STUDIES RELATED TO WILDERNESS

# WILDERNESS AREAS



# WHITE MOUNTAIN AND ADJACENT AREAS, NEW MEXICO

GEOLOGICAL SURVEY BULLETIN 1453

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March 3, 1849

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

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*With a section on*

## AEROMAGNETIC INTERPRETATION

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STUDIES RELATED TO WILDERNESS—WILDERNESS AREAS

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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 forest previously classified as "wilderness," "wild," or "canoe" were incorporated into the National Wilderness Preservation System as wilderness areas. The act provides that the U.S. Geological Survey and the U.S. 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—WILDERNESS AREAS

# MINERAL RESOURCES OF THE WHITE MOUNTAIN WILDERNESS AND ADJACENT AREAS, LINCOLN COUNTY, NEW MEXICO

By KENNETH SEGERSTROM, U.S. Geological Survey, and
RONALD 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. In total, 902 samples were taken by the U.S. Geological Survey and 813 by the U.S. 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 1,525 meters. Sierra Blanca rises to 3,659 meters above sea level in the Mescalero Apache Indian Reservation just south of the wilderness boundary. Area of the wilderness is 126 square kilometers, and proposed additions total 52 square kilometers 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 that 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, N. Mex., 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 thus 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. A relatively small plug of rhyolite is in the wilderness area between Big Bear and Little Bear

Canyons. 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 parts per million or greater. Four of the anomalous areas are underlain by the Three Rivers stock, and a fifth is underlain by the Rialto stock.

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. Samples taken by the U.S. Bureau of Mines from mine dumps, ore stockpiles, and veins yielded high anomalous results at some places.

Nonmetallic mineral resources of the area include fluorite, quartz crystals, corundum, alumina, and coal. Their occurrence is described in this report, but with the possible exception of alumina, 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. No evidence exists to indicate a potential for petroleum production, nor for the development of a geothermal resource in the area.

# INTRODUCTION

## LOCATION AND ACCESSIBILITY

The White Mountain Wilderness encompasses a rugged and roadless part of the Lincoln National Forest, in Lincoln County, south-central New Mexico. Rising steeply above the desert to the west, the wilderness comprises a major southern extension of the Rocky Mountains culminating in the White Mountains massif. The White Mountains have been extensively pitted by mine prospects, and the meager water resources have been tapped by pipelines; the still-undeveloped wilderness area is small (126 $km^2$) and of irregular shape. 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 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. More than 100 motels were located in and near the town in 1974, along with 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 11–12.8 km 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 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, with hairpin curves, but blacktopped, leads from Alto, 10.5 km north of Ruidoso, to the Sierra Blanca Ski Area, 31 km by road west of Alto.
2. Forest Road No. 107, graveled on lower part, unsurfaced on upper part, leads up Bonito Creek canyon from State Highway 37 westward to the mouth of Argentina Canyon, a distance of 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 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 1.6 km north of Nogal up Tortolita Canyon to the wilderness boundary, a distance of 11.3 km.

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 26 km southwest of Carrizozo, to Three Rivers Campground at the wilderness boundary, a distance of 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 a 2,440-m-long tramway carries passengers 518 m vertically to an elevation of 3,447 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.

A crest trail passes near the summit house of the ski lift and traverses the wilderness to Nogal Peak, a distance of 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.

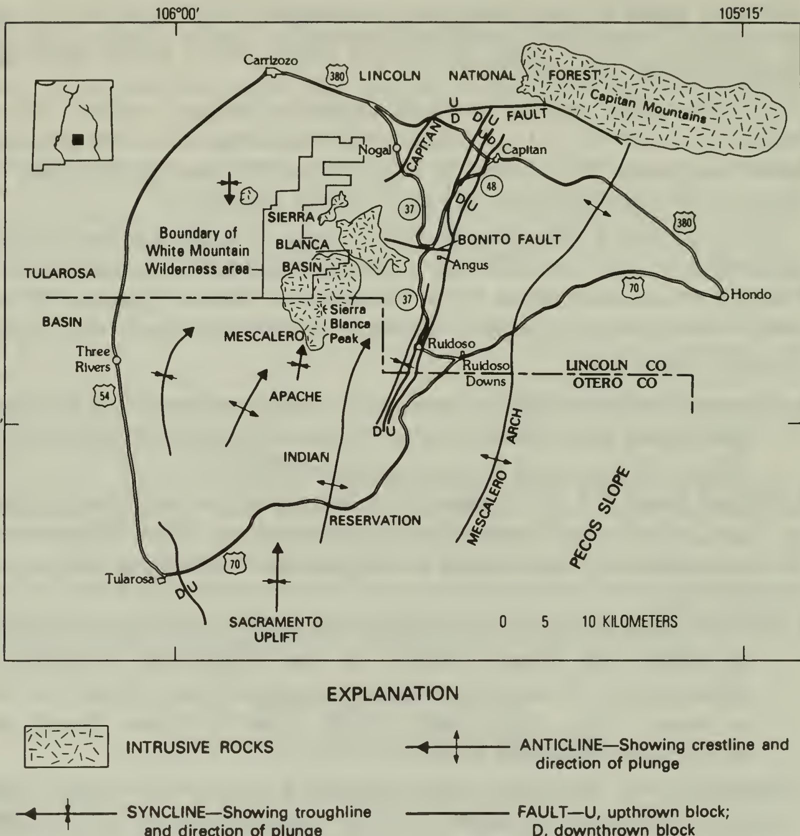


FIGURE 1.—Part of southern New Mexico, showing structural setting of the White Mountain Wilderness and vicinity. (Modified from Kelley and Thompson 1964, pl. 1.)

## TOPOGRAPHY

The White Mountain Wilderness area includes part of the tremendous west escarpment of the White Mountains; from a point on the crest about 0.8 km north of the county line between Lincoln and Otero Counties to Three Rivers Canyon, a distance of 4 km, there is a drop of 1,372 m. The ridge between Indian Creek and Three Rivers Canyon, near the south boundary of the wilderness area, is extremely rugged, dissected as it is by steep gullies with numerous falls 15–30 m or more high. The wildness and enormous height of the west escarpment would be notable in any regional setting; it is even more notable in its proximity to the bajada terrain to the west.

The eastern slope of the wilderness is also deeply dissected, but interfluves descend like ramps 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 Kilometers down the Pecos slope to the east. The poorly defined eastern base of the White Mountains—roughly along State Highway 37—is about 2,135 m above sea level, about 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 the drainage to the east is funneled 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 springfed and perennial. On the other hand, collection basins of the streams that drop off the western escarpment are so minuscule that nowhere there does perennial flow extend beyond the wilderness boundary.

## CLIMATE AND VEGETATION

The White Mountain Wilderness is an area 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 11°C cooler than nearby valley and basin localities, and the average annual rainfall, about 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 Mountains 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 (Jones, 1904, p. 168–172). The Nogal district was described in much more detail by L.C. Graton a few years later (in Lindgren and others, 1910) and then briefly again by Lasky and Wooton (1933). The first geologic map and structure section of the area were by Darton

(1922, pl. 40, fig. 28); on that map intrusive rocks and extrusive rocks are not separated.

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 a tributary canyon in the southeastern part of the wilderness (sec. 14, T. 10 S., R. 11 E.) and a quartz-crystal deposit on the divide between south Rio Bonito and Three Rivers Canyons were also investigated; no reports were published.

In 1959, G. B. Griswold's book on the mineral resources of Lincoln County appeared. In this comprehensive study all 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 (1964) was the first one to be published on molybdenum occurrences in the White Mountains. 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 was published (Dane and Bachman, 1965), at a scale of 1:500,000. The State map overgeneralizes the geology of the White Mountains with its portrayal of a single large pluton covering most of the wilderness area.

In the early 1960's, T. B. Thompson began a series of investigations that 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 nomenclature for the Sierra Blanca Volcanics is followed except for the stratigraphic rank assigned to its three divisions. Thompson's Walker, Church Mountain, and Nogal Peak are given member rank in this report because they are divisions or parts of a unit of formation rank, namely the Sierra Blanca Volcanics. 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), 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 U.S. Geological Survey authors to spend practically all their time in geochemical prospecting, investigations of mineralized outcrops, interpretation of analytical results, and interpretation of the aeromagnetic survey in 1970 which was made especially for this study (pl. 1). 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 by the U.S. Geological Survey 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 1:31,680, and in this way plate 2 of this report was compiled.

Investigations by U.S. Bureau of Mines personnel included a search of all public records for mining-claim locations (fig. 2), 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, the one person most knowledgeable on 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 Upper Cretaceous Mesaverde Formation (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 formation was first defined by Holmes (1877), and its type locality is Mesa Verde, Montezuma County, southwestern Colorado. In both southwestern Colorado and south-central New Mexico, the Mesaverde is divisible into a lower sandstone about 61 m thick, a middle shale-coal unit about 61 m thick, and an upper sandstone about 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 AND TERTIARY SEDIMENTARY ROCKS

The McRae Formation of Late Cretaceous and early Tertiary age unconformably overlies the Mesaverde Formation. The unit crops out only in the west-central part of the area (pl. 1). The McRae Formation (herein adopted) was first defined by Kelley and 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 732 m (Weber, 1964, p. 105).

## TERTIARY VOLCANIC AND SEDIMENTARY ROCKS

### SIERRA BLANCA VOLCANICS OF THOMPSON (1964)

Most of the White Mountain Wilderness is underlain by the Sierra Blanca Volcanics of Thompson (1964), a formation of Oligocene age composed of three members that are exposed in the study area: Walker Andesite Breccia, Church Mountain Latite, and Nogal Peak Trachyte. Outcrops of the Sierra Blanca 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 later used by Weber (1964), unconformably overlie the McRae Formation and Mesaverde Formation and occupy much of the terrain shown as "intrusive" on the State map (Dane and Bachman, 1965). The type section extends from Elder Canyon to Nogal Peak (Sierra Blanca Peak quadrangle), approximately in the center of the wilderness area. There, the measured thickness of the Sierra Blanca Volcanics is 1,1019 m (Thompson, 1964, p. 76).

#### Walker Andesite Breccia Member of Thompson (1964)

The oldest and thickest member in the Sierra Blanca Volcanics is the Walker Andesite Breccia Member (718 m), named for a ranch on the western side of the White Mountains. As described by Thompson the Walker contains 36 flow units in the vicinity of Nogal Peak and consists of a basal flow breccia 214 m thick overlain by alternating flow and flow-breccia units (1972, p. 2342–2347). Locally these units are hydrothermally altered and intruded by dikes. Breccia fragments are 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 Walker. 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 Walker. 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 flow is a light-gray erosion-resistant andesite flow that is intercalated between less resistant red-to-maroon andesite breccias of the Walker Andesite Breccia Member.

#### Nogal Peak Trachyte Member of Thompson (1964)

A sequence of five volcanic flow units 300 m thick overlies the Walker Andesite Breccia Member (Thompson, 1964) on Nogal Peak, with apparent conformity. Two characteristics distinguish this trachyte, designated as the Nogal Peak Trachyte Member, from the underlying andesite breccia: composition and 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 Nogal Peak 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 Member since its emplacement; consequently it is unmineralized.

### Church Mountain Latite Member of Thompson (1964)

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

As the lithologic name implies, the Church Mountain Latite is more felsic than the underlying rocks. Phenocrysts in the porphyry consist, in order of decreasing abundance, of 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 m.y. (Thompson, 1972). This is the only determination that has been made for the age of the Sierra Blanca Volcanics.

### OGALLALA (?) FORMATION

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

The name Nogal Fanglomerate has been applied to these rocks (Thompson, 1964), but the present authors feel that this local name is unnecessary. Also, the term "Nogal" is preempted by usage prior to 1964, as the Permian Nogal Formation, a formation name that was abandoned in 1937 by Lang. We agree with Thompson that our map unit 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, 1.6 km south of the wilderness area, for a distance of about 1 km down the 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.

## TERTIARY 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 that seem to be unrelated to the stocks. All are of Oligocene age. The stocks and dikes intrude the Walker Andesite Breccia Member, but they do not intrude upper members 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 1 km in diameter is exposed in Little Bear Canyon (Sierra Blanca Peak quadrangle, south-central part of report area). The andesite is emplaced in a volcanic vent believed to be the source of porphyry flows of the Walker Andesite Breccia Member. "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 6.9 $km^2$, 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.

### SYENITE DIKE

A north-striking, steeply east dipping syenite dike about 100 m wide crops out for about 3.2 km in the northwestern part of the wilderness area. According to Thompson (1972), the dike is correlative with the Willow Hill sills about 8 km to the northwest and outside the area shown in 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, written commun., 1970, 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 2.5 km east of the area shown in plate 1. The resulting date was 26.6±1.3 m.y., or late Oligocene (Thompson, 1966, p. I-11).

### 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 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 groundmass 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 other rocks in the stock (Giles and Thompson, 1972, p. 2135).

The Three Rivers stock has been hydrothermally altered in places, particularly along the north and east 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 PLUG BETWEEN BIG BEAR AND LITTLE BEAR CANYONS

A small rhyolite plug about 0.5 km in diameter intrudes the Walker Andesite Breccia Member and the intrusive andesite porphyry in Little Bear Canyon, about 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 4 km. Unpublished mapping of the plug and dikes is 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, the Sierra Blanca Volcanics. Intrusion of the rhyolite plug between Big Bear and Little Bear Canyons 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 (pl. 1) are fine-grained syenite, too small and discontinuous to be shown at the map scale. They are difficult to trace, particularly in their source. 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 described in a foregoing paragraph.

The dike swarm about 1.6 km northwest of the Three Rivers stock is rhyolitic and akin to the rhyolite plug between Big Bear and Little Bear Canyons.

Most dikes shown in the northeastern part of the map area, between Nogal and Nogal Canyon, are diabase; they are members of a prominent north-northeast-trending dike swarm which extends from there to the town of Capitan, 12 km east of Nogal (Elston and Snider, 1964). These dikes intrude the Walker Andesite Breccia Member 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 1.5 km from the floor of the Sierra Blanca basin to the crest of the Mescalero arch in a distance of about 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 nondeformative, 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 that were difficult to trace 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 exhibits maximum displacement of about 400 m at a point northeast of the town of Capitan (Kelley and Thompson, 1964, p. 116); the fault 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 of the east-trending Bonito fault (fig. 1 and pl. 1), which displaces beds about 457 m near Angus (fig. 1). The stratigraphic throw along the splays is not over 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, 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 west 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 White Mountain Wilderness area. Data were recorded by fluxgate magnetometer flown at an elevation of 3,800 m along north-south flight lines, spaced about 1.6 km apart. Total magnetic intensity relative to an arbitrary datum, at a contour interval of 20 gammas, is shown on plate 1; 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 commonly observed; it 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. Alternatively, the magnetic low could indicate that the stock is relatively less magnetic than adjacent rock. This is not likely. The Three Rivers 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.

The Three Rivers stock is roughly rectangular, with northeast- and northwest-trending sides. This figure does not fit the outcrop pattern very well, but it is alined with the two main directions observed in the regional structure.

A positive magnetic anomaly (approximately that part of the field contained within the 2,200-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 "2,543" gammas) may be due to an individual buried intrusive, or a subsurface southward extension of the Rialto stock, a monzonite that crops out in Bonito Creek canyon.

The presence of buried intrusives and coalescing of the intrusive bodies at depth are 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 2,200-gamma and the 2,300-gamma contour level, the edge of the buried intrusive body (or ensemble of bodies) trends from the molybdenum prospects in Eagle Creek northwest about 6½ km to an exposure of andesite porphyry in Little Bear Canyon, and from there trends to the north-northeast across upper Bonito Creek 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 Creek 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 no magnetic expression of this fault is observed 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 alined with the Capitan Trend, but the magnetic data provide no basis for connecting this trend with the end of the Capitan fault on the east edge of the geologic map.

## MINERAL RESOURCES

Numerous mineral deposits have been found in the White Mountain Wilderness, some of which were economically exploitable. On the basis of present values, about $1 million worth of metals has been produced from the Nogal mining district, located partly in the wilderness (pl. 1) and from the Bonito mining district, outside the area to the east (Thompson, 1973, p. 10). Most, if not all, of this production has been from areas 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 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 tonnage 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.

## GEOCHEMICAL SAMPLING AND ANALYTICAL TECHNIQUES

Geochemical sampling traverses were run along most streams and some ridges. The distribution of U.S. Geological Survey sample localities is given on plate 2. 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 stereopairs 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 when required ground to minus 80 mesh. All samples were analyzed by 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. Most samples were also analyzed for certain rare-earth and associated elements.

Because the detection limit for gold by standard semiquantitative 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. With the same detection limit 19 additional samples were analyzed only by atomic absorption. 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 GEOCHEMICAL 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 on 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 are outlined by contours of equal concentrations at 15, 30, 45 ppm (parts per million) 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" is centered at the head of Little Bear Canyon in the south-central part of the wilderness area; this anomaly lies along the north margin of the Three Rivers stock, partly in intrusive breccia. The highest molybdenum concentration in this area, 70 ppm, occurred in sample 104.

Anomaly "C," with a maximum of 150 ppm molybdenum in samples from 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 extended area during the late 1960's were not available to the U.S. Geological Survey.

Anomaly "E," outside both 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).

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 rhyolite plug between Big Bear and Little Bear Canyons, 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 kilometer 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 in the course of the present wilderness study, although copper deposits are present in the Schelerville mining district along the northwest 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 Member, 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, sec. 8, T. 9 S., R. 11 E.).

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

Zinc was detected in very few samples; however, the limit of dectection in semiquantitative spectrographic analysis is 100 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 (sec. 3, T. 10 S., R. 11 E.), 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 4 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 only as high as 0.2 ppm.

Gold was also detected in four of ten samples of gravel from a terrace deposit near the mouth of the canyon of Rio Bonito, east of the area covered by plates 1 and 2. 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 ranged as high as 7 ppm. Anomalous silver concentrations of 5 ppm and 7 ppm were found in stream-sediment samples 781 and 782, respectively (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 partly outside both 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, and 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 39, from the head of Indian Creek, near the south 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, U.S. Geological Survey, shows that hornblende is the dominant component, with several percent of riebeckite,

$Na_2(Fe,Mg)_5Si_8O_{22}(OH)_2$, and smaller amounts of xenotime, $YPO_4$, which commonly contains erbium, cerium, and other rare earths. Mineral grains resembling pyrochlore, $(Na,Ca)_2(Nb,Ta)_2O_6(OH,F)$, were also present in this sample and in 40, taken nearby (W. R. Griffitts, written commun., March 1974).

Stream-sediment samples 39, 49, and several others taken nearby were derived from the Three Rivers stock—specifically from the equigranular syenite of molybdenum anomaly "A" (pl. 2).

## MINING CLAIMS

The distribution and extent of mining claims in the area are shown in figure 2.

### HISTORY AND PRODUCTION

The oldest mining claim on record in the vicinity of the White Mountain Wilderness is on file at the Lincoln County, N. Mex., courthouse. The claim was recorded in Nogal Precinct No. 1 in 1863. Anderson (1957, p. 92) dated 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 Canyon and Bonito Creek Canyon. 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 about 20 kilometers north of the wilderness area.

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.

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 kilometers east of the wilderness. The west sides of the Eagle Creek and Cedar Creek mining districts adjoin the wilderness, but few 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 of 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, covered about 126 $km^2$, and lay mainly in the upper Bonito watershed, essentially the same land that is now under the jurisdiction of the Bonito Watershed Act (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 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 proper-

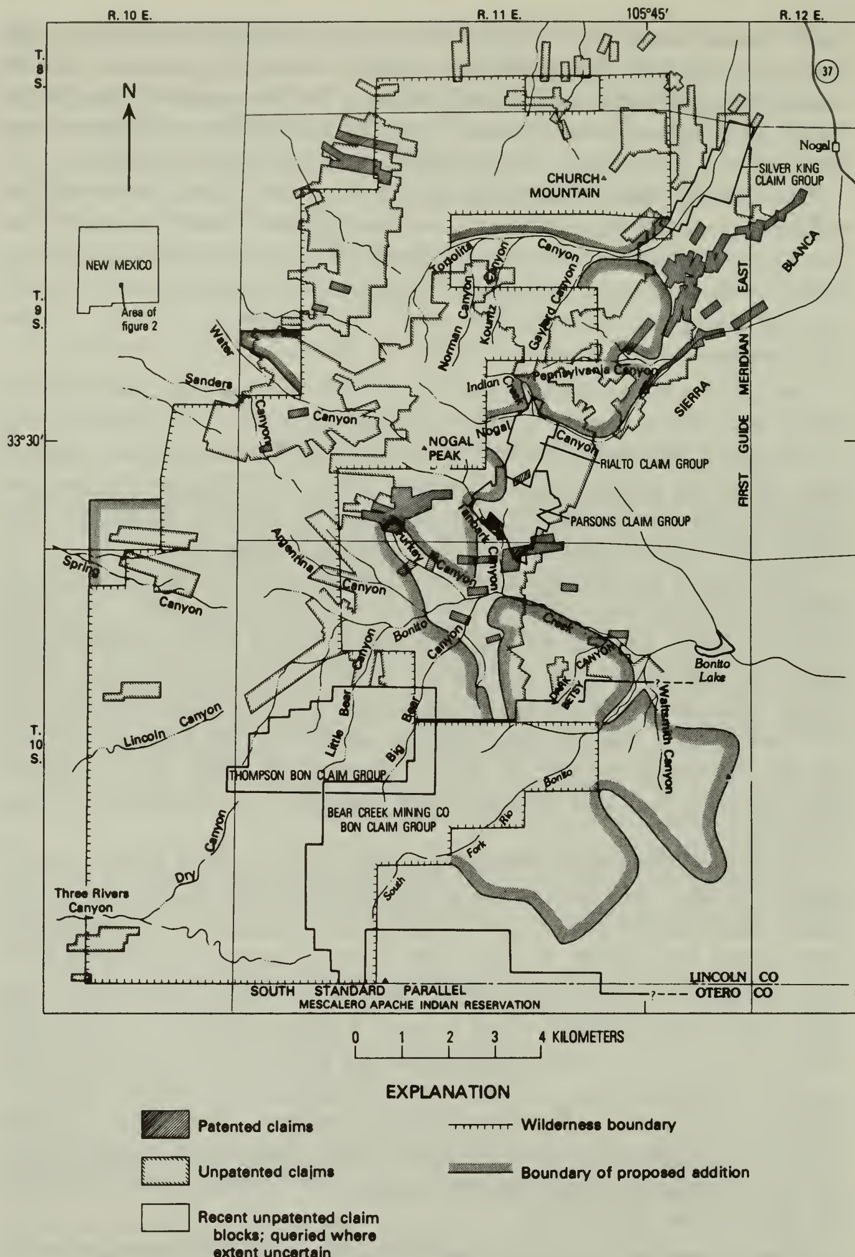


FIGURE 2.—Approximate mining-claim coverage in the White Mountain Wilderness, New Mexico.

ties and 19 placers in the Nogal and Bonito mining districts. Nearly all this output has been from mines within 1.6 km of the wilderness; some production has been recorded from adjoining roadless areas.

Before 1910, mineral production from the study area was 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 68-t/day mill with amalgam plates. During 1937 to 1953, output from this mine (sometimes known as the Pershing mine) was about 829 / t (metric tons) 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 Parsons (Hopeful) mine, about 400 m from the wilderness, is not known; however, Griswold (1959, p. 43) reported that about 68,000 t of ore had been removed. The average ore value is said to have been $3.50 per ton ($0.907/t) in gold, based on a gold price of $20 per ounce (28.34 grams) (Lindgren and others, 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) reported output from the Ace mine of about 145 t 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 $1.76/kg) for copper, $0.22 per pound (about $0.48/kg) for lead, $0.35 per pound (about $0.77/kg) for zinc, and $3.50 per pound (about $7.75/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 of 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:

| *Range of values* | *Number of samples* | *Percentage* |
|---|---|---|
| $5.00 to $10.00 | 135 | 48 |
| $10.00 to $15.00 | 55 | 19 |
| $15.00 to $20.00 | 14 | 5 |
| Over $20.00 | 78 | 28 |
| Total | 282 | 100 |

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.

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. 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. Chemical analyses of these samples showed lower values than the spectrographic analyses.

Results of the examination of 14 major drainages, or areas, are outlined in figure 3. Each of these areas is described separately in 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.

