)	(\$/ton)	(\$/t)
271	1.3-foot chip	0.03	1.0	0.54	19	7.74	8.51
272	1-inch of gouge	.03	1.0	.32	11	6.42	7.06
273	3.5-foot chip	.03	1.0	.56	20	7.86	8.65
274	8-inch chip	.02	0.7	.34	12	5.04	5.54
275	8-inch chip	.02	0.7	.22	8	3.00	3.30
276	2.2-foot chip	.04	1.4	.50	17	9.00	9.90

Samples 277-290

The samples were collected from the SW 1/4 sec. 15 and NW 1/4 sec. 22, T. 9 S., R. 11 E. where there are seven prospects on the brush-covered west slope of Norman Canyon. Six of the workings are pits or trenches. The seventh, which is the largest of the workings, consists of a 25-foot (7.6-m) open cut connected to a 17-foot (5.2-m) adit that opens to a 9-foot (2.8-m) wide stope. The prospects are located on quartz veins, iron-manganese gossans, fracture zones, and siliceous zones, all of which occur along a fault that contains a barium-rich, iron-manganese carbonate vein. Of the 14 samples taken in the area, only the six samples listed in the following table contained significant values.

<u>Sample No.</u>	<u>Type</u>	Gold		Silver		Lead <u>(percent)</u>	Value	
		(ounce per ton)	(g/t)	(ounce per ton)	(g/t)		(\$/ton)	(\$/t)
278	2.3-foot chip	0.02	0.7	0.40	14	1.2	10.68	11.74
279	3.0-foot chip	.02	0.7	.70	24		7.20	7.92
280	3.0-foot chip	.01	0.3	.68	23		5.58	6.14
283	5-inch chip	.02	0.7	.66	22		6.96	7.66
284	1-inch chip	.04	1.4	.10	3.4		6.60	7.26
285	Dump, grab	.04	1.4	.16	5.5		6.96	7.66

Samples 291 and 292

Two samples were selected from a shallow, partly timbered prospect pit at the head of Kountz Canyon. The pit is in an iron-stained, weathered fracture zone containing a quartz vein as much as 4-inches (10 cm) wide. Sample 291 contained 0.52 ounce silver per ton (18 g/t).

Samples 293 and 294

The samples were taken from a caved working which is on the canyon slope below the pit just described. The working, possibly an adit, was driven S.60°E. on a narrow manganese-bearing quartz vein. Sample 293 assayed 0.02 ounce gold per ton (0.7 g/t) and sample 294 assayed 0.40 ounce silver per ton (14 g/t).

Samples 295-298

Four samples were selected from three prospect pits near the head of an upper tributary of Tortolita Canyon in E 1/2 sec. 16, T. 9 S., R. 11 E. The pits were sunk on an outcrop of gray carbonate rock containing narrow quartz veins. The structure is possibly an extension of the fault zone in Norman Canyon. Assay results of the samples were negligible.

Samples 299 and 300

The samples were taken from two prospect pits in lower Norman Canyon in N 1/2 sec. 15. The workings are just outside the wilderness. The only noteworthy assay value was 0.02 ounce gold per ton (0.7 g/t) contained in a 1-foot (31-cm) chip sample (300).

Lower Tortolita Canyon Area
(samples 301-324 and 765-771)

The workings in the Tortolita Canyon area are near the northeast corner of the wilderness and most are located between Dry Gulch and Tortolita Canyon. Some are located northwest of Tortolita Canyon and others near the head of Dry Gulch and in tributaries to Nogal Canyon. Patented claims in Dry Gulch not shown on plate 1 were located on geologic structures that apparently do not extend into the wilderness. Copper claims near the town of Nogal were not examined.

Pan samples from placer claims in Dry Gulch indicate that some of them may have a high gold content. The placers, which have not been exploited because of a lack of water in the area, probably derived their gold from lodes on patented claims at the head of Dry Gulch.

The patented lode claims, commonly referred to as the Helen Rae or American groups probably accounted for most of the mineral production from the Nogal mining district. The Helen Rae, Evalena, and American mines are described in detail by Griswold (1959). Only minor drilling and other exploration work has been done on the properties since World War II; the mills and other buildings are badly deteriorated.

Thirty-one samples were taken in lower Tortolita Canyon and in minor tributaries of Nogal Canyon (fig. 9). Of these, only five sample

Figure 9.--Near here.

sites are within the proposed wilderness addition. Twelve samples, all from east of the study area, assayed values exceeding \$5.00 per ton (\$5.50/t).

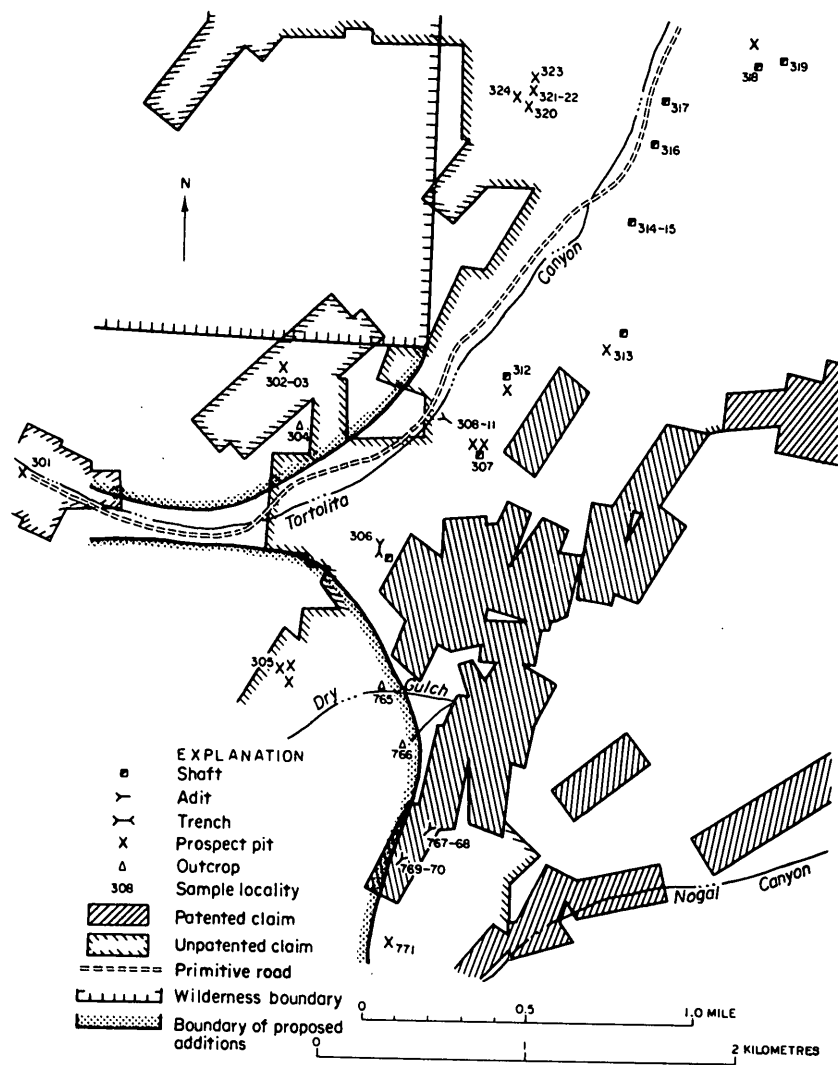


FIGURE 9.—Map of lower Tortolita Canyon area.

Sample 301

The sample came from the uppermost working found along lower Tortolita Creek. The working is a pit in a small altered zone that may be an inlier of older igneous rock in latite. The sample, a random chip sample of the altered material, contained no significant values.

Samples 302-304

The samples were taken northwest of lower Tortolita Creek and south of the wilderness boundary from a small mineralized area in otherwise unaltered Church Mountain latite. The only working there is a prospect pit sunk on an altered zone 3-feet (91-cm) wide that contains quartz, limonite, and siderite veinlets. The zone is traceable for nearly 1,000 feet (about 300 m) on a N.70°E. trend. Two random samples (302 and 303) from the pit showed no metal concentration of consequence. Likewise, only traces of gold and silver were detected in a random chip sample (304) from slightly altered rock occurring in a structure downslope from the pit.

Samples 305-307

The samples were taken from several prospects excavated over a distance of 3 miles (4.8 km) along the top of a ridge forming the south and southeast sides of Tortolita Canyon. Only the larger workings were sampled; most are accessible from a four-wheel drive road on the ridge or from a better road in the canyon.

Sample 305 came from the southwesternmost of the prospects which is comprised of three pits about 1 mile (about 400 m) within the study area. A grab sample of broken rock at one of the pits showed no metal concentration of consequence.

Another sample was taken about one-half mile (about 800 m) northeast of sample site 305 and outside the study area where several caved and debris-filled workings are near what is thought to be the common boundary of the Last Corner and the Smuggler patented claims. A selected sample (306) of pieces of siderite scattered around a 50-foot (15.3-m) trench contained no noteworthy values.

A sample (307) of galena-bearing rock was from a small stockpile of a 50-foot (15.3-m) shaft sunk on a vein near the southwest corner of the Michigan patented claim. The site is nearly one-half mile (about 800 m) northeast of sample site 306 and outside the study area. The sample contained only 0.61 percent lead.

Samples 308-311

Four samples were taken from a 580-foot (177 m) adit, thought to be the old Silver King tunnel, at the bottom of Tortolita Canyon just northwest of sample site 307. The adit trends S.55°E. on a silicified fracture zone; a 3-foot (91-cm) wide quartz vein is exposed at the face. A 26-foot (7.9 m) crosscut was driven S.65°W. at a point 190 feet (58.0 m) from the portal. Sample 310, taken across 3 feet (91 cm) of dike or vein matter 60 feet (18.3 m) from the portal, assayed 0.4 ounce silver per ton (14 g/t) and 0.57 percent lead. At the same location, sample 311 from a 10-inch (25 cm) siderite-quartz vein assayed 0.30 ounce silver per ton (1.0 g/t) and 0.28 percent copper.

Sample 312

A sample (312) was chipped from broken rock at a 20-foot (6.1 m) shaft, possibly the Silver King No. 1, and assayed 0.30 ounce silver per ton (10 g/t), 0.46 percent lead, and 0.34 percent zinc, for a total metal value of \$6.20 per ton (\$6.82/t). The working is outside the study area.

Sample 313

A selected sample (313) was chipped from boulder-size fragments 1-foot (31 cm) in diameter of azurite- and malachite-bearing siderite and andesite. The sample came from a pile of broken rock around a shallow, detritus-filled prospect pit on the crest of a ridge about one-half mile (about 800 m) east of the study area. The sample yielded a copper content of 2.27 percent and a silver content of 1.0 ounce per ton (34 g/t) for a combined value of \$42.32 per ton (\$46.55/t).

Samples 314 and 315

The samples came from a caved shaft high on the east side of Tortolita Canyon over one-half mile (805 m) east of the wilderness boundary. The shaft is about 100 feet (30.5 m) deep and filled with water to within 30 feet (9.2 m) of the collar. A selected sample (314) of copper minerals from the wall rock, representing a width of 4 feet (1.2 m), assayed 0.30 ounce silver per ton (10 g/t) and 2.85 percent copper, about \$47.00 per ton (\$51.70/t). A grab sample (315) of the dump that may have been a high grade specimen assayed 3.04 percent copper, or \$50.44 per ton (\$55.48/t).

Samples 316 and 317

The samples were taken from two shallow shafts at the bottom of Tortolita Canyon nearly one-half mile (about 800 m) north of sample site 314-315. The south shaft, now partially debris filled, was originally about 15 feet (4.6 m) deep. It was sunk on a 6-foot (1.8 m) wide zone of uncemented, highly brecciated, porphyritic andesite in which are interlaced siderite stringers containing disseminated copper minerals. The zone strikes N.35°E. A chip sample (316) across the zone assayed 0.30 ounce silver per ton and 0.21 percent copper (\$5.16 per ton; \$5.67/t). The north shaft is about 35 feet (10.7 m) deep and is about 1,000 feet (about 300 m) from the south shaft. The north shaft was sunk on a shear zone. A grab sample (317) from the weathered dump showed no important metal concentrations.

Sample 318

The sample came from a small stockpile at the Copper King No. 1 shaft which is about 1 mile (1.6 km) east of the wilderness boundary. The shaft, 20 feet (6.1 m) deep and filled with water was sunk on a 2-foot (61-cm) wide lamprophyre dike striking N.70°W. The sample assayed 0.60 ounce silver per ton (21 g/t) and 4.0 percent copper, a combined value of \$67.60 per ton (\$74.36/t).

The area of the Copper King claim is noted locally for its nuggets of native copper.

Sample 319

Sample 319 was from the dump of a 30-foot (9.2 m) shaft located east of sample site 318, probably on the Baby or Desire Claims. The shaft was put down on a siderite-lamprophyre zone striking N.30°E. The sample assayed 0.13 percent copper.

Samples 320-324

Five samples were from volcanic rock in four pits put down in a small siliceous zone in the juniper- and pinon-timbered foothills of Church Mountain on the west side of Tortilita Canyon. All samples were taken from broken rock around the pits. Silver values were significant in four of five samples taken at the pits and values for it and gold are shown in the following table.

Sample No.	Type	Gold		Silver	
		(ounce per ton)	(g/t)	(ounce per ton)	(g/t)
320	Dump, selected	0.01	0.3	0.62	21
321	Random chip	.02	0.7	2.00	69
322	Dump, selected	.01	0.3	1.02	35
323	Dump, quartz	.005	0.2	.26	9
324	Dump, selected	.02	0.7	.60	21

Overall values for the samples ranged from \$5.22 to \$15.00 per ton (\$5.74 to \$16.50/t).

Samples 765 and 766

Two samples (765 and 766) of alluvium were taken near the study area boundary in the vicinity of Dry Gulch, a drainage known to contain minor amounts of placer gold. The panned concentrates taken from separate Dry Gulch tributaries contained no significant values.

Samples 767 and 768

The samples were taken from an adit east of the study area. The adit was driven southwest on a shear zone that strikes N.40°E. and dips from vertical to 85°NW. A water-filled winze of undetermined depth makes the working inaccessible beyond 40 feet (12.2 m) from the portal. The samples were taken at the portal: 767 was collected from three quartz veins across widths of 4 inches (10 cm), 2 inches (5 cm), and 2 inches (5 cm); 768 was chipped across a 5-foot (1.5 m)-wide shear zone that includes the veins. Both samples assayed a trace of gold and 0.2 ounce silver per ton (7 g/t).

Samples 769 and 770

The samples were from a working southwest of sample sites 767-768 and just east of the study area. The working, estimated to be at least 300 feet (91.5 m) long, was driven S.8°W. for the first 35 feet (10.7 m) on a shear zone in weathered andesite and the remaining distance S.60°W. on a gouge zone dipping 64° NW. The drift is caved 110 feet (33.6 m) from the portal. Sample 769 was chipped across 6 inches (15 cm) of gouge in the hanging wall at the caved zone and assayed 0.1 ounce silver per ton (3.4 g/t). Sample 770 was chipped across the gouge zone about 35 feet (10.7 m) from the portal, assayed a trace of gold and 0.1 ounce silver per ton (3.4 g/t).

Sample 771

Sample 771 was taken from an 8- by 6- by 4-foot (2.4- by 1.8- by 1.2-m) pit sunk on a 1.5-foot (46-cm) shear zone. The sample was chipped across the zone and assayed nil values for gold and silver.

Windy and Pine Canyons Area (samples 325-367)

Forty-three samples were taken at 11 sites in the Windy-Pine Canyon vicinity (fig. 10). Of these, only four sites are in the wilderness;

Figure 10.--Near here.

none of the samples showed assay values of any consequence.

Prospects along the northern boundary of the wilderness are located on a dike system radiating northerly from the Church Mountain volcanic pile. Many of the dikes are lamprophyres; some are andesite and are commonly porphyritic. A large altered area in secs. 33 and 34, T. 8 S., R. 11 E. may be significant; copper showings occur on its northern edge and may indicate a mineral potential. The area has not been thoroughly prospected, probably because it lacks outcrops of quartz. The alteration is clearly apparent on colored aerial photographs taken of the area in 1969 (Lincoln National Forest film series EU0, exposure 13-79, available from the Ogden, Utah, office). It was not determined whether the alteration was hydrothermal or supergene.

Sample 325

Sample 325 was a grab sample from the dump of a shallow pit put down on altered volcanic rock. The pit was the only working found, although the area, sec. 1, T. 9 S., R. 11 E., is one of numerous claims. The sample contained no gold or silver values.

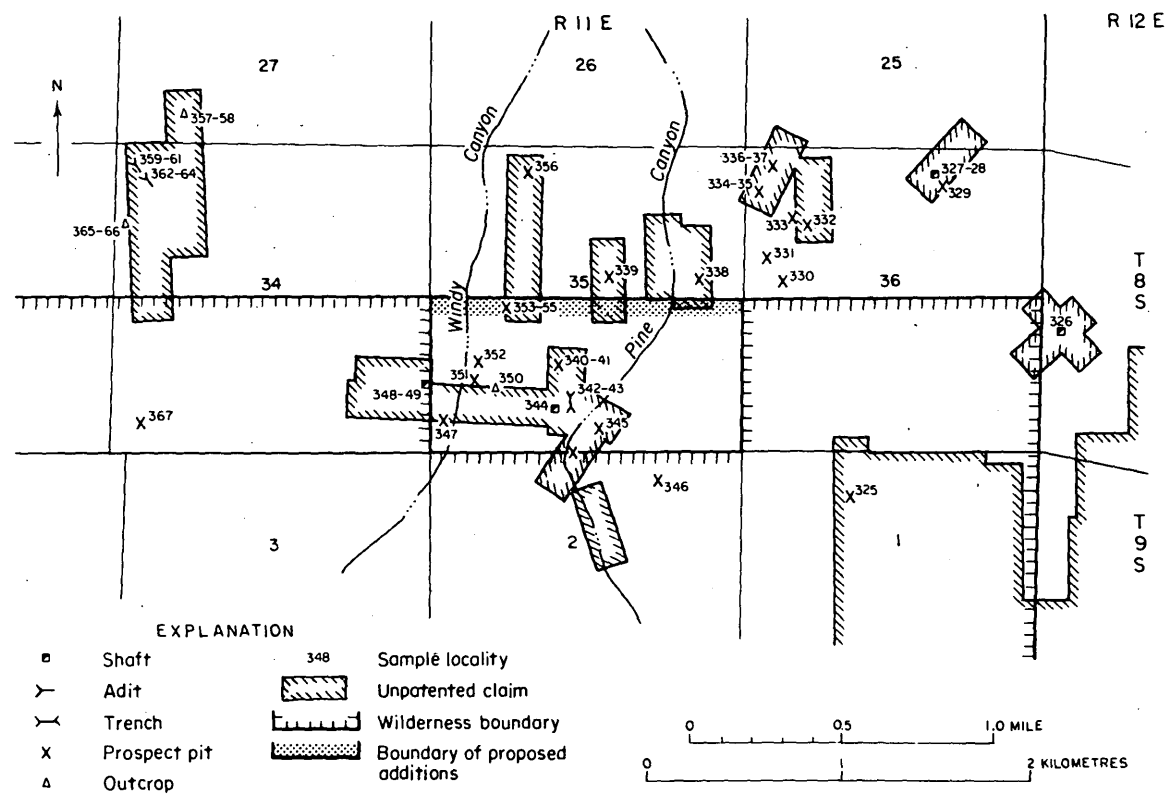


FIGURE 10.— Map of Windy and Pine Canyons area.

Sample 326

Sample 326 was a grab sample from the dump of a caved shaft just east of the wilderness boundary. The shaft, excavated in an isolated altered zone in andesite breccia, is estimated to have been 20 feet (6.1 m) deep before it caved. The sample was barren.

Samples 327-329

Two samples were collected from the vicinity of a shaft situated in the grass-covered foothills north of the wilderness in NE 1/4 sec. 36, T. 8 S., R. 11 E. The shaft is filled with caved debris to within about 20 feet (6.1 m) of the surface, but judged from the size of the dump, which is badly eroded, it may have been as much as 100 feet (30.5 m) deep. The shaft was sunk on an aplite(?) dike, which is one of three parallel dikes that trend N.20°W. in a zone 75 feet (22.9 m) wide.

Sample 327 was a grab sample of quartz showing minor copper stain from a stockpile at a shaft. The sample showed extremely low metal values.

Sample 328, a grab sample from the dump assayed 0.01 ounce gold per ton (0.3 g/t) and 0.98 ounce silver per ton (34 g/t), about \$7.38 per ton (\$8.12/t). Sample 329, a 1.2 foot (37 cm) chip sample taken at a prospect pit 50 feet (15.3 m) southeast of the shaft shows negligible metal values.

Samples 330-337

Eight samples were taken from six prospect pits in NW 1/4 sec. 36. Some pits were sunk in the more intensely iron-stained parts of fracture zones in altered igneous rock; others were sunk on siderite and quartz veins. Of eight samples taken at these pits, however, only two (334 and 335) contained significant metal values. These were grab samples from a siderite stockpile at a 10-foot (3.1 m) deep pit; they assayed 0.13 percent and 0.50 percent copper--\$8.00 per ton (\$8.80/t).

Samples 338-339

Sample 338 was from a prospect pit located in E 1/2 sec. 35 in the Pine Canyon drainage. The pit was sunk in an area of altered andesite agglomerate 20 feet (6.1 m) in diameter. A notice, dated 1910, was found for the Santo Nino claim. The sample, a fragment of broken rock, assayed 0.70 ounce silver per ton. Sample 339, a grab sample, was taken from the dump of a pit in a manganese-stained zone in an altered area; in a west fork of Pine Canyon; the only metal value detected was 0.16 percent zinc.

