Mineral Resources of the Blue Range Primitive Area Greenlee County, Arizona, and Catron County, New Mexico

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With a section on
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STUDIES RELATED TO WILDERNESS—PRIMITIVE AREAS

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An evaluation of the mineral potential of the area

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STUDIES RELATED TO WILDERNESS

PRIMITIVE AREAS

Pursuant to the Wilderness Act (Public Law 88–577, Sept. 3, 1964) and the Conference Report on Senate bill 4, 88th Congress, the U.S. Geological Survey and the U.S. Bureau of Mines are making mineral surveys of wilderness and primitive areas. Areas officially designated as "wilderness," "wild," or "canoe" when the act was passed were incorporated into the National Wilderness Preservation System. Areas classed as "primitive" were not included in the Wilderness System, but the act provided that each primitive area should be studied for its suitability for incorporation into the Wilderness System. The mineral surveys constitute one aspect of the suitability studies. This bulletin reports the results of a mineral survey in the Blue Range primitive area, Greenlee County, Arizona and Catron County, New Mexico. The area discussed in the report includes the Blue Range primitive area as officially designated and also certain additional contiguous areas that have been proposed for consideration for wilderness status. The area that was studied is referred to in this report as the Blue Range primitive area.

This bulletin is one of a series of similar reports on primitive areas.

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MINERAL RESOURCES OF THE BLUE RANGE PRIMITIVE AREA, GREENLEE COUNTY, ARIZONA AND CATRON COUNTY, NEW MEXICO

By JAMES C. RATTÉ, E. R. LANDIS, and DAVID L. GASKILL, U.S. GEOLOGICAL SURVEY, and R. G. RAABE, U.S. BUREAU OF MINES

SUMMARY

The Blue Range primitive area comprises about 380 square miles in southeastern Arizona and southwestern New Mexico. Elevations in this mountainous region range from about 4,500 feet at the level of Blue River to nearly 9,400 feet on the high rim west of the river.

Rocks within and adjacent to the primitive area consist entirely of volcanic rocks or clastic sedimentary rocks derived almost entirely from volcanic sources. A thickness of about 5,000 feet of these rocks is exposed. They are mainly Oligocene and late Miocene in age, but some are of Pliocene age or younger. The rocks are highly faulted, and the major faults define sets that trend northeast, northwest, and approximately west. The northeast-trending faults are part of a fault system 15–30 miles wide that extends 70 miles or more from the vicinity of Clifton and Morenci, Ariz., to Apache Creek, N. Mex. This fault system is athwart the prevailing northwest trend of faults and rock units in southeastern Arizona and southwestern New Mexico.

The mineral-resource potential of the area was appraised by means of geologic mapping, geochemical sampling, an aeromagnetic survey, and close examination of all mining claims and areas of mineralized or altered rocks. Approximately 700 stream-sediment samples were taken, including about 60 pan concentrates and 225 samples of unaltered, altered, and mineralized rocks.

No evidence of potential mineral resources was found in more than 90 percent of the primitive area. Hydrothermal alteration and low-level geochemical anomalies in the Red Mountain-Oak Creek and the Squaw Creek-Maple Canyon areas, however, indicate that they may contain ore deposits at greater depth. Of the two, available evidence indicates that the Squaw Creek-Maple Canyon area has the greater mineral potential, particularly for molybdenum and copper. A positive aeromagnetic anomaly near the south edge of the primitive area and in the western part of the Squaw Creek-Maple Canyon area is similar to anomalies in other parts of western United States that are known to be caused by buried intrusive igneous rocks, some of which have ore deposits associated with them. A thorough assessment of the mineral potential at depth in the Squaw Creek-Maple Canyon area would require exploratory drilling that is beyond the scope of this investigation.

The likelihood of mineral-fuel deposits in the area is slight. Presence of materials such as coal, oil, oil shale, or natural gas would depend on the presence of sedimentary rocks of Paleozoic or Mesozoic age beneath the Tertiary volcanic rocks. Although such prevolcanic sedimentary rocks may be present, they are inferred from indirect evidence to be thin, and because coal- or oil-bearing rocks are absent in adjacent areas the potential for fossil fuels is considered to be low.

There are no mines in the primitive area and there is no record of mineral production from the area. No patented mining claims are in the area. Several groups of unpatented mining claims exist, but none show more than traces of metallic minerals.

GEOLOGY AND MINERAL RESOURCES

By JAMES C. RATTÉ, E. R. LANDIS, and DAVID L. GASKILL

INTRODUCTION

LOCATION AND GENERAL FEATURES

The Blue Range primitive area, which is in the Apache National Forest, comprises about 345 square miles in Greenlee County, Ariz., and approximately 35 square miles in Catron County, N. Mex. (fig. 1). Nearby towns in Arizona are Alpine and Springerville, 15 and 40 miles north, respectively, and Morenci and Clifton, 20 miles south. In New Mexico, Luna is 15 miles north of the primitive area, Reserve 10 miles northeast, and Glenwood 10 miles southeast. The area studied for this report (fig. 2) includes the officially designated Blue Range Primitive Area plus additional areas that may be considered for inclusion in the Wilderness System.

Physical Features

The Blue Range primitive area is in a mountainous region (fig. 3) that includes much of the upper drainage basin of the Blue River, a major tributary of the San Francisco River (fig. 1). The west boundary of the study area is approximately the divide between the Black River, a tributary of Salt River, and Blue River drainages. The New Mexico portion of the area is drained by Pueblo Creek, which also flows to the San Francisco River. Except in these streams and some of the larger secondary streams that head in the high rim west of the Blue River, streamflow is largely intermittent.

As shown in figure 4, the primitive area is divided roughly into four parts by the Blue River, which crudely bisects the area north-south, and by a steep south-facing escarpment, commonly identified as the Mogollon Rim, that projects from west to east across the area north of Red Mountain and along the south flank of Bear Mountain. The northeast quadrant consists of the Bear Mountain-Whiterocks Mountain mass and the northeast-trending Brushy Mountains. The northwest

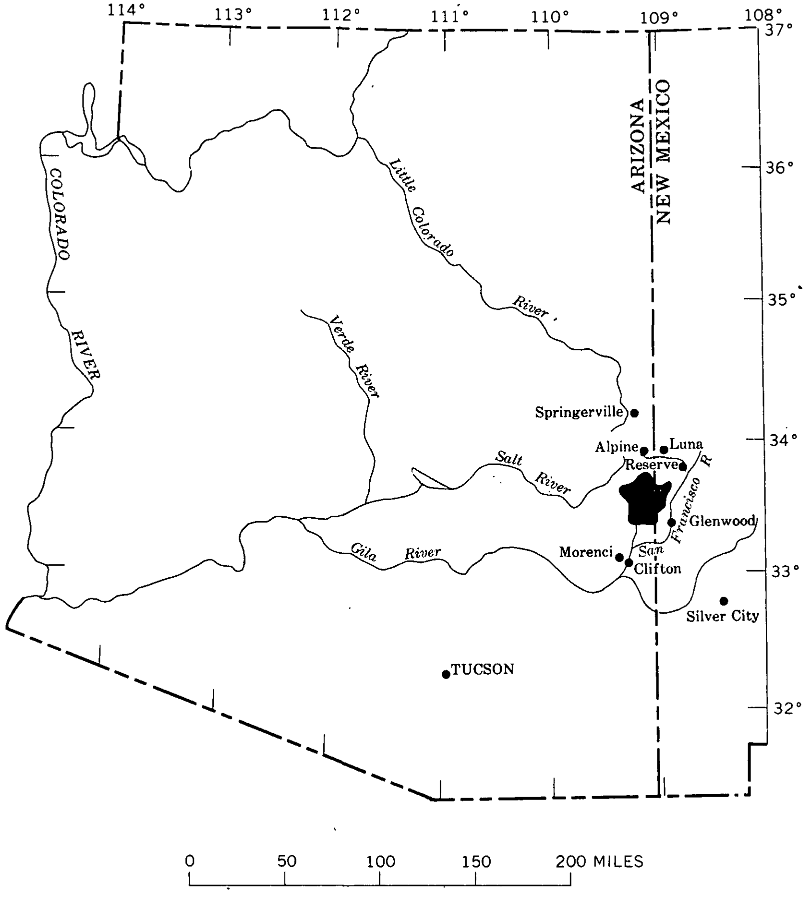

FIGURE 1.—Index map showing location of Blue Range primitive area (black), Arizona and New Mexico.

quadrant includes the high rim at the east edge of a broad surface that dips gently westward to the Black River. This deeply incised rim overlooks highly dissected slopes west of the Blue River. The southwest quadrant embraces the circular mass that is Red Mountain and the east flanks of Rose Peak; the southeast quadrant includes Alma Mesa and the northwest slopes of Maple Peak. The highest elevation in the area is nearly 9,400 feet, at Blue Lookout west of the Blue River along the east-west escarpment (fig. 4). Rose Peak, Red Mountain, Bear Mountain, Whiterocks Mountain, and Maple Peak all rise above 8,000 feet. The Blue River enters the primitive area at about 5,800 feet elevation and crosses the south boundary at a little less than 4,500 feet; thus the maximum relief from the west rim to the bottom of the canyon is nearly 5,000 feet.

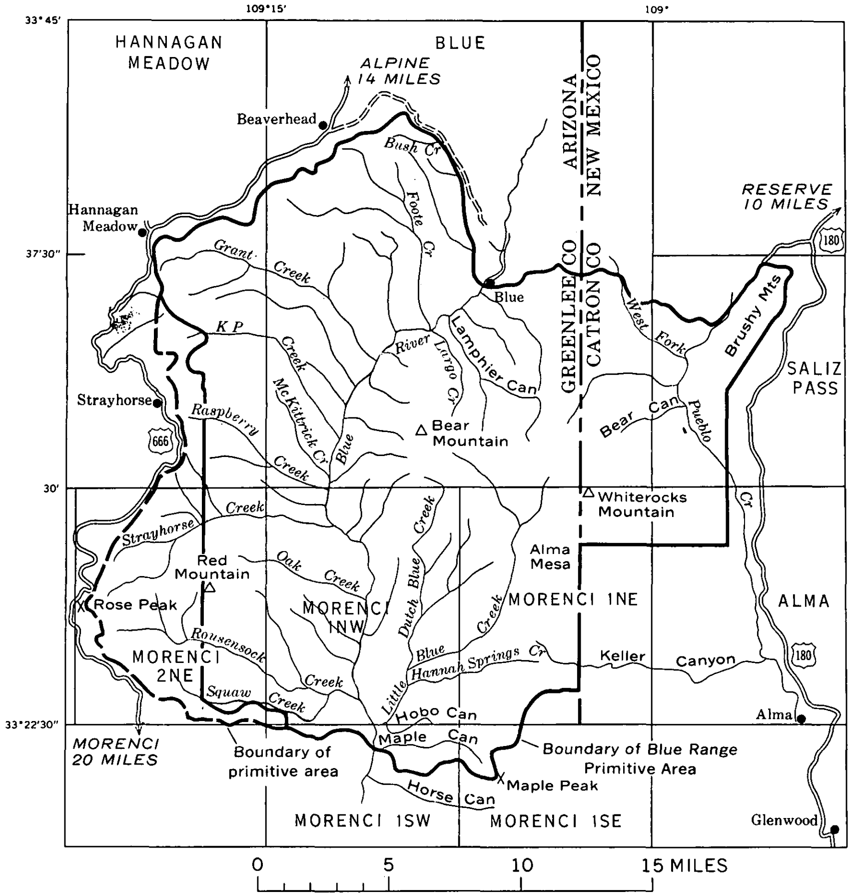

Figure 2.—Index map showing boundary of Blue Range primitive area, boundary of study area (not shown where coincident with primitive area boundary), and quadrangle names.

Within the primitive area, the valley of the Blue River ranges from open canyon in much of the stretch north of the major east-west escarpment to steep-walled gorge through large segments to the south. Its walls are cut by scenic tributary canyons, in many of which the streams enter the main canyon over falls several tens of feet high. Perhaps the most spectacular canyons, and certainly the deepest, are those that slice back into the high rim west of the Blue River; these include the canyons of Bush, Foote, Fishhook, Grant, and Steeple Creeks, and biggest of all, the canyon of KP Creek, which is nearly one half of a mile deep north of Blue Lookout. Strayhorse, Oak, Rousensock, and Squaw Creeks have all cut impressive canyons in the southwest part of the area, and Hannah Springs Creek, the Little Blue, and Dutch Blue Creeks, east of the Blue River, flow through narrow defiles hundreds of feet deep in many places.

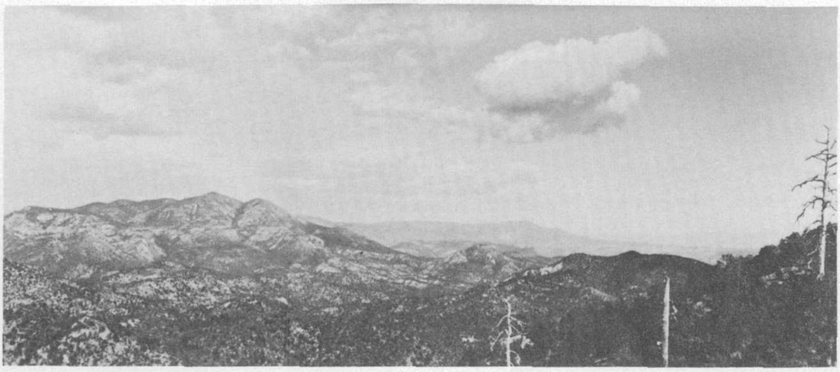

FIGURE 3.—Blue Range primitive area as viewed northeastward from U.S. Route 666 south of Rose Peak. Red Mountain to left; Whiterocks Mountain on skyline—right center; Mogollon Range in New Mexico on far skyline to right.

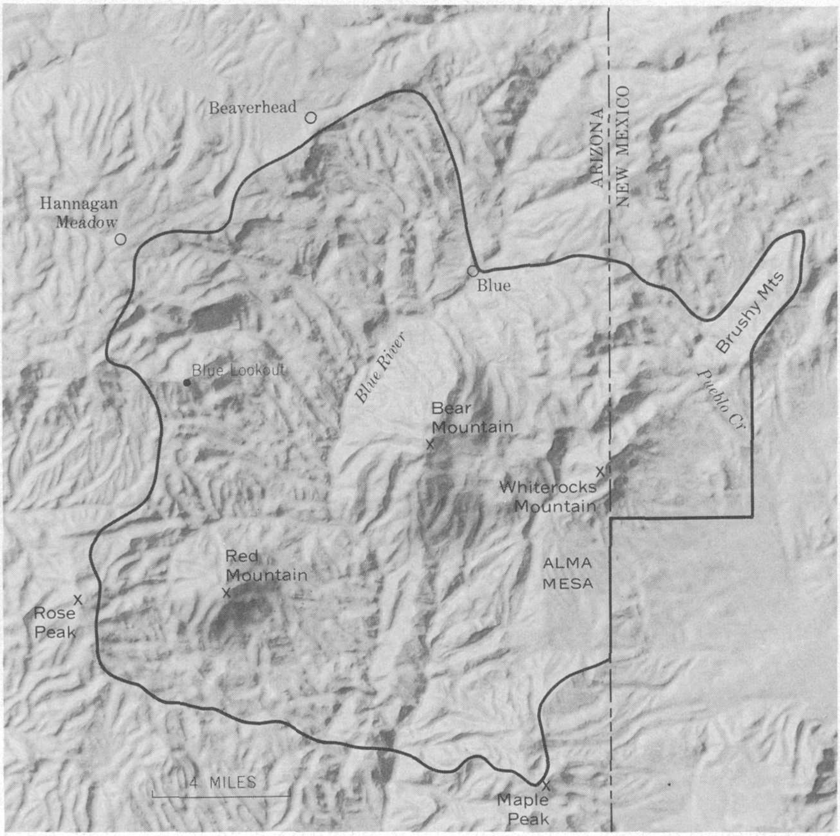

FIGURE 4.—Physiographic diagram of Blue Range primitive area and vicinity.

The east-west escarpment is but one of several linear features of somewhat east-west trend that show conspicuously on the physiographic diagram (fig. 4). Also visible in the diagram are strong linear trends oriented northeast, northwest, and north-south, all of which reflect trends in the geologic structure of the area.

Climate and Vegetation

Because of the nearly 5,000-foot range in elevation, climate varies greatly, and plant life shows highly diverse forms from valley bottoms to high rims. The average annual precipitation, from records of the U.S. Weather Bureau for the period 1948–65, is slightly less than 25 inches at Beaverhead Lodge at an elevation of 8,000 feet just outside the northwest corner of the primitive area (fig. 2), and is slightly less than 15 inches at the Fritz Ranch about 4 miles south of the area, along the Blue River. Much of the precipitation falls as snow at the higher elevations and as rain at the lower elevations during the winter months; most of the remainder falls during thunderstorms in the summer. Snow may persist well into May on heavily wooded north slopes at high elevations.

Plant associations representative of the Upper Sonoran, Transition, and Canadian life zones occur within the area. Cottonwood and sycamore mark the flood plains of the major streams, and cactus, mesquite, and associated plants dot the slopes at low elevations, where bare rock generally dominates the scenery. Contrasting markedly with this desert and foothills flora is a thick mixed evergreen forest, which includes pine, spruce, and fir on the high west rim, along the Bear Mountain-Whiterocks Mountain ridge, and at similar elevations elsewhere. Many of the steep slopes at high elevations have a thick cover of oak brush and locust; manzanita is common, particularly where rhyolitic igneous rocks are prevalent.

Archeology

In addition to many scenic physical features, the primitive area is dotted with numerous archeological sites. Petroglyphs are preserved on rocks along the Red Hill Road just west of the Blue River, outside the primitive area; pit houses are abundant on terraces along the Blue River as well as on several flat-topped divides, such as between Alder Peak and U.S. Route 666 at the south edge of the area, and southwest of Saddle Mountain in the northeast part of the area. Small cliff dwellings can be found high in the rhyolite cliffs on south-facing exposures on Red Mountain.

Present-day Human Activities

Narrow areas along the Blue River are occupied by small ranches that depend largely on the bordering primitive area for grazing. Lumber operations are carried on immediately west of the primitive area.

A recreational industry based largely on the hunting of deer, elk, bear, lion, and turkey also contributes to the livelihood of area residents. A U.S. Post Office is maintained at Blue at the north boundary of the area.

PREVIOUS GEOLOGIC STUDIES

Prior geologic work in the study area consists of reconnaissance geologic mapping of the Reserve quadrangle, New Mexico, at a scale of 2 miles equals 1 inch, by Weber and Willard (1959b), and geologic mapping of Greenlee and Graham Counties, Ariz., at a scale of 6 miles equals 1 inch, by Wilson, Moore, and others (1958). Some of the rocks of the study area correlate with rocks in the Alpine-Nutrioso area 10 miles to the north that were described by Wrucke (1961).

PRESENT STUDIES AND ACKNOWLEDGMENTS

The purpose of this minerals survey is to appraise the mineral resources of the primitive area. This study has involved geologic mapping at a compilation scale of 1 mile equals 1 inch (pl. 1), geochemical sampling of rocks and stream sediments (pl. 2; tables 2–5), and an aeromagnetic survey of the area (pl. 1). Thirty-two man-weeks were spent in the field between May 1967 and June 1968; field studies were aided by helicopter transportation during approximately half of the field time.

Our thanks are extended to Charles Pineo and Walter Welton, whose assistance in the field in July and August 1967 consistently exceeded the requirements of a 40-hour week.

We are indebted to Dr. Paul Damon, of the University of Arizona Geochronology Laboratory, for providing radiometric ages on four samples collected jointly during his visit to the study area in October 1967.

Our studies also were aided by discussions with Prof. Wolfgang Elston, University of New Mexico Geology Department, and by field trips conducted by him in areas of New Mexico adjacent to the study area.

We also wish to thank Mr. and Mrs. Bob Birdwell of the 6K6 Ranch, and Mr. Fred Fritz and Mr. George Stacy, both of Clifton, Ariz., for extended courtesies during this investigation.

GEOLOGIC SETTING

Structurally and physiographically, the Blue Range primitive area is within the transition zone between the Colorado Plateaus and the Basin and Range provinces (Wilson and Moore, 1959). It is in a region where the strata are more severely faulted and disturbed than in the

Colorado Plateaus province to the north, and where the mountains are in relative disarray as compared to the linear ranges and intervening basins of the Basin and Range province to the south. However, as the physiographic and structural provinces in Arizona have been more recently defined (Heindl and Lance, 1960, p. 15, 17), the primitive area lies wholly within the Colorado Plateaus province.

All the rocks exposed in the study area are either volcanic rocks or epiclastic volcanic rocks; that is, sedimentary rocks composed of volcanic debris. These rocks are of middle and late Tertiary age and are in the southwest part of the White Mountain and Datil volcanic areas (Cohee, and others, 1961), which cover approximately 20,000 square miles in southwestern New Mexico and eastern Arizona.

The character of the rocks beneath the Tertiary volcanic rocks is pertinent to the economic appraisal of the study area, but direct evidence of the extent and thickness of such rocks is fragmentary. Although Paleozoic and Mesozoic rocks probably were deposited throughout the region, some of these rocks likely were removed by erosion before the Tertiary volcanic rocks accumulated. It is estimated that between two and three thousand feet of Paleozoic and Mesozoic sediments were deposited in the vicinity of the study area (McKee, 1951, pl. 3), and as much as 2,000 feet of Paleozoic rocks may remain beneath the Tertiary volcanics (Kottlowski, 1965, fig. 2). The areal extent of the rocks under the volcanic cover depends largely upon the configuration of the Burro uplift, a northwest-trending late Paleozoic to early Mesozoic uplift (Elston, 1958; Hewitt, 1959), the exposed core of which contains metamorphic and igneous rocks of Precambrian age in southwestern New Mexico. The core of the uplift, as shown by Kottlowski (1963, 1965), projects into the southern part of the study area, thereby presenting the possibility that Tertiary volcanic rocks rest directly on Precambrian rocks in that part of the area.

Rocks of Cambrian, Ordovician, Devonian, and Mississippian age crop out south and southeast of the primitive area near Clifton, Ariz., and Silver City, N. Mex., but these pre-Pennsylvanian rocks are not present in a well 35 miles north of the area (Foster, 1964, p. 13–14). Where present, Pennsylvanian-age rocks are as much as 1,000 feet thick beneath the study area (Kottlowski, 1965, fig. 6), but any Permian rocks or Mesozoic rocks that may have been deposited in this area probably were stripped by erosion before the Tertiary volcanic rocks were deposited (Kottlowski, 1963, p. 78, 85, figs. 17, 18).

In addition to the Paleozoic and Mesozoic rocks exposed in and north of the Clifton-Morenci mining district about 20 miles south of the primitive area (Lindgren, 1905a; Wilson, Moore, and others, 1958), and north of Springerville, about 40 miles north of the area (Wilson, Moore, and others, 1958), several small outcrops of Pennsylvanian rocks occur less than 20 miles north of the area (Weber and Willard, 1959b; Wrucke, 1961). Some if not all of these small exposures are rafted blocks or inclusions in the Tertiary volcanic rocks. During the present study, limestone boulders were found in lenses of sedimentary conglomerate several tens of feet thick in the northwestern part of the primitive area.

In summary, the meager evidence available suggests that Precambrian rocks may underlie the Tertiary volcanic rocks of the southern part of the area and that elsewhere as much as 2,000 feet of Paleozoic rocks may be present beneath the Tertiary rocks.

ROCKS IN THE STUDY AREA

VOLCANIC SEQUENCE

The rocks of the Blue Range primitive area are shown in stratigraphic sequence in table 1. Some of the rocks represent a somewhat local volcanic accumulation, and only a few rock units extend throughout the area. Each unit is named for the prevalent rock type in the areas where it is shown on the map (pl. 1). Most of the volcanic rock units consist of numerous flows and pyroclastic layers with a considerable range in composition. Some areas of complex structure and (or) heterogeneous rock units can be fully understood only by more detailed mapping. However, the map units shown on plate 1 are believed to be adequate to describe the major aspects of the geology.

TABLE 1.—*Tertiary volcanic sequence in the Blue Range primitive area*

Rock unit	*Approximate thickness (feet)*	*Isotope age (million years)*
Gila Conglomerate	0–1, 100	
Includes some basaltic lava flows.		
Erosional unconformity.		
Basaltic andesite	2, 000	23. 3±0. 7
Quartz latite and rhyolite (south half only)	0–1, 000	23. 4±0. 7
Extrusive-intrusive dome complex; dikes of complex intrude lower lava flows of basaltic andesite, but complex appears to be older than most of basaltic andesite unit.		
Unconformity.		
Rhyolite tuff (north half only)	300–1, 000	24. 9±0. 7
Welded rhyolite ash-flow tuff sheet interlayered with conglomerate, sandstone, andesitic lava flows, and other rhyolite and quartz latite ash-flow tuffs.		
Rhyolite of Red Mountain (south half only)	0–1, 700	
Welded rhyolite ash-flow tuffs, lava flows, and intrusive rhyolite.		
Erosional unconformity.		
Pyroxene-hornblende andesite (south)	2, 000	37. 4±3. 9
Epiclastic volcanic rocks (north)	2, 000	
Includes some lava flows and nonvolcanic conglomerate containing clasts of fossiliferous limestone and gneissic granite.		

The general relationships between the map units are shown diagrammatically in figure 5, and their distribution is shown on plate 1. The oldest rocks are exposed in the southwestern part of the area, where they consist of about 2,000 feet or more of lava flows, flow breccias, and pyroclastic breccias of pyroxene-hornblende andesite, cut by numerous dikes of the same composition. There is little differential weathering between the dikes and layered rocks, and consequently the dikes are not readily traced across the countryside. Thus, they were noted primarily where they crop out along drains and generally are not shown on the geologic map. The rocks in this unit are believed to form a composite andesitic volcano whose center probably was within the southwestern part of the study area.

In the north half of the area, the andesitic lava flows and breccias gradually give way to epiclastic volcanic sediments that range from laharic and mudflow-type breccias to volcanic conglomerate, sandstone, and siltstone with a maximum thickness of at least 2,000 feet. Excellent exposures of these rocks can be observed along the Red Hill Road, which gets its name from the dominant red color of the matrix of the sedimentary rocks, and along the road east from Blue. Andesitic to dacitic lava flows appear to be interlayered more or less throughout the clastic unit, and are increasingly abundant to the south, although

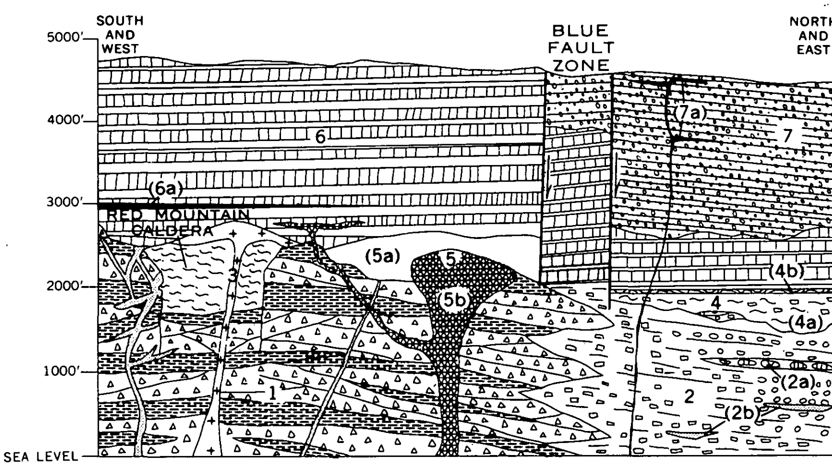

FIGURE 5.—Diagrammatic geologic section in the Blue Range primitive area. 1, Pyroxene-hornblende andesite flows, breccias, and dikes. 2, Epiclastic volcanic rocks; 2a, conglomerate containing limestone and granite gneiss; 2b, interlayered andesitic lava flows. 3, Rhyolite of Red Mountain (ash-flow tuff, lava flows, and intrusive rhyolite). 4, Rhyolite tuff; 4a, ash-flow tuff member; 4b, breccia member. 5, Quartz latite and rhyolite dome complex; 5a, lava facies; 5b, intrusive facies. 6, Basaltic andesite; 6a, peralkaline rhyolite ash-flow tuff. 7, Gila Conglomerate; 7a, interlayered basaltic lava flows. Horizontal scale, arbitrary.

they probably nowhere exceed 5 percent of the unit. The sedimentary materials are largely andesitic to dacitic debris, much of which undoubtedly was derived from the andesitic volcano in the southwestern part of the area.

In the northwestern part of the area, and most readily examined along the Red Hill Road beneath Red Bluff (pl. 1), the sedimentary unit includes about 120 feet of sandy conglomerate characterized by beds that contain as much as 70 percent or more nonvolcanic materials. Well-rounded, mostly subspherical pebbles, cobbles, and boulders as much as 2 feet long include a variety of carbonate rocks and a gneissic biotite granite, along with some other crystalline rocks. These beds, which are near the middle of the sedimentary unit, crop out from the Red Hill Road south to the mouth of the Right Fork of Foote Creek; they also were observed about 5 miles northeast of Red Bluff, outside the primitive area, between Milligan Peak and the Blue River.

Many of the carbonate clasts contain abundant fossils of calcareous algae, and brachiopod and crinoid fragments. Fusulinids from some of the limestone were identified by D. A. Myers of the U.S. Geological Survey, who reported (oral commun., 1967) that they range in age from Middle to Late Pennsylvanian. The large size of some of the limestone clasts, indeed their very presence, indicates a source probably within a few miles of the site of deposition. The nearest present exposures of such rocks are about 12 miles south of the primitive area, near Morenci, Ariz.

The transitional contact between the sedimentary unit and the pyroxene-hornblende andesite unit is arbitrarily drawn north of Strayhorse Creek, west of the Blue fault zone (pl. 1), and on the lower southwest slopes of Bear Mountain east of the Blue River (pl. 1). Lava flows interbedded in the sedimentary unit were mapped only locally, as in the nothwest corner of the area and south of the ridge between Bear and Whiterocks Mountains.

In most places in the north half of the area, the sedimentary unit is overlain unconformably by a rhyolite tuff unit having an aggregate thickness of 300–1,000 feet. It has a lower member, mainly a rhyolite ash-flow sheet, and an upper heterogeneous and poorly defined breccia member that consists of volcanic and fluviatile breccia and some conglomerate and sandstone. Locally, the rocks of the breccia member might better be included in the overlying basaltic andesite unit, and the unconformity at the base of that unit probably is within the breccia member in a number of places. The following description is restricted largely to the ash-flow member, which, in addition to the main rhyolite ash-flow sheet, locally contains conglomerate, sandstone, andesitic flows, and other thin rhyolite and quartz latite ash-flow tuffs. At some

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locations, such as west of Saddle Mountain in the northeast part of the study area, gravel and sandstone beds of the ash-flow member were deposited on a rough topography beneath the main rhyolite ash-flow sheet. In most of the area, however, the ash-flow sheet is at the bottom of the rhyolite tuff unit and buries the old surface (fig. 6). In Yam Canyon this surface has a maximum relief of at least several hundred feet and possibly much more.

West of the Blue River, the rhyolite ash-flow sheet ranges in thickness from a few tens of feet to about 200 feet and is overlain by conglomerate and sandstone of the breccia member that is very similar or identical to much of the epiclastic unit beneath the ash-flow sheet, except that in many places it is characteristically buff rather than red. Distinctive white to buff sandstone with sweeping crossbeds is common in the upper member of the rhyolite tuff unit near the Red Hill Road and Castle Rock (pl. 1) and is probably correlative with similar crossbedded sandstone in the Alpine-Nutrioso area, described by Wrucke (1961, p. H17–H19) as having a matrix of zeolite. Platy, porphyritic andesitic flows, which are interlayered with the upper member from Sawed Off Mountain to Raspberry Peak, are mapped separately in that area (pl. 1). East of the Blue River, the rhyolite ash-flow sheet is at least 500 feet thick along Little Blue Creek, in Yam Canyon, and in the Brushy Mountains. North and south from

FIGURE 6.—Erosional unconformity beneath rhyolite ash-flow sheet of rhyolite tuff unit. Relief on buried topography on west side of Yam Canyon is 100–200 feet. Ts, epiclastic volcanic rocks; Tra, rhyolite ash-flow tuff.

Whiterocks Mountain, other rocks are mapped with the ash-flow member, as previously noted, but the rhyolite ash-flow sheet is probably 200–400 feet thick in most places.

In the southwestern part of the primitive area, the rhyolite of Red Mountain is interpreted as filling a 2- to 3-mile-diameter caldera in the older pyroxene-hornblende andesite (pl. 1, fig. 5). The rhyolite includes at least 700 feet of rhyolite ash-flow tuff, overlain and intruded by fine-grained rhyolite lava. The ash-flow tuff is in two main cooling units. The lower one is about 500 feet thick and contains as much as 40–50 percent angular fluidal rhyolite fragments as much as 2 feet in diameter (fig. 7). The upper cooling unit, about 200 feet thick, is similar in composition to the lower one but contains few lithic inclusions. The pseudobedding characteristics evident in figure 7 are an original feature of this ash-flow deposit. Presumably, the breccia layers formed as a result of pulsating explosions that disintegrated a plug or protrusive mass of rhyolite. The rhyolite body just northeast of the main mass on Red Mountain (pl. 1) fills a small vent, but the two other bodies along Oak Creek and the tiny outlier south of Strayhorse Creek are probably remnants of rhyolite lava flows. The main source of the ash flows and lava was the Red Mountain caldera.

The rhyolite ash-flow tuffs of Red Mountain (pl. 1) and the rhyolite ash-flow sheet in the north part of the area (pl. 1) are very similar

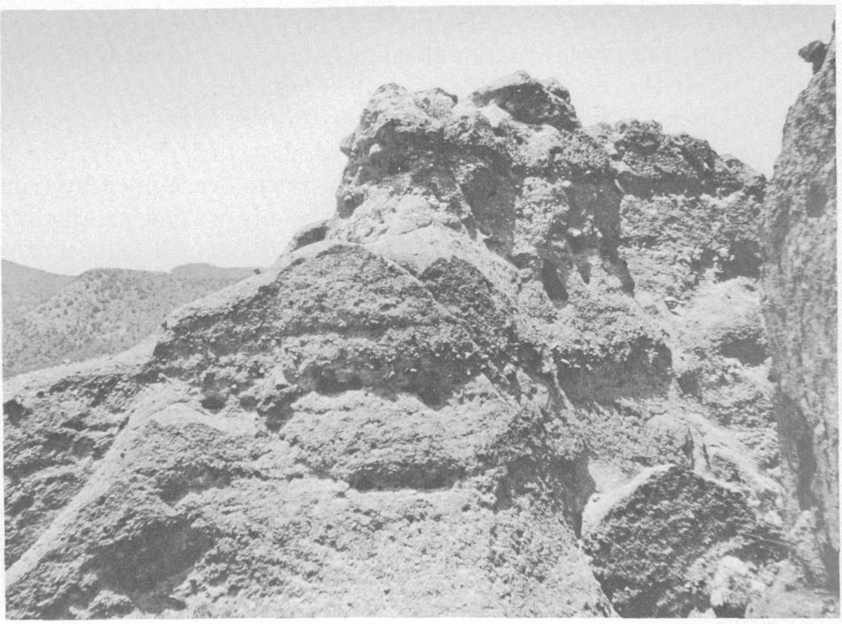

FIGURE 7.—Rhyolite ash-flow breccia on southwest flank of Red Mountain. Largest blocks are 1–2 feet in diameter.

in many respects—both contain small quartz and sanidine (moonstone) phenocrysts and lack appreciable biotite. The rhyolite of Red Mountain is found only south of Strayhorse Creek, and the rhyolite ash-flow sheet of the rhyolite tuff unit is cut off by east-west faults nearly 5 miles north of Strayhorse Creek. As discussed more fully in the section on correlations, the rhyolite ash-flow sheet of the rhyolite tuff unit may have a source different from that of the rhyolite of Red Mountain, although both probably represent the same general period of rhyolite volcanism.

Except for the rhyolite of Red Mountain, whose relationships to younger rocks can only be inferred, the rock units previously described are overlain in many places by the basaltic andesite unit. This unit consists of as much as 2,000 feet of basaltic andesite flows interlayered locally with thin gravel beds and a sheet of distinctive peralkaline rhyolite ash-flow tuff. Typical flows of basaltic andesite are black to dark gray, holocrystalline, a few tens of feet thick, and vesicular to amygdaloidal; they have oxidized flow breccia at the top or bottom or both. Many other flows are lighter gray and appear to be more dacitic or latitic than basaltic. The rocks in this unit commonly contain small altered mafic phenocrysts which give them a red spotted appearance, but they are not highly porphyritic. The upper flows appear to be more mafic, and small fresh yellow olivine crystals are visible in some of them.