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/t) for any one sample are noted in the text of the report. This arbitrarily fixed value was calculated from the estimated future metal prices previously listed, based on 1974 spring listings. Metals that could not be economically recovered as byproducts were not considered in the calculations.

## MINES, PROSPECTS, AND MINERALIZED AREAS

### UPPER BONITO CREEK CANYON AREA

Hundreds of mining claims were located in Bonito Creek 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 in figure 4. Generally, assay values were low and sample widths narrow.

#### BONITO CREEK CANYON (SAMPLES 1-25)

A total of 25 samples was taken from 10 locations along Bonito Creek canyon. Assay values were low: only two samples (10 and 14) contained combined metal values of more than $5.00 per ton ($5.50/t). 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.

*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 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 12.2 m deep, is now debris filled to within 6.1 m of surface. Two 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 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. An 87-cm chip sample across an outcrop contained no values of consequence.

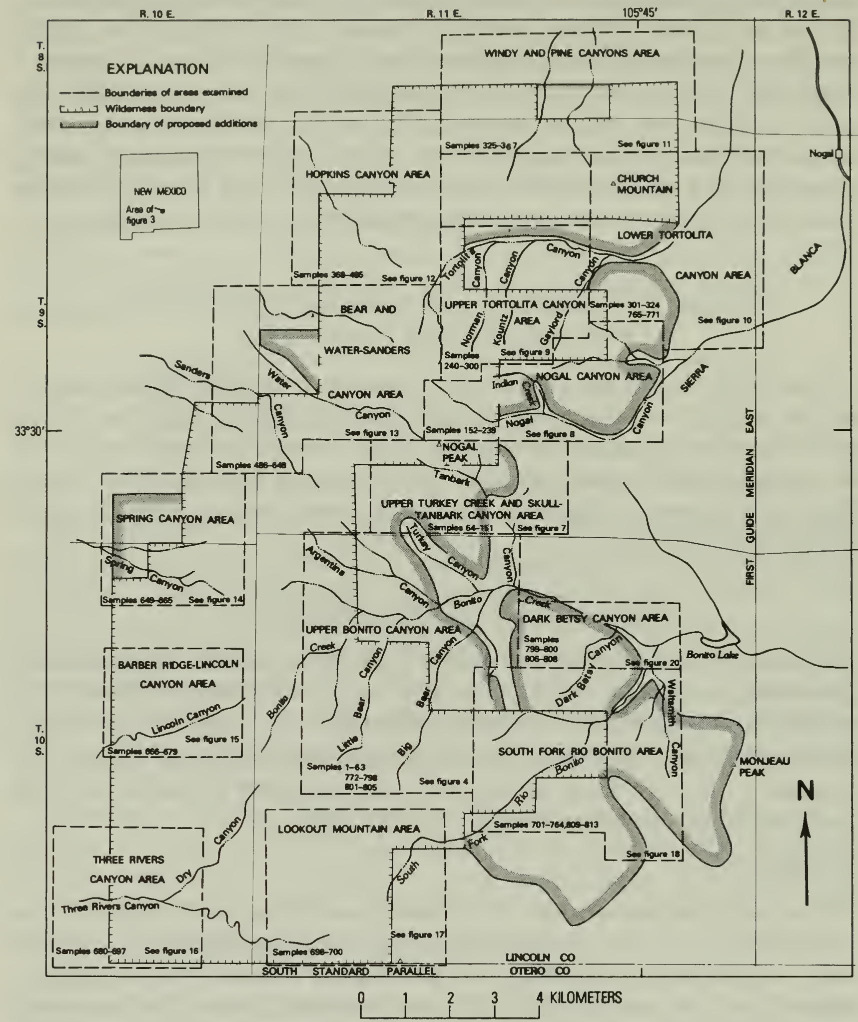


FIGURE 3.—Areas examined by the U.S. Bureau of Mines in and near the White Mountain Wilderness and proposed additions, New Mexico.

## *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.

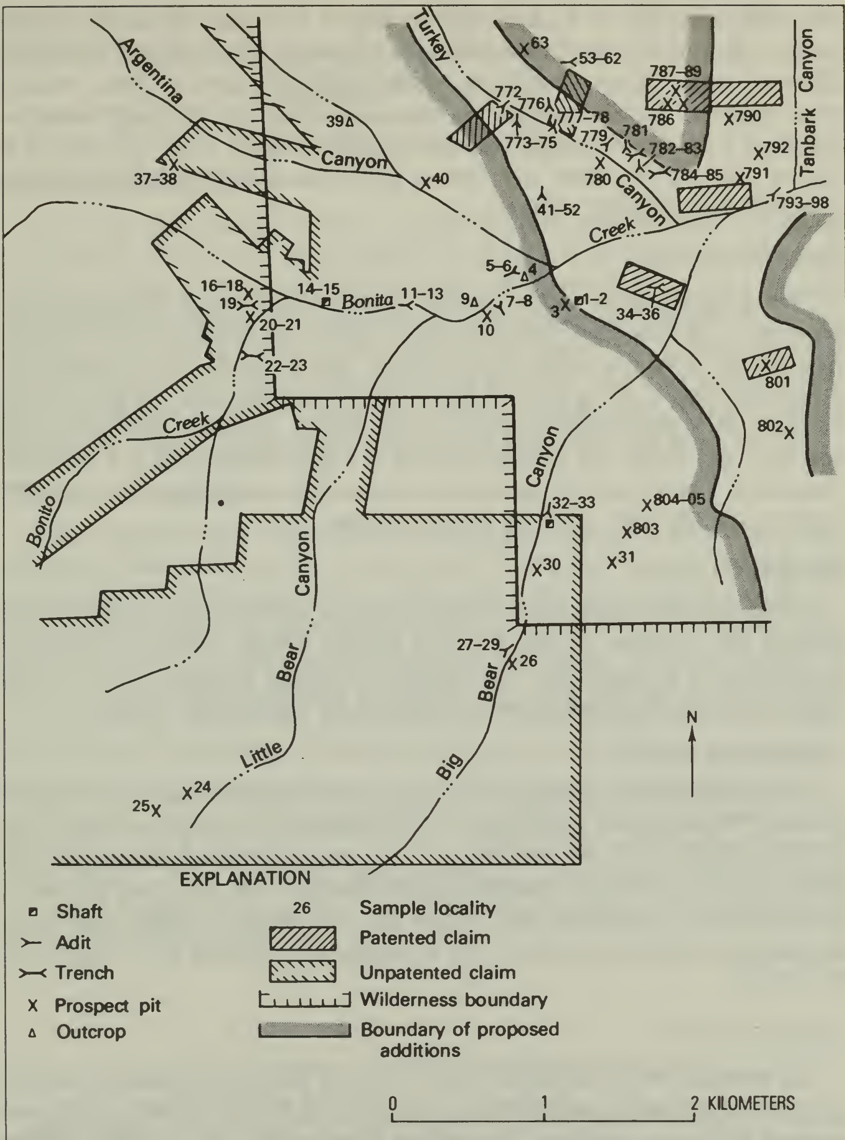


FIGURE 4.—Upper Bonito Canyon area, showing sample localities discussed in text.

### *Samples 7 and 8*

Two samples were taken from an adit (Bonita No. 1) on Bonito Creek canyon just upstream from the mouth of Argentina Canyon.

The adit was driven 11.3 m south, then 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 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 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/t) 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 Bonito Creek. The zone was prospected by a 6.7-m drift. The samples, chipped across 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 diplapidated headframe of the sealed Silver Spoon shaft. The shaft, thought to be 45.8 m deep, is just outside the wilderness on the north bank of Bonito Creek canyon. Sample 14, chipped across a 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 Creek and an unnamed drainage south of Argentina Canyon (fig. 4). A claim notice was found for the EPS–1 claim. Workings there include three trench excavations with a combined length of 22.9 m and a 19.8-m bulldozer cut. The fault zone, which bears N. 20° W., contains a quartz vein as much as 74 cm wide. Analyses of five samples that contain significant but low-grade values are tabulated; leaders indicate sought, none found.

| Sample No. | Type | Gold (ounce per ton) | Silver (ounce per ton) | Gold (gram per metric ton) | Silver (gram per metric ton) |
|---|---|---|---|---|---|
| 16 | 0.4-m chip | | 0.38 | --- | 13 |
| 18 | 25.4-cm chip | | .38 | --- | 13 |
| 19 | 0.8-m 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 51-cm chip sample and a sample of rock showing minor copper stain were collected from a steeply inclined 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 (0.34 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 Creek, Little Bear Canyon, and the unnamed drainage in between (fig. 4). 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 coal. The nearest coal deposits are to the west, 3.2–6.4 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 3.2 km to the west.

## BIG BEAR CANYON (SAMPLES 26-36 AND 801-805)

Big Bear Canyon is one of the principal tributaries of 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 ($5.00/t).

*Samples 26–29*

Four samples were taken from prospect workings just within the wilderness along Big Bear Canyon. The workings examined include a 9.2-m cut and a 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 Canyon, 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 Bear Creek in Big Bear Canyon just outside the wilderness, but within the study area. The body has been opened by a 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 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 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 Canyon and has been prospected for but not found on the east side of the creek. Thompson stated that two adits—separated 16.5 m vertically and a shaft sunk to a reported 61 m and later filled with waste—constitute the work done on the property. He added that the vein ranges in width from 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 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 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 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 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 1.6 km north of the Great Western mine, and straddling the boundary of the proposed addition, was only cursorily examined. A 3.1×3.1×39.0-m-deep, steeply inclined, inaccessible shaft lies outside the addition. A sample (801) was taken from the dump, which is estimated to contain 272 t of material. The sample assayed nil for gold and silver.

A grab sample (802) was from the dump of a 1.2×2.4×5.2-m-deep pit located 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 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 Bear Creek. Sample 803, chipped across a 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 136 t of material showed no precious metal values. The material in the dump came from a caved adit driven in a weathered diorite on a N. 12° E. trend. Also a grab sample (805) from a small pit 9.2 m away showed no precious metal values.

## ARGENTINA CANYON (SAMPLES 37-51)

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 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 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/t).

*Sample 39*

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

*Sample 40*

The sample was chipped across a 25-cm quartz vein on the north bank below the forks of Argentina Canyon. 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).

*Samples 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. 5).

Early development at the Argentine mine consisted of a 107-m shaft and a drift said to have been driven 122 m at the 76.3-m level (fig. 5). In 1948, an adit driven to intersect the shaft at the 76 level was about 1.8 m too low. According to Arvel Runnels, who owns the property, the face of the drift displays a very good showing of copper, but it could not be examined because of bad air behind a caved section at sample location 41. A 6.1-m winze was also inaccessible. The extension of the shaft below the 76-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.

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. Leaders indicate not found; leaders in value columns indicate value less than $5.00 per ton ($5.50/t).

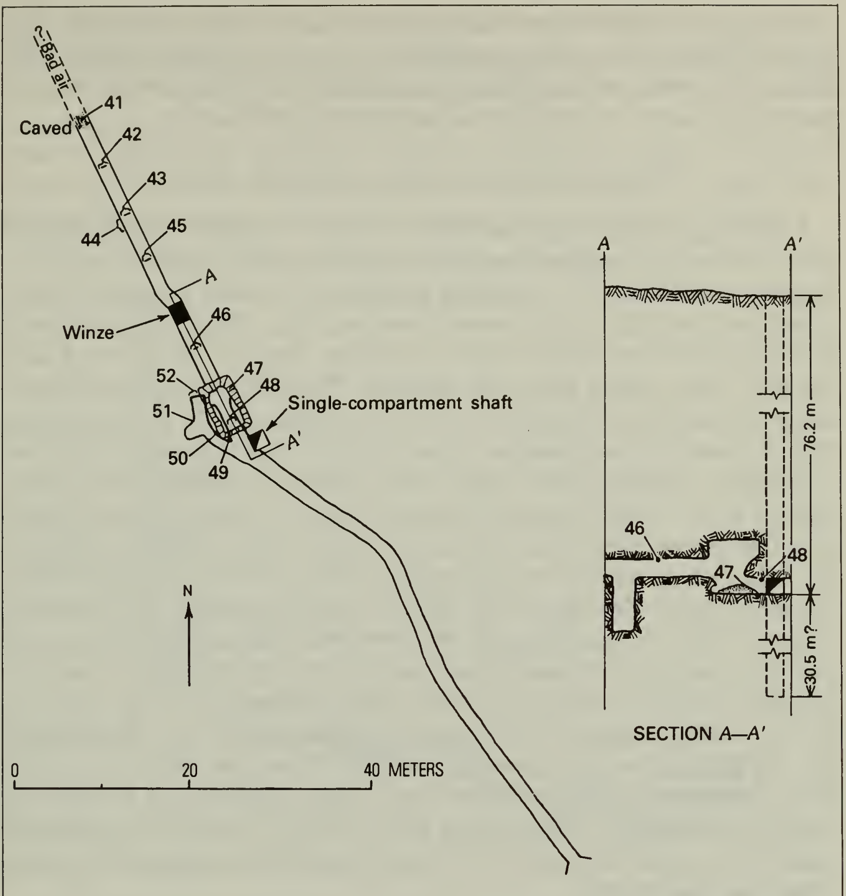


**FIGURE 5.—Plan and partial longitudinal section of Argentine mine, showing locality of samples 41–52.**

| *Sample No.* | *Type* | *Silver (ounces per ton)* | *(g/t)* | *Copper* | *Lead* | *Zinc* | *Molybdenum (ppm)* | *Calculated value (dollars/ton)* | *(dollars/t)* |
|---|---|---|---|---|---|---|---|---|---|
| | | | | *(percent)* | | | | | |
| 41 | Muck pile, grab | 0.10 | 3.4 | 0.23 | 0.35 | 0.53 | 300 | $11.03 | $12.13 |
| 42 | 0.8-m chip | .40 | 14 | ——— | .17 | .18 | 500 | 7.40 | 8.14 |
| 43 | 1-m chip | 2.48 | 85 | .29 | .96 | 3.40 | 200 | 47.54 | 52.29 |
| 44 | 1.2-m chip | .42 | 14 | ——— | .09 | ——— | 200 | ——— | ——— |
| 45 | 1.19-m chip | .58 | 20 | .15 | .30 | 1.20 | ——— | 15.78 | 17.36 |
| 46 | 1.16-m 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 | 0.8-m chip | .82 | 28 | ——— | ——— | .31 | 200 | 7.09 | 7.80 |
| 49 | 1.6-m chip | .18 | 6 | ——— | ——— | ——— | ——— | ——— | ——— |
| 50 | 0.4-m chip | .22 | 8 | .08 | .26 | .21 | 100 | ——— | ——— |
| 51 | 0.7-m 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 addition. The working consists of a main crosscut adit, a caved inclined shaft, and several prospect pits. The main adit bears N. 35° E. for 25 m, then N. 20° E. for 28 m, then N. 18° W. for 3 m to the face. Four major veins are exposed. The first, 30 m from the portal, is 76 cm wide; it 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 58-cm-wide bleb of mineralized rock 37.5 m from the portal assayed only 0.2 ounce silver per ton (7 g/t). The second vein, 44.8 m from the portal, is 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, 50.6 m from the portal, is 61 cm wide, strikes N. 45° W., and dips 82° NE. A 61-cm chip sample (795) across the vein assayed 0.6 ounce silver per ton (20 g/t). The fourth vein, exposed 31 cm from the face, is 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) 5 cm wide, located 51.9 m from the portal, contained 0.1 ounce silver per ton (3 g/t); a body of mineralized rock 58 cm wide, located 37.5 m from the portal, contained 0.2 ounce silver per ton (6 g/t).

Sample 792 was taken across a 82-cm vein in a pit about 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 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 Canyon. 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, also plot in the vicinity. The adit bears N. 74° W. for 44.2 m and turns nearly due north for 27.5 m. The samples, localities of which are shown in figure 6, were taken from altered porphyritic andesite, fracture zones, and quartz veins as much as 76 cm wide. Sample 55 was from a 5-cm quartz veinlet, and sample 56 was from a 91-cm-wide shear zone crossing the drift.

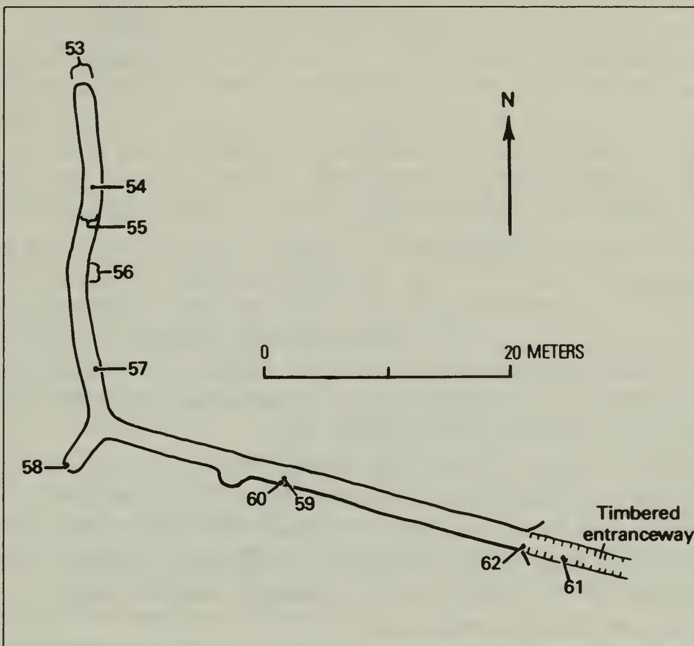


FIGURE 6.—Plan of Jester(?) adit, showing locality of samples 53-62.

The sample values shown following are submarginal; dollar values range from $4.92 to $11.11 per ton ($5.41-$12.22/t) for the 10 samples. Leaders indicate sought, not found.

| Sample | Type | Gold (ounce per ton) | Gold (g/t) | Silver (ounce per ton) | Silver (g/t) | Copper | Lead (percent) | Zinc |
|---|---|---|---|---|---|---|---|---|
| 53 | 0.8-m chip | 0.02 | 0.7 | 0.40 | 14 | ——— | ——— | ——— |
| 54 | Muck pile, grab | .02 | .7 | .56 | 19 | ——— | ——— | ——— |
| 55 | 5-cm chip | .02 | .7 | .36 | 12 | 0.27 | ——— | ——— |
| 56 | 0.9-m chip | .04 | 1.4 | .42 | 14 | .04 | ——— | 0.37 |
| 57 | 28-cm chip | .02 | .7 | .38 | 13 | ——— | ——— | ——— |
| 58 | 0.8-m chip | .02 | .7 | .32 | 11 | ——— | ——— | ——— |
| 59 | 0.8-m chip | .03 | 2.1 | .44 | 15 | ——— | ——— | ——— |
| 60 | 1.8-m chip | .02 | .7 | .38 | 13 | ——— | ——— | ——— |
| 61 | 0.4-m chip | .02 | .7 | .48 | 16 | ——— | ——— | ——— |
| 62 | 0.6-m 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 183 m east-southeast of sample site 772. The 64-m adit was driven northwest in diorite. A chip sample (774) taken across a 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 1.2-m chip sample (775) taken across the back 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 a 20-cm chip sample taken across a northeast-bearing fracture zone in quartz diorite about 119 m northeast of sample site 773; the zone is exposed in a short adit that bears N. 41° E. for 17.1 m and then N. 65° E. for 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 183 m south of sample site 776. The adit was driven northeast in quartz diorite, and the innermost 3.1 m is along a 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 1.5 m from the portal bears N. 67° E. and dips 61° NW. A 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 6.1-m adit bearing S. 37° E. and driven in altered diorite. The adit is about 320 m downstream on the north side of the creek from sample sites 777–778. The sample, a 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 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 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 244 m on the surface. Griswold and Missaghi (1964, p. 1) showed the prospect to be in a zone of unaltered monzonite. At the time of this study, the adit was completely water filled. 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 9.2-m adit bearing N. 12° E. and driven along a nearly vertical shear zone in quartz diorite. The working is located 61 m east of the old Bailey(?) adit. The sample, chipped across a 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. A 3.4-m adit extends from the east and of a 9.2-m trench. A 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 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 403 m northeast of the sample sites on the creek of lower Turkey Canyon. 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 20.4 m along a 5–30-cm quartz vein that dips 80° S. Beyond this point, the adit is filled with muck and debris to within 31 cm of the back. At 12.2 m from the portal, a 9.2-m raise extends to the surface; at 13.7 m is a winze filled to within 1.5 m of the adit floor; at 20.4 m is a stub drift that extends 2.4 m to the north. Two samples of vein rock and one sample across the full width were taken in the adit. An 8-cm veinlet sample (787) taken on the south wall 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 98-cm width of the back and included both the vein and adjacent wall rock; it showed a trace of gold and 3.3 ounces silver per ton (113 g/t) ($34.06 per ton; $37.47/t). Sample 789 was taken 1.5 m from the portal. It was chipped across 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 1,134 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 ridge line about 91.5 m away from the Old Abe working. The vein there strikes N. 78° W. and dips 67° S. A 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 obtained about 400 m east from the Old Abe workings, near the Renowned OK patented claim, where a 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 CANYON AREA

Eighty-eight samples were taken from numerous prospect workings in the upper Turkey Canyon and the south fork of upper Tanbark Canyon drainage areas; also, their connecting ridges were examined. The sampling was confined to secs. 27, 28, 33, and 34, T. 9 S., R. 11 E. (fig. 7).

#### UPPER TURKEY CANYON (SAMPLES 64-104)

Forty-one samples were taken from 18 places in the upper Turkey Canyon 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 3 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 Canyon in SW1/4 sec. 33, T. 9 S., R. 11 E. Sample 64

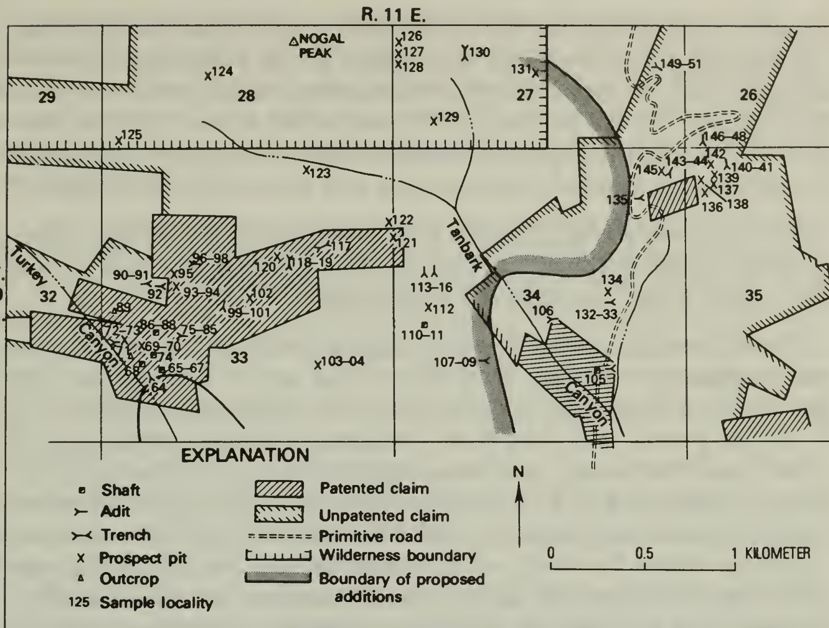


FIGURE 7.—Upper Turkey Creek and Skull-Tanbark Canyon area, showing locality of samples 64–151.

was taken from a dump estimated to contain 181 t of country rock, mostly andesite; assay results showed no unusual mineral content.