Samples 340-343

Sample 340 was taken across a 4-foot (1.2 m) wide iron-bearing vein near the top of a ridge in Pine Canyon in the south-central part of sec. 35. The vein, which strikes N.59°E. is exposed in a prospect pit. The sample contained 43 percent iron. Sample 341 was of gossan on the dump and assayed 1.30 ounces silver per ton (45 g/t), 39 percent iron, 1,400 ppm molybdenum, 0.65 percent lead, and 0.54 percent zinc, about \$24.24 per ton (\$26.66/t) in estimated gross metal value. Sample 342 was from a boulder-size fragment of magnetite on the dump of a 20-foot (6.1 m) trench southeast of the pit. The sample yielded 43 percent iron; a grab sample (343) from the dump contained only 7 percent iron. No outcrop of iron-bearing minerals was seen at the trench, however, the occurrence is about one-fourth mile (about 400 m) north of the wilderness.

Samples 344-346

Sample 344 was taken from the dump of a caved shaft near the center of S 1/2 sec. 35. The shaft is estimated to have been 30 feet (9.2 m) deep. Sample 345 was taken from the dump of a prospect pit sunk a short distance from the main bend of Pine Canyon. The sample, which was of iron-stained material, contained a trace of silver. Sample 346 was taken from the dump of a prospect pit sunk at the head of a branch of Pine Canyon in NE 1/4 sec. 2, T. 9 S., R. 11 E. and just inside the wilderness. The working is near the contact of the Church Mountain latite and an altered zone. Analysis of a sample (346) showed no significant metal values.

Samples 347-356

Ten samples were taken from a shaft, an outcrop, and five prospect pits in the Windy Canyon drainage. The principal prospect in the area is a shallow shaft in SE 1/4 sec. 34, T. 8 S., R. 11 E. The partly timbered shaft was originally about 20 feet (6.1 m) deep, but is now filled with debris to within 10 feet (3.1 m) of the collar. The workings are on shear zones, quartz, veins, gossan, and siderite veins, as much as 6 feet (1.8 m) wide, in altered volcanic rocks. Porphyritic andesite dikes cut through the area. The only noteworthy value (0.59 percent lead) was contained in sample 355, a grab sample from a dump at a small pit.

Samples 357-364

Two samples were from copper-bearing outcrops on leased state grazing land very near the wilderness boundary in SW 1/4 sec. 27 and NW 1/4 sec. 34, T. 8 S., R. 11 E. These showings are in the foothills southwest of the Cleo Duggar ranch. A zone of copper-stained andesite 7 inches (18 cm) wide and an altered area 5 feet (1.5 m) in diameter, 10 feet (3.1 m) to the west are exposed in the northernmost outcrops examined. Sample 357 taken from across the zone assayed 0.32 ounce silver per ton (11 g/t) and 1.0 percent copper, about \$17.92 per ton (\$19.71/t). A float sample (358) from the altered area assayed 0.62 ounce silver per ton (21 g/t) and 1.4 percent copper, about \$26.12 per ton (\$28.73/t).

Three samples were taken from two short adits about one-fourth mile (about 400 m) southwest of the copper showings. The lower working consists of a 20-foot (6.1 m) cut connected to a 54-foot (16.5 m) adit bearing S.20°E. along a brecciated fracture zone associated with a lamprophyre dike. No metal concentrations were detected in analysis of three samples (359-361) taken at the site. The upper working consists of a 29-foot (16.5 m) cut connected to a 17-foot (5.2 m) adit from the end of which branch three short drifts 8 to 10 feet (2.4 to 3.1 m) long. The backs of the branch drifts near the juncture of the main drift. Only minor silver, 0.46 and 0.32 ounce per ton (16 g/t and 11 g/t) was detected in samples 363 and 364.

Samples 365 and 366

The samples came from a copper-stained outcrop at the base of the foothills southwest of the adits just described. A sample (365) from a 10-inch (25 cm) copper-stained-quartz zone in 5-foot (1.5 m) lens of weathered andesite agglomerate assayed 0.34 ounce silver per ton (12 g/t) and 0.36 percent copper, about \$7.80 per ton (\$8.58/t). Six feet (1.8 m) south, a 6-foot (1.8 m) chip sample (366) taken across a parallel copper-stained structure assayed 0.14 percent copper.

Sample 367

A grab sample was from the dump of a prospect pit in the wilderness near the top of the ridge in the southwest corner of sec. 34. Analysis failed to reveal any significant metal values.

Hopkins Canyon area (samples 368-485)

A total of 118 samples was collected and assayed from 65 prospects, workings, and outcrops in Hopkins Canyon and vicinity in secs. 4, 5, 8, 9, and 17, T. 9 S., R. 11 E. (fig. 11). Nearly half of these samples

Figure 11.--Near here.

assayed values of more than \$5.00 per ton (\$5.50/t), gross metal value. These workings are in an area where intense mining activity took place in the past but resulted in small production. The areas of Schelerville Camp and the Commerical-Golden Pick-Ace mines were explored as early as 1880. Ten claims were patented in the area; those portions within the present wilderness were purchased by the Federal Government in 1968.

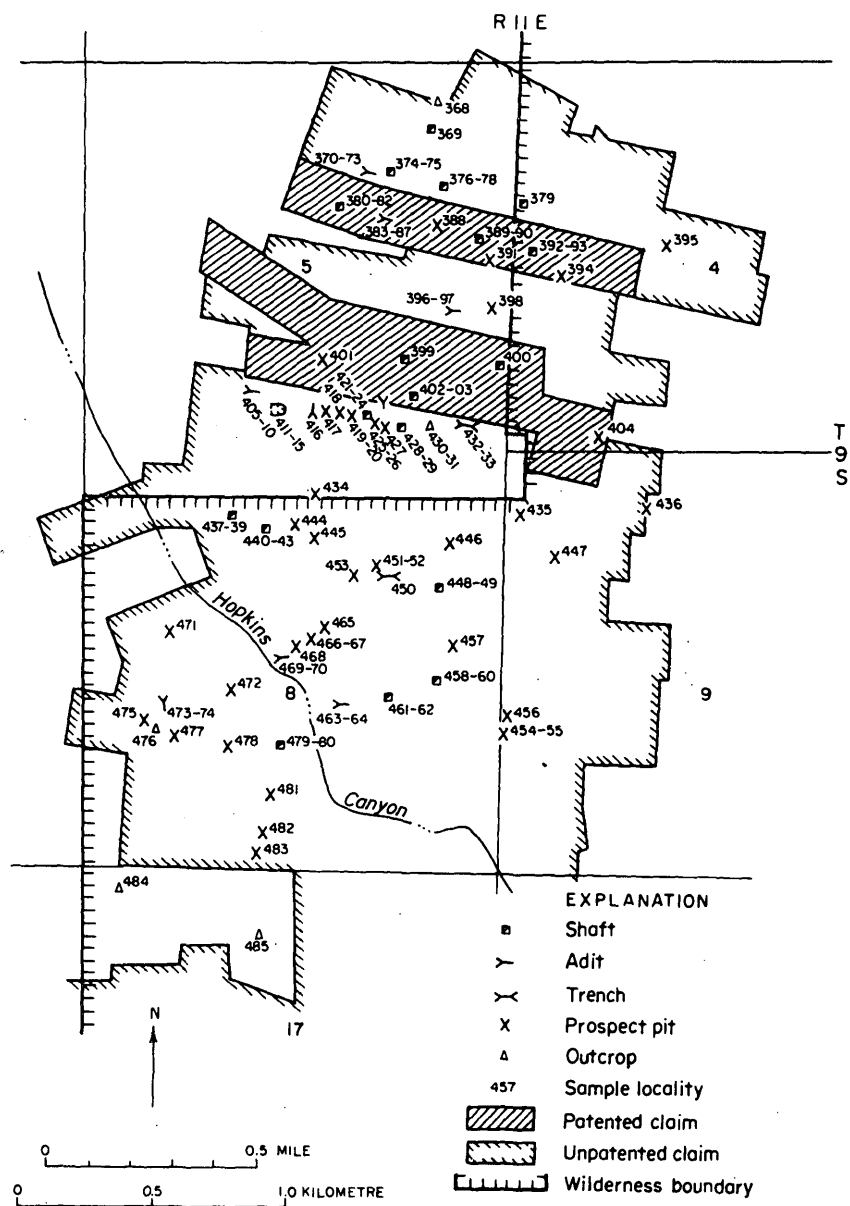


FIGURE 11.—Map of Hopkins Canyon area and vicinity.

Patents were issued for the Red Jim, Delaware, Trust, Cinnamon, Union Jack, Bornite, and Privateer claims (south group shown on fig. 11) in 1887. Patents were issued for the Homestake-Grub Stake-Butcher Boy group (north group) in 1906. A small mining camp, at one time called Schelerville, was established near the Homestake mine. The mines and prospects in sec. 5 are on land of the Cleo Duggar ranch; the mineral rights, however, except on patented claims, rest with the United States Government.

Mineral showings, most of which are copper, occur in an area associated with lamprophyre(?) or porphyritic-andesite dikes. The mineralization occurred in quartz, siderite, barite, or calcite veins, many of which are very long. Other copper minerals are disseminated in andesite or occur as fracture fillings in lens-shaped zones.

Sample 368

The sample came from the extreme NW 1/4 sec. 5, the northernmost mineral occurrence in the area. The showing is about 1,000 feet (about 300 m) west of the wilderness boundary. Malachite is disseminated in weathered andesite. A sample chipped from mineralized rock assayed 1.0 ounce silver per ton (34 g/t) and 3.47 percent copper, about \$61.52 per ton (\$67.67/t).

Sample 369

The sample was collected from a shaft located upslope and 400 feet (122 m) south from the outcrop just described. The shaft was originally about 15 feet (4.6 m) deep prior to caving. It was sunk on an altered zone in andesite 20 inches (51 cm) wide that includes a subzone of disseminated copper about 14 inches (56 cm) wide, and a weathered quartz vein 6 inches (15 cm) wide. A chip sample taken across the mineralized zone yielded only 0.08 percent copper. This working is thought to be on the Junction claim.

Samples 370-379

Ten samples were collected from a vein system located in NE 1/4 sec. 5. The system was explored by four workings that trend nearly east-west. Mining claims in the area include the Sailor Boy, located in 1881, and the Buster Brown (ca. 1907). All of the workings examined are west of the wilderness. Except for the shaft at sample site 379.

Three samples were taken from the westernmost working, an adit driven S.85°E. for 79 feet (24.1 m). Altered-andesite samples 370 and 372 contained only small amounts of gold and silver. Sample 371 from a 1.5-foot (46 cm) shear zone 26 feet (7.9 m) from the face assayed 0.21 percent copper. A 1.1-foot (34 cm) chip sample (373) across a fracture zone in the face of a north-trending 7-foot (2.1 m) stub drift 39 feet (11.9 m) from the portal assayed 0.02 ounce gold per ton (0.7 g/t) and 3.46 ounces silver per ton (119 g/t) or \$22.26 per ton (\$24.49/t) in precious metals.

High copper values were obtained in two chip samples taken from a vein exposed in a 10-foot (3.1 m) shaft just up slope from the adit. Sample 374 was taken in the east wall where the vein is 1.5 feet (46 cm) wide. The sample assayed 0.01 ounce gold per ton (0.34 g/t) and 5.58 ounces silver per ton (191 g/t) and 8.3 percent copper (\$167.78 per ton; \$184.56/t). Sample 375 was taken in the west wall where the vein is 3 feet (91 cm) wide. The sample assayed 0.02 ounce gold per ton (0.7 g/t), 1.56 ounces silver per ton (54 g/t), and 8.1 percent copper, about \$141.96 per ton (\$156.16/t). The vein is probably not mineralized at depth; no significant copper values were encountered in a lower adit. Copper may have been leached from elsewhere and precipitated in the vein to give the high copper values. The same vein was sampled in a 35-foot (10.7 m) shaft located east of sample sites 374-375. There it is 6 feet (1.8 m) wide and was mined in a cut ten feet (3.1 m) deep extending eastward from the shaft for 15 feet (4.6 m). Three continuous samples (376-378) each two feet (61 cm) long were taken from the face of the cut across the width of the vein. Copper assays were 0.43 percent, 0.86 percent, and 3.40 percent, respectively. Silver assays were negligible except for sample 378 from which 1.30 ounces silver per ton (45 g/t) was obtained. Metal values were \$9.88, \$15.26, and \$66.70 per ton (respectively, \$10.87/t, \$16.79/t, and \$73.37/t). This shaft is on the old Centipede claim.

Sample 379 was taken from a shaft sunk on a zone of copper-bearing andesite agglomerate. The shaft, which is 33 feet (11.6 m) deep and inaccessible, is on top of a ridge and several hundred feet east of the working just described. A grab sample (379) of a small ore stockpile assayed 3.36 ounces silver per ton (115 g/t) and 2.4 percent copper, about \$58.56 per ton (\$64.42/t). This working is just within the wilderness near its western boundary.

Samples 380-395

Sixteen samples were taken from another vein system located on the Homestake-Grub Stake-Butcher Boy patented claims. Mrs. Cleo Duggar owns the part of the group in sec. 5; the Federal Government bought the part in the wilderness. The Homestake claim was located in 1900; but other claims, including the Moscow, were located as early as 1880. Of this group of sixteen samples, 392-395 were the only ones taken from workings within the wilderness.

Three samples came from the vicinity of a shaft, which is the principal working on the claims. The shaft is at least 100 feet (35 m) deep and it was sunk on a vertical shear zone containing numerous quartz stringers. A selected sample (380), taken from copper-bearing chips of rock around the collar, assayed 0.01 ounce gold per ton (0.3 g/t) and 0.32 ounce silver per ton (11 g/t) and 0.58 percent copper, about \$12.70 per ton (\$13.97/t). A grab sample (381) taken from the dump, which is composed mainly of unaltered igneous intrusive rock resembling diorite (Griswold, 1959), showed no important mineral content. A selected sample (382), taken from a 10-foot (3.1 m) wide zone of altered rock on the north face of the dump, assayed 1.30 ounces silver per ton (45 g/t) and 1.6 percent copper, about \$33.40 per ton (\$36.74/t).

Five samples (383-387) were taken at intervals along an adit near the bottom of an arroyo, located upslope from the Homestake shaft. The shaft was driven 74 feet (22.6 m) S.70°E. on a fracture zone containing quartz with sparse copper minerals. Copper values ranged from 0.09 to 0.19 percent except in sample 386 which showed nothing of value. Sample widths ranged from 4 inches (10 cm) to 4.5 feet (1.4 m). A chip sample (388) was taken across a 5-inch (13 cm) quartz vein exposed in a pit on the slope above the adit. Galena was identified in the vein. The sample assayed 0.42 percent copper and 4.1 percent lead, about \$20.56 per ton (\$22.62/t).

Three samples were taken from the vicinity of the Grub Stake shaft. The shaft is about 20 feet (6.1 m) deep and was sunk on a 6-inch (15 cm) altered zone in andesite agglomerate and porphyritic andesite containing copper. Sample 389 taken across the altered material contained 1.12 ounces silver per ton (38 g/t) and 1.9 percent copper, about \$37.12 per ton (\$40.83/t). A grab sample (390) from a stockpile contained 0.72 ounce silver per ton (24.7 g/t) and 0.40 percent copper, about \$10.72 per ton (\$11.79/t). The third sample (391) was from a 2-inch (5 cm) quartz veinlet exposed in a prospect pit southeast of the shaft. Metal values in the sample were extremely low.

Two grab samples were taken from small piles of mixed quartz and siderite vein matter of the Butcher Boy shaft. The shaft, which is 38 feet (11.6 m) deep and inaccessible, is located in the wilderness in sec. 4. One sample (392) assayed 0.16 percent copper, 0.27 percent lead, and 0.53 percent zinc, about \$6.27 per ton (\$6.90/t). The other sample (393) showed 1.34 ounces silver per ton (46 g/t) and 0.58 percent copper, about \$17.32 per ton (\$19.05/t).

Sample 394 was taken from a 1-foot (31 cm) wide siderite vein in a prospect pit east of the Butcher Boy; assay values were negligible. Siderite also crops out in a 2-foot (61 cm) vein at a pit across the arroyo about 1,500 feet (458 m) east of the Butcher Boy shaft. A sample (395) taken across the zone contained no important mineral values.

Samples 396-398

Three samples were taken from an area west of the wilderness and between the two groups of patented claims. Two workings are located there. The west working is a 25-foot (7.6 m) cut connected to a 55-foot (16.8 m) adit bearing S.80°E. The working is probably the old Columbia mine. It was driven on a vein or altered dike in andesite breccia. A sample (396) taken across the 3.5-foot (1.1 m) back of the drift 22 feet (6.7 m) from the portal assayed 0.11 percent copper. A combined sample (397) taken at the brow of the portal included 4 inches (10 cm) of gouge sampled on the hanging wall side and a 4-inch (10 cm) quartz vein on the footwall side. It assayed 1.1 percent lead. The east working, also on the vein, is a shallow shaft or pit that had once been about 10 feet (3.1 m) deep. A sample (398) of sugary-textured quartz on the dump did not contain significant metal values.

Samples 399 and 400

The samples were taken from the vicinity of workings south of those just described. The workings were put down on a vein system thought to be covered by the Trust, Red Jim, and Delaware lode claims. Sample 339 was of weathered rock in the dump of a 26-foot (7.9 m) shaft which may have a drift extending from the bottom. The samples yielded low gold and silver values. Unstable ground around the collar of the shaft prohibited sampling of the vein.

A grab sample (400) was taken from the dump of a caved shaft on a ridge just outside the wilderness. The shaft apparently was sunk on a 3-foot (91 cm) siderite vein. Assay values were negligible.

Samples 401-404

Samples 401-404 came from the vicinity of three excavations on a vein covered by patented claims south of the Trust, Red Jim, and Delaware claims. Sample 401 was from the dump of a shallow prospect along the road to the Commercial mine. Analysis of the sample showed no important metal concentrations.

A chip sample (402) taken across a 1-foot (31-cm) vein near the Union Jack(?) shaft assayed 0.10 percent copper. The shaft was sunk about 20 feet (6.1 m) on a narrow quartz vein in porphyritic andesite; unstable ground at the collar prevented sampling in the shaft. A sample (403) of altered rock from the dump yielded 0.01 ounce gold per ton (0.3 g/t) and 0.66 ounce silver per ton (23 g/t), about \$5.46 per ton (\$6.01/t).

A chip sample (404) was taken across a 6-inch (15-cm) quartz vein containing breccia fragments. The vein is exposed in a pit located on the steep hillslope east of the ridge across which the Bornite claim lies. The sample assayed 0.70 ounce silver per ton (24 g/t).

Samples 405-433

Twenty nine samples were taken from a group of prospects and mine workings, called the Commercial mine, in the area of unpatented claims in S 1/2 sec. 5, T. 9 S., R. 11 E. One of the first claims to be located there was the Minnie Lea in 1880, but it was not patented. Later locations include the Bull Dyker in 1900, the Hand-S group (Commercial mine) in 1905, and the Betty and Stella claims in 1921. At the time of this investigation, the Betty and Stella, and other contiguous claims (Hat, Cap, Silver-Copper), were owned by C. E. Degner and Bryce Duggar. All of the workings examined are outside the wilderness.

W. G. Sandell made a private examination of the Commercial mine in 1969; he stated that the silver-copper vein ranged from 20 feet (6.1 m) wide at the west end of the area to 3 feet (91 cm) wide on the Hat claim at the east end. The strike length is nearly 4,000 feet (1,200 m). In those places Griswold reported the vein to be wide; it appears to consist of zones of intensely altered, fractured, or sheared rock containing lesser veins of silica or carbonate as much as 5 feet (1.5 m) wide. Sandell concluded that there was a good potential for enrichment near the water table and for a good sulfide zone below the water table. One of his recommendations was the possibility of an in-situ leaching operation using an acidified sodium nitrite solution. The solution would be percolated through the vein and collected near the water table.

The samples were taken from 11 workings studied along the vein. Sites examined include the west adit which was driven 103 feet (31.4 m) S.75°E; a pit 30 feet (9.2 m) in diameter; an adit 10 feet (3.1 m) long located east of the pit and nearly filled with debris; five small prospect pits; the caved Betty shaft(?); and the Stella shaft 105 feet (32.0 m) deep, which was inaccessible because of rotted timber.

Samples were taken across shear, fracture, and altered zones, and across veins and fault gouge. Sample results are listed below; dollar values per ton range from \$5.20 to \$143.48 (\$5.72 to \$157.83/t).

Sample No.	Type	Gold		Silver		Copper ² (percent)	Lead ³	Value	
		(ounce per ton)	(g/t)	(ounce per ton)	(g/t)			(\$/ton)	(\$/t)
405	2.2-foot chip	0.01	0.3			0.93		16.38	18.02
406	4.3-foot chip	.01	0.3			.34		6.94	7.63
407	5.3-foot chip	.01	0.3			.22		5.02	5.52
408	1.7-foot chip	.01	0.3	1.60	55	1.80		39.90	43.89
409	5.2-foot chip	.01	0.3			.15			
410	1.0-foot chip	.01	0.3	1.12	38	1.50		32.22	35.44
⁴ 411	1.7-foot chip	.01	0.3			.51		9.66	10.63
⁴ 412	6.0-foot chip	.01	0.3			.23		5.18	5.70
⁴ 413	-----do-----	.01	0.3						
⁴ 414	-----do-----								
⁵ 415	Selected	.02	0.7	.52	18	2.00	0.64	43.67	48.04
416	4.3-foot chip	.01	0.3						
417	5-inch chip	.01	0.3			.19			
418	8-inch chip	.04	1.4	12.20	418	3.80	.79	143.48	157.83
419	-----do-----	.01	0.3			1.00	.69	20.54	22.59
420	Dump, grab	.01	0.3	.40	14	.35	.62	12.23	13.45
421	-----do-----	.01	0.3						
⁶ 422	3.8-foot chip	.01	0.3			.53		9.98	10.78
423	1.1-foot chip	.01	0.3						
⁷ 424	5.0-foot chip								
⁷ 425	4.5-foot chip	.01	0.3						
426	Dump, grab	.01	0.3	.54	19	.37	.80	14.18	15.60
427	6.0-foot chip	.01	0.3			.13	1.80	11.50	12.65
428	Dump, grab	.01	0.3	1.00	34	.29		12.14	13.35
429	Stockpile	.02	0.7	2.06	71	.43	2.20	31.92	35.11
⁸ 430	3.0-foot chip	.01	0.3						
431	2.2-foot chip	.01	0.3	1.10	38	.21	2.00	22.15	24.36
432	8-inch chip	.01	0.3						
433	Dump, grab	.01	0.3				.51		

¹Shown only if more than 0.3 ounce per ton (10 g/t).