The peralkaline ash-flow tuff ranges in thickness from 0 to several hundred feet. The most densely welded section is along lower KP Creek (fig. 8), where the ash-flow tuff is about 300 feet thick. It thins rapidly south and north of KP Creek and breaks up into separate cooling units and lenses of poorly welded pumiceous ash-flow tuff (fig. 9), which pinch out within the basaltic andesite unit or are overlapped by Gila Conglomerate. About 80 feet of partly to densely welded peralkaline rhyolite ash-flow tuff north of Raspberry Creek, about a mile northwest of Crooks Mesa, is the only occurrence of this rock observed west of the Blue fault zone (pl. 1).

East of the Blue River, opposite the mouth of Strayhorse Creek, the peralkaline tuff unit is several hundred feet thick and consists of bedded pumiceous pyroclastic rocks, water-laid volcanic breccia, and other volcanic sediments, and it includes only 10–20 feet of densely welded ash-flow tuff near the top. The thickness and heterogeneity of pyroclastic rocks in this area and the presence of some small dikes suggest that it might be the vent area for the peralkaline ash flows (fig. 10). No other evidence for a vent was found. Other exposures of the peralkaline tuff east of the Blue River are between upper Dutch Blue Creek and Hobo Canyon.

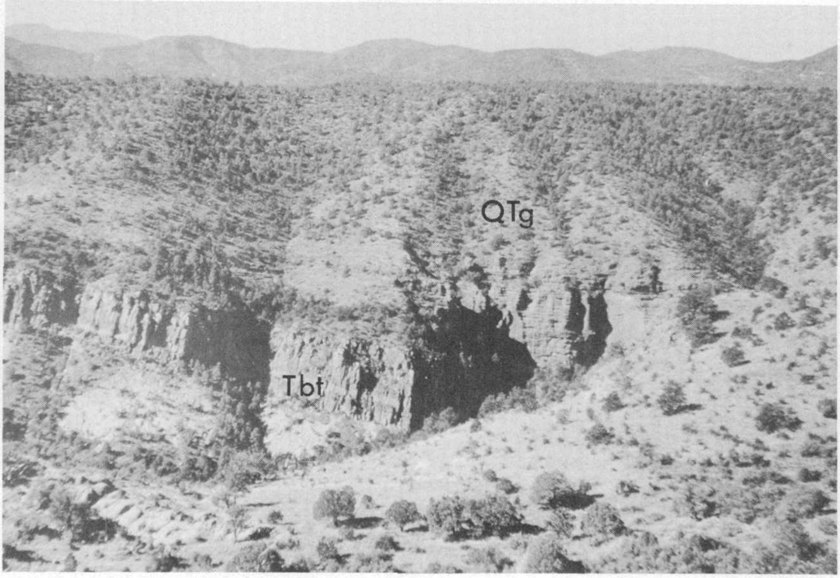

FIGURE 8.—Peralkaline rhyolite ash-flow tuff (Tbt) of basaltic andesite unit unconformably beneath more gently tilted beds of Gila Conglomerate (Qtg). View south across canyon of lower KP Creek.

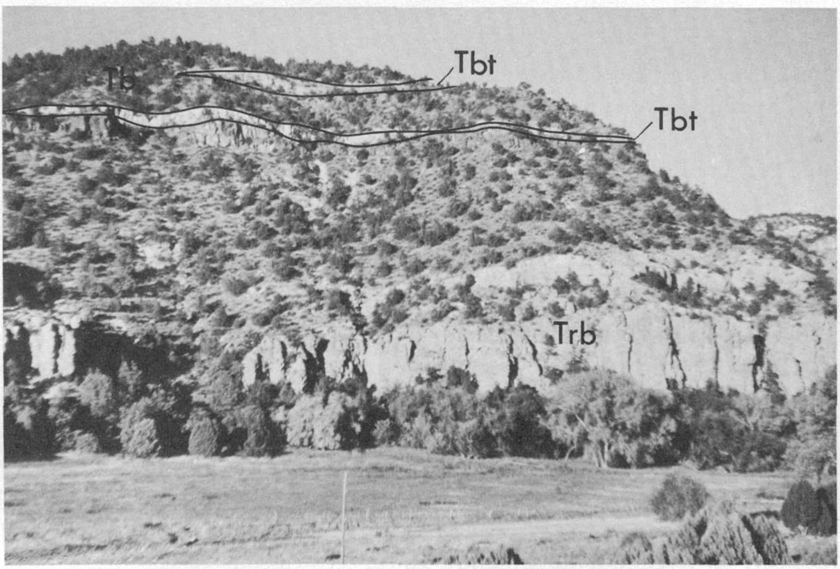

FIGURE 9.—Thin peralkaline tuff layers (Tbt) in lower part of basaltic andesite unit (Tb) at mouth of Fishhook Creek. Remainder of section is breccia member (Trb) of rhyolite tuff unit.

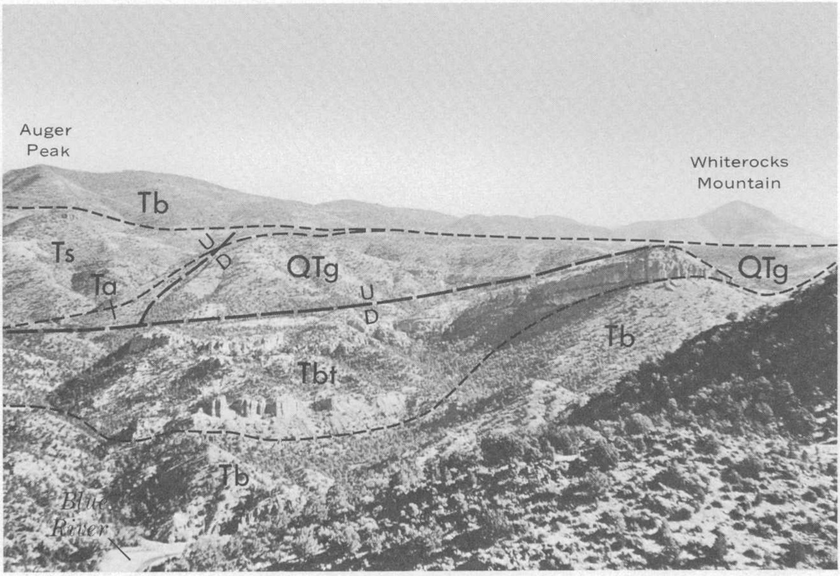

FIGURE 10.—Possible vent area of peralkaline rhyolite ash-flow tuff (Tbt) in basaltic andesite unit (Tb). View northeast from hill west of Blue River about 1 mile below mouth of Strayhorse Creek. Ts, epiclastic volcanic rocks; Qtg, Gila Conglomerate. Heavy lines are faults: U, upthrown side; D, downthrown side.

An extrusive-intrusive dome complex that consists largely of biotite- and hornblende-bearing quartz latite to rhyolite lavas several hundred feet thick occurs mainly near the south boundary of the study area (pl. 1). Smaller bodies of similar rock on the north side of Strayhorse Creek and outside the southwest corner of the primitive area are correlated with them. This unit is shown in the diagrammatic geologic section (fig. 5) as a lava dome in which an intrusive facies, represented mainly by rhyolite vitrophyre along lower Rousensock Creek and possibly by perlitic rocks between Maple and Horse Canyons, was injected into an earlier lava pile. Rhyolite and quartz latite porphyry dikes associated with the dome cut the complex and also the basal flows of the basaltic andesite unit along upper Strayhorse Creek; other contacts between rocks of the complex and adjacent lavas also appear to be intrusive, particularly around Alder Peak and the mountain 1½ miles east of Alder Peak. Some of the rocks mapped as pyroxene-hornblende andesite adjacent to the dome complex in this area may be part of the basaltic andesite. Elsewhere, as along lower Little Blue Creek and in Hobo Canyon, basaltic andesite overlies the dome complex. Thus, geologic relationships indicate that the quartz latite and rhyolite dome complex is younger than the earliest flows of the basaltic andesite in some areas, but is older than the earliest basaltic andesite flows in others.

The very shallow depths at which the intrusive vitrophyre along Rousensock Creek was emplaced is shown by a pumice breccia dike that can be traced from the level of the intrusive rocks into bedded pyroclastic deposits in a small saucer-shaped vent north of the creek.

GILA CONGLOMERATE

The Gila Conglomerate rests unconformably on the faulted and eroded older rocks (figs. 8, 11). It fills the lows in a mountainous topography and leaves islands of older rocks, such as the basaltic andesite in the southeastern part of the area (pl. 1). Consequently, its thickness is variable and subject to interpretation, but it is probably 1,100 feet or more along Little Blue Creek, south of Yam Canyon, and probably exceeds 800 feet under Foote Creek Mesa, west of the Blue River.

The unit consists mainly of buff to gray boulder conglomerate, which commonly is locally derived. Where the boulders are dominantly of basaltic andesite or rhyolite ash-flow tuff, the Gila Conglomerate is readily distinguished from the older, predominantly red, and more indurated conglomerate of the epiclastic volcanic rocks. However, where

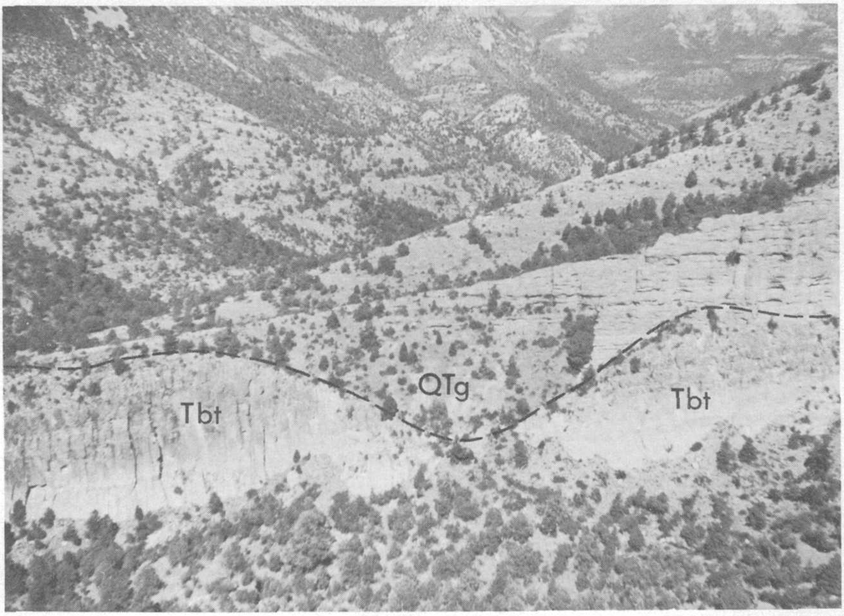

FIGURE 11.—Gila Conglomerate (Qtg) filling channel in peralkaline rhyolite ash-flow tuff (Tbt) on north side of canyon of lower KP Creek.

the Gila Conglomerate includes a more heterogeneous assemblage of rock types, it may be much more difficult to define a contact between the two conglomerates.

Basaltic flows are interlayered with the conglomerate, particularly from Alma Mesa to Cottonwood Creek in the eastern part of the study area, and in the strip of Gila Conglomerate south of the Red Hill Road, where the flows are accompanied by several basaltic dikes. Some basaltic flows and conglomerate that cap ridges in the highly faulted terrane north of Bear Mountain and east of the Blue River may actually be Gila Conglomerate rather than the basaltic andesite shown on plate 1. Quaternary lag gravels and (or) pediment deposits which form mantles tens of feet thick on many of the interfluves underlain by Gila Conglomerate are here included in the Gila.

SURFICIAL DEPOSITS

Surficial deposits shown on plate 1 consist of alluvium along the Blue River and Pueblo Creek and landslide deposits. The two largest landslides cover 5–10 square miles each in the Paradise Park area beneath the northwest rim and along the Blue River on the northwest flank of Bear Mountain. The sliding in both of these areas and in most of the smaller ones is largely the result of the erosion of soft ash-flow deposits from under thick accumulations of lava flows.

AGE AND CORRELATION OF MAP UNITS

The volcanic rocks in the Blue Range primitive area are part of a Tertiary volcanic field that covers about 20,000 square miles; the Arizona part of this field is know as the White Mountain volcanic area and the New Mexico part, as the Datil volcanic area (Cohee and others, 1961). The New Mexico part of the primitive area lies in the Reserve quadrangle, where the rhyolite tuff unit and epiclastic volcanic unit of this report were referred to the Datil Formation by Weber and Willard (1959b). The Datil Formation (Winchester, 1920, p. 9) as now shown on the geologic map of New Mexico (Dane and Bachman, 1965) is a widespread volcanic complex that has been described in the region adjacent to the primitive area by Stearns (1962, p. 7–22) and Elston (1968). The name Datil has not been used in this report because of the uncertainty of the relative ages of the volcanic rocks in the primitive area and the type Datil in the Bear Mountains, Socorro County, N. Mex., which has been bracketed in the Oligocene between about 29 and 38 m.y. (million years) (Burke and others, 1963; Weber and Bassett, 1963).

The following four samples of volcanic rocks in the primitive area were collected for potassium-argon age determinations in cooperation with Dr. Paul Damon, who directed the analytical work in the Geochronology Laboratories at the University of Arizona (Elston and others, 1968). Three of the samples analyzed have isotopic ages near the Oligocene-Miocene boundary and the fourth is late Eocene-early Oligocene. Descriptions, locations, and ages of the samples follow:

1. Hornblende from the oldest rock, the pyroxene-hornblende andesite unit along U.S. Route 666 in the southwest corner of the primitive area (BR-89B, pl. 1) has an age of 37.4±3.9 m.y. The calculated age has a high standard deviation caused by a high atmospheric-argon correction.
2. Sanidine from densely welded ash-flow tuff of the rhyolite tuff unit collected from low cliffs on the east side of the Blue River between Lamphier and S Canyons (BR-85, pl. 1) has an age of 24.9±0.7 m.y.
3. Biotite phenocrysts from intrusive (?) perlitic vitrophyre of the quartz latite and rhyolite complex along Rousensock Creek above the mouth of Squaw Creek (BR-109A, pl. 1) have an age of 23.4±0.7 m.y.
4. The whole-rock age of olivine basaltic andesite from a road cut at the junction of the Rose Peak lookout road with U.S. Route 666 (BR-89A, pl. 1) is 23.3±0.7 m.y. This rock, though practically holocrystalline, may contain a small amount of glass (<1 percent).

The isotopic ages of these four samples seem to be compatible with our knowledge of the geologic history of the area. They provide the only basis for estimating the length of time represented by the erosional unconformity at the top of the epiclastic volcanic unit. However, the assumption that these four dated samples are representative of the age of all of the rocks included in the map units shown on plate 1 probably is false. Other units, such as the platy andesite flows, which locally define the base of the basaltic andesite unit, probably bridge part of the gap between the youngest and oldest dated rocks.

DISTINGUISHING FEATURES AND CHEMISTRY OF THE VOLCANIC ROCKS

Many of the rocks in the various volcanic units are somewhat similar, but they can generally be distinguished by color and the kinds and abundance of phenocrysts. Most of the rocks in the pyroxene-hornblende andesite unit contain phenocrysts of both pyroxene and hornblende, although the phenocrysts may range widely in relative size and abundance. Rocks of the basaltic andesite unit are commonly darker than pyroxene-hornblende andesite, contain less hornblende, and commonly contain olivine. Rocks of the quartz latite and rhyolite complex are distinguished by light color and the presence of biotite or hornblende or both. Both the rhyolite of Red Mountain and the widespread rhyolite ash-flow sheet of the rhyolite tuff unit contain phenocrysts of quartz and alkali feldspar, the latter commonly of the variety which displays opalescent colors and is called moonstone. Both rock types lack appreciable biotite or other mafic minerals.

It has been suggested in an earlier part of this report that the rhyolite of Red Mountain and the rhyolite ash-flow sheet of the rhyolite tuff unit may have had separate sources. Evidence bearing on this question from the rocks themselves is inconclusive. In the field, the two units appear to contain the same phenocrysts and look virtually identical. However, thin sections of the rocks show that the rhyolite of Red Mountain commonly contains both alkali feldspar and small amounts of plagioclase. In several thin sections of the rhyolite ash-flow sheet, on the other hand, less than six plagioclase crystals and small chips were noted, and some of them were mantled by alkali feldspar as if they might have been foreign to the original magma.

By contrast with the other rhyolite ash-flow tuffs, the peralkaline rhyolite ash-flow tuff that is interlayered in the basaltic andesite unit is practically devoid of phenocrysts, and ash-flow tuff associated with the quartz latite and rhyolite complex is relatively rich in biotite but lacks quartz and alkali feldspar phenocrysts.

Plagioclase phenocrysts are common in many of the rock types, but are particularly abundant in some of the quartz latite and rhyolite flows along Rousensock and Squaw Creeks. Dacitic-andesitic flows, locally distinguished from or included in the basaltic andesite unit, are also plagioclase rich and contain more and generally larger phenocrysts than the flows interlayered in the pyroxene-hornblende andesite and the epiclastic unit.

Several samples of the rhyolite ash-flow sheet of the rhyolite tuff unit have a reverse remanent magnetic polarity, whereas peralkaline rhyolite ash-flow tuff along lower KP Creek and east of the mouth of Strayhorse Creek has normal polarity.

Basaltic flows in Gila Conglomerate in the northeastern part of the primitive area have distinctive glassy plagioclase phenocrysts not found in the basaltic andesite flows from Bear Mountain to Whiterocks Mountain or west of the Blue River. Similar flows, containing glassy plagioclase phenocrysts, that were mapped with the basaltic andesite unit between Bear Mountain and Saddle Mountain also may be in the Gila Conglomerate.

Flows at the base of the basaltic andesite unit near Raspberry Creek and west of the Blue River from HU Bar Ranch to north of Oak Creek are distinctive and were called platy andesite in the field because of their strong flow structure. These flows, which commonly are reddish brown, appear massive at first glance, but under closer observation iron-stained plagioclase phenocrysts 5–10 mm (millimeters) long may be seen. These flows are typical of neither the basaltic andesite unit, with which they were mapped, nor the underlying pyroxene-hornblende andesite.

Nine rapid-type chemical analyses showing the major-oxide composition of some of the volcanic rocks and the calculated theoretical mineral compositions or rock norms are shown in table 6. The trace-element composition of the volcanic rocks is shown in table 7. The analyzed rocks have been named by comparing the analyses and norms with average compositions of various rock types presented by Nockolds (1954). The alternative names shown in table 6 correspond to the nomenclature of Rittmann (1952).

The rhyolite of Red Mountain is not represented in the rapid-rock analyses in table 6, but comparison of the average trace-element contents of 16 samples of this rhyolite with 10 samples of the rhyolite ash-flow sheet of the rhyolite tuff unit (table 7) shows that the rhyolite of Red Mountain contains considerably greater amounts of Sn, Sr, Be, Nb, Zr, and Zn, and somewhat less V, Cr, Ba, and Mn than the rhyolite ash-flow sheet. These differences could be evidence of a different origin for the two rhyolite bodies, but may be accounted for partly by the concentration of relatively volatile elements in the Red Mountain vent area.

STRUCTURE

STRUCTURAL SETTING

The Blue Range primitive area lies near the southeastern edge of the Colorado Plateaus structural province where the boundary between that province and the Basin and Range province is obscured by Tertiary volcanic rocks in the White Mountains and Datil Volcanic areas, as shown on the "Tetonic Map of the United States" (Cohee and others 1961). At the north edge of the volcanic areas, nearly horizontal Mesozoic sedimentary rocks pass beneath the volcanic rocks; at the south edge, the volcanic rocks form a mountainous region bordered by somewhat tilted Paleozoic and Mesozoic sedimentary rocks. The region south of the volcanic areas in southeastern Arizona and southwestern New Mexico is characterized by northwest-trending mountain ranges, intervening basins, and associated faults.

Numerous faults in and near the primitive area are shown in figure 12, some of which were mapped during aerial reconnaissance at the time of the aeromagnetic survey. A belt of northeast-trending faults define a graben zone 15–30 miles wide, which crosses the regional northwesterly structural trend (pl. 1). The faults along the front of

TABLE 6.—*Chemical analyses, normative minerals, and classification of volcanic rocks, Blue Range primitive area*

[Analysts: P. L. D. Elmore, L. A. Artis, H. Smith, J. L. Glenn, G. W. Chloe, J. Kelsey, S. D. Botts, J. W. Budinsky, P. J. Aruscavage. Method used was a single solution procedure described by Shapiro (1967, p. 187-191). Sample localities shown on plate 1]

Field No.	BR-96A	BR-19A	BR-89A	BR-92	BR-109B	BR-109A	BR-85	BR-1	BR-2
Sample No.	1	2	3	4	5	6	7	8	9
Chemical analyses, recalculated waterfree									
SiO_2	48.4	53.6	55.3	74.5	62.6	71.5	75.5	58.7	58.2
Al_2O_3	18.1	17.3	16.6	12.0	16.5	15.0	12.8	17.4	17.6
Fe_2O_3	3.2	5.1	3.1	2.8	6.1	1.5	1.2	5.6	6.3
FeO	7.6	4.1	5.2	.52	.45	.63	.12	.62	.12
MgO	5.7	5.1	4.6	.22	.86	.88	.42	3.6	2.7
CaO	9.7	6.2	6.7	.34	3.2	1.6	.76	6.2	6.2
Na_2O	3.4	3.7	3.6	4.7	4.0	3.9	3.4	4.4	4.5
K_2O	1.1	2.3	2.3	4.5	4.4	4.3	5.4	2.1	2.9
TiO_2	2.0	1.6	1.4	.16	1.2	.40	.19	.92	.91
P_2O_5	.50	.82	.81	.02	.56	.21	.02	.35	.36
MnO	.18	.12	.14	.09	.07	.15	.12	.08	.14
CO_2	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05
Cl	.036	.01	.011	.009	.004	.020	.002	.02	.00
F	.052	.08	.082	.095	.013	.037	.042	.05	.04
Water content, reported in original analysis									
H_2O^-	0.16	1.0	0.29	0.20	0.77	0.79	0.37	1.6	1.1
H_2O^+	.40	1.5	.65	.42	.83	3.4	.49	1.4	.90
Powdered density	2.85	2.79	2.80	2.55	2.75	2.45	2.65	2.68	2.68
Bulk density	2.78	2.74	2.62	1.97	2.55	2.38	2.24	2.64	2.28
Norms									
Quartz		4.9	5.4	30.1	16.6	28.7	32.6	8.9	6.8
Corundum					1.0	1.8			
Orthoclase	6.5	13.3	13.7	26.7	25.8	25.3	32.2	12.2	16.9
Albite	28.6	31.1	30.6	36.3	33.6	32.6	29.0	37.4	38.1
Anorthite	30.9	24.1	22.3		11.4	6.2	3.3	21.4	19.3
Halite	.1								
Acmite				3.1					
Diopside	11.1	.8	4.3	.7				5.0	5.5
Hypersthene	1.8	13.2	14.4	.2	2.2	2.2	1.1	6.7	4.1
Olivine	11.2								
Magnetite	4.7	7.4	4.5	1.5		1.3	.3		
Hematite				.7	6.1	.5	1.1	5.6	6.3
Ilmenite	3.8	3.1	2.7	.3	1.1	.8	.4	1.5	.6
Titanite								.3	1.5
Rutile					.6				
Apatite	1.2	1.9	1.9		1.3	.5		.8	.8
Fluorite				.2	.2				

Sample No.	*Classification*	*Description*
1	Alkali andesite or olivine andesite.	Basaltic flow in Gila Conglomerate. Diabsaic texture, modal andesine-labradorite, olivine, and clinopyroxene. Alma Mesa area.
2, 3	Doreite or trachy-andesite.	Basaltic andesite flow. Microlitic texture, tiny olivine phenocrysts. Upper Raspberry Creek. Sample 3 from Rose Peak area.
4	Peralkaline rhyolite	Welded peralkaline rhyolite ash-flow tuff. In basaltic andesite unit. Porous eutaxitic pumice fragments have spherulitic texture in thin section. No phenocrysts. East of Blue River below mouth of Stray-horse Creek.
5	Dellenite or quartz latite.	Platy andesite in basaltic-andesite unit. Glomeroporphyritic plagioclase (andesine-labradorite) in pilotaxitic matrix. North of HU Bar Ranch.
6	Rhyolite	Biotite quartz latite-rhyolite vitrophyre, having 20–25 percent oligoclase and biotite phenocrysts. Rousensock Creek above mouth of Squaw Creek.
7	Alkali rhyolite	Rhyolite ash-flow tuff; 5–10 percent quartz and alkali feldspar (moonstone) phenocrysts; trace of biotite. East side of Blue River at Old Blue Ranger Station.
8, 9	Doreite or trachy-andesite.	Hornblende-pyroxene andesite. Basaltic hornblende phenocrysts predominate over clinopyroxene phenocrysts. East side of Blue River above mouth of Little Blue Creek. Sample 9 from west side of Blue River opposite mouth of Little Blue Creek.

TABLE 7.—*Average values and range of some major and trace elements in unaltered volcanic rocks, as determined by semiquantitative sp ectro graphic analyses, Blue Range primitive area*

[>, greater than value shown; N, looked for but not detected; L, detected but below sensitivity limit. Data from table 2]

	Percent				Parts per million																			
	Mg	Fe	Ca	Ti	V	Mo	Sn	Ni	Cr	Ba	Sr	B	Pb	Mn	Be	Nb	Y	Cu	Zr	La	Zn	Sc	Co	Hg
Rhyolite of Red Mountain (16 samples):																								
Avg	0.21	3	0.3	0.1	13	3	19	2	2	132	50	14	58	300	5	48	100	10	800	40	250	4	N	0.06
Max	1.5	5	1.5	.3	70	15	30	15	30	1,000	700	50	100	500	7	100	150	20	>1,000	100	700	10	5	.13
Min	L	2	L	.03	N	N	N	N	N	N	N	L	15	200	1	15	10	3	100	N	N	N	N	L
Rhyolite ash-flow sheet (10 samples):																								
Avg	.6	1.8	.2	.2	33	2.8	N	1.4	3.9	213	N	17	50	715	2.5	27	71	9	235	49	N	5.6	1.4	.06
Max	3	3	.3	.3	70	7	L	7	20	1,000	L	30	70	1,500	3	30	100	15	500	100	L	15	7	.16
Min	.1	.5	.07	.1	10	N	N	L	N	70	N	10	15	150	1	15	20	L	100	N	N	L	N	L
Latite-rhyolite (20 samples):																								
Avg	1.4	4.2	2.1	.5	57	L	N	22	26	1,200	500	8	37	500	.5	12	26	22	210	33	N	10	5	.05
Max	3	10	3	1	100	5	N	150	200	2,000	1,000	30	70	700	2	30	70	70	500	70	N	20	20	.15
Min	L	.5	.3	.15	10	N	N	L	N	500	N	L	15	150	N	L	10	2	100	20	N	N	N	L
Pyroxene-hornblende andesite (21 samples):																								
Avg	4	9	4	1	113	N	N	95	175	1,400	800	2	27	614	N	5	27	64	184	25	N	17	17	.04
Max	7	15	7	>1	200	5	N	200	700	3,000	1,500	10	70	1,000	2	20	70	100	200	70	N	30	30	.18
Min	.07	.2	1.5	.07	15	N	N	2	L	30	N	N	N	200	N	N	L	L	5	N	N	N	N	L
Basaltic andesite (22 samples):																								
Avg	4	9	4.1	1+	150	N	N	130	325	1,100	700	7	19	750	N	10	31	68	186	34	N	28	21	.03
Max	7	15	7	>1	500	N	N	300	1,500	1,500	1,000	30	50	1,500	1.5	30	70	150	300	70	L	30	70	.18
Min	1.5	5	1.5	.5	10	N	N	10	7	700	300	L	L	300	N	N	20	15	150	L	N	15	5	L

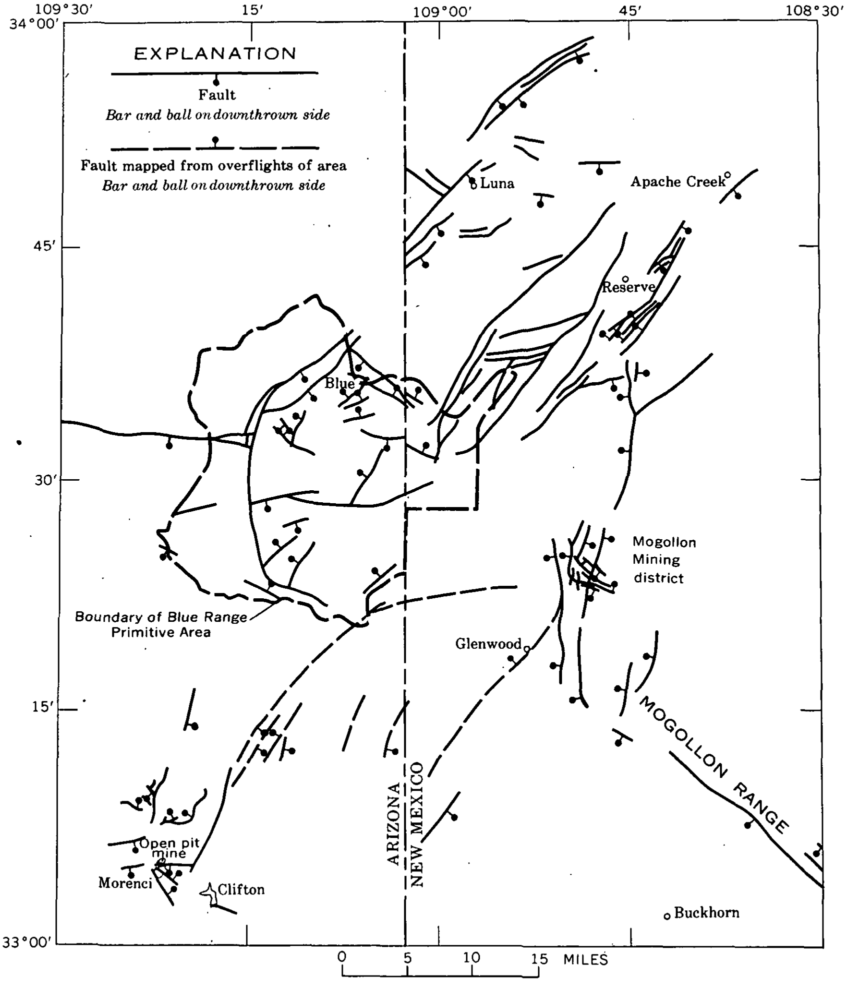

FIGURE 12.—Tectonic map of the Blue Range primitive area and vicinity, Arizona-New Mexico. Sources of data: Weber and Willard (1959a, b), Elston (1960), Wilson, Moore, and other (1958), and Lindgren (1905b).

the Mogollon Range north of Buckhorn (fig. 12), however, are part of a strong set of northwest-trending faults, which includes the Mimbres fault north of Silver City and northwest-trending faults southwest of Buckhorn, that are beyond the area of figure 14.

STRUCTURE IN THE PRIMITIVE AREA

The structural character of the rocks within the Blue Range study area is determined largely by faulting. This is particularly so in the north half of the area, where the quartz and moonstone-bearing rhyolite ash-flow tuff and the peralkaline rhyolite tuff layers are useful in locating faults and estimating their displacements. In the south half of the area, good marker beds are largely absent, and many more faults may be present than are shown on plate 1, but here the structure also reflects original volcanic forms such as the andesitic composite volcano, in which initial dips of 15°–25° and more are preserved, probably little modified by tectonic tilting. The Red Mountain caldera and the intrusive and extrusive forms of the quartz latite and rhyolite complex are other structural features of the south part of the area.

VOLCANIC STRUCTURE

In the north half of the area, a gentle westward dip prevails over large areas both west (fig. 13) and east of the Blue River, but locally, attitudes are varied and related almost entirely to tilting of large and small faulted blocks.

Contacts between the volcanic formations are generally unconformable as is commonly the rule in a volcanic terrane, but notable erosional breaks were observed only beneath the rhyolite tuff unit and the Gila conglomerate. The unconformity beneath the rhyolite tuff unit in the north half of the primitive area presumably carries through between the basaltic andesite and underlying pyroxene-hornblende andesite in

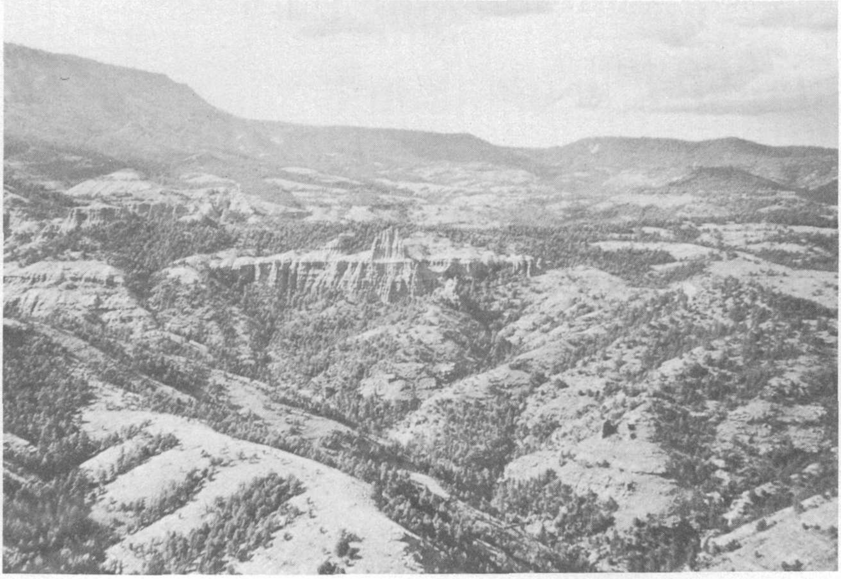

FIGURE 13.—Gently dipping beds of epiclastic volcanic rocks in northwest part of primitive area. View northwestward into head of Fishhook Creek near Devils Washboard (pl. 1).

the south half of the area, where the time break, based on isotopic-age data, is approximately 14 m. y.

The pyroxene-hornblende andesite pile is interpreted as a composite volcano because of the heterogeneity of the volcanic materials, local steep dips that appear unrelated to faulting, and gradational relations with flanking sedimentary deposits of the epiclastic unit. The volcanic material includes lava flows, much flow breccia, some pyroclastic breccia, and numerous dikes of diverse trends.

Adjacent to the andesite north of Strayhorse Creek, the epiclastic unit contains blocks of porphyritic andesite as much as 6 feet in diameter in lahars or mud-flow-type breccias. A few miles south of the primitive area, the andesite unit is overlapped by and (or) faulted against younger rocks, so that its full distribution is unknown. However, an eruptive center or centers was probably within or close to the southwestern part of the primitive area.

The rhyolitic rocks that form Red Mountain fill a subcircular depression, 2–3 miles across, in the older andesites. This depression is interpreted to be a caldera. The contact between the rhyolite and the enclosing andesite dips toward the center of Red Mountain from all sides and shows local relief of at least 700 feet on the caldera walls. However, on the southwest flank of Red Mountain the fact that the ash-flow tuffs dip 10°–15° S. off the mountain (fig. 14) indicates either initial dips within the caldera walls or later tilting.

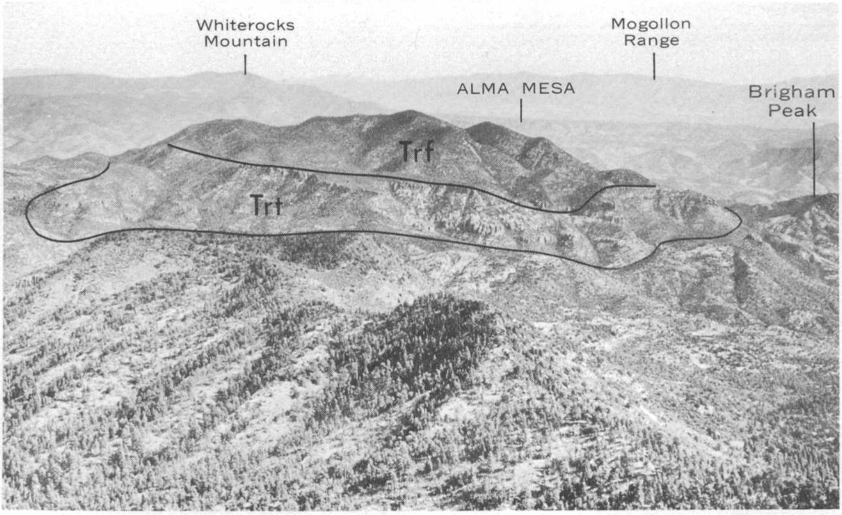

FIGURE 14.—Ash-flow tuffs (Trt) and lava flows and intrusive rhyolite (Trf) in Red Mountain caldera. View eastward from Rose Peak. Pyroxene-hornblende andesite and basaltic andesite in foreground.

The main source of rhyolite was almost certainly in the caldera, to which the ash flows are restricted and where the main mass of rhyolite flows and intrusive rhyolite occurs. The abundance of angular rhyolite blocks in the ash-flow tuffs also is interpreted as indicating proximity of the rocks to their source. The rhyolite that makes up the angular blocks must represent an earlier deposit, probably in part a plug that was shattered by the eruptions that deposited the ash flows now exposed on Red Mountain. Outside the caldera, rhyolite lava filled and overflowed a small vent on the northeast flank of Red Mountain, and the two rhyolite bodies along Oak Creek may be partly intrusive.