Samples 65–67 were taken from a shallow shaft on the Montezuma claim that was probably 7.6 m deep originally but is now filled with caved material to within 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 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 6.1 m deep. The sample contained no significant values. Sample 69 was taken from a prospect pit 9.2 m upslope and put down on a 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 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 15.3 m west, sample 71 was taken across a 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, about a hundred meters above the bottom of a west-leading fork of Turkey Canyon. A dump at a prospect pit in a siliceous zone was sampled (72); the assay showed no important metal content. About 9 m southwest of the pit, sample 73 was taken across a 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 31-cm east-striking quartz vein was sampled (74) at the collar of a shallow shaft that was filled with caved material to within 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 159 m on bearings varying from S. 83° E. at the portal to S. 75° E. at the face. A 4.1-m crosscut is in the south wall 39.3 m from the face; a narrow stope, 3.1 m high and 7.6 m long, is about 68.6 m from the face. Most of the adit was driven on a quartz vein as much as 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 in tabulation. Leaders indicate sought, not found.

| Sample No.[1] | Type | Gold (ounce per ton) | Gold (g/t) | Silver (ounce per ton) | Silver (g/t) | Zinc (percent) | Value (dollars/ton) | Value (dollars/t) |
|---|---|---|---|---|---|---|---|---|
| 75 | 0.8-m chip | 0.06 | 2.1 | 0.36 | 12 | ——— | $11.16 | $12.30 |
| 76 | 1.3-m chip | .02 | .7 | .56 | 19 | 0.29 | 8.39 | 9.23 |
| 77 | 1.5-m chip | .04 | 1.4 | .20 | 7 | .67 | 10.69 | 11.76 |
| 78 | 1.1-m chip | .03 | 1.0 | .30 | 10 | .31 | 8.47 | 9.32 |
| 79 | 1.4-m chip | .02 | .7 | .36 | 12 | .32 | 7.40 | 8.14 |
| 80 | 0.6-m chip | .02 | .7 | .38 | 13 | ——— | 5.28 | 5.81 |
| 81 | 25.4-cm chip | .08 | 2.7 | .32 | 11 | ——— | 13.92 | 15.31 |
| 82 | 2.1-m chip | .06 | 2.1 | .12 | 4 | ——— | 9.00 | 9.90 |
| 83 | 0.4-m chip | .04 | 1.4 | .08 | 2.7 | ——— | 6.00 | 6.60 |
| 84 | 0.9-m chip | .08 | 2.7 | .20 | 7 | ——— | 12.00 | 13.20 |
| 85 | 1.7-m 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 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 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 15.3 m west of the dump showed no significant mineral values.

A random chip sample (89) taken across a 4.0–4.9-m width of green-stained andesite showed no significant mineral values. The outcrop is about 305 m northwest of the King Rex shaft.

Several caved workings are located near an upper east fork of Turkey Canyon. The westernmost working is a trench, or a caved adit, excavated along two iron-stained quartz veins that strike N. 75° E. and measure 40 cm and 15 cm wide. The veins contain bornite and chalcopyrite, but very minor copper values were detected in 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 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, 9.2 m long, is connected to an adit that bears N. 80° E. for 3.7 m and S. 55° E. for 4.3 m. The working is the northernmost examined in upper Turkey Canyon. The samples (96–98) were taken across quartz stringers, and across a quartz-filled fracture zone 1.1 m wide. Sample widths were 25 cm, 7.6 cm, and 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 1.1-m sample (98) had a value of $9.12 per ton ($10.03/t).

Two samples were taken from an adit about 400 m southeast of site 96–98 that is believed to be on the Stonewall Jackson patent. The adit, driven into a ridge, bears N. 25° E. for 11.9 m. A 1.5-m chip sample (99) across the face assayed 0.06 ounce gold and 0.82 ounce silver per ton (2.1 g/t and 28.7 g/t) for a gross value of $13.92 per ton ($15.31/t). Sample 100, 5 cm wide, came from a structure filled with quartz and fault gouge that crosses the drift 4.6 m from the face; it 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 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 15-cm east-west-striking vein in a small prospect pit on the divide between Turkey and the next canyon east in SE1/4 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 CANYON AREA (SAMPLES 105-151)

The greatest concentration of mining activity in the Bonito mining district has been in Tanbark Canyon (fig. 7), mainly in secs. 33, 34, and 35, T. 9 S., R. 11 E. Eleven lode claims and two millsites 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 the patented claims lie outside the study area (pl. 2; fig. 2).

At the time of the first phase of this investigation, drilling for molybdenum was underway in NE1/4 sec. 34. At the same time the Etta-Emma molybdenum prospect was being reopened in the extreme SW1/4 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.

Griswold (1959) reported that an adit approximately 112 m long, a raise of 12.2 m, and a shallow winze constitute the main working at the Renowned O.K. Galena, sphalerite, and minor chalcopyrite constitute 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 31 cm in width. Griswold stated that 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 Canyon area. Assay values were negligible except for the 17 samples tabulated here.

[Tr, trace; N, sought but not found; Leaders indicate unsought]

| Sample No. | Type | Gold (ounce per ton) | Gold (g/t) | Silver (ounce per ton) | Silver (g/t) | Copper | Lead (percent) | Zinc | Molybdenum (ppm) | Value (dollars/ton) | Value (dollars/t) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 105 | Dump, quartz | 0.03 | 1.0 | 3.20 | 110 | ——— | 2.42 | 1.17 | ——— | $42.54 | $46.80 |
| 107 | 0.4-m chip | Tr | Tr | .8 | 27 | ——— | .67 | ——— | ——— | 7.75 | 8.53 |
| 108 | 0.4-m 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 | 0.6-m chip | ——— | ——— | ——— | ——— | ——— | .87 | .19 | <1,000 | 10.61 | 11.67 |
| 114 | 0.6-m chip | .01 | .3 | .38 | 13 | 0.07 | .60 | .72 | ——— | 11.46 | 12.61 |
| 115 | 0.4-m chip | .01 | .3 | 2.20 | 75 | .08 | 3.10 | .83 | <1,000 | 41.15 | 45.27 |
| 124 | Random chip | .01 | .3 | 1.10 | 38 | ——— | ——— | ——— | ——— | 8.10 | 8.91 |
| 128 | 1.5-m chip | .02 | .7 | .40 | 14 | ——— | ——— | ——— | ——— | 5.40 | 5.94 |
| 130 | Dump, grab | .02 | .7 | .40 | 14 | ——— | ——— | ——— | ——— | 5.40 | 5.94 |
| 136 | 1.1-m chip | .01 | .3 | 3.60 | 123 | ——— | ——— | ——— | 300 | 25.20 | 27.72 |
| 145 | 0.3-m chip | .07 | 2.4 | Tr | Tr | ——— | ——— | ——— | ——— | 10.50 | 11.55 |
| 146 | Selected | Tr | Tr | Tr | Tr | ——— | ——— | ——— | 13,000 | 91.00 | 100.10 |
| 147 | 20-cm chip | Tr | Tr | N | N | ——— | ——— | ——— | 13,500 | 94.50 | 103.95 |
| 148 | Selected | N | N | Tr | Tr | ——— | ——— | ——— | 1,700 | 11.90 | 13.09 |
| 149 | 0.9-m chip | Tr | Tr | .10 | 3.4 | ——— | ——— | ——— | 1,200 | 8.40 | 9.24 |
| 150 | 0.9-m chip | .005 | .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 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 the west fork of Tanbark 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 800 m west of the Silver King shaft and probably within the proposed wilderness addition. The adit is 45.8 m long and trends westerly. A 20.1-m-long crosscut about 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 8.2 m from the main drift, assayed 0.67 and 0.63 percent lead, over widths of 37 cm and 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 49-cm limonite-quartz zone 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 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 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 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 an unmapped tributary of upper Tanbark Canyon in NW1/4 sec. 34, T. 9 S., R. 11 E. (fig. 7). 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, 41.2 m long and as much as 7.6 m deep, that connects with an adit 78.7 m long driven generally N. 24° W. on a quartz vein. About 13.7 m in from the portal is a 7.6-m opening to the surface. A narrow stope 3.1 m long and 4.6 m high is 28.1 m from the face. Sample 113, taken across 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 61 cm of vein at a point 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 37-cm vein exposed 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 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. 7).

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 6.1-m trench on the ridge; sample 120 was chipped across a 18-cm quartz vein in a pit 45.8 m from the trench.

*Samples 121–123*

At these sites in NE1/4 sec. 33, T. 9 S., R. 11 E., three prospect pits were examined. Assay values were negligible.

*Sample 124*

Sample 124 was taken from a prospect pit in the saddle at the westernmost head of Tanbark Canyon about 400 m southwest of Nogal Peak. The locality is in the wilderness in SW1/4 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 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.

*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 uppermost Tanbark 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 an 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 2.8-m pit sunk in pyritized and altered rock about 400 m east of sample site 130, showed only insignificant values.

*Samples 132–134*

Two samples (132 and 133) were taken in an adit located in E1/2 sec. 34, T. 9 S., R. 11 E., just west of a primitive road (fig. 7). The adit is 12.2 m long and bears N. 60° W. Another sample (134) was from a pit 6.1 m north of the adit portal. All were chip samples with widths from 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.

*Samples 135*

The sample came from an adit on the Jennie Lind claim in the ruins of the old townsite of Parsons City in NE1/4 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 13.1 m on a N. 80° W. bearing and 6.4 m on a N. 40° W. bearing. The sample was chipped across 91 cm of altered igneous rock 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 Parsons 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 28.4 m long and has a plan like a question mark: the adit from the portal bears N. 5° E. for 5.8 m, gradually changes to N. 55° E. for about 15.3 m, and turns to N. 85° W. for the last 7.3 m. It declines at about 10° from the portal. A 1.1-m 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 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 7.6 m and 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 31 cm wide that occurs in a 15.3-m caved working about 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 SW1/4 SW1/4 sec. 26 and outside the proposed addition to the wilderness. These prospects are now covered by the Rialto claim. Sample 146 was a grab sample from a stockpile 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 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 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 entire claim group is subject to the Bonito Watershed Act as discussed in P.L.8. 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 SE1/4 sec. 27, about 610 m from the wilderness and along the new road from Nogal Canyon to the Parsons mine. The Fulmer tunnel is a 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 707 m, the longest hole being 224 m. All holes were drilled easterly and inclined 30° to 60° from horizontal. Cleveland-Cliffs Iron Co. drilled 18 holes in 1964—no data are available.

In 1963 Griswold examined the molybdenum deposit in detail under the sponsorship of the New Mexico Bureau of Mines and Mineral Resources and published the results (Griswold and Missaghi, 1964). In addition to reporting the sampling he did there, Griswold reported details of the exploraton 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 W1/2 sec. 26 and E1/2 sec. 27; however, the only samples were taken from the Fulmer tunnel. A 91-cm chip sample (149) taken across the back 1.8 m from the face showed 1,200 ppm (0.12 percent) molybdenum ($8.40 per ton; $9.24/t); another 91-cm chip sample (150) 7.6 m from the face assayed 990 ppm molybdenum ($6.93 per ton; $7.62/t); and a 1.4-m chip sample (151) 76.3 m from the portal contained 360 ppm (0.04 percent) molybdenum.

### NOGAL CANYON AREA

Numerous workings and extensive mining-claim coverage occur 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 Canyon areas. Sample localities and claim boundaries are shown in figure 8.

#### 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:

[TR, trace; leaders indicate sought, not found]

| Sample No. | Type | *Gold* (ounce per ton) | *Gold* (g/t) | *Silver* (ounce per ton) | *Silver* (g/t) | *Lead* | *Zinc* (percent) | *Molybdenum* (ppm) | *Value* (dollars/ton) | *Value* (dollars/t) |
|---|---|---|---|---|---|---|---|---|---|---|
| 175 | 1-m 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 | .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 | .7 | .04 | 1.4 | ——— | ——— | 900 | 9.30 | 10.23 |
| 193 | Selected | .02 | .7 | .10 | 3.4 | ——— | ——— | 300 | 5.10 | 5.61 |
| 196 | Dump, grab | .02 | .7 | .52 | 18 | ——— | ——— | ——— | 6.12 | 6.73 |
| 197 | 1.1-m chip | .005 | .2 | 1.06 | 35 | ——— | ——— | ——— | 6.36 | 7.00 |

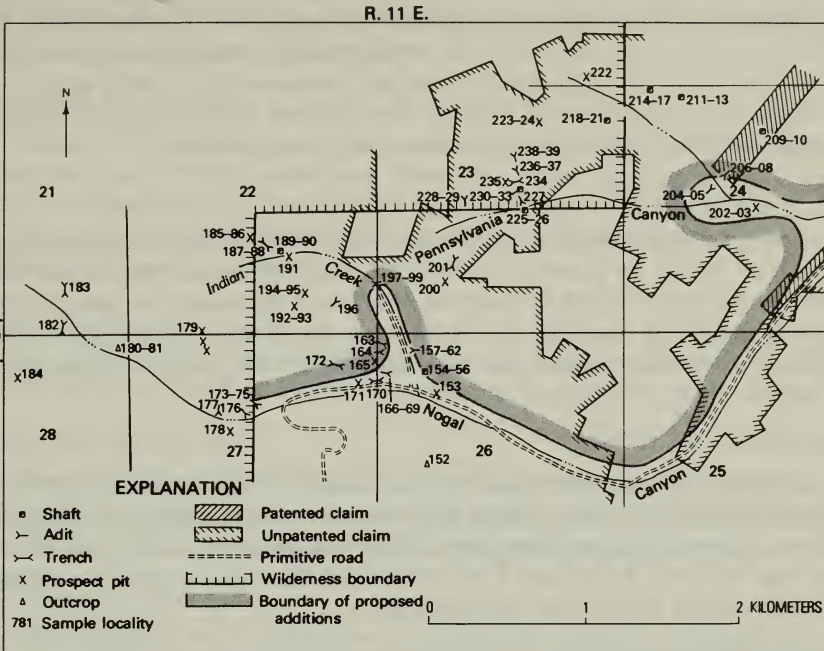


FIGURE 8.—Nogal Canyon area, showing locality of samples 152-239.

*Sample 152*

The sample was a piece of float, apparently from an iron-bearing vein that is reported to trend northwest from the NW1/4 sec. 26, to the NE1/4 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 5-cm quartz stringer and showed no significant mineral content.

*Samples 154-156*

Three samples were taken from the vicinity of a caved 26-m-deep 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. A specimen assayed 0.65 percent molybdenum.

*Samples 157-162*

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

*Samples 163–165*

Samples 163 and 164 were taken from two caved workings, near each of which lie dumps of 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 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 respectively 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 slope of Nogal Canyon just upstream from the mouth of Indian Creek. Another sample was taken across a 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 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 near the east line of NW1/4 sec. 27, T. 9 S., R. 11 E., west of the Nogal Canyon road. One of the workings, an 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 1.1 m of the back at a point 5.2 m from the face, however, yielded 0.54 ounce silver per ton (19 g/t), and a chip sample (175) taken across 98 cm of the back 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 7.6 m long just inside the wilderness. The sample showed no significant metal values.

*Samples 177 and 178*

Sample 177 came from a cave adit on the north wall of Nogal Canyon 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 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).

*Sample 184*

The sample came from a prospect pit in altered rock on the divide between Nogal Canyon and Water Canyon to the west; 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 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 (17 g/t) and 0.41 percent lead. A 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 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 ferrimolybdite, 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 25.3 m. A 3.7-m crosscut was driven northerly 11.6 m from the face of the main adit. Sample 197 chipped from the face across 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 58-cm chip, yielded 0.44 ounce silver per ton (15 g/t), and a 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 15.3 m. No metal concentration was detected in the analysis of a dump sample (200). A grab sample (201) was taken in a 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 CANYON-CLIPPER AREA (SAMPLES 202-239)

Numerous prospects and mine workings were examined in the north forks of Pennsylvania Canyon and an unnamed drainage in secs. 23 and 24, T. 9 S., R. 11 E. (fig. 8). 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.

*Samples 202 and 203*

Two samples were taken from the easternmost working examined in Pennsylvania Canyon. The working is a 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 the unnamed branch of Pennsylvania 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 the unnamed tributary of Pennsylvania 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 the unnamed 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 156 m of shafts, drifts, and tunnels on the Rochford, and 33.6 m of workings on the Clipper (R. Forsythe, oral 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 16.8 m. It reveals little evidence of mineralization, and it is possible that 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 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 (1.4 g/t; 26.6 g/t); sample 210 assayed 0.03 ounce gold per ton and 0.46 ounce silver per ton (10.5 g/t; 16.1 g/t) ($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 the unnamed tributary of Pennsylvania Canyon and a tributary of Tortolita Canyon to the northeast. 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 6.1 m deep originally and was sunk on a shear zone. The western shaft is filled with debris to within about 1.2 m of the surface; caving has broadened the collar so the diameter is now nearly 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 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 31-cm quartz-bearing fracture zone. Sample 215 was chipped across an 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 ferrimolybdite-stained rock contained only 200 pm molybdenum. Assay data and calculated metal values are shown in table form.

[Leaders indicate sought, not found]

| Sample No. | Type | Gold (ounce per ton) | Gold (g/t) | Silver (ounce per ton) | Silver (g/t) | Copper (percent) | Lead (percent) | Zinc (percent) | Value (dollars/ton) | Value (dollars/t) |
|---|---|---|---|---|---|---|---|---|---|---|
| 211 | 18-cm chip | 0.03 | 1.0 | 0.42 | 14 | ——— | ——— | ——— | $ 7.02 | $ 7.72 |
| 212 | 5-cm chip | .04 | 1.4 | .62 | 21 | ——— | ——— | ——— | 9.72 | 10.69 |
| 213 | Dump, grab | .03 | 1.0 | .26 | 9 | ——— | ——— | ——— | 6.06 | 6.66 |
| 214 | 31-cm | .04 | 1.4 | .44 | 15 | ——— | ——— | ——— | 8.64 | 9.50 |
| 215 | 7.5-cm chip | .04 | 1.4 | .54 | 19 | 0.16 | ——— | 0.16 | 11.80 | 12.98 |
| 216 | Dump, grab | .03 | 1.0 | .46 | 16 | ——— | 0.73 | 0.16 | 13.34 | 14.67 |
| 217 | Dump selected | .03 | 1.0 | .96 | 33 | .13 | 3.20 | ——— | 26.42 | 29.06 |

*Samples 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 just described (sample sites 211–217). The site is just inside the wilderness. Three samples were chipped from a fracture zone as much as 1.5 m wide on which the shaft was sunk. Sample 218, a 76-cm chip sample, assayed 0.02 ounce gold per ton (0.7 g/t), 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 76-cm chip sample, contained 0.04 ounce gold per ton (1.4 g/t) and 0.54 ounce silver per ton (19 g/t), net worth about $9.24 per ton ($10.16/t); sample 220, a 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 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 (1.4 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 400 m southwest of sample location 222 (fig. 8). 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 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 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 pipelike 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 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 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 boxwork and quartz scattered on the dump of a debris-filled prospect pit about 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 11.0-m cut and a 4.3-m adit that bears S. 65° E. The sample, a 91-cm chip sample, was taken from across the face of the adit. It assayed 0.02 ounce gold (0.7 g/t) and 0.96 ounce silver (32 g/t) 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 (1.4 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 30.5 m long. The sample was taken across 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. 9). 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).

#### 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 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 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).

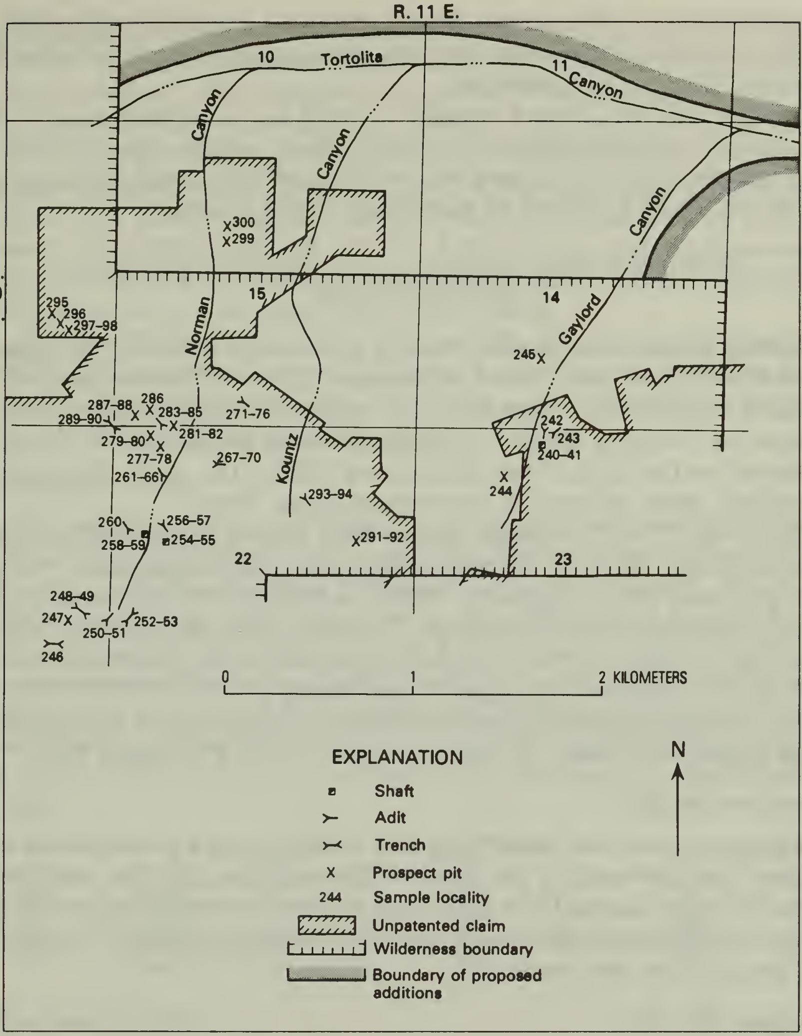


FIGURE 9.—Upper Tortolita Canyon area, showing locality of samples 240–300.

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 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 76 cm of fault gouge in the face of the trench and showed no significant metal values.

### UPPER TORTOLITA, NORMAN, AND KOUNTZ CANYONS (SAMPLES 246-300)

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 refers 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 a few hundred meters, 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 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 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 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 9.0 m deep originally and now filled with debris to within 4.6 m of the collar, was sunk on a 37-cm quartz vein that strikes N. 25° W. A chip sample (258) taken across the vein and a 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 4.6 m long, was driven on a 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 14.3-m adit driven N. 45° W., a 2.8 × 3.1-m stope at the face, and a water-filled winze located 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 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:

| Sample No. | Type | Gold (ounce per ton) | Gold (g/t) | Silver (ounce per ton) | Silver (g/t) | Value (dollars/ton) | Value (dollars/t) |
|---|---|---|---|---|---|---|---|
| 261 | 33-cm chip | 0.03 | 1.0 | 0.46 | 16 | $7.26 | $7.99 |
| 262 | 18-cm chip | .02 | .7 | .44 | 15 | 5.64 | 6.20 |
| 263 | 85-cm chip | .04 | 1.4 | .60 | 21 | 9.60 | 10.56 |
| 264 | 76-cm chip | .02 | .7 | .58 | 20 | 6.48 | 7.13 |
| 265 | 1.1-m chip | .02 | .7 | .56 | 19 | 6.36 | 7.00 |
| 266 | 30-cm chip | .02 | .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 2.4-m adit driven N. 80° E. in a siliceous zone. Sample 267 was taken from a 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 1.0-m chip sample taken across part of the east wall of a connecting 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 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 61-cm transverse siliceous zone, was relatively barren.

*Samples 271–276*

Six samples were collected from a short adit about 366 m north of the same ridge slope as that just described. The adit, which follows a gouge-bearing fracture zone, was driven for 15.3 m on a S. 72° E. bearing. Near the face, a stub drift was driven another 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.

| | | Gold | | Silver | | Value | |
|---|---|---|---|---|---|---|---|
| Sample No. | Type | (ounce per ton) | (g/t) | (ounce per ton) | (g/t) | (dollars/ton) | (dollars/t) |
| 271 | 40-cm chip | 0.03 | 1.0 | 0.54 | 19 | $7.74 | $8.51 |
| 272 | 2.5-cm of gouge | .03 | 1.0 | .32 | 11 | 6.42 | 7.06 |
| 273 | 1.1-m chip | .03 | 1.0 | .56 | 20 | 7.86 | 8.65 |
| 274 | 20-cm chip | .02 | .7 | .34 | 12 | 5.04 | 5.54 |
| 275 | 20-cm chip | .02 | .7 | .22 | 8 | 3.00 | 3.30 |
| 276 | 67-cm chip | .04 | 1.4 | .50 | 17 | 9.00 | 9.90 |

*Samples 277–290*

The samples were collected from the SW1/4 sec. 15 and NW1/4 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 7.6-m open cut connected to a 5.2-m adit that opens to a 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 6 samples listed in the following table contained significant values.