²Shown only if more than 0.10 percent.

³Shown only if more than 0.40 percent.

⁴Segments of the same pit face.

⁵Also 0.39 percent zinc.

⁶Also 0.38 percent zinc.

⁷Samples 424 and 425 are from segments of the same pit face.

⁸Segments of outcrop in arroyo.

Samples 434-436

The samples were taken from two prospect pits on the ridge south of the Commercial mine and another on the ridge point near the canyon bottom in sec. 9. The eastern pit was sunk on a slightly silicified altered area containing a zone of brecciated rock cemented by quartz. Assay results of a selected sample (436) of dump rock showed 0.33 percent lead. Chip samples (434 and 435) from the other two pits contained insignificant values.

Samples 437-443

The samples were from a working in the wilderness in N 1/2 sec. 8, T. 9 S., R. 11 E. The working has been occasionally referred to as the Junction mine. Descriptions of mining claims located in the area are vague; none of the old claims plot there, except for the Sylvanite and Telluride claims that were located in 1910. Griswold (1959, p. 75) believed that the two shafts might be the Silver Pick and Golden Pick located in 1934. The headframes have collapsed; no evidence exists of recent mining activity except for shallow pits east of the shafts.

The west shaft is steeply inclined and is at least 100 feet (30.5 m) deep. Unstable ground did not permit sampling in the shaft. Sample 437 was collected from a 4-inch vein of silicified rock at the collar. Assay results were insignificant as were those for a dump sample (438). A selected sample (439) of copper-stained rock on the dump, however, assayed 0.47 percent copper, about \$7.52 per ton (\$8.27/t). The east shaft is also steeply inclined and about 100 feet (30.5 m) deep. It was sunk on a fracture zone containing rock weakly mineralized with copper. Four samples (440-443) of dump material and rock from the fracture zone showed no metal concentrations of consequence. The highest values were in sample 442 which contained 0.015 ounce gold per ton (5 g/t) and 0.04 ounce silver per ton (1.4 g/t), and 0.04 percent copper.

Samples 444 and 445

The samples were from two pits on the hillside just east of the shafts at sample sites 440-443. The pits are believed to be on the Magma No. 1 and 2 claim group, which is adjoined by the Cap and Silver-Copper claims to the north. The Magma No. 1 and 2 were located by C. E. Degner in 1970. The west pit was sunk on a barium-rich siderite vein 7 inches (18 cm) wide striking N.60°W. A sample (444) from across the vein assayed 0.96 ounce silver per ton (33 g/t) and 0.21 percent copper, about \$9.12 per ton (\$10.03/t). A sample (445) of rock from the dump of the east pit had insignificant assay results. The width of the vein could not be accurately measured, but it was probably about 1 foot (31 cm).

Sample 446

At this site, fragments of barite (sample 446) were selected from the dump of a small prospect. Assay values were negligible.

Sample 447

Sample 447 was a 1.3-foot (40-cm) chip sample taken across siderite-bearing material exposed in a prospect pit. The sample was nearly barren in metal values.

Samples 448-453

Two samples were collected from the dump of a 30-foot (9.2 m) shaft about 1,000 feet (about 300 m) inside the wilderness in NE 1/4 sec. 8. The shaft is one of a group of workings, thought to be on the old Thanksgiving claim. It was sunk on a 2-foot (61 cm) wide manganese-stained limonite vein striking N.75°W. The two samples (448 and 449) showed low metal values.

A selected samples was from the stockpile of a caved working located on the nose of a ridge west of the workings just described. The vein, the same as the one at sample sites 448-449, has been exposed in a caved working that may originally have been a 30- to 40-foot (9.2- to 12.2-m) trench or adit and a prospect pit. A maximum width of the vein is about 1 foot (31 cm) where it was observed in the caved working. A selected sample (450) from a stockpile assayed 2.28 ounces silver per ton (78 g/t) and 1.7 percent copper, about \$40.88 per ton (\$44.97/t). Copper-stained porphyritic andesite fragments as much as 1 foot (31 cm) in diameter were noted on the dump; a sample (451) chipped from them assayed 1.4 percent copper (\$22.40 per ton; \$24.64/t) Another sample, 452, taken across a 3.7-foot (1.1-m) altered dike exposed in the east face of the working assayed 0.1 percent copper. Insignificant metal values were contained in a 2.8-foot (85 cm) chip sample (453) across altered material in the pit.

Samples 454-485

Thirty samples (454-483) were taken from 23 prospects and mine workings that are now referred to as the Idaho group. All the workings are in the wilderness, either in sec. 8 or just east of it. Two additional samples, 484 and 485, are from outcrops in sec. 17. Access to the workings is by four-wheel-drive road up Hopkins Canyon to the wilderness boundary. Location descriptions indicate numerous claims are in the Hopkins Canyon area. One of them, the Columbus, was located in 1903; others may have been located much earlier. Some of the workings may have comprised the old Ace mine that was located in 1925 by John M. Cravens until about 1940. The principal claim was the Idaho located in 1941; contiguous claims, the Calumet-Idaho group, were added in 1959, by C. E. Degner, claimant. The group consists of the Idaho Lode, Idaho Lode No. 1, and the Calumet-Idaho Nos. 1-4 claims.

Samples 454-456

Two chip samples (454 and 455) were taken in two pits just east of sec. 8; an additional sample (456) was taken from an adjoining dump. All the samples were of iron-stained material which assayed results were negligible.

Sample 457

Sample (457) was a grab sample from the dump of a pit sunk in a broad area of altered rock. No significant values were contained in the sample.

Samples 458-460

Samples 458-460 were from stockpiles in the vicinity of Idaho Shaft No. 2, a 133-foot (40.6-m) deep working. Two 1-ton (0.9 t) stockpiles of copper-stained, iron-manganese gossan are on the dump and another stockpile is 125 feet (38.1 m) northwest. The samples were obtained from these stockpiles. Sample 458 assayed 0.02 ounce gold per ton (0.7 g/t), 4.32 ounces silver per ton (148 g/t), and 3.8 percent copper, about \$89.70 per ton (\$98.67/t); sample 459 contained 0.03 ounce gold per ton (1.0 g/t), 5.12 ounces silver per ton (176 g/t), and 2.9 percent copper, about \$81.62 per ton (\$89.78/t); and sample 460 yielded 2.42 ounces silver per ton (83 g/t) and 1.2 percent copper, about \$33.72 per ton (\$37.09/t). Because of unstable ground at the collar of the shaft, the width of the vein could not be estimated.

Samples 461 and 462

Two samples were taken from Idaho shaft No. 1, which is about 300 feet (about 90 m) southwest of shaft No. 2. Shaft No. 1 was reported to be sunk 80 feet (24.4 m) on a shear zone of calcite, siderite, and barite at least 50 feet (15.3 m) wide and which contains a 1-foot (31-cm) quartz-siderite vein. A chip sample (461) taken across the vein contained extremely low gold and silver values. Minor copper stain was noted on material in the dump. A selected sample (462), however, assayed 0.01 ounce gold (0.3 g/t) and 0.54 ounce silver per ton (19 g/t) and only 0.17 percent copper, about \$7.46 per ton (\$8.21/t).

Samples 463 and 464

Two samples were taken from an adit 120 feet (36.6 m) long driven in an unsuccessful effort to intersect a vein on the ridge west and below the twin Idaho shafts. Sample results were of no consequence.

Samples 465-470

These samples were collected from three pits and an adit that explored a vein striking N.60°E. on the hillside west of the Idaho shafts. At the upper pit, which is caved, copper minerals are disseminated in very coarse-grained andesite over an indicated width of 15 feet (4.6 m). Sample 465 was taken from a stockpile of this rock and assayed 0.50 ounce silver per ton (17 g/t) and 0.68 percent copper, about \$13.88 per ton (\$15.27/t). Sample 466 was collected from a pit 200 feet (61.0 m) farther down the canyon slope. The sample was chipped across a 6-inch (15 cm) zone of copper-stained andesite and assayed 1.90 ounces silver per ton (65 g/t) and 0.81 percent copper, about \$24.36 per ton (\$26.80/t). Sample 467, taken from an 8-inch (20 cm) siderite vein parallel to the 6-inch (15 cm) zone, showed 0.70 percent copper, about \$11.70 per ton (\$12.87/t). A third prospect is 50 feet (15.3 m) below the second described pit. A 1-ton (0.9 t) stockpile of copper-stained andesite was sampled (468); it contained 0.60 ounce silver per ton (21 g/t) and 2.2 percent copper, about \$38.80 per ton (\$42.68/t).

Sample 469 was taken from a working in the canyon bottom. The working is an adit that was driven 113 feet (34.5 m) in an arc varying from N.40°E. at the portal to N.70°E. at the face. The sample is a 4-foot (1.2-m) chip sample taken across the face; it contained nothing of value. Sample 470 was chipped from copper-bearing boulder-size fragments 2 feet (61 cm) in diameter piled on the left wall of a 28-foot (8.5 m) cut at the portal. The sample assayed 2.30 ounces silver per ton (79 g/t) and 5.8 percent copper, about \$106.60 per ton (\$117.26/t). The adit apparently had been started on an exposed zone of disseminated copper minerals in andesite, but the zone pinches out just inside the portal. Because of the lenticular character of the zone and the non-continuous character of the mineral deposits exposed in the pits upslope, the overall configuration may be that of a series of mineralized lenses strung out bead-like along a favorable zone in the andesite.

Samples 471 and 472

The samples are from a prospect pit at the mouth of Hopkins Canyon and another on the ridge west of the Idaho workings; the assays showed insignificant metal values.

Samples 473-477

These samples were taken from an adit, three pits, and a shaft in the drainage south of Hopkins Canyon. Most of the workings probably were excavated between 1937 and 1939 when Dr. Caroline McCune located a group of claims in the vicinity. An adit 110 feet (33.6 m) long was driven S.30°E. in an apparent effort to undercut outcrops on an overlooking ridge. A 4-foot (1.2 m) chip sample (473) and a grab sample (474) from the dump contained extremely low gold and silver values. A sample (475), chipped from a 5-inch (13-cm) siderite vein in a prospect pit(?) on the ridge slope west of the adit, assayed 0.72 ounce silver per ton (25 g/t). A random chip sample (476) of a copper-bearing lens in andesite in a second pit up the ridge slope from the first described, assayed 1.54 ounces silver per ton (53 g/t) and 1.0 percent copper, about \$25.24 per ton (\$27.76/t). Another sample was taken across a 2-foot (61-cm) width of a dike at least 6 feet (1.8 m) wide in a third pit about 50 feet (15.3 m) farther upslope. from the second pit. The sample assayed 0.46 ounce silver per ton (16 g/t) and 0.86 percent copper, about \$16.52 per ton (\$18.17/t).

Samples 478-480

The samples were collected from the north slope of the same ridge about 400 feet (122 m) farther east of the workings just described. There a shallow pit exposes copper minerals in a vein trending N.70°E. A grab sample (478) of broken vein rock assayed 3.98 ounces silver per ton (137 g/t) and 2.4 percent copper, about \$62.28 per ton (\$68.51/t). Although the width of the vein could not be measured, copper-bearing boulder-size fragments on the dump indicate a wide vein may exist. The samples (479 and 480) were taken from the dump of a shaft 25 feet (7.6 m) deep sunk on the same body. This excavation, which is 300 feet (91.5 m) east of the shallow pit, exposes a 4-foot (1.2 m) copper- and iron-stained zone on the southwest of Hopkins Canyon. One sample (479) is a specimen sample of copper-stained rock from the dump that assayed 1.32 ounces silver per ton (45 g/t) and 1.6 percent copper, about \$33.52 per ton (\$36.87/t). Another sample (480) from the dump assayed 0.48 ounce silver per ton (16 g/t) and 0.19 percent copper, about \$5.92 per ton (\$6.51/t).

Samples 481-485

Sample 481 was of stockpiled material mined from a 4-foot (1.2 m) wide vein exposed in a prospect south of the shaft near which sample 480 was taken. The vein, which is in andesite and strikes N.60°W., is mainly siderite, with minor amounts of quartz, barite, and oxidized copper minerals. An assay of sample 481 showed 1.40 ounces silver per ton (48 g/t), 0.86 percent copper, and less than 1,000 ppm molybdenum about \$29.16 per ton (\$32.08/t).

Two samples, 482 and 483 were taken from two pits on the hillside below sample site 481. The lower pit lies 25 feet (7.6 m) downslope from the upper pit. The pits were excavated in dense, fine-grained andesite near a lamprophyre dike. Copper is disseminated in the andesite. Because of heavy overburden, however, the strike, dip, and width of the mineralized zone could not be determined. A sample (482) of broken material taken at the upper or north pit assayed 1.92 ounces silver per ton (66 g/t) and 5.7 percent copper, about \$102.72 per ton (\$112.99/t). A selected sample (483) from the dump of the lower pit, assayed 0.02 ounce gold per ton (0.7 g/t), 2.24 ounces silver per ton (77 g/t), and 1.2 percent copper, about \$35.64 per ton (\$39.20/t).

A chip sample (484) was taken across a 2-inch (5 cm) quartz stringer which is one of several narrow, copper-stained, siderite-quartz stringers that crop out in the arroyo below the workings just described. The assay showed no significant mineral values.

A sample (485) of quartz float was taken in the Bear Canyon drainage just over the ridge south of Hopkins Canyon; the only noteworthy value obtained was from the spectrographic analysis that showed less than 1,000 ppm molybdenum.

Bear and Water - Sanders Canyons Area

The area of Bear, Water, and Sanders Canyons that was examined and sampled lies in secs. 17, 19, 20, 21, 29, and 30. T. 9 S., R. 11 E., and sec. 25, T. 9 S., R. 10 E. (fig. 12) and includes many workings and

Figure 12.--Near here.

prospects. Access to most of the area is by an unmaintained road up Water Canyon; the workings in upper Bear Canyon can be reached by trail from Nogal Canyon.

A total of 163 samples was taken at dozens of localities in upper and lower Bear Canyon, Water Canyon, and Sanders Canyon. Of these, 145 are from within the wilderness; the remainder are within a half mile (800 m) of the wilderness boundary. Sixty-five samples had assay values greater than \$5.00 per ton (\$5.50/t), gross metal value; five had values greater than \$100 per ton (\$110/t); and one, a selected sample from a small ore stockpile, had a value of more than \$350 per ton (\$385/t).

Bear Canyon (samples 486-549)

Exploration probably first began when Edson E. Baird located several dozen claims in the Bear (Baird?) Canyon drainage beginning in 1880. Various other claims were located in the area since then.

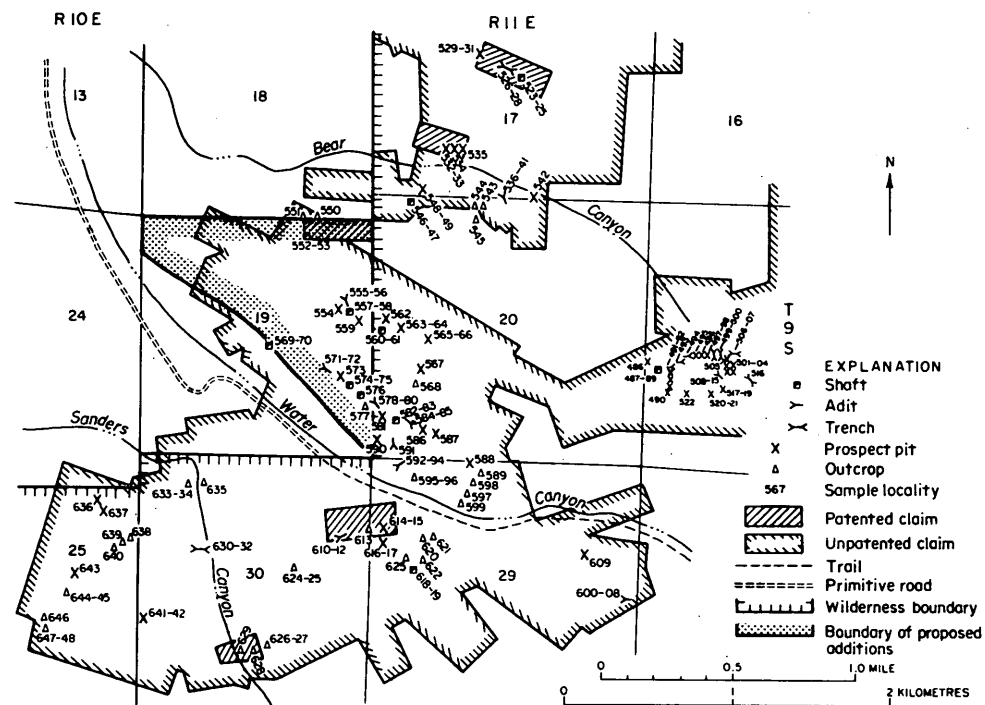


FIGURE 12.—Map of Bear and Water-Sanders Canyons area.

Upper Bear Canyon

Most of the work in the Bear Canyon drainage was done in sec. 21, at the head of the canyon, by Donald R. and Will G. Thornborrow, who located claims there beginning in 1911 and operated the properties until about 1942. The workings in sec. 21 are on a group of gold-bearing quartz veins. Twenty-two prospects and mine workings were examined in this vicinity, including a shaft and five adits, mainly along one vein. Thirty-seven samples were taken, 19 of which showed gold and silver values ranging from \$5.52 to \$38.10 per ton (\$6.07/t to \$41.91/t). These assay results indicate a possible potential for small-scale mining operations in the area.

Samples 486-522

A total of 55 samples was taken from workings in the upper Bear Canyon area. The Midnight(?) on the ridge at the west end of the vein system, had been sunk 27 feet (8.2 m) in silicic rock. Two of three adits on the canyon slope to the east are caved; originally they probably were about 100 feet (30.5 m) long. The upper, third adit, was driven 26 feet (7.9 m) on a bearing of S.75°W. in silicic rock. The east adit, which may be the Easter prospect, started on a fault, probably in an effort to intersect a quartz vein outcrop. A prospect, thought to be the Illinois, is located on a cross-structure, mainly a shear zone, which is exposed about 700 feet (214 m) south of the vein system. The working is a partly timbered, narrow, Y-shaped adit and drift. The adit forms the stem. The right, or south, drift was driven S.65°E. for 111 feet (39.9 m). The north drift begins 44 feet (13.4 m) in from the portal and was driven northeast in an arc varying from N.80°E. to N.65°E. for 36 feet (11.0 m).

Samples were taken at intervals along the structures in the three adits and from veins exposed in the pits. Several samples of dump material and quartz veins were panned; in nearly every one of these samples, small gold flakes were observed in the concentrates. Significant assay data of samples containing high metal values are shown below:

Sample No.	Type	Gold		Silver		Value	
		(ounce per ton)	(g/t)	(ounce per ton)	(g/t)	(\$/ton)	(\$/t)
491	2.5-foot chip	0.07	2.4	-	-	10.50	11.55
493	Quartz from dump	.23	8	0.60	21	38.10	41.91
494	-----do-----	.06	2.1	-	-	9.00	9.90
500	Stockpile	.16	5	.50	17	27.00	29.70
508	2.5-foot chip	.06	2.1	.52	18	12.12	13.33
509	3.5-foot chip	.02	0.7	.42	14	5.52	6.07
510	3.9-foot chip	.03	1.0	.30	10	6.30	6.93
511	3.2-foot chip	.04	1.4	.54	19	9.24	10.16
512	2.5-foot chip	.10	3.4	1.24	42	22.44	24.68
513	4.1-foot chip	.06	2.1	.44	15	11.64	12.80
514	2.6-foot chip	.08	2.7	.74	25	6.44	7.08
515	2.4-foot chip	.06	2.1	-	-	9.00	9.90
516	Dump, selected	.01	0.3	.38	13	6.98	7.68
517	2.3-foot chip	.08	2.7	.76	26	16.56	18.22
518	1.1-foot chip	.10	3.4	.70	24	19.20	21.12
519	Dump selected	.20	7	1.20	41	37.20	40.92
520	1.8-foot chip	.04	1.4	.46	16	8.76	9.64
521	2.2-foot chip	.06	2.1	.30	10	10.80	11.88
522	1.2-foot chip	.05	1.7	.32	11	9.42	10.36

Lower Bear Canyon

Most of the workings in lower Bear Canyon are in sec. 17. Two patented claims, the Sugar Stake located in 1880 and the Homestake located in 1888, and now owned by Jack Harkey are also located there. Mine workings on the Sugar Stake have caved and are filled with debris. Twenty-seven samples were taken in the area of which 10 showed assay values in excess of \$5.00 per ton (\$5.50/t). Assay results and sample widths, however, indicate little potential for the lower part of Bear Canyon.

Samples 523-531

Sample 523 was taken across a 10-inch (25-cm), heavily oxidized zone in deeply weathered material in the wall of the Sugar Stake shaft. The shaft, now caved, is shown as being 65 feet (19.8 m) deep on the 1892 Mineral Survey Plat. The sample assayed 0.56 ounce silver per ton (19 g/t) and 0.46 percent zinc, about \$6.58 per ton (\$7.24/t). Sample 524 from a small stockpile on the dump assayed 5.08 ounces silver per ton (174 g/t), 5.9 percent lead, and 1.2 percent zinc, about \$64.84 per ton (\$71.32/t). The material appeared to have come from a 4-inch (10 cm) vein. Assay values were negligible in a random sample (525) taken from the dump.

Three chip samples (526-528) were taken at a badly eroded trench west of the shaft. The samples were 1.0, 6.0, and 6.0 feet (31 cm, 1.8 m, and 1.8 m) wide, respectively. Although minor copper stain is evident, no significant mineral values were detected.

Three samples (529-531) were taken at a 15- by 4-foot (4.6 m by 1.2 m) deep pit just west of the Sugar Stake end line. The pit exposes an iron-stained quartz vein striking N.75°W. Two of the samples were chip samples 1.6, and 1.2 feet (49 cm and 37 cm) wide; the third was a grab sample of dump material. Analyses showed insignificant metal values.