The quartz latite and rhyolite complex includes a series of lava domes near the south boundary of the primitive area and a small dome along upper Strayhorse Creek (pl. 1). The domes near the south boundary are grouped around three general centers of eruption: (1) east of the Blue River from Horse Canyon to Little Blue Creek, (2) Rousensock-Squaw Creeks area, and (3) outside the southwest corner of the primitive area. Although the domes consist largely of lava flows, they contain intrusive rocks and some pyroclastic layers. The intrusive rocks comprise: (1) quartz latite and rhyolite dikes that cut hornblende-pyroxene andesite, the lower part of the basaltic andesite unit, and older flows of the dome complex, (2) larger bodies that appear to form intrusive cores in the dome lavas, and (3) bodies that have the form of sills or laccoliths. The extrusive or intrusive form of the rocks is not apparent in many places. Rocks that are texturally similar to lava flows commonly appear to have intrusive contacts.

Rhyolite vitrophyre exposed in the canyon of Rousensock Creek above the mouth of Squaw Creek exemplifies the intrusive core of a dome. Perlitic and lithoidal layers outline flowage folds and show steep and erratic dips within the vitrophyre. The depth of the vitrophyre beneath the surface at the time of intrusion was about 700 feet as shown by a small pyroclastic vent that is part of the complex on the north side of Rousensock Creek, about three-fourths of a mile west of the mouth of Thomas Creek.

FAULTS

Faults in the study area have three dominant trends—northeast, northwest, and approximately west. Some faults, including a significant segment of the Blue fault zone (pl. 1), have a more northerly strike, but this seems to be a subsidiary trend. The faults are steep normal faults that have displacements ranging from a few tens of feet to greater than 1,000 feet. Much of the fault movement preceded deposition of the Gila Conglomerate. The Gila is displaced by many of the faults, but its displacement by some of the major faults appears to be considerably less than the displacement of older units by the

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same faults. In many places it is unclear whether the Gila Conglomerate is faulted or whether it merely covers the traces of older faults.

Northeast-trending faults are the most numerous in the study area. Included in this trend are faults of large displacements in the Blue fault zone and others along the Brushy Mountains and east of Whiterocks Mountain. Large displacements have also occurred along west-trending faults such as the Strayhorse fault and the fault south of Bear Mountain and north of Alma Mesa. Most of the faults of large displacement are elements of regional fault systems, but many of the smaller faults probably originated as a result of volcanic activity.

Blue Fault Zone

The Blue fault zone in the north part of the study area is 1–2 miles wide and consists of several northeast-trending strands. Many small faults in the zone are not shown on plate 1. The rhyolite ash-flow sheet of the rhyolite tuff unit is dropped to the east along the zone in two main steps. The first step displaces the ash-flow tuff about 1,800 feet, and the second step, involving several faults, drops the tuff an additional 400–500 feet down to the level of the Blue River. The aggregate displacement of the ash-flow tuff across the Blue fault zone at the north edge of the primitive area is at least 2,200 feet. Southwest of KP Creek, the Blue fault zone bends to a nearly north-south trace, and from KP Creek to Raspberry Creek the displacement across the fault is probably at least 1,200 feet. South of Raspberry Creek the zone is shown as a single fault on plate 1, and south of Tornado Creek the position of the fault is largely inferred. Near the south boundary of the primitive area, its identity is lost in the quartz latite and rhyolite complex. The arcuate trend of the Blue fault trace in this area would likely be modified by more detailed mapping southeast of Red Mountain and south of the primitive area, but if the correlation of basaltic andesite along the Blue River with the rim-forming basaltic andesite in the Rose Peak area is correct, the Blue fault must continue approximately as mapped.

The nearly east-west Strayhorse fault continues west from the study area for at least 15 miles to the Black River (Wilson, Moore, and others, 1958). Our mapping indicates that east of Strayhorse (pl. 1) this fault splits into two faults that continue east to the Blue fault zone. The basal contact of the basaltic andesite is dropped to the south about 1,200 feet across the southern split of the fault. Several east-west faults east of the Blue fault zone could be continuations of the split Strayhorse faults.

An east-west fault that has a displacement comparable to the Strayhorse fault crosses the Blue River north of the mouth of Strayhorse

Creek, but if this is a continuation of the Strayhorse fault the Blue fault zone has displaced it several miles in a right lateral direction. No other evidence exists for such displacement. The fault has been mapped from Alma Mesa to the Blue fault. On the south side of Bear Mountain, basaltic andesite has been dropped along the fault down to the Blue River, a displacement of 1,000–2,000 feet. Northwest of Red Mountain, an east-northeast-trending fault could be the same fault. However, the position of the contact between basaltic andesite and pyroxene andesite in this area is so uncertain that even the direction of displacement across the fault is in doubt.

AEROMAGNETIC INTERPRETATION

By GORDON P. EATON, U.S. Geological Survey

In March 1968 the U.S. Geological Survey flew an aerial magnetic survey of the region between lat 33°15′ and 33°42.3′ N. and long 108°57′ and 109°24.5′ W., which includes the Blue Range primitive area, Arizona and New Mexico. The survey was flown at a barometric elevation of 10,500 feet and a flightline spacing of 1 mile. The magnetic data were compiled at a scale of 1: 62,500 and a contour interval of 20 gammas (pl. 1). Correlations between the magnetic data and the bedrock geology are described briefly below. No laboratory measurements or rock magnetic properties were made.

The magnetic map (pl. 1) can be divided into three areas on the basis of different magnetic patterns. The most conspicuous of the three areas is the northwestern third of the map, where anomalies of high amplitude and short wavelength occur. This area is underlain by flows and flow breccias of basaltic andesite, and the east edge of these rocks coincides approximately with the east edge of the area of conspicuous anomalies, the south edge of which is marked by the Strayhorse fault. The anomalies are typical of those associated with nearly flat lying intermediate and mafic volcanic rocks elsewhere in the western United States.

Although flat-lying basaltic andesite continues south of the Strayhorse fault, the magnetic properties of these rocks appear to be different from those to the north, except for a small area near Rose Peak. In general, basaltic andesites at elevations below 7,500 feet are typified by much gentler magnetic relief and fewer local anomalies. This is due in part to their lying farther below the flight datum, but elevation alone is not sufficient to account for the difference, as may be seen from the magnetic field in the area around Bear Mountain. Basaltic andesite occurs there between 6,800 and 8,400 feet elevation, but magnetic variations are slight and their configuration is dissimilar to those north of the Strayhorse fault. These differences may reflect a lower magnetic susceptibility for the basaltic andesite in the lower part of the stratigraphic section, or they may be a function of the total stratigraphic thickness of these rocks.

The central part of the aeromagnetic map is characterized by a broad, irregular, troughlike, magnetic low that trends westerly across the study area from Alma Mesa to a point 3 miles west of Brigham Peak. The trough crosses outcrops of most of the rock types exposed in the study area, but for the most part it is underlain by pyroxene-hornblende andesite and Gila Conglomerate. Along the Blue River the magnetic intensity is slightly higher over basaltic andesite than it is over adjacent Gila Conglomerate. On the west, the trough appears to end at the outcrop edge of the basaltic andesites of the Rose Peak area, which suggests that the trough is an expression of the relative field strengths associated with the exposed rocks, rather than a reflection of variations in rocks at depth.

Superimposed on this trough are several anomalies of local extent: a magnetic high 2 miles south of Brigham Peak, a broad magnetic low 5.5 miles east-southeast of Brigham Peak, and a more pronounced low, having moderately steep flanks, in the Alma Mesa area. The Alma Mesa low is in an area where the Gila Conglomerate, with some interlayered basalt, is probably at least 1,000 feet thick on the south side of major east- to northeast-trending faults (pl. 1). The rocks beneath the Gila Conglomerate probably include rhyolite tuff and volcaniclastic rocks and possibly basaltic andesite. Although the magnetic low could be due to an abrupt local thickening of Gila Conglomerate, the general configuration of the low suggests that there may be a major change in magnetic properties of the volcanic rocks beneath the conglomerate. Additional geophysical data are required for a more specific interpretation of this anomaly.

Two miles south of Brigham Peak a magnetic high with an amplitude of at least 80 gammas is centered over the axis of the magnetic trough. The area within the 600-gamma contour of this anomaly is underlain by pyroxene-hornblende andesite, which contains several small areas of altered rocks, and the foot of the eastern flank of the anomaly is likewise in an area of altered rock. The altered rocks appear to be andesite but may include quartz latite and rhyolite of the adjacent dome complex (pl. 1). The general configuration of the magnetic anomaly suggests the occurrence, at shallow depth, of a steep-walled body, equidimensional in ground plan. Such a body might represent a conduit from which the andesite was derived or a blind intrusive body of the quartz latite and rhyolite. The attitude of pyroxene-hornblende andesite layers in this area is notably steeper than in most areas, and quartz latitic and andesitic dikes are common within the area of the anomaly.

This anomaly could have economic significance. The igneous rocks with which many metallic ore deposits are associated in the western United States are reflected in magnetic highs bordered by magnetic lows. The highs reflect fresh intrusive rock, and the lows reflect chemically altered rocks in which ferromagnetic minerals have been destroyed, thereby providing a susceptibility contrast with the adjacent unaltered rock.

A magnetic low of 20–30 gammas is centered over Rousensock Creek about 5 miles east of the 80-gamma high (pl. 1). The low is over an area of quartz latite and rhyolite surrounded by pyroxene-hornblende andesite. Within this area, rhyolite vitrophyre in the canyon of Rousensock Creek is believed to be the intrusive core of a quartz latite and rhyolite dome, and a small pyroclastic vent is present on the north side of Rousensock Creek, west of Thomas Creek. The quartz latite within this low is locally frothy and slightly argillized, and some intensely altered rock is exposed near the west end of this magnetic low.

A positive anomaly in the form of a southwest-plunging nose occurs over the Red Mountain caldera. If the northeast-trending gradient on the side of the magnetic trough in this area were removed, a residual anomaly would remain over the Red Mountain caldera similar to the positive anomaly south of Brigham Peak.

The area north of Alma Mesa and east of Paradise Park displays less magnetic relief than the other two divisions, and it contains no anomalies pertinent to this study.

MINERAL RESOURCES

In this report the term "resources" applies to materials in the ground that are known to be minable now and materials that are likely to become minable in the future. Based on the types of rocks present and the mineral commodities mined in adjacent areas, mineral resources to be looked for in the Blue Range primitive area include: (1) Metallic resources such as gold, silver, and copper, which are mined in the Mogollon district of New Mexico 15 miles east of the primitive area and in the Clifton-Morenci district 20 miles to the south. Molybdenum, lead, zinc, tin, and beryllium also might occur in this geologic setting. (2) Nonmetallic resources such as alunite, clay, fluorite, pumice, perlite, and zeolite. (3) Oil, gas, and coal in pre-Tertiary rocks beneath the volcanic rocks. (4) Geothermal energy. No resources of these or any other mineral commodities were known within the Blue Range primitive area when this investigation began, nor were any discovered during the present investigation. However, a strip along the south part of the primitive area has a greater potential for metallic mineral deposits than do other parts of the area.

METHODS OF INVESTIGATION

The mineral-resource potential of the Blue Range primitive area was investigated by compiling existing geologic data, by mapping geology to determine major structural and lithologic features, and by geochemical sampling and analysis of stream sediments, panned concentrates, and unaltered, altered, and mineralized rocks. About 75 percent of the geochemical samples are of stream sediments from throughout the area and of panned concentrates from the Blue River and the mouths of major tributaries. Most of the samples were analyzed by semiquantitative spectrography for 30 metallic elements and chemically, for mercury, arsenic, and gold (tables 2–5).

The aeromagnetic survey of the study area supplemented the ground studies.

METALLIC MINERAL RESOURCES

Disseminated copper-molybdenum deposits in igneous rocks or combined precious-metal–base-metal veins are the most likely types of metallic mineral deposits to be found in the Blue Range primitive area. Disseminated copper-molybdenum deposits might be of either Late Cretaceous to early Tertiary age like the major disseminated copper deposit and associated veins of the Morenci-Clifton district, 20 miles south of the primitive area, or middle to late Tertiary age and related to the altered rocks in the south part of the primitive area.

Upper Cretaceous to lower Tertiary deposits would be very difficult to find and could underlie the primitive area at depth in one place as well as another. However, the south part of the area is considered more favorable because of its relative proximity to known deposits in the Clifton-Morenci district. The deposits there are in a mineralized monzonite porphyry pluton that has been dated as 55 m.y. old; it is buried beneath a younger volcanic sequence that contains rocks as old as 33 m.y. (Livingston and others, 1968) and that is similar to the volcanic sequence in the primitive area. The monzonite porphyry extends northeast from Morenci 5–10 miles (Lindgren, 1905a) within the belt of northeast-trending faults shown in figure 12. Thus, other plutons of Late Cretaceous to Tertiary age may underlie the middle to upper Tertiary volcanic sequence in the Blue Range primitive area. Extrapolation from the geology of the Clifton quadrangle (Lindgren, 1905a) and the geology of Graham and Greenlee Counties (Wilson, Moore, and others, 1958) indicates that the bottom of the younger volcanic sequence may be less than 3,000 feet below the level of the Blue River at the south edge of the primitive area.

Disseminated copper-molybdenum deposits in middle to upper Tertiary rocks are not known in this region, but they do occur in northern New Mexico and Colorado. For example, at Questa, N. Mex., a disseminated molybdenum deposit has been dated as 22–23 m.y. old (Damon, 1968, p. 53). Vein and contact-metamorphic deposits of middle to late Tertiary age occur in areas somewhat closer to the primitive area, as in the Mogollon district and at Magdalena, N. Mex. (Elston and others, 1968, p. A–IV–14).

As a result of initial field studies the search for metallic mineral resources was concentrated in two large and several smaller areas of hydrothermally altered volcanic rock (pl. 1). One of the larger areas is on Red Mountain and along upper Oak Creek; the other is near the Blue River between Hobo and Maple Canyons. The smaller areas of intense alteration are scattered between Squaw and Rousensock Creeks, mainly west of the trail between the two creeks.

The altered rocks in the Red Mountain-Oak Creek area are mainly rhyolite flows, intrusive rhyolite, and, less commonly, ash-flow tuffs. The alteration is almost certainly related to late vent activity in the rhyolite source area on Red Mountain. Fumarolic activity at the base of rhyolite lava flows probably accounts for the alteration of the rhyolite and underlying andesitic rocks in some areas, such as on the small hilltop south of Strayhorse Creek (pl. 1) and possibly along Oak Creek, although some of the rhyolite here may be intrusive.

In general, the alteration seems to be of the argillic type. Where the alteration is most intense, the original volcanic rocks are changed mostly to clay minerals and silica. Fine-grained pyrite is disseminated in some of the more silicified rocks which occur largely as ribs or pipes along fractures that probably served as channelways for the altering solutions. The localized occurrence and pipelike or craterlike form of several of the smaller areas of altered rocks indicate that the alteration took place in a shallow fumarolic type of volcanic environment.

The most intensely altered rocks in the Red Mountain area are along fractures near the top of Red Mountain, in the small rhyolite vent on the northeast spur of Red Mountain, and in the larger rhyolite body along Oak Creek. The intensely altered rocks are silicified and (or) argillized, but the more widespread alteration is a red hematitic staining. Pyrite was not observed in this area, but alunite was identified in altered rock on the north side of Oak Creek. Fine-grained fluorite occurs locally in openings in some of the flow-banded rhyolite near the top of Red Mountain and in breccia fragments in welded ash-flow tuff. Altered rocks in the Red Mountain-Oak Creek area commonly contain anomalous amounts of beryllium, molybdenum, lead, tin, and zinc (figs. 15, 16, 17) when compared to published estimates of the distribution of these elements in granitic rocks of the earth's crust (Turekian and Wedepohl, 1961, table 2; Shawe and Bernold, 1966). However, by the same comparisons, relatively unaltered samples of the rhyolite of

Red Mountain (table 7) also contain anomalous values of most of these elements. Although somewhat higher values occur in the altered rocks, the anomalies are low level and of the same order of magnitude as in the unaltered rock. The anomalous amounts of these elements are far below ore grade. Neither alunite nor fluorite is present in economically recoverable quantities.

These rhyolites are within the Arizona-New Mexico beryllium belt described by Shawe (1966), where silicic igneous rocks having unusually high beryllium and fluorine contents are common, and where exploration may lead to the discovery of nonpegmatitic beryllium deposits similar to those at Spor Mountain, Utah, according to Shawe

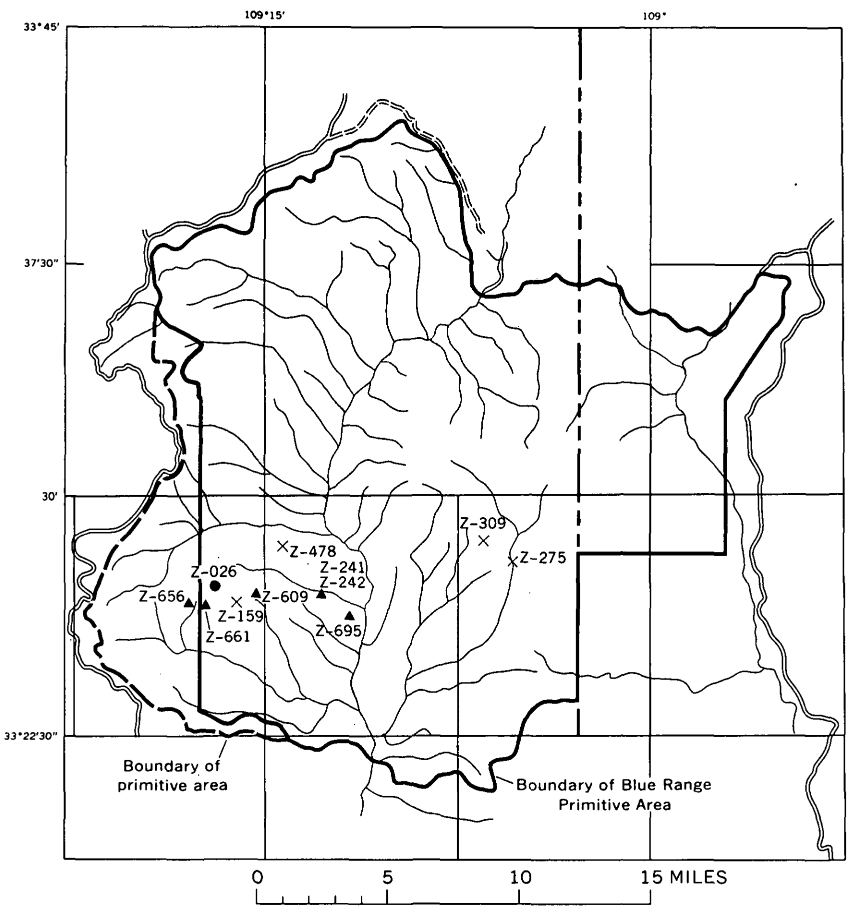

FIGURE 15.—Map of Blue Range primitive area showing localities of rock samples containing 7–15 ppm (parts per million) beryllium and (or) 20 ppm or more tin. ×, 7–15 ppm Be; ●, 20 ppm or more Sn; ▲, 7–15 ppm Be and 20 ppm or more Sn.

(1966, p. C206). However, the Spor Mountain deposits occur in a thick sedimentary formation that consists of reworked rhyolitic rocks containing numerous carbonate pebbles; the permeability of the formation and its high calcium-carbonate content are cited by Shawe as factors possibly controlling the deposition of beryllium minerals. No analogous geologic situation was found in the Blue Range primitive area, where anomalous beryllium concentrations are restricted to trace amounts in rhyolite.

The altered rocks between Hobo and Horse Canyons and those in several smaller areas of intensely altered rocks north of Squaw Creek and beyond the southwest corner of the study area are all believed to be genetically related to the quartz latite and rhyolite dome complex.

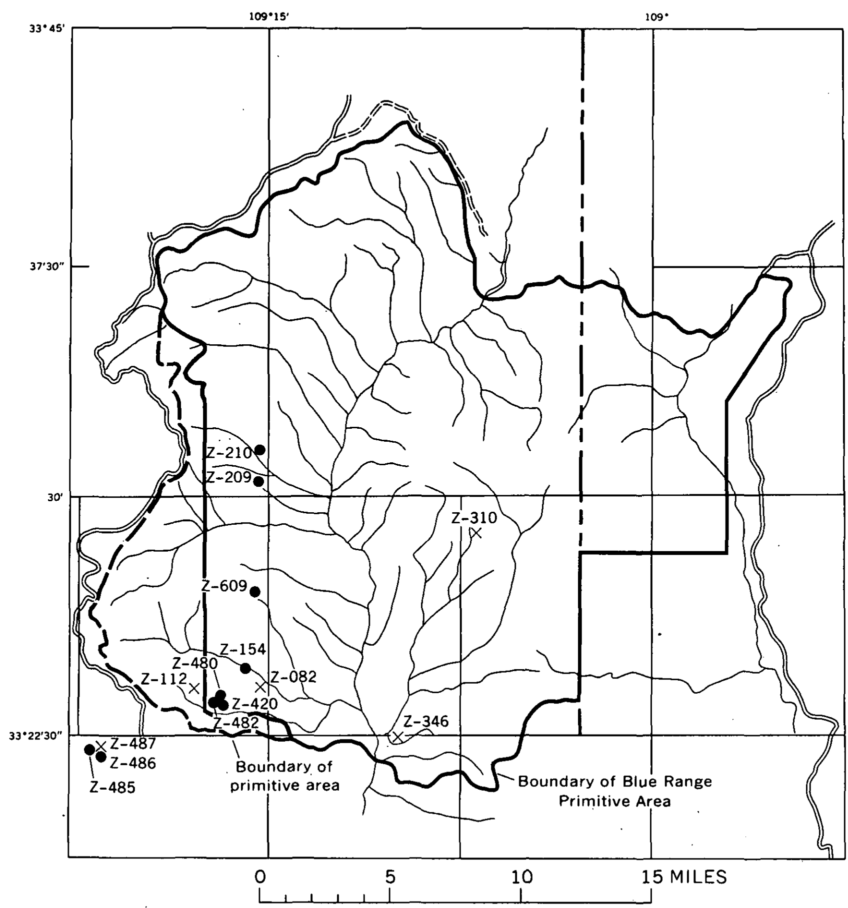

FIGURE 16.—Map of Blue Range primitive area showing localities of rock samples containing 7 ppm or more molybdenum. ×, 7 ppm Mo; ●, 10 ppm or more Mo.

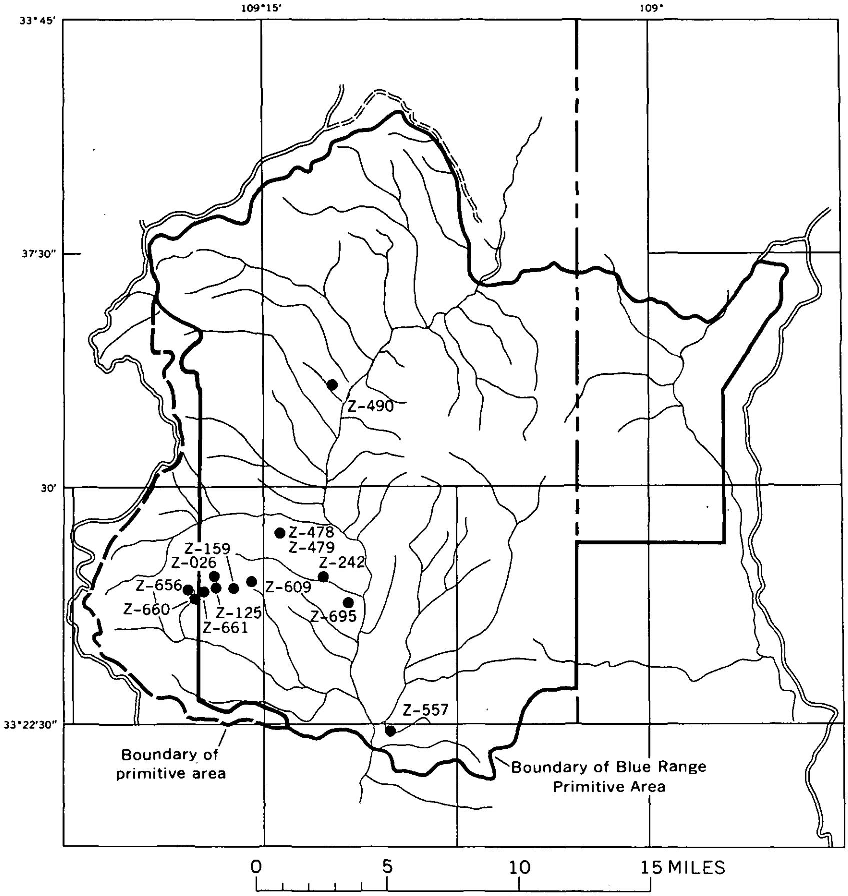

FIGURE 17.—Map of Blue Range primitive area showing localities of rock samples containing 70 ppm or more lead and (or) 200 ppm or more zinc.

Most of the altered rock east of the Blue River is quartz latite or rhyolite, but west of the river andesite is also altered. Commonly, the original rock cannot be determined, and pipelike masses of altered rock in andesite can be interpreted either as small intrusions of quartz latite or rhyolite or as altered andesite that could have formed about intersecting fractures near a fumarolic vent.

The alteration of the rocks in the Hobo Canyon-Squaw Creek area is similar to that in the Red Mountain area, but it is commonly more intense. Pyrite is visible in several areas of silicified and argillized rock. Secondary copper minerals occur in small fractures in intensely altered volcanic rocks along the Blue River at the south edge of the primitive area, where they were pointed out to us by Mr. George Stacy.

According to Stacy (oral commun., 1967), the claims on which these occurrences are located were investigated by geologic, geochemical, and geophysical methods by a major mining company about 1963–64; this investigation resulted in the discovery of a weak to moderate metal anomaly.

The localities of samples that have anomalous amounts of molybdenum, zinc, lead, copper, arsenic, and mercury are shown in figures 16, 17, 18, 19, and 20. The amounts of the elements for particular samples are listed in table 3. These results show that small amounts of several metals were introduced or concentrated in the altered rock, probably during alteration. Although the anomalous-metal values are low and their distribution does not define a precise exploration target,

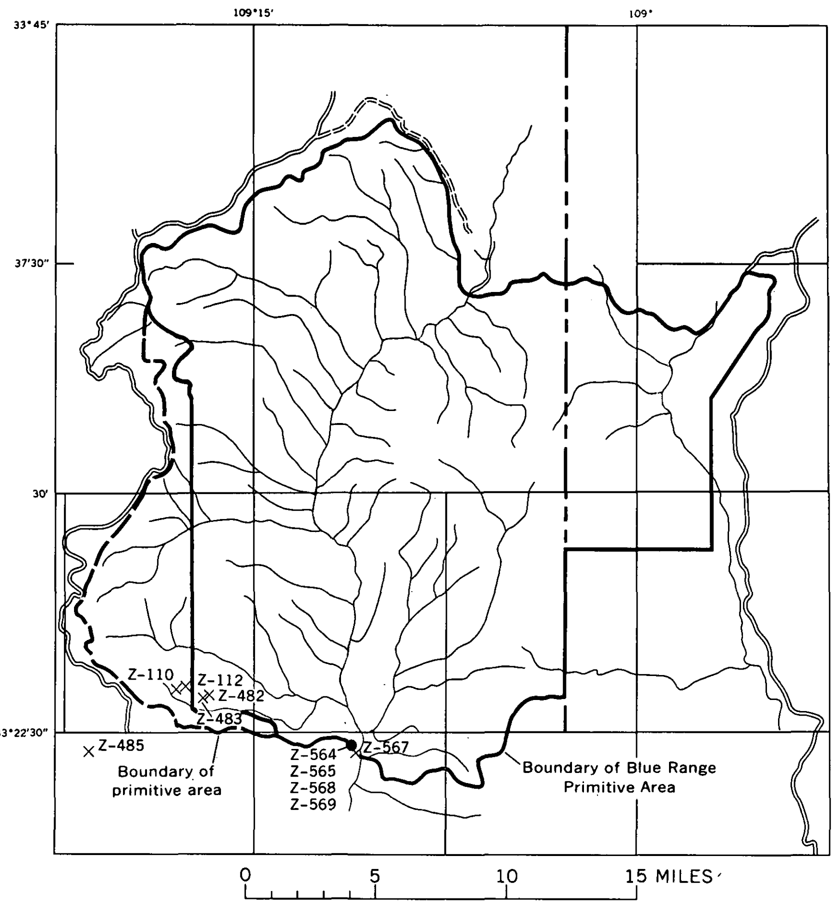

FIGURE 18.—Map of Blue Range primitive area showing localities of rock samples containing 100 ppm or more copper. ×, 100–150 ppm Cu; ●, more than 150 ppm Cu.

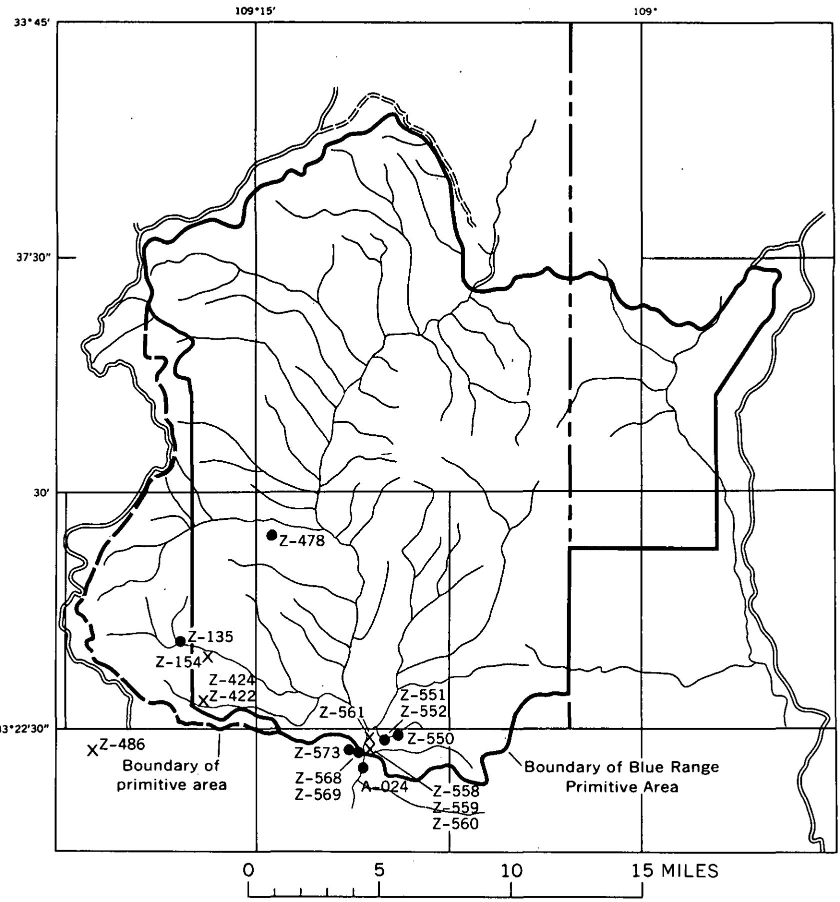

FIGURE 19.—Map of Blue Range primitive area showing localities of rock samples containing more than 10 ppm arsenic. ●, 10–30 ppm As; ×, more than 30 ppm As.

they do suggest the possibility of ore bodies at depth beneath the altered rocks.

In similar altered volcanic rocks on claims near Pine Flat about 3 miles southwest of the study area (pl. 1), Mr. and Mrs. Robert Birdwell report assay values of 0.01 oz (ounces) gold, 0.04 oz silver, and 0.08 percent copper, which are equivalent to about 0.4 ppm gold, 1.7 ppm silver, and 800 ppm copper. Analyses of samples from these and other claims near Pine Flat (pl. 2) obtained during the present study are reported in table 3, Z484 to Z488. These altered and weakly mineralized rocks are also adjacent to a domical body of quartz latite and rhyolite.

In addition to the anomalies related to sizable areas of altered rocks, anomalous values of some elements also were found in samples from

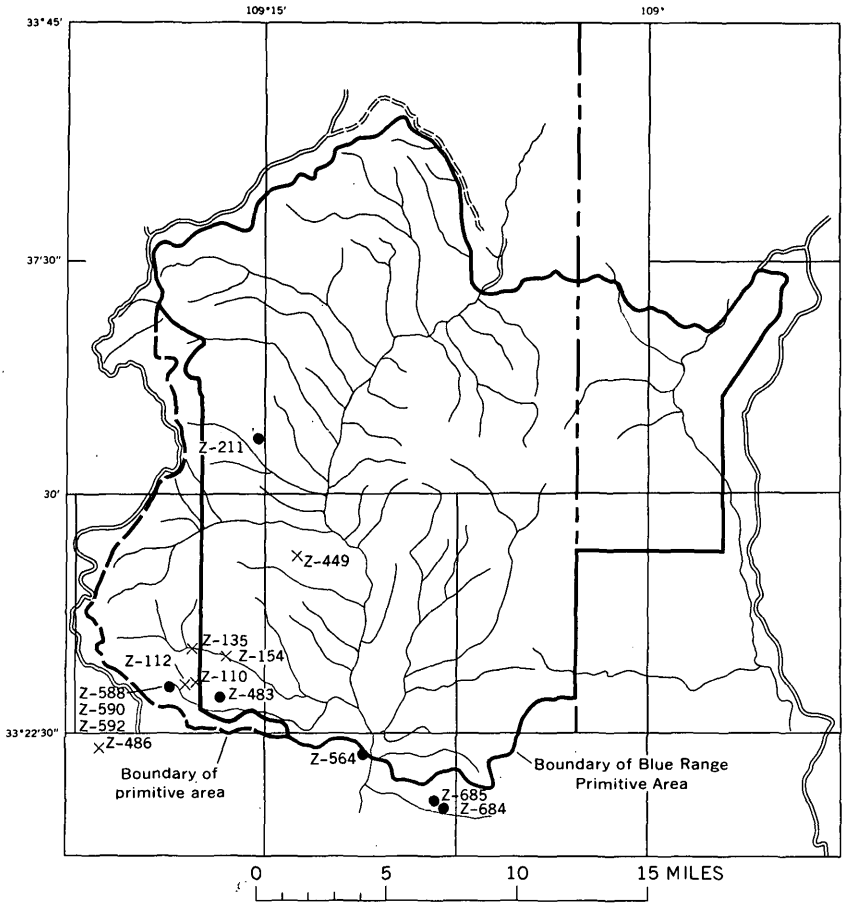

FIGURE 20.—Map of Blue Range primitive area showing localities of rock samples containing 0.5 ppm or more mercury. ×, 0.5–0.9 ppm Hg; ●, 1 ppm or more Hg.

several small sheared and brecciated zones, such as those along the forks of Raspberry Creek southwest of Crooks Mesa and on the north side of McKittrick Creek (pl. 1). Quartz and calcite vein material was found locally in the Blue fault zone and along a number of other faults. By far the largest vein found in the primitive area is about 1 mile east of the Blue River along a split of the major east-west fault south of Bear Mountain. The vein, as much as 10 feet wide, consists of brecciated quartz, much of which is chalcedonic or agatelike, and calcite. It can be traced for at least 200 yards. At its east end it forms the footwall(?) of a steeply dipping argillized zone about 50 yards wide. No anomalous-metal values were found in it or in other veins in the primitive area.

Rumored occurrences of copper minerals in the northeast part of the primitive area were not verified. Layers of greenish-blue altered andesitic cobbles and boulders found in the volcanic conglomerate and breccia in this area likely were mistaken for copper-stained material. Celadonite, a blue-green micaceous alteration mineral in igneous rocks, often is mistaken for secondary copper minerals. Pyrite was found in altered volcanic conglomerate in one locality, but neither samples of it nor samples of other similarly altered rock contained significant amounts of metal.

AREAS OF METALLIC RESOURCE POTENTIAL

The two patterned areas in figure 21 are the most likely parts of the Blue Range primitive area to have a metallic resource potential. These areas, the Red Mountain-Oak Creek and Squaw Creek-Maple Canyon areas, also contain most of the altered volcanic rocks found during this study. The Red Mountain-Oak Creek area has a possible resource potential, as indicated by the caldera structure, the presence of former volcanic vents, and the enrichment of altered rhyolitic rocks in beryllium, tin, molybdenum, lead, and zinc. However, a concentration of relatively mobile or volatile elements may be expected near any volcanic center, and nothing approaching commercial concentrations of metals was found in the area.

The area of greatest metallic resource potential, as outlined in figure 21, contains the hydrothermally altered volcanic rocks of the Squaw Creek-Maple Canyon area. Within the altered rocks, small pipes, reefs, and fracture zones that contain silicified and pyritized rock and low-level anomalous concentrations of metal are further guides to possible metallic ore deposits at depth. Further work may disclose specific exploration targets, but it must be emphasized that although altered rocks and favorable structures are widely recognized as guides to ore, they by no means insure its presence.