[Leaders indicate sought, not found]

| | | Gold | | Silver | | Lead | Value | |
|---|---|---|---|---|---|---|---|---|
| Sample No. | Type | (ounce per ton) | (g/t) | (ounce per ton) | (g/t) | (percent) | (dollars/ton) | (dollars/t) |
| 278 | 73-cm chip | 0.02 | 0.7 | 0.40 | 14 | 1.2 | $10.68 | $11.74 |
| 279 | 93-cm chip | .02 | .7 | .70 | 24 | ——— | 7.20 | 7.92 |
| 280 | 93-cm chip | .01 | .3 | .68 | 23 | ——— | 5.58 | 6.14 |
| 283 | 13-cm chip | .02 | .7 | .66 | 22 | ——— | 6.96 | 7.66 |
| 284 | 2.5-cm chip | .04 | 1.4 | .10 | 3.4 | ——— | 6.60 | 7.25 |
| 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 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 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 E1/2 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 N1/2 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 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 figure 2 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. 10). Of these, only five sample 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).

*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.

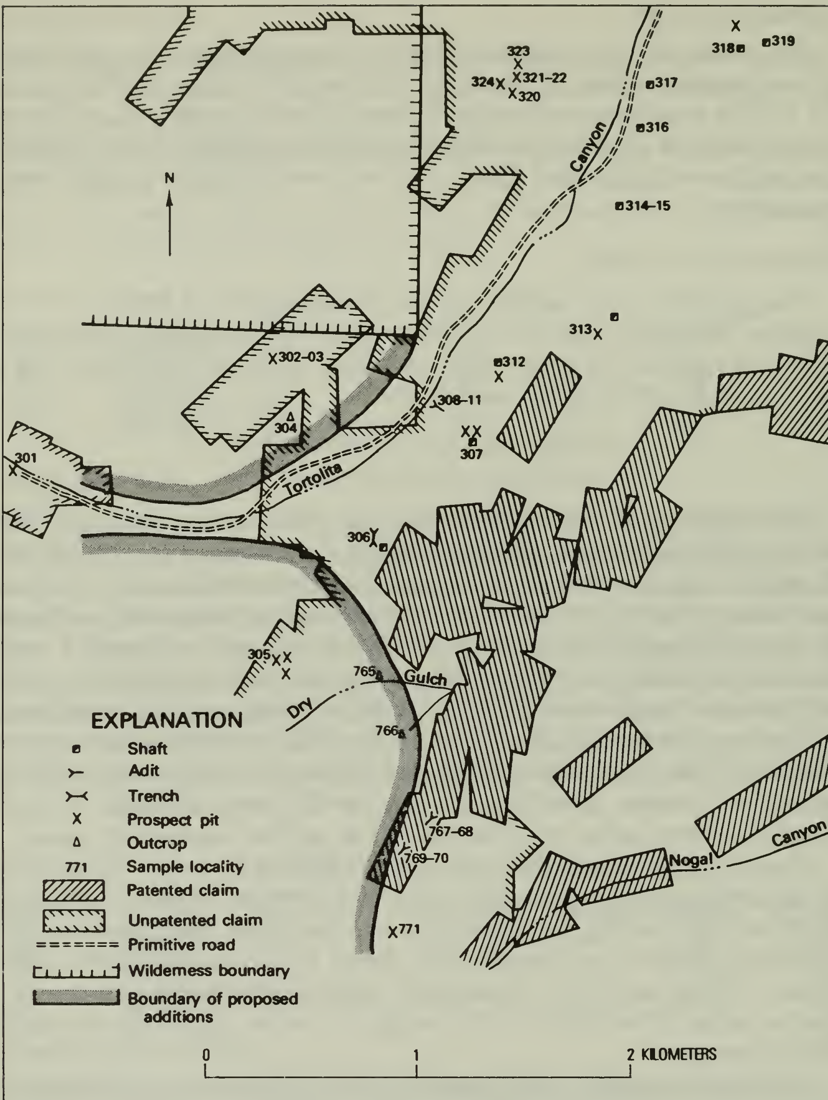


FIGURE 10.—Lower Tortolita Canyon area showing locality of samples 301-324 and 765-771.

*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 Member of the Sierra

Blanca Volcanics. The only working there is a prospect pit sunk on an altered zone 91 cm wide that contains quartz, limonite, and siderite veinlets. The zone is traceable for 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 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 composed of three pits 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 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 15.3-m trench contained no noteworthy values.

A sample (307) of galena-bearing rock was picked from a small stockpile of a 15.3-m shaft sunk on a vein near the southwest corner of the Michigan patented claim. The site is 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 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 91-cm-wide quartz vein is exposed at the face. A 7.9-m crosscut was driven S. 65° W. at a point 58.0 m from the portal. Sample 310, taken across 91 cm of dike or vein matter 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 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 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 30 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 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 more than 800 m east of the wilderness boundary. The shaft is about 30 m deep and filled with water to within 9.2 m of the collar. A sample (314) of stockpiled development rock, representing a vein width of 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, which probably included some of the stockpile material, 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 about 800 m north of sample site 314–315. The south shaft, now partially debris filled, was originally about 5 m deep. It was sunk on a 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 10.7 m deep and is 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 1.6 km east of the wilderness boundary. The shaft, 6.1 m deep and filled with water, was sunk on a 61-cm-wide lamprophyre dike striking N. 70° W. Sample 318 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 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 Tortolita Canyon. All samples were taken from broken rock around the pits. Silver values were significant in four of five samples taken at the pits; values for it and gold are shown in the following table.

| Sample No. | Type | Gold (ounce per ton) | Gold (g/t) | Silver (ounce per ton) | Silver (g/t) |
|---|---|---|---|---|---|
| 320 | Dump, selected | 0.01 | 0.3 | 0.62 | 21 |
| 321 | Random chip | .02 | .7 | 2.00 | 69 |
| 322 | Dump, selected | .01 | .3 | 1.02 | 35 |
| 323 | Dump, quartz | .005 | .2 | .26 | 9 |
| 324 | Dump, selected | .02 | .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 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 12.2 m from the portal. The samples were taken at the portal: 767 was collected from three quartz veins across widths of 10 cm, 5 cm, and 5 cm; 768 was chipped across a 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 91.5 m long, was driven S. 8° W. for the first 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 33.6 m from the portal. Sample 769 was chipped across 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 10.7 m from the portal; it assayed a trace of gold and 0.1 ounce silver per ton (3.4 g/t).

*Sample 771*

Sample 771 was taken from a 2.4 × 1.8 × 1.2-m pit sunk on a 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 Canyons area, secs. 25–27, 34–36, T. 8 S., R. 11 E., and secs. 1–3, T. 9 S., R. 11 E. (fig. 11). Of these, only four sites are in the wilderness.

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 EUO, exposure 13–79, available from the Ogden, Utah, office).

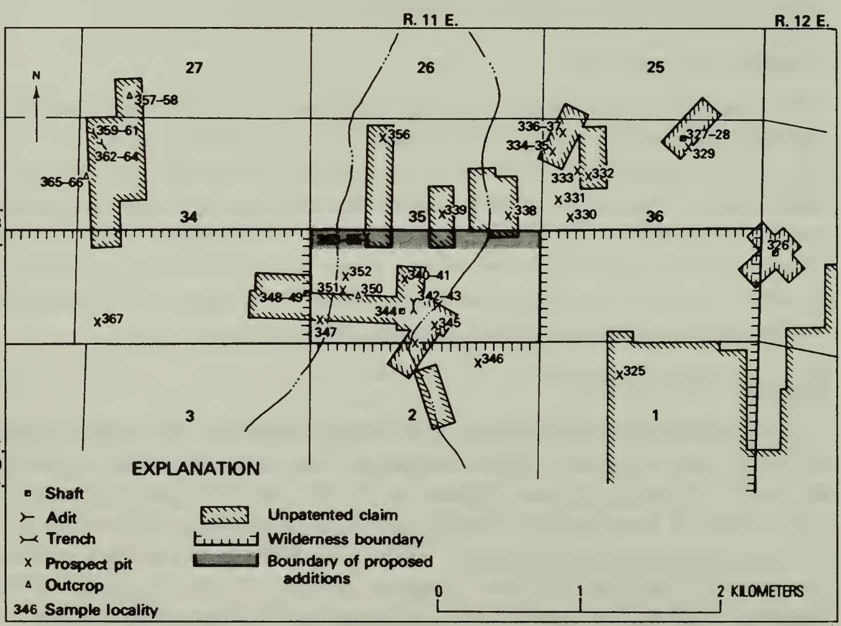


FIGURE 11.—Windy and Pine Canyons area, showing locality of samples 325–367.

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.

*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 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 NE1/4 sec. 36, T. 8 S., R. 11 E. The shaft is filled with caved debris to within about 6.1 m of the surface, but judged from the size of the dump, which is badly eroded, it may have been as much 30 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 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 37-cm chip sample taken at a prospect 15.3 m southeast of the shaft, shows negligible metal values.

*Samples 330–337*

Eight samples were taken from six prospect pits in NW1/4 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 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 E1/2 sec. 35 in the eastern drainage illustrated in figure 11. The pit was sunk in an area of altered andesite agglomerate 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 the same drainage; the only metal value detected was 0.16 percent zinc.

*Samples 340–343*

Sample 340 was taken across a 1.2-m-wide iron-bearing vein near the top of a ridge in the south-central part of sec. 35. The vein strikes N. 59° E. and 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 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 400 m north of the wilderness.

*Samples 344–346*

Sample 344 was taken from the dump of a caved shaft near the center of S1/2 sec. 35. The shaft is estimated to have been 9.2 m deep. Sample 345 was taken from the dump of a prospect pit sunk a short distance from the main bend of the eastern drainage illustrated in figure 11. 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 this same canyon in NE1/4 sec. 2, T. 9 S., R. 11 E., and just inside the wilderness. The working is near the contact of the Church Mountain Latite Member of the Sierra Blanca Volcanics 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 western drainage illustrated in figure 11. The principal prospect in the area is a shallow shaft in SE1/4 sec. 34, T. 8 S., R. 11 E. The partly timbered shaft was originally about 6.1 m deep, but is now filled with debris to within 3.1 m of the collar. The workings are on shear zones, quartz veins, gossan, and siderite veins, as much as 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 SW1/4 sec. 27 and NW1/4 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 18 cm wide and an altered area 1.5 m in diameter 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 400 m southwest of the copper showings. The lower working consists of a 6.1-m cut connected to a 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 16.5-m cut connected to a 5.2-m adit, from the end of which branch three short drifts 2.4-3.1 m long. 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 25-cm copper-stained quartz zone in a 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). Two meters south, a 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 the Hopkins Canyon area in secs. 4, 5, 8, 9, and 17, T. 9 S., R. 11 E. (fig. 12). Nearly half of these samples 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 Commercial-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.

Patents were issued for the Red Jim, Delaware, Trust, Cinnamon, Union Jack, Bornite, and Privateer claims (south group shown on fig. 12) in 1887. Patents were issued for the Homestake-Grub Stake-Butcher Boy group (north group) in 1906. A small mining camp, at

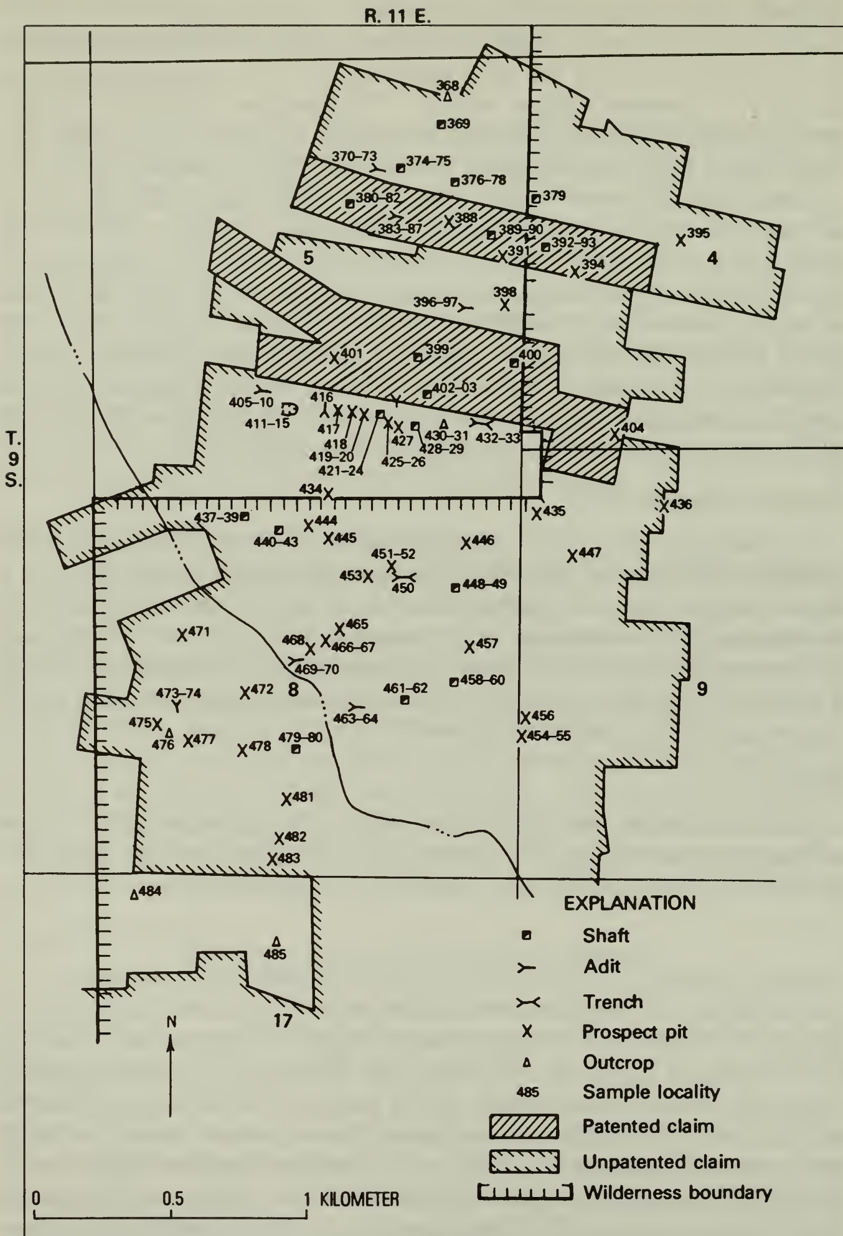


FIGURE 12.—Hopkins Canyon area and vicinity, showing locality of samples 368–485.

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 NE1/4 sec. 5, the northernmost mineral occurrence in the area. The showing is 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 122 m south from the outcrop just described. The shaft was originally about 4.6 m deep prior to caving. It was sunk on an altered zone in andesite 51 cm wide that includes a subzone of disseminated copper about 56 cm wide and a weathered quartz vein 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 NE1/4 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 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 24.1 m. Altered-andesite samples 370 and 372 contained only small amounts of gold and silver. Sample 371 from a 46-cm shear zone 7.9 m from the face assayed 0.21 percent copper. A 34-cm chip sample (373) across a fracture zone in the face of a north-trending 2.1-m stub drift 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 3.1-m shaft just upslope from the adit. Sample 374 was taken in the east wall where the vein is 46 cm wide. The sample assayed 0.01 ounce gold per ton (0.34 g/t), 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 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). 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 10.7-m shaft located east of sample sites 374–375. There it is 1.8 m wide and was mined in a cut 3.1 m deep extending eastward from the shaft for 4.6 m. Three continuous samples (376–378) each 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. Corresponding gold assays were 0.02, 0.01, and 0.03 ounce per ton (0.69 g/t, 0.34 g/t, and 1.03 g/t). 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 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. 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 that is the principal working on the claims. The shaft is at least 30 m deep and 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), 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 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 adit was driven 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 10 cm to 1.4 m. A chip sample (388) was taken across a 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 6.1 m deep and was sunk on a 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 ($340.83/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 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 11.6 m deep and inaccessible, is located in the wilderness area 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 31-cm-wide siderite vein in a prospect pit east of the Butcher Boy; assay values were negligible. Siderite also crops out in a 61-cm vein at a pit across the arroyo about 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 7.6-m cut connected to a 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 1.1-m back of the drift 6.7 m from the portal assayed 0.11 percent copper. A combined sample (397) taken at the brow of the portal included 10 cm of gouge sampled on the hanging wall side and a 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 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 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 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 31-cm vein near the Union Jack(?) shaft assayed 0.10 percent copper. The shaft was sunk about 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 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 S1/2 sec. 5, T. 9 S., R. 11 E. One of the first claims to be located there was the Minnie Lea (Mineral Survey 744) 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 the workings examined are outside the wilderness.

The mine is briefly described by Griswold (1959), and W. G. Sandell made a private examination of the Commercial mine in 1969; he stated (unpub. data, 1969) that the silver-copper vein ranged from 6.1 m wide at the west end of the area to 91 cm wide on the Hat claim at the east end. The strike length is nearly 1,200 m. In those places where Sandell reported the vein to be exceptionally wide, it appears to consist of zones of intensely altered, fractured, or sheared rock containing lesser veins of silica or carbonate as much as 1.5 m wide.

Sandell concluded that a good potential existed 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, which 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 31.4 m S. 75° E.; a pit 9.2 m in diameter; an adit 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 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 tabulated; listed dollar values per ton range from $5.02 to $143.48 ($5.72 to $157.83/t).

| Sample No. | Type | Gold (ounce per ton) | Gold (g/t) | Silver[1] (ounce per ton) | Silver[1] g/t) | Copper[2] (percent) | Lead (percent) | Value (dollars/ton) | Value (dollars/t[3]) |
|---|---|---|---|---|---|---|---|---|---|
| 405 | 70-cm | 0.01 | 0.3 | ——— | ——— | 0.93 | ——— | $16.38 | $18.02 |
| 406 | 1.3-m chip | .01 | .3 | ——— | ——— | 0.34 | ——— | 6.94 | 7.63 |
| 407 | 1.6-m chip | .01 | .3 | ——— | ——— | 0.22 | ——— | 5.02 | 5.52 |
| 408 | 52-cm chip | .01 | .3 | 1.60 | 55 | 1.80 | ——— | 39.90 | 43.89 |
| 409 | 1.6-m chip | .01 | .3 | ——— | ——— | .15 | ——— | ——— | ——— |
| 410 | 31-cm chip | .01 | .3 | 1.12 | 38 | 1.50 | ——— | 32.22 | 35.44 |
| [4]411 | 52-cm chip | .01 | .3 | ——— | ——— | .51 | ——— | 9.66 | 10.63 |
| [4]412 | 1.8-m chip | .01 | .3 | ——— | ——— | .23 | ——— | 5.18 | 5.70 |
| [4]413 | do | .01 | .3 | ——— | ——— | ——— | ——— | ——— | ——— |
| [4]414 | do | ——— | ——— | ——— | ——— | ——— | ——— | ——— | ——— |
| [5]415 | Selected | .02 | .7 | .52 | 18 | 2.00 | 0.64 | 43.67 | 48.04 |
| 416 | 1.3-m chip | .01 | .3 | ——— | ——— | ——— | ——— | ——— | ——— |
| 417 | 15-cm chip | .01 | .3 | ——— | ——— | .19 | ——— | ——— | ——— |
| 418 | 20-cm chip | .04 | 1.4 | 12.20 | 418 | 3.80 | .79 | 143.48 | 157.83 |
| 419 | do | .01 | .3 | ——— | ——— | 1.00 | .69 | 20.54 | 22.59 |
| 420 | Dump, grab | .01 | .3 | .40 | 14 | .35 | .62 | 12.23 | 13.45 |
| 421 | do | .01 | .3 | ——— | ——— | ——— | ——— | ——— | ——— |
| [6]422 | 1.2-m chip | .01 | .3 | ——— | ——— | .53 | ——— | 9.98 | 10.78 |
| 423 | 34-cm chip | .01 | .3 | ——— | ——— | ——— | ——— | ——— | ——— |
| [7]424 | 1.5-m chip | ——— | ——— | ——— | ——— | ——— | ——— | ——— | ——— |
| [7]425 | 1.4-m chip | .01 | .3 | ——— | ——— | ——— | ——— | ——— | ——— |
| [8]426 | Dump, grab | .01 | .3 | .54 | 19 | .37 | .80 | 14.18 | 15.60 |
| 427 | 1.8-m chip | .01 | .3 | ——— | ——— | .13 | 1.80 | 11.50 | 12.65 |
| 428 | Dump, grab | .01 | .3 | 1.00 | 34 | .29 | ——— | 12.14 | 13.35 |
| 429 | Stockpile | .02 | .7 | 2.06 | 71 | .43 | 2.20 | 31.92 | 35.11 |
| [9]430 | 91-cm chip | .01 | .3 | ——— | ——— | ——— | ——— | ——— | ——— |
| 431 | 70-cm chip | .01 | .3 | 1.10 | 38 | .21 | 2.00 | 22.15 | 24.36 |
| 432 | 20-cm chip | .01 | .3 | ——— | ——— | ——— | ——— | ——— | ——— |
| 433 | Dump, grab | .01 | .3 | ——— | ——— | ——— | .51 | ——— | ——— |

[1]Shown only if more than 0.3 ounce per ton (10 g/t).
[2]Shown only if more than 0.10 percent.
[3]Shown only if more than 0.40 percent.
[4]Segments of the same pit face.
[5]Also 0.39 percent zinc.
[6]Also 0.38 percent zinc and 12.5 percent barium.
[7]Samples 424 and 425 are from segments of the same pit face.
[8]Also 13.0 percent barium.
[9]Segments 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 N1/2 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 30.5 m deep. Unstable ground did not permit sampling in the shaft. Sample 437 was collected from a 10-cm 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 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 (0.5 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 Nos. 1 and 2 were located by C. E. Degner in 1970. The west pit was sunk on a barium-rich siderite vein 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 a stockpile at the Magma No. 1 discovery pit assayed 22.5 percent barium. The width of the vein could not be accurately measured, but it was probably about 31 cm.

*Sample 446*

At this site, a random chip sample was taken of limonite-stained rock exposed in a small prospect. Assay values were negligible.

*Sample 447*

Sample 447 was a 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 9.2-m shaft about 300 m inside the wilderness in NE1/4 sec. 8. The shaft is one of a group of workings, thought to be on the old Thanksgiving claim. It was sunk on a 61-cm-wide manganese-stained limonite vein striking N. 75° W. The two samples (448 and 449) showed low metal values.

The vein is exposed on the nose of a ridge to the west, in a caved working that may originally have been a 9.2-12.2-m trench or adit and a prospect pit. A maximum width of the vein is about 31 cm where it was observed in the caved working. A grab 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 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 1.1-m altered dike exposed in the east face of the working assayed 0.1 percent copper. Insignificant metal values were contained in an 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, except samples 484 and 485, which are from outcrops in sec. 17. Access to the workings is by four-wheel-drive vehicle up the canyon illustrated in figure 12 to the wilderness boundary. Location descriptions indicate numerous claims 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 composed the old Ace mine that was located in 1925 and held 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; assay 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 40.6-m-deep working. Two 0.9-t stockpiles of copper-stained iron-manganese gossan are on the dump, and another stockpile is 38.1 m northwest. 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 determined, but the gossan is at least 2 m wide. The alteration zone strikes east-west and dips 70° N.

*Samples 461 and 462*

Two samples were taken from Idaho shaft No. 1, which is about 90 m southwest of shaft No. 2. Shaft No. 1 was reported to be sunk 24.4 m on a shear zone of calcite, siderite, and barite at least 15.3 m wide that contains a 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 dump sample (462), however, assayed 0.01 ounce gold (0.3 g/t), 0.54 ounce silver per ton (19 g/t), and 0.17 percent copper, about $7.46 per ton ($8.21/t).

*Samples 463 and 464*

Two samples were taken from an adit 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 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 61 m farther down the canyon slope. The sample was chipped across a 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 a 20-cm siderite vein parallel to the 15-cm zone, showed 0.70 percent copper, about $11.70 per ton ($12.87/t). A third prospect is 15.3 m below the second described pit. A 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 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 1.2-m chip sample taken across the face; it contained nothing of value. Sample 470 was chipped from copper-bearing boulder-size fragments 61 cm in diameter piled on the left wall of an 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 noncontinuous character of the mineral deposits exposed in the pits upslope, the overall configuration may be that of a series of mineralized lenses strung out beadlike along a favorable zone in the andesite.