Samples 532-535

Four samples were taken from mine workings on the patented Homestake claim in main Bear Canyon. The workings, which include three shallow pits that were sampled, have been nearly obliterated by erosion. Sample 532 was chipped across a 1.6-foot (49 cm) calcite vein exposed in one of the pits. The vein strikes N.65°E. and dips 75°SW. Another chip sample (533) from the same pit included 7 inches (18 cm) silicified material and 8 inches (20 cm) of gouge from the north side of the vein. Sample 534 was taken from another pit sunk on the same calcite vein. It was chipped across the 3.0-foot (91 cm) width of the vein and included 1.6 feet (49 cm) of gouge from the south side of the vein. Sample 535 was chipped across an 8-foot (2.4-m) altered dike in a third pit farther east. Only minor silver (0.38 ounce per ton; 13 g/t, or less) was detected.

Samples 536-541

Six samples were taken from an adit 72 feet (22.0 m) long at a small waterfall upstream from the Homestake claim. The adit was driven S.25°E. for 59 feet (18.0 m) then S.10°E. for 13 feet (4.0 m) and crosscuts a quartz vein near the face. Samples were taken from three mineralized zones in the vein where the vein is exposed on each wall. On the east wall about 4 feet (1.2 m) from the face, sample 536 was taken across a 2.6-foot (79 cm) width of the vein. It assayed 0.04 ounce gold per ton (1.4 g/t), about \$6.00 per ton (\$6.60/t). A second sample from the east wall (537) was taken across 7 inches (18 cm) of gritty clay that adjoins the vein on its south side and across 1.3 feet (40 cm) of the same material that adjoins it on the north side. This composite sample (537) assayed 0.08 ounce gold per ton (2.7 g/t), about \$12.00 per ton (\$13.20/t). Adjacent to the face, on the east wall, a sample (538) was cut across a 1.4-foot (43-cm) quartz vein striking N.87°E. and dipping 83°N.; it assayed 0.14 ounce gold per ton (5 g/t) and 0.64 ounce silver per ton (22 g/t), about \$24.84 per ton (\$27.32/t). Sample 539, a 6-inch (15 cm) chip sample was taken across a shattered zone in the west wall at the face. It assayed 0.02 ounce gold per ton (0.7 g/t) and 0.36 ounce silver per ton (12 g/t), about \$5.16 per ton (\$5.68/t). Sample 540, a 1.2-foot (37 cm) chip sample taken across the vein where it is exposed in the west wall assayed 0.02 ounce gold per ton (0.7 g/t) and 0.6 ounce silver per ton (21 g/t), about \$6.60 per ton (\$7.26/t). Sample 540 corresponds to sample 538 in the east wall. Sample 541, a 2.7-foot (82-cm) chip sample, also taken across the vein where it is exposed in the west wall assayed 0.02 ounce gold per ton (0.7 g/t), 0.40 ounce silver per ton (14 g/t), and 500 ppm molybdenum, about \$8.90 per ton (\$9.79/t). It corresponds to sample 536 in the east wall.

Samples 542-545

A sample (542) of quartz was from the dump of a caved and debris-filled prospect pit about 400 feet (122 m) east of the adit just described. The dump is estimated to contain 25 tons (22.7 t) of material. The sample, which assayed 0.06 ounce gold per ton (2.1 t), about \$9.00 per ton (\$9.90/t) came from a vein that may be an eastward extension of that from which samples 536-541 were taken.

This same vein system appears to crop out on the ridge west of the adit. There, sample 543 was taken across 1.7 feet (52 cm) of a quartz vein and included shattered wall rock. The sample assayed 0.03 ounce gold per ton (1.0 g/t) and 1.16 ounce silver per ton (40 g/t), about \$11.46 per ton (\$12.61/t). A 1-foot (31 cm) chip sample (544) of the same vein taken in a saddle farther west along the ridge, assayed 0.01 ounce gold per ton (0.3 g/t) and 1.12 ounces silver per ton (38 g/t), about \$8.22 per ton (\$9.04/t). The vein strikes N.85°W. A sample (545) of quartz float at an old prospect pit contained no significant values.

Samples 546-549

Four samples were taken about one-fourth mile (about 400 m) west of the workings in lower Bear Canyon. A quartz vein exposed in a shaft there may be an extension of that exposed in the workings of lower Bear Canyon. Sample 546, a 10-inch (25 cm) chip sample, taken where the vein is exposed in the collar of the shaft showed no significant metal values. A grab sample (547), however, assayed 0.02 ounce gold per ton (0.7 g/t), 0.82 ounce silver per ton (28 g/t) and 0.17 percent copper, about \$10.64 per ton (\$11.70/t). Two other samples (548 and 549), from a lamprophyre dike exposed in a pit about 300 feet (91.5 m) northeast of the shaft contained only minor silver values, 0.44 and 0.40 ounce per ton (15 g/t and 14 g/t, respectively). Sample 548 was chipped across an 8-foot (2.4 m) wide dike; 549 was chipped across a 4-inch (10 cm) width of the contact zone of the dike with altered andesite.

Water and Sanders Canyons (samples 550-648)

Three patented claims, about 60 unpatented claims, and dozens of prospects and mine workings are in a mineralized area in the drainages of Water and Sanders Canyons. The area is at the end of the Water Canyon road in secs. 19, 20, 29, and 30, T. 9 S., R. 11 E., and in E 1/2 sec. 25, T. 9 S., R. 10 E. All of the claims and workings except those in sec. 19 are within the wilderness.

The mining history of the area dates from 1880 when a number of claims were located on the vein now known as the Surprise. Scores of claims were later located on the mineralized area.

Three claims were patented in this vicinity: the Copper Glance, in 1895; the Copper Matte, in 1892; and the Water Cress, in 1893.

I. Reuben Goodman, of Baltimore, Maryland, presently owns the Copper Glance and Copper Matte. The I-bar-X ranch owns the Water Cress, a wedge-shaped claim in Sanders Canyon.

Between 1928 and 1940, Carl E. Degner and John B. Coon located a block of claims in the Water Canyon-Sanders Canyon area. Fifty-five claims make up the Surprise, Park Gold, Little Hecla, and Copper Lode groups. According to Griswold (1959, p. 76), the last development work in the area was in 1956 when New Mexico Copper Corp., Carl E. Degner, president, commenced to develop the claims with the expectation of shipping copper ore to the company's mill in Carrizozo.

According to a private, unpublished report, Waldemar N. Ervin examined some of the properties about 1941. Ervin stated that the principal vein is the Surprise vein, which is about 8,000 feet (2,440 m) long and strikes N.61°W. The vein was reported by Ervin to be 12 to 35 feet (3.7 to 10.7 m) wide, averaging 20 feet (6.1 m). He reported the Surprise (Red Chief?) shaft to be 85 feet (25.9 m) deep, and the Iron Blossom shaft 120 feet (36.6 m) deep with 80 feet (24.4 m) of drifts at the bottom. The Surprise vein system appears to extend from the Iron Blossom shaft in the center of sec. 19 to a prospect pit at the center of the south line of sec. 20. Along this 1-mile (1.6 km) stretch, 20 samples (569-588) were taken from numerous workings.

The veins of the area are associated with syenite, lamprophyre, or porphyritic andesite dikes that intruded andesite volcanic flows. Veins are principally composed of quartz, barite, siderite, calcite, and gossans left from oxidation and leaching of pyrite. Also present are mineralized lenses of andesite as much as several feet across that contain copper.

Of 99 samples taken from numerous localities, 34 assayed in excess of \$5.00 per ton (\$5.50/t). Some very high-grade values were obtained, but these generally were selected samples from narrow showings. High copper and silver values obtained in certain localities indicate that small ore deposits might be present.

Samples 550-553

Two samples were taken at outcrops on the north side of the Copper Glance claim, a patented claim in SE 1/4 sec. 18 and NE 1/4 sec. 19, T. 9 S., R. 11 E., just west of the wilderness. One sample (550) was chipped across a 5-inch (13 cm) vein that strikes N.10°W., nearly perpendicular to the Copper Glance vein. The sample was about half chalcopyrite and assayed 9.70 percent copper and 0.56 ounce silver per ton (19 g/t), about \$158.06 per ton (\$173.87/t). The second sample (551) was taken across a 3.5-foot (1.1-m) wide lamprophyre dike parallel to the main Copper Glance structure. The sample contained no significant metal.

Two samples were from the dump of the Copper Glance shaft. The shaft is the main excavation on the claim and is filled with debris to within 22 feet (6.7 m) of the collar. A selected sample (552) representing a 1-inch (3 cm) copper-amethyst stringer on which the shaft had been sunk, assayed 0.02 ounce gold per ton (0.7 g/t), 8.60 ounces of silver per ton (295 g/t), and 4.74 percent copper, about \$130.44 per ton (\$143.48/t). A grab sample (553) from the dump assayed 0.16 percent copper.

Samples 554-566

Thirteen samples were taken along a system of veins covered by the Silver Dollar claim and the north three rows of claims in the Surprise group, and eight prospect workings were examined. The principal workings include an adit and shaft combination in sec. 19. The shaft, sunk in silicified rock, was connected at the 50-foot (15.3 m) level with a 100-foot (30.5 m) adit. A caved shaft observed in sec. 20 probably was originally about 20 feet (about 6 m) deep.

Six of the samples (554-559) were taken just west of the wilderness; the others (560-566) are from workings within the wilderness. Of the samples collected in this vicinity, five had assays showing values more than \$5.00 per ton (\$5.50/t). Sample 556, chipped across 4 feet (1.2 m) of mineralized rock at the portal of the adit, contained 0.08 ounce gold per ton (2.7 g/t), about \$12.00 per ton (\$13.20/t). Samples 557 and 558 were from the dump of the main shaft. Sample 557 taken from a 1- to 2-ton ore stockpile on the dump, assayed 1.40 ounces silver per ton (48 g/t), 0.60 percent copper, and 0.81 percent lead, about \$21.56 per ton (\$23.72/t). Sample 558, a selected sample, contained 6.0 ounces silver per ton (21 g/t), 1.73 percent copper, 1.90 percent lead, and 0.31 percent zinc, about \$74.21 per ton (\$81.63/t); this sample probably contained ore that had been washed over the dump. Sample 565, was chipped across a 4-foot (1.2 m) mineralized area that has a pit sunk on it. The pit is the easternmost working in the area under consideration. The sample assayed 0.88 ounce silver per ton (30 g/t), and 3.79 percent copper, about \$65.92 per ton (\$72.51/t). Sample 566 was a grab sample from a dump at the same locality and showed 0.34 ounce silver per ton (12 g/t) and 0.54 percent copper for a value of \$10.68 per ton (\$11.75/t). Low silver values were contained in two samples: 0.70 ounce per ton (24 g/t) in sample 562 and 0.42 ounce per ton (14 g/t) in sample 563.

Samples 567 and 568

The samples came from a small area containing copper minerals near the ridge crest in SW 1/4 sec. 20 inside the wilderness. Sample 567 was from the dump of a shallow pit and showed no significant metal concentration, whereas sample 568, a random chip sample, taken across a nearby lens of weathered and altered andesite 10 ft (3.1 m) wide, assayed 1.4 ounces silver per ton (48 g/t) and 1.67 percent copper for a gross metal value of \$35.12 per ton (\$38.63/t).

Samples 569 and 570

The 120-ft (36.6 m) inaccessible Iron Blossom shaft is on the west end of the Surprise vein system and was sunk on a leached and altered zone. The zone is at least 85 ft (25.4 m) wide, and has a mushroom-like shape, hence the name Iron Blossom. Two chip samples were taken across the middle 20 ft (6.1 m) of the oxidized zone. The only significant mineral value, 0.54 ounce silver per ton (19 g/t), was contained in sample 569.

Samples 571 and 572

Two chip samples were taken from the back of an adit located at the end of a road east of the Iron Blossom shaft. A crosscut was driven S. 65° E. for 42 ft (12.8 m), and S. 45° E. for 19 ft (5.8 m), in an attempt to intersect veins cropping out on the hill above. Analyses of the samples showed nothing of interest.

Sample 573

The sample was from a pit located east of the working just described. The pit is 17 feet (5.2 m) in diameter and was sunk on an altered shear zone of the same width. The sample was chipped across a 3-foot (91-cm) width of an iron-stained band within the shear zone and contained no significant values.

Sample 574 and 575

Two samples were from stockpiles on the dump of a 10-foot (3.1 m) shaft. The shaft, located a short distance southeast of the pit just described was sunk on an oxidized vein 4-feet (1.2 m) wide that strikes N.80°W. The samples assayed 0.78 ounce and 1.38 ounces silver per ton (27 g/t and 47 g/t), respectively.

Samples 576 and 577

Samples 576 and 577 are chip samples of 1 and 1.8 foot (31 and 55 cm) taken across a barite vein exposed at the collar of a completely caved shaft. The vein strikes N.45°W. The dump is estimated to contain 50 tons (45.5 t) of mineralized material. Barite was the most abundant constituent, and sample 577 contained 0.5 ounce silver per ton (17 g/t).

Samples 578-580

Three samples were taken from the area of an adit east of the shaft just described. The adit was driven 40 feet (12.2 m) S.35°E. on a vein, and is now inaccessible. The samples were taken across both walls of a trench crosscutting the vein at the adit portal and from the dump. Sample 578, chipped across an interval of 1.1 feet (34 cm) in the trench, assayed 1.38 ounces silver per ton (47 g/t), about \$8.28 per ton (\$9.11/t), and sample 579, a 1.2-foot (37 cm) chip sample from the opposite wall of the trench, contained 1.28 ounces silver per ton (44 g/t), about \$7.68 per ton (\$8.45/t). Sample 580, a grab sample from the dump showed 0.01 ounce gold per ton (0.3 g/t), 1.48 ounces silver per ton (51 g/t), and 0.18 percent copper, about \$13.26 per ton (\$14.59/t).

Sample 581

The sample was from a small stockpile of ore on a dump. The dump, of about 50 tons (45 t) lies east of the adit just described; no mine working was in evidence. The sample assayed the highest silver of any taken in the wilderness investigation--49.66 ounces per ton (1.7 kg/t). It also contained 2.94 percent copper, 0.80 percent lead, 0.41 percent antimony, and 0.10 percent arsenic. Total value of this remarkable specimen sample was calculated at \$350 per ton.(\$386/t). The high-grade ore probably was from some other area than that of the dump where it was piled.

Samples 582 and 583

Two samples were taken from a stockpile of ore of approximately 5 tons (4.5 t) on the dump of the 85-foot (25.9 m) Surprise shaft. Material similar in appearance to that in the stockpile was observed in part of the vein (a zone 10 feet (3.1 m) wide), on which the shaft had been sunk. Although the highly mineralized part could not be reached for sampling, oxidized copper minerals were observed. Sample 582 contained 0.01 ounce gold per ton (0.3 g/t), 18.46 ounces silver per ton (633 g/t), and 2.51 percent copper, about \$152.42 per ton (\$167.66/t). Sample 583 showed 0.02 ounce gold (0.7 g/t) and 14.44 ounces silver per ton (495 g/t) and 2.56 percent copper, about \$130.60 per ton (\$143.66/t). Copper minerals were identified as malachite, azurite, tetrahedrite, and tennantite.

Samples 584 and 585

Part of the Surprise vein was sampled in two places at the brow of an adit. The adit, 20 feet (6.1 m) long and bearing N.65°W., is located 150 feet (45.8 m) east of the Surprise shaft. Sample 584, chipped across a 2.5 foot (76 cm), copper-stained zone, assayed 0.04 ounce gold per ton (1.4 g/t), 13.52 ounces silver per ton (464 g/t), and 1.94 percent copper, 0.60 percent lead, and 1,300 ppm molybdenum; this sample assay indicated a value of \$129.90 per ton (\$142.89/t). Sample 585, chipped across a silicic zone, contained 0.96 ounce silver per ton (33 g/t) and 0.01 ounce gold per ton (0.3 g/t), about \$7.26 per ton (\$7.99/t).

Samples 586-589

Three caved pits or short adits were sampled near the canyon bottom east of sample site 584-585. An iron-stained vein at this site strikes N.50°-70°W. Sample 586, a 3.2-foot (98-cm) chip sample, taken across the vein, assayed 0.03 ounce gold per ton (1.0 g/t), 0.90 ounce silver per ton (31 g/t), and 0.27 percent copper, about \$14.22 per ton (\$15.64/t). Farther east, sample 587 was chipped across 1.7 feet (52 cm) of the vein; it assayed 0.05 ounce gold (1.7 g/t), and 0.50 ounce silver per ton (17 g/t), about \$10.50 per ton (\$11.55/t). A sample (588) of selected material from the dump of a shallow prospect farther east on the ridge crest showed 0.03 ounce gold per ton (1.0 g/t) and 0.30 ounce silver per ton (10 g/t), about \$6.30 per ton (\$6.93/t). Sample 589, chipped across 2.3 feet (70 cm) of a copper-stained andesite zone on a ridge north of Water Canyon Spring, showed only 0.12 percent copper.

Samples 590-599

Ten samples were collected from the workings in the vicinity of the Surprise Contact claim in SW 1/4 sec. 20, and NW 1/4 sec. 29, T. 9 S., R. 11 E. In addition to a pit and two adits, four mineralized outcrops were sampled. The workings and outcrops lie along structures parallel to or crossing the Surprise vein. Analytical results were of no consequence.

Amethystine quartz and minor copper stain were noted in a selected sample from the dump at a shallow pit; the sample (590) contained 2.0 ounces silver per ton (69 g/t), about \$12.00 per ton (\$13.20/t).

A 6-foot (1.8 m) chip sample (591) was taken at the contact between an andesite flow and a bed of loosely cemented conglomerate. The sample came from an adit driven 10 feet (3.1 m) into the bank of an arroyo just east of the pit. It showed no metal concentration.

A chip sample (592) was taken across a 2-inch (5 cm) veinlet in the brow of the Surprise Contact adit. The adit is caved, but judged from the size of the dump, it probably was less than 50 feet (15.3 m) long. It trends N.20°E. The sample assayed 1.08 ounces silver per ton. Two other samples (593 and 594) taken at the same place showed only minor silver values, 0.32 and 0.30 ounce per ton (11 g/t and 10 g/t), respectively.

Two samples were taken from the area where a series of parallel, iron-stained quartz and calcite veins crop out on the hillside, near a spring 200 (61.0 m) feet southeast of the Surprise Contact adit. Sample 595 was taken from across a 6-inch (15-cm) quartz vein and sample 596 across a 1.4-foot (43-cm) quartz vein in a 15-foot (4.6-m) wide shatter zone; one, 595, contained 0.49 percent zinc.

Three samples were taken from a zone of fractured, porphyritic andesite with malachite coatings on the fracture surfaces. The zone is several hundred feet wide and is located about 1,000 feet (about 300 m) east of the spring. Copper values in two random chip samples (597 and 598) taken from there, however, were low. In the same area, is a 12-foot (3.7-m) lamprophyre dike striking east-west. A chip sample (599) across 1 foot (31 cm) of the iron-stained part of the dike assayed 0.01 ounce gold per ton (0.3 g/t) and 0.76 ounce silver per ton (26 g/t), about \$6.06 per ton (\$6.67/t).

Samples 600-608

Nine samples were collected from an adit in the bottom of an upper branch of Water Canyon in E 1/2 sec. 29. No claim descriptions refer to the adit site, although it may have originally been located as the Black Cap in 1883, but it is believed to be covered now by the Park Gold Tunnel lode. The adit, which strikes S.25°E., according to C. E. Degner of Carrizozo, personal commun., 1972, is 400 feet (122 m) long. A section of the adit has caved 184 feet (56.1 m) from the portal and water behind the caved area prevented an examination at the face.

The samples were taken at intervals across quartz veins and fracture zones along the length of the adit as far as the caved area. Eight samples (600-607) assayed low but significant values in silver; values ranged from 0.32 to 0.62 ounce per ton (11 to 21 g/t). One sample (602) contained 0.28 percent copper. The caved area is located at a 4-foot (1.2 m) quartz vein that is oriented obliquely to the adit, striking north and dipping 65°E. Copper stain was noted in the vein material and associated gouge.

Sample 609

A 4-inch (10-cm) chip sample was taken from an east-trending, caved working 10 feet long. It showed no significant values.

Samples 610-619

Three samples were taken from the west end of the Copper Matte patented claim that lies in the area of the juncture of McCoy (or McIvers) Canyon with Water Canyon. No major workings were seen on the Copper Matte. An adit, 10 feet (5.1 m) long and 6 feet wide, is near the bottom of the canyon. Three samples were taken at the adit face; sample 610 was taken across 3.0 feet (91 cm) of the left half and sample 611 was taken across 3.0 feet (91 cm) of the right half. Sample 612 was a 5-inch (13 cm) chip sample of a quartz vein in the face adjacent to the left wall. Assays ranged from 0.38 to 0.54 ounce silver per ton. Sample 613 was of float from the slope above the adit and yielded 0.40 ounce silver per ton (14 g/t).

Four samples were taken of dikes on the ridge east of the adit. A 5-foot (1.5 m) lamprophyre dike and a parallel dike of porphyritic andesite are exposed in several shallow pits. A sample (614) across a 1-foot (31 cm) interval of the andesite dike assayed 0.01 ounce gold per ton (0.3 g/t), 0.36 ounce silver per ton (12 g/t), and 1.14 percent copper, about \$21.90 per ton (\$24.09/t) in total metal value. Fragments of quartz and barite from one of the pits (sample 615) showed 0.01 ounce gold per ton (0.3 g/t) and 0.66 ounce silver per ton (23 g/t), about \$5.46 per ton (\$6.01/t). Assay results from a 6-inch (15 cm) chip sample (616) and from a random chip (617) were negligible.