NONMETALLIC RESOURCES

The only nonmetallic resources of possible economic interest in the Blue Range study area are deposits of perlite and pumice associated with the quartz latite and rhyolite dome complex in the southern part of the area. Light-gray vitrophyre of rhyolitic composition and waxy luster is exposed in the creek bottom for nearly one-fourth of a mile along Rousensock Creek, above the junction with Squaw Creek. The vitrophyre is massive except for bands of pink lithoidal rock and zones of tiny spherulites the size of pinheads. In thin section, the vitrophyre is seen to be microscopically perlitic and to contain about 25 percent phenocrysts, mainly plagioclase and biotite. Chemical analysis shows a water content of 4.2 percent (table 6). This body of glassy

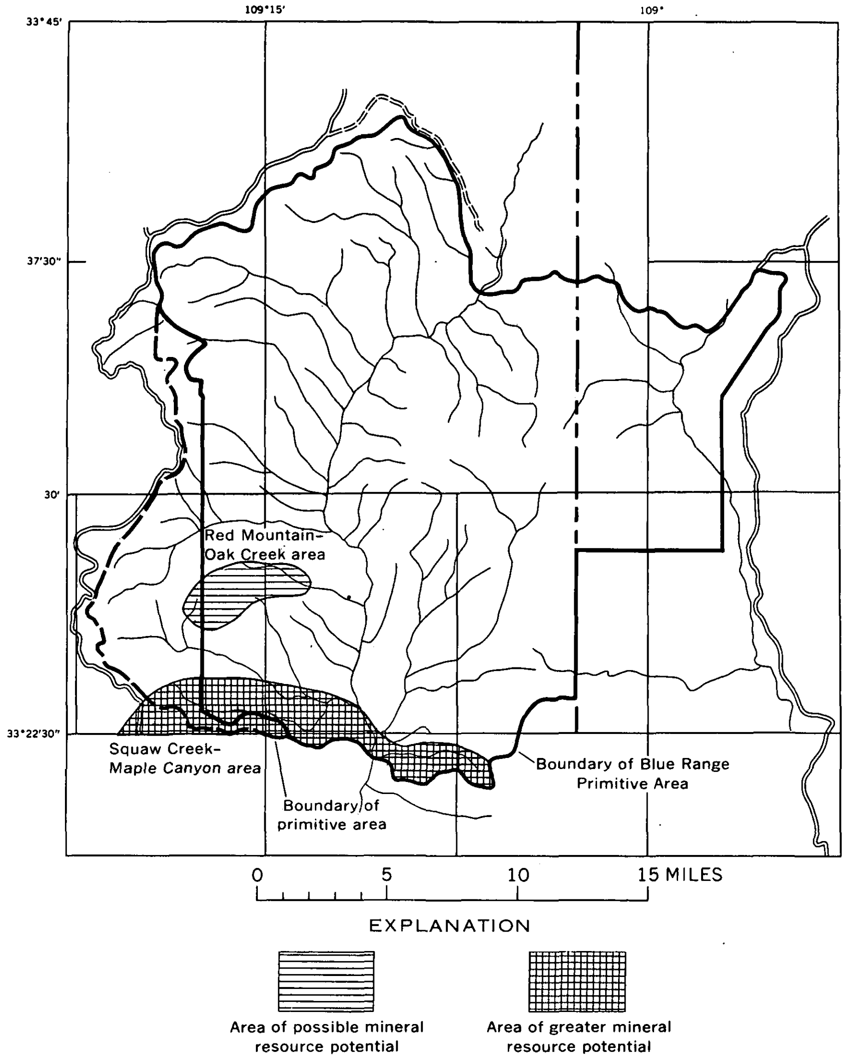

FIGURE 21.—Map of Blue Range primitive area showing areas of mineral-resource potential.

perlitic rock is believed to be intrusive into a domal pile of lava flows and is probably much more extensive than shown by present exposures. However, assuming that the vitrophyre is all similar to that which is exposed at the surface, the high phenocryst content along with the presence of spherulites and lithoidal bands make it unsuitable as a source of commercial perlite. Perlite and some pumice occur as layers and small intrusive(?) bodies in the quartz latite and rhyolite complex from Maple Canyon to Horse Canyon (pl. 1), but here, also, poor quality precludes its classification as a perlite or pumice resource.

Zeolite minerals have been reported in the matrix of crossbedded sandstone in the Alpine-Nutrioso area (Wrucke, 1961, p. H17), and they may be present in similar sandstone beds in the northwestern part of the primitive area. However, the zeolite minerals make up only about 25 percent of the rock, according to Wrucke, and hence are far below the purity necessary to be considered as a zeolite resource.

Although clay minerals are abundant locally in the hydrothermally altered rocks, marketable clay is not present in sufficient abundance or purity to be of commercial interest.

COAL, OIL, AND GAS RESOURCES

The mineral-fuel resource potential of the Blue Range primitive area depends entirely on the nature and extent of pre-Tertiary sedimentary rock units that may lie beneath the volcanic rocks. Although coal-bearing rocks of Late Cretaceous age are exposed north, west, and east of the primitive area, the exposures of Upper Cretaceous rocks closest to the area are of the lower non-coal-bearing part of the series. If ever present, the coal-bearing Upper Cretaceous rocks were probably eroded before deposition of the Tertiary volcanic rocks. Upper Cretaceous rocks in the Clifton-Morenci area to the south are not reported to contain coal (Lindgren, 1905b, p. 73, 74). Based on available information, the possibilities for coal of economic value under the primitive area are virtually nil.

Available data indicate only four oil and gas exploration tests drilled in eastern Arizona and western New Mexico within a radius of 35 miles of the primitive area; none of the tests found significant shows of oil or gas. In a recent report on the petroleum possibilities of Catron County, N. Mex., Foster (1964, p. 49) summarized the available information about the area immediately east of the Blue Range study area and concluded that "Southwestern Catron County is quite complex structurally, and also is an area of considerable mineralization associated with faulting. Most of this area is not considered favorable for oil and gas exploration." This conclusion seems to be supported by the evidence for relatively thin Paleozoic and Mesozoic rocks beneath the volcanic rocks of the primitive area and by the extensive faulting and volcanic activity that characterizes it.

An evaluation of the oil-shale resource potential of the fine-grained clastic rocks of New Mexico indicates very little possibility of such resources in the rocks that underlie the Blue Range primitive area (Foster and others, 1966).

GEOTHERMAL ENERGY

In recent years, there has been an increasing interest in geothermal-energy resources, primarily for the generation of electrical power.

Such energy resources are associated with volcanic areas. One thermal spring and associated seeps are known in the Blue Range primitive area; these were brought to our attention by Mr. George Stacy of Clifton, Ariz. The spring is located above the mouth of Hannah Springs Creek (pl. 1), where the hot water issues from a fracture trending about N. 25° E. in rocks of the quartz latite and rhyolite dome complex. The water is somewhat warmer than 120°F (49°C), the maximum temperature readable on the thermometer used. A partial analysis of one 250-ml (milliliter) sample of the water is shown in table 8.

A geothermal-energy resource depends on a critical combination of factors involving, in addition to a higher-than-normal heat content in the earth, a suitable heat reservoir which may or may not be accompanied by surface discharge (White, 1965). Therefore, while the hot spring on Hannah Springs Creek does imply a higher-than-normal heat flow in the earth, and possibly could be related to a geothermal-energy reservoir, the spring in itself is not an energy resource, and the geology as known does not indicate the likelihood of a thermal reservoir in this area.

TABLE 8.—*Semiquantitative spectrographic analysis of thermal-spring water near mouth of Hannah Springs Creek, Blue Range primitive area, Arizona*

[Analyst: J. M. Motooka. Sample size, 250 milliliters; pH, approximately 8.8; total dissolved solids, about 600 ppm. L indicates element present but below level of sensitivity. Also looked for spectrographically but not detected were Mn, Ag, As, Au, Ba, Be, Bi, Cd, Co, La, Mo, Nb, Ni, Sb, Sc, Sn, W, Y, and Zn. Limits of detection same as in tables 2–5]

Element	*Amount (parts per million)*	*Element*	*Amount (percent)*
B	10	Fe	L
Cr	20		
Cu	10	Mg	L
Pb	15		
Sr	150	Ca	1.5
V	100		
Zr	L	Ti	.005

CONCLUSIONS

Two areas near the south border of the Blue Range primitive area have a greater mineral potential than does the remainder of the proposed wilderness. The more promising of these is the Squaw Creek-Maple Canyon area (fig. 21). The Red Mountain-Oak Creek area contains altered rocks and has weak geochemical anomalies but seems somewhat less promising in mineral potential than the Squaw Creek-Maple Canyon area. A thorough assessment of the mineral potential at depth in the areas would require exploration beyond the scope of this study.

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ECONOMIC APPRAISAL

By R. G. RAABE, U.S. Bureau of Mines

INTRODUCTION

In 1967, the U.S. Bureau of Mines made an economic appraisal of the Blue Range primitive area in Apache National Forest, Arizona and New Mexico. Preliminary work consisted of gathering all available mining claim data in and adjacent to the primitive area (fig. 22) through a search of the records of Catron County, N. Mex., and Greenlee County, Ariz. The records of the U.S. Bureau of Land Management for Arizona and New Mexico, U.S. Forest Service, New Mexico State Land Office, and Arizona State Oil and Gas Conservation Commission were also consulted. Individuals employed by the mining industry having knowledge of the mineral potential within the primitive area, claimants available for interview, and a few local residents also contributed information.

INVESTIGATIONS

The Blue Range primitive area encompasses about 380 square miles. For the purpose of this investigation the boundary of the area of study was extended approximately 2 miles beyond the primitive area, thus including about 500 square miles (fig. 22).

Record searches and field examinations disclosed no evidence of mineral or petroleum production within the Blue Range primitive area. There are no federal mineral or petroleum leases within the area and no patented mining claims, although several patented homesteads and numerous unpatented mining claims are in or near the primitive area. The search of records of unpatented mining claims in Greenlee County Court House, Clifton, Ariz., and Catron County Court House, Reserve, N. Mex., disclosed no proof of labor documentation for many of the claims in and near the primitive area.

Eight groups of claims are in or near the primitive area. The group designated "A" in figure 22 consists of 200 contiguous claims as follows:

Claim	*Numbers (inclusive)*	*Claim*	*Numbers (inclusive)*
Base Line	1–26	Pine Basin	1–30
Hobo	1–54	Pony	1–14
Horse Canyon	1–10	Red Rock	1–21
Maple	1–11	Westside	1–20
Parkey	1–14		

In much of the area covered by the claims, the Tertiary volcanic rocks are noticeably altered to brilliant-red-brown iron oxides. The claimant reported that two drill holes, about 700 and 300 feet deep,

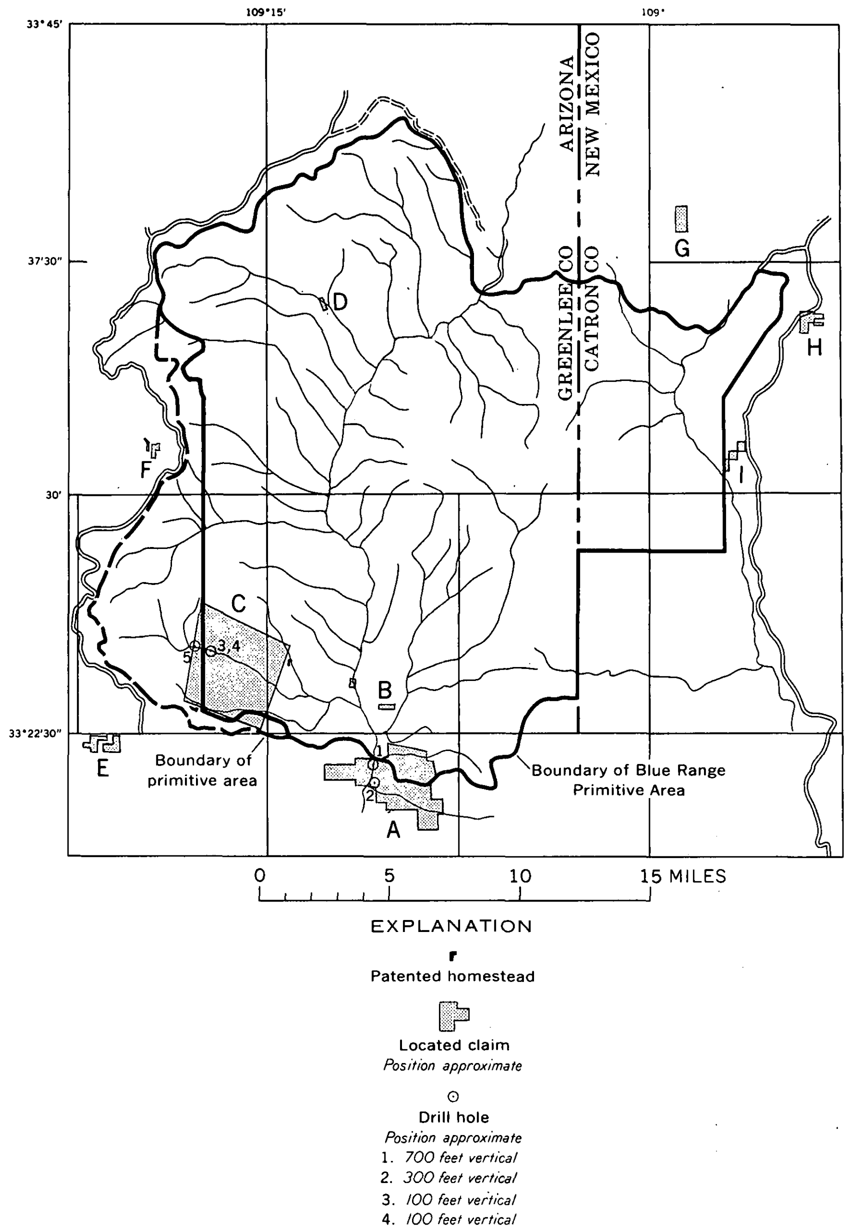

FIGURE 22.—Claim map of Blue Range primitive area, Arizona and New Mexico.

were put down several years ago (fig. 22). No logs of the holes were made and the drill core was not available for inspection. Additional exploration work has been done on this group of mining claims by a large mining company.

The two groups of claims designated "B" in figure 22, just north of group A, are the Bell 1–5 inclusive (northernmost group) and Open Draw 1–4 inclusive. No evidences of mining or mineralization were found on these claims.

Claim group C (fig. 22) consists of 288 contiguous claims (Blue 1–288 inclusive) which were located by one claimant in the summer of 1968. Three 100 foot vertical holes were drilled along upper Rousensock Creek, south of Brigham Peak, as part of the discovery work on these claims. The drilling sites were visited and the drill core was examined by J. C. Ratté of the U.S. Geological Survey and George Leland of the U.S. Bureau of Mines in the spring of 1969, accompanied by Mr. Grant Godfrey of Safford, Arizona, a representative of the claimant. Two of the drill holes are adjacent to a silicified and pyritized zone in andesitic flow breccia or flow rock about 40 feet wide and trending about N. 75° E. Rock reported to have been blasted from surface outcrops at one of the drill sites shows traces of a light green secondary copper mineral; 1 ppm silver and 700 ppm copper were reported in spectrographic analyses of this rock. The third hole at a locality about one-half of a mile upstream from the first two holes was drilled in bleached and limonite-stained andesitic flow breccia or flow rock containing sparsely disseminated pyrite, which may be related to brecciation along a weak fracture zone that trends about N. 80° E. There does not appear to be any significant mineralization at either of the drilling localities, which were chosen more for their accessibility than as prime exploration targets. No anomalous metal values except those cited above were reported in six samples of altered rock collected at the drill sites. Elsewhere in the area now covered by the claims of group C, field examination in 1967 of preexisting claims did not reveal monumented claim corners or evidence of mining, but several occurrences of rock alteration similar to that in the area of claim group A were noted.

The area covered by the lone claim at site D (fig. 22), Paradise, was investigated, and no corner monuments, discovery cut, or any other evidences of mining were found. Rocks in the general area are devoid of alteration, and no veins or mineralization were seen during the field examination.

In the Grace Birdwell 1–7 inclusive and Roy Grot 1–9 inclusive claims, southwest of and just outside the area of study (area E, fig. 22), some narrow veinlike zones of weak rock alteration in discovery cuts were observed.

Claim groups F (Hillside, White Eagle, Arbie Lee), G (Hidden Horse 1–12 inclusive), H (Olympia 1–13 inclusive), and I (Bristol 1–7 inclusive) are all outside the area of study and were searched without finding alteration, mineralization, claim corners, discovery cuts, or any evidences of mining.

CONCLUSIONS

Investigations of the Blue Range primitive area by the U.S. Bureau of Mines did not disclose any evidence of commercial mineral deposits. Neither were such deposits found as a result of work by the U.S. Geological Survey; consequently, no evaluations of reserves were made. However, the conspicuous rock alteration in the southern part of the primitive area (area A, fig. 22) has attracted prospectors. The altered rocks and the anomalous-metal content reported by the U.S. Geological Survey make the area a likely site for further mineral exploration.

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TABLES 2–5

TABLE 2.—*Analyses of unaltered rocks from the Blue Range*

[Numbers in parentheses indicate sensitivity limit of method used. The symbol > indicates that an undeter amount of the element is present below the sensitivity limit; N indicates that the element was looked for D. J. Grimes, Elizabeth Martinez, Elwin Mosier; mercury analyses by W. W. Janes, W. R. Vaughn Campbell, Elizabeth Martinez, R. L. Miller, M. S. Rickard, John Viets. Abbreviations used in table

Semiquantitative spectrographic analyses 1/

	(percent)				(ppm)										
Sample	Mg (.02)	Fe (.05)	Ca (.05)	Ti (.002)	V (10)	Mo (5)	Sn (10)	Ni (2)	Cr (5)	Ba (10)	Sr (50)	B (10)	Pb (10)	Mn (10)	Be (1)
							Basalt flow in Gila Conglomerate								
Z639	5.0	15.0	5.0	>1.0	50	L	N	70	70	500	500	10	N	700	N
							Quartz latite-rhyolite dome complex								
Z553 3/	.1	.5	.3	1	15	N	N	L(5)	L	500	N	20	20	150	L
Z593 3/	.3	.7	1	.15	10	N	N	L	L	500	100	L	15	500	2
Z603	1	3	1.5	.3	20	N	N	L	N	700	150	L	30	700	1
Z611	.03	5	3	.3	70	N	N	15	70	2,000	1,000	L	20	300	L
Z625	3	5	3	.7	50	N	N	100	100	1,000	700	L	30	500	L
Z626	2	7	3	.7	70	L	N	150	200	2,000	700	15	50	700	L
Z628	3	7	2	.7	70	5	N	7	7	1,500	300	20	50	300	1
Z629	L	10	3	.7	50	N	N	5	5	1,500	300	10	20	700	L
Z640	.7	3	.7	.3	50	N	N	L	L	700	100	15	70	500	1.5
Z641	1	5	1	.5	50	5	N	L	L	1,500	150	20	70	700	1.5
Z642	.7	3	.5	.5	70	N	N	L	L	1,000	L	10	50	700	1
Z643	1.5	5	3	.7	100	N	N	15	30	1,500	1,000	L	50	300	1.5
Z644	1.5	3	2	.3	70	N	N	50	70	1,000	500	L	30	500	L
Z669	·1	3	1.5	.3	20	N	N	10	L	1,500	500	L	30	500	1
Z670	3	7	3	.7	100	N	N	70	30	1,500	700	L	20	500	L
Z671	1.5	3	1.5	.3	70	N	N	5	L	1,500	700	10	30	700	1.5
Z672	1.5	3	1.5	.2	70	N	N	5	L	1,500	500	10	30	300	L
Z673	.7	5	2	.5	100	N	N	10	20	700	300	L	20	700	1
Z679 4/	2	2	7	.3	30	7	N	7	L	700	200	30	70	500	1.5
Z683	2	3	1.5	.3	50	N	N	5	L	1,000	300	L	30	500	1
							Basaltic andesite [Includes andesitic-dacitic flows indicated by asterisk]								
Z031 3,5/	3	10	2	1	500	N	N	150	500	700	500	10	10	700	N
Z032 3,5/	5	10	2	1	300	N	N	150	300	700	700	L	L	1,000	N
Z072 3/	1	3	1.5	.7	30	5	N	N	15	1,000	300	20	10	300	1
Z219 3,5/	5	10	5	>1	300	N	N	300	500	1,000	700	L	30	1,000	L
Z598	7	10	7	>1	70	N	N	300	700	1,500	700	L	30	500	N
Z605	1.5	10	1.5	1	70	N	N	L	7	1,000	300	10	30	300	L
Z615	1	7	3	>1	100	N	N	150	150	1,000	500	10	15	1,000	N
Z616 *	3	7	3	.7	100	N	N	70	70	1,000	500	20	30	700	L
Z617	2	10	3	1	100	N	N	150	200	1,000	700	15	50	1,500	L
Z619	3	7	7	>1	100	N	N	150	700	1,000	700	10	30	700	L
Z621 *	2	7	3	.7	100	N	N	7	N	700	300	10	20	700	L
Z622 *	2	7	3	>1	70	N	N	70	70	1,000	500	20	30	700	L
Z623	7	15	5	1	150	N	N	150	150	1,500	700	15	15	1,000	N
Z624	7	10	7	.7	150	N	N	150	500	1,500	700	15	20	700	L
Z633	.7	5	1.5	1	70	N	N	N	7	1,000	300	30	30	500	1.5
Z634	7	10	5	.7	150	N	N	150	1,500	1,500	700	L	L	500	L
Z635	1.5	1.5	1.5	.15	70	5	N	5	L	700	1,000	L	50	300	3
Z637	7	15	7	1	300	L	N	100	70	300	500	15	L	1,500	N
Z647	1	7	1.5	.15	70	N	N	20	15	1,000	1,000	L	20	300	3
Z648	3	7	5	.7	150	N	N	150	150	1,000	1,000	L	20	700	L
Z649	5	5	3	.5	100	N	N	150	300	1,500	700	L	20	700	L
Z650	3	7	3	.7	100	N	N	150	150	1,000	700	.L	20	500	L
Z651	3	5	3	.7	100	N	N	70	70	1,500	1,000	L	20	700	1
Z678	3	7	5	.7	150	N	N	150	150	1,000	700	L	15	700	L
A247	7	15	7	>1	150	N	N	150	500	1,500	700	L	30	700	N

1/ Also looked for spectrographically, but not found except as noted were: Au(10), Sb(200), W(50), Bi(10), Cd(20), and Ag(0.5).

3/ As detected but less than 10 ppm.

5/ Au detected but less than .02 ppm.

primitive area, Greenlee County, Ariz., and Catron County, N. Mex.

mined amount of the element is present above the number shown; L indicates that an undetermined but not found. Analysts: semiquantitative spectrographic analyses by K. J. Curry, Arnold Farley, Jr., arsenic analyses by C. O. Hershey, Gary Dounay, K. R. Murphy, T. M. Stein; gold analyses by W. L. alt., altered; amygdal., amygdaloidal; bio., biotite; hbld., hornblende; pyrox., pyroxene]

	Semiquantitative spectrographic analyses--Continued (ppm)								Chemical analyses 2/ (ppm)		
Sample	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Zn (200)	Sc (5)	Co (5)	Hg (.01)	Map Coordinate (pl. 2)	Sample description
					Basalt flow in Gila Conglomerate						
Z639	30	30	70	150	L	N	30	50	L	K-9	Olivine-pyroxene.
					Quartz latite-rhyolite dome complex						
Z553	10	10	5	200	20	N	N	N	.02	M-6	Banded felsite.
Z593	10	15	3	150	20	N	5	5	.15	K-2	Dike, biotite.
Z603	15	20	2	200	50	N	5	N	.01	K-2	Do.
Z611	L	15	15	150	50	N	20	10	.04	I-2	Hornblende-biotite.
Z625	10	15	30	150	30	N	15	7	.03	K-7	Biotite-quartz.
Z626	15	20	70	200	30	N	15	10	.01	K-6	Pyroxene > biotite.
Z628	30	50	30	500	70	N	15	7	.10	K-3	Plagioclase porphyry.
Z629	15	30	30	300	30	N	20	7	L	K-4	Biotite-hornblende.
Z640	20	30	30	200	20	N	7	L	.01	L-1	Vitrophyre, biotite.
Z641	20	70	20	300	30	N	10	L	L	K-1	Biotite.
Z642	20	50	20	300	30	N	7	L	.02	K-1	Felsite, biotite.
Z643	20	50	20	300	50	N	15	5	.09	K-1	Biotite.
Z644	10	10	15	100	20	N	10	5	.14	H-2	Dike, hbld-bio.
Z669	10	20	30	200	30	N	7	5	.01	L-5	Biotite.
Z670	L	30	50	150	30	N	15	20	.08	L-5	Hornblende.
Z671	L	15	10	150	30	N	5	5	.04	L-4	Glassy, biotite.
Z672	L	10	15	150	30	N	5	L	.04	L-4	Do.
Z673	15	30	10	200	30	N	15	10	.10	L-4	Hornblende > biotite.
Z679	15	20	20	150	30	N	L	L	.01	M-8	Perlite.
Z683	L	15	10	150	30	N	5	L	.04	M-8	Hornblende.
					Basaltic andesite [Includes andesitic-dacitic flows indicated by asterisk]						
Z031	L	20	30	200	20	L	15	30	.01	F-3	Olivine.
Z032	L	30	30	200	20	L	20	50	.05	F-3	Olivine(?).
Z072	15	15	30	300	50	N	10	20	.02	J-6	Platy andesite.
Z219	N	20	50	200	30	L	30	50	L	F-7	Olivine-pyroxene.
Z598	15	30	70	200	70	N	15	20	L	J-1	
Z605	20	20	20	300	50	N	20	5	.05	J-6	Platy andesite.
Z615	15	30	50	150	30	N	15	20	L	F-7	Olivine-pyroxene.
Z616	10	20	30	150	20	N	15	15	L	H-8	Hornblende > pyroxene.
Z617	15	30	100	200	50	N	20	15	L	H-10	Olivine.
Z619	15	30	100	150	30	N	15	15	L	G-10	Pyroxene-olivine(?).
Z621	15	30	30	150	30	N	15	10	L	G-9	Hornblende-pyroxene.
Z622	15	50	30	300	50	N	20	10	.02	H-8	Hbld. > bio. > pyroxene.
Z623	15	30	150	300	50	N	20	20	L	L-8	Olivine.
Z624	10	30	150	150	50	N	15	15	.02	K-8	Olivine(?) amygdal.
Z633	30	30	15	300	30	N	15	5	L	I-4	Platy andesite.
Z634	10	50	100	150	L	N	20	20	.08	G-3	Pyroxene-alt. hbld.
Z635	30	70	15	200	20	N	L	N	.02	J-1	Rhyolite tuff.
Z637	30	70	150	150	L	N	30	70	L	D-10	Olivine(?).
Z647	15	15	10	100	30	N	5	N	.14	I-1	Bedded rhyolite tuff.
Z648	L	30	70	150	30	N	20	15	.18	I-1	
Z649	L	20	70	150	30	N	15	10	.06	I-1	Vitrophyre, pyroxene.
Z650	L	20	50	150	30	N	15	10	.10	I-1	Amygdaloidal.
Z651	L	20	70	150	30	N	15	7	.04	I-1	
Z678	L	30	50	200	50	N	15	20	.04	M-8	Olivine.
A247	15	50	100	300	70	N	30	20	.02	B-5	Olivine(?).

2/ As(10) and Au(.02) determined chemically but not found except as noted.

4/ Bi detected but less than 10 ppm.

TABLE 2.—*Analyses of unaltered rocks from the Blue Range primitive*

Semiquantitative spectrographic analyses 1/

	(percent)				(ppm)											
Sample	Mg (.02)	Fe (.05)	Ca (.05)	Ti (.002)	V (10)	Mo (5)	Sn (10)	Ni (2)	Cr (5)	Ba (10)	Sr (50)	B (10)	Pb (10)	Mn (10)	Be (1)
							Basaltic andesite--Continued [Includes andesitic-dacitic flows indicated by asterisk]									
A249	7.0	15.0	5.0	>1.0	150	N	N	150	500	1,500	1,000	L	20	700	N
A253	1.5	15	3	1	10	N	N	10	5	700	700	15	20	700	N
							Rhyolite of Red Mountain--Ash flows									
Z601	.15	5	.05	.15	10	10	30	L	L	20	L	20	70	300	7
Z607	.05	5	.15	.15	10	10	30	L	L	70	L	15	100	300	7
Z652	.15	3	.07	.15	70	N	20	5	N	70	N	30	50	300	7
Z653	.15	3	L	.15	10	N	30	5	N	50	N	10	70	300	5
Z657	.07	3	.15	.1	10	N	20	L	L	30	N	L	50	300	7
Z658	.2	3	.07	.07	15	N	20	L	L	30	N	10	70	300	7
Z659 4,6/	.05	3	.05	.07	L	N	20	L	L	30	N	10	70	300	5
							Rhyolite of Red Mountain--Lava flows and intrusive rhyolite									
Z027 5,7/	L	3	.1	.05	N	N	20	5	L	N	N	20	50	300	5
Z599	.07	3	.15	.03	L	N	30	L	N	20	L	15	70	300	5
Z610	1.5	3	1.5	.3	50	N	N	15	30	700	700	L	15	300	L
Z654	.7	5	1.5	.3	30	15	N	L	L	1,000	200	L	20	500	1
Z655	.15	2	.5	.07	10	10	10	L	L	100	N	50	30	500	3
Z662	L	3	L	.03	L	N	20	L	L	N	N	L	50	200	5
Z663 8/	.05	3	.05	.05	L	N	20	L	L	L	N	15	70	200	5
Z664 4/	.03	2	.07	.03	L	N	20	L	L	N	N	15	100	300	5
A060 3,5/	L	3	.07	.03	N	N	20	L	L	L	N	20	50	300	5
							Rhyolite ash-flow sheet									
Z238 3,5/	.5	2	.3	.2	15	L	L	7	7	150	L(100)	15	50	700	3
Z514 3/	.1	.5	.07	.1	10	N	N	L(5)	N	70	N	10	15	200	2
Z596	.7	3	.3	.2	70	N	N	L	5	300	L	30	70	1,500	3
Z613	3	1.5	.07	.15	15	N	N	7	N	150	N	10	30	500	1
Z700 2/	.3	3	.15	.15	20	7	L	L	L	100	N	15	30	300	1.5
Z236	.2	.5	.1	.1	50	N	N	L	20	1,000	N	15	20	3,000	2
A250	.3	2	.2	.3	30	7	N	L	7	70	L	15	70	150	3
A251	.7	2	.3	.2	70	N	N	L	L	70	L	15	70	200	3
A252	.3	1.5	.3	.3	30	7	N	L	L	70	L	20	70	300	3
A254	.3	2	.3	.3	20	7	N	L	L	150	L	20	70	300	3
							Pyroxene-hornblende andesite									
Z109 3,5/	1.5	3	2	.5	70	L	N	20	15	700	1,500	L	10	300	L
Z257 3/	.07	.2	1.5	.07	15	N	N	2	7	30	N	N	N	200	N
Z595	3	15	7	1	150	N	N	70	30	1,500	700	L	30	700	N
Z597	7	15	7	>1	100	N	N	200	700	300	700	L	L	500	N
Z602	3	15	3	.5	50	N	N	7	20	1,500	700	10	20	500	N
Z604	7	7	5	1	70	N	N	150	70	1,500	100	L	30	700	L
Z606	7	3	1.5	.7	30	5	N	L	L	1,500	200	L	30	200	1
Z608	7	7	5	.7	100	N	N	70	70	1,500	700	L	20	1,000	L
Z612	3	7	3	1	100	N	N	100	150	1,000	700	L	20	500	N
Z618	5	10	5	>1	100	N	N	200	500	1,000	500	L	10	700	L
Z630 9/	.2	7	5	.7	70	N	N	70	70	700	700	L	30	700	L
Z631	5	7	5	.7	100	N	N	70	100	1,000	700	L	30	700	L
Z632	2	7	3	.7	70	N	N	70	150	1,500	700	L	30	500	L
Z635	3	15	3	1	150	N	N	100	70	2,000	1,000	10	30	500	L
Z638	2	7	1.5	.7	150	N	N	30	70	1,500	500	10	70	300	L
Z645	3	5	3	.7	150	N	N	70	150	1,500	500	L	20	300	2
Z646	3	7	3	.7	100	N	N	150	200	1,500	700	L	15	500	L
Z668	3	7	3	1	150	N	N	150	700	3,000	1,000	L	30	500	L
Z682	3	7	3	1	15	N	N	30	10	1,000	700	L	15	700	L
A020 3,5/	2	7	2	.7	200	N	N	70	70	1,000	700	L	10	700	L

6/ 1.5 ppm Ag.

8/ Ag detected but less than 0.5 ppm.

area, Greenlee County, Ariz., and Catron County, N. Mex.—Continued

	Semiquantitative spectrographic analyses--Continued (ppm)								Chemical analyses 2/ (ppm)		
Sample	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Zn (200)	Sc (5)	Co (5)	Hg (.01)	Map Coordinate (pl. 2)	Sample description
					Basaltic andesite--Continued [Includes andesitic-dacitic flows indicated by asterisk]						
A249	10	70	50	200	50	N	30	20	0.01	C-3	Olivine.
A253	10	30	30	150	30	N	30	20	L	F-9	Plagioclase porphyry.
					Rhyolite of Red Mountain--Ash flows						
Z601	100	100	3	>1,000	N	300	L	N	.03	J-2	Densely welded.
Z607	70	100	7	>1,000	100	300	10	N	.03	I-2	Do.
Z652	50	150	10	1,000	50	300	L	N	.06	J-2	Do.
Z653	30	150	10	1,000	30	300	L	N	.08	J-2	Partially welded.
Z657	50	150	10	>1,000	70	N	5	N	.10	J-2	Bedded tuff.
Z658	50	100	20	>1,000	30	700	7	N	.04	J-2	Cognate(?) inclusion.
Z659	30	150	5	>1,000	50	500	7	N	.04	J-2	Densely welded.
					Rhyolite of Red Mountain--Lava flows and intrusive rhyolite						
Z027	50	100	5	1,000	100	L	L	N	.06	I-3	Contains fluorite.
Z599	100	100	L	>1,000	30	300	L	N	L	I-3	Intrusive(?).
Z610	15	10	15	150	L	N	10	5	L	H-2	Flow banded, vent.
Z654	20	30	15	150	50	N	10	L	.08	J-2	Dike, crystalline.
Z655	20	30	10	100	20	N	5	N	.04	J-2	Dike, vitrophyre.
Z662	30	30	10	300	L	500	L	N	.12	I-3	Flow banded.
Z663	50	100	7	500	30	300	5	N	.13	L-5	Intrusive(?).
Z664	50	100	30	500	30	300	L	N	.06	L-5	Do.
A060	50	100	5	1,000	50	200	N	N	.07	I-3	Do.
					Rhyolite ash-flow sheet						
Z238	15	70	7	200	30	N	L	7	.07	H-8	
Z514	20	50	L	150	N	N	L	N	.01	C-14	Densely welded.
Z596	30	70	15	300	70	N	7	N	.12	F-5	Do.
Z613	30	30	2	200	30	N	L	N	.03	F-4	Do.
Z700	20	70	10	200	70	L	5	N	.16	H-8	Do.
Z236	15	20	2	100	20	N	L	7	.14	D-8	Do.
A250	50	100	15	300	70	N	7	N	.08	C-5	
A251	30	100	10	200	50	N	7	N	.01	C-6	Densely welded.
A252	30	100	15	200	50	N	5	N	L	D-10	Do.
A254	30	100	15	500	100	N	15	N	L	D-10	Do.
					Pyroxene-hornblende andesite						
Z109	L	L	100	100	L	N	7	10	.11	K-2	
Z257	N	L	L	15	N	N	N	N	.06	G-9	Dike.
Z595	L	30	50	150	20	N	20	20	.01	H-5	Pyroxene.
Z597	15	30	70	200	N	N	20	30	L	F-5	Hornblende(?) > pyroxene.
Z602	L	20	30	150	30	N	10	10	L	K-2	Dike, hornblende.
Z604	10	30	100	150	30	N	15	10	.02	I-6	Hornblende > pyroxene.
Z606	20	20	5	150	30	N	10	L	.03	J-2	Hornblende-biotite.
Z608	10	20	30	150	70	N	15	15	L	J-2	Hornblende.
Z612	10	20	15	150	20	N	5	15	.02	H-3	Pyroxene-hornblende.
Z618	20	20	100	150	30	N	20	20	L	H-9	Dike.
Z630	L	15	50	150	30	N	15	15	.02	J-4	Pyroxene-carbonate.
Z631	L	20	100	150	30	N	15	15	L	H-4	Hornblende > pyroxene.
Z632	L	15	100	200	30	N	15	10	.09	L-2	Do.
Z635	10	70	100	200	50	N	15	20	L	I-5	Hornblende.
Z638	15	70	70	200	30	N	15	10	.01	H-5	Hornblende > pyroxene.
Z645	L	10	70	200	L	N	20	10	.10	I-1	Biotite, pyroxene.
Z646	L	10	30	150	20	N	15	15	.04	I-1	
Z668	L	30	100	200	30	N	20	20	.08	L-5	Biotite-pyroxene.
Z682	L	20	30	150	20	N	15	20	.03	M-8	Pyroxene.
A020	L	15	30	150	20	N	10	20	.03	L-6	Hornblende > pyroxene.