*Samples 471 and 472*

The samples are from a prospect pit on the southwest side of the canyon of figure 12 and another pit 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 a drainage south of the canyon illustrated in figure 12. 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 33.6 m long was driven S. 30° E. in an apparent effort to undercut outcrops on an overlooking ridge. A 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 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 a 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 61-cm width of a dike at least 1.8 m wide in a third pit about 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 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 that a wide vein may exist. The samples (479 and 480) were taken from the dump of a shaft 7.6 m deep sunk on the same body. This excavation, which is 91.5 m east of the shallow pit, exposes a 1.2-m copper- and iron-stained zone on the southwest side of the main 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 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 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 stockpile 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 5-cm quartz stringer that 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 the main Hopkins Canyon area; the only noteworthy value obtained was from the spectrographic analysis, which showed less than 1,000 ppm molybdenum.

### BEAR AND WATER AND SANDERS CANYONS AREA

The Bear and Water-Sanders Canyons area 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. 13) and includes many workings and prospects. Access to most of the area is by an unmaintained road up Water Canyon; the workings in the upper reaches of the northernmost canyon can be reached by a trail west from Nogal Canyon.

A total of 163 samples was taken at dozens of localities in all three canyons in the area. Of these, 145 are from within the wilderness; the

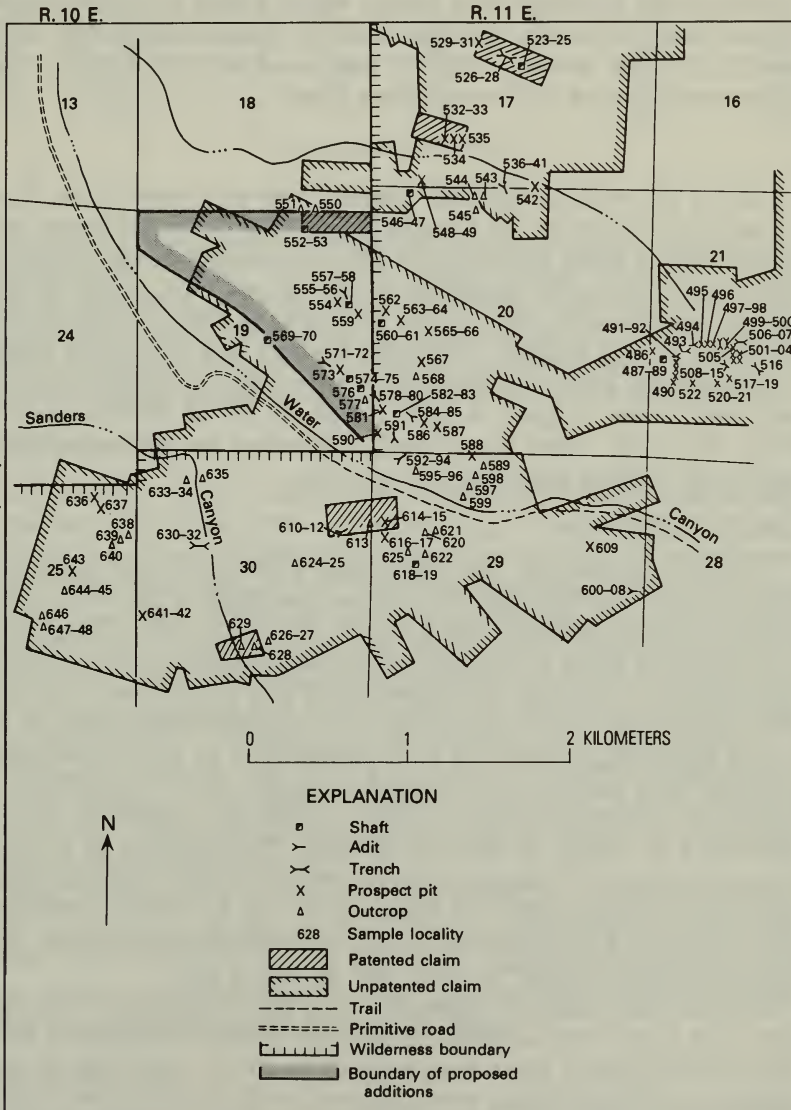


FIGURE 13.—Bear and Water-Sanders Canyons area, showing locality of samples 486–648.

remainder are within 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 sample from a small ore stockpile, had a value of more than $350 per ton ($385/t).

### BEAR CANYON AREA (SAMPLES 486-549)

Exploration probably first began when Edson E. Baird located several dozen claims in the Bear (Baird?) Canyon claim area (north one-third of area shown in fig. 13) beginning in 1880. Various other claims were located in the area since then.

#### Upper Bear Canyon Area

Most of the work in the Bear Canyon area 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–$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(?) shaft on the ridge at the west end of the vein system had been sunk 8.2 m in silicic rock. Two of three adits on the canyon slope to the east are caved; originally they probably were about 30.5 m long. The upper, third adit was driven 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 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 39.9 m. The north drift begins 13.4 m in from the portal and was driven northeast in an arc varying from N. 80° E. to N. 65° E. for 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 tabulated:

[Leaders indicate sought, not found]

| Sample No. | Type | Gold (ounce per ton) | Gold (g/t) | Silver (ounce per ton) | Silver (g/t) | Value (dollars/ton) | Value (dollars/t) |
|---|---|---|---|---|---|---|---|
| 491 | 76-cm | 0.07 | 2.4 | ——— | ——— | $10.50 | $11.55 |
| 493 | Quartz chip 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 | 76-cm chip | .06 | 2.1 | .52 | 18 | 12.12 | 13.33 |
| 509 | 1.1-m chip | .02 | .7 | .42 | 14 | 5.52 | 6.07 |
| 510 | 1.2-m chip | .03 | 1.0 | .30 | 10 | 6.30 | 6.93 |
| 511 | 98-cm chip | .04 | 1.4 | .54 | 19 | 9.24 | 10.16 |
| 512 | 76-cm chip | .10 | 3.4 | 1.24 | 42 | 22.44 | 24.68 |
| 513 | 1.25-m chip | .06 | 2.1 | .44 | 15 | 11.64 | 12.80 |
| 514 | 79-cm chip | .08 | 2.7 | .74 | 25 | 6.44 | 7.08 |
| 515 | 73-cm chip | .06 | 2.1 | ——— | ——— | 9.00 | 9.90 |
| 516 | Dump, selected | .01 | .3 | .38 | 13 | 6.98 | 7.68 |
| 517 | 70-cm chip | .08 | 2.7 | .76 | 26 | 16.56 | 18.22 |
| 518 | 34-cm chip | .10 | 3.4 | .70 | 24 | 19.20 | 21.12 |
| 519 | Dump, selected | .20 | 7 | 1.20 | 41 | 37.20 | 40.92 |
| 520 | 55-cm chip | .04 | 1.4 | .46 | 16 | 8.76 | 9.64 |
| 521 | 67-cm chip | .06 | 2.1 | .30 | 10 | 10.80 | 11.88 |
| 522 | 37-cm chip | .05 | 1.7 | .32 | 11 | 9.42 | 10.36 |

## Lower Bear Canyon Area

Most of the workings in the lower Bear Canyon area are in sec. 17. Two patented claims, the Sugar Stake located in 1880 and the Homesteak 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).

### *Samples 523–531*

Sample 523 was taken across a 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 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 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 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 4.6×1.2-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 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 that may be on the patented Homesteak claim in the main Bear Canyon area. The workings, which include three shallow pits that were sampled, have been nearly obliterated by erosion. Sample 532 was chipped across a 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 18 cm of silicified material and 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 91-cm width of the vein and included 49 cm of gouge from the south side of the vein. Sample 535 was chipped across a 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 22.0 m long at a small waterfall upstream from the Homesteak claim. the adit was driven S. 25° E. for 18.0 m, then S. 10° E. for 4.0 m; it 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 1.2 m from the face, sample 536 was taken across a 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 18 cm of gritty clay that adjoins the vein on its south side and across 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 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 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 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 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 122 m east of the adit just described. The dump is estimated to contain 22.7 t of material. The sample, which assayed 0.06 ounce gold per ton (2.1 g/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 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 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 400 m west of the workings in the lower Bear Canyon area. A quartz vein exposed in a shaft there may be an extension of that exposed in the workings of the lower Bear Canyon area. Sample 546, a 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 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 a 2.4-m-wide dike; 549 was chipped across a 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 E1/2 sec. 25, T. 9 S., R. 10 E. All 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 private, unpublished data, Waldemar N. Ervin examined some of the properties about 1941. Ervin stated that the principal vein is the Surprise vein, which is about 2,400 m long and strikes N. 61° W. The vein was reported by Ervin to be 3.7-10.7 m wide, averaging 6.1 m. He reported the Surprise (Red Chief?) shaft to be 25.9 m deep, and the Iron Blossom shaft 36.6 m deep with 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 1.6-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 sulfides. Also present are mineralized lenses of andesite as much as a meter or more across that contain copper.

Of 99 samples taken from numerous localities, 34 assayed in excess of $5.00 per ton ($5.50/t). 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 SE1/4 sec. 18 and NE1/4 sec. 19, T. 9 S., R. 11 E., just west of the wilderness. One sample (550) was chipped across a 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 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 6.7 m of the collar. A sample (552) representing a 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), 4.74 percent copper, and 17.2 percent barium, 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 15.3-m level with a 30.5-m adit. A caved shaft observed in sec. 20 probably was originally about 6 m deep.

Six of the samples (554–559) were taken just west of the wilderness; the others (560–566) came 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 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 1–2-t 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 dump sample, contained 6.0 ounces silver per ton (206 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 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 SW1/4 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 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 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 25.4 m wide and has a mushroomlike shape, hence the name Iron Blossom. Two chip samples were taken across the middle 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 12.8 m, and S. 45° E. for 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 5.2 m in diameter and was sunk on an altered shear zone of the same width. The sample was chipped across a 91-cm width of an iron-stained band within the shear zone and contained 0.01 ounce gold per ton (0.34 g/t) and 15.8 percent barium.

*Sample 574 and 575*

Two samples were from stockpiles on the dump of a 3.1-m shaft. The shaft, located a short distance southeast of the pit just described, was sunk on an oxidized vein 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. Sample 575 contained 25.7 percent barium.

*Samples 576 and 577*

Samples 576 and 577 are chip samples of 31 and 55 cm respectively 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 45.5 t of mineralized material. Barite was the most abundant constituent (35.3 percent and 20.1 percent barium), 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 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 34 cm in the trench, assayed 1.38 ounces silver per ton (47 g/t) and 0.09 percent copper, about $8.28 per ton ($9.11/t); and sample 579, a 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). Barium assays were 27.8 percent and 36.9 percent in samples 578 and 579 respectively.

*Sample 581*

The sample was from a small stockpile of ore on a dump of about

45 t, lying east of the adit just described. The sample assayed 49.66 ounces silver 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 the sample was calculated at $350 per ton ($386/t). Due to sloughing, the origin of this high-grade material could not be determined.

*Samples 582 and 583*

Two samples were taken from a stockpile of ore of approximately 4.5 t on the dump of the 25.9-m Surprise shaft. Material similar in appearance to that in the stockpile was observed in part of the vein (a zone 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), 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, 6.1 m long and bearing N. 65° W., is located 45.8 m east of the Surprise shaft. Sample 584, chipped across a 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), 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 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 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 70 cm of a copper-stained andesite zone on a ridge north of Water Canyon (sec. 29), 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 SW1/4 sec. 20, and NW1/4, 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.

Amethystine quartz and minor copper stain were noted in a stockpile grab sample from the dump of 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 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 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 5-cm vein 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 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 61 m southeast of the Surprise Contact adit. Sample 595 was taken from across a 15-cm quartz vein, and sample 596 across a 43-cm quartz vein in a 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 about 100 m wide and is located 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 3.7-m lamprophyre dike striking east-west. A chip sample (599) across 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 E1/2 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., is 122 m long (C. E. Degner, Carrizozo, N. Mex., oral commun., 1972). A section of the adit has caved 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 (11–21 g/t). One sample (602) contained 0.28 percent copper. The caved area is located at a 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 10-cm chip sample was taken from an east-trending caved working 3 m long. It showed no significant values.

*Samples 610–619*

Three samples were taken from the west end of the Copper Matte patented claim NE1/4 sec. 30, T. 9 S., R. 11 E. No major workings were seen on the Copper Matte. An adit 3.1 m long and 1.8 m wide is near the bottom of the canyon. Three samples were taken at the adit face; sample 610 was taken across 91 cm of the left half, and sample 611 was taken across 91 cm of the right half. Sample 612 was a 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 1.5-m lamprophyre dike and a parallel dike of porphyritic andesite are exposed in several shallow pits. A sample (614) across a 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 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 15.3 m deep but is now filled with debris to within 8.2 m of the surface. A level may have been driven along the vein at that depth. The shaft was sunk on a 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 6.1 m wide. A sample (618) from a stockpile of less than 1 t 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 0.6-m-wide vein is indicated by the material. 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 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 3-cm chip (622) yielded 0.38 ounce silver per ton (13 g/t) and 0.31 percent copper ($8.74 per ton; $9.61/t). 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 93 $m^2$ was sampled on the east rim of Sanders Canyon. A sample (624) from a mineralized lens 46 cm long and 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 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(?) the patented Water Cress claim in S1/2 sec. 30, T. 9 S., R. 11 E. No workings were found in the area; 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 15.3-m trench on the west side of Sanders Canyon. The vein trends N. 80° W. and ranges from 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 (7.7, 18.2, 15.4 g/t), 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 (12–21 g/t).

*Samples 636–648*

Thirteen samples were taken from the area of foothills and mountain slope in E1/2 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 91 cm wide and striking S. 45° E., is exposed in a 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 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 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 3.3 m 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 14). Other siderite and quartz veins occur in the Spring Canyon drainage, and most of them are in the wilderness in secs. 1 and 2, T. 10 S., R. 10 E. (fig. 14). 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 9.2-12.2 m in an intensely altered zone 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 30.5 m wide (sample location 657).

#### SPRING CANYON (SAMPLES 658-665)

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

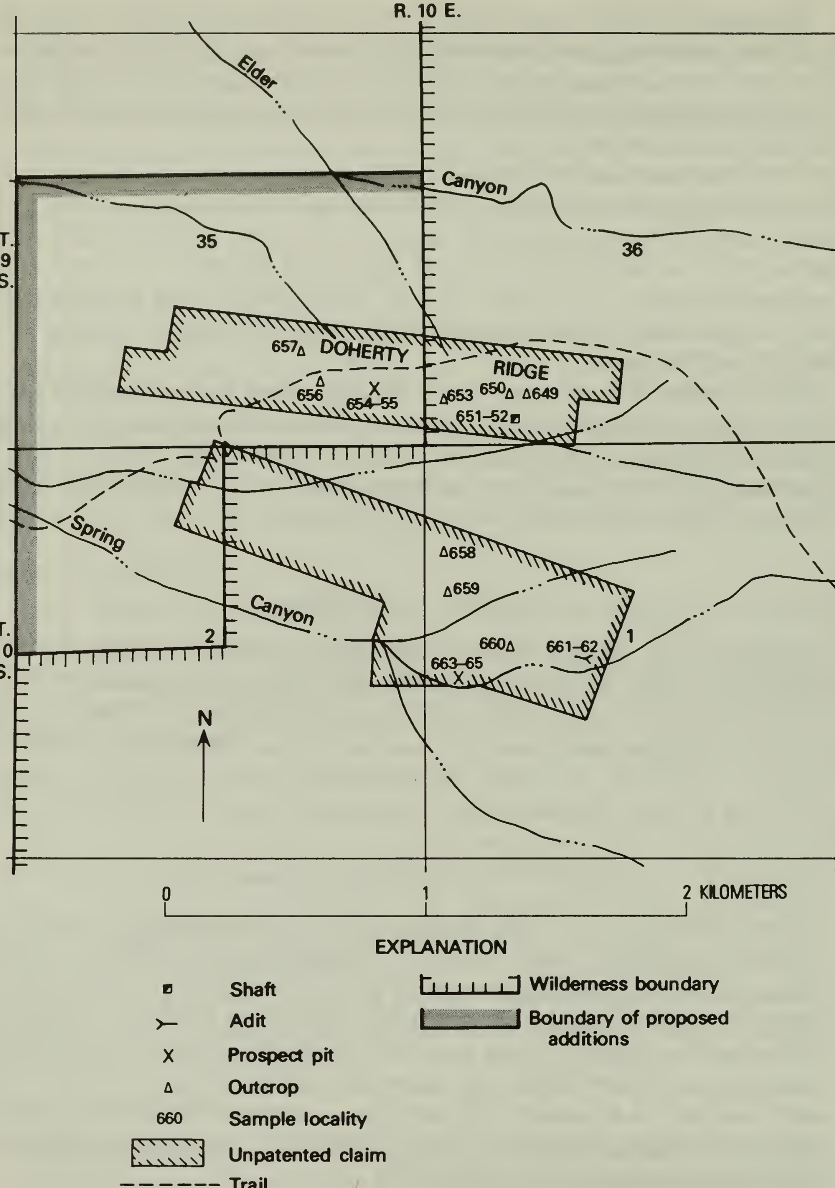


FIGURE 14.—Spring Canyon area, showing locality of samples 649-665.

*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 a few hundred meters. The three veins that were examined range from 31 cm to 1.8 m in width. Sample 660, taken across an interval of 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 12.2 m N. 75° W. along a group of narrow quartz veinlets associated with a 61-cm-wide basaltic dike in porphyritic andesite. The samples, both 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 4.6 m east-west by 1.2–1.5 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 within the wilderness (fig. 15)—assayed values greater than $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 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 31 cm of copper-stained material in a mineralized lens in NE1/4 sec. 14, yielded only 0.01 percent copper.

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

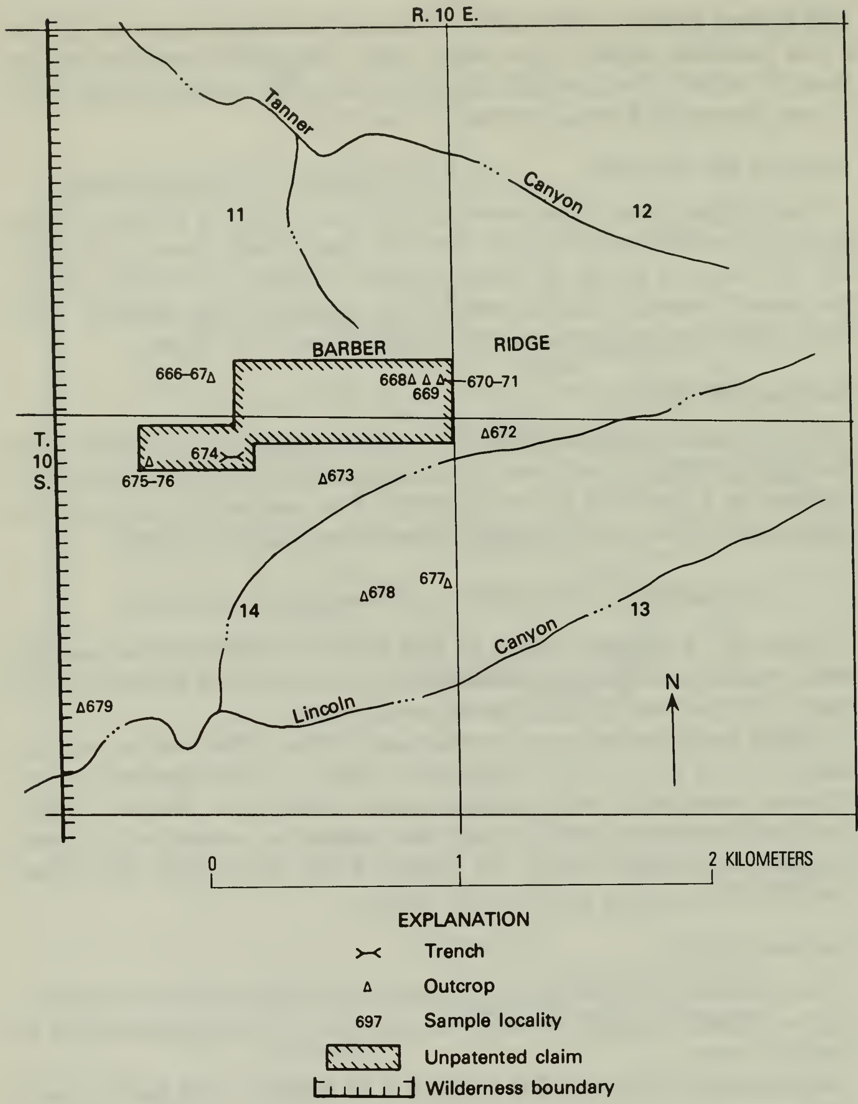


FIGURE 15.—Barber Ridge-Lincoln Canyon area, showing locality of samples 666–679.

Two chip samples, 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 NW1/4 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 76-cm chip sample (677) across a talclike outcrop showed no metal concentrations. A sample (678) of float from a 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 46-cm chip sample (679) was cut across an 8-cm lamprophyre dike and 38 cm of an adjacent iron-stained zone. The sample site is 4.6 m downstream from a 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 RIVERS CANYON AREA (SAMPLES 680-697)

Eight samples were taken from a number of claims located on quartz outcrops about 400 m south of the Three Rivers Canyon campground in the southwest corner of the White Mountain Wilderness (fig 16). Three shallow shafts and two pits were sunk on quartz veins that contain copper and lead minerals. The north working is a shaft that has caved and filled with debris to within 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) was taken from the dump (estimated at 22.7 t); it 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 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 4.6-m shaft. About 30 m west, a wedge-shaped trench was cut about 4.6 m deep; farther west is a 3.1-m-deep pit. The westernmost working on this vein is a 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 tabulated here:

[Leaders indicate sought, not found; leaders in value columns indicate insignificant values]

| Sample No. | Type | Silver (ounce per ton) | Silver (g/t) | Copper | Lead (percent) | Zinc | Value (dollars/ton) | Value (dollars/t) |
|---|---|---|---|---|---|---|---|---|
| 682 | Dump, grab | 0.50 | 17 | 0.57 | ——— | ——— | $12.12 | $13.13 |
| 683 | 13-m chip | .40 | 14 | ——— | ——— | ——— | ——— | ——— |
| 684 | Stockpile | .30 | 10 | ——— | 1.14 | 1.55 | 19.42 | 21.36 |
| 685 | 10-cm chip | .30 | 10 | ——— | 1.08 | ——— | 8.65 | 9.52 |
| 689 | Dump, grab | .30 | 10 | ——— | .44 | ——— | ——— | ——— |
| 693 | do | .30 | 10 | ——— | .58 | ——— | ——— | ——— |

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.