Two samples were collected from the site of the Park Gold No. 3 shaft. The shaft, on the ridge southeast of the Copper Matte, was originally 50 feet (15.3 m) deep, but is now filled with debris to within 27 feet (8.2 m) of the surface. A level may have been driven along the vein at that depth. The shaft was sunk on a 2-foot (61 cm) vein that lies along the south side of a system of porphyritic andesite, andesite, and lamprophyre dikes that strikes N.70°E. and is 20 feet (6.1 m) wide. A selected sample (618) from the dump assayed 0.86 ounce silver per ton (30 g/t), 0.41 percent copper, and 1.55 percent lead (gross metal value of \$18.54 per ton (\$20.39/t)). A sample (619) from the dump assayed 0.32 ounce silver per ton (11 g/t).

Samples 620-623

Copper minerals were noted in east-west-trending veins that crop out north of the Park Gold shaft. A 2-inch (5 cm) chip sample (621) assayed 0.64 ounce silver per ton (22 g/t) and 1.04 percent copper, about \$21.98 per ton (\$24.18/t); a 1-inch (3 cm) chip (622) yielded 0.38 ounce silver per ton (13 g/t) and 0.31 percent copper (\$8.74 per ton). No significant values were contained in two samples of float (620 and 623).

Samples 624 and 625

A zone of weathered, copper-bearing andesite of about 1,000 square feet (93 m^2) was sampled on the east rim of Sanders Canyon. A sample (624) from a mineralized lens 1.5 feet (46 cm) long and 3-inches (8 cm) thick from within the zone assayed 0.88 ounce silver per ton (30 g/t) and 2.94 percent copper for a value of \$52.32 per ton (\$57.55/t). A random chip sample (625) from a copper-stained area 25 feet (7.6 m) upslope from sample site 624 assayed 0.26 percent copper.

Samples 626-629

Four samples were taken across mineralized outcrops occurring on a wedge-shaped patented claim in S 1/2 sec. 30, T. 9 S., R. 11 E. No workings were found in the area, but if once present they have either been covered or destroyed by erosion. Only low metal values were detected analytically.

Samples 630-635

Three samples were from a vein exposed in a 50-foot (15.3 m) trench on the west side of Sanders Canyon. The vein trends N.80°W. and ranges from 2.6 to 6.0 feet (79 cm to 1.8 m) in width. The samples (630-632) are all chip samples taken across the width of the vein and contain minor silver values, 0.22, 0.52, and 0.44 ounce per ton, respectively. Three samples (633-635) taken from outcrops near the mouth of the canyon also showed low silver values ranging from 0.36 to 0.62 ounce per ton (12 to 21 g/t).

Samples 636-648

Thirteen samples were taken from the area of foothills and mountain slope in E 1/2 sec. 25, T. 9 S., R. 10 E., an area that is thought to be covered by the Little Hecla group of claims. The area is underlain by a group of quartz and siderite veins associated with lamprophyre dikes. Two samples (636 and 637) of a quartz vein in the foothills at the north end of the area showed no metal concentrations. The vein, as much as 3 feet (91 cm) wide and striking S.45°E. is exposed in a 15-foot (4.6 m) long trench.

Samples (638-640) were taken of three intersecting quartz veins in a siliceous zone exposed on the ridge above the trench. The veins, all about 3 feet (91 cm) in width, strike N.20°W., due west, and N.70°W. The samples assayed 0.44, 0.58, and 0.70 ounce silver per ton, (15, 20, and 24 g/t), respectively.

Two grab samples (641 and 642) of broken rock were taken from the dump of a shaft on the ridge on the west side of Sanders Canyon. The shaft, now filled, was originally about 20 feet (6.1 m) deep. Both samples contained 0.01 ounce gold per ton (0.3 g/t) and assayed 0.70 and 1.52 ounces silver per ton (24 and 52 g/t), and 0.08 and 0.10 percent copper, respectively, (gross metal values of \$5.70 and \$12.22 per ton (\$6.26 and \$13.44/t)).

Six samples (643-648) are from siderite veins in the foothills area west of the shallow shaft, an area of deep arroyos that drain into Chavez Canyon, a tributary of Sanders Canyon. The veins are as much as 10 inches (25 cm) wide, and have been explored by one shallow pit. Only traces of silver were detected in the samples.

Spring Canyon area

Siderite and quartz veins occur along Doherty Ridge in the wilderness in sec. 36 and just outside the wilderness in sec. 35, T. 9 S., R. 10 E., (fig. 13). Other siderite and quartz veins occur in the Spring

Figure 13.--Near here

Canyon drainage and most of them are in the wilderness in secs. 1 and 2, T. 10 S., R. 10 E., (fig. 13). Both areas are covered by claims, but none of the veins have been explored at depth.

Doherty Ridge (samples 649-657)

Nine samples were taken from two excavations and five outcrops on Doherty Ridge. The samples contained extremely low metal values. The east working is a shaft sunk 30 to 40 feet (9.2 to 12.2 m) in an intensely altered zone about 1,000 feet (about 300 m) in diameter containing randomly striking, pyrite-bearing quartz veins and barite-siderite veins. The shaft is timbered and water-filled; the adjacent rock is porous limonite. The west working is a shallow pit sunk on a narrow siderite vein at the nose of the ridge. On the west flank of the ridge, the siderite-rich zone is 100 feet (30.5 m) wide (sample location 657).

Spring Canyon (samples 658-665)

Eight samples (658-665) were taken at five localities on unpatented claims near the headwaters of Spring Canyon. Only one sample (660) contained a significant mineral value, 0.5 ounce silver per ton (17 g/t).

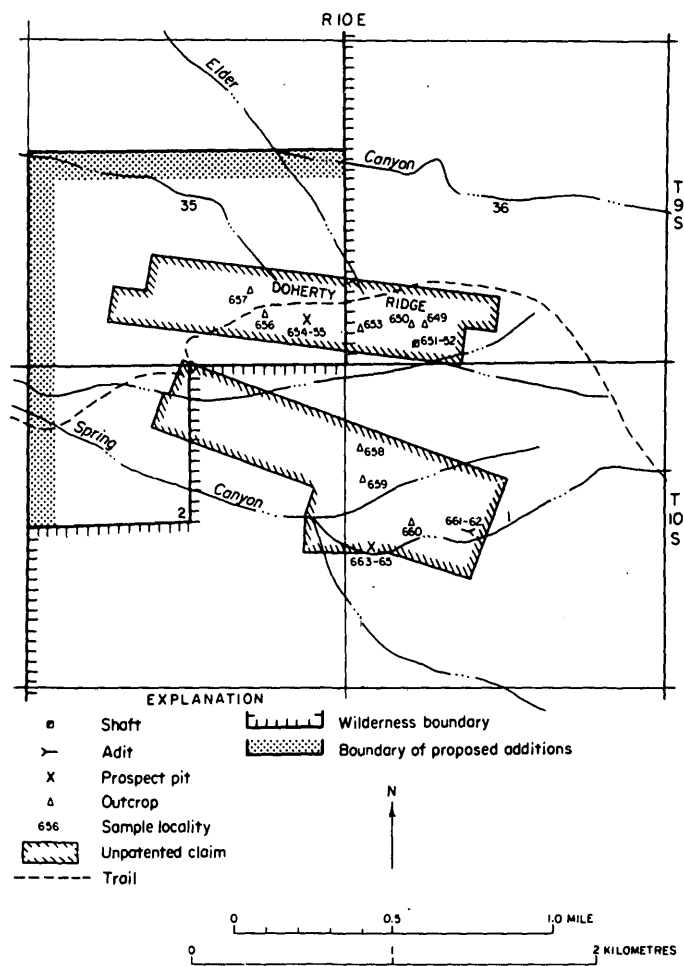


FIGURE 13.-Map of Spring Canyon area.

Samples 658-660

Three chip samples were chipped from a group of parallel siderite veins that crop out on the mountain slopes between Doherty Ridge and Spring Canyon. The veins trend east-west and have lengths of several hundreds of feet. The three veins that were examined range from 1 to 6 feet (31 cm to 1.8 m) in width. Sample 660 taken across an interval of 1 foot (31 cm), showed 0.5 ounce silver per ton (17 g/t).

Samples 661 and 662

The samples were taken near the bottom of Spring Canyon at the portal of an inaccessible adit. The adit was driven about 40 feet (12.2 m) N.75°W. along a group of narrow quartz veinlets associated with a 2-foot (61 cm) wide basaltic dike in porphyritic-andesite. The samples, both 1-inch (3 cm) chip samples, contained insignificant mineral values.

Samples 663-665

Three random chip samples were taken of a large quartz mass along the Spring Canyon trail west of the adit just described. The body is exposed in a prospect pit measuring 15 feet (4.6 m) east-west by 4 to 5 feet (1.2 to 1.5 m) north-south. The quartz showed insignificant assay values.

Barber Ridge-Lincoln Canyon area (samples 666-679)

Three of 14 samples taken in the Barber Ridge-Lincoln Canyon area--entirely with the wilderness (fig. 14)--assayed values greater than

Figure 14.--Near here.

\$5.00 per ton (\$5.50/t) gross metal value.

Copper occurrences were investigated in the wilderness in secs. 11 and 14, T. 10 S., R. 10 E. Thompson (1966, p. 103) reported copper minerals associated with carbonaceous material on Barber Ridge. Two local residents reported that they worked at a shaft on a copper prospect somewhere along the slopes of the north fork of Lincoln Canyon; the working could not be found.

Samples 666-679

Ten mineralized outcrops and one prospect trench were sampled. Copper minerals occur as lenses in andesite at the intersections of fracture zones.

Samples 666, 667, and 668 assayed 0.37 percent, 0.18 percent, and 0.34 percent copper, respectively. Sample widths ranged from 1 to 1.6 feet (31 to 49 cm). Four other samples (669-672) taken from outcrops in the vicinity contained very low gold and silver values, although sample 671 contained 0.34 ounce silver per ton (12 g/t). Sample 673 taken across 1 foot (31 cm) of copper-stained material in a mineralized lens in NE 1/4 sec. 14, yielded only 0.01 percent copper.

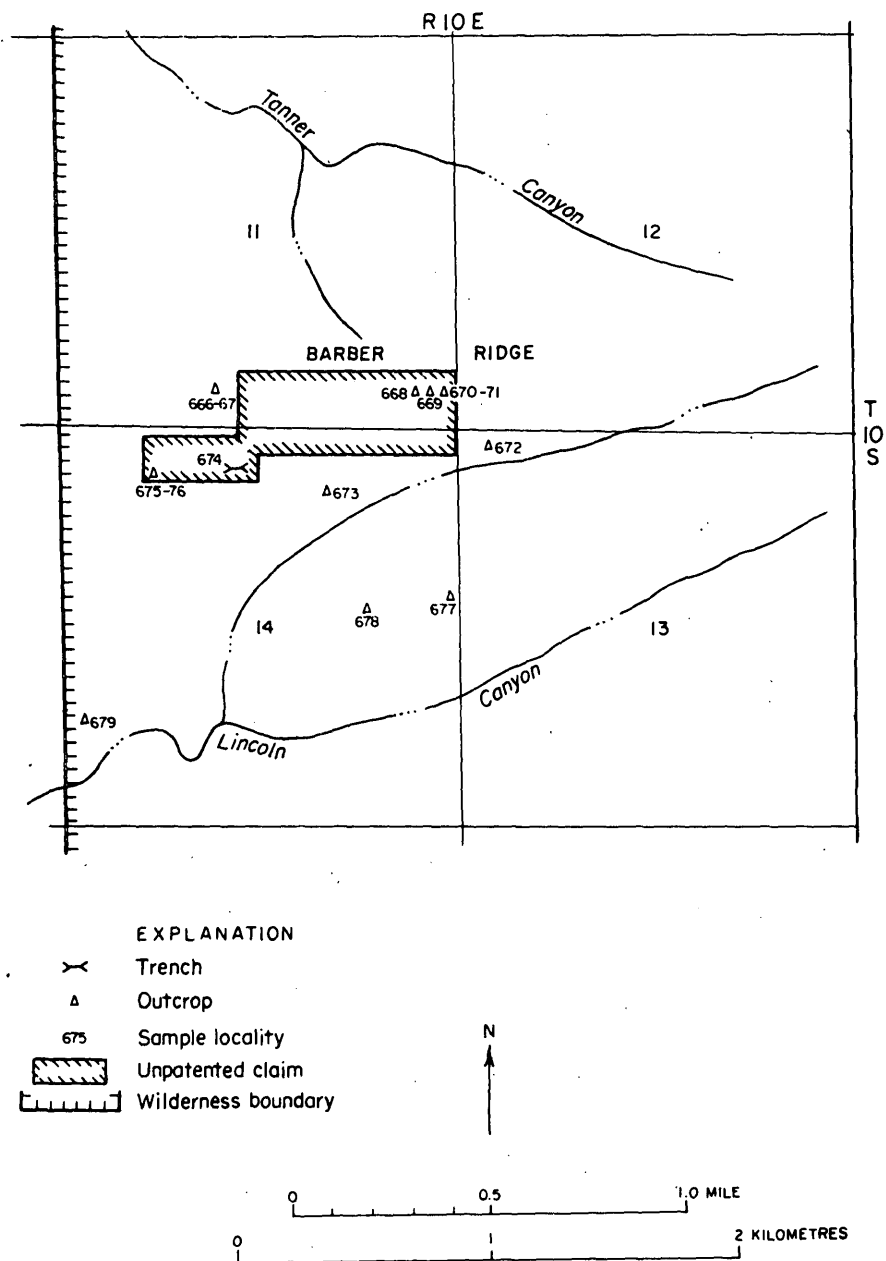


FIGURE 14.- Map of Barber Ridge-Lincoln Canyon area.

A chip sample (674) was taken from the only prospect observed in the Barber Ridge-Lincoln Canyon area, a shallow trench sunk on an 8-inch (20 cm) quartz vein associated with a 10-foot (3.1 m) wide lamprophyre dike. A sample of the vein assayed 0.50 ounce silver per ton (17 g/t).

Two chip samples, 4 and 8 feet (1.2 and 2.4 m) long, were cut across a deeply weathered part of a large zone of altered rock near the bottom of a canyon in NW 1/4 sec. 14. Very low gold and silver values were contained in sample 675; sample 676 assayed 0.50 ounce silver per ton (17 g/t). A 2.5-foot chip sample (677) across a talc-like outcrop showed no metal concentrations. A sample (678) of float from a 1-inch (3 cm) quartz vein picked up on the ridge between the main forks of Lincoln Canyon contained 0.4 ounce silver per ton (14 g/t).

A 1.5-foot (46 cm) chip sample (679) was cut across a 3-inch (8 cm) lamprophyre dike and 1.3 feet (38 cm) of an adjacent iron-stained zone. The sample site is 15 feet (3.8 m) downstream from a 3-foot (91 cm) wide lamprophyre dike in the bottom of a tributary flowing in from west side of Lincoln Canyon the sample assayed 0.01 ounce gold (0.3 g/t) and 1.16 ounces silver per ton (40 g/t), about \$8.46 per ton (\$9.31/t).

Three River Canyon area (samples 680-697)

Eight samples were taken from a number of claims located on quartz outcrops about one-fourth mile (about 400 m) south of the Three Rivers Canyon campground in the southwest corner of the White Mountain Wilderness (fig. 15). Three shallow shafts and two pits were sunk on

Figure 15.--Near here.

quartz veins that contain copper and lead minerals. The north working is a shaft that has caved and filled with debris to within 6 feet (1.8 m) of the surface. It was sunk on the contact of conglomerate with iron-stained, fine-grained andesite. The contact strikes N.70°W. No significant metal concentrations were detected on analysis of two chip samples (680 and 681) from the contact zone. A grab sample (682) from the dump, estimated to be 25 tons (22.7 t), assayed 0.50 ounce silver per ton (17 g/t) and 0.57 percent copper, about \$12.12 per ton (\$13.33/t).

South of the site of sample 682, a quartz vein about 1 foot (31 cm) wide trends east-west along a minor fault. Workings along this vein straddle the wilderness boundary near the quarter corner between secs. 34 and 35. The eastern prospect is a partly timbered 15-foot (4.6 m) shaft. About 100 feet (about 30 m) west, a wedge-shaped trench was cut about 15 feet (4.6 m) deep; farther west is a 10-foot (3.1 m) deep pit. The westernmost working on this vein is a 26-foot (7.9 m) shaft. Fifteen samples (682-696) were taken at these workings; significant values were contained in 5 of the 15 samples and are listed below:

<u>Sample No.</u>	<u>Type</u>	<u>Silver</u>		<u>Copper</u>	<u>Lead</u> (percent)	<u>Zinc</u>	<u>Value</u>	
		(ounce per ton)	(g/t)				(\$/ton)	(\$/t)
682	Dump, grab	0.50	17	0.57			12.12	13.33
683	5-inch chip	.40	14					
684	Stockpile	.30	10		1.14	1.55	19.42	21.36
685	4-inch chip	.30	10		1.08		8.65	9.52
689	Dump, grab	.30	10		.44			
693	-----do-----	.30	10		.58			

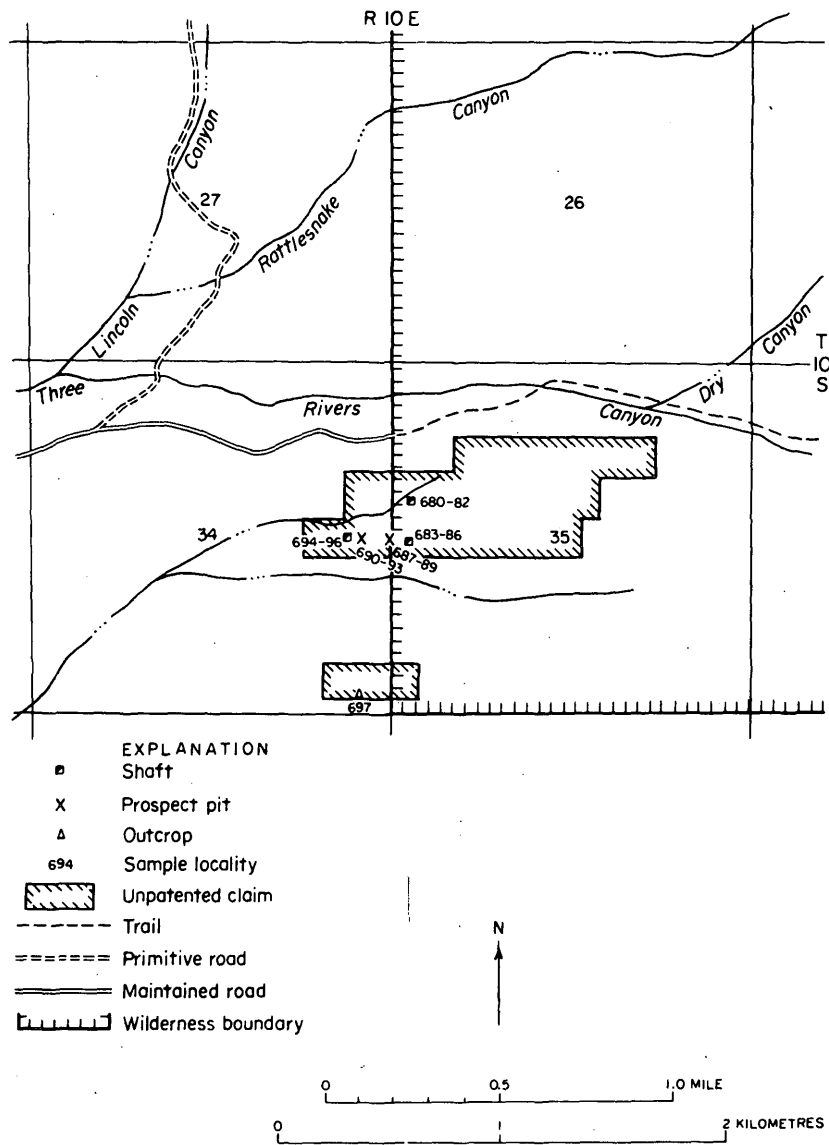


FIGURE 15.—Map of Three Rivers Canyon area.

A random chip sample (697) was taken of a lamprophyre dike at the southwest corner of the wilderness where the Last Lode claim was located in 1881; the sample was nearly barren.

Lookout Mountain area (samples 698-700)

Thirteen samples were taken from the Lookout Mountain area which is located in the extreme southern part of the White Mountain Wilderness. The only working found there is a pit on the ridge running northwest from Lookout Mountain (fig. 16). A pit was excavated in a gossan of box-work

Figure 16.--Near here.

limonite that contains fist-sized pieces of pyrite occurring in crystalline aggregations. A grab sample (698) of the gossan contained 360 ppm molybdenum. A 2-foot (61 cm) wide chip sample (699) across the more siliceous part of the gossan contained 150 ppm molybdenum. The excavation is near the most elevated part of the wilderness--11,200 feet (3,416 m). The pit lies in an area that was probably once included in a group of several hundred mining claims called the Bon group. This Bon group, which adjoins Thompson's group of 104 Bon claims, was located for molybdenum by Bear Creek Mining Co. in 1963 and 1964. The approximate boundary of the group is shown on plate 1. Exploration roads were constructed and several holes were drilled there during 1963-68 by permission of the Forest Service. Results are not available.