7/ 10 ppm As.

9/ .02 ppm Au.

TABLE 2.—*Analyses of unaltered rocks from the Blue Range primitive*

Semiquantitative spectrographic analyses 1/

	(percent)				(ppm)										
Sample	Mg (.02)	Fe (.05)	Ca (.05)	Ti (.002)	V (10)	Mo (5)	Sn (10)	Ni (2)	Cr (5)	Ba (10)	Sr (50)	B (10)	Pb (10)	Mn (10)	Be (1)
Pyroxene-hornblende andesite--Continued															
A021 3,5/	2.0	10.0	2.0	0.5	150	N	N	50	100	1,000	700	L	10	700	L
A248	5	7	3	>1	100	N	N	150	300	1,000	1,000	L	50	300	L
A255	.5	5	3	.7	70	N	N	70	70	1,000	700	10	30	500	L
A256	2	10	5	1	200	N	N	100	70	1,000	700	L	30	700	N

area, Greenlee County, Ariz., and Catron County, N. Mex.—Continued

Sample	Semiquantitative spectrographic analyses--Continued (ppm) Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Zn (200)	Sc (5)	Co (5)	Chemical analyses 2/ (ppm) Hg (.01)	Map Coordinate (pl. 2)	Sample description
					Pyroxene-hornblende andesite--Continued						
A021	L	20	70	150	20	N	10	20	.04	L-6	Pyroxene = hornblende.
A248	L	15	30	150	20	N	15	10	L	C-5	Dike, hbld. > pyroxene.
A255	L	30	70	150	L	N	15	15	.07	E-6	Hornblende.
A256	L	30	70	150	L	N	30	20	.18	E-6	Pyroxene(?)

TABLE 3.—*Analyses of altered rock samples from the Blue Range*

[Numbers in parentheses indicate sensitivity limit of method used. The symbol > indicates that an amount of the element is present below the sensitivity limit; N indicates that the element was looked D. J. Grimes, R. T. Hopkins, Jr., Elizabeth Martinez, Elwin Mosier, G. W. Sears, Jr., K. C. Watts; Stein, A. J. Toevs; gold analyses by W. L. Campbell, Elizabeth Martinez, R. L. Miller, M. S. Rickard, calcite; fa., fault; FeOst, iron oxide stained; fract., fracture; gn., green; MnOst, manganese oxide stained,

	Semiquantitative spectrographic analyses 1/ (ppm)														
Sample	Mg (.02)	Fe (.05)	Ca (.05)	Ti (.002)	V (10)	Mo (5)	Sn (10)	Ni (2)	Cr (5)	Ba (10)	Sr (50)	B (10)	Pb (10)	Mn (10)	Be (1)
							Altered rocks								
Z005	0.5	2.0	3.0	0.15	30	N	N	20	5	200	N	10	N	300	N
Z026	.02	10	.05	.05	10	N	20	L(5)	5	50	N	15	100	1,500	3
Z035	1	7	1.5	.5	200	N	N	20	10	500	700	L	10	300	N
Z037	.5	3	.5	.5	150	N	N	20	50	500	500	10	10	200	N
Z062	3	1.5	10	.3	50	L	N	70	150	200	300	10	L	300	L
Z077	1.5	1	1.5	.3	15	L	N	2	N	700	700	L	30	300	L
Z082	.07	10	.1	.05	50	7	L	5	N	100	50	15	N	30	5
Z085	.3	1	1.5	.3	30	N	N	N	N	300	100	L	L	300	L
Z090	.15	1	20	.02	15	N	N	N	N	15	2,000	30	N	1,500	N
Z100	.15	1.5	1.5	.5	50	N	N	2	N	1,000	300	L	10	100	1.5
Z110	.03	3	.07	1	50	L	N	7	15	5,000	1,000	15	L	150	L
Z111	L	5	L	.05	50	L	L	N	10	500	500	10	L	15	L
Z112	.02	7	.07	.5	50	7	L	L	10	500	300	L	L	30	L
Z125	.05	3	L	.2	10	5	L	7	L	70	N	L	15	30	3
Z135	.15	1.5	.07	.1	50	L	N	7	L	200	50	L	L	150	1
Z154 2/	.2	1.5	1.5	.2	30	10	N	10	10	500	L	L	15	300	3
Z159	.05	1.5	.1	.07	N	N	L	7	L	15	N	10	30	300	15
Z208 3/	.15	5	.3	.5	100	L	N	7	50	300	2,000	20	30	150	L
Z209 2/	.7	5	.5	1	200	15	N	10	150	700	3,000	30	50	100	1
Z210 2/	.5	5	.2	.7	200	20	N	7	100	300	1,500	20	30	30	L
Z211	.7	5	3	.5	70	5	N	7	100	1,000	5,000	L	15	20	L
Z214	3	10	5	.7	300	N	N	100	300	1,000	5,000	L	10	700	L
Z240	.02	.3	.15	.03	15	N	15	N	10	150	100	15	20	150	3
Z241	.03	5	.1	.07	50	L	L	7	20	150	100	L	30	300	10
Z242	.07	.7	.2	.15	50	5	20	7	20	150	300	10	70	150	7
Z243	.05	.5	.2	.07	L	N	15	L(5)	7	L	N	70	50	150	2
Z275	1	3	2	.3	30	N	N	10	20	300	1,000	10	30	1,500	7
Z309	1.5	5	1	.3	200	N	N	70	70	1,000	200	15	15	3,000	7
Z310 2/	.2	1.5	.15	.2	100	7	L	7	5	150	150	15	50	100	2
Z346	1	10	.3	.5	100	7	N	10	100	100	1,000	20	10	30	L
Z347	.5	5	.2	.5	20	L	N	5	15	150	300	10	15	30	L
Z394	.2	3	.3	.2	20	N	N	10	L	1,000	100	L	30	200	N
Z401	1.5	7	5	.5	70	N	N	20	N	1,500	1,000	10	20	100	L
Z407	.2	1	.5	.5	30	N	N	2	15	1,500	3,000	15	50	50	L
Z417	.3	3	2	.5	70	L	N	50	30	500	500	N	N	300	L
Z418	.03	.7	.15	.3	70	N	N	N	5	300	150	L	30	30	L
Z419	.15	3	.7	1	100	N	N	15	15	300	2,000	70	10	700	N
Z420	.03	7	.1	.5	100	15	N	5	7	500	300	15	10	30	L
Z421	.05	1	.07	.5	70	L	N	N	15	500	200	30	50	30	L
Z422	L	10	.07	.015	20	N	N	N	7	70	200	15	N	30	L
Z423	.02	3	.07	.02	10	N	N	N	L	200	70	10	N	20	L
Z424	.05	15	.07	.03	150	N	N	N	L	100	70	20	L	30	L
Z425	.03	3	.07	.7	10	5	N	7	20	300	N	L	N	1,000	N
Z449	.7	---	10	.5	100	N	N	20	70	1,000	1,000	L	20	500	1
Z460	.2	---	.7	.2	150	N	N	100	20	1,000	2,000	N	20	200	1.5
Z474	1	---	5	.2	50	N	N	5	N	300	200	L	10	700	L
Z476	2	---	3	1	150	L	N	200	300	1,000	1,500	L	15	1,000	L
Z478	3	---	.5	.1	30	L	N	5	N	300	N	10	70	>5,000	10
Z479	2	---	L	.1	L	N	N	2	N	10	N	10	50	200	5
Z480 4/	N	---	.07	.7	70	10	N	L	N	1,000	1,000	L	30	10	L

1/ Also looked for spectrographically but not found except as noted: Au(10), As(200), Sb(100), W(50), Bi(10), Cd(20) and Ag(0.5).

2/ Ag detected but less than 0.5 ppm.

primitive area, Greenlee County, Ariz., and Catron County, N. Mex.

undetermined amount of the element is present above the number shown; L indicates that an undetermined for but not found. Analysts: semiquantitative spectrographic analyses by K. J. Curry, Arnold Farley, Jr., mercury analyses by W. W. Janes; arsenic analyses by Gary Dounay, C. O. Hershey, K. R. Murphy, T. M. T. A. Roemer, John Viets. Abbreviations used in table: alt., altered; and., andesite; brec., breccia; cal., NW, northwest; porph., porphyry; qtz., quartz; rhy., rhyolite; sil., silicified; stnd., stained]

	Semiquantitative spectrographic analyses--Continued (ppm)								Chemical analyses (ppm)			Map	
Sample	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Zn (200)	Sc (5)	Co (5)	Hg (.01)	As (10)	Au (.02)	Coordinate (pl. 1)	Sample description
						Altered rocks--Continued							
Z481	15	20	50	500	50	N	10	N	.13	L	.02	K-3	Silicified; limonitic.
Z482	10	30	150	700	50	N	10	L	.04	10	N	K-3	Limonite in fract.
Z483	L	10	150	500	N	N	L	5	11	L	N	K-3	Quartz-pyrite.
Z484	L	10	10	150	30	N	7	N	.16	10	N	L-1	Silicified; pyrite.
Z485	L	10	100	200	20	N	5	N	.16	10	.02	L-1	Limonite-hematite.
Z486	L	10	50	100	N	N	5	N	.60	40	N	L-1	Limonite in fract.
Z487	L	10	10	300	50	N	7	N	.26	10	N	L-1	Hematitic.
Z488	L	L	15	150	20	N	7	N	.22	L	N	L-1	Silicified; pyrite.
Z489	70	70	3	700	N	N	N	N	.10	10	N	I-4	Altered andesite.
Z490	L	L	20	100	L	N	5	5	.04	10	N	G-5	Sil. fault? brec.
Z493	L	5	20	150	20	N	10	5	.16	L	N	G-3	Silicified; hematite.
Z494	L	7	5	150	20	N	10	N	.06	10	N	G-3	Quartz, hematite?
Z495	L	L	10	100	20	N	5	L	.04	10	N	H-4	Sil. fault brec.
Z496	N	L	2	L	N	N	N	L	.04	N	N	I-6	Quartz-calcite vein.
Z497	N	L	3	10	N	N	N	5	.08	N	N	H-6	Calcite-quartz vein.
Z498	30	20	3	500	L	N	L	N	.02	N	N	H-6	Quartz breccia vein.
Z499	70	30	2	700	N	N	5	L	.07	N	N	H-6	Quartz vein.
Z532	L	7	10	100	20	N	5	7	.04	N	N	I-5	Quartz-calcite vein.
Z533	N	L	L	L	L	N	N	N	.02	N	N	I-5	Do.
Z535	L	5	30	50	L	N	10	5	.04	10	N	L-6	Silicified brec. pipe.
Z536	L	N	20	30	L	N	7	L	.08	10	N	L-6	Do.
Z538	N	L	3	50	N	N	N	5	.03	N	N	L-6	Quartz vein.
Z550	L	L	5	50	L	N	5	L	.01	30	N	L-6	Altered latite-rhy.
Z551	L	5	5	150	20	N	7	L	.01	30	N	L-6	Do.
Z552	10	L	5	100	20	N	5	N	.02	20	N	L-6	Silicified-opalized.
Z554	10	N	3	100	N	N	L	L	.06	L	N	M-7	Sil. latite-rhyolite.
Z557	L	L	30	100	N	N	L	L	.04	10	N	L-6	FeOst fracture.
Z558	L	5	30	30	20	N	7	10	.01	40	N	L-6	Green stained rock.
Z559	N	N	20	20	N	N	5	N	.05	70	N	L-6	Limonite on fract.
Z560	L	5	50	100	L	N	7	10	L	20	N	L-6	Green stained rock.
Z561	10	5	30	150	L	N	5	5	.02	40	N	L-6	MnOst? rock.
Z562	L	L	30	70	N	N	7	5	.02	N	N	L-6	Hematitic.
Z563	L	15	20	100	L	N	10	7	.03	10	N	M-6	Fault gouge.
Z564	L	5	3,000	70	L	N	7	5	2.3	L	N	L-6	Chrysocolla?, fract.
Z565	L	30	500	150	L	N	15	15	.02	N	N	L-6	Yellow stnd., porous.
Z566	10	5	30	100	L	N	15	5	.20	10	N	L-6	6-8' Sil. chip sample.
Z567	10	5	100	100	N	N	10	5	.19	10	.02	L-6	Grab off muck pile.
Z568	10	L	500	100	N	N	5	30	.01	30	.02	L-6	MnOst, gn. stnd. rock.
Z569	L	L	500	100	N	N	15	7	.01	30	N	L-6	Secondary Cu, fract.
Z570	L	N	30	70	N	N	7	5	L	10	N	L-6	Brecciated porphyry.
Z571	L	15	15	100	N	N	10	7	.01	N	N	L-6	Slightly alt. brec.
Z572	L	5	L	L	N	N	N	N	L	N	N	L-6	Vein(?) quartz.
Z573	L	10	10	100	L	N	7	7	.01	20	N	L-6	Slightly alt. porph.
Z574	L	15	15	150	20	N	10	10	.03	L	N	L-6	Limonite stnd. andesite.
Z577	10	15	3	150	L	N	10	10	.02	N	N	L-5	gn. stnd. andesite.
Z582	10	10	5	100	L	N	7	7	.07	10	N	M-6	Hematitic fa. gouge.
Z583	L	15	5	150	N	N	20	15	.03	L	N	M-6	Fault breccia.
Z586	L	7	7	100	L	N	7	L	.45	10	N	K-2	Blue-gn. veinlets, and.
Z587	L	5	3	100	N	N	N	N	.07	L	N	K-2	Silicified.
Z588	L	L	3	70	N	N	N	N	1	N	N	K-2	Silicified, pyrite.

6/ 10 ppm Bi(10).

7/ .7 ppm Ag(0.5).

TABLE 3.—*Analyses of altered rock samples from the Blue Range primitive*

	Semiquantitative spectrographic analyses--Continued (ppm) 3/								Chemical analyses (ppm)				
Sample	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Zn (200)	Sc (5)	Co (5)	Hg (.01)	As (10)	Au (.02)	Map Coordinate (pl. 1)	Sample description
							Altered rocks						
Z005	L	N	10	30	N	N	5	5	---	L	L	G-5	Gn. stnd. qtz., and brec.
Z026	50	200	10	>1,000	N	200	5	N	---	10	L	I-3	FeOst fract. in rhy.
Z035	L	20	30	150	20	N	10	10	---	L	L	K-2	Gn. stnd. flow brec.
Z037	L	10	20	150	N	N	10	5		10	L	K-2	Fract. zone in andesite.
Z062	L	15	20	50	N	N	5	20	.04	L	N	I-6	Calcite in andesite brec.
Z077	L	15	30	70	N	N	N	7	.03	L	N	K-4	Bleached rhy.-latite.
Z082	10	5	30	20	N	N	N	N	.06	L	N	K-4	Limonitic float.
Z085	L	7	L	100	20	N	5	10	.09	L	N	L-3	Limonite stnd. andesite.
Z090	N	N	L	N	N	N	N	N	.12	L	N	L-3	Calcite in andesite dike.
Z100	10	7	20	50	30	N	7	N	.13	10	N	L-3	-------------------------
Z110	L	L	100	70	L	N	5	N	.70	L	N	K-2	Silicified pyrite.
Z111	L	L	15	50	L	N	L	N	.14	L	N	K-2	Yellow, silicified.
Z112	L	L	150	70	L	N	5	N	.50	L	N	K-2	Altered, NW fract.
Z125	30	30	3	500	20	300	L	N	.07	L	N	I-3	FeOst fract.
Z135	L	L	30	30	N	N	5	N	.70	30	.1	J-2	Qtz. in FeOst andesite.
Z154	L	5	20	70	20	L	5	15	.80	60	.2	K-3	Shear zone.
Z159	50	200	L	1,000	70	300	L	N	L	10	.02	I-3	Silicified rhy. vent.
Z208	L	7	20	300	30	N	10	5	.08	L	N	G-4	FeOst brec. zone.
Z209	N	10	30	300	50	N	20	5	L	10	N	G-3	Do.
Z210	L	5	20	200	30	N	15	N	.08	L	N	G-3	Do.
Z211	L	5	10	200	20	N	7	N	1	L	N	G-3	Do.
Z214	N	20	15	150	30	N	30	20	.28	L	N	J-6	Altered andesite.
Z240	70	70	10	700	20	N	L	10	.12	L	N	I-5	Argillized rhyolite.
Z241	50	70	7	500	L	N	L	7	.12	L	N	I-5	Silicified rhyolite.
Z242	200	200	10	1,000	70	N	L	10	.11	L	N	I-5	Altered rhyolite.
Z243	100	70	10	700	50	N	L	10	.08	L	N	I-5	Silicified rhyolite.
Z275	30	70	20	300	70	N	7	L	.28	L	N	I-8	Quartz in fault zone.
Z309	L	30	15	200	30	N	15	20	.19	L	N	H-8	Fault gouge.
Z310	50	50	2	300	70	N	L	L	.09	L	N	H-8	Fault zone.
Z346	L	N	20	150	L(50)	N	15	N	.07	L	N	L-6	Alt. latitic porphyry.
Z347	10	N	20	300	L(50)	N	5	N	.05	L	N	L-6	Opaline rock.
Z394	L	10	10	300	L(50)	N	N	N	.06	L	N	K-5	Altered rhyolite.
Z401	L	20	20	100	50	N	10	10	.03	L	N	K-4	-------------------------
Z407	10	10	20	150	30	N	7	N	.8	L	N	L-5	Altered latite.
Z417	L	10	30	70	L	N	7	20	.12	L	N	K-3	Sil., argillized.
Z418	L	15	30	100	20	N	7	N	L	L	N	K-3	Do.
Z419	L	10	30	150	20	N	15	30	L	L	N	K-3	Do.
Z420	10	10	30	150	30	N	10	5	.04	L	N	K-3	Do.
Z421	10	10	30	200	70	N	7	N	.04	10	N	K-3	Do.
Z422	L	N	5	L	N	N	N	N	.04	20	N	K-3	Heavy, yellow.
Z423	L	L	L	10	N	N	N	N	.04	10	N	K-3	Porous, yellow.
Z424	L	N	10	15	20	N	N	N	.08	200	N	K-3	Limonitic.
Z425	20	5	30	300	20	N	L	L	.4	10	N	K-3	Silicified; pyritic.
Z449	L	20	15	300	30	N	7	5	.80	L	N	I-4	Cal.-limonite brec.
Z460	10	20	30	150	50	N	20	N	.08	L	N	F-4	Altered flow base.
Z474	N	L	50	100	N	N	5	5	.03	L	N	F-3	Qtz. in fault breccia.
Z476	10	30	70	200	50	N	30	50	.24	L	N	I-3	Andesite brec., limonite.
Z478	70	200	30	700	50	500	N	N	.20	20	.02	H-4	Alt. rhy. flow base.
Z479	100	100	50	700	50	200	L	N	.02	L	N	H-4	Silicified rhyolite.
Z480	15	30	30	500	70	N	10	N	.06	L	N	K-3	Silicified; limonitic.

3/ 0.5 ppm Ag.

4/ 15 ppm Bi(10).

area, Greenlee County, Ariz., and Catron County, N. Mex.—Continued

Semiquantitative spectrographic analyses 1/

(ppm)

Sample	Mg (.02)	Fe (.05)	Ca (.05)	Ti (.002)	V (10)	Mo (5)	Sn (10)	Ni (2)	Cr (5)	Ba (10)	Sr (50)	B (10)	Pb (10)	Mn (10)	Be (1)
							Altered rocks--Continued								
Z481	0.02	---	0.07	0.5	70	N	N	L	N	1,000	700	L	50	10	L
Z482	.07	---	.1	.7	100	10	N	L	N	1,000	700	20	30	20	1
Z483	L	---	.1	.7	30	N	N	5	N	1,000	N	L	N	20	L
Z484	.05	---	.05	.5	100	L	N	L	N	500	500	15	15	20	1
Z485 5/	L	---	L	.5	150	10	N	N	N	1,000	700	15	100	10	1
Z486 6/	N	---	N	.2	200	20	N	N	N	1,000	700	20	30	15	L
Z487	L	---	L	.7	100	7	N	N	N	2,000	700	L	50	10	L
Z488	.02	---	.02	.5	100	N	N	L	N	1,000	500	L	20	15	L
Z489	.1	2	.07	.07	20	5	15	N	5	30	N	30	50	20	5
Z490	.07	L	.07	.2	70	7	N	5	50	300	700	15	20	20	L
Z493	.1	2	.07	.3	100	5	N	L	70	700	2,000	L	20	50	L
Z494	.3	.2	1.5	.3	20	L	N	L	50	700	3,000	L	10	L	N
Z495	.1	1.5	.3	.2	50	5	N	L	15	150	500	L	15	30	N
Z496	.15	.2	10	.05	L	N	N	L	L	100	N	N	L	15	N
Z497	.7	.5	10	.07	20	N	N	L	L	200	300	N	L	2,000	L
Z498	.02	.15	2	.07	L	N	N	L	L	50	N	N	N	70	N
Z499	.03	.2	L	.2	10	N	N	L	7	150	N	N	N	50	N
Z532	.2	1	.5	.2	50	N	N	30	50	300	200	10	L	150	L
Z533	.2	.5	15	.01	10	N	N	L	L	150	500	N	L	3,000	L
Z535	.05	1.5	.3	.2	70	L	N	5	15	500	700	10	10	150	L
Z536	L	2	.1	.2	50	L	N	L	5	300	300	L	L	10	N
Z538	.2	.5	7	.05	10	N	N	5	7	200	100	N	L	200	N
Z550	.05	1.5	.2	.2	70	5	N	5	30	500	500	10	20	20	N
Z551	.05	1	.07	.2	50	L	N	L	20	300	500	10	15	10	N
Z552	.03	.7	.1	.2	30	L	N	L	10	500	300	20	15	10	N
Z554	.05	1	.05	.5	20	N	N	L	15	300	N	N	N	70	N
Z557 5/	.07	2	.1	.2	50	L	N	L	10	300	300	15	150	50	L
Z558	.1	.7	.07	.2	50	L	N	10	L	300	700	10	20	70	L
Z559	L	2	.05	.1	150	5	N	5	50	500	700	15	L	20	N
Z560	1.5	1	.2	.3	70	L	N	10	5	500	500	L	10	50	L
Z561 5/	.1	2	.1	.3	200	5	L	L	200	500	700	10	15	70	N
Z562	.03	1.5	.07	.3	100	L	N	L	300	1,000	500	L	10	L	N
Z563	1	1.5	3	.3	70	L	N	50	200	500	300	L	10	70	L
Z564 7/	.2	.5	.07	.2	50	N	N	L	7	700	500	L	10	L	L
Z565	.2	1	.2	.5	70	N	N	50	10	300	500	15	10	L	L
Z566 2/	L	1	.07	.3	100	N	N	L	10	700	700	L	L	10	N
Z567	.07	1.5	.05	.5	100	L	N	7	5	300	200	10	L	L	L
Z568	.2	2	.3	.5	200	L	N	20	5	150	N	10	N	100	L
Z569	.1	1	.5	.3	150	L	N	10	7	500	500	L	L	50	L
Z570	L	.5	.07	.2	70	N	N	L	7	500	500	N	10	L	N
Z571	.7	1.5	1.5	.3	70	L	N	30	50	500	500	L	10	200	L
Z572	.15	.5	7	.05	10	N	N	10	5	200	N	L	N	100	L
Z573	.2	1	.3	.3	50	L	N	20	20	200	300	20	L	50	N
Z574	.7	1.5	.1	.5	100	L	N	30	50	700	700	L	10	150	L
Z577	1	1.5	1.5	.5	100	L	N	10	L	300	500	L	L	300	N
Z582 5/	.5	2	.3	.3	100	L	N	20	30	500	200	L	10	150	L
Z583	1	1	2	3	50	N	N	100	150	500	300	10	L	500	N
Z586	.2	1.5	.05	.3	70	L	N	15	50	500	300	L	L	30	L
Z587	L	.7	.03	.1	15	L	N	L	5	700	500	20	L	10	N
Z588	L	.7	.03	.15	L	N	N	L	L	500	N	L	N	20	N

5/ Bi detected but less than 10 ppm.

TABLE 3.—*Analyses of altered rock samples from the Blue Range primitive*

Semiquantitative spectrographic analyses 1/ (ppm)

Sample	Mg (.02)	Fe (.05)	Ca (.05)	Ti (.002)	V (10)	Mo (5)	Sn (10)	Ni (2)	Cr (5)	Ba (10)	Sr (50)	B (10)	Pb (10)	Mn (10)	Be (1)
Altered rocks--Continued															
Z589	L	1.0	0.07	0.3	20	N	N	L	7	700	200	10	N	10	N
Z590	L	1	.03	.2	20	N	N	5	7	300	300	L	L	20	N
Z591	.03	1.5	.05	.3	50	N	N	5	10	500	700	15	L	L	N
Z592	L	1	L	.2	50	N	N	L	20	700	500	10	L	L	L
Z609	.07	3	.15	.07	10	10	30	10	L	L	N	15	50	300	7
Z614	1.5	.2	.7	.07	70	N	N	L	20	300	200	10	30	10	2
Z656	1.5	7	.05	.07	15	L	20	L	L	70	N	70	70	200	7
Z660	L	1.5	L	.03	L	N	15	L	L	N	N	L	15	50	5
Z661 2/	L	1	.05	.05	L	N	20	L	L	N	N	L	70	100	7
Z674	.5	3	1	.3	50	N	N	L	L	1,000	300	L	30	150	L
Z684	.03	3	.07	.7	100	N	N	5	15	1,500	500	L	10	10	L
Z685	.03	2	.1	.7	70	5	N	5	30	1,500	300	20	L	20	L
Z695 5/	.03	2	L	.03	10	N	20	7	10	30	N	10	70	150	7
A022 5/	.5	.3	.5	.5	100	N	N	15	100	500	700	15	50	1,000	L
A023	L	.05	.05	.3	200	N	N	L	100	300	500	N	15	L	N
A024	L	15	.05	.3	500	N	N	L	70	500	500	L	20	10	N
A025	L	15	.1	.1	10	N	N	L	L	150	200	L	15	N	N
A079	.5	10	1	.3	150	N	N	20	50	1,000	500	10	10	200	N
A082	L	10	L	.2	20	N	N	L	5	100	500	L	N	10	N
A104	.7	3	3	.2	100	N	N	5	7	700	500	---	15	700	N
A105	.7	7	3	.3	150	N	N	7	15	3,000	1,000	---	10	500	N
A237	.7	2	1.5	.3	70	N	N	50	500	200	100	L	L	300	L
A244	.15	.5	1.5	.05	10	N	N	N	50	30	200	N	N	200	N
A245	1.5	2	2	.3	30	N	N	5	7	1,000	1,500	N	L	700	L
A246	1.5	5	1.5	.5	70	N	N	15	10	1,000	1,500	L	10	700	N

area, Greenlee County, Ariz., and Catron County, N. Mex.—Continued

	Semiquantitative spectrographic analyses--Continued (ppm)								Chemical analyses (ppm)				
Sample	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Zn (200)	Sc (5)	Co (5)	Hg (.01)	As (10)	Au (.02)	Map Coordinate (pl. 1)	Sample description
							Altered rocks--Continued						
Z589	10	L	10	150	N	N	L	N	.07	N	N	K-2	Silicified, limonite.
Z590	L	10	10	100	N	N	L	L	8.05	L	N	K-2	Silicified, pyrite.
Z591	L	7	15	100	L	N	5	N	.15	L	N	K-2	Argillized.
Z592	L	L	10	150	N	N	5	N	2.7	N	N	K-2	Silicified, pyrite.
Z609	50	70	10	>1,000	L	300	10	N	.04	N	N	I-4	Silicified vent rhy.
Z614	30	30	2	200	20	N	15	N	L	N	N	I-4	Alunite?
Z656	50	150	7	>1,000	L	300	7	N	.06	N	N	J-2	Hematitic rhyolite.
Z660	30	150	15	1,000	N	500	6	N	.20	N	N	J-3	Do.
Z661	50	150	10	>1,000	N	700	5	N	.02	N	N	J-3	Do.
Z674	10	20	15	150	30	N	7	N	.14	N	N	L-3	Latitic dike qtz.-py.
Z684	L	15	30	150	30	N	15	N	2.20	N	N	M-7	Argillic, pyritic.
Z685	L	L	7	150	L	N	10	N	>10	N	N	M-7	Edge of alt. rhy. dike.
Z695	50	100	7	1,000	30	200	L	N	.08	N	N	J-5	Silicified rhy. float.
A022	L	10	50	<50	20	N	10	10	.14	L	N	M-6	Altered colluvium.
A023	L	L	10	50	N	N	L	L	.04	10	L	M-6	Argillized.
A024	L	N	15	100	N	N	10	N	.04	20	L	M-6	Hematitic stnd.
A025	L	N	10	100	N	N	5	N	.06	10	L	M-6	Opaline.
A079	L	10	20	150	N	N	10	5	----	---	---	K-2	Altered andesite.
A082	L	N	30	100	N	N	10	N	----	---	---	K-2	Altered float.
A104	N	15	15	70	N	N	---	5	.06	---	N	D-5	Green breccia; pyrite.
A105	N	20	30	100	N	N	---	10	.03	---	N	D-5	Gn.-black stnd. brec.
A237	L	15	5	100	L	N	20	10	.03	L	N	B-7	Gn. stnd. conglomerate.
A244	N	N	L	L	N	N	N	L	.03	N	N	B-7	Calcite from fault.
A245	L	20	10	150	30	N	5	10	.02	N	N	B-6	Gn. stnd. conglomerate.
A246	L	20	50	150	30	N	10	20	.02	N	N	B-6	Do.

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TABLE 4.—*Analyses of stream-sediment samples from the Blue Range*

[Numbers in parentheses indicate sensitivity limit of method used. The symbol > indicates that an unde amount of the element is present below the sensitivity limit: N indicates that the element was looked Martinez, D. J. Grimes, K. J. Curry, K. C. Watts; Mercury analyses by W. W. James, and S. L. Noble; Elizabeth Martinez, W. L. Campbell, T. A. Roemer, M. S. Rickard, R. L. Miller]

Semiquantitative Spectrographic Analyses 1/

	(percent)				(ppm)								
Sample	Mg (.02)	Fe (.05)	Ca (.05)	Ti (.002)	V (10)	Mo (5)	Ni (2)	Cr (5)	Ba (10)	Sr (100)	B (10)	Pb (10)	Mn (10)
					Stream sediments								
Z001	1.5	7.0	2.0	1.0	200	N	70	150	1,000	700	20	20	1,000
Z006	2	5	3	.5	200	N	50	70	1,500	1,000	10	50	1,500
Z008	1.5	7	3	1	200	N	70	150	1,500	1,500	20	30	1,500
Z009	2	7	5	1	300	N	150	500	2,000	2,000	30	50	>5,000
Z011	2	5	2	.5	100	N	70	100	700	700	10	10	1,000
Z013	2	5	5	1	200	N	50	100	1,000	1,000	15	20	2,000
Z014	2	5	5	1	200	N	70	150	1,500	1,000	10	20	1,500
Z015	1.5	7	1.5	.5	200	N	50	150	500	500	L	15	700
Z018	1.5	5	2	.2	100	N	50	50	500	700	10	15	700
Z020	2	7	3	.5	150	N	70	500	1,000	700	30	30	1,000
Z022	3	7	3	1	200	N	100	300	1,500	1,000	10	20	1,000
Z023	2	7	2	.5	150	N	50	100	700	1,000	10	20	1,000
Z024	3	7	2	1	200	N	300	500	1,500	700	15	30	1,500
Z025	2	5	2	.5	200	N	150	500	1,000	700	10	30	700
Z028	2	7	2	1	200	N	150	500	1,000	500	10	30	700
Z029	2	7	1	.3	100	N	70	300	700	700	L	30	500
Z030	1.5	5	1.5	.3	100	N	70	200	700	500	20	15	500
Z033	1.5	7	2	.3	150	N	100	300	700	700	10	20	700
Z034	2	7	1.5	.3	150	N	100	300	700	700	10	15	1,000
Z036	1.5	7	1.5	.5	200	N	70	100	700	1,000	10	20	1,000
Z038	1.5	7	1	.3	200	N	70	100	500	700	L	15	700
Z039	1.5	5	1.5	.3	100	N	70	150	500	500	10	15	500
Z040	.7	2	1.5	.3	50	L	30	70	700	700	L	10	300
Z041 3/	.7	1.5	1.5	.3	50	L	50	50	1,000	700	L	10	300
Z045	1	2	1.5	.5	50	L	70	100	700	700	L	10	300
Z050	2	1.5	1.5	.3	30	L	70	300	500	300	10	20	300
Z051	1	1.5	2	.5	50	L	30	100	700	700	N	15	300
Z054	1.5	1.5	2	.7	50	L	50	150	700	500	15	20	300
Z056	1.5	1.5	1.5	.5	70	L	30	70	500	300	10	10	300
Z058	2	2	2	.7	50	L	70	100	700	500	10	15	300
Z060	1.5	2	3	.7	50	L	30	70	700	700	L	10	300
Z063	2	2	2	.5	30	L	50	100	500	500	10	20	300
Z065	2	3	3	.5	50	L	50	150	700	500	15	20	300
Z067	2	2	2	.5	50	L	70	100	500	300	10	L	300
Z069	2	3	1.5	.7	50	L	100	70	700	300	10	30	300
Z071	2	3	3	.7	30	L	50	10	700	500	10	10	300
Z073	1.5	1.5	2	.3	30	L	30	20	500	300	10	L	300
Z074	1	1.5	1	.5	30	L	30	30	300	200	10	L	300
Z075	1.5	1.5	1.5	.7	30	L	30	20	700	300	10	20	300
Z076	2	2	1.5	.5	30	L	30	20	700	700	15	20	300
Z078	1.5	2	2	.5	70	L	50	30	500	700	L	15	300
Z079	1.5	3	3	.3	50	N	30	50	1,000	1,000	L	N	300
Z080	.5	1.5	1	.7	50	N	20	20	700	300	L	L	300
Z081	.7	2	1.5	.3	50	N	30	30	500	700	L	10	300
Z083	.3	1.5	1	1	70	N	5	15	700	150	10	10	300
Z084	.5	1	2	.7	50	N	10	20	700	200	10	15	300
Z086	.7	2	1.5	.3	50	N	15	30	1,000	700	10	15	300
Z087	.2	2	1	.7	50	N	N	L	700	150	10	10	300
Z088	1	3	1	.7	70	N	15	30	1,000	500	L	10	300
Z089	.3	2	1	.7	50	N	N	L	1,000	300	10	20	300

1/ Also looked for spectrographically but not found in any sample except as noted: Au(10), As(200), Sb(100), Sn(10), Ag(0.5), Zn(200), Cd(20), W(50) for most samples, but W(20) for Z001 to A039, A001 to A084, and A257, 258.