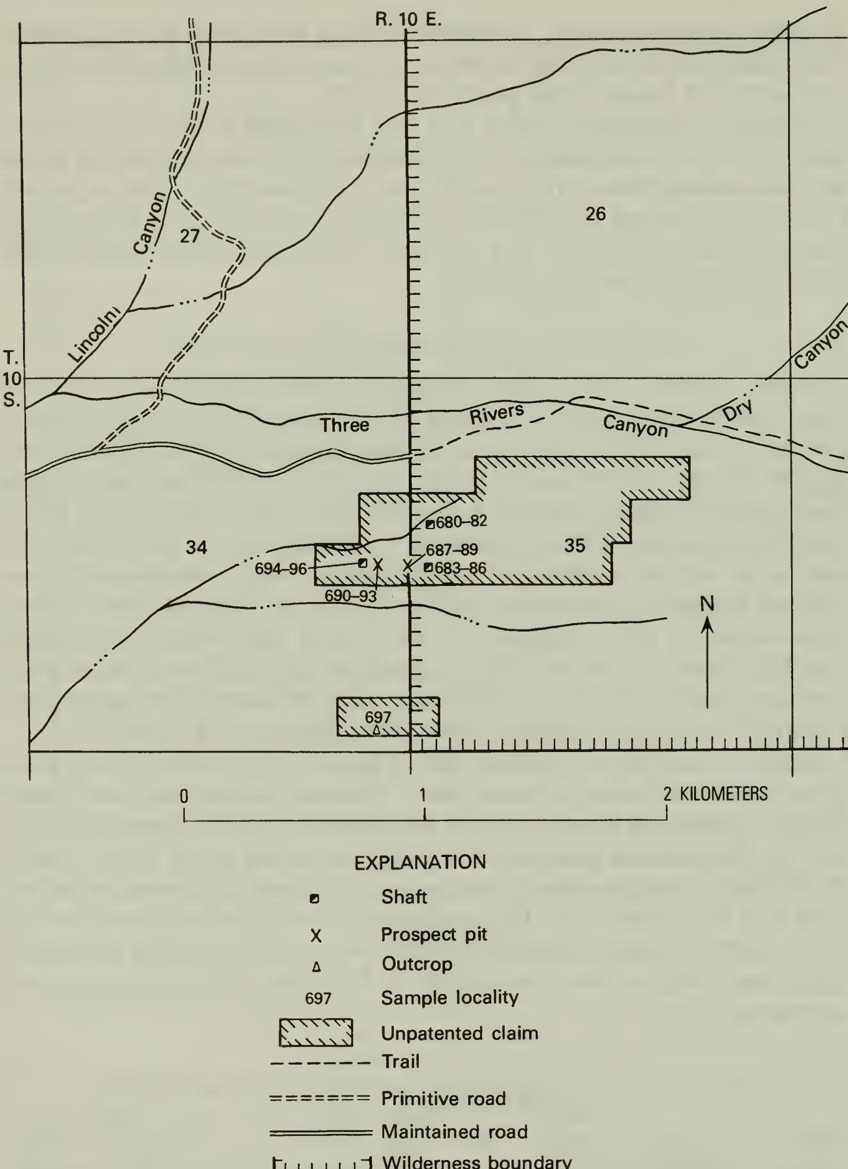


FIGURE 16.—Three Rivers Canyon area, showing locality of samples 680-697.

## LOOKOUT MOUNTAIN AREA (SAMPLES 698-700)

Three 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 run-

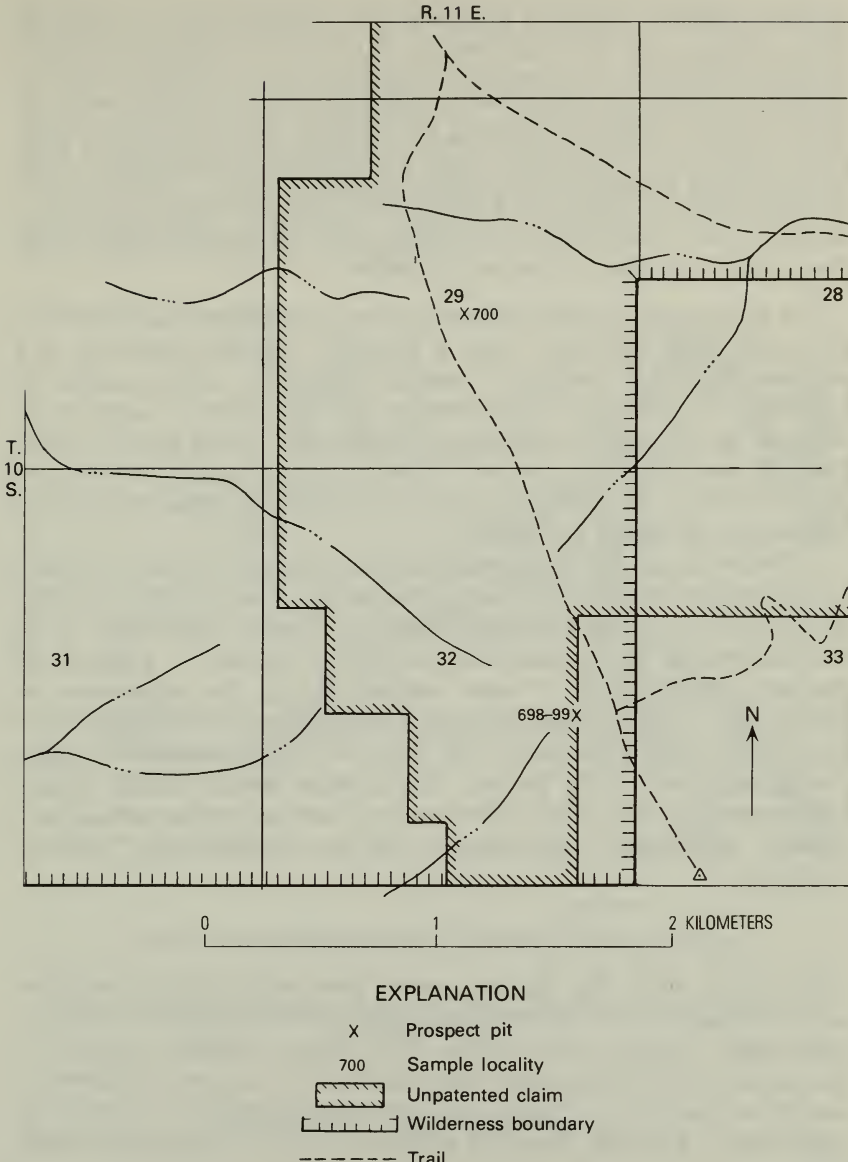


FIGURE 17.—Lookout Mountain area, showing locality of samples 698–700.

ning northwest from the peak in sec. 33, T. 10 S., R. 11 E. (fig. 17). A pit was excavated in a gossan of boxwork limonite that contains fistsized pieces of pyrite occurring in crystalline aggregations. A grab sample (698) of the gossan contained 360 ppm molybdenum. A 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—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 in figure 2a. Exploration roads were constructed, and several holes were drilled there during 1963-68 by permission of the Forest Service. Results are not available.

The Bon group of claims covers an area of widespread alteration in the wilderness that 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 that does not lie in the wilderness, as the E. C. Group.

A fissure about 300 m long containing clusters of quartz crystals was examined in the wilderness in the center of sec. 29 (fig. 17). Mining claims were located there in 1943, and 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 AREA AND VICINITY

The South Fork Rio Bonito canyon area and vicinity comprises seven sections in the southeastern part of the study area (fig. 18). Sixty-eight samples were taken from eight localities within six drainages. In the discussion that follows, the canyon is referred to simply as South Fork. Thirty-nine sites were examined. 10 within the wilderness, 12 in the proposed additions, and 17 outside the study area.

#### UPPER SOUTH FORK OF RIO BONITO CANYON (SAMPLES 701-703)

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

Two samples were taken from the area of two short adits on the banks of South Fork in sec. 22, T. 10 S., R. 11 E. The area is in the wilderness. Both adits, 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 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 ridgetop about 1.6 km northwest of the adits.

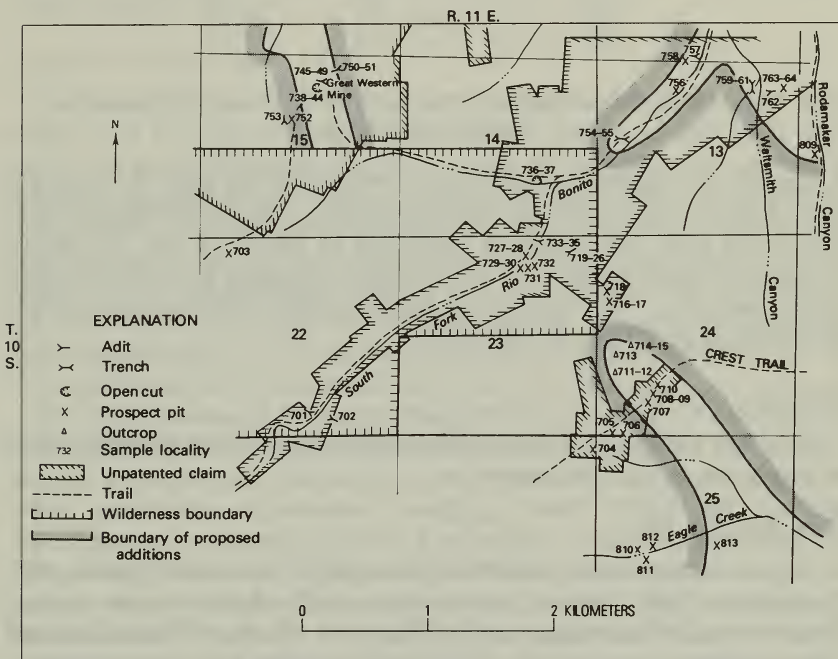


FIGURE 18.—South Fork Rio Bonito canyon and vicinity, showing locality of samples 701–737.

## 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 5-cm quartz veinlet, contained 0.60 ounce silver per ton (21 g/t); 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:

| Sample No. | Silver (ounce per ton) | Silver (g/t) |
|---|---|---|
| 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 and its drainage area to the southeast. All the workings are in the study area, and most of them are in the N1/2 sec. 23. Seven samples assayed significant silver values ranging from 0.40 to 0.82 ounce per ton (14 to 28 g/t); three 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 NE1/4 sec. 23. It is 33.2 m long and follows a lamprophyre dike. Of the eight samples taken only one sample (725), a 70-cm chip sample, showed a significant value—0.40 ounce silver per ton (14 g/t).

*Samples 727–732*

These 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 43-cm altered zone and contained 0.46 ounce silver per ton (15.6 g/t). Samples with values in excess of $5.00 per ton ($5.50/t) are tabulated:

| Sample No. | Type | Gold (ounce per ton) | Gold (g/t) | Silver[1] (ounce per ton) | Silver[1] (g/t) | Molybdenum (ppm) | Value (dollars/ton) | Value (dollars/t) |
|---|---|---|---|---|---|---|---|---|
| 728 | Selected | 0.01 | 0.3 | 0.40 | 14 | 700 | $ 8.80 | $ 9.68 |
| 729 | do | .01 | .3 | .66 | 23 | 2,500 | 22.96 | 25.26 |
| 730 | do | .005 | .2 | .18 | 6 | 1,500 | 10.50 | 11.55 |

[1]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 3.1-m adit driven along an altered zone; a sample from the dump (735) 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 15.3 m wide and reportedly several thousand feet long. The zone is in the wilderness near the mouth of the tributary canyon in E1/2 sec. 14 (fig. 18). 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 64 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 micrometers. 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), respectively. 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 37-39 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 (fig. 19), which is located on a ridge in NE1/4 sec. 15. It is reached by means of four-wheel-drive vehicle road in a south-trending tributary canyon of Big Bear Creek (figs. 3,4). Part of the property lies within the study area, but the 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, cemented with silica. The fragments constituting the breccia are commonly less than 8 cm in diameter. Outcrops of the breccia are orange red and contrast with the color of other gold-bearing breccias in the area, which are yellowish tan.

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

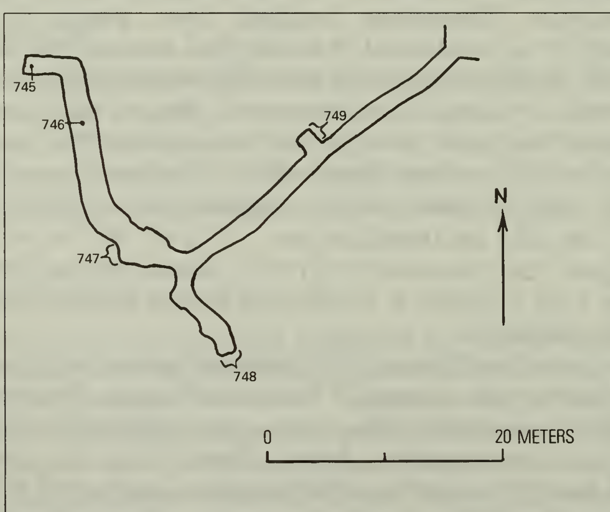


FIGURE 19.—Plan of upper adit of the Great Western mine, showing locality of samples 745-749.

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 (fig. 18). The pit, or cut, is about 15.3 m long and bears N. 40° W. It is open on the southeast end and is 14.3 m at the face—the northwest end. The width ranges from 4.1 m at the open end to 6.3 m near the face. Samples were taken around the perimeter of the pit across two 6.1-m intervals in each wall and across two 2.4-m intervals in the face. Assay results are shown in the following table:

| Sample No. | Type | Gold (ounce per ton) | Gold (g/t) | Silver (ounce per ton) | Silver (g/t) | Value (dollars/ton) | Value (dollars/t) |
|---|---|---|---|---|---|---|---|
| 738 | 6.1-m random chip | 0.03 | 1.0 | 0.56 | 19 | $7.86 | $8.65 |
| 739 | do | .01 | .3 | .20 | 7 | 2.10 | 2.31 |
| 740 | 2.4-m random chip | .01 | .3 | .38 | 13 | 3.78 | 4.16 |
| 741 | do | .02 | .7 | .54 | 18 | 6.24 | 6.86 |
| 742 | 6.1-m random chip | .02 | .7 | .82 | 28 | 7.92 | 8.71 |
| 743 | do | .01 | .3 | .62 | 21 | 5.22 | 5.74 |
| 744 | 8-cm 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); the width of the sample was only 8 cm.

*Samples 745–749*

Five samples were taken from the upper underground working of the Great Western mine (figs. 18, 19). This working consists of an adit driven S. 50° W. about 30 m. Two drives extend from the end of the adit, one about 23 m N. 35° W. and the other 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:

[Leaders indicate sought, not found; leaders in value columns indicate insignificant values]

| Sample No. | Type | Gold (ounce per ton) | Gold (g/t) | Silver (ounce per ton) | Silver (g/t) | (percent) | Value (dollars/ton) | Value (dollars/t) |
|---|---|---|---|---|---|---|---|---|
| 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 | 1-m chip | .02 | .7 | 5.04 | 172.9 | ——— | 33.24 | 36.56 |
| 748 | 1.2-m chip | .02 | .7 | .56 | 19.2 | ——— | 6.36 | 7.00 |
| 749 | 1.1-m chip | .02 | .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 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 South Fork. Most of the workings are in NE1/4 sec. 13 and outside the study area. Two of the samples (757 and 758), which were taken across 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 610 m downstream from sample sites 754–755. The pit exposes a shear zone in syenite. The sample, a 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 32.0 m or more. A water-filled winze is located 10.7 m from the portal. The sample was taken across a 15-cm iron- and manganese-stained quartz vein in a 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 a 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 15 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).

### WALTSMITH CANYON AREA (SAMPLES 759-764)

Six samples were taken from the vicinity of three workings in Waltsmith Canyon, a tributary of South Fork Rio Bonito canyon (fig. 18). The workings are in NE1/4 sec. 13 and outside the study area. Only one sample (760) contained values in excess of $5.00 per ton ($5.50/t). The 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 3.0 m in the face of the cut. One sample (760) was taken across 76 cm of weathered quartz and black, dense limonite, and it 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 762-764*

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

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

## RODAMAKER CANYON (SAMPLES 809)

Only one of the several excavations observed in lower Rodamaker Canyon was sampled. The working is about 91 m north of the proposed wilderness addition. It consists of a 61-m-deep shaft, 2.4×3.1 m in section, from which, at the 15-m level, a 6.1-m drift was driven, bearing N. 18° W. The drift followed a 10-cm vein that dips 72° SW. A chip sample (809) taken across the vein 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. (fig. 18). 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 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 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.

### 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. 20). All the workings are within the study 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).

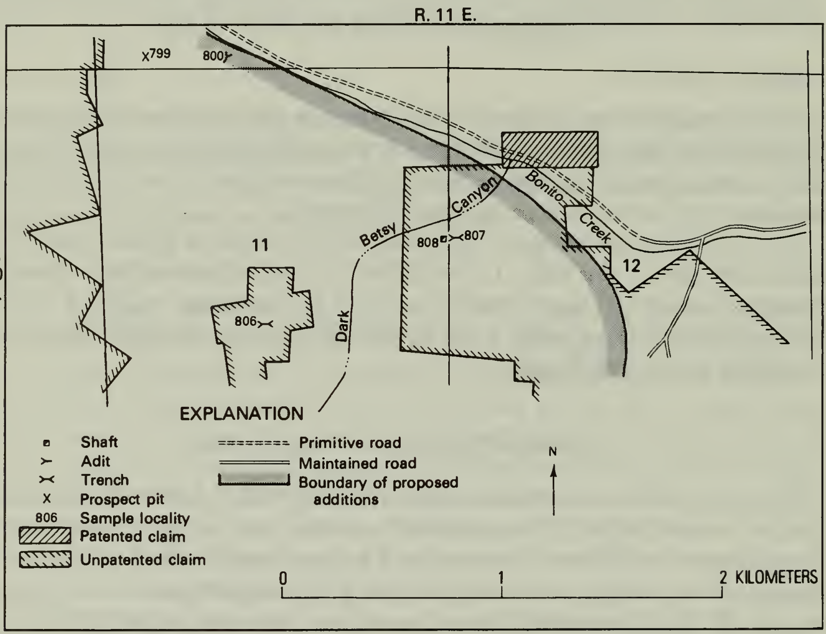


FIGURE 20.—Dark Betsy Canyon and vicinity, showing locality of samples 799, 800, and 806–808.

#### *Samples 799 and 800*

Two samples were taken from two workings in weathered andesite about 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 806*

The sample was collected from a shallow 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.

*Samples 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 15–20-cm galena-bearing quartz vein was taken in the 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).

## NONMETALLIC 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 rhyolite plug between Big Bear and Little Bear Canyons (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 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 an east-facing escarpment of the watershed divide between Three Rivers and South Fork Rio Bonito (sec. 29, T. 10 S., R. 11 E.).

Corundum occurs near the northeastern edge of the Three Rivers 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 a tributary canyon of South Fork Rio Bonito in the southeastern part of the wilderness (fig. 18; secs. 14 and 15, T. 10 S., R. 11 E.) 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 Member of the Sierra Blanca Volcanics, on the south side of Barber Ridge (sec. 14, T. 10 S., R. 10 E.) 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, and so 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 competiton 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 16 km north of Carrizozo (fig. 1), is the source of a basaltic lava flow that may have been extruded in historic time; despite its nearness, no evidence exists that volcanic activity took place in the White Mountains since Oligocene time.

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# TABLES 1–3

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, element detected, but in amount too low to determine; N, element looked for but not found. Section, township, and range refer to plate 2]

| Sample | Section–T. S.–R. E. | Semiquantitative spectrographic analyses (ppm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Cu (5) | La (20) | Mo (5) | Nb (10) | Pb (10) | Sc (5) | Sr (100) | Y (5) | Zr (10) |
| **Syenitic rocks** | | | | | | | | | | |
| 1 | 32-10-11 | 15 | 100 | 20 | 50 | 50 | 10 | 150 | 70 | 200 |
| 1A | 33-10-11 | 15 | 200 | 50 | 70 | 50 | 7 | N | 70 | 700 |
| [1]2A | 32-10-11 | 5 | 500 | 100 | 50 | 70 | 7 | 100 | 200 | 50 |
| 3 | 32-10-11 | 20 | 30 | 3 | 20 | 70 | 7 | 300 | 20 | 100 |
| 3A | 32-10-11 | L | 300 | 30 | 150 | 200 | 7 | L | 70 | 700 |
| 4 | 32-10-11 | 20 | 70 | 3 | 20 | 30 | 7 | 500 | 30 | 150 |
| 4A | 29-10-11 | 5 | 20 | 30 | 30 | 70 | 7 | 100 | 70 | 700 |
| [2]5 | 29-10-11 | L | 100 | N | 50 | 20 | 7 | 200 | 50 | 150 |
| [3]5A | 29-10-11 | L | 20 | N | 30 | 20 | 7 | N | 30 | 200 |
| 6 | 29-10-11 | 7 | 100 | N | 30 | 20 | 7 | 200 | 50 | 100 |
| 6A | 29-10-11 | 5 | 150 | N | 50 | 20 | 15 | 100 | 70 | 500 |
| 7 | 29-10-11 | 7 | 100 | 7 | 50 | 30 | 10 | 200 | 70 | 200 |
| 7A | 29-10-11 | N | 150 | 5 | 30 | 20 | 10 | N | 70 | 500 |
| [4]8 | 20-10-11 | 20 | 100 | 20 | 30 | 20 | 7 | 500 | 30 | 150 |
| 8A | 20-10-11 | 5 | 100 | 15 | 30 | 30 | 10 | N | 30 | 200 |
| 9 | 20-10-11 | 15 | 100 | L | 50 | 30 | 7 | 200 | 50 | 200 |
| 9A | 20-10-11 | 10 | N | N | 30 | 20 | 7 | N | 20 | 150 |
| 11A | 20-10-11 | 15 | 200 | N | 70 | 30 | 15 | N | 70 | 700 |
| 12A | 20-10-11 | 15 | 150 | N | 50 | 30 | 10 | N | 70 | 500 |
| 13A | 20-10-11 | N | 150 | N | 70 | 70 | 10 | N | 70 | 700 |
| 14 | 30-10-11 | 20 | 70 | N | 10 | 15 | 5 | 150 | 50 | 100 |
| 14A | 25-10-10 | L | 150 | N | 30 | 50 | 10 | 300 | 50 | 150 |
| 15A | 24-10-11 | 10 | 70 | 70 | 30 | 10 | 7 | N | 20 | 200 |
| [5]16A | 24-10-11 | N | 150 | 150 | 50 | 300 | 15 | N | 50 | 500 |
| 17A | 24-10-11 | 10 | 70 | N | 30 | 30 | 10 | 500 | 30 | 200 |
| 18A | 24-10-11 | N | 100 | N | 30 | 30 | 10 | 500 | 50 | 200 |
| 19A | 34-10-11 | 5 | 200 | 5 | 70 | 30 | 10 | N | 70 | 700 |
| [6]20A | 34-10-11 | L | 100 | 10 | 70 | 70 | 10 | N | 70 | 500 |
| 22A | 35-10-11 | L | 100 | 5 | 30 | 30 | 10 | N | 30 | 200 |
| 23A | 35-10-11 | 10 | 150 | 5 | 50 | 30 | 10 | N | 50 | 300 |

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

| Sample | Section T. S. R. E. | Semiquantitative spectrographic analyses--Continued (ppm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Cu (5) | La (20) | Mo (5) | Nb (10) | Pb (10) | Sc (5) | Sr (100) | Y (5) | Zr (10) |
| Syenitic rocks--Continued | | | | | | | | | | |
| [7]23B | 35-10-11 | N | 70 | 70 | 30 | 20 | 7 | N | 30 | 200 |
| [8]24A | 34-10-11 | 5 | 300 | 30 | 70 | 30 | 10 | N | 150 | 500 |
| 25A | 34-10-11 | 5 | 20 | 100 | 50 | 50 | 10 | N | 70 | 500 |
| 30 | 28-10-11 | 5 | 150 | 7 | 50 | 20 | 7 | 200 | 70 | 300 |
| 41 | 5-11-11 | 15 | 150 | 7 | 70 | 30 | 7 | 200 | 100 | 300 |
| 44 | 6-11-11 | L | 70 | N | 30 | 20 | 5 | 150 | 30 | 200 |
| 80 | 32-10-11 | 50 | 70 | N | 30 | 30 | 7 | 300 | 30 | 200 |
| 84 | 32-10-11 | 7 | 100 | 10 | 70 | 50 | 10 | 200 | 70 | 300 |
| 89 | 20-10-11 | 10 | 150 | L | 70 | 50 | 10 | 200 | 70 | 300 |
| 90 | 20-10-11 | 10 | 100 | 5 | 50 | 20 | 7 | 500 | 50 | 200 |
| 91 | 17-10-11 | 10 | 70 | L | 50 | 20 | 10 | 700 | 50 | 300 |
| 92 | 17-10-11 | 10 | 150 | 7 | 70 | 30 | 7 | 300 | 70 | 300 |
| 101 | 20-10-11 | 20 | 70 | 15 | 30 | 20 | 10 | 700 | 30 | 150 |
| 104 | 20-10-11 | 50 | 70 | 70 | 30 | 15 | 7 | 200 | 50 | 200 |
| 307 | 32-10-11 | 20 | 70 | 20 | 50 | 50 | 7 | 150 | 50 | 150 |
| 308 | 32-10-11 | 15 | 150 | 70 | 50 | 70 | 10 | 200 | 50 | 200 |
| 309 | 32-10-11 | 10 | 70 | 30 | 50 | 30 | 7 | 200 | 30 | 200 |
| 310 | 31-10-11 | 15 | 50 | 5 | 30 | 30 | 7 | 150 | 20 | 200 |
| 311 | 31-10-11 | 15 | 70 | N | 30 | 30 | 7 | 150 | 20 | 300 |
| 312 | 31-10-11 | 15 | 100 | N | 30 | 30 | 10 | 150 | 30 | 200 |
| 313 | 6-11-11 | 15 | 70 | N | 30 | 20 | 7 | 300 | 20 | 200 |
| 314 | 6-11-11 | 10 | 150 | 5 | 70 | 30 | 7 | 150 | 50 | 300 |
| 315 | 1-11-10 | 15 | 150 | 7 | 20 | 20 | 7 | 300 | 30 | 100 |
| 411 | 36-10-10 | 20 | 70 | N | 20 | 20 | 7 | 200 | 30 | 100 |
| 413 | 20-10-11 | 10 | 70 | 15 | 20 | 20 | 10 | 200 | 30 | 100 |
| 414 | 20-10-11 | 15 | 70 | L | 20 | 20 | 7 | 200 | 20 | 10C |
| 415 | 20-10-11 | 10 | 70 | 7 | 30 | 20 | 10 | 200 | 30 | 100 |
| 416 | 21-10-11 | 10 | 70 | 7 | 30 | 20 | 10 | 150 | 50 | 150 |
| 417 | 21-10-11 | 10 | 70 | 10 | 30 | 20 | 7 | 150 | 30 | 100 |
| 418 | 21-10-11 | 15 | 50 | L | 15 | 15 | 5 | 200 | 20 | 70 |
| 419 | 21-10-11 | 20 | 30 | N | 10 | 30 | 5 | 150 | 15 | 50 |
| 420 | 21-10-11 | 20 | 50 | 5 | 20 | 20 | 10 | 150 | 30 | 70 |
| 421 | 21-10-11 | 15 | 50 | N | 15 | 20 | 5 | 150 | 20 | 50 |
| 422 | 22-10-11 | 15 | 30 | N | 15 | 15 | 5 | 150 | 20 | 50 |
| 426 | 4-11-11 | 7 | 150 | 15 | 30 | 70 | 10 | 200 | 70 | 100 |