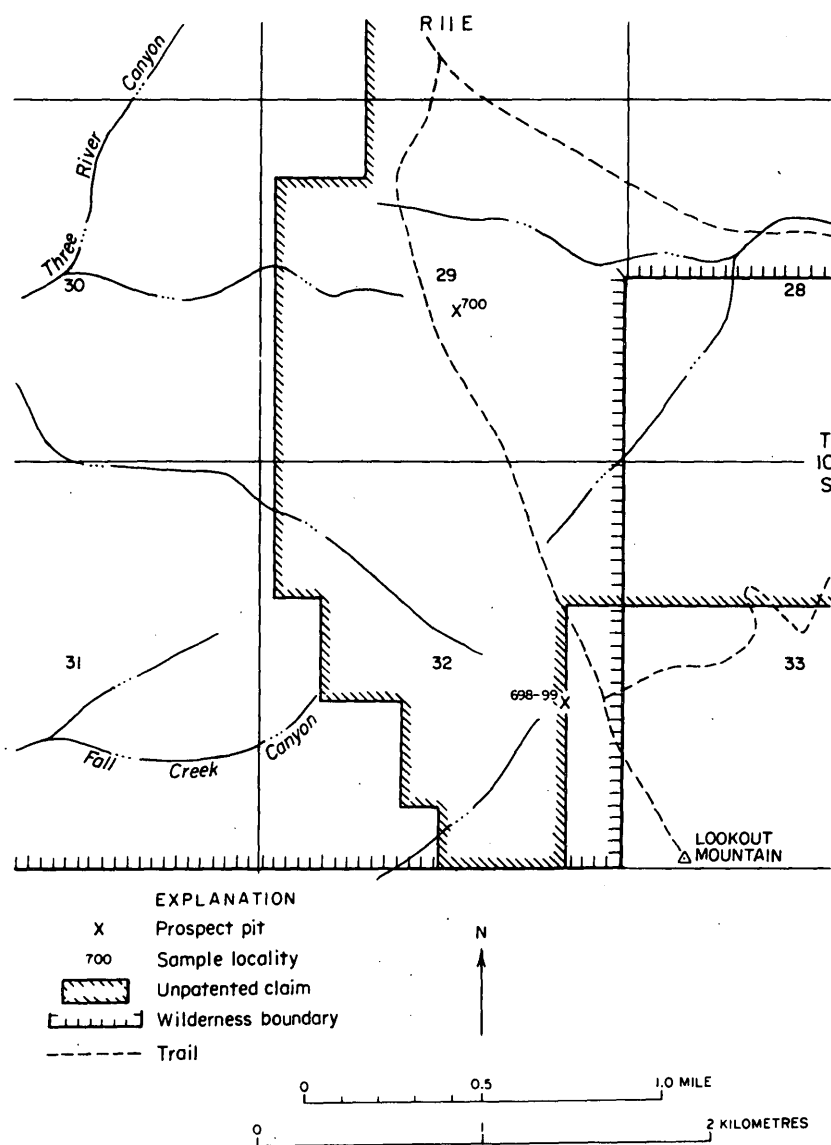


FIGURE 16.-Map of Lookout Mountain area.

The Bon group of claims covers an area of widespread alteration in the wilderness which may have a potential for the discovery of a porphyry-type molybdenum deposit. Stringent administration of regulations concerning the wilderness may have been a factor in the decision not to conduct additional exploration of the area.

In 1970, Perry-Knox-Kaufman, Inc., of Tucson, Ariz., agent for St. Joe Minerals Corp., relocated that part of the area which does not lie in the wilderness, as the E. C. Group. A fissure about 1,000 feet (about 300 m) long containing clusters of quartz crystals was examined in the wilderness in the center of sec. 29 (fig. 16). Mining claims were located there in 1943. During World War II, the U.S. Bureau of Mines examined part of the deposit in a search for optical-quality quartz. It was learned during the wilderness investigation that a former claimant mined several hundred pounds of the crystals and reportedly sold them to rock collectors at prices averaging about \$5 per pound. The crystals are the smoky variety and are covered with a thin silicate crust. Their only value would be as mineral specimens. One sample (700) was collected but was not analyzed.

South Fork Rio Bonito Canyon and Vicinity

The South Fork Rio Bonito Canyon and vicinity comprises seven sections in the southeastern part of the study area (fig. 17). Sixty-eight

Figure 17.--Near here.

samples were taken from eight localities within six drainages. In the discussion that follows, the canyon is referred to simply as Rio Bonito. Thirty-nine sites were examined: 10 within the wilderness, 12 in the proposed additions, and 17 outside the study area. For the most part, assay results were low; only 14 samples contained values in excess of \$5.00 per ton (\$5.50/t).

Upper South Fork of Rio Bonito Canyon (samples 701-703)

Only one of the three samples taken at three workings in the Upper Rio Bonito contained a significant value; sample 701 assayed 0.40 ounce silver per ton (14 g/t).

Samples 701-703

Four samples were taken from the area of two short adits on the banks of South Fork Rio Bonito Canyon in sec. 22, T. 10 S., R. 11 E. The area is in the wilderness. Both adits, 25 feet (7.6 m) long, were driven in silicified and pyritized igneous rock, one bearing N.50°W. on the north bank and the other due east on the south bank. Samples 701 and 702 taken at the portal of each adit assayed extremely low-grade molybdenum, 300 and 100 ppm, respectively, in addition sample 701 yielded 0.40 ounce silver per ton (14 g/t). No metal concentration was detected in the assay of a grab sample (703) taken from the dump of a prospect on a ridge top about 1 mile (1.6 km) northwest of the adits.

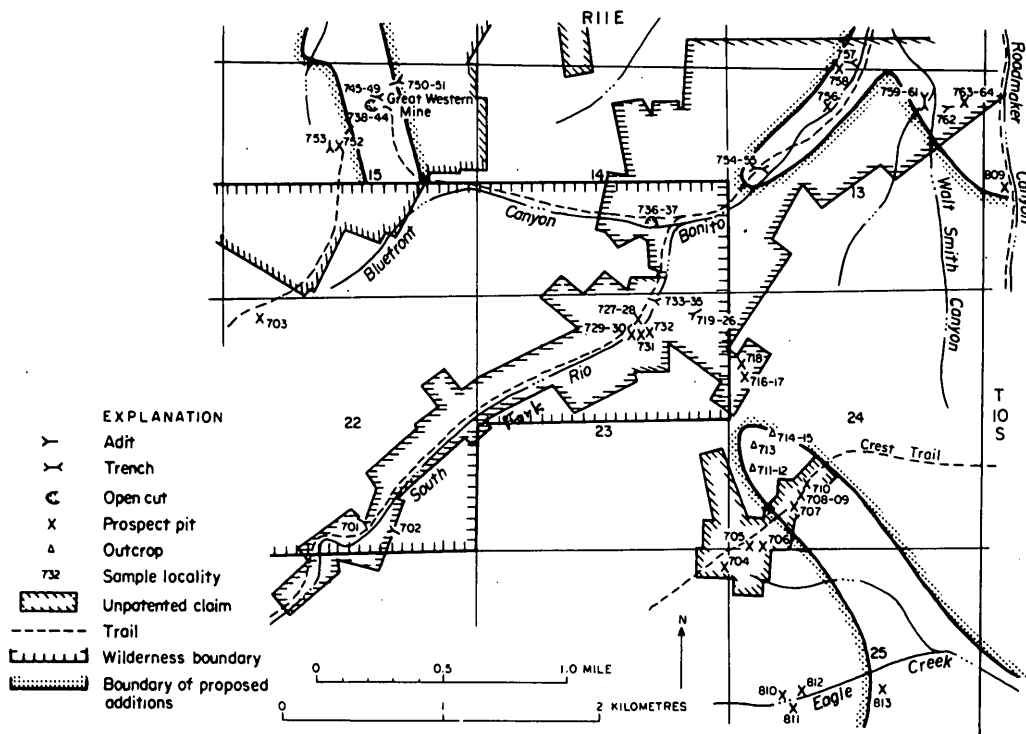


FIGURE 17.—Map of South Fork Rio Bonito Canyon and vicinity.

Crest Trail area (samples 704-715)

Samples 704-710

Seven samples were taken from the area of six prospect pits found along the Crest Trail in secs. 24 and 25, T. 10 S., R. 11 E. Claims were first located in the area in 1882, but the principal activity appears to have taken place in 1902. The pits were probably sunk to prospect for gold or silver along a quartz vein. Only two of the samples assayed significant values. Sample 706, a chip across a 2-inch (5 cm) quartz veinlet, contained 0.60 ounce silver per ton (21 g/t), and sample 709, a random chip sample, yielded 0.40 ounce silver per ton (14 g/t).

Samples 711-715

Five random chip samples were taken of quartz boulders lying in the bed of an exploration road north of sample sites 704-710. Of the five samples, four showed significant assay results:

<u>Sample No.</u>	<u>Silver</u>	
	<u>(ounce per ton)</u>	<u>(g/t)</u>
711	0.80	27
712	.40	14
713	.80	27
715	.40	14

Middle part of the South Fork of Rio Bonito Canyon (samples 716-737)

Twenty-two samples were taken from the middle part of the South Fork Rio Bonito and its drainage area to the southeast. All the workings are in the study area, and most of them are in the N 1/2 sec. 23.

Seven samples assayed significant silver values ranging from 0.40 to 0.82 ounce per ton (14 to 28 g/t); three select samples (728-730) contained values in excess of \$5.00 per ton (\$5.50/t).

Samples 716-718

Only low amounts of metals were indicated in three samples taken at two prospect pits at this site.

Samples 719-726

Eight samples were collected from the Free Gold Tunnel site. Located in 1902, the adit is near the mouth of the canyon a short distance inside the wilderness in NE 1/4 sec. 23. It is 109 feet (33.2 m) long and follows a lamprophyre dike. Of the eight samples taken only one sample (725), a 2.3-foot (7.0 m) chip sample, showed a significant value--0.40 ounce silver per ton (14 g/t).

Samples 727-732

The samples, some of which contained the highest molybdenum assays obtained during the wilderness investigations, came from a cluster of four prospect pits in the wilderness on the north bank of South Fork. The first claims were probably located here in 1888. Because the pits were caved, all samples were selected from dumps or siliceous material scattered on the dumps. Sample 731 was an exception; it was taken from a 1.4-foot (43 cm) altered zone and contained 0.46 ounce silver per ton. Samples with values in excess of \$5.00 per ton (\$5.50/t) are listed below:

<u>Sample no.</u>	<u>Type</u>	Gold		Silver		<u>Molybdenum</u> (ppm)	Value	
		(ounce per ton)	(g/t)	(ounce per ton)	(g/t)		(\$/ton)	(\$/t)
728	Selected	0.01	0.3	0.40	14	700	8.80	9.68
729	---do---	.01	0.3	.66	23	2,500	22.96	25.26
730	---do---	.005	0.2	.18	6	1,500	10.50	11.55

A significant value of 0.46 ounce silver per ton was contained
in sample 731.

Samples 733-735

Two chip samples (733 and 734) were taken in a 10-foot (3.1 m) adit driven along an altered zone; a sample (735) from the dump was also taken. The only significant value was in sample 734; it assayed 0.36 ounce silver per ton (12 g/t).

Samples 736 and 737

Two samples were taken from an aluminum-rich, sericitized zone about 50 feet (15.3 m) wide and, reportedly several thousand feet long. The zone is in the wilderness near the mouth of Bluefront Canyon in E 1/2 sec. 14. Records of mining claims located on the ground date to 1904. The rock was quarried and used in the construction of a public building in the old mining town of White Oaks, about 40 miles (64.6 km) north. After construction began, it was noticed that the blocks crumbled after prolonged exposure to the air and quarrying operations were halted. At the time of this investigation, several piles of the building blocks still remained at the mine site.

The U.S. Bureau of Mines investigated the property in 1944 for its corundum content. Samples were taken for metallurgical tests. Thin-section examination showed that the corundum was in small grains with maximum dimensions ranging from about 20 to 100 microns. A mineral count of a sink-float concentrate showed the corundum to be about 40 percent free. Tests showed that the ore contained about 10 percent corundum and that it was amenable to beneficiation treatment to separate the mineral. The project was abandoned at the end of World War II before a comprehensive evaluation could be made. Now, corundum is produced on a large scale from bauxite, an aluminum ore.

The deposit was relocated in 1970 for alunite and was retitled the Blue Front lode; Clarence A. Griffin and Ernest Key, of Carrizozo, N. Mex., were claimants.

Two grab samples (736 and 737), taken of broken rock in stockpiles at the old quarry site, assayed 0.82 and 0.48 ounce silver per ton (28 and 16 g/t). They were not analyzed for aluminum; however, the investigation during World War II showed the corundum-bearing rock to be 43.03 percent alumina (Al_2O_3).

The deposit has little potential as a source of corundum, which appears to be low-grade and spotty, but the high alumina content may make it a potential source of aluminum. Alunite, a mineral with an alumina content of about 37 to 39 percent, is presently being investigated as an alternative to bauxite as a source of aluminum.

The Great Western Mine and vicinity (samples 738-753)

Sixteen samples were taken from the Great Western mine which is located on a ridge in NE 1/4 sec. 15. It is reached by means of a four-wheel-drive vehicle road up Jasper Canyon from Big Bear Creek (fig. 18). Part of the property lies within the study area but the

Figure 18. Near here.

workings, which include an open pit and two adits, are just outside it. Ruined buildings and mill foundations are in the mine area. The mine is in a deposit of auriferous breccia which is cemented with silica. The fragments constituting the breccia are commonly less than 3 inches (8 cm) in diameter. Outcrops of the breccia are orange-red and contrast the color of other gold-bearing breccias in the area which are yellowish-tan.

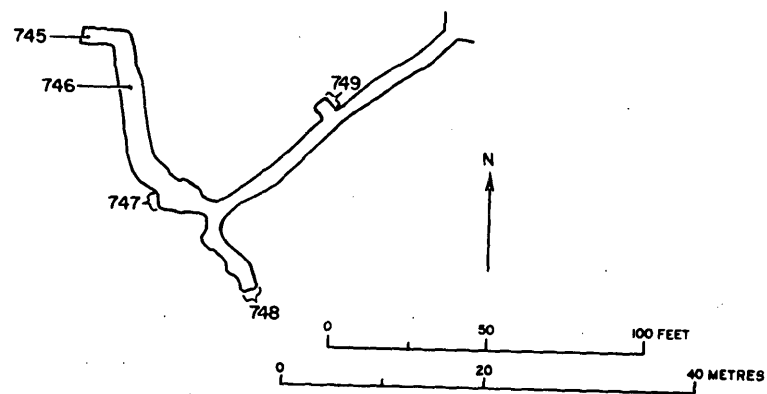


FIGURE 18. - Plan of upper adit of the Great Western mine.

The breccia was staked as early as 1887 when J. C. Coggins and L. H. Bourne located a group of claims. In 1902, Minor D. Gaylord and F. F. Parsons relocated the deposit as the Castle Rock group. The breccia was again located in about 1910 by Fred Pfingsten and Hugh Grafton, pioneer settlers in the area. The Great Western name evidently was given to the mine in 1908 by T. J. Grafton. It was relocated by that name in 1910, 1911, 1939, and 1965. Other location names used include the Mabel Pershing group, in 1955, and the Pershing group from 1955 to 1958. In 1974, the Great Western mine was under lease, with option to buy, to the Azcon Corporation of St. Louis, Mo. Azcon is a Consolidated Gold Fields Group Company.

Samples 738-744

Seven samples were taken from the open pit. The pit, or cut, is about 50 feet (15.3 m) long and bears N.40°W. It is open on the southeast end and is 47 feet (14.3 m) at the face--the northwest end. The width ranges from 13.3 feet (4.1 m) at the open end to 20.7 feet (6.3 m) near the face. Samples were taken around the perimeter of the pit across two 20-foot (6.1 m) intervals in each wall and across two 8-foot (2.4 m) intervals in the face. Assay results are shown in the following table:

<u>Sample No.</u>	<u>Type</u>	<u>Gold</u>		<u>Silver</u>		<u>Value</u>	
		(ounce per ton)	(g/t)	(ounce per ton)	(g/t)	(\$/ton)	(\$/t)
738	20-foot random chip	0.03	1.0	0.56	19	7.86	8.65
739	-----do-----	.01	0.3	.20	7	2.10	2.31
740	8-foot random chip	.01	0.3	.38	13	3.78	4.16
741	-----do-----	.02	0.7	.54	18	6.24	6.86
742	20-foot random chip	.02	0.7	.82	28	7.92	8.71
743	-----do-----	.01	0.3	.62	21	5.22	5.74
744	3-inch chip	.03	1.0	.80	27	9.30	10.23

A fault plane forms the northwest wall of the pit. Several samples of fault gouge were panned and found to contain gold flakes. A sample (744) of the material assayed only 0.03 ounce gold per ton (1.0 g/t) and 0.80 ounce silver per ton (27 g/t), about \$9.30 per ton (\$10.23/t), but the width of the sample was only 3 inches (8 cm).

Samples 745-749

Five samples were taken from the upper underground working of the Great Western mine. The working consists of an adit that was driven S.50°W. about 100 feet (about 30 m), two drives extend from the end of the adit, one about 75 feet (about 23 m) N.35°W. and the other 25 feet (7.6 m) S.30°E. The working apparently was the result of an endeavor to undercut the open pit. The samples were of breccia and gouge; assay results generally were fairly high as listed in the following table:

<u>Sample No.</u>	<u>Type</u>	<u>Gold</u>		<u>Silver</u>		<u>Zinc</u> <u>(percent)</u>	<u>Value</u>	
		<u>(ounce</u> <u>per ton)</u>	<u>(g/t)</u>	<u>(ounce</u> <u>per ton)</u>	<u>(g/t)</u>		<u>(\$/ton)</u>	<u>(\$/t)</u>
745	Muck-pile grab	0.005	0.2	0.08	2.7			
746	-----do-----	.05	1.7	.12	4.1	0.05	11.00	12.10
747	3.2-foot chip	.02	0.7	5.04	172.9		33.24	36.56
748	4.0-foot chip	.02	0.7	.56	19.2		6.36	7.00
749	3.5-foot chip	.02	0.7	6.86	235.3		44.16	48.58

Samples 750-751

A lower adit had several feet of water backed behind a small cave-in at the portal and could not be sampled. Two grab samples from the dump contained nothing of significance.

Samples 752 and 753

Two samples were taken of an outcrop of massive quartz occurring in the breccia body about one-fourth mile (about 400 m) southwest of the Great Western mine. The samples from a pit and a trench showed no significant metal values.

Lower South Fork of Rio Bonito Canyon (samples 754-758)

Five samples were taken at four prospect workings along the lower part of the Rio Bonito. Most of the workings are in NE 1/4 sec. 13 and outside the study area. Two of the samples (757 and 758), which were taken across 6 and 8 inch (15 and 20 cm) veins, assayed combined values of \$23.44 and \$30.59.

Samples 754 and 755

Two chip samples were taken from a trench excavated in a small exposure of altered syenite near the wilderness boundary on the west bank of the canyon. Assay results were negligible.

Sample 756

Sample 756 was taken from a prospect pit located about 2,000 feet (610 m) downstream from sample sites 754-755. The pit exposes a shear zone in syenite. The sample, a 3.2 foot (98 cm) chip sample, taken across the exposure contained no significant values.

Samples 757 and 758

Two samples were taken from a silver, lead, and zinc deposit located on the west side of the South Fork campground. Sample 757 was taken at the portal of an adit that extends 105 feet (32.0 m) or more. A water-filled winze is located 35 feet (10.7 m) from the portal. The sample was taken across a 6 inch (15 cm) iron- and manganese-stained quartz vein in a 3-foot (91 cm) wide shear zone and assayed 1.38 ounces silver per ton (47 g/t), 0.82 percent lead, 0.65 percent zinc, and less than 1,000 ppm molybdenum, for a total value of \$23.44 per ton (\$25.78/t).

Sample 758 was taken across an 8 inch (20 cm) vein associated with a lamprophyre dike that strikes N.75°E. The vein is exposed in a prospect pit on the hillside about 50 feet (15.2 m) above the adit just described. The sample assayed 3.36 ounces silver per ton (115 g/t), 0.78 percent lead, and less than 1,000 ppm molybdenum, about \$30.59 per ton (\$33.65/t).

Walt Smith Canyon (samples 759-764)

Six samples were taken from the vicinity of three workings in Walt Smith Canyon, a tributary of South Rio Bonito Canyon. The workings are in NE 1/4 sec. 13 and outside the study area. Only one sample (760) contained values in excess of \$5.00 per ton (\$5.50/t). Two other samples (761 and 762) contained significant silver values--0.56 and 0.52 ounces per ton (19 and 18 g/t), respectively.

Claims were first located in the area about 1882. The Yours Truly claim, one of the first, was located in 1882 and again in 1898 by H. Consbruck, who also claimed the Humbolt in the same area during the period 1898-1918. Other claims in the vicinity were located by A. Waldschmidt, for whom the canyon was named.

Samples 759-761

Three samples were taken from a bulldozed cut in a broad zone of altered syenite or monzonite containing narrow quartz veins. The cut may obscure a shaft and dump. The samples were cut across an interval of 9.8 feet (3.0 m) in the face of the cut. One sample (760) was taken across 30 inches (76 cm) of weathered quartz and black, dense limonite, and assayed 1.90 ounces silver per ton (65 g/t). Another sample (761) of the same material(?) contained 0.56 ounce silver per ton (19 g/t).

Samples 762, 763, and 764

Three samples were taken from an area several hundred feet east of the dozer cut. Located there is a water-filled adit, reported to be 100 feet (30.5 m) long. A 5-foot (1.5 m) chip sample (762) across the brow at the portal assayed 0.52 ounce silver per ton (17.8 g/t).

A 3.5-foot (1.1-m) channel sample (763) was taken across a quartz vein in a small cut above the adit. It contained no important values. Three feet (91 cm) of weathered quartz on the hanging wall and 1-foot (31 cm) on the footwall (west side) were combined in a sample (764); the assay results were insignificant.

Rodamaker Canyon (sample 809)

Only one of the several excavations observed in lower Rodamaker Canyon was sampled. The working is about 100 yards (91.5 m) north of the proposed addition. It consists of a 200-foot (61.0 m) deep shaft, 8 by 10 feet (2.4 by 5.1 m) in section, from which, at the 50-foot (15.3 m) level, a 20-foot (6.1 m) drift was driven bearing N.18°W. The drift followed a 4-inch (10 cm) vein that dips 72° SW. A chip sample (809) taken across the vein 10 feet (3.1 m) from the shaft in the north wall of the drift contained 0.2 ounce silver per ton (7 g/t).

Eagle Creek (samples 810-813)

Four samples were taken from the vicinity of four workings located on Eagle Creek near the center of sec. 25, T. 10 S., R. 11 E. Three of the pits are within the newly proposed addition, and one is just outside.

A grab sample (810) from the dump of a shallow trench 15 feet (4.6 m) long assayed neither gold nor silver values. A grab sample (811), taken from the dump of a small pit excavated on a series of quartz stringers, yielded only 0.2 ounce silver per ton (7 g/t); a random chip sample (812) across a 15-foot (4.6 m) limonitic zone at a prospect pit showed 0.1 ounce silver per ton (3 g/t). The limonitic zone trends N.70°E. Gold and silver values were nil in a random chip sample (813) taken in an old prospect cut just outside the proposed addition.