3/ Ag detected but less than 0.5 ppm; Sn detected but less than 10 ppm.

primitive area, Greenlee County, Ariz., and Catron County, N. Mex.

termined amount of the element is present above the number shown; L indicates that an undetermined for but not found. Analysts: semiquantitative spectrographic analyses by Arnold Farley, Jr., Elizabeth arsenic analyses by Z. C. Stephenson, Gary Dounay, K. R. Murphy, A. J. Toevs; gold analyses by

Semiquantitative Spectrographic Analyses [1]

	(percent)				(ppm)								
Sample	Mg (.02)	Fe (.05)	Ca (.05)	Ti (.002)	V (10)	Mo (5)	Ni (2)	Cr (5)	Ba (10)	Sr (100)	B (10)	Pb (10)	Mn (10)
					Stream sediments--Continued								
Z091	1.0	2.0	1.5	0.5	70	N	30	70	700	700	L	15	300
Z092	.7	2	1	.3	50	N	20	50	700	500	L	15	300
Z093	.7	3	1.5	.7	50	N	20	30	1,000	1,000	L	L	300
Z094	1	3	1.5	.5	70	N	20	30	1,000	700	30	10	300
Z095	.7	2	1.5	.7	70	N	50	30	1,000	700	15	L	300
Z096	.7	1.5	1.5	.7	70	N	20	20	300	300	15	20	200
Z097	1	3	1.5	.7	70	L	70	300	700	1,000	L	L	300
Z098	1	3	2	.7	70	L	50	100	700	1,000	10	10	500
Z099	.7	2	1.5	.7	70	N	30	30	1,000	500	10	10	200
Z101	.7	2	1	.3	50	N	30	30	500	500	L	10	300
Z102	.7	3	1	.5	70	L	30	50	700	700	L	L	300
Z103	1	2	1.5	.5	70	L	50	20	700	700	L	L	300
Z104	1	3	1.5	.5	70	L	30	30	700	1,000	L	10	300
Z105	1	3	1.5	.5	70	L	30	30	700	1,000	L	15	300
Z106	1	5	1.5	.7	70	L	50	50	700	1,000	L	L	300
Z107	.7	3	1.5	.7	70	L	30	30	700	1,000	L	L	300
Z108	.7	3	1.5	.7	50	L	50	30	700	700	L	L	300
Z113	1.5	5	1.5	.5	70	L	50	30	700	1,500	L	10	700
Z114	1.5	3	1.5	.5	70	L	50	30	1,000	1,000	L	L	500
Z115	1	3	1.5	.3	70	L	30	30	500	1,500	L	10	300
Z116	1.5	3	1	.3	70	L	30	30	500	300	L	10	300
Z117	1.5	5	2	.5	70	L	30	50	700	1,000	L	10	500
Z118	1	3	1.5	.3	50	L	30	30	300	700	L	L	300
Z119	1.5	3	1.5	.7	70	L	50	30	700	1,000	L	10	300
Z120	1.5	3	1.5	.5	50	L	50	30	700	1,000	L	L	300
Z121	1.5	3	1.5	.5	50	L	50	30	1,000	1,000	L	10	300
Z122	1.5	3	1.5	.5	70	L	50	50	700	1,000	L	10	300
Z123	1.5	3	1.5	.5	70	L	30	30	700	700	L	10	300
Z124 [4]	.5	1.5	.7	.3	30	L	30	30	300	200	L	10	300
Z127	1	3	1.5	.7	50	L	30	70	700	700	L	10	300
Z128	1.5	3	1	.7	70	L	30	50	700	1,000	L	10	300
Z129	1.5	3	2	.7	50	L	30	70	700	700	L	10	300
Z130	1.5	3	1.5	.7	50	L	30	50	700	500	L	L	300
Z131	1	3	1.5	.7	70	L	30	30	500	500	L	15	300
Z132	1	3	1.5	.7	50	L	30	30	500	1,000	L	15	300
Z133	1.5	3	1.5	.7	50	L	50	30	700	700	L	15	500
Z134	1	3	1.5	.7	50	L	30	30	500	700	10	15	300
Z136	1	3	1	.7	50	L	30	30	500	700	L	15	300
Z137	1	2	1.5	.7	30	L	30	50	500	700	L	15	300
Z138	1	2	1.5	.7	50	L	30	30	700	700	L	10	300
Z139	1.5	3	1.5	.7	50	L	30	30	500	700	L	10	500
Z140	1	3	1.5	.7	50	L	30	50	500	700	L	L	300
Z141	1	3	1.5	.7	30	L	50	30	500	500	10	15	500
Z142	1	3	1.5	.7	30	L	30	30	700	700	L	15	500
Z143	1	3	1.5	.7	30	L	30	50	500	700	L	15	500
Z144	1	3	1.5	.7	50	L	30	30	500	700	L	10	500
Z145	1	3	1.5	.7	50	L	30	30	500	700	L	10	500
Z146	1	3	1.5	.7	50	L	50	50	500	500	10	10	500
Z147	1	3	1.5	.7	50	L	30	30	500	500	10	20	500
Z148	1	2	1	.3	70	L	30	50	1,000	1,000	L	15	300
Z149	1	2	1	.5	30	L	50	30	1,000	700	L	15	500
Z150	1.5	3	1.5	.5	30	L	50	50	1,500	1,000	L	L	300
Z151	1.5	3	1.5	.5	30	L	30	50	1,500	700	L	10	500
Z152	1.5	3	2	.5	30	L	50	100	700	700	L	L	300
Z153	1.5	3	2	.5	30	L	30	30	1,000	1,500	L	L	300

[4] Zn detected but less than 200 ppm.

TABLE 4.—*Analyses of stream-sediment samples from the Blue Range primitive*

Semiquantitative Spectrographic Analyses 1/

Sample	(percent) Mg (.02)	Fe (.05)	Ca (.05)	Ti (.002)	(ppm) V (10)	Mo (5)	Ni (2)	Cr (5)	Ba (10)	Sr (100)	B (10)	Pb (10)	Mn (10)
Stream sediments--Continued													
Z155	1.5	2.0	2.0	0.3	30	L	15	30	1,000	700	L	L	500
Z156	1.5	3	1.5	.7	30	L	30	30	1,000	1,000	L	L	500
Z157	1.5	3	1	.5	30	L	30	30	1,000	1,000	L	15	500
Z158	1	2	1	.3	30	L	30	30	700	1,000	L	10	200
Z160 5/	1.5	1.5	1.5	.5	30	L	10	30	1,000	700	L	10	300
Z161	1	1.5	1	.2	30	L	30	30	500	700	L	L	300
Z162	1	2	1	.5	30	L	50	30	1,000	500	L	L	500
Z163	1	3	1	.5	30	L	50	100	700	1,000	L	L	500
Z164	1	2	1	.5	30	L	30	50	500	500	L	L	500
Z165	1	1.5	2	.5	30	L	20	30	500	700	L	L	300
Z166	1	1.5	1.5	.7	30	L	50	50	700	700	L	L	500
Z167	1	2	1	.7	30	L	30	100	700	700	L	L	300
Z168	1	2	1	.7	30	L	30	100	700	300	L	10	500
Z169	1	2	1	.5	30	L	30	150	700	700	10	10	500
Z170	1	2	1	.7	30	L	30	150	700	700	L	10	500
Z171	1	5	3	.7	50	L	70	300	1,500	700	L	L	1,500
Z172	1.5	3	2	.7	70	L	100	300	1,000	500	10	L	1,500
Z173	1.5	5	1.5	.7	70	L	100	300	2,000	1,000	L	L	1,000
Z174	1.5	3	2	.7	70	L	70	200	1,000	700	L	L	700
Z175	1.5	3	2	.7	70	L	70	300	1,000	700	L	L	500
Z176	1.5	3	2	.7	70	L	50	70	1,000	700	L	L	700
Z177	1.5	3	2	.7	70	L	30	50	1,500	1,000	L	15	700
Z178	1.5	5	2	.7	70	L	70	150	1,500	1,000	L	L	700
Z179	1.5	5	2	.7	70	L	70	200	1,500	700	L	L	500
Z180	1	3	1.5	.7	50	L	50	30	1,000	700	L	L	700
Z181	1	3	1.5	.7	70	L	30	30	1,000	700	L	L	700
Z182	1.5	3	1.5	.7	70	L	70	100	1,000	1,000	L	10	700
Z183	1.5	3	1.5	.7	70	L	70	200	1,000	700	L	L	700
Z184	1.5	3	1.5	.7	70	L	70	150	1,000	1,000	L	10	700
Z185	1.5	3	1.5	.7	70	L	70	200	1,000	200	L	L	700
Z186	1.5	3	1.5	.7	70	L	70	150	1,000	300	L	15	700
Z187	1.5	3	1.5	.7	70	L	70	150	1,000	700	L	L	700
Z188	1.5	3	1	.7	70	L	70	30	1,000	700	L	L	700
Z189	1.5	3	2	.7	70	L	100	200	1,000	1,000	L	L	700
Z190	1.5	3	2	.7	70	L	70	70	1,000	1,000	L	L	700
Z191	1.5	3	2	.5	70	L	30	70	1,000	1,000	L	L	500
Z192	1.5	5	2	.7	70	L	70	200	1,000	1,000	L	L	700
Z193	1.5	5	2	.7	70	L	70	300	1,000	1,000	L	L	700
Z194	1.5	2	1.5	1	50	L	70	300	1,000	700	L	10	500
Z195	2	3	2	1	50	L	70	300	700	1,000	L	L	500
Z196	1.5	3	2	.7	70	L	70	200	1,000	1,000	L	L	300
Z197	2	3	1.5	.3	70	L	50	30	700	1,000	L	L	300
Z198	1.5	3	1.5	.5	70	L	70	300	700	1,000	L	L	500
Z199	1.5	3	1.5	.7	70	L	50	70	700	700	L	10	700
Z200	1.5	3	1.5	1	70	L	70	200	700	1,000	L	L	300
Z201	1.5	3	1	.7	70	L	50	30	700	1,000	L	L	300
Z202	1	3	1.5	.7	70	L	50	50	700	1,000	L	L	300
Z203	1.5	3	2	.7	70	L	50	30	1,000	1,000	L	L	300
Z204	1.5	3	2	.7	70	L	70	100	1,000	1,000	L	L	300
Z205	1.5	3	2	.7	70	L	70	150	1,000	1,500	L	15	300
Z206 6/	5	10	7	1	200	N	150	500	1,000	1,500	10	30	1,500
Z207 7/	3	10	5	1	200	N	100	300	1,000	1,000	L	30	700
Z212	3	7	2	.7	100	N	300	300	700	700	15	20	1,000
Z213	2	10	2	.7	200	N	70	150	700	500	20	30	700
Z215	3	10	3	.7	200	20	150	300	1,000	500	L	30	1,000

5/ Sn detected but less than 10 ppm.

6/ 0.7 ppm Ag.

area, Greenlee County, Ariz., and Catron County, N. Mex.—Continued

Semiquantitative Spectrographic Analyses 1/

	(percent)				(ppm)								
Sample	Mg (.02)	Fe (.05)	Ca (.05)	Ti (.002)	V (10)	Mo (5)	Ni (2)	Cr (5)	Ba (10)	Sr (100)	B (10)	Pb (10)	Mn (10)
					Stream sediments--Continued								
Z216	3.0	10	5.0	0.7	200	N	100	300	1,500	500	15	30	1,500
Z217 8/	3	10	2	.7	200	L	100	150	1,000	500	100	30	1,000
Z218	5	10	3	>1	200	N	200	500	1,500	700	30	70	1,500
Z220	3	10	3	1	300	N	150	300	1,000	500	10	30	700
Z221	3	10	3	1	200	N	100	150	700	500	15	50	700
Z222 9/	1.5	10	1.5	1	150	N	70	150	700	300	20	70	1,000
Z223	3	10	2	1	200	N	100	150	700	300	L	10	1,000
Z224	3	15	5	>1	300	N	100	300	1,000	700	15	30	1,000
Z225	3	15	.3	1	300	N	100	200	700	500	10	20	1,000
Z226	2	10	1.5	1	200	N	70	150	700	500	10	30	1,000
Z227	3	10	1.5	1	300	N	100	150	700	700	10	30	1,000
Z228	2	10	2	1	300	N	70	100	700	700	10	30	700
Z229	2	7	1.5	.7	100	L	100	150	700	700	20	30	700
Z230 10/	2	10	3	.7	200	N	70	100	1,000	1,000	10	30	1,500
Z231	3	10	2	.7	150	N	100	200	700	700	10	30	1,000
Z232	3	10	1.5	.7	200	N	100	200	700	700	L	30	1,000
Z233	2	7	1.5	.5	100	N	70	150	700	500	L	20	1,000
Z234	1.5	7	1	.5	70	L	30	70	500	150	10	50	1,000
Z235 9/	2	10	2	.7	150	5	150	300	700	300	L	20	1,500
Z236	1.5	10	1.5	.7	150	L	100	300	700	500	15	30	1,000
Z237	1.5	10	1.5	1	200	N	100	300	1,000	500	15	50	3,000
Z244	2	.7	1	.5	100	N	70	150	700	500	15	30	1,000
Z245	1	3	.7	.3	50	N	15	30	200	100	15	70	1,000
Z246	.7	5	.7	.3	70	15	20	70	300	100	30	70	2,000
Z247	2	7	2	.5	150	N	70	150	700	700	10	20	2,000
Z248	2	7	1.5	.5	200	N	70	100	700	700	10	30	2,000
Z249	1.5	5	1.5	.3	150	N	30	50	500	500	10	20	2,000
Z250	2	7	2	.3	200	L	50	50	300	700	L	10	7,000
Z251	1.5	5	1.5	.3	100	N	50	70	300	500	10	30	300
Z252	2	7	2	.3	150	N	50	70	300	700	L	10	100
Z253	3	7	2	.5	70	N	30	20	200	500	L	L	500
Z254 10/	3	7	2	.5	100	N	30	30	300	500	L	10	500
Z255	2	7	2	.5	100	N	30	20	300	700	10	15	700
Z256	3	7	2	.5	100	N	30	30	500	700	L	20	1,000
Z258	.7	5	1.5	.3	70	N	10	15	500	700	N	15	500
Z259	.7	3	1.5	.5	150	N	20	30	300	500	N	10	500
Z260	.7	3	2	.3	100	N	10	10	500	500	N	L	700
Z261	.5	3	1	.3	70	N	7	10	300	300	N	10	500
Z262	.3	3	1	.5	70	N	7	15	300	200	10	15	700
Z263	.3	3	1	.3	70	N	5	7	300	200	L	15	700
Z264	.7	3	1.5	.3	70	N	7	20	300	700	N	L	500
Z265	1	3	1.5	.7	70	N	10	20	500	700	N	L	700
Z266	.7	3	1.5	.5	70	N	7	15	300	700	N	L	700
Z267	.7	3	1.5	.3	70	N	7	15	500	700	N	L	700
Z268	.7	3	1.5	.3	70	N	7	20	500	700	N	L	700
Z269	.7	2	1.5	.3	50	N	7	15	500	300	N	L	1,000
Z271	3	10	5	.1	300	N	50	30	1,000	500	20	20	700
Z272	1.5	7	2	1	200	N	70	50	700	300	20	20	1,000
Z273	3	15	3	1	150	N	50	10	500	300	20	15	700
Z274	3	15	3	>1	150	N	30	30	1,000	300	20	15	1,500
Z276	3	15	3	>1	150	N	70	70	1,000	500	30	15	1,500
Z277	1.5	15	7	>1	100	N	50	50	1,000	500	20	20	1,000
Z278	2	15	5	1	150	N	70	70	1,000	500	30	20	1,000
Z279	2	15	3	1	100	N	70	200	1,000	300	50	20	1,500
Z280	2	15	5	>1	200	N	70	150	1,000	300	20	15	1,000

8/ Zn detected but less than 200 ppm; Sn detected but less than 10 ppm.

9/ Sn detected but less than 10 ppm.

TABLE 4.—*Analyses of stream-sediment samples from the Blue Range primitive*

Semiquantitative Spectrographic Analyses 1/

	(percent)				(ppm)								
Sample	Mg (.02)	Fe (.05)	Ca (.05)	Ti (.002)	V (10)	Mo (5)	Ni (2)	Cr (5)	Ba (10)	Sr (100)	B (10)	Pb (10)	Mn (10)
					Stream sediments--Continued								
Z281	2.0	15	7.0	>1.0	150	N	70	150	1,500	700	30	30	1,000
Z282	3	15	7	>1	150	N	70	200	1,000	700	30	20	1,000
Z283	3	15	7	>1	200	N	70	150	1,000	700	20	20	2,000
Z284	2	15	7	1	150	N	70	500	1,000	700	20	20	1,500
Z285	3	>20	7	>1	150	N	150	70	1,500	300	30	15	3,000
Z286	1.5	10	7	1	150	N	50	70	1,000	300	20	10	1,000
Z287	2	15	5	1	150	N	50	200	1,500	500	20	15	1,500
Z288	3	15	7	1	150	N	70	70	1,000	500	20	10	1,000
Z289	2	10	5	1	150	N	70	70	1,000	500	20	10	1,000
Z290	2	10	3	1	150	N	70	150	1,000	500	20	15	1,000
Z291	3	15	5	1	150	N	70	100	1,000	500	20	15	1,000
Z292	2	10	3	1	150	N	70	70	1,000	500	20	15	1,000
Z293	2	20	5	>1	150	N	70	200	1,500	500	30	15	1,500
Z294	2	5	2	.7	150	N	70	150	700	700	15	30	700
Z295	2	7	5	1	150	N	70	200	1,000	1,000	20	30	700
Z296	2	5	3	.7	100	15	70	100	1,000	1,000	20	30	700
Z297	2	5	2	1	100	N	70	200	700	700	15	30	700
Z298	1.5	5	3	1	150	N	70	150	1,000	700	15	30	700
Z299	3	7	5	1	150	L	150	300	1,000	1,000	15	30	1,000
Z300	3	7	5	1	200	N	100	200	1,000	1,500	15	30	1,000
Z301	2	7	2	.7	200	7	70	100	700	700	10	30	1,000
Z302	2	7	3	1	200	N	70	150	700	1,000	15	30	1,500
Z303	2	5	2	1	200	N	100	200	700	700	15	20	700
Z304	2	5	2	1	200	N	150	300	1,000	700	15	30	700
Z305	1.5	5	2	.7	70	N	70	200	1,000	700	L	30	700
Z306	2	5	3	1	150	N	70	150	1,000	700	10	20	700
Z307	2	5	2	1	100	N	70	150	700	700	10	30	1,000
Z308	2	5	5	1	200	N	70	150	1,000	700	30	20	700
Z311	2	7	3	1	200	N	100	200	1,000	1,000	15	30	1,000
Z312	1.5	7	2	1	200	N	100	200	1,000	1,500	30	30	1,000
Z313	2	5	3	1	150	N	70	200	1,000	1,500	20	30	1,500
Z314	2	5	3	1	150	N	70	200	1,000	1,500	20	30	1,000
Z315	3	10	3	>1	200	N	150	700	700	700	30	20	1,500
Z316	2	5	3	.7	100	N	50	200	700	700	15	30	700
Z317	2	7	3	.7	150	N	150	200	1,000	1,000	15	30	1,000
Z318	2	7	5	1	200	N	150	300	1,000	1,500	10	30	1,500
Z319	2	5	3	.7	100	N	150	100	1,000	1,000	10	30	1,000
Z320	2	5	3	.5	100	N	150	150	700	700	15	30	700
Z322	2	10	3	>1	200	N	150	500	1,000	1,000	10	30	700
Z323	2	10	2	1	200	N	150	200	1,000	700	10	30	1,000
Z324	2	5	1.5	.3	70	N	200	300	700	700	L	20	1,000
Z325	2	5	2	.7	100	N	500	500	1,000	700	L	30	1,000
Z326	2	5	2	.7	150	N	100	100	1,000	1,000	15	30	1,000
Z327	2	5	2	.5	150	N	100	150	1,000	700	L	30	1,000
Z328	2	5	3	.7	200	N	150	150	1,500	1,500	15	30	1,500
Z329	2	5	1.5	.7	100	N	100	100	700	700	L	30	1,000
Z330	2	5	2	.5	100	N	150	100	1,000	700	10	30	1,000
Z331	1.5	5	2	.7	100	N	100	100	1,000	700	L	20	1,000
Z332	2	5	1.5	.5	100	N	150	150	700	700	L	10	1,000
Z333	2	5	2	.5	100	N	150	300	700	700	15	30	1,000
Z334	2	5	3	.5	100	N	150	150	1,000	1,000	10	20	1,000
Z335	2	5	1.5	.5	100	N	150	150	700	700	L	20	700
Z336	2	5	3	.7	150	N	150	300	700	700	10	30	1,000
Z337	1.5	5	1.5	.3	100	N	100	70	500	500	L	20	700
Z338	2	5	3	.7	100	7	150	300	700	700	L	20	1,000
Z339	2	5	2	.7	200	N	150	150	700	700	L	15	1,000
Z340•	2	5	5	1	70	N	200	300	700	1,000	10	30	1,500
Z341	3	3	2	.3	200	N	70	150	500	700	20	20	700
Z342	3	7	5	.1	200	L	150	500	1,000	1,000	50	20	1,000
Z343	2	7	3	.7	200	N	150	500	1,000	700	20	20	1,000

area, Greenlee County, Ariz., and Catron County, N. Mex.—Continued

Semiquantitative Spectrographic Analyses 1/

	(percent)				(ppm)								
Sample	Mg (.02)	Fe (.05)	Ca (.05)	Ti (.002)	V (10)	Mo (5)	Ni (2)	Cr (5)	Ba (10)	Sr (100)	B (10)	Pb (10)	Mn (10)
					Stream sediments--Continued								
Z344	2.0	5	5.0	0.5	200	L	70	150	700	1,000	10	50	1,000
Z345	2	10	.1	.5	100	L	100	200	1,000	500	20	15	500
Z348	2	10	.2	.5	100	L	200	1,000	1,000	200	10	L	500
Z349	2	10	.2	.5	100	L	200	300	1,000	200	10	L	500
Z350	1	10	.2	.5	100	L	100	200	1,000	300	10	L	500
Z351	1	10	.2	.5	50	L	50	100	1,000	300	10	L	500
Z352	1	10	.2	.5	100	L	70	100	1,000	300	10	10	500
Z353	1	10	.2	.5	100	L	100	300	1,000	500	10	10	500
Z354	2	10	.2	.5	100	L	200	200	1,000	500	10	10	500
Z355	1	10	.2	.5	100	L	100	100	1,000	200	10	10	500
Z356	2	10	.2	.5	100	L	100	200	1,000	300	10	10	500
Z357	1	10	.2	.5	100	L	100	200	1,000	300	10	15	500
Z358	1	10	2	.5	100	L	100	150	1,000	100	10	10	500
Z359	2	10	2	.5	100	L	200	200	1,000	300	10	10	500
Z360	1	10	2	.5	100	L	100	100	1,000	300	10	10	500
Z361	1	10	2	.5	100	L	100	100	1,000	300	10	L	500
Z362	1	10	2	.5	100	L	100	200	1,000	200	20	10	500
Z363	1	10	2	.5	100	L	100	200	1,000	300	10	10	500
Z364	1	10	2	.5	100	L	100	200	1,000	300	10	L	500
Z365	1	10	2	.5	100	L	100	200	1,000	300	10	10	500
Z366	1	10	2	.5	200	L	100	200	1,000	100	10	L	500
Z367	2	10	2	.5	100	L	150	200	1,000	300	10	10	500
Z368	1	10	3	.2	100	L	100	200	2,000	300	10	10	500
Z369	1	10	2	.1	70	L	100	100	2,000	100	10	50	200
Z370	1	10	2	.2	70	L	200	200	2,000	200	10	20	500
Z371	1	10	2	.2	70	L	100	200	2,000	300	10	20	500
Z372	1	10	2	.2	70	L	200	200	2,000	500	10	20	500
Z373	1	10	2	.2	70	L	100	200	2,000	300	10	10	500
Z374	1	10	2	.2	70	L	100	100	2,000	300	L	10	500
Z375	1	10	2	.2	200	L	100	200	2,000	300	10	20	500
Z376	1	10	2	.2	200	L	100	100	2,000	300	10	10	500
Z377	1	10	2	.2	200	L	100	100	2,000	300	10	20	200
Z378	2	10	2	.2	100	L	200	100	2,000	300	10	10	200
Z379	2	10	2	.5	100	L	200	500	2,000	300	10	20	500
Z380	2	10	2	.1	100	L	100	200	2,000	300	10	30	500
Z381	1	10	2	.2	100	L	100	200	2,000	300	10	20	500
Z382	1	10	2	.5	100	L	200	500	2,000	300	10	10	500
Z383	1	10	2	.2	100	L	100	300	2,000	300	10	10	500
Z384	1	10	2	.2	100	L	100	300	2,000	300	10	10	500
Z385	1	10	2	.2	100	L	200	300	2,000	300	10	20	200
Z386	1	10	2	.2	100	L	100	200	2,000	300	10	10	200
Z387	1	10	2	.2	100	L	100	200	2,000	300	10	20	500
Z388	1	10	2	.2	100	L	100	200	2,000	300	L	20	200
Z389	1	10	2	.2	100	L	100	70	2,000	300	L	20	200
Z390	1	10	2	.2	100	L	100	50	1,000	300	L	10	200
Z391	2	10	1	.5	100	N	70	100	1,000	700	L	10	500
Z392	2	10	1	.5	100	N	70	100	1,000	1,000	L	10	500
Z393	2	7	1	.5	100	N	70	100	1,000	1,500	L	10	500
Z395	2	2	1	.5	50	N	30	50	700	1,000	L	50	500
Z396	2	10	2	.7	70	N	50	100	1,000	2,000	L	50	700
Z397	3	7	2	.7	100	N	50	70	1,500	1,500	L	30	700
Z398	2	7	1.5	.5	150	N	50	70	1,000	1,500	L	20	700
Z399	2	5	1	.5	70	N	30	50	1,000	1,000	10	30	1,000
Z400	3	10	1.5	.5	100	N	70	100	1,500	1,500	L	30	700
Z402	2	7	1.5	.5	70	N	15	N	1,500	700	10	70	2,000
Z403	2	10	1.5	.5	100	N	70	70	1,000	2,000	L	30	700
Z404	1.5	10	1	.5	70	N	50	50	1,500	1,500	L	20	700
Z405	2	10	1	.7	100	N	50	70	1,500	2,000	L	20	700
Z406	2	10	1.5	.3	100	N	70	70	1,500	2,000	L	20	700
Z408	1.5	10	1.5	.5	100	N	30	50	1,000	2,000	10	30	1,000

TABLE 4.—*Analyses of stream-sediment samples from the Blue Range primitive*

Semiquantitative Spectrographic Analyses 1/

	(percent)				(ppm)								
Sample	Mg (.02)	Fe (.05)	Ca (.05)	Ti (.002)	V (10)	Mo (5)	Ni (2)	Cr (5)	Ba (10)	Sr (100)	B (10)	Pb (10)	Mn (10)
					Stream sediments--Continued								
Z409	1.0	10.0	1.5	0.5	100	N	30	50	1,000	2,000	10	20	500
Z410	1	7	2	.3	70	N	30	30	1,500	1,500	10	20	500
Z411	5	7	3	.3	70	N	300	1,000	2,000	1,500	20	50	700
Z412	1	5	1	.5	70	N	20	10	1,500	1,000	10	30	500
Z413	2	7	1.5	.5	100	N	150	200	2,000	1,500	L	30	1,000
Z414	2	7	1.5	.3	100	N	30	50	1,000	1,000	L	30	700
Z415	1.5	10	1.5	.5	100	N	50	100	1,500	1,500	10	30	700
Z416	2	10	2	.5	150	N	70	70	1,500	1,500	L	30	1,000
Z426	.7	15	1	>1	200	L	30	30	3,000	300	30	30	1,500
Z427	2	3	2	.7	150	N	70	100	700	1,000	10	30	1,000
Z428	.7	3	1	1	100	N	20	20	300	200	20	15	1,000
Z429	1.5	10	2	1	150	N	30	70	700	700	10	20	1,500
Z430	2	20	2	>1	500	L	100	300	700	300	15	10	2,000
Z431	.7	15	1	>1	200	L	70	100	500	300	10	10	1,000
Z432	1.5	7	2	.7	100	N	30	30	700	700	15	15	1,000
Z433	2	10	1.5	.5	150	N	50	50	1,000	1,000	N	30	700
Z434	2	10	1.5	.5	150	N	70	100	1,000	1,500	10	20	700
Z435	3	10	2	.5	200	N	70	100	1,500	1,000	L	30	1,000
Z436	3	10	1.5	.5	150	N	100	150	1,000	3,000	L	20	700
Z437	2	10	1.5	.5	100	N	70	100	1,500	2,000	L	50	700
Z438	2	10	1.5	.5	150	N	50	100	1,000	1,500	L	30	700
Z439	2	10	1.5	.5	70	N	50	100	2,000	2,000	L	30	700
Z440	2	10	2	.7	100	N	30	50	1,500	1,500	10	20	700
Z441	2	10	1	.5	100	N	50	50	1,000	2,000	L	15	500
Z442	2	15	1.5	.7	150	N	150	500	1,500	2,000	L	20	700
Z443	2	10	1	.5	70	N	100	200	1,000	700	L	L	300
Z444	2	10	2	.5	200	N	100	200	1,500	2,000	L	15	1,000
Z445	3	15	2	.7	150	N	50	30	1,000	1,000	L	20	1,000
Z446	2	15	1.5	.7	200	N	70	200	1,000	700	L	15	700
Z447	3	10	1.5	.7	150	N	200	300	1,500	700	L	15	700
Z448	3	10	1.5	.7	150	N	70	200	1,500	2,000	L	30	700
Z451	2	5	1	.5	70	N	30	50	500	700	L	L	500
Z452	3	10	2	.7	200	N	100	200	1,500	3,000	L	30	1,000
Z453	3	10	3	.7	150	N	50	100	1,000	2,000	L	30	1,000
Z454	3	10	2	.7	150	N	70	100	1,000	2,000	L	30	1,000
Z455	2	7	2	.5	150	N	100	100	1,500	2,000	L	20	700
Z456	2	5	.2	.7	200	L	100	300	1,000	1,500	L	20	700
Z457	1.5	7	1	.5	100	N	100	150	1,500	1,000	L	20	500
Z458	3	15	2	.7	100	N	100	200	1,000	2,000	L	20	700
Z459	3	15	1.5	.7	100	N	50	70	1,500	1,500	L	30	700
Z461	2	10	2	1.5	100	N	70	150	1,000	2,000	10	30	700
Z462	2	5	1.5	.5	100	N	150	200	1,000	700	10	20	700
Z463	3	10	2	1.5	150	N	100	150	1,000	1,500	10	50	1,000
Z464	2	3	2	1	150	N	100	200	1,000	2,000	L	20	500
Z465	2	10	1.5	.5	150	N	100	150	1,500	1,500	L	20	1,000
Z466	2	10	1.5	1.5	100	N	50	70	1,000	1,000	L	20	700
Z467	2	5	1.5	.5	100	N	100	300	1,000	1,500	L	20	1,000
Z468	1.5	5	1.5	.5	100	N	50	70	1,000	700	L	15	700
Z469	2	3	1.5	.5	100	N	50	70	1,000	1,000	L	20	700
Z470	1.5	5	1.5	.5	150	N	70	70	1,500	1,500	L	50	700
Z471	2	3	1.5	.5	100	N	30	70	1,000	1,000	10	20	500
Z472	2	7	2	.5	150	N	150	150	1,500	2,000	L	30	700
Z473	3	5	1.5	.5	150	N	100	200	1,500	2,000	L	30	700
Z475	2	3	1.5	.5	100	N	50	50	1,000	700	L	20	500
Z477	1	---	1	.7	100	N	50	70	500	200	L	10	500
Z491	1	1.5	1	.3	70	L	30	15	500	300	L	L	300
Z492	1	1.5	1.5	.5	70	L	100	150	700	500	L	10	500
Z500	.5	1.5	1	.3	70	L	10	15	500	300	10	15	700
Z501	.5	1.5	1	.5	50	L	10	15	300	200	15	15	700
Z502	1	2	1	.1	100	L	30	20	300	200	10	L	700

area, Greenlee County, Ariz., and Catron County, N. Mex.—Continued

Semiquantitative Spectrographic Analyses 1/

	(percent)				(ppm)								
Sample	Mg (.02)	Fe (.05)	Ca (.05)	Ti (.002)	V (10)	Mo (5)	Ni (2)	Cr (5)	Ba (10)	Sr (100)	B (10)	Pb (10)	Mn (10)
					Stream sediments--Continued								
Z503	1.0	2.0	1.5	0.3	50	L	20	10	500	500	L	10	300
Z504	.5	1.5	1	.5	70	L	20	20	300	200	10	15	500
Z505	1	2	2	.5	100	L	20	30	700	500	10	L	700
Z506	1	2	1.5	.5	100	L	20	20	500	500	10	L	500
Z507	.5	1.5	1	.3	50	N	30	50	300	300	15	10	500
Z508	1	1.5	1.5	.3	70	L	15	7	500	500	L	10	500
Z509	1	1.5	1.5	.5	70	N	15	10	300	500	L	10	500
Z510	.5	1	1	.2	30	L	10	7	300	300	L	10	200
Z511	.5	1.5	1	.3	50	N	10	7	200	300	L	L	200
Z512	1	1.5	1.5	.3	50	L	10	10	500	300	10	L	500
Z513	.5	1	.5	.3	30	L	5	7	200	500	10	10	500
Z515	1	2	1.5	.7	70	L	10	10	500	200	15	10	500
Z516	.5	1.5	1	.3	50	L	7	10	300	500	10	L	500
Z517	1	2	1.5	.3	70	L	7	10	500	500	10	L	700
Z518	1	1.5	1.5	.5	70	N	7	7	300	300	L	L	500
Z519	1.5	1.5	2	.5	70	L	10	5	500	700	L	L	700
Z520	1	1.5	1.5	.5	100	L	20	100	500	300	10	10	700
Z521	.5	1	1	.3	70	L	15	30	300	300	10	L	500
Z522	1.5	2	2	.5	100	N	150	500	500	500	L	L	500
Z523	.5	1.5	1.5	.3	70	N	20	50	300	300	L	10	500
Z524	.5	1.5	2	.2	50	N	20	30	500	300	10	10	500
Z525	.7	1.5	2	.2	50	N	20	100	500	300	L	10	700
Z526	.7	2	2	.3	70	N	20	50	700	300	10	15	500
Z527	.7	2	1.5	.5	70	N	30	150	500	500	10	10	500
Z528	.5	2	1	.5	100	N	20	100	500	300	15	15	700
Z529	.5	1.5	1	.3	70	N	30	50	300	300	20	10	500
Z531	.7	2	1.5	.5	70	N	30	100	700	300	15	10	500
Z537	1	1.5	1.5	.3	70	N	50	50	700	500	10	10	300
Z541	1	2	2	.5	70	N	50	300	700	500	L	10	500
Z542	1	2	2	.5	70	N	50	500	700	500	L	L	500
Z543	1	2	2	.5	70	N	50	300	700	500	10	10	500
Z544	1	1.5	2	.5	70	L	100	200	700	700	10	10	500
Z545	.7	1.5	1.5	.5	70	L	20	50	500	300	20	10	100
Z546	1.5	2	3	.5	100	N	100	300	700	700	L	L	300
Z547	1.5	2	2	.5	100	N	100	500	700	700	L	10	500
Z548	.5	1.5	1.5	.3	70	N	50	50	700	700	10	20	300
Z549	1	2	2	.5	100	N	100	200	700	700	10	10	500
Z555	1.5	2	1.5	.5	100	N	100	200	700	500	10	10	500
Z556	1.5	2	2	.5	100	N	150	300	700	700	L	L	500
Z578	1	2	1	.3	70	N	50	50	500	500	10	15	500
Z579	1	2	1.5	.5	70	N	70	70	500	500	10	10	300
Z580	.7	1	1	.3	70	N	50	50	500	500	10	10	500
Z581	1	1.5	2	.5	70	N	50	50	700	500	10	10	500
Z680	3	10	5	1	150	N	70	150	1,000	1,000	L	30	1,000
Z681	3	7	3	1	150	N	70	100	1,000	700	L	30	1,000
Z686	1.5	7	1.5	1	100	N	70	150	700	700	10	30	700
Z687	2	15	3	>1	300	N	150	300	1,000	700	15	30	700
Z688	3	7	3	.7	100	N	70	150	1,000	700	L	30	700
Z689	3	7	2	.7	100	N	70	200	1,000	700	15	30	700
Z690	3	10	3	1	200	N	70	300	1,000	1,000	15	30	1,000
Z691	3	7	3	.7	100	N	100	300	1,500	700	10	30	1,000
Z692	2	15	3	1	150	N	100	300	1,500	1,000	20	20	1,000
Z694	5	7	3	1	150	N	150	500	1,000	500	15	30	1,000
Z696	5	10	2	1	150	N	200	500	1,000	300	L	20	1,000
Z697	3	10	2	1	150	N	200	700	700	500	L	20	1,000
Z698	2	10	3	1	150	N	100	200	700	700	15	20	1,000
Z699	3	10	3	1	150	N	150	300	1,000	700	15	30	1,500
A001 11/	2	5	1	.3	100	N	150	300	700	500	50	30	700
A003 12/	1	7	1.5	.5	200	N	70	150	500	300	10	20	1,000
A005	1.5	5	1	.5	70	N	100	200	700	300	15	20	1,000