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

| Sample | Section T. S. R. E. | Semiquantitative spectrographic analyses--Continued (ppm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Cu (5) | La (20) | Mo (5) | Nb (10) | Pb (10) | Sc (5) | Sr (100) | Y (5) | Zr (10) |
| | | | | | Syenitic rocks--Continued | | | | | |
| 427 | 4-11-11 | 5 | 150 | 15 | 30 | 50 | 10 | 200 | 70 | 300 |
| 428 | 4-11-11 | L | 150 | 30 | 30 | 30 | 7 | 200 | 50 | 200 |
| 429 | 4-11-11 | 15 | 100 | 50 | 50 | 50 | 7 | 150 | 50 | 300 |
| 430 | 4-11-11 | L | 200 | 7 | 30 | 30 | 10 | 150 | 70 | 200 |
| 431 | 9-11-11 | L | 150 | N | 30 | 50 | 10 | 200 | 70 | 500 |
| 436 | 33-10-11 | 7 | 70 | 10 | 50 | 70 | 5 | 100 | 30 | 200 |
| 437 | 33-10-11 | 10 | 70 | 7 | 20 | 30 | 7 | 200 | 50 | 500 |
| 440 | 34-10-11 | 15 | 70 | 5 | 30 | 20 | 7 | 200 | 30 | 200 |
| 441 | 34-10-11 | 7 | 150 | 20 | 70 | 20 | 7 | 150 | 70 | 1,000 |
| 443 | 35-10-11 | 15 | 50 | 5 | 50 | 20 | 7 | 150 | 50 | 300 |
| 445 | 27-10-11 | 15 | 50 | L | 20 | 20 | 5 | 150 | 20 | 200 |
| 446 | 26-10-11 | 15 | N | N | N | 10 | N | 100 | N | 30 |
| 447 | 26-10-11 | 30 | 50 | 15 | 20 | 30 | 7 | 300 | 20 | 150 |
| 448 | 26-10-11 | 20 | 70 | 7 | 20 | 20 | 5 | 200 | 30 | 150 |
| 752 | 13-10-12 | 5 | 70 | N | 20 | 15 | 7 | 300 | 20 | 300 |
| 753 | 13-10-12 | 5 | 70 | N | 30 | 10 | 7 | 300 | 15 | 150 |
| 755A | 24-10-12 | 20 | 70 | N | 30 | 10 | 15 | 700 | 20 | 300 |
| | | | | | Volcanic rocks | | | | | |
| 26A | 19- 9-11 | 20 | 70 | N | 20 | 30 | 15 | 1,000 | 30 | 150 |
| 27A | 19- 9-11 | 15 | 20 | N | N | 30 | 15 | 700 | 20 | 100 |
| 29A | 19- 9-11 | 15 | 70 | N | N | 20 | 20 | 1,000 | 30 | 150 |
| 31A | 19- 9-11 | 15 | 20 | N | N | 20 | 30 | 1,000 | 30 | 100 |
| 48 | 19-10-11 | 20 | 70 | N | 20 | 15 | 15 | 1,000 | 30 | 100 |
| 53 | 19-10-11 | 15 | 70 | N | 30 | 15 | 7 | 700 | 30 | 150 |
| 94 | 17-10-11 | 30 | 70 | L | 20 | 15 | 10 | 1,500 | 30 | 150 |
| 116 | 27- 9-11 | 20 | 100 | 5 | 50 | 20 | 7 | 1,500 | 30 | 150 |
| 121 | 28- 9-11 | 15 | 70 | L | 50 | 20 | 10 | 1,000 | 30 | 150 |
| 123 | 33- 9-11 | 20 | 70 | 5 | 30 | 15 | 10 | 700 | 30 | 150 |
| 124 | 32- 9-11 | 15 | 100 | N | 30 | 20 | 5 | 500 | 30 | 150 |
| 127 | 32- 9-11 | 15 | 100 | L | 30 | 15 | 7 | 1,000 | 30 | 150 |
| 128 | 32- 9-11 | 10 | 100 | L | 30 | 15 | 7 | 1,000 | 50 | 150 |
| 129 | 32- 9-11 | 15 | 70 | L | 20 | 15 | 7 | 700 | 30 | 150 |
| 130 | 28- 9-11 | 10 | 70 | 5 | 30 | 20 | 10 | 1,000 | 30 | 150 |

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

| Sample | Section | T. S. | R. E. | Semiquantitative spectrographic analyses--Continued (ppm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Cu (5) | La (20) | Mo (5) | Nb (10) | Pb (10) | Sc (5) | Sr (100) | Y (5) | Zr (10) |
| Volcanic rocks--Continued | | | | | | | | | | | | |
| 131 | 28 | 9 | 11 | 10 | 100 | L | 30 | 15 | 7 | 1,500 | 30 | 150 |
| 135 | 28 | 9 | 11 | 15 | 100 | N | 50 | 15 | 7 | 700 | 30 | 150 |
| 140 | 28 | 9 | 11 | 10 | 50 | 7 | 20 | 15 | 15 | 700 | 30 | 100 |
| 142 | 28 | 9 | 11 | 10 | 70 | N | 50 | 30 | 7 | 500 | 20 | 100 |
| 144 | 28 | 9 | 11 | 15 | 100 | 7 | 70 | 70 | 5 | 500 | 20 | 150 |
| 145 | 28 | 9 | 11 | 15 | 70 | N | 50 | 30 | 7 | 500 | 20 | 150 |
| 146 | 28 | 9 | 11 | 15 | 70 | 5 | 50 | 50 | 7 | 500 | 20 | 150 |
| 147 | 21 | 9 | 11 | 10 | 70 | L | 50 | 30 | 10 | 300 | 30 | 150 |
| 148 | 21 | 9 | 11 | 10 | 70 | L | 20 | 20 | 15 | 700 | 30 | 100 |
| 154 | 6 | 10 | 11 | 20 | 100 | N | 30 | 20 | 10 | 1,000 | 30 | 100 |
| 156 | 7 | 10 | 11 | 10 | 100 | N | 70 | 30 | 5 | 500 | 20 | 100 |
| 159 | 12 | 10 | 10 | 15 | 70 | N | 50 | 15 | 10 | 700 | 30 | 100 |
| 163 | 12 | 10 | 10 | 15 | 100 | N | 30 | 20 | 10 | 1,500 | 20 | 100 |
| 165 | 11 | 10 | 10 | 70 | 70 | N | 30 | 15 | 15 | 2,000 | 30 | 100 |
| 166 | 14 | 10 | 10 | 50 | 70 | N | 30 | 15 | 15 | 2,000 | 30 | 100 |
| 167 | 14 | 10 | 10 | 20 | 70 | N | 20 | 15 | 20 | 1,000 | 30 | 70 |
| 173 | 14 | 10 | 10 | 30 | 70 | N | 30 | 20 | 10 | 1,500 | 20 | 100 |
| 174 | 14 | 10 | 10 | 30 | 50 | N | 20 | 15 | 20 | 1,000 | 30 | 70 |
| 184 | 10 | 9 | 11 | 20 | 150 | L | 50 | 30 | 5 | 1,000 | 30 | 150 |
| 187 | 10 | 9 | 11 | 15 | 100 | N | 50 | 30 | 5 | 1,000 | 30 | 200 |
| 198 | 6 | 10 | 11 | 20 | 100 | N | 30 | 15 | 7 | 2,000 | 30 | 150 |
| 199 | 6 | 10 | 11 | 20 | 150 | N | 30 | 15 | 7 | 2,000 | 30 | 150 |
| 201 | 6 | 10 | 11 | 20 | 100 | N | 20 | 15 | 10 | 1,500 | 30 | 150 |
| 203 | 1 | 10 | 10 | 20 | 70 | N | 20 | 15 | 15 | 1,000 | 30 | 150 |
| 212 | 2 | 10 | 10 | 30 | 70 | N | 15 | 15 | 15 | 1,000 | 20 | 100 |
| 217 | 2 | 9 | 11 | 15 | 100 | N | 50 | 20 | 7 | 1,000 | 30 | 300 |
| 227 | 9 | 9 | 11 | 20 | 70 | N | 20 | 30 | 7 | 500 | 20 | 100 |
| 228 | 9 | 9 | 11 | 15 | 100 | N | 30 | 20 | 7 | 700 | 30 | 100 |
| 234 | 4 | 9 | 11 | 15 | 100 | N | 30 | 70 | 7 | 700 | 30 | 70 |
| 240 | 32 | 9 | 11 | 20 | 70 | L | 30 | 20 | 10 | 500 | 50 | 150 |
| 241 | 32 | 9 | 11 | 15 | 70 | L | 20 | 15 | 10 | 700 | 30 | 100 |
| 253 | 30 | 9 | 11 | 30 | 70 | N | 20 | 10 | 50 | 1,000 | 30 | 70 |
| 254 | 30 | 9 | 11 | 70 | 100 | L | 20 | 30 | 30 | 150 | 20 | 70 |
| 258 | 23 | 9 | 11 | 15 | 70 | 30 | 50 | 15 | 10 | 300 | 30 | 150 |
| 268 | 21 | 9 | 11 | 15 | 70 | N | 30 | 15 | 10 | 300 | 30 | 150 |

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

| Sample | Section T. S. R. E. | Semiquantitative spectrographic analyses--Continued (ppm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Cu (5) | La (20) | Mo (5) | Nb (10) | Pb (10) | Sc (5) | Sr (100) | Y (5) | Zr (10) |
| Volcanic rocks--Continued | | | | | | | | | | |
| 276 | 17- 9-11 | 50 | 100 | N | 30 | 20 | 15 | 1,500 | 50 | 150 |
| 281 | 17- 9-11 | 50 | 70 | N | 30 | 20 | 15 | 1,000 | 30 | 100 |
| 289 | 31- 9-11 | 15 | 100 | N | 30 | 15 | 10 | 500 | 30 | 100 |
| 291 | 31- 9-11 | 30 | 70 | N | 30 | 20 | 7 | 300 | 30 | 150 |
| 291A | 6-10-11 | 20 | 50 | L | 10 | 15 | 10 | 2,000 | 15 | 100 |
| 300 | 36- 9-10 | 50 | 70 | N | 20 | 15 | 15 | 1,000 | 30 | 70 |
| 304A | 36- 9-10 | 50 | N | L | N | N | 7 | 300 | 10 | 30 |
| 316 | 1-11-10 | 20 | 70 | 5 | 50 | 20 | 7 | 700 | 20 | 150 |
| 317 | 1-11-10 | 30 | 50 | 7 | 50 | 20 | 7 | 700 | 20 | 150 |
| 318 | 36-10-10 | 20 | 70 | 7 | 30 | 20 | 7 | 300 | 30 | 200 |
| 319 | 35-10-10 | 20 | 70 | N | 20 | 15 | 10 | 1,000 | 30 | 150 |
| 320 | 35-10-10 | 50 | 50 | N | 20 | 15 | 15 | 700 | 20 | 100 |
| 321 | 35-10-10 | 30 | 70 | N | 20 | 10 | 15 | 1,000 | 20 | 100 |
| 322 | 35-10-10 | 20 | 70 | N | 15 | 10 | 15 | 1,000 | 20 | 100 |
| 324 | 16- 9-11 | 50 | 70 | N | 30 | 15 | 7 | 700 | 20 | 150 |
| 328 | 17- 9-11 | 20 | 70 | L | 30 | 30 | 10 | 300 | 30 | 100 |
| 365 | 5- 9-11 | 50 | 70 | 15 | 20 | 70 | 10 | 1,000 | 20 | 100 |
| 368 | 5- 9-11 | 20 | 50 | N | 20 | 30 | 15 | 700 | 20 | 100 |
| 374 | 10- 9-11 | 15 | 70 | 5 | 30 | 50 | 7 | 1,000 | 30 | 200 |
| 376 | 9- 9-11 | 15 | 70 | 5 | 30 | 30 | 5 | 500 | 20 | 150 |
| 379 | 4- 9-11 | 20 | 100 | N | 30 | 20 | 15 | 1,000 | 50 | 150 |
| 383 | 4- 9-11 | 30 | 70 | 5 | 20 | 20 | 15 | 1,000 | 30 | 150 |
| 386 | 4- 9-11 | 15 | 70 | L | 50 | 20 | 7 | 1,500 | 30 | 150 |
| 391 | 34- 8-11 | 30 | 70 | N | 30 | 20 | 10 | 700 | 30 | 100 |
| 393 | 28- 9-11 | 20 | 70 | L | 30 | 20 | 7 | 700 | 30 | 150 |
| 402 | 34- 9-11 | 30 | 70 | 5 | 30 | 30 | 10 | 1,000 | 30 | 200 |
| 405 | 34- 9-11 | 50 | 70 | L | 30 | 50 | 10 | 1,000 | 30 | 150 |
| 423 | 15-10-11 | 30 | 70 | 10 | 30 | 30 | 7 | 500 | 30 | 70 |
| 731 | 19- 9-11 | 10 | 30 | N | 15 | 30 | 15 | 300 | 20 | 500 |
| 737 | 35- 9-10 | 5 | 50 | 5 | 20 | L | 7 | 700 | 20 | 300 |
| 746 | 35- 9-10 | 30 | 30 | N | L | L | 15 | 1,000 | 20 | 150 |
| 749 | 13- 9-11 | 50 | 30 | L | L | L | 15 | 1,000 | 15 | 150 |
| 750 | 11- 9-11 | 10 | 30 | L | 30 | 20 | 7 | 300 | 15 | 300 |
| 776 | 11-10-11 | 20 | 70 | N | 70 | 10 | L | 150 | 20 | 300 |
| 778 | 11-10-11 | 20 | 30 | N | 30 | 15 | L | 150 | 30 | 500 |

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

| Sample | Section | T. S. | R. E. | Semiquantitative spectrographic analyses--Continued (ppm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Cu (5) | La (20) | Mo (5) | Nb (10) | Pb (10) | Sc (5) | Sr (100) | Y (5) | Zr (10) |
| | | | | Volcanic rocks--Continued | | | | | | | | |
| 783 | 11 | 10 | 11 | 30 | 20 | 7 | 20 | L | 7 | 150 | N | 150 |
| 785 | 26 | 9 | 11 | 100 | 50 | L | 30 | 20 | 10 | 500 | 15 | 300 |
| E6 | 35 | 10 | 10 | 20 | 100 | N | 20 | 10 | 15 | 1,500 | 30 | 70 |
| [9]E24 | 34 | 10 | 10 | 50 | 70 | N | 15 | 15 | 15 | 1,500 | 30 | 70 |
| E25 | 34 | 10 | 10 | 20 | 70 | N | 10 | 15 | 15 | 1,000 | 15 | 100 |
| E48 | 26 | 10 | 10 | 20 | 50 | N | 15 | 15 | 15 | 1,000 | 30 | 100 |
| E50 | 26 | 10 | 10 | 20 | 70 | N | 15 | 15 | 15 | 1,000 | 30 | 100 |
| E72 | 6 | 10 | 11 | 15 | 100 | N | 30 | 15 | 10 | 1,000 | 30 | 100 |
| E77 | 6 | 10 | 11 | 15 | 100 | N | 30 | 15 | 10 | 1,500 | 30 | 100 |
| E146 | 2 | 10 | 10 | 30 | 70 | N | 20 | 15 | 15 | 1,000 | 30 | 100 |
| E151 | 2 | 10 | 10 | 20 | 70 | N | 10 | 15 | 15 | 700 | 30 | 100 |
| E152 | 2 | 10 | 10 | 20 | 70 | N | 15 | 15 | 15 | 1,000 | 20 | 100 |
| E157 | 35 | 9 | 10 | 20 | 70 | N | 20 | 15 | 15 | 700 | 30 | 150 |
| E172 | 15 | 9 | 11 | 20 | 70 | N | 30 | 15 | 10 | 1,000 | 30 | 150 |
| E179 | 21 | 9 | 11 | 15 | 100 | L | 50 | 15 | 10 | 500 | 30 | 150 |
| E213 | 17 | 9 | 11 | 15 | 100 | N | 50 | 20 | 7 | 1,500 | 30 | 150 |
| E219 | 5 | 10 | 11 | 20 | 70 | N | 30 | 20 | 10 | 700 | 30 | 150 |
| E221 | 5 | 10 | 11 | 20 | 70 | L | 50 | 20 | 10 | 700 | 30 | 150 |
| E245 | 24 | 9 | 11 | 20 | 70 | L | 30 | 30 | 7 | 1,000 | 30 | 150 |
| E248 | 36 | 8 | 12 | 30 | 70 | N | 15 | 30 | 15 | 500 | 30 | 200 |
| E259 | 36 | 8 | 11 | 70 | 70 | L | 30 | 20 | 10 | 700 | 30 | 150 |
| E263 | 5 | 9 | 11 | 50 | 50 | N | 20 | 30 | 10 | 700 | 20 | 100 |
| E264 | 5 | 9 | 11 | 50 | 30 | N | 20 | 50 | 7 | 700 | 15 | 100 |
| E265 | 8 | 9 | 11 | 50 | 70 | N | 20 | 30 | 10 | 700 | 20 | 150 |
| E357 | 11 | 10 | 10 | 30 | 70 | N | 10 | 20 | 15 | 1,000 | 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, element detected, but in amount too low to determine; N, element looked for but not found. Section, township, and range refer to plate 2]

| | | Semiquantitative spectrographic analyses (ppm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample | Section T. S. R. E. | Cu (5) | La (20) | Mo (5) | Nb (10) | Pb (10) | Sc (5) | Sr (50) | Y (5) | Zr (10) |
| 10 | 20-10-11 | 10 | 100 | L | 50 | 20 | 10 | 700 | 50 | 200 |
| 13 | 19-10-11 | 10 | 70 | 10 | 30 | 20 | 7 | 700 | 50 | 150 |
| 20 | 36-10-10 | 20 | 70 | L | 20 | 100 | 15 | 1,500 | 30 | 100 |
| 22 | 35-10-10 | 20 | 70 | N | 20 | 50 | 15 | 1,000 | 30 | 100 |
| 27 | 28-10-11 | 15 | 150 | 15 | 70 | 50 | 7 | 150 | 150 | 200 |
| 28 | 28-10-11 | 10 | 150 | 10 | 50 | 20 | 10 | 200 | 70 | 200 |
| 29 | 28-10-11 | 15 | 100 | 20 | 30 | 20 | 5 | 150 | 50 | 200 |
| 32 | 22-10-11 | 5 | 100 | 20 | 50 | 30 | 7 | 200 | 50 | 300 |
| 36 | 23-10-11 | L | 150 | 15 | 50 | 30 | 7 | 150 | 50 | 200 |
| 37 | 32-10-11 | 7 | 150 | 30 | 70 | 70 | 7 | 200 | 100 | 200 |
| 38 | 32-10-11 | 15 | 150 | 7 | 70 | 70 | 7 | 200 | 100 | 300 |
| [1]39 | 32-10-11 | 30 | 300 | 5 | 50 | 50 | 7 | 300 | 1,500 | 300 |
| [2]40 | 32-10-11 | L | 100 | 15 | 100 | 70 | 5 | 100 | 100 | 500 |
| [3]42 | 6-11-11 | 15 | 150 | 7 | 50 | 30 | 7 | 200 | 70 | 200 |
| 43 | 6-11-11 | L | 150 | 10 | 70 | 30 | 7 | 150 | 70 | 300 |
| 55 | 18-10-11 | 10 | 70 | N | 30 | 20 | 10 | 2,000 | 30 | 100 |
| 63 | 7-10-11 | 15 | 100 | N | 50 | 15 | 7 | 2,000 | 30 | 100 |
| 79 | 32-10-11 | 7 | 100 | 15 | 30 | 30 | 7 | 500 | 50 | 200 |
| 85 | 31-10-11 | 7 | 100 | 15 | 50 | 30 | 7 | 200 | 70 | 300 |
| 88 | 30-10-11 | 7 | 150 | 10 | 70 | 30 | 10 | 200 | 70 | 300 |
| 100 | 20-10-11 | 20 | 100 | 15 | 30 | 30 | 10 | 1,000 | 30 | 150 |
| 105 | 20-10-11 | 20 | 150 | 15 | 20 | 20 | 5 | 200 | 50 | 150 |
| 113 | 8-10-11 | 70 | 150 | L | 50 | 200 | 7 | 500 | 50 | 300 |
| 125 | 32- 9-11 | 15 | 150 | N | 70 | 20 | 7 | 500 | 50 | 300 |
| 139 | 29- 9-11 | 50 | 70 | L | 20 | 15 | 7 | 1,000 | 30 | 150 |
| 150 | 21- 9-11 | 10 | 100 | N | 70 | 30 | 5 | 700 | 30 | 150 |
| 153 | 27- 9-11 | 10 | 100 | L | 70 | 30 | 7 | 1,000 | 30 | 150 |
| 168 | 14-10-10 | 50 | 70 | N | 20 | 15 | 15 | 2,000 | 30 | 70 |
| 170 | 14-10-10 | 50 | 100 | N | 30 | 20 | 10 | 2,000 | 30 | 100 |
| 172 | 14-10-10 | 30 | 70 | N | 30 | 20 | 15 | 2,000 | 30 | 100 |