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Dark Betsy Canyon and vicinity

(samples 799, 800, and 806-808)

Five samples were taken from five workings in the Dark Betsy Canyon and vicinity (fig. 19). All the workings are within the study

Figure 19.--Near here.

area but are distant from the wilderness. Two of the samples (807 and 808) contained values in excess of \$5.00 per ton (\$5.50/t).

Sample Site 799 and 800

Two samples were taken from two workings in weathered andesite about 1 mile (1.6 km) up Bonito Canyon from the mouth of Dark Betsy Canyon. A random chip sample (799) was cut in a prospect pit; a grab sample (800) was taken from the dump of a caved adit. Neither sample assayed values in gold and silver.

Sample Site 806

The sample was collected from a shallow 30 foot (9.2 m) trench located east of Dark Betsy Canyon in the south-central part of sec. 11. The trench exposed a pyritized zone in weathered diorite. Assay results for gold and silver were nil in a random chip sample (806) taken across the zone.

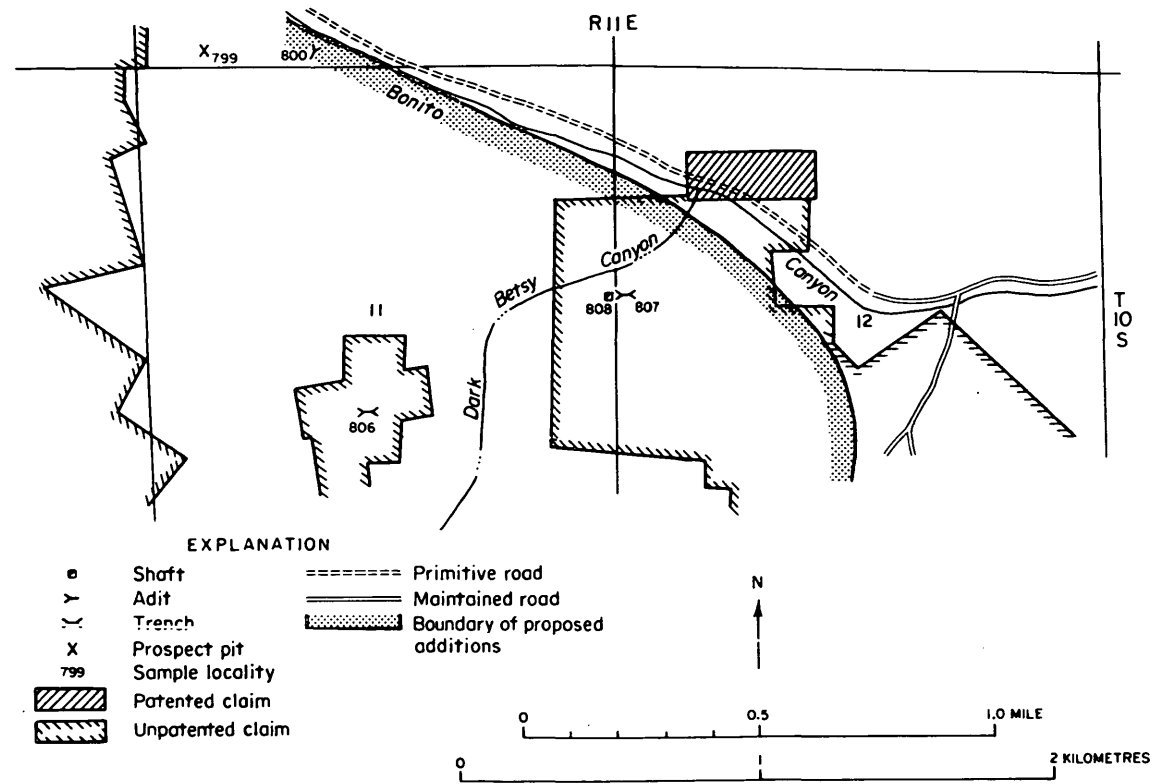


FIGURE 19.—Map of Dark Betsy Canyon and vicinity.

Sample Site 807 and 808

The samples came from a prospect trench and the ore dump of a caved shaft just south of Dark Betsy Canyon and on the north-south section line between secs. 11 and 12. A sample (807) of a 6- to 8-inch (15- to 20-cm) galena-bearing quartz vein was taken in the 25-foot (7.6 m) long trench. Assay results were 0.2 ounce silver per ton (7 g/t), 0.78 percent lead, and 0.49 percent zinc for a combined value of \$6.86 per ton (\$7.54/t). A grab sample (808) from a stockpile near the caved shaft contained 1.3 ounces silver per ton (45 g/t), 1.91 percent lead, and 1.26 percent zinc, about \$25.02 per ton (\$27.53/t).

Non-metallic mineral resources

Fluorite crystals occur in miarolitic cavities and open fractures in all three of the mapped lithofacies of the Three Rivers stock, and cryptocrystalline fluorite occurs in silica veinlets that characterize hydrothermally altered parts of the intrusion (Giles and Thompson, 1972, p. 2134-2136). Accessory fluorite also occurs in the plug at Cone Peak (Thompson, 1974, p. 17). Pyrochlore, believed to be present in stream sediments at the head of Indian Creek, also contains the element fluorine. It is extremely unlikely, however, that fluorite occurs in or near the wilderness area in concentrations sufficiently high to be of economic significance.

Specimen-quality quartz-crystals as much as 6-8 inches (15-20 cm) long are found in the miarolitic cavities and open fractures of the Three Rivers stock. These have been collected by local people on a small scale and sold to tourists. The principal collecting localities are along and east-facing escarpment of the watershed divide between Three Rivers and South Fork Rio Bonito (T. 10 S., R. 11 E., sec. 29).

Corundum occurs near the northeastern edge of the Three River stock. It is very fine-grained and so sparsely distributed in the host rock (sericitized syenite) that it is not commercially minable.

An alumina-rich zone near the mouth of Blue Front Canyon in the southeastern part of the wilderness may have potential as a source of aluminum. In particular, a large area with an indicated alumina (Al_2O_3) content in excess of 40 percent warrants further investigation.

Lenses in the Walker andesite breccia, on the south side of Barber Ridge (T. 10 S., R. 10 E., sec. 14) contains carbonaceous remains of wood (Thompson, 1966, p. 103), but these lenses are not of high-enough carbon content or extent to constitute a minable source of fuel. No potential for petroleum production exists in the area.

Sand and gravel deposits, although present in the wilderness and its proposed additions, are much smaller and less accessible than those of adjacent areas, so that it is inconceivable that they could ever be of economic value in the foreseeable future.

Massive syenite suitable for building stone is plentiful, but the combination of distance from markets and competition from cheaper building materials makes it improbable that this resource would ever be used.

Geothermal resources

The potential for the existence of a geothermal energy resource in the area appears poor, for no known thermal springs or young igneous rocks occur in the wilderness and its proposed additions. Little Black Peak, located 10 mi (16 km) north of Carrizozo (fig. 1) is the source of a basaltic lava flow which may have been extruded in historic time (Allen, 1951, p. 9-11), but despite its nearness, there is no evidence that volcanic activity took place in the White Mountains since Oligocene time.

References cited

- Allen, J. E., 1951, The Carrizozo malpais: Roswell Geol. Soc., 5th Field Conf., Guidebook of the Carrizozo-Capitan-Chupadera Mesa region, Lincoln and Socorro Counties, New Mexico, p. 9-11.
- Anderson, E. C., 1957, The metal resources of New Mexico and their economic features through 1954: New Mexico Bur. Mines and Mineral Resources Bull. 39, 92 p.
- Bodine, M. C., 1956, Geology of the Capitan coal field, Lincoln County, New Mexico: New Mexico Bur. Mines and Mineral Resources Circ. 35.
- Bonito Watershed Act, 53 Stat. 817, 16 U.S.C. 482e-482j, 1939.
- Bretz, J. H., and Horberg, C. L., 1949, The Ogallala formation west of the Llano Estacado (New Mexico): Jour. Geology, v. 57, no. 5, p. 477-490.
- Dane, C. H., and Bachman, G. O., 1965, Geologic map of New Mexico: U.S. Geol. Survey, 1:500,000.
- Darton, 1922, Geologic structure of parts of New Mexico: U.S. Geol. Survey Bull. 726-E, p. 173-275.
- Elston, W. E., and Snider, H. L., 1964, Differentiation and alkali metasomatism in dike swarm complex and related igneous rocks near Capitan, Lincoln County, New Mexico, in New Mexico Geol. Soc. Guidebook 15th Field Conf., Ruidoso Country: p. 140-147.
- Gaylord, M. D., 1901, Nogal mining district: International Industrial Record, July 20, 1901, p. 35-37.
- Giles, D. L., and Thompson, T. B., 1972, Petrology and mineralization of a molybdenum-bearing alkalic stock, Sierra Blanca, New Mexico: Geol. Soc. America Bull., v. 83, p. 2129-2148.

- Graton, L. C., 1910, in Lindren, Waldemar, Graton, L. C., and Gordon, C. H., The geology and ore deposits of New Mexico: U.S. Geol. Survey Prof. Paper 68, 361 p.
- Griswold, G. B., 1959, Mineral deposits of Lincoln County, New Mexico: New Mexico Bur. Mines and Mineral Resources Bull. 67, 117 p.
- Griswold, G. B., and Missaghi, Fazlollah, 1964, Geology and geochemical survey of a molybdenum deposit near Nogal Peak. Lincoln County, New Mexico: New Mexico Bur. Mines and Mineral Resources, Circ. 67, 24 p.
- Holmes, W. H., 1877, Report (on the San Juan district, Colorado); U.S. Geol. and Geog. Survey Terr. 9th Ann. Rept. for 1875, p. 245, 248, pl. 35.
- Jones, F. A., 1904, New Mexico mines and minerals: Santa Fe, New Mexico Printing Co., 349 p.
- Kelley, V. C., and Silver, C., 1952, Geology of the Caballo Mountains with special references to regional stratigraphy and structure and to mineral resources, including oil and gas: New Mexico Univ. Pub. Geol., no. 4, 286 p.
- Kelley, V. C., and Thompson, T. B., 1964, Tectonics and general geology of the Ruidoso-Carrizozo region, central New Mexico, in New Mexico Geol. Soc. Guidebook 15th Field Conf., Ruidoso Country, p. 110-121.
- Lasky, S. G., and Wooton, T. P., 1933, The metal resources of New Mexico and their economic features: New Mexico Bur. Mines and Mineral Resources Bull. 7, 178 p.

- Mardirosian, C. A., 1964, Geochemical exploration of Crow mine area,
Lincoln County, New Mexico: Univ. of Utah Graduate School, 84 p.
- Richmond, G. M., 1964, Glacial deposits on Sierra Blanca Peak,
New Mexico, in New Mexico Geol. Soc. Guidebook 15th Field Conf.,
Ruidoso Country: p. 76-78.
- Thompson, T. B., 1964, A stratigraphic section of the Sierra Blanca
Volcanics in the Nogal Peak area, Lincoln County, New Mexico, in
New Mexico Geol. Soc. Guidebook 15th Field Conf., Ruidoso
Country: p. 76-78.
- _____ 1966, Geology of the Sierra Blanca, Lincoln and Otero Counties,
New Mexico: New Mexico Univ., Ph.D. thesis, 146 p.
- _____ 1968, Hydrothermal alteration and mineralization of the Rialto
stock, Lincoln County, New Mexico: Econ. Geology, v. 63, p. 943-949.
- _____ 1972, Sierra Blanca igneous complex: Geol. Soc. America Bull.,
v. 83, p. 2341-2356.
- _____ 1973, Mineral deposits of Nogal and Bonito mining district,
New Mexico: New Mexico Bur. Mines and Mineral Resources Circ.
123, 29 p.
- _____ 1974, Geology and mineral deposits--Sierra Blanca igneous complex
in New Mexico Geol. Soc. and New Mexico Bur. Mines and Mineral
Resources. Symposium on base metal and fluorspar districts of New
Mexico abstracts, p. 16-17.
- Weber, R. H., 1964, Geology of the Carrizozo quadrangle, New Mexico,
in New Mexico Geol. Soc. Guidebook 15th Field Conf., Ruidoso
Country: p. 100-109.

Table 1.--*Semiquantitative spectrographic analyses of selected elements in unmineralized syenitic and volcanic rocks in the White Mountain Wilderness and vicinity, New Mexico.*

[Number in parentheses below element symbol is lower sensitivity limit. ppm, parts per million; L, indicates that element was detected, but in amount too low to determine; N, indicates element was looked for but not found.]

Semiquantitative spectrographic analyses

Sample	T. R. S. (pl. 2)	(ppm)								
		Cu (5)	La (20)	Mo (5)	Nb (10)	Pb (10)	Sc (5)	Sr (100)	Y (5)	Zr (10)
Syenitic rocks										
1	10-11-32	15	100	20	50	50	10	150	70	200
1A	10-11-33	15	200	50	70	50	7	N	70	700
2A	10-11-32	5	500	100	50	70	7	100	200	50
3	10-11-32	20	30	3	20	70	7	300	20	100
3A	10-11-32	L	300	30	150	200	7	L	70	700
4	10-11-32	20	70	3	20	30	7	500	30	150
4A	10-11-29	5	20	30	30	70	7	100	70	700
5	10-11-29	L	100	N	50	20	7	200	50	150
5A	10-11-29	L	20	N	30	20	7	N	30	200
6	10-11-29	7	100	N	30	20	7	200	50	100
6A	10-11-29	5	150	N	50	20	15	100	70	500
7	10-11-29	7	100	7	50	30	10	200	70	200
7A	10-11-29	N	150	5	30	20	10	N	70	500
8	10-11-20	20	100	20	30	20	7	500	30	150
8A	10-11-20	5	100	15	30	30	10	N	30	200
9	10-11-20	15	100	L	50	30	7	200	50	200
9A	10-11-20	10	N	N	30	20	7	N	20	150
11A	10-11-20	15	200	N	70	30	15	N	70	700
12A	10-11-20	15	150	N	50	30	10	N	70	500
13A	10-11-20	N	150	N	70	70	10	N	70	700
14	10-11-30	20	70	N	10	15	5	150	50	100
14A	10-10-25	L	150	N	30	50	10	300	50	150
15A	10-11-24	10	70	70	30	10	7	N	20	200
16A	10-11-24	N	150	150	50	300	15	N	50	500
17A	10-11-24	10	70	N	30	30	10	500	30	200
18A	10-11-24	N	100	N	30	30	10	500	50	200
19A	10-11-34	5	200	5	70	30	10	N	70	700
20A	10-11-34	L	100	10	70	70	10	N	70	500
22A	10-11-35	L	100	5	30	30	10	N	30	200
23A	10-11-35	10	150	5	50	30	10	N	50	300
23B	10-11-35	N	70	70	30	20	7	N	30	200
24A	10-11-34	5	300	30	70	30	10	N	150	500
25A	10-11-34	5	20	100	50	50	10	N	70	500
30	10-11-28	5	150	7	50	20	7	200	70	300
41	11-11-5	15	150	7	70	30	7	200	100	300
44	11-11-6	L	70	N	30	20	5	150	30	200
80	10-11-32	50	70	N	30	30	7	300	30	200
84	10-11-32	7	100	10	70	50	10	200	70	300
89	10-11-20	10	150	L	70	50	10	200	70	300
90	10-11-20	10	100	5	50	20	7	500	50	200
91	10-11-17	10	70	L	50	20	10	700	50	300
92	10-11-17	10	150	7	70	30	7	300	70	300
101	10-11-20	20	70	15	30	20	10	700	30	150
104	10-11-20	50	70	70	30	15	7	200	50	200
307	10-11-32	20	70	20	50	50	7	150	50	150
308	10-11-32	15	150	70	50	70	10	200	50	200
309	10-11-32	10	70	30	50	30	7	200	30	200
310	10-11-31	15	50	5	30	30	7	150	20	200
311	10-11-31	15	70	N	30	30	7	150	20	300
312	10-11-31	15	100	N	30	30	10	150	30	200
313	11-11-6	15	70	N	30	20	7	300	20	200
314	11-11-6	10	150	5	70	30	7	150	50	300
315	11-10-1	15	150	7	20	20	7	300	30	100
411	10-10-36	20	70	N	20	20	7	200	30	100
413	10-11-20	10	70	15	20	20	10	200	30	100
414	10-11-20	15	70	L	20	20	7	200	20	100
415	10-11-20	10	70	7	30	20	10	200	30	100
416	10-11-21	10	70	7	30	20	10	150	50	150
417	10-11-21	10	70	10	30	20	7	150	30	100
418	10-11-21	15	50	L	15	15	5	200	20	70

Semiquantitative spectrographic analyses--Continued

Sample	T. R. S. (pl. 2)	(ppm)								
		Cu (5)	La (20)	Mo (5)	Nb (10)	Pb (10)	Sc (5)	Sr (100)	Y (5)	Zr (10)
Syenitic rocks--Continued										
419	10-11-21	20	30	N	10	30	5	150	15	50
420	10-11-21	20	50	5	20	20	10	150	30	70
421	10-11-21	15	50	N	15	20	5	150	20	50
422	10-11-22	15	30	N	15	15	5	150	20	50
426	11-11- 4	7	150	15	30	70	10	200	70	100
427	11-11- 4	5	150	15	30	50	10	200	70	300
428	11-11- 4	L	150	30	30	30	7	200	50	200
429	11-11- 4	15	100	50	50	50	7	150	50	300
430	11-11- 4	L	200	7	30	30	10	150	70	200
431	11-11- 9	L	150	N	30	50	10	200	70	500
436	10-11-33	7	70	10	50	70	5	100	30	200
437	10-11-33	10	70	7	20	30	7	200	50	500
440	10-11-34	15	70	5	30	20	7	200	30	200
441	10-11-34	7	150	20	70	20	7	150	70	1000
443	10-11-35	15	50	5	50	20	7	150	50	300
445	10-11-27	15	50	L	20	20	5	150	20	200
446	10-11-26	15	N	N	N	10	N	100	N	30
447	10-11-26	30	50	15	20	30	7	300	20	150
448	10-11-26	20	70	7	20	20	5	200	30	150
752	10-12-13	5	70	N	20	15	7	300	20	300
753	10-12-13	5	70	N	30	10	7	300	15	150
755A	10-12-24	20	70	N	30	10	15	700	20	300
Volcanic rocks										
26A	9-11-19	20	70	N	20	30	15	1000	30	150
27A	9-11-19	15	20	N	N	30	15	700	20	100
29A	9-11-19	15	70	N	N	20	20	1000	30	150
31A	9-11-19	15	20	N	N	20	30	1000	30	100
48	10-11-19	20	70	N	20	15	15	1000	30	100
53	10-11-19	15	70	N	30	15	7	700	30	150
94	10-11-17	30	70	L	20	15	10	1500	30	150
116	9-11-27	20	100	5	50	20	7	1500	30	150
121	9-11-28	15	70	L	50	20	10	1000	30	150
123	9-11-33	20	70	5	30	15	10	700	30	150
124	9-11-32	15	100	N	30	20	5	500	30	150
127	9-11-32	15	100	L	30	15	7	1000	30	150
128	9-11-32	10	100	L	30	15	7	1000	50	150
129	9-11-32	15	70	L	20	15	7	700	30	150
130	9-11-28	10	70	5	30	20	10	1000	30	150
131	9-11-28	10	100	L	30	15	7	1500	30	150
135	9-11-28	15	100	N	50	15	7	700	30	150
140	9-11-28	10	50	7	20	15	15	700	30	100
142	9-11-28	10	70	N	50	30	7	500	20	100
144	9-11-28	15	100	7	70	70	5	500	20	150
145	9-11-28	15	70	N	50	30	7	500	20	150
146	9-11-28	15	70	5	50	50	7	500	20	150
147	9-11-21	10	70	L	50	30	10	300	30	150
148	9-11-21	10	70	L	20	20	15	700	30	100
154	10-11- 6	20	100	N	30	20	10	1000	30	100
156	10-11- 7	10	100	N	70	30	5	500	20	100
159	10-10-12	15	70	N	50	15	10	700	30	100
163	10-10-12	15	100	N	30	20	10	1500	20	100
165	10-10-11	70	70	N	30	15	15	2000	30	100
166	10-10-14	50	70	N	30	15	15	2000	30	100
167	10-10-14	20	70	N	20	15	20	1000	30	70
173	10-10-14	30	70	N	30	20	10	1500	20	100
174	10-10-14	30	50	N	20	15	20	1000	30	70
184	9-11-10	20	150	L	50	30	5	1000	30	150
187	9-11-10	15	100	N	50	30	5	1000	30	200