11/ 0.7 ppm Ag

TABLE 4.—*Analyses of stream-sediment samples from the Blue Range primitive*

Semiquantitative Spectrographic Analyses 1/

	(percent)				(ppm)								
Sample	Mg (.02)	Fe (.05)	Ca (.05)	Ti (.002)	V (10)	Mo (5)	Ni (2)	Cr (5)	Ba (10)	Sr (100)	B (10)	Pb (10)	Mn (10)
					Stream sediments--Continued								
A006	2.0	7.0	1.0	0.5	100	N	70	100	1,000	500	15	50	700
Z009	1.5	5	1	.3	100	N	70	100	700	500	L	30	1,000
A010	2	5	1.5	.5	200	N	50	100	500	300	10	30	1,000
A011	3	5	1.5	.5	70	N	150	200	700	500	L	15	1,000
A012	1	3	1.5	.3	100	N	50	70	700	700	L	20	700
A013	1	3	1.5	.3	150	N	50	100	500	500	10	20	700
A016	1	3	1.5	.3	100	N	50	50	500	500	L	15	1,000
A017	1.5	3	1.5	.3	100	N	50	150	500	300	L	20	1,000
A019	1.5	5	1.5	.3	200	N	50	70	500	500	10	15	700
A026	1.5	5	1.5	.3	70	N	70	100	700	700	L	15	500
A028	1.5	3	1.5	.3	70	N	50	20	500	500	L	20	700
A031	2	5	2	.5	100	N	70	150	1,000	700	15	20	1,000
A033	2	5	2	.3	150	N	70	100	1,000	700	10	20	1,000
A035	2	5	1.5	.3	100	N	70	200	700	500	L	10	1,000
A036	2	5	2	.5	150	N	70	150	1,000	700	50	20	1,000
A038	2	3	2	.3	100	N	50	70	700	500	10	20	1,000
A040	1.5	3	1.5	.3	70	N	30	70	500	500	L	15	700
A041	1.5	3	.5	.2	30	N	30	50	200	N	L	30	1,000
A043	2	5	1.5	.3	100	N	50	70	300	500	10	20	700
A045	1.5	5	1.5	.3	50	N	50	70	700	700	10	20	700
A047	1.5	3	.7	.2	100	N	30	50	300	500	10	15	500
A049	1.5	3	1	.3	100	N	50	150	500	500	10	20	500
A051	1.5	3	1	.3	100	N	50	100	500	500	15	20	700
A053	1.5	5	1	.3	100	N	50	150	700	300	20	30	700
A055	1.5	3	1	.3	100	N	50	100	700	700	20	30	700
A057	2	5	1.5	.3	100	N	100	500	1,000	700	15	30	700
A058	1.5	5	1.5	.3	100	N	700	150	1,000	500	10	30	700
A059 13/	2	3	1	.3	50	N	150	500	700	200	30	20	500
A062	1.5	5	1	.3	150	N	50	100	300	300	10	30	700
A063	1.5	5	1.5	.3	100	N	150	500	1,000	300	10	15	700
A064 13/	2	5	1.5	.5	150	N	100	500	500	300	50	20	700
A065	2	3	1.5	.3	100	N	70	200	700	500	20	20	500
A067	2	5	1.5	.3	200	N	100	300	1,000	500	20	20	1,000
A068	2	5	1.5	.5	200	N	100	300	1,000	700	15	15	700
A069	1.5	5	2	.3	200	N	100	300	1,000	500	50	30	1,000
A070	1.5	3	1	.3	200	N	70	100	700	700	L	30	1,000
A071	1	3	1	.2	150	N	50	100	700	700	10	20	200
A072	1	5	2	.5	200	N	100	500	1,000	300	20	30	500
A073	1.5	5	1.5	.5	200	N	100	500	700	500	10	20	500
A074	1.5	5	1.5	.3	200	N	50	70	700	1,000	L	20	500
A075	3	7	3	.1	200	N	70	150	1,500	2,000	30	30	1,000
A076	2	5	5	.5	100	N	50	50	1,500	2,000	20	30	1,000
A077	2	7	3	.1	200	N	50	70	1,000	1,500	15	20	1,000
A078	2	7	5	.1	100	N	70	200	1,500	1,500	10	20	1,000
A080	3	5	2	.5	200	N	70	200	1,500	1,000	10	20	1,000
A081	1	7	.5	1	200	N	50	70	1,000	700	50	20	150
A083	---	---	---	---	---	---	---	---	---	---	---	---	---
A084	2	7	3	1	200	N	70	150	1,000	1,000	20	30	1,000
A085	.7	3	1.5	.5	70	N	10	30	500	500	N	L	500
A086	.7	2	1.5	.3	70	N	30	100	300	300	N	L	300
A087	.2	.7	.5	.1	30	N	20	30	150	100	N	N	150
A088	.5	1.5	.5	.3	50	N	30	50	300	150	N	10	300
A089	.7	2	1	.3	70	N	7	7	300	700	N	L	300
A090	.7	2	1.5	.5	100	N	7	15	500	700	N	L	700
A091	.7	3	2	.7	150	N	10	30	300	700	N	10	700

13/ Ag detected but less than 0.5 ppm.

area, Greenlee County, Ariz., and Catron County, N. Mex.—Continued

Semiquantitative Spectrographic Analyses 1/

Sample	Mg (.02) (percent)	Fe (.05)	Ca (.05)	Ti (.002)	V (10) (ppm)	Mo (5)	Ni (2)	Cr (5)	Ba (10)	Sr (100)	B (10)	Pb (10)	Mn (10)
Stream sediments--Continued													
A092	0.7	3.0	1.5	0.5	70	N	7	20	500	1,000	N	L	500
A093	.7	2	1.5	.3	70	N	30	70	500	500	N	L	500
A094	.7	3	1.5	.7	70	N	70	150	500	500	N	L	700
A095	.7	3	1.5	.5	100	N	10	30	500	500	N	L	500
A096	1	3	2	.5	70	N	7	20	500	700	N	L	700
A097	1	2	1.5	.2	70	N	5	15	300	300	N	L	300
A098	.7	3	1.5	.3	70	N	20	30	500	700	N	10	700
A099	1	3	2	.5	70	N	20	70	500	700	N	L	700
A100	.7	3	2	.7	70	N	20	70	500	700	N	N	500
A101	.7	2	1.5	.3	70	N	15	30	500	500	L	20	500
A102	1	3	2	.7	70	N	70	150	700	700	N	L	500
A103	.7	3	1	1	70	N	100	200	700	300	N	10	500
A106	.5	1.5	1	.5	50	N	30	150	500	150	N	L	300
A107	.3	1.5	.7	.3	30	N	20	70	300	70	N	L	300
A108	1.5	5	3	.5	100	N	70	300	700	700	15	10	1,000
A109	1	3	1.5	.3	70	N	50	70	300	300	10	20	500
A110	1	3	2	.5	70	N	70	200	500	700	15	10	1,500
A111	1.5	3	3	.7	100	N	70	300	700	1,000	15	10	700
A112	1.5	3	1.5	.5	70	N	70	300	500	700	20	10	500
A113	1	3	2	.5	100	N	30	100	500	500	15	L	500
A114	.7	3	1.5	.3	70	N	50	100	300	300	10	15	500
A115	1	3	1.5	.3	70	N	50	70	500	500	10	20	700
A117	1	3	2	.5	70	N	70	100	500	700	15	15	500
A118	.7	3	2	.5	70	N	30	70	500	700	15	10	500
A119	.7	3	1.5	.5	70	N	50	150	300	200	15	20	500
A120	1.5	3	1.5	.3	100	N	30	100	700	300	10	15	1,000
A121	1	3	2	.5	70	N	50	100	500	700	15	15	300
A122	1	2	2	.3	70	N	50	70	300	300	10	L	200
A123	1	3	2	.5	70	N	70	150	500	700	15	10	1,000
A124	1	3	2	.7	70	N	70	150	500	700	15	10	700
A125	.7	1.5	1.5	.3	70	N	30	30	500	200	15	L	300
A126	1	2	2	.3	70	N	30	30	300	300	15	15	500
A127	1	2	2	.5	70	N	70	70	500	300	15	L	500
A128	1	5	2	.7	100	L	30	50	500	700	15	15	700
A129	1	10	3	1	150	N	50	50	500	500	15	L	700
A130 14/	1	5	2	.5	70	N	30	30	500	700	15	10	500
A131	1	5	2	.7	100	N	30	30	500	700	15	10	500
A132	1	3	1.5	.7	100	N	30	70	300	500	15	10	500
A133	1	5	2	.5	100	N	20	30	500	700	10	10	500
A134	1	5	3	.5	100	L	20	20	500	700	10	15	1,000
A137	.7	3	3	.5	70	L	15	15	500	500	10	15	700
A138	.7	3	2	.3	70	N	15	15	300	700	N	15	500
A139	.7	3	1.5	.5	70	N	30	20	300	700	N	15	500
A140	.7	5	1.5	.5	70	N	30	20	500	700	L	L	700
A141	.7	3	1.5	.5	70	N	20	20	300	700	L	10	700
A142	1	3	2	.7	100	N	30	15	300	700	L	10	1,000
A143	1	5	2	.7	150	N	50	70	500	700	15	15	1,000
A144	.7	3	1.5	.7	100	N	20	30	500	700	N	N	700
A145	.7	2	1.5	.3	70	N	10	7	300	500	N	N	500
A146	.7	3	2	.5	70	N	10	7	700	700	N	L	1,000
A147	.7	3	1.5	.5	100	N	15	15	500	700	N	L	700
A148	.7	2	1.5	.3	70	N	15	7	500	500	N	L	500
A149	.5	5	.7	>1	300	N	50	100	300	300	10	N	1,000
A151	.7	3	1.5	.5	70	N	20	20	500	700	N	N	500
A152	.3	7	1.5	>1	200	N	70	150	700	150	10	15	700
A153	.7	3	2	.7	70	N	20	30	500	700	N	L	700
A154	1	3	2	.5	70	N	70	100	500	700	N	L	700
A155	.7	3	2	.5	70	N	70	100	500	500	N	L	700
A156	.7	7	2	1	200	N	70	150	700	300	10	N	700
A157	.7	3	1.5	.7	70	N	50	100	500	500	N	L	700

14/ 1.5 ppm Ag.

TABLE 4.—*Analyses of stream-sediment samples from the Blue Range primitive*

Semiquantitative Spectrographic Analyses 1/

	(percent)				(ppm)								
Sample	Mg (.02)	Fe (.05)	Ca (.05)	Ti (.002)	V (10)	Mo (5)	Ni (2)	Cr (5)	Ba (10)	Sr (100)	B (10)	Pb (10)	Mn (10)
Stream sediments--Continued													
A158	0.7	1.0	2.0	0.3	50	N	30	100	500	700	10	10	500
A159	.7	1.5	2	.5	70	N	30	100	500	700	L	10	500
A160	.5	2	1	.3	70	N	7	15	500	300	N	L	300
A161	.7	3	1.5	.5	70	N	10	30	500	300	L	L	700
A162	.3	2	1	.3	70	N	7	30	300	200	N	N	500
A163	.5	2	1.5	.3	70	N	7	20	500	300	N	10	500
A164	.7	2	1.5	.3	70	N	15	20	300	300	N	N	300
A165	.5	2	1	.3	50	N	10	15	300	300	N	10	300
A166	1	3	2	.3	70	N	15	15	300	700	N	10	700
A167	.7	2	1.5	.5	70	N	10	15	700	300	N	10	700
A168	.3	2	1	.3	50	N	7	20	500	200	N	10	700
A169	1	3	1.5	.3	70	N	10	10	500	500	N	10	700
A170	.7	3	1.5	.3	70	N	15	15	500	500	N	10	700
A171	1	3	2	.5	70	N	15	20	300	700	N	L	500
A172	1.5	3	2	.7	70	N	20	10	500	700	N	L	700
A173	1.5	3	2	.5	70	N	7	5	300	500	N	10	1,000
A174	1.5	3	2	.3	70	N	7	5	500	700	N	L	700
A175	1.5	3	2	.7	100	N	20	20	500	700	N	L	700
A176	1.5	3	1.5	.3	70	N	20	15	500	700	N	L	700
A177	1	3	2	.7	100	N	30	20	500	700	N	L	700
A178	.7	3	1.5	.5	70	N	10	10	300	300	N	N	700
A179	.7	2	1	.3	70	N	20	30	500	300	N	L	700
A180	.7	2	1	.3	70	N	50	70	300	300	N	15	700
A181	.5	1.5	1	.3	70	N	30	30	300	300	L	10	700
A182	1	2	1.5	.3	70	N	70	70	300	300	N	L	500
A183	1	3	1.5	.5	70	N	50	100	300	300	N	L	700
A184	1	3	1.5	.5	70	N	70	100	300	500	N	L	700
A185	1	3	1.5	1	70	N	70	70	300	300	L	L	1,000
A186	1.5	3	2	.3	70	N	30	30	700	1,000	N	L	700
A187	1	3	1.5	.3	70	N	30	30	500	500	N	15	1,000
A188	.7	3	1.5	.3	70	N	30	50	300	700	L	15	1,000
A189	.7	3	1.5	.5	70	N	50	30	300	700	L	20	1,000
A190	.7	2	1.5	.3	70	L	30	50	300	500	N	15	1,000
A191	1	3	2	.3	70	N	30	70	300	700	L	70	1,000
A193	1	3	2	.7	100	N	50	70	500	700	N	15	1,000
A194	1	3	1.5	.5	100	N	70	50	300	700	L	10	1,000
A195	.7	3	1.5	.5	70	N	30	30	300	700	N	20	700
A196	1	3	1.5	.3	70	N	70	100	500	700	N	10	1,000
A198	1.5	10	3	.5	100	N	70	70	1,000	500	10	20	1,000
A199	1.5	7	3	.7	150	N	70	70	1,000	300	30	20	1,000
A200	1.5	5	3	.7	100	N	50	30	700	300	20	15	700
A201	1.5	3	2	.7	100	N	70	50	700	300	20	15	1,000
A202	2	7	3	>1	150	N	100	100	1,000	300	20	15	1,000
A203	2	5	3	>1	150	N	100	70	700	300	30	15	1,000
A204	1.5	10	3	.7	100	N	100	70	1,000	500	30	15	700
A205	2	15	5	>1	100	N	150	150	700	500	30	15	1,000
A206	1.5	15	.7	>1	150	N	150	300	1,500	150	50	20	3,000
A207	2	10	3	.7	100	N	200	70	700	700	30	20	1,500
A208	3	15	5	>1	150	N	100	70	700	300	20	20	1,000
A209 15/	3	15	5	>1	100	N	100	100	1,000	500	20	15	1,000
A210	3	15	5	.7	150	N	100	50	700	700	15	15	1,000
A211	1.5	15	3	1	100	N	70	100	1,000	500	15	15	1,000
A212	1.5	15	2	1	100	N	100	50	700	500	20	15	1,500
A213	3	15	5	.7	100	N	50	70	700	300	30	15	1,500
A214	2	15	3	.7	100	N	70	70	700	500	20	10	1,000

15/ 2 ppm Ag.

area, Greenlee County, Ariz., and Catron County, N. Mex.—Continued

Semiquantitative Spectrographic Analyses 1/

Sample	(percent) Mg (.02)	Fe (.05)	Ca (.05)	Ti (.002)	(ppm) V (10)	Mo (5)	Ni (2)	Cr (5)	Ba (10)	Sr (100)	B (10)	Pb (10)	Mn (10)
					Stream sediments--Continued								
A215	2.0	15.0	3.0	0.7	100	N	70	70	700	500	20	20	1,000
A216	2	15	5	1	150	N	70	50	700	500	10	15	3,000
A217	2	15	5	.7	150	N	15	50	700	500	10	10	1,000
A218	1.5	15	7	.7	150	N	15	50	700	500	10	15	1,000
A219	2	15	7	.7	150	N	15	50	1,000	500	30	15	1,500
A220	2	15	3	.7	100	N	30	70	700	500	30	20	1,000
A221	2	15	3	.7	100	N	30	150	700	500	30	15	1,000
A222	2	15	3	.7	100	N	20	70	700	500	20	15	1,000
A223	3	15	5	>1	300	N	70	50	700	150	20	15	1,000
A224	2	5	2	.7	200	N	20	100	1,000	1,000	L	30	700
A225	1	10	1.5	.5	150	N	20	50	1,000	1,000	L	20	700
A226	2	5	1.5	.5	150	N	20	30	1,000	1,000	L	30	700
A227	2	7	1.5	.7	150	N	30	70	1,500	2,000	L	20	700
A228	1.5	7	1.5	.5	100	N	20	20	700	1,000	L	15	700
A229	2	10	1.5	.7	200	N	30	100	1,000	1,000	L	20	1,000
A230	2	5	1	.3	70	N	100	200	700	700	L	20	500
A231	1.5	7	1.5	.5	70	N	100	150	1,000	500	L	30	700
A232	3	10	2	.7	150	N	150	300	1,500	1,500	L	20	1,000
A233	1	1.5	2	.5	50	N	100	150	500	500	10	10	500
A234	1	1.5	2	.3	70	N	30	30	500	500	10	10	500
A235	.7	2	3	.7	100	L	20	50	700	500	10	10	1,000
A238	.7	1	1.5	.2	30	N	7	L	300	500	L	L	300
A239	1	1.5	2	.3	70	L	15	15	500	500	L	L	500
A240	1	1	2	.3	70	N	10	10	500	700	L	10	500
A241	1	1.5	2	.5	70	N	15	30	500	700	10	L	500
A242	.7	1.5	3	.5	70	N	15	7	700	700	10	10	>5,000
A243	.7	1.5	2	.3	70	N	20	70	500	500	10	10	500
A257	3	7	3	1	100	N	100	200	1,000	1,000	N	30	700
A258	3	15	3	>1	150	N	150	300	1,500	700	10	30	700

TABLE 4.—*Analyses of stream-sediment samples from the Blue Range primitive*

	Semiquantitative spectrographic analyses--Continued (ppm)									Chemical analyses 2/ (ppm)			
Sample	Bi (10)	Be (1)	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Sc (5)	Co (5)	Hg (.02)	As (10)	Au (.02)	Map Coordinate (plate 2)
						Stream sediments							
Z001	L	L	10	30	50	200	N	20	50	0.26	L	L	H-5
Z006	L	L	10	15	30	200	N	20	20	.22	L	L	G-5
Z008	L	1	10	20	30	200	N	20	30	.05	L	L	G-5
Z009	L	1	15	20	50	200	N	30	50	.22	L	L	G-5
Z011	L	L	10	15	20	150	N	15	20	.10	L	L	F-5
Z013	L	L	10	15	30	150	N	30	30	.05	L	N	F-5
Z014	L	L	10	20	30	200	N	20	30	.04	L	L	E-6
Z015	L	L	10	20	20	150	N	15	20	.03	L	L	D-6
Z018	L	1	10	30	20	150	N	10	15	.14	L	L	D-7
Z020	L	1.5	15	50	20	200	N	20	20	.09	L	L	D-8
Z022	L	1	10	30	30	200	N	30	20	.15	L	L	I-2
Z023	L	L	L	20	30	150	N	20	20	.15	L	L	I-2
Z024	L	1	15	30	50	200	N	30	50	.15	L	L	I-1
Z025	L	L	L	10	50	150	N	15	20	.10	L	L	I-1
Z028	L	1	10	30	30	150	N	20	30	.04	L	L	F-2
Z029	L	1	L	20	30	150	N	20	20	.40	L	L	F-2
Z030	L	L	L	15	20	100	N	15	20	.10	L	L	F-3
Z033	L	L	10	20	30	150	N	15	20	.15	L	L	F-3
Z034	L	L	10	20	20	150	N	20	20	.40	L	L	F-3
Z036	L	L	L	30	30	200	N	20	20	.09	L	N	K-2
Z038	L	L	L	15	30	100	N	20	30	.05	L	N	K-2
Z039	L	L	10	20	20	100	N	10	20	.03	L	L	D-8
Z040	N	L	L	15	30	70	30	7	20	----	---	---	H-5
Z041	N	1	L	15	50	100	30	7	20	.50	L	N	H-5
Z045	N	2	10	15	30	70	20	7	20	.06	L	N	H-6
Z050	N	1	L	15	30	70	N	10	20	.05	L	N	H-6
Z051	N	L	L	10	30	50	N	7	20	.04	L	N	H-6
Z054	N	L	L	15	30	70	30	7	N	.04	L	N	I-6
Z056	N	L	10	10	30	70	20	7	15	.05	L	N	I-6
Z058	N	L	10	10	50	100	50	10	10	.03	L	N	I-6
Z060	N	L	N	15	30	70	N	7	20	.06	L	N	I-6
Z063	N	L	L	5	30	70	N	7	10	.05	L	N	J-6
Z065	N	L	L	15	50	70	N	7	15	L(.01)	L	N	J-6
Z067	N	L	L	10	30	100	20	7	15	.05	L	N	J-6
Z069	N	L	L	15	30	70	30	10	15	.04	L	N	J-6
Z071	N	L	L	15	30	70	30	10	20	.05	L	N	J-6
Z073	N	1	L	10	30	50	20	7	15	.02	L	N	J-4
Z074	N	L	L	10	30	50	20	7	10	.04	L	N	J-4
Z075	N	L	L	15	30	70	30	7	10	.02	L	N	K-4
Z076	N	L	L	15	50	70	20	7	20	.02	L	N	K-4
Z078	N	L	L	5	30	50	L	7	20	.03	L	N	K-4
Z079	N	L	L	L	30	30	N	7	15	.04	L	N	K-3
Z080	N	L	L	5	20	70	L	7	10	.04	L	N	K-4
Z081	N	L	L	L	30	50	N	7	20	.06	L	N	K-4
Z083	N	L	10	7	20	150	30	7	15	.04	L	N(.04)	K-3
Z084	N	1	L	7	30	100	30	7	10	.05	L	N	L-3
Z086	N	L	L	5	30	70	20	7	10	.04	L	N	L-3
Z087	N	L	L	7	3	70	30	7	N	.10	L	N	L-3
Z088	N	L	L	5	30	70	30	7	20	.07	L	N	L-3
Z089	N	1.5	L	5	15	100	30	7	10	24.0	L	N	K-3

2/ Sensitivity limit for gold is 0.02 ppm for normal 10 gram sample. Where insufficient sample was available, the sensitivity limit ranges up to 0.1 ppm as shown in parentheses for individual samples.

area, Greenlee County, Ariz., and Catron County, N. Mex.—Continued

	Semiquantitative spectrographic analyses--Continued (ppm)									Chemical analyses 2/ (ppm)			
Sample	Bi (10)	Be (1)	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Sc (5)	Co (5)	Hg (.02)	As (10)	Au (.02)	Map Coordinate (plate 2)
						Stream sediments--Continued							
Z091	N	L	L	L	30	70	20	10	20	.15	L	N	L-3
Z092	N	L	L	5	30	50	20	10	30	.18	L	N	K-3
Z093	N	L	L	5	30	50	20	10	30	.10	L	N	K-3
Z094	N	L	L	5	50	70	30	10	30	.05	L	N(.04)	K-2
Z095	N	L	L	5	30	50	30	10	30	.08	L	N	J-1
Z096	N	L	L	L	30	50	20	10	20	.24	L	N	J-1
Z097	N	L	L	5	30	50	N	10	30	.16	L	N	J-1
Z098	N	L	L	5	50	70	30	10	30	.10	L	N	J-1
Z099	N	1.5	10	5	30	100	30	10	20	.05	L	N	J-5
Z101	N	L	L	L	70	70	L	7	30	.22	L	N	K-2
Z102	N	L	L	5	70	50	L	7	30	.08	L	N(.04)	K-2
Z103	N	L	L	L	70	70	L	7	30	.05	L	N	K-3
Z104	N	L	L	L	70	70	L	7	30	.40	L	N(.04)	K-2
Z105	N	L	L	L	100	70	20	7	50	.14	L	N	K-2
Z106	N	L	L	L	70	70	L	7	20	.05	L	N	K-2
Z107	N	L	L	L	70	70	20	7	30	.10	L	N	K-2
Z108	N	L	L	L	100	70	20	7	20	.07	L	N	K-2
Z113	N	L	L	L	70	70	30	15	30	.03	L	N	J-2
Z114	N	L	L	L	70	70	20	7	20	.07	L	N	J-2
Z115	N	1	L	L	70	70	L	10	20	.07	L	N	J-2
Z116	N	L	L	5	70	70	L	10	20	.09	L	N	J-2
Z117	N	L	L	5	100	70	30	10	20	.05	L	N	J-2
Z118	N	L	L	5	70	70	L	7	20	.06	L	N	J-2
Z119	N	L	L	5	70	70	L	7	20	.03	L	N	J-2
Z120	N	L	L	L	70	70	L	7	20	.08	L	N(.04)	J-2
Z121	N	1	L	5	100	70	L	7	20	.06	L	N	J-2
Z122	N	L	L	5	70	50	L	7	20	.05	L	N	J-2
Z123	N	L	L	5	70	50	L	7	15	.07	L	N	J-2
Z124	N	5	15	20	15	300	L	7	15	.09	L	N	J-2
Z127	N	L	L	10	30	150	L	7	20	.07	L	N	J-3
Z128	N	N	L	7	30	70	L	7	20	.04	L	N	J-3
Z129	N	N	L	7	30	50	L	10	20	.05	L	N	J-3
Z130	N	N	L	7	30	70	L	10	20	.04	L	N	J-3
Z131	N	N	L	5	30	70	N	10	20	.06	L	N	K-3
Z132	N	L	L	5	30	70	L	7	20	.03	L	N	J-2
Z133	N	L	L	5	50	70	N	10	20	.03	L	N	J-2
Z134	N	L	L	5	50	70	N	10	20	.05	L	N	J-2
Z136	N	L	L	L	50	70	N	7	20	.06	L	N	J-3
Z137	N	L	L	L	50	50	N	7	20	.05	L	N	J-3
Z138	N	L	L	L	50	50	N	7	20	.04	L	N	J-3
Z139	N	L	L	L	50	70	N	7	20	.03	N	N	J-3
Z140	N	L	L	L	50	70	N	7	20	.05	L	N	J-3
Z141	N	L	L	L	50	70	20	7	20	.05	L	N(.04)	J-3
Z142	N	L	L	L	50	50	N	7	20	.05	L	N(.04)	J-3
Z143	N	L	L	L	50	70	N	7	20	.12	L	N	J-3
Z144	N	L	L	10	50	70	N	7	20	.08	L	N	K-3
Z145	N	L	L	7	30	70	N	7	20	.06	L	N	K-3
Z146	L	L	L	5	50	70	N	7	20	.03	L	N	K-3
Z147	N	L	L	5	50	70	N	7	20	.03	L	N	K-3
Z148	N	L	L	7	30	70	30	10	20	.03	L	N	K-3
Z149	N	L	L	7	50	50	30	10	20	.05	L	N	J-3
Z150	N	L	L	7	30	70	20	10	20	.03	L	N	K-3
Z151	N	L	L	7	30	100	30	10	20	.03	L	N(.04)	K-3
Z152	N	L	L	7	30	70	30	10	15	.09	L	N	K-3
Z153	N	L	L	7	30	70	30	7	15	.05	L	N(.04)	J-3

TABLE 4.—*Analyses of stream-sediment samples from the Blue Range primitive*

	Semiquantitative spectrographic analyses--Continued (ppm)									Chemical analyses 2/ (ppm)			
Sample	Bi (10)	Be (1)	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Sc (5)	Co (5)	Hg (.02)	As (10)	Au (.02)	Map Coordinate (plate 2)
						Stream sediments--Continued							
Z155	N	L	L	7	50	70	30	7	15	.05	L	N	K-3
Z156	N	L	L	7	50	70	30	10	15	.04	L	N	K-3
Z157	N	L	L	7	50	70	20	10	15	.05	L	N	K-3
Z158	N	L	L	7	50	70	L	7	10	.10	L	N	K-3
Z160	N	L	L	7	50	70	30	7	15	.09	L	N	H-2
Z161	N	L	L	5	30	50	20	7	15	.04	L	N	H-2
Z162	N	1	L	7	30	70	30	7	20	.09	L	N	H-2
Z163	N	L	L	7	50	70	20	7	15	.08	L	N	H-2
Z164	N	1	L	7	50	70	20	7	15	.12	L	N	H-2
Z165	N	L	L	5	30	70	20	7	10	.07	L	N	H-2
Z166	N	L	L	7	50	70	20	10	15	.15	L	N	H-2
Z167	N	L	L	7	30	70	20	7	15	.10	L	N	H-2
Z168	N	L	L	7	50	70	20	10	15	.06	L	N	H-2
Z169	N	2	L	7	100	70	20	7	15	.20	L	N	H-2
Z170	N	L	L	7	70	70	20	7	15	.05	L	N	H-1
Z171	N	1	L	10	30	70	30	10	20	.04	L	N	H-1
Z172	N	1	L	10	70	70	50	10	20	.04	L	N	H-1
Z173	N	1	L	7	70	100	30	7	20	.07	L	N(.04)	H-1
Z174	N	1	L	10	50	70	20	7	20	.15	L	N	I-2
Z175	N	1	L	7	50	50	20	7	20	.06	L	N	I-2
Z176	N	L	L	7	50	70	20	7	20	.07	L	N(.04)	I-2
Z177	N	L	L	7	50	70	20	7	20	.05	L	N	I-2
Z178	N	1	L	7	50	100	20	7	20	.05	L	N	I-2
Z179	N	L	L	7	50	70	L	7	20	.06	L	N	I-2
Z180	N	1	L	10	50	50	L	7	20	.06	L	N	I-2
Z181	N	1	L	7	30	70	20	7	20	.09	L	N	H-2
Z182	N	L	L	7	50	70	30	7	20	.10	L	N	H-2
Z183	N	L	L	5	30	70	30	7	20	.07	L	N	H-2
Z184	N	L	L	10	50	70	50	7	20	.08	L	N	H-2
Z185	N	L	L	7	30	70	30	7	20	.12	L	N	H-2
Z186	N	L	L	7	50	70	30	7	20	.08	L	N	H-2
Z187	N	L	L	7	50	70	20	7	20	.08	L	N	H-2
Z188	N	L	L	5	30	70	20	7	20	.04	L	N	H-2
Z189	N	L	L	7	50	70	30	7	20	.05	L	N	H-2
Z190	N	L	L	7	30	70	30	7	20	.06	L	N	H-2
Z191	N	L	L	5	50	70	50	7	20	.05	L	N	H-3
Z192	N	L	L	7	50	70	50	7	20	.05	L	N	H-3
Z193	N	L	L	10	50	70	50	7	20	.05	L	N	H-3
Z194	N	L	L	7	20	70	30	7	20	.06	L	N	H-3
Z195	N	L	L	7	30	70	30	10	20	.09	L	N	H-3
Z196	N	L	L	7	30	70	30	7	20	.05	L	N	H-3
Z197	N	L	L	7	20	70	N	10	20	.02	L	N	H-3
Z108	N	L	L	7	30	70	20	10	20	.09	L	N	H-3
Z199	N	L	L	7	30	70	20	10	20	.03	L	N	H-3
Z200	N	L	L	7	30	70	20	10	20	.06	L	N	H-3
Z201	N	L	L	5	30	70	20	7	15	.04	N	N	H-3
Z202	N	N	L	7	30	70	30	10	20	.06	N	N	G-4
Z203	N	L	L	7	30	70	30	7	20	.07	N	N	G-4
Z204	N	L	L	7	30	70	30	7	20	.08	N	N	G-4
Z205	N	L	L	7	30	70	30	7	20	.06	L	N	G-4
Z206	N	1	15	30	50	200	50	30	50	.08	L	N	G-3
Z207	N	L	N	20	30	200	30	30	50	.06	L	N	G-3
Z212	N	1	10	20	50	200	50	20	30	.05	L	N	F-4
Z213	N	1.5	10	30	20	200	50	30	20	.05	L	N	F-4
Z215	N	L	L	30	30	200	30	20	30	.04	L	N	J-5

7/ Ag detected but less than 0.5 ppm

area, Greenlee County, Ariz., and Catron County, N. Mex.—Continued

Sample	Semiquantitative spectrographic analyses--Continued (ppm) Bi (10)	Be (1)	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Sc (5)	Co (5)	Chemical analyses 2/ (ppm) Hg (.02)	As (10)	Au (.02)	Map Coordinate (plate 2)
					Stream sediments--Continued								
Z216	N	2	10	70	30	500	50	20	20	.08	L	N	J-5
Z217	N	5	30	50	30	300	30	15	20	.07	L	N	I-5
Z218	N	5	50	70	70	500	70	30	50	.06	L	N	I-5
Z220	N	1.5	20	50	30	300	50	20	30	.05	L	N	I-5
Z221	N	2	20	50	30	200	30	15	20	.08	L	N	I-5
Z222	N	5	100	100	20	700	50	15	20	.08	L	N	I-5
Z223	N	1	L	20	30	150	30	20	20	.05	L	N	I-5
Z224	N	1.5	20	50	50	200	30	30	30	.05	L	N	I-5
Z225	N	1.5	L	15	30	150	20	20	20	.03	L	N	I-5
Z226	N	3	20	50	20	200	30	10	15	.04	L	N	I-5
Z227	N	1.5	N	20	30	200	30	20	20	.05	L	N	I-5
Z228	N	1.5	N	30	30	150	50	15	20	.04	L	N	I-5
Z229	N	5	30	70	30	300	50	10	30	.06	L	N	I-5
Z239	N	1.5	L	30	70	200	50	20	70	.09	L	N	I-4
Z231	N	1.5	10	50	30	200	30	20	30	.14	10	N	I-4
Z232	N	L	L	15	50	150	30	30	50	.09	L	N	I-4
Z233	N	1.5	L	20	30	200	50	15	30	.09	L	N	I-4
Z234	N	7	70	100	20	700	50	7	20	.08	L	N	I-3
Z235	N	1.5	15	30	30	200	70	30	30	.16	L	N	I-3
Z236	N	L	L	20	30	200	30	30	30	.06	L	N	H-8
Z237	N	1.5	10	30	50	200	50	30	50	.07	L	N	H-8
Z244	N	1.5	15	30	20	200	30	15	20	.05	L	N	H-8
Z245	N	2	10	50	15	150	20	7	15	.20	L	N	H-8
Z246	N	3	15	70	15	300	50	7	15	.20	L	N	H-9
Z247	N	L	L	20	30	200	30	30	30	.10	L	N	H-9
Z248	N	L	L	20	30	150	20	30	30	.06	L	N	H-9
Z249	N	1.5	10	30	20	200	30	20	20	.09	L	N	H-9
Z250	N	L	L	15	30	100	L	30	30	.05	L	N	H-9
Z251	N	1.5	10	30	20	200	30	15	20	.08	L	N	H-9
Z252	N	L	L	20	30	150	20	30	30	.03	L	N	H-9
Z253	N	N	L	15	30	100	N	15	30	.05	L	N	H-9
Z254	N	L	L	15	30	100	L	15	30	.04	L	N	H-9
Z255	N	L	L	20	30	150	20	20	20	.06	L	N	G-9
Z256	N	1	L	30	30	150	30	15	30	.05	L	N	G-9
Z258	N	N	N	15	30	70	L	10	15	.03	L(.1)	N	E-12
Z259	N	N	N	10	30	50	N	10	20	.06	L(.1)	N	E-12
Z260	N	N	N	15	30	70	N	7	20	.04	L(.1)	N	E-12
Z261	N	N	N	10	30	50	N	7	20	.20	L(.1)	N	E-12
Z262	N	1	10	15	30	70	N	5	15	.05	L(.1)	N	E-12
Z263	N	1	N	15	20	70	N	5	10	.09	L(.1)	N	E-12
Z264	N	N	N	15	30	70	N	7	20	.06	L(.1)	N	E-12
Z265	N	N	N	15	30	70	N	10	30	.06	L(.1)	N	E-11
Z266	N	N	N	15	20	70	N	7	20	.08	L(.1)	N	E-12
Z267	N	N	N	15	30	70	N	7	20	.05	L(.1)	N	F-11
Z268	N	N	N	10	30	70	N	7	20	.01	L(.1)	N	F-12
Z269	N	N	N	10	30	70	N	7	15	.05	L(.1)	N	F-12
Z271	N	1	15	30	700	150	20	20	20	.19	L	N	F-11
Z272	N	1.5	15	30	30	150	20	20	20	.09	L	N	F-11
Z273	N	1	15	30	30	200	30	20	20	.06	L	N	F-11
Z274	N	L	10	30	30	150	30	20	30	.02	L	N	F-11
Z276	N	L	20	50	30	100	20	15	20	.05	L	N	I-8
Z277	N	5	30	70	20	200	50	10	15	.03	L	N	J-8
Z278	N	3	20	30	30	200	50	15	15	.05	L	N	J-8
Z279	N	7	30	30	30	300	50	10	15	.08	L	N	J-8
Z280	N	1	30	70	50	300	70	15	20	.05	L	N	J-8

10/ Ag detected but less than 0.5 ppm.