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—Continued*

| Sample | Section-T. S.-R. E. | Semiquantitative spectrographic analyses--Continued (ppm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Cu (5) | La (20) | Mo (5) | Nb (10) | Pb (10) | Sc (5) | Sr (50) | Y (5) | Zr (10) |
| 177 | 14-10-10 | 20 | 70 | N | 15 | 10 | 15 | 2,000 | 30 | 70 |
| 178 | 14-10-10 | 30 | 70 | N | 20 | 15 | 15 | 2,000 | 30 | 100 |
| 179 | 14-10-10 | 30 | 70 | N | 20 | 15 | 15 | 2,000 | 30 | 70 |
| 180 | 15-10-10 | 20 | 70 | N | 20 | 15 | 15 | 2,000 | 30 | 70 |
| 197 | 3- 9-11 | 20 | 100 | L | 30 | 30 | 7 | 2,000 | 30 | 150 |
| 202 | 1-10-10 | 15 | 100 | N | 30 | 20 | 7 | 2,000 | 30 | 150 |
| 208 | 1-10-10 | 50 | 70 | N | 20 | 20 | 15 | 1,000 | 30 | 150 |
| 209 | 1-10-10 | 50 | 70 | N | 20 | 20 | 20 | 1,000 | 30 | 150 |
| 213 | 2-10-10 | 50 | 70 | N | 20 | 15 | 15 | 1,500 | 30 | 100 |
| 214 | 2- 9-11 | 15 | 70 | N | 70 | 20 | 5 | 500 | 30 | 300 |
| 218 | 2- 9-11 | 10 | 100 | N | 70 | 20 | 5 | 1,000 | 30 | 200 |
| 219 | 2- 9-11 | 20 | 150 | N | 50 | 20 | 7 | 2,000 | 30 | 200 |
| 220 | 1- 9-11 | 20 | 100 | 10 | 30 | 70 | 7 | 700 | 20 | 200 |
| 221 | 35- 8-11 | 70 | 100 | 7 | 30 | 30 | 10 | 700 | 30 | 200 |
| 232 | 9- 9-11 | 50 | 100 | 7 | 30 | 50 | 7 | 700 | 20 | 100 |
| 238 | 4- 9-11 | 50 | 100 | N | 30 | 20 | 15 | 1,500 | 30 | 100 |
| 249 | 30- 9-11 | 50 | 70 | N | 30 | 20 | 15 | 700 | 30 | 100 |
| 250 | 30- 9-11 | 50 | 50 | N | 20 | 15 | 30 | 700 | 20 | 70 |
| 251 | 30- 9-11 | 50 | 70 | N | 30 | 20 | 30 | 1,000 | 20 | 70 |
| 252 | 30- 9-11 | 50 | 70 | N | 20 | 15 | 30 | 1,000 | 30 | 70 |
| 255 | 22- 9-11 | 30 | 70 | 20 | 50 | 30 | 7 | 500 | 30 | 150 |
| 260 | 23- 9-11 | 20 | 70 | 15 | 30 | 20 | 7 | 500 | 30 | 150 |
| 263 | 14- 9-11 | 20 | 70 | 7 | 50 | 50 | 15 | 700 | 30 | 100 |
| 264 | 14- 9-11 | 30 | 70 | 7 | 30 | 50 | 10 | 700 | 30 | 100 |
| 265 | 14- 9-11 | 20 | 70 | L | 50 | 50 | 10 | 500 | 30 | 150 |
| 266 | 14- 9-11 | 20 | 100 | 7 | 50 | 50 | 10 | 1,000 | 30 | 150 |
| 278 | 20- 9-11 | 50 | 70 | N | 30 | 30 | 10 | 1,000 | 30 | 70 |
| 279 | 17- 9-11 | 50 | 70 | N | 30 | 15 | 10 | 1,000 | 30 | 70 |
| 280 | 17- 9-11 | 50 | 100 | N | 30 | 20 | 15 | 1,000 | 30 | 100 |
| 282 | 17- 9-11 | 50 | 70 | N | 30 | 20 | 15 | 1,500 | 30 | 100 |
| 283 | 17- 9-11 | 50 | 70 | N | 20 | 20 | 15 | 1,000 | 30 | 70 |
| 284 | 17- 9-11 | 50 | 70 | N | 30 | 20 | 10 | 1,000 | 30 | 150 |
| 286 | 32- 9-11 | 20 | 100 | L | 70 | 15 | 7 | 500 | 30 | 200 |
| 296 | 31- 9-11 | 50 | 70 | N | 30 | 15 | 10 | 700 | 30 | 100 |
| 297 | 31- 9-11 | 50 | 70 | N | 30 | 15 | 10 | 1,500 | 30 | 100 |

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—Continued*

| Sample | Section- T. S.- R. E. | Semiquantitative spectrographic analyses--Continued (ppm) Cu (5) | La (20) | Mo (5) | Nb (10) | Pb (10) | Sc (5) | Sr (50) | Y (5) | Zr (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| 298 | 31- 9-11 | 50 | 70 | N | 30 | 20 | 7 | 1,500 | 20 | 70 |
| 299 | 36- 9-10 | 150 | 70 | N | 20 | 20 | 10 | 1,000 | 20 | 70 |
| 301 | 36- 9-10 | 50 | 70 | N | 20 | 15 | 10 | 500 | 20 | 100 |
| 302 | 36- 9-10 | 50 | 70 | N | 20 | 10 | 10 | 500 | 20 | 100 |
| 303 | 36- 9-10 | 50 | 70 | N | 20 | 10 | 10 | 700 | 20 | 100 |
| 304 | 36- 9-10 | 50 | 70 | N | 30 | 15 | 15 | 1,000 | 30 | 100 |
| 305 | 35- 9-10 | 50 | 70 | N | 30 | 15 | 10 | 1,000 | 30 | 70 |
| 326 | 16- 9-11 | 50 | 70 | L | 50 | 30 | 7 | 500 | 30 | 150 |
| 332 | 8- 9-11 | 50 | 70 | 15 | 30 | 30 | 10 | 700 | 30 | 100 |
| 334 | 8- 9-11 | 50 | 70 | L | 30 | 30 | 15 | 1,000 | 30 | 100 |
| 336 | 8- 9-11 | 300 | 70 | L | 30 | 30 | 10 | 1,000 | 30 | 100 |
| 337 | 24- 9-11 | 50 | 100 | N | 30 | 30 | 7 | 500 | 20 | 150 |
| 338 | 24- 9-11 | 50 | 50 | N | 15 | 50 | 10 | 300 | 15 | 150 |
| 339 | 24- 9-11 | 50 | 70 | N | 30 | 30 | 10 | 700 | 30 | 150 |
| 342 | 24- 9-11 | 10 | 100 | 15 | 50 | 30 | 5 | 500 | 20 | 150 |
| 345 | 23- 9-11 | 30 | 70 | 5 | 30 | 50 | 7 | 500 | 15 | 150 |
| 346 | 23- 9-11 | 30 | 70 | 5 | 30 | 50 | 7 | 500 | 15 | 150 |
| 364 | 5- 9-11 | 30 | 70 | N | 30 | 100 | 10 | 700 | 20 | 150 |
| 367 | 5- 9-11 | 20 | 70 | N | 30 | 50 | 15 | 700 | 20 | 100 |
| 370 | 5- 9-11 | 50 | 70 | N | 20 | 30 | 15 | 1,000 | 30 | 150 |
| 371 | 10- 9-11 | 20 | 70 | 5 | 30 | 70 | 7 | 500 | 30 | 200 |
| 373 | 10- 9-11 | 10 | 70 | 5 | 30 | 50 | 5 | 700 | 20 | 200 |
| 374 | 9- 9-11 | 15 | 70 | 5 | 30 | 50 | 7 | 1,000 | 30 | 200 |
| 399 | 34- 9-11 | 70 | 70 | N | 30 | 15 | 7 | 700 | 20 | 100 |
| 401 | 34- 9-11 | 70 | 70 | L | 30 | 30 | 10 | 700 | 20 | 150 |
| 403 | 34- 9-11 | 50 | 70 | 5 | 30 | 30 | 10 | 1,000 | 30 | 150 |
| 404 | 34- 9-11 | 50 | 70 | L | 30 | 100 | 10 | 1,000 | 30 | 150 |
| 406 | 34- 9-11 | 50 | 70 | 5 | 30 | 30 | 10 | 700 | 30 | 200 |
| 424 | 16-10-11 | 15 | 50 | 10 | 10 | 20 | 5 | 150 | 30 | 50 |
| 425 | 16-10-11 | 30 | 70 | 15 | 20 | 70 | 7 | 700 | 20 | 70 |
| 433 | 4-11-11 | 7 | 70 | 15 | 50 | 50 | 7 | 150 | 30 | 200 |
| 434 | 4-11-11 | 5 | 70 | 20 | 70 | 70 | 5 | 150 | 30 | 200 |
| 435 | 33-10-11 | 5 | 100 | 15 | 50 | 70 | 5 | 150 | 50 | 500 |
| 444 | 26-10-11 | 15 | 100 | 30 | 30 | 30 | 7 | 150 | 50 | 300 |
| 450 | 23-10-11 | 15 | 70 | 20 | 20 | 20 | 5 | 200 | 50 | 200 |

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—Continued*

| Sample | Section T. S. R. E. | Semiquantitative spectrographic analyses--Continued (ppm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Cu (5) | La (20) | Mo (5) | Nb (10) | Pb (10) | Sc (5) | Sr (50) | Y (5) | Zr (10) |
| 451 | 23-10-11 | 7 | 100 | 15 | 30 | 15 | 10 | 500 | 70 | 300 |
| 452 | 23-10-11 | 7 | 150 | 30 | 30 | 20 | 10 | 300 | 70 | 300 |
| 453 | 14-10-10 | 100 | 70 | N | 30 | 15 | 15 | 1,500 | 30 | 150 |
| 454 | 14-10-10 | 50 | 70 | N | 20 | 15 | 15 | 1,000 | 30 | 150 |
| 455 | 14-10-10 | 70 | 30 | N | 10 | 15 | 7 | 1,000 | 15 | 70 |
| 456 | 14-10-10 | 70 | 70 | N | 15 | 15 | 15 | 1,500 | 20 | 100 |
| 742 | 35- 9-10 | 10 | 30 | 15 | N | L | 15 | 500 | 20 | 150 |
| 751 | 24-10-12 | 10 | 50 | 10 | 30 | 20 | 10 | 300 | 30 | 300 |
| 760 | 13-10-12 | 10 | 50 | N | 20 | N | N | N | N | N |
| 764 | 13-10-11 | 5 | 50 | L | 30 | 50 | 7 | 300 | N | N |
| 765 | 10-10-11 | 10 | 30 | L | 20 | 50 | 7 | 200 | N | N |
| 766 | 10-10-11 | 20 | 70 | 20 | 30 | 30 | 7 | 300 | N | N |
| 768 | 4-10-11 | 30 | 30 | N | 20 | 100 | 7 | 500 | N | N |
| 770 | 3-10-11 | 30 | 50 | 10 | 20 | 300 | 7 | 300 | N | N |
| 771 | 4-10-11 | 20 | 30 | N | 20 | 70 | 7 | 500 | N | N |
| 773 | 3-10-11 | 30 | 30 | L | 15 | 70 | 7 | 500 | 15 | 500 |
| 774 | 11-10-11 | 10 | 50 | N | 20 | 50 | 7 | 300 | 20 | 300 |
| 777 | 11-10-11 | 5 | 50 | N | 20 | 50 | 7 | 300 | 20 | 300 |
| 779 | 11-10-11 | 20 | 30 | N | 20 | 50 | 10 | 300 | 15 | 300 |
| [5]781 | 11-10-11 | 20 | N | 5 | 20 | 30 | 7 | 200 | 10 | 200 |
| [6]782 | 11-10-11 | 10 | N | 5 | 30 | L | 7 | 200 | 10 | 200 |
| E1 | 34-10-10 | 15 | 70 | 10 | 20 | 10 | 15 | 1,500 | 30 | 100 |
| E11 | 14-10-11 | L | 100 | 20 | 50 | 20 | 7 | 500 | 50 | 150 |
| E12 | 14-10-11 | L | 100 | 30 | 50 | 20 | 7 | 200 | 50 | 200 |
| E13 | 14-10-11 | 7 | 70 | 10 | 50 | 20 | 7 | 300 | 50 | 200 |
| E17 | 15-10-11 | 30 | 70 | 15 | 30 | 15 | 7 | 500 | 30 | 150 |
| E19 | 15-10-11 | 20 | 70 | 20 | 30 | 15 | 10 | 500 | 50 | 200 |
| E20 | 15-10-11 | 7 | 150 | 15 | 50 | 30 | 7 | 300 | 50 | 300 |
| E21 | 15-10-11 | 5 | 100 | 10 | 50 | 20 | 7 | 300 | 50 | 300 |
| E22 | 15-10-11 | L | 100 | 15 | 50 | 20 | 7 | 150 | 50 | 300 |
| E38 | 8-10-11 | 15 | 100 | L | 30 | 15 | 7 | 2,000 | 30 | 150 |
| E62 | 26-10-10 | 30 | 100 | N | 20 | 15 | 15 | 2,000 | 30 | 100 |
| E63 | 27-10-10 | 20 | 100 | N | 20 | 15 | 15 | 2,000 | 30 | 100 |
| E67 | 5-10-11 | 15 | 70 | N | 30 | 15 | 7 | 2,000 | 30 | 150 |
| E88 | 16-10-11 | 10 | 150 | 10 | 50 | 20 | 15 | 300 | 50 | 200 |

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—Continued*

| Sample | Section T. S. R. E. | Semiquantitative spectrographic analyses--Continued (ppm) Cu (5) | La (20) | Mo (5) | Nb (10) | Pb (10) | Sc (5) | Sr (50) | Y (5) | Zr (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| E89 | 16-10-11 | 7 | 70 | 10 | 50 | 20 | 10 | 200 | 50 | 200 |
| E90 | 16-10-11 | 7 | 100 | 10 | 50 | 20 | 10 | 300 | 50 | 200 |
| E91 | 16-10-11 | 10 | 150 | 10 | 50 | 20 | 10 | 300 | 70 | 200 |
| E92 | 16-10-11 | 10 | 100 | 10 | 50 | 20 | 10 | 200 | 50 | 200 |
| E93 | 16-10-11 | 7 | 100 | 15 | 50 | 20 | 10 | 300 | 70 | 300 |
| E94 | 16-10-11 | 7 | 150 | 10 | 50 | 20 | 15 | 300 | 50 | 300 |
| E96 | 21-10-11 | 7 | 100 | 15 | 50 | 20 | 10 | 300 | 50 | 300 |
| E97 | 21-10-11 | 7 | 70 | 10 | 30 | 20 | 7 | 300 | 30 | 150 |
| E98 | 16-10-11 | 50 | 70 | 15 | 30 | 70 | 7 | 700 | 30 | 100 |
| E99 | 9-10-11 | 7 | 150 | 10 | 50 | 20 | 10 | 500 | 70 | 200 |
| E100 | 9-10-11 | 10 | 70 | 15 | 50 | 30 | 7 | 700 | 30 | 150 |
| E104 | 4-10-11 | 15 | 70 | N | 30 | 50 | 7 | 1,500 | 30 | 150 |
| E107 | 4-10-11 | 20 | 70 | 5 | 30 | 70 | 7 | 1,000 | 30 | 150 |
| E108 | 4-10-11 | 30 | 70 | 5 | 30 | 70 | 7 | 1,000 | 30 | 100 |
| E109 | 20- 9-11 | 50 | 70 | N | 20 | 20 | 15 | 700 | 30 | 150 |
| E111 | 20- 9-11 | 50 | 70 | N | 30 | 15 | 15 | 1,000 | 30 | 100 |
| E112 | 20- 9-11 | 70 | 70 | N | 30 | 30 | 15 | 1,500 | 30 | 150 |
| E114 | 20- 9-11 | 70 | 70 | N | 20 | 30 | 10 | 1,500 | 30 | 100 |
| E115 | 26- 9-11 | 20 | 100 | 10 | 30 | 20 | 7 | 1,000 | 30 | 150 |
| E116 | 23- 9-11 | 30 | 100 | 15 | 20 | 15 | 7 | 1,000 | 30 | 150 |
| E119 | 27- 9-11 | 50 | 70 | 15 | 20 | 30 | 7 | 1,000 | 50 | 150 |
| E122 | 27- 9-11 | 50 | 70 | 15 | 30 | 30 | 10 | 700 | 30 | 150 |
| E125 | 27- 9-11 | 15 | 100 | 5 | 70 | 20 | 7 | 700 | 30 | 200 |
| E129 | 27- 9-11 | 20 | 100 | 15 | 20 | 30 | 10 | 700 | 30 | 100 |
| E130 | 26- 9-11 | 50 | 70 | 10 | 30 | 30 | 10 | 1,000 | 30 | 100 |
| [7]E133 | 26- 9-11 | 15 | 100 | 7 | 30 | 30 | 70 | 1,000 | 30 | 100 |
| E136 | 26- 9-11 | 20 | 100 | 10 | 50 | 20 | 10 | 1,000 | 30 | 150 |
| E193 | 16- 9-11 | 20 | 100 | N | 70 | 20 | 10 | 1,000 | 30 | 150 |
| E197 | 1- 9-12 | 50 | 70 | N | 30 | 20 | 15 | 1,500 | 30 | 100 |
| E203 | 13- 9-11 | 15 | 70 | N | 30 | 20 | 7 | 2,000 | 20 | 150 |
| E204 | 13- 9-11 | 15 | 70 | N | 70 | 20 | 7 | 1,000 | 20 | 200 |
| E206 | 14- 9-11 | 15 | 100 | L | 50 | 20 | 10 | 2,000 | 30 | 150 |
| E213 | 4-10-11 | 70 | 100 | N | 50 | 50 | 15 | 1,500 | 30 | 150 |
| E215 | 5-10-11 | 200 | 50 | N | 10 | 20 | 15 | 700 | 20 | 70 |
| E216 | 5-10-11 | 200 | 50 | N | 15 | 20 | 15 | 500 | 20 | 70 |

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—Continued*

| Sample | Section | T. S. | R. E. | Semiquantitative spectrographic analyses--Continued (ppm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Cu (5) | La (20) | Mo (5) | Nb (10) | Pb (10) | Sc (5) | Sr (50) | Y (5) | Zr (10) |
| E238 | 24- | 9- | 11 | 20 | 70 | 5 | 30 | 50 | 7 | 700 | 30 | 150 |
| E246 | 36- | 8- | 12 | 70 | 70 | L | 30 | 20 | 10 | 1,000 | 30 | 150 |
| E247 | 36- | 8- | 12 | 50 | 70 | L | 30 | 30 | 10 | 1,000 | 30 | 150 |
| E251 | 36- | 8- | 11 | 50 | 70 | N | 30 | 20 | 7 | 500 | 20 | 150 |
| E256 | 36- | 8- | 11 | 50 | 70 | L | 30 | 30 | 10 | 700 | 30 | 150 |
| E260 | 36- | 8- | 11 | 50 | 70 | L | 50 | 20 | 10 | 1,500 | 30 | 150 |
| E261 | 35- | 8- | 11 | 50 | 70 | N | 30 | 20 | 10 | 500 | 30 | 150 |
| E262 | 5- | 9- | 11 | 30 | 50 | L | 30 | 50 | 10 | 700 | 20 | 150 |
| E266 | 8- | 9- | 11 | 50 | 70 | L | 20 | 30 | 10 | 1,000 | 30 | 150 |
| E272 | 10- | 9- | 11 | 20 | 70 | 5 | 50 | 70 | 7 | 1,000 | 20 | 200 |
| E295 | 35- | 9- | 11 | 30 | 70 | 15 | 30 | 15 | 7 | 700 | 20 | 150 |
| E298 | 34- | 9- | 11 | 50 | 100 | 50 | 50 | 30 | 7 | 1,000 | 30 | 300 |
| E299 | 34- | 9- | 11 | 30 | 100 | 15 | 50 | 30 | 7 | 700 | 30 | 200 |
| E300 | 34- | 9- | 11 | 30 | 70 | 30 | 30 | 30 | 7 | 1,000 | 30 | 200 |
| [8]E302 | 34- | 9- | 11 | 50 | 100 | 100 | 30 | 30 | 7 | 1,000 | 30 | 150 |
| E303 | 34- | 9- | 11 | 50 | 70 | 20 | 50 | 50 | 7 | 500 | 20 | 150 |
| E304 | 34- | 9- | 11 | 30 | 70 | 20 | 50 | 30 | 7 | 700 | 20 | 150 |
| E305 | 34- | 9- | 11 | 50 | 70 | 15 | 30 | 70 | 7 | 1,500 | 20 | 150 |
| E326 | 26- | 9- | 10 | 50 | 70 | N | 10 | 20 | 30 | 1,500 | 20 | 70 |
| E334 | 25- | 10- | 11 | 7 | 100 | 15 | 70 | 30 | 7 | 150 | 50 | 200 |
| E337 | 25- | 10- | 11 | 15 | 100 | 30 | 30 | 20 | 7 | 200 | 30 | 200 |
| E338 | 25- | 10- | 11 | L | 150 | 7 | 70 | 20 | 7 | 150 | 50 | 300 |
| E340 | 25- | 10- | 11 | L | 150 | 7 | 70 | 20 | 7 | 150 | 50 | 300 |
| E341 | 25- | 10- | 11 | 7 | 100 | 15 | 50 | 20 | 10 | 200 | 50 | 300 |
| E342 | 25- | 10- | 11 | L | 100 | 7 | 70 | 20 | 7 | 150 | 50 | 300 |
| E344 | 3- | 10- | 10 | 50 | 70 | N | 10 | 20 | 50 | 700 | 30 | 70 |
| E345 | 3- | 10- | 10 | 50 | 70 | N | 10 | 20 | 20 | 1,000 | 20 | 70 |
| E346 | 3- | 10- | 10 | 50 | 70 | N | 10 | 15 | 20 | 1,000 | 20 | 70 |
| E347 | 2- | 10- | 10 | 50 | 70 | N | 10 | 15 | 15 | 1,000 | 20 | 70 |
| E348 | 2- | 10- | 10 | 50 | 70 | N | 15 | 15 | 15 | 1,000 | 30 | 100 |
| E352 | 11- | 10- | 10 | 50 | 70 | N | 10 | 15 | 15 | 1,000 | 30 | 100 |
| E353 | 11- | 10- | 10 | 50 | 70 | N | 10 | 15 | 15 | 1,000 | 30 | 70 |
| E354 | 11- | 10- | 10 | 50 | 70 | N | 15 | 20 | 15 | 1,000 | 30 | 70 |
| E361 | 10- | 10- | 10 | 50 | 70 | N | 10 | 20 | 15 | 1,000 | 30 | 70 |
| E363 | 10- | 10- | 10 | 50 | 70 | N | 7 | 20 | 15 | 700 | 30 | 70 |

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—Continued*

| Sample | Section | T. S. | R. E. | Semiquantitative spectrographic analyses--Continued (ppm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Cu (5) | La (20) | Mo (5) | Nb (10) | Pb (10) | Sc (5) | Sr (50) | Y (5) | Zr (10) |
| E365 | 10 | 10 | 10 | 50 | 70 | N | 7 | 20 | 15 | 1,000 | 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 | 1,000 | 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, element detected, but in amount too low to determine; N, element looked for but not found. Section, township, and range refer to plate 2]

| Sample | Section T. S. R. E. | Atomic absorption (ppm) | Semiquantitative spectrographic analyses (ppm) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Au (0.02) | Ag (0.5) | Cu (5) | La (20) | Mo (5) | Nb (10) | Pb (10) | Zn (200) | Other elements |
| 2 | 33-10-11 | 0.2 | N | 7 | 150 | 30 | 70 | 100 | N | Be 10; Sn 10. |
| 8A | 20-10-11 | N | N | 5 | 100 | 15 | 30 | 30 | N | None listed. |
| 10A | 20-10-11 | N | 0.7 | 7 | 200 | N | 50 | 50 | N | Do. |
| 21A | 35-10-11 | N | 7 | N | 70 | 150 | 20 | 30 | N | Do. |
| 28A | 19- 9-11 | N | N | 5 | 20 | N | N | 20 | 700 | Do. |
| 30A | 19- 9-11 | N | N | 100 | N | 30 | N | 300 | 10,000 | Do. |
| 277A | 17- 9-11 | 0.07 | N | 100 | 30 | L | N | 70 | N | Do. |
| 281A | 17- 9-11 | N | N | 50 | N | N | N | 70 | 1,500 | Mn 10,000. |
| 432 | 4-11-11 | N | 2 | L | 700 | 1,500 | 15 | 30 | 300 | Ce 1,000; Nd 500. |
| 761 | 13-10-12 | N | N | 50 | 30 | L | 70 | 70 | N | None listed. |
| 763 | 12-10-11 | N | N | 30 | 100 | 15 | 20 | 30 | N | Do. |
| 767A | 4-10-11 | N | N | 5 | 30 | N | L | 10 | N | Do. |
| 769 | 4-10-11 | N | 5 | 20 | 30 | 15 | L | 1,500 | N | Do. |
| 770A | 3-10-11 | N | N | 5 | 20 | 20 | 30 | 70 | N | Do. |
| 771A | 4-10-11 | N | 1 | 20 | N | 15 | N | 150 | N | Do. |
| E296 | 34- 9-11 | 0.2 | N | 50 | 70 | 50 | 50 | 50 | N | Do. |

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