Semiquantitative spectrographic analyses--Continued

Sample	T. R. S. (pl. 2)	(ppm)								
		Cu (5)	La (20)	Mo (5)	Nb (10)	Pb (10)	Sc (5)	Sr (100)	Y (5)	Zr (10)
Volcanic rocks--Continued										
198	10-11- 6	20	100	N	30	15	7	2000	30	150
199	10-11- 6	20	150	N	30	15	7	2000	30	150
201	10-11- 6	20	100	N	20	15	10	1500	30	150
203	10-10- 1	20	70	N	20	15	15	1000	30	150
212	10-10- 2	30	70	N	15	15	15	1000	20	100
217	9-11- 2	15	100	N	50	20	7	1000	30	300
227	9-11- 9	20	70	N	20	30	7	500	20	100
228	9-11- 9	15	100	N	30	20	7	700	30	100
234	9-11- 4	15	100	N	30	70	7	700	30	70
240	9-11-32	20	70	L	30	20	10	500	50	150
241	9-11-32	15	70	L	20	15	10	700	30	100
253	9-11-30	30	70	N	20	10	50	1000	30	70
254	9-11-30	70	100	L	20	30	30	150	20	70
258	9-11-23	15	70	30	50	15	10	300	30	150
268	9-11-21	15	70	N	30	15	10	300	30	150
276	9-11-17	50	100	N	30	20	15	1500	50	150
281	9-11-17	50	70	N	30	20	15	1000	30	100
289	9-11-31	15	100	N	30	15	10	500	30	100
291	9-11-31	30	70	N	30	20	7	300	30	150
291A	10-11- 6	20	50	L	10	15	10	2000	15	100
300	9-10-36	50	70	N	20	15	15	1000	30	70
304A	9-10-36	50	N	L	N	N	7	300	10	30
316	11-10- 1	20	70	5	50	20	7	700	20	150
317	11-10- 1	30	50	7	50	20	7	700	20	150
318	10-10-36	20	70	7	30	20	7	300	30	200
319	10-10-35	20	70	N	20	15	10	1000	30	150
320	10-10-35	50	50	N	20	15	15	700	20	100
321	10-10-35	30	70	N	20	10	15	1000	20	100
322	10-10-35	20	70	N	15	10	15	1000	20	100
324	9-11-16	50	70	N	30	15	7	700	20	150
328	9-11-17	20	70	L	30	30	10	300	30	100
365	9-11- 5	50	70	15	20	70	10	1000	20	100
368	9-11- 5	20	50	N	20	30	15	700	20	100
374	9-11-10	15	70	5	30	50	7	1000	30	200
376	9-11- 9	15	70	5	30	30	5	500	20	150
379	9-11- 4	20	100	N	30	20	15	1000	50	150
383	9-11- 4	30	70	5	20	20	15	1000	30	150
386	9-11- 4	15	70	L	50	20	7	1500	30	150
391	8-11-34	30	70	N	30	20	10	700	30	100
393	9-11-28	20	70	L	30	20	7	700	30	150
402	9-11-34	30	70	5	30	30	10	1000	30	200
405	9-11-34	50	70	L	30	50	10	1000	30	150
423	10-11-15	30	70	10	30	30	7	500	30	70
731	9-11-19	10	30	N	15	30	15	300	20	500
737	9-10-35	5	50	5	20	L	7	700	20	300
746	9-10-35	30	30	N	L	L	15	1000	20	150
749	9-11-13	50	30	L	L	L	15	1000	15	150
750	9-11-11	10	30	L	30	20	7	300	15	300
776	10-11-11	20	70	N	70	10	L	150	20	300
778	10-11-11	20	30	N	30	15	L	150	30	500
783	10-11-11	30	20	7	20	L	7	150	N	150
785	9-11-26	100	50	L	30	20	10	500	15	300
9/ E6	10-10-35	20	100	N	20	10	15	1500	30	70
E24	10-10-34	50	70	N	15	15	15	1500	30	70
E25	10-10-34	20	70	N	10	15	15	1000	15	100

Semiquantitative spectrographic analyses--Continued

Sample	T. R. S. (pl. 2)	(ppm)								
		Cu (5)	La (20)	Mo (5)	Nb (10)	Pb (10)	Sc (5)	Sr (100)	Y (5)	Zr (10)
Volcanic rocks--Continued										
E48	10-10-26	20	50	N	15	15	15	1000	30	100
E50	10-10-26	20	70	N	15	15	15	1000	30	100
E72	10-11- 6	15	100	N	30	15	10	1000	30	100
E77	10-11- 6	15	100	N	30	15	10	1500	30	100
E146	10-10- 2	30	70	N	20	15	15	1000	30	100
E151	10-10- 2	20	70	N	10	15	15	700	30	100
E152	10-10- 2	20	70	N	15	15	15	1000	20	100
E157	9-10-35	20	70	N	20	15	15	700	30	150
E172	9-11-15	20	70	N	30	15	10	1000	30	150
E179	9-11-21	15	100	L	50	15	10	500	30	150
E213	9-11-17	15	100	N	50	20	7	1500	30	150
E219	10-11- 5	20	70	N	30	20	10	700	30	150
E221	10-11- 5	20	70	L	50	20	10	700	30	150
E245	9-11-24	20	70	L	30	30	7	1000	30	150
E248	8-12-36	30	70	N	15	30	15	500	30	200
E259	8-11-36	70	70	L	30	20	10	700	30	150
E263	9-11- 5	50	50	N	20	30	10	700	20	100
E264	9-11- 5	50	30	N	20	50	7	700	15	100
E265	9-11- 8	50	70	N	20	30	10	700	20	150
E357	10-10-11	30	70	N	10	20	15	1000	20	70

- 1/ Sample 2A contains 15 ppm beryllium and 300 ppm zinc.
- 2/ Sample 5 contains 10 ppm beryllium.
- 3/ Sample 5A contains 15 ppm beryllium.
- 4/ Sample 8 contains 15,000 ppm manganese.
- 5/ Sample 16A contains 3 ppm silver.
- 6/ Sample 20A contains 300 ppm zinc.
- 7/ Sample 23B contains 0.7 ppm silver.
- 8/ Sample 24A contains 0.5 ppm silver.
- 9/ Sample E24 contains 7,000 ppm manganese.

Table 2.--*Semiquantitative spectrographic analyses of selected stream sediments, those with anomalous concentrations of at least one element in the White Mountain Wilderness and vicinity, New Mexico.*

[Number in parentheses below element symbol is lower sensitivity limit. ppm, parts per million; L, indicates that element was detected, but in amount too low to determine; N, indicates element was looked for but not found.]

Semi quantitative spectrographic analyses

Sample	T. R. S. (pl. 2)	(ppm)								
		Cu (5)	La (20)	Mo (5)	Nb (10)	Pb (10)	Sc (5)	Sr (50)	Y (5)	Zr (10)
10	10-11-20	10	100	L	50	20	10	700	50	200
13	10-11-19	10	70	10	30	20	7	700	50	150
20	10-10-36	20	70	L	20	100	15	1500	30	100
22	10-10-35	20	70	N	20	50	15	1000	30	100
27	10-11-28	15	150	15	70	50	7	150	150	200
28	10-11-28	10	150	10	50	20	10	200	70	200
29	10-11-28	15	100	20	30	20	5	150	50	200
32	10-11-22	5	100	20	50	30	7	200	50	300
36	10-11-23	L	150	15	50	30	7	150	50	200
37	10-11-32	7	150	30	70	70	7	200	100	200
1/38	10-11-32	15	150	7	70	70	7	200	100	300
2/39	10-11-32	30	300	5	50	50	7	300	1500	300
3/40	10-11-32	L	100	15	100	70	5	100	100	500
42	11-11- 6	15	150	7	50	30	7	200	70	200
43	11-11- 6	L	150	10	70	30	7	150	70	300
55	10-11-18	10	70	N	30	20	10	2000	30	100
63	10-11- 7	15	100	N	50	15	7	2000	30	100
79	10-11-32	7	100	15	30	30	7	500	50	200
85	10-11-31	7	100	15	50	30	7	200	70	300
88	10-11-30	7	150	10	70	30	10	200	70	300
100	10-11-20	20	100	15	30	30	10	1000	30	150
105	10-11-20	20	150	15	20	20	5	200	50	150
113	10-11- 8	70	150	L	50	200	7	500	50	300
125	9-11-32	15	150	N	70	20	7	500	50	300
139	9-11-29	50	70	L	20	15	7	1000	30	150
150	9-11-21	10	100	N	70	30	5	700	30	150
153	9-11-27	10	100	L	70	30	7	1000	30	150
168	10-10-14	50	70	N	20	15	15	2000	30	70
170	10-10-14	50	100	N	30	20	10	2000	30	100
172	10-10-14	30	70	N	30	20	15	2000	30	100
177	10-10-14	20	70	N	15	10	15	2000	30	70
178	10-10-14	30	70	N	20	15	15	2000	30	100
179	10-10-14	30	70	N	20	15	15	2000	30	70
180	10-10-15	20	70	N	20	15	15	2000	30	70
197	9-11- 3	20	100	L	30	30	7	2000	30	150
202	10-10- 1	15	100	N	30	20	7	2000	30	150
208	10-10- 1	50	70	N	20	20	15	1000	30	150
209	10-10- 1	50	70	N	20	20	20	1000	30	150
213	10-10- 2	50	70	N	20	15	15	1500	30	100
214	9-11- 2	15	70	N	70	20	5	500	30	300
218	9-11- 2	10	100	N	70	20	5	1000	30	200
219	9-11- 2	20	150	N	50	20	7	2000	30	200
220	9-11- 1	20	100	10	30	70	7	700	20	200
221	8-11-35	70	100	7	30	30	10	700	30	200
232	9-11- 9	50	100	7	30	50	7	700	20	100
238	9-11- 4	50	100	N	30	20	15	1500	30	100
249	9-11-30	50	70	N	30	20	15	700	30	100
250	9-11-30	50	50	N	20	15	30	700	20	70
251	9-11-30	50	70	N	30	20	30	1000	20	70
252	9-11-30	50	70	N	20	15	30	1000	30	70
255	9-11-22	30	70	20	50	30	7	500	30	150
260	9-11-23	20	70	15	30	20	7	500	30	150
263	9-11-14	20	70	7	50	50	15	700	30	100
264	9-11-14	30	70	7	30	50	10	700	30	100
265	9-11-14	20	70	L	50	50	10	500	30	150

Semiquantitative spectrographic analyses--Continued

Sample	T. R. S. (pl. 2)	(ppm)								
		Cu (5)	La (20)	Mo (5)	Nb (10)	Pb (10)	Sc (5)	Sr (50)	Y (5)	Zr (10)
266	9-11-14	20	100	7	50	50	10	1000	30	150
278	9-11-20	50	70	N	30	30	10	1000	30	70
279	9-11-17	50	70	N	30	15	10	1000	30	70
280	9-11-17	50	100	N	30	20	15	1000	30	100
282	9-11-17	50	70	N	30	20	15	1500	30	100
283	9-11-17	50	70	N	20	20	15	1000	30	70
284	9-11-17	50	70	N	30	20	10	1000	30	150
286	9-11-32	20	100	L	70	15	7	500	30	200
296	9-11-31	50	70	N	30	15	10	700	30	100
297	9-11-31	50	70	N	30	15	10	1500	30	100
298	9-11-31	50	70	N	30	20	7	1500	20	70
299	9-10-36	150	70	N	20	20	10	1000	20	70
301	9-10-36	50	70	N	20	15	10	500	20	100
302	9-10-36	50	70	N	20	10	10	500	20	100
303	9-10-36	50	70	N	20	10	10	700	20	100
304	9-10-36	50	70	N	30	15	15	1000	30	100
305	9-10-35	50	70	N	30	15	10	1000	30	70
326	9-11-16	50	70	L	50	30	7	500	30	150
332	9-11- 8	50	70	15	30	30	10	700	30	100
334	9-11- 8	50	70	L	30	30	15	1000	30	100
336	9-11- 8	300	70	L	30	30	10	1000	30	100
337	9-11-24	50	100	N	30	30	7	500	20	150
338	9-11-24	50	50	N	15	50	10	300	15	150
339	9-11-24	50	70	N	30	30	10	700	30	150
342	9-11-24	10	100	15	50	30	5	500	20	150
345	9-11-23	30	70	5	30	50	7	500	15	150
346	9-11-23	30	70	5	30	50	7	500	15	150
364	9-11- 5	30	70	N	30	100	10	700	20	150
367	9-11- 5	20	70	N	30	50	15	700	20	100
370	9-11- 5	50	70	N	20	30	15	1000	30	150
371	9-11-10	20	70	5	30	70	7	500	30	200
373	9-11-10	10	70	5	30	50	5	700	20	200
374	9-11- 9	15	70	5	30	50	7	1000	30	200
399	9-11-34	70	70	N	30	15	7	700	20	100
401	9-11-34	70	70	L	30	30	10	700	20	150
403	9-11-34	50	70	5	30	30	10	1000	30	150
404	9-11-34	50	70	L	30	100	10	1000	30	150
406	9-11-34	50	70	5	30	30	10	700	30	200
424	10-11-16	15	50	10	10	20	5	150	30	50
425	10-11-16	30	70	15	20	70	7	700	20	70
433	11-11- 4	7	70	15	50	50	7	150	30	200
434	11-11- 4	5	70	20	70	70	5	150	30	200
435	10-11-33	5	100	15	50	70	5	150	50	500
444	10-11-26	15	100	30	30	30	7	150	50	300
450	10-11-23	15	70	20	20	20	5	200	50	200
451	10-11-23	7	100	15	30	15	10	500	70	300
452	10-11-23	7	150	30	30	20	10	300	70	300
453	10-10-14	100	70	N	30	15	15	1500	30	150
454	10-10-14	50	70	N	20	15	15	1000	30	150
455	10-10-14	70	30	N	10	15	7	1000	15	70
456	10-10-14	70	70	N	15	15	15	1500	20	100
742	9-10-35	10	30	15	N	L	15	500	20	150
751	10-12-24	10	50	10	30	20	10	300	30	300
760	10-12-13	10	50	N	20	N	N	N	N	N
764	10-11-13	5	50	L	30	50	7	300	N	N

Semiquantitative spectrographic analyses---Continued

Sample	T. R. S. (pl. 2)	(ppm)								Zr (10)
		Cu (5)	La (20)	Mo (5)	Nb (10)	Pb (10)	Sc (5)	Sr (50)	Y (5)	
765	10-11-10	10	30	L	20	50	7	200	N	N
766	10-11-10	20	70	20	30	30	7	300	N	N
768	10-11- 4	30	30	N	20	100	7	500	N	N
770	10-11- 3	30	50	10	20	300	7	300	N	N
771	10-11- 4	20	30	N	20	70	7	500	N	N
773	10-11- 3	30	30	L	15	70	7	500	15	500
774	10-11-11	10	50	N	20	50	7	300	20	300
777	10-11-11	5	50	N	20	50	7	300	20	300
5/779	10-11-11	20	30	N	20	50	10	300	15	300
781	10-11-11	20	N	5	20	30	7	200	10	200
6/782	10-11-11	10	N	5	30	L	7	200	10	200
E1	10-10-34	15	70	10	20	10	15	1500	30	100
E11	10-11-14	L	100	20	50	20	7	500	50	150
E12	10-11-14	L	100	30	50	20	7	200	50	200
E13	10-11-14	7	70	10	50	20	7	300	50	200
E17	10-11-15	30	70	15	30	15	7	500	30	150
E19	10-11-15	20	70	20	30	15	10	500	50	200
E20	10-11-15	7	150	15	50	30	7	300	50	300
E21	10-11-15	5	100	10	50	20	7	300	50	300
E22	10-11-15	L	100	15	50	20	7	150	50	300
E38	10-11- 8	15	100	L	30	15	7	2000	30	150
E62	10-10-26	30	100	N	20	15	15	2000	30	100
E63	10-10-27	20	100	N	20	15	15	2000	30	100
E67	10-11- 5	15	70	N	30	15	7	2000	30	150
E88	10-11-16	10	150	10	50	20	15	300	50	200
E89	10-11-16	7	70	10	50	20	10	200	50	200
E90	10-11-16	7	100	10	50	20	10	300	50	200
E91	10-11-16	10	150	10	50	20	10	300	70	200
E92	10-11-16	10	100	10	50	20	10	200	50	200
E93	10-11-16	7	100	15	50	20	10	300	70	300
E94	10-11-16	7	150	10	50	20	15	300	50	300
E96	10-11-21	7	100	15	50	20	10	300	50	300
E97	10-11-21	7	70	10	30	20	7	300	30	150
E98	10-11-16	50	70	15	30	70	7	700	30	100
E99	10-11- 9	7	150	10	50	20	10	500	70	200
E100	10-11- 9	10	70	15	50	30	7	700	30	150
E104	10-11- 4	15	70	N	30	50	7	1500	30	150
E107	10-11- 4	20	70	5	30	70	7	1000	30	150
E108	10-11- 4	30	70	5	30	70	7	1000	30	100
E109	9-11-20	50	70	N	20	20	15	700	30	150
E111	9-11-20	50	70	N	30	15	15	1000	30	100
E112	9-11-20	70	70	N	30	30	15	1500	30	150
E114	9-11-20	70	70	N	20	30	10	1500	30	100
E115	9-11-26	20	100	10	30	20	7	1000	30	150
E116	9-11-23	30	100	15	20	15	7	1000	30	150
E119	9-11-27	50	70	15	20	30	7	1000	50	150
E122	9-11-27	50	70	15	30	30	10	700	30	150
E125	9-11-27	15	100	5	70	20	7	700	30	200
E129	9-11-27	20	100	15	20	30	10	700	30	100
E130	9-11-26	50	70	10	30	30	10	1000	30	100
2/E133	9-11-26	15	100	7	30	30	70	1000	30	100
E136	9-11-26	20	100	10	50	20	10	1000	30	150
E193	9-11-16	20	100	N	70	20	10	1000	30	150
E197	9-12- 1	50	70	N	30	20	15	1500	30	100
E203	9-11-13	15	70	N	30	20	7	2000	20	150

Semiquantitative spectrographic analyses--Continued

Sample	T. R. S. (pl. 2)	(ppm)								
		Cu (5)	La (20)	Mo (5)	Nb (10)	Pb (10)	Sc (5)	Sr (50)	Y (5)	Zr (10)
E204	9-11-13	15	70	N	70	20	7	1000	20	200
E206	9-11-14	15	100	L	50	20	10	2000	30	150
E213	10-11- 4	70	100	N	50	50	15	1500	30	150
E215	10-11- 5	200	50	N	10	20	15	700	20	70
E216	10-11- 5	200	50	N	15	20	15	500	20	70
E238	9-11-24	20	70	5	30	50	7	700	30	150
E246	8-12-36	70	70	L	30	20	10	1000	30	150
E247	8-12-36	50	70	L	30	30	10	1000	30	150
E251	8-11-36	50	70	N	30	20	7	500	20	150
E256	8-11-36	50	70	L	30	30	10	700	30	150
E260	8-11-36	50	70	L	50	20	10	1500	30	150
E261	8-11-35	50	70	N	30	20	10	500	30	150
E262	9-11- 5	30	50	L	30	50	10	700	20	150
E266	9-11- 8	50	70	L	20	30	10	1000	30	150
E272	9-11-10	20	70	5	50	70	7	1000	20	200
E295	9-11-35	30	70	15	30	15	7	700	20	150
E298	9-11-34	50	100	50	50	30	7	1000	30	300
E299	9-11-34	30	100	15	50	30	7	700	30	200
8/ E300	9-11-34	30	70	30	30	30	7	1000	30	200
E302	9-11-34	50	100	100	30	30	7	1000	30	150
E303	9-11-34	50	70	20	50	50	7	500	20	150
E304	9-11-34	30	70	20	50	30	7	700	20	150
E305	9-11-34	50	70	15	30	70	7	1500	20	150
E326	9-10-26	50	70	N	10	20	30	1500	20	70
E334	10-11-25	7	100	15	70	30	7	150	50	200
E337	10-11-25	15	100	30	30	20	7	200	30	200
E338	10-11-25	L	150	7	70	20	7	150	50	300
E340	10-11-25	L	150	7	70	20	7	150	50	300
E341	10-11-25	7	100	15	50	20	10	200	50	300
E342	10-11-25	L	100	7	70	20	7	150	50	300
E344	10-10- 3	50	70	N	10	20	50	700	30	70
E345	10-10- 3	50	70	N	10	20	20	1000	20	70
E346	10-10- 3	50	70	N	10	15	20	1000	20	70
E347	10-10- 2	50	70	N	10	15	15	1000	20	70
E348	10-10- 2	50	70	N	15	15	15	1000	30	100
E352	10-10-11	50	70	N	10	15	15	1000	30	100
E353	10-10-11	50	70	N	10	15	15	1000	30	70
E354	10-10-11	50	70	N	15	20	15	1000	30	70
E361	10-10-10	50	70	N	10	20	15	1000	30	70
E363	10-10-10	50	70	N	7	20	15	700	30	70
E365	10-10-10	50	70	N	7	20	15	1000	30	70
E366	10-10-10	70	70	N	L	20	50	700	30	70
E367	10-10-10	50	70	N	15	20	10	1000	30	70

- 1/ Sample 39 contains 20 ppm beryllium and 700 ppm neodymium.
 2/ Sample 40 contains 10 ppm beryllium.
 3/ Sample 42 contains 10 ppm beryllium.
 4/ Sample 282 contains 3 ppm silver.
 5/ Sample 781 contains 5 ppm silver.
 6/ Sample 782 contains 7 ppm silver.
 7/ Sample E133 contains 50 ppm tin.
 8/ Sample E302 contains 0.2 ppm gold.

Table 3.--*Analyses of selected elements in mineralized rocks in the White Mountain Wilderness and vicinity, New Mexico.*

[Number in parentheses below element symbol is lower sensitivity limit. ppm, parts per million; L, indicates that element was detected, but in amount too low to determine; N, indicates element was looked for but not found.]

Sample	T. R. S. (pl. 2)	Semiquantitative spectrographic analyses								
		Atomic absorption (ppm)	(ppm)							
		Au (0.02)	Ag (0.5)	Cu (5)	La (20)	Mo (5)	Nb (10)	Pb (10)	Zn (200)	Other elements
2	10-11-33	0.2	N	7	150	30	70	100	N	Be 10; Sn 10.
8A	10-11-20	N	N	5	100	15	30	30	N	
10A	10-11-20	N	0.7	7	200	N	50	50	N	
21A	10-11-35	N	7	N	70	150	20	30	N	
28A	9-11-19	N	N	5	20	N	N	20	700	
30A	9-11-19	N	N	100	N	30	N	300	10,000	Mn 10,000. Ce 1,000; Nd 500.
277A	9-11-17	0.07	N	100	30	L	N	70	N	
281A	9-11-17	N	N	50	N	N	N	70	1,500	
432	11-11- 4	N	2	L	700	1,500	15	30	300	
761	10-12-13	N	N	50	30	L	70	70	N	
763	10-11-12	N	N	30	100	15	20	30	N	
767A	10-11- 4	N	N	5	30	N	L	10	N	
769	10-11- 4	N	5	20	30	15	L	1,500	N	
770A	10-11- 3	N	N	5	20	20	30	70	N	
771A	10-11- 4	N	1	20	N	15	N	150	N	
E296	9-11-34	0.2	N	50	70	50	50	50	N	