TABLE 4.—*Analyses of stream-sediment samples from the Blue Range primitive*

	Semiquantitative spectrographic analyses--Continued (ppm)									Chemical analyses 2/ (ppm)			Map
Sample	Bi (10)	Be (1)	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Sc (5)	Co (5)	Hg (.02)	As (10)	Au (.02)	Coordinate (plate 2)
						Stream sediments--Continued							
Z281	N	2	30	70	50	300	50	15	15	.05	L	N	J-8
Z282	N	3	30	70	50	200	50	15	20	.05	L	N	J-8
Z283	N	2	30	70	30	300	50	15	20	.03	L	N	J-8
Z284	N	2	30	50	30	300	50	15	20	.04	L	N	J-8
Z285	N	L	30	50	30	500	50	20	50	.04	L	N	J-8
Z286	N	3	20	50	70	300	50	10	15	.04	L	N	K-8
Z287	N	3	20	50	70	300	50	10	15	.04	L	N	K-8
Z288	N	5	20	50	100	300	50	10	20	.05	L	N	I-7
Z289	N	5	20	50	100	300	50	10	15	.06	L	N	I-7
Z290	N	7	30	30	20	300	50	10	15	.08	L	N	I-7
Z291	N	3	20	30	30	300	50	15	15	.04	L	N	I-7
Z292	N	3	20	30	30	300	50	10	15	.07	L	N	I-7
Z293	N	3	20	30	50	300	50	15	20	.05	L	N	I-7
Z294	N	1.5	20	30	30	200	20	15	20	.09	L	N	I-8
Z295	N	1.5	20	50	30	300	30	20	30	.09	L	N	I-7
Z296	N	1.5	15	20	30	200	20	15	20	---	L	N	I-7
Z297	N	1.5	15	30	30	300	30	15	20	.07	L	N	I-7
Z298	N	1	10	30	30	200	30	20	30	.04	L	N	I-8
Z299	N	L	15	30	50	300	30	30	30	.05	L	N	I-8
Z300	N	1.5	L	30	50	200	30	30	30	.08	L	N	H-8
Z301	N	1	L	15	30	150	20	15	20	.09	L	N	H-8
Z302	N	L	L	15	30	150	20	20	30	.03	L	N	H-7
Z303	N	L	10	20	20	200	20	20	30	.05	L	N	I-7
Z304	N	1.5	15	30	30	300	30	20	30	.05	L	N	I-7
Z305	N	1.5	20	30	20	300	20	10	15	.06	L	N	I-8
Z306	N	1.5	10	30	15	200	20	15	20	.03	L	N	I-8
Z307	N	1.5	10	30	20	200	20	15	20	.07	L	N	I-8
Z308	N	1	L	30	30	200	30	20	20	.03	L	N	I-8
Z311	N	2	15	20	30	150	20	L	30	.12	L	N	H-7
Z312	N	L	15	30	50	300	20	L	30	.08	L	N	L-8
Z313	N	1.5	15	20	30	300	50	L	30	.09	L	N	K-8
Z314	N	1.5	20	20	30	200	50	L	20	.04	L	N	K-8
Z315	N	L	20	15	50	200	20	30	50	.05	L	N	K-8
Z316	N	1.5	20	20	20	200	20	15	15	.06	L	N	K-8
Z317	N	2	15	70	20	300	70	20	30	.07	L	N	K-8
Z318	N	1	L	30	20	200	70	30	30	.06	L	N	K-8
Z319	N	1.5	10	30	20	300	50	20	20	.04	L	N	K-8
Z320	N	1.5	L	30	15	500	30	15	20	.03	L	N	K-8
Z322	N	L	15	50	30	500	50	30	50	.05	L	N	K-8
Z323	N	1	10	30	30	200	30	30	50	.04	L	N	K-8
Z324	N	1	L	20	30	100	30	15	30	.04	L	N	L-8
Z325	N	L	L	20	50	200	30	30	50	---	L	N	L-8
Z326	N	1.5	L	30	30	200	50	20	20	.05	L	N	K-8
Z327	N	L	L	30	20	200	30	20	20	.06	L	N	K-8
Z328	N	3	10	70	20	500	70	30	30	.05	L	N	K-8
Z329	N	1	L	30	15	200	30	10	15	---	L	N	K-8
Z330	N	1	10	50	20	300	30	15	20	.05	L	N	K-8
Z331	N	1	L	30	10	150	30	15	15	.05	L	N	K-8
Z332	N	1	10	20	20	200	50	20	20	---	L	N	K-8
Z333	N	1	L	30	20	200	30	15	15	.22	L	N(.04)	K-8
Z334	N	1.5	L	30	15	200	30	20	30	.03	L	N	K-7
Z335	N	1	10	50	20	200	30	20	15	.09	L	N	K-7
Z336	N	1.5	10	20	20	150	50	20	20	.05	L	N	K-7
Z337	N	1	L	30	15	150	20	10	15	.08	L	N	K-7
Z338	N	1	10	30	20	200	30	20	20	.06	L	N	K-6
Z339	N	L	L	30	15	200	20	15	15	.05	L	N	K-6
Z340	N	1	10	50	20	300	30	20	20	.07	L	N	K-6
Z341	N	1	L	30	20	200	30	15	30	.07	L	N	K-6
Z342	N	1.5	10	30	50	300	70	30	50	.09	L	N	K-6
Z343	N	2	10	20	50	200	30	30	70	.06	L	N	L-6

area, Greenlee County, Ariz., and Catron County, N. Mex.—Continued

Sample	Semiquantitative spectrographic analyses--Continued (ppm) Bi (10)	Be (1)	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Sc (5)	Co (5)	Chemical analyses 2/ (ppm) Hg (.02)	As (10)	Au (.02)	Map Coordinate (plate 2)
						Stream sediments--Continued							
Z344	N	2	15	50	20	300	70	20	30	.06	L	N	L-6
Z345	N	L	15	20	50	150	L(50)	15	15	.05	L	N	L-6
Z348	N	L	L	20	50	150	L(50)	15	20	.06	L	N	L-6
Z349	N	L	L	20	50	150	L(50)	15	20	.06	L	N	L-6
Z350	N	L	L	15	20	150	L(50)	10	15	.05	L	N	L-7
Z351	N	L	L	30	20	150	L(50)	10	10	---	L	N	L-7
Z352	N	L	L	20	20	150	L(50)	10	15	.05	L	N	L-7
Z353	N	L	L	30	50	150	L(50)	15	20	.04	L	.02	L-7
Z354	N	L	L	30	20	150	L(50)	15	20	.06	L	.02	H-7
Z355	N	L	L	20	50	150	L(50)	15	20	.10	L	N	H-7
Z356	N	L	L	15	50	150	L(50)	15	20	.06	L	N	H-6
Z357	N	L	L	15	50	150	L(50)	15	20	.05	L	N	H-6
Z358	N	L	L	15	20	150	L(50)	15	15	.05	L	N	H-7
Z359	N	L	L	15	20	150	L(50)	20	20	.06	L	N	H-7
Z360	N	L	L	15	20	150	L(50)	15	20	.06	L	N	H-7
Z361	N	L	L	15	50	150	L(50)	15	20	.03	L	N	G-6
Z362	N	L	L	50	50	150	L(50)	15	15	.06	L	N	K-6
Z363	N	L	L	50	20	150	L(50)	30	20	.05	L	N	K-6
Z364	N	L	L	50	50	150	L(50)	15	15	.04	L	N	K-7
Z365	N	L	L	50	20	150	L(50)	15	15	.03	L	N	K-7
Z366	N	L	L	30	20	150	L(50)	10	10	.05	L	N	K-7
Z367	N	L	L	20	20	150	L(50)	10	20	.06	L	N	K-7
Z368	N	1	L	30	20	200	L(50)	10	15	.05	L	N	K-7
Z369	N	5	15	50	20	1,000	L(50)	5	10	.09	L	N	K-7
Z370	N	1	L	15	20	300	L(50)	10	5	.04	L	N	K-7
Z371	N	1	L	15	20	300	L(50)	10	20	.05	L	N	J-7
Z372	N	1	L	15	20	200	L(50)	20	15	.05	L	N	J-7
Z373	N	1	L	10	20	200	L(50)	20	20	.05	L	N	J-6
Z374	N	L	L	20	20	200	L(50)	15	15	.04	L	N	J-7
Z375	N	2	L	30	20	300	L(50)	20	20	.04	L	N	J-7
Z376	N	2	L	30	20	300	L(50)	20	20	.05	L	N	J-7
Z377	N	2	15	70	20	500	L(50)	20	15	.08	L	N	J-7
Z378	N	1	L	30	20	300	L(50)	15	20	.04	L	N	I-7
Z379	N	2	15	70	20	300	L(50)	30	50	.03	L	N	I-7
Z380	N	1	L	20	20	200	L(50)	20	20	.05	L	N	I-7
Z381	N	1	L	15	20	500	L(50)	10	20	.03	L	N	I-7
Z382	N	N	L	15	20	200	L(50)	20	20	.03	L	N	K-7
Z383	N	1	L	30	20	300	L(50)	10	20	.04	L	N	K-7
Z384	N	2	L	30	20	300	L(50)	10	20	.04	L	N	J-7
Z385	N	2	L	30	20	300	L(50)	10	20	.06	L	N	J-7
Z386	N	2	L	30	20	300	L(50)	15	15	.06	L	N	J-7
Z387	N	2	L	50	20	500	L(50)	10	15	.03	L	N	J-7
Z388	N	1	L	20	20	300	L(50)	10	20	.08	L	N	K-6
Z389	N	1	L	15	20	150	L(50)	20	20	.05	L	N	K-5
Z390	N	1	L	15	20	150	L(50)	10	20	.06	L	N	K-5
Z391	N	1	L	10	20	200	L(50)	10	20	.04	L	N	K-5
Z392	N	1	L	10	20	200	L(50)	10	20	.02	L	N	K-5
Z393	N	N	L	10	20	200	L(50)	10	20	.06	L	N	K-5
Z395	N	L	L	15	30	150	30	10	15	.07	L	N	K-5
Z396	N	N	L	15	70	150	20	15	15	.04	10	N	K-5
Z397	N	L	L	20	50	100	20	15	15	.08	L	N	K-5
Z398	N	L	L	20	50	150	30	15	15	.07	L	N	K-5
Z399	N	L	L	20	50	150	30	15	15	.05	L	N	K-4
Z400	N	L	L	20	70	100	L	15	20	.04	L	N	K-4
Z402	N	L	L	30	30	200	50	15	10	.03	L	N	K-4
Z403	N	L	L	15	70	150	20	20	20	.02	L	N	K-4
Z404	N	L	L	15	50	150	20	10	15	.03	L	N	K-4
Z405	N	N	L	15	30	100	30	15	15	.05	L	N	K-4
Z406	N	L	10	20	50	150	30	20	20	.03	L	N	K-4
Z408	N	L	10	15	20	150	20	15	15	.05	L	N	L-4

TABLE 4.—*Analyses of stream-sediment samples from the Blue Range primitive*

	Semiquantitative spectrographic analyses--Continued (ppm)									Chemical analyses 2/ (ppm)			
Sample	Bi (10)	Be (1)	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Sc (5)	Co (5)	Hg (.02)	As (10)	Au (.02)	Map Coordinate (plate 2)
						Stream sediments--Continued							
Z409	N	N	L	20	20	150	20	15	15	.06	L	N	L-4
Z410	N	L	L	20	30	150	30	10	10	.05	L	N(.04)	L-5
Z411	N	L	L	30	100	150	50	30	20	.03	L	N	L-5
Z412	N	L	10	15	30	200	50	10	10	.04	L	N	L-5
Z413	N	1	10	20	50	150	50	15	20	.02	L	N	L-5
Z414	N	N	L	20	30	150	50	15	15	.05	L	N	L-5
Z415	N	L	L	15	50	100	30	15	20	.05	L	N	L-5
Z416	N	N	L	20	70	150	30	20	30	.06	L	N	L-5
Z426	N	1	20	20	50	300	50	15	50	L	L	N	K-3
Z427	N	L	L	15	50	150	30	15	50	.06	L	N	K-3
Z428	N	L	15	15	30	200	20	10	20	.04	10	N	K-3
Z429	N	1	15	15	30	150	30	15	50	.03	L	N	K-3
Z430	N	N	L	15	50	70	30	30	100	.10	L	N	K-3
Z431	N	N	20	15	30	300	20	20	100	.21	L	N	K-4
Z432	N	1	L	15	30	150	30	10	20	.06	L	N	K-4
Z433	N	N	L	15	70	100	30	15	30	.02	L	N	J-4
Z434	N	1.5	10	30	50	150	50	15	20	.06	L	N	J-4
Z435	N	L	10	20	70	150	20	15	20	.04	L	N	J-4
Z436	N	N	10	20	70	150	20	15	30	.03	L	N	J-4
Z437	N	L	10	15	50	150	30	10	20	.02	L	N	K-5
Z438	N	L	L	20	50	200	30	10	15	.03	L	N	K-5
Z439	N	1	10	20	70	150	30	10	15	.02	L	N	K-5
Z440	N	1.5	L	30	50	200	50	10	10	.03	L	N	K-5
Z441	N	N	10	10	70	100	20	15	15	.06	L	N	K-4
Z442	N	N	L	15	100	100	30	15	20	.08	L	N	H-5
Z443	N	N	L	10	30	100	L	7	15	.13	L	N	H-4
Z444	N	L	10	20	70	200	50	15	50	.08	L	N	H-4
Z445	N	L	L	15	100	150	20	10	20	.08	L	N	H-4
Z446	N	L	L	15	30	150	30	10	15	.18	L	N	H-4
Z447	N	L	10	15	100	150	30	15	20	.15	L	.02	H-4
Z448	N	L	L	20	70	100	50	15	20	.08	L	N	H-4
Z451	N	N	L	10	30	70	L	5	15	.03	L	N	H-4
Z452	N	L	L	20	100	150	50	20	50	.15	L	N	H-4
Z453	N	L	L	20	50	200	30	20	50	.10	L	N	H-4
Z454	N	1	L	30	70	200	30	20	50	.10	L	N	H-4
Z455	N	L	10	20	70	200	50	15	30	.07	L	N	H-4
Z456	N	L	10	20	100	150	20	20	20	.09	L	N	H-4
Z457	N	L	10	20	70	200	30	10	30	.04	L	N	H-4
Z458	N	L	10	20	50	200	20	15	30	.07	L	N	H-4
Z459	N	L	10	15	70	150	L	15	30	.04	L	.02	H-3
Z461	N	L	10	15	70	200	50	15	30	.08	L	N	F-4
Z462	N	L	10	30	50	200	70	15	20	.04	L	N	G-4
Z463	N	1	10	20	100	200	70	20	50	.06	L	N	G-4
Z464	N	L	10	20	50	150	50	20	20	.08	L	N	G-4
Z465	N	L	10	20	100	200	50	15	50	.06	L	N	G-4
Z466	N	L	10	15	50	200	50	10	30	.05	L	N	G-4
Z467	N	N	L	20	30	150	30	15	50	.05	L	N	F-4
Z468	N	L	L	15	30	150	20	10	15	.06	L	N	F-4
Z469	N	L	10	15	50	150	20	10	15	.09	L	N	F-4
Z470	N	L	L	15	70	150	20	10	30	.08	L	N	F-4
Z471	N	L	L	15	50	150	30	10	15	.05	L	N	F-4
Z472	L	L	10	20	70	200	50	15	30	.08	L	N	F-4
Z473	N	N	L	20	70	150	30	15	50	.08	L	N	F-4
Z475	N	L	L	15	70	150	20	10	15	.03	L	N	F-3
Z477	N	L	10	15	10	150	30	10	10	.03	L	N	H-5
Z491	N	L	L	10	10	100	L	7	10	.70	N	N	H-5
Z492	N	L	10	15	15	100	L	10	10	.07	L	N	G-5
Z500	N	1.5	10	30	10	150	L	7	15	.05	N	N	E-12
Z501	N	1	15	50	7	150	20	7	15	.05	L	N	E-12
Z502	N	L	20	20	20	150	20	15	20	.05	N	N(.04)	E-12

area, Greenlee County, Ariz., and Catron County, N. Mex.—Continued

	Semiquantitative spectrographic analyses--Continued (ppm)									Chemical analyses 2/ (ppm)			
Sample	Bi (10)	Be (1)	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Sc (5)	Co (5)	Hg (.02)	As (10)	Au (.02)	Map Coordinate (plate 2)
						Stream sediments--Continued							
Z503	N	L	10	15	15	100	L	10	10	.07	L	N	E-12
Z504	N	L	15	30	7	150	L	7	20	.05	N	N	E-12
Z505	N	L	10	20	15	200	N	15	30	.04	10	N	E-12
Z506	N	L	L	15	15	150	N	10	20	.04	N	N	E-12
Z507	N	L	10	20	15	150	N	7	50	.06	L	N	E-12
Z508	N	L	L	15	10	100	L	15	7	.03	N	N	E-12
Z509	N	L	10	15	10	100	N	10	10	.03	N	N	D-12
Z510	N	L	L	10	5	70	L	7	7	.04	N	N(.03)	D-12
Z511	N	N	L	10	3	70	N	7	7	.03	N	N	C-14
Z512	N	L	10	15	5	100	L	10	7	.05	N	N	C-14
Z513	N	1	10	20	5	100	L	7	5	.03	N	N	C-14
Z515	L	L	10	50	15	150	20	10	10	.02	N	N	C-14
Z516	L	L	L	15	5	100	L	5	7	.02	N	N	G-12
Z517	L	L	L	15	5	100	N	10	7	.03	N	N	G-12
Z518	N	L	L	10	7	100	N	7	7	.03	L	N	F-12
Z519	N	L	L	15	10	100	N	15	10	.03	L	N	F-12
Z520	N	1	15	20	10	150	20	10	10	.04	10	N	H-11
Z521	N	1	15	20	7	150	20	7	7	.03	L	N	H-11
Z522	N	L	10	15	20	150	N	20	30	.01	N	N	H-12
Z523	N	L	10	20	7	100	N	7	10	.01	N	N	H-12
Z524	N	L	L	15	3	100	N	7	7	<.01	L	N	H-12
Z525	N	L	L	20	3	100	N	7	7	.02	10	N	H-12
Z526	N	L	L	20	5	150	N	7	10	.02	L	N	I-12
Z527	N	L	10	15	5	100	N	10	10	.05	L	N	I-12
Z528	N	L	15	30	5	200	30	10	20	<.01	10	N	K-10
Z529	N	L	10	15	7	100	20	7	10	.03	N	N	L-10
Z531	N	L	10	15	7	100	20	10	20	.02	10	N(.04)	K-11
Z537	N	L	L	10	15	100	L	10	20	.03	L	N	L-6
Z541	N	L	L	15	20	150	20	15	20	.02	N	N	L-7
Z542	N	L	L	15	20	150	20	15	20	.02	N	N	L-7
Z543	N	L	L	15	20	150	20	15	20	.02	L	N	L-7
Z544	N	L	10	15	10	150	L	20	20	.03	N	N	L-6
Z545	N	L	10	15	15	150	L	15	7	.02	10	N	L-6
Z546	N	L	L	15	15	150	30	20	20	.02	N	N(.04)	L-6
Z547	N	L	10	20	20	150	20	20	20	.02	N	N	L-6
Z548	N	1	L	15	20	150	20	10	10	.02	20	N	L-6
Z549	N	L	L	15	20	150	20	15	30	.02	N	N	L-6
Z555	N	L	10	15	15	150	20	15	20	.02	N	N	L-8
Z556	N	L	L	15	15	150	20	20	20	.03	N	N(.04)	L-8
Z578	N	L	10	20	15	150	30	10	10	.01	N	N	J-5
Z579	N	1.5	10	20	15	200	30	10	10	.03	N	N	J-4
Z580	N	L	10	15	10	150	N	15	10	.02	N	N	J-4
Z581	N	L	10	15	15	150	N	15	10	.02	N	N	J-5
Z680	L	N	L	20	50	150	30	15	20	.02	L	N	M-8
Z681	L	N	L	15	50	150	L	15	10	.04	L	.02	M-8
Z686	L	N	10	15	50	150	20	15	20	.03	L	N	M-7
Z687	L	N	L	30	70	150	20	15	20	.08	L	.02	M-7
Z688	L	N	L	20	70	150	20	15	15	.04	L	.02	M-7
Z689	L	1	10	20	70	150	50	15	15	.10	L	.02	M-7
Z690	L	N	L	20	70	150	30	15	15	.07	N	N	M-7
Z691	L	N	10	20	70	150	30	15	30	.06	N	N	M-7
Z692	L	N	L	20	70	150	30	15	15	.03	N	.03	M-6
Z694	L	1	15	30	100	200	70	15	10	.06	N	.02	J-5
Z696	L	N	10	20	70	200	20	20	10	.06	N	N	J-5
Z697	L	N	15	20	70	150	30	15	10	.06	N	N	J-5
Z698	L	N	L	20	70	150	30	20	10	.05	N	N	H-8
Z699	L	N	10	30	70	200	30	20	10	.18	N	N	H-8
A001	N	1	10	50	30	200	50	20	30	.26	L	L	J-6
A003	N	L	L	30	20	150	N	15	20	.12	L	L	J-6
A005	N	1	L	20	30	300	N	20	30	.07	L	L	J-6

12/ Zn detected but less than 200 ppm.

TABLE 4.—*Analyses of stream-sediment samples from the Blue Range primitive*

Sample	Semiquantitative spectrographic analyses--Continued (ppm)									Chemical analyses 2/ (ppm)			Map
	Bi (10)	Be (1)	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Sc (5)	Co (5)	Hg (.02)	As (10)	Au (.02)	Coordinate (plate 2)
						Stream sediments--Continued							
A006	N	1	10	50	30	300	20	20	30	.40	L	L	J-6
A009	N	L	L	15	20	150	20	15	20	.06	L	N	K-5
A010	N	L	L	20	20	150	L	15	20	.21	L	L	K-6
A011	N	L	L	30	30	200	N	20	30	.04	L	L	K-6
A012	N	L	L	20	20	200	20	15	15	.03	L	L	K-5
A013	N	L	10	20	30	150	L	15	15	.35	L	N(.1)	K-6
A016	N	L	L	15	20	100	L	10	15	.06	L	N	K-5
A017	N	L	10	30	15	200	N	15	20	.09	L	L	L-6
A019	N	L	L	30	15	150	N	15	20	.12	L	L	L-6
A026	N	L	L	20	20	150	50	20	20	.10	L	L	H-5
A028	N	L	L	15	20	100	N	10	15	.11	L	L	H-5
A031	N	L	L	20	30	150	N	20	20	.11	L	L	H-5
A033	N	L	L	20	20	200	20	20	20	.03	L	L	G-5
A035	N	L	L	20	20	150	N	20	20	.06		L	G-5
A036	N	L	L	20	30	150	N	20	20	.40	L	L	F-5
A038	N	L	L	30	20	150	20	15	20	.17	L	L	E-5
A040	N	L	L	20	20	150	N	15	15	.08	L	L	E-6
A041	N	3	15	50	7	200	N	5	15	.10	L	L	F-5
A043	N	L	L	20	15	100	N	10	20	.13	L	L	E-6
A045	N	L	L	20	20	150	20	30	20	.04	L	L	E-6
A047	N	L	L	20	20	150	N	15	15	.06	L	L	E-7
A049	N	N	L	15	20	100	N	20	20	.12	L	L	D-7
A051	N	2	10	30	30	150	20	30	20	.07	L	L	D-7
A053	N	2	10	70	20	200	N	30	20	.07	L	L	D-8
A055	N	1.5	10	50	20	150	N	20	20	.10	L	L	D-8
A057	N	1	L	15	30	100	N	50	30	.06	L	L	I-2
A058	N	1	L	15	30	150	N	50	30	.14	L	L	I-1
A059	N	L	L	10	30	100	N	20	30	.10	L	L	I-1
A062	N	15	10	30	20	150	N	30	20	.08	L	L	J-2
A063	N	N	L	10	20	150	N	20	50	.26	L	L	F-2
A064	N	L	L	10	30	150	20	30	30	.30	L	L	F-2
A065	N	N	L	10	20	100	20	20	20	.80	L	L	F-3
A067	N	1	10	20	20	150	N	50	30	.12	L	L	F-3
A068	N	1	15	20	20	150	50	50	20	.10	L	L	F-3
A069	N	1.5	10	15	20	150	20	50	30	.14	L	L	F-3
A070	N	L	L	15	20	100	N	30	30	.04	L	L	F-3
A071	N	L	L	10	15	150	20	20	15	.46	L	L	F-3
A072	N	L	10	15	20	200	N	50	30	.35	L	L	F-2
A073	N	N	L	15	20	150	20	50	30	1.20	L	L	F-2
A074	N	N	L	10	20	100	N	30	30	.14	L	L	K-1
A075	L	1	10	20	50	200	N	30	50	.06	L	L	K-1
A076	L	1	10	20	50	200	N	20	30	.10	L	N	K-1
A077	L	L	L	15	50	150	N	20	30	.12	L	N	
A078	N	L	L	15	30	150	N	20	30	.12	L	---	K-2
A080	L	L	L	20	30	150	N	20	20	.06	L	N	K-2
A081	L	N	L	15	30	150	N	15	15	.12	L	L	K-2
A083	---	---	---	---	---	---	---	---	---	.34	L	N	K-2
A084	L	L	L	20	50	200	N	30	50	.14	L	L	K-2
A085	N	N	N	10	30	70	N	7	15	.04	L	N	B-5
A086	N	N	N	10	30	70	20	7	15	.02	L	N	A-6
A087	N	N	N	5	20	30	N	L	L	.28	L	N(.1)	B-5
A088	N	N	N	15	20	70	N	5	10	.06	L	N	B-5
A089	N	N	N	10	30	70	N	7	15	.01	L	N	A-6
A090	N	N	N	15	30	70	N	7	20	.03	L	N	A-7
A091	N	N	N	15	50	70	N	7	50	.02	L	N	A-7

area, Greenlee County, Ariz., and Catron County, N. Mex.—Continued

Sample	Semiquantitative spectrographic analyses--Continued (ppm) Bi (10)	Be (1)	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Sc (5)	Co (5)	Chemical analyses 2/ (ppm) Hg (.02)	As (10)	Au (.02)	Map Coordinate (plate 2)
						Stream sediments--Continued							
A092	N	N	N	15	30	100	N	7	30	.02	L	N	A-7
A093	N	N	N	10	30	70	N	5	20	.03	L	N	B-5
A094	N	N	N	15	30	70	20	10	30	.06	L	N	C-5
A095	N	N	N	10	30	70	N	7	15	.03	L	N	C-5
A096	N	N	N	15	30	70	N	7	15	.01	L	N	D-5
A097	N	N	N	10	30	70	N	7	10	.01	L	N	D-5
A098	N	N	N	15	30	70	N	7	20	.03	L	N	D-5
A099	N	N	N	15	30	70	N	7	30	.04	L	N	D-5
A100	N	N	N	15	30	70	N	7	20	.03	L	N	D-5
A101	N	N	N	10	30	70	N	7	20	.02	L	N	D-5
A102	N	N	N	10	50	70	L	10	30	L	L	N	C-4
A103	N	N	L	15	50	100	L	10	70	.05	L	N	C-4
A106	N	N	N	10	30	70	N	7	10	.03	L	N	C-3
A107	N	N	N	10	30	70	N	5	7	.04	L	N	C-3
A108	N	L	L	15	70	100	20	15	30	.01	L	N	C-3
A109	N	L	L	15	30	70	30	10	15	.01	L	N	C-3
A110	N	L	N	15	30	70	20	15	30	.03	L	N	C-3
A111	N	L	N	15	50	70	20	15	30	.03	L	N	C-3
A112	N	L	L	15	30	100	L	15	20	.12	L	N(.1)	D-4
A113	N	L	N	15	30	100	L	10	20	.04	L	N	D-4
A114	N	L	L	15	30	70	L	7	15	.07	L	N	D-4
A115	N	L	L	10	30	70	L	10	20	.04	L	N	D-4
A117	N	1	N	15	70	70	L	15	20	.04	L	N	D-4
A118	N	L	N	15	30	100	L	15	20	.03	L	N	D-5
A119	N	L	L	15	30	100	20	10	20	.03	L	N	E-5
A120	N	L	L	15	30	150	20	10	20	.06	L	N	E-5
A121	N	L	L	15	30	150	L	10	20	.04	L	N	E-5
A122	N	L	L	10	30	100	L	10	10	.02	L	N	E-5
A123	N	L	L	15	50	100	20	10	30	.07	L	N	F-5
A124	N	L	10	15	30	150	L	10	20	.08	L	N	E-4
A125	N	L	L	10	30	100	L	7	7	.20	L	N	E-4
A126	N	1	L	15	30	70	L	15	10	.07	L	N	E-4
A127	N	L	L	15	30	100	20	10	15	.06	L	N	E-4
A128	N	L	10	15	30	100	L	15	20	.03	L	N	B-6
A129	N	L	10	20	30	150	L	15	30	.01	L	N	B-6
A130	N	L	10	15	30	100	L	15	20	.03	L	N	B-6
A131	N	L	L	15	30	70	L	10	20	.02	L	N	B-6
A132	N	L	L	15	30	70	N	10	20	.01	L	N	B-6
A133	N	L	L	15	30	100	N	10	20	.03	L	N	C-6
A134	N	L	L	15	30	100	L	10	20	.02	L	N	C-7
A137	N	L	L	15	30	100	L	10	20	.02	L	N	B-6
A138	N	L	L	10	30	100	N	10	20	.03	L	N	B-6
A139	N	L	L	15	30	100	L	7	20	.02	L	N	B-6
A140	N	L	L	15	30	100	20	10	20	.03	L	N	B-6
A141	N	L	L	15	30	150	L	7	20	.03	L	N	B-6
A142	N	L	L	15	30	100	20	10	30	.01	L	N	B-6
A143	N	L	L	15	50	150	L	15	50	.02	L	N	B-6
A144	N	N	N	15	30	70	N	7	30	.02	L	N	B-6
A145	N	N	N	10	30	70	N	7	20	.03	L	N	C-7
A146	N	N	N	15	30	70	N	7	30	.03	L	N	C-6
A147	N	N	N	15	30	70	L	7	30	.03	L	N	C-6
A148	N	N	N	15	30	70	N	7	30	.04	L	N	C-6
A149	N	N	N	7	50	70	N	10	200	.05	L	N	D-6
A151	N	N	N	15	30	70	N	10	20	.03	L	N	C-6
A152	N	N	N	30	30	150	N	10	70	.02	L	N	A-7
A153	N	N	N	10	30	70	N	7	20	.03	L	N	B-7
A154	N	N	L	10	30	70	N	7	20	.03	L	N	B-7
A155	N	N	N	10	30	70	N	7	20	.03	L	N	B-7
A156	N	N	L	50	30	300	N	10	50	.02	L	N	C-7
A157	N	N	L	15	30	100	N	7	20	.02	L	N	C-7

TABLE 4.—*Analyses of stream-sediment samples from the Blue Range primitive*

	Semiquantitative spectrographic analyses--Continued (ppm)									Chemical analyses 2/ (ppm)			
Sample	Bi (10)	Be (1)	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Sc (5)	Co (5)	Hg (.02)	As (10)	Au (.02)	Map Coordinate (plate 2)
						Stream sediments--Continued							
A158	N	L	10	15	5	100	N	10	10	0.04	10	0.02	C-8
A159	N	L	10	15	5	100	L	15	10	.02	N	N	C-8
A160	N	L	N	10	20	70	L	5	10	.05	L	N	D-10
A161	N	L	N	15	30	70	L	7	15	.05	L	N	D-10
A162	N	L	N	7	30	70	L	7	7	.03	L	N	D-10
A163	N	L	N	10	30	70	L	7	10	L(.01)	L	N	D-11
A164	N	N	N	15	30	70	N	5	20	.03	L	N	D-11
A165	N	N	N	10	30	70	N	7	15	.01	L	N	E-11
A166	N	N	N	10	30	70	N	5	30	.02	L	N	E-11
A167	N	N	N	15	50	70	N	7	20	.03	L	N	E-11
A168	N	N	N	10	20	70	N	5	10	.03	L	N	D-10
A169	N	N	N	15	30	100	N	7	20	.05	L	N	E-10
A170	N	N	N	15	50	70	N	7	20	.05	L	N	E-10
A171	N	N	N	10	30	70	N	7	30	.05	L	N	E-10
A172	N	N	N	15	50	100	N	7	30	.02	L	N	E-10
A173	N	N	N	15	50	100	N	7	20	.05	L	N	E-11
A174	N	N	N	15	30	70	N	7	30	.02	L	N	E-11
A175	N	N	N	15	50	100	N	10	30	.07	L	N	E-11
A176	N	N	N	15	30	100	N	7	30	.06	L	N	E-11
A177	N	N	N	15	30	70	N	10	30	.07	L	N	E-11
A178	N	N	N	15	30	70	N	7	20	.07	L	N	E-11
A179	N	1	L	50	30	70	L	7	15	.05	L	N	D-10
A180	N	1.5	L	30	30	150	20	7	15	.09	L	N	D-10
A181	N	1.5	L	20	30	70	20	7	15	.09	L	N	D-9
A182	N	1	N	15	30	70	L	7	15	.04			
A183	N	1	L	15	30	100	N	10	30	.06	L	N	D-9
A184	N	L	L	15	30	70	L	7	30	.04	L	N	D-9
A185	N	L	L	30	30	300	N	15	50	.08	L	N	D-9
A186	N	N	N	7	30	50	N	7	30	.08	L	N	F-9
A187	N	L	N	10	50	70	N	7	20	.12	L	N	F-9
A188	N	1	L	15	30	70	20	7	20	.08	L	N	E-9
A189	N	1	L	15	70	70	L	7	30	.06	L	N	E-9
A190	N	2	L	15	30	70	20	7	20	.07	L	N	E-9
A191	N	1.5	L	15	70	70	L	7	20	.06	L	N	E-9
A193	N	N	N	15	50	70	N	10	50	.06	L	.02	F-9
A194	N	L	N	15	50	70	N	7	30	.08	L	.02	F-8
A195	N	N	L	15	30	70	N	7	30	.06	L	.02	F-8
A196	N	L	N	10	50	70	N	10	30	.07	L	N	E-8
A198	N	1.5	15	20	30	100	50	20	50	.07	L	N	E-8
A199	N	2	15	30	30	200	30	20	50	.08	L	N	E-7
A200	N	2	15	20	20	100	30	20	30	.06	L	N	D-7
A201	N	3	15	20	30	150	30	20	30	.08	L	N	D-8
A202	N	1.5	20	30	20	150	30	20	50	.04	L	N	D-8
A203	N	1.5	15	30	30	200	30	15	50	.09	L	.02	D-8
A204	N	1.5	15	30	30	150	30	15	50	.08	L	N	D-8
A205	N	1.5	15	30	30	150	30	15	50	.05	L	.02	D-8
A206	N	3	20	50	50	300	70	15	70	.11	L	N	F-7
A207	N	1	10	15	30	200	50	15	50	.04	L	N	F-7
A208	N	1	10	15	30	200	30	15	50	.05	L	.02	E-7
A209	N	1.5	10	30	30	200	30	15	70	.05	L	N	E-7
A210	N	1	10	30	20	200	50	15	50	.03	L	N	E-7
A211	N	1	15	20	30	200	50	15	50	.06	L	N	E-6
A212	N	1	10	20	30	200	30	15	70	.04	L	N	E-6
A213	N	1	10	20	30	200	30	15	70	.03	L	N	E-6
A214	N	1.5	15	20	20	200	30	15	50	.03	L	N	E-6

area, Greenlee County, Ariz., and Catron County, N. Mex.—Continued

	Semiquantitative spectrographic analyses--Continued (ppm)									Chemical analyses 2/ (ppm)			
Sample	Bi (10)	Be (1)	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Sc (5)	Co (5)	Hg (.02)	As (10)	Au (.02)	Map Coordinate (plate 2)
						Stream sediments--Continued							
A215	N	2	15	20	50	200	30	15	70	.04	L	.02	E-6
A216	N	1.5	15	20	50	200	30	15	50	.02	L	N	A-7
A217	N	1	15	20	30	200	30	15	50	.04	L	N	A-7
A218	N	3	15	20	30	200	30	15	30	.03	L	N	B-7
A219	N	1.5	15	20	30	200	30	15	30	.04	L	N	B-7
A220	N	1.5	15	30	30	200	30	15	50	.03	L	N	D-8
A221	N	1.5	15	20	30	200	20	15	50	.04	L	N	E-8
A222	N	1.5	15	20	30	300	L	15	50	.03	L	N	E-8
A223	N	L	15	15	150	70	30	5	70	.03	L	N	E-11
A224	N	L	10	20	50	150	30	15	15	.03	L	N	C-6
A225	N	N	10	20	50	100	20	10	15	.02	L	N	C-6
A226	N	L	10	20	50	150	20	10	15	.01	L	.02	C-6
A227	N	N	10	20	50	150	20	10	15	.02	L	N	D-6
A228	N	N	10	15	50	100	20	7	15	.02	L	N	C-6
A229	N	N	10	15	50	150	20	10	70	.02	L	N	C-6
A230	N	L	L	15	70	100	20	7	15	.05	L	N	E-2
A231	N	L	10	20	50	150	50	10	15	.40	L	N	E-3
A232	N	L	10	30	100	200	50	20	70	.07	L	N	E-3
A233	N	L	10	20	5	100	N	15	15	.01	N	N	B-7
A234	N	L	L	15	7	150	70	15	15	.02	L	N	B-8
A235	N	L	10	20	7	150	N	15	20	.05	N	N	B-7
A238	N	L	L	15	5	200	N	10	7	.04	L	N	D-7
A239	N	L	L	15	7	100	L	15	15	L(.01)	L	N	C-7
A240	N	L	L	15	7	150	N	10	7	.03	N	N	C-6
A241	N	L	L	15	5	100	N	15	10	.03	L	N	C-7
A242	N	L	L	15	5	200	N	15	50	.03	N	N	D-5
A243	N	L	L	15	7	150	N	10	10	.04	N	N	E-12
A257	L	N	10	20	30	150	30	15	20	.05	N	.08	I-7
A258	L	N	L	30	50	200	30	20	30	.02	N	N	I-7

TABLE 5.—*Analyses of pan-concentrate samples from the Blue Range*

Numbers in parentheses indicate sensitivity limit of method used. The symbol > indicates that an amount of the element is present below the sensitivity limit; N indicates that the element was l oked J. M. Motooka, Elizabeth Martinez; mercury analyses by W. W. Janes, S. L. Noble; arsenic analyses R. L. Miller, M. S. Rickard, T. A. Roemer, R. B. Tripp]

	Semiquantitative spectrographic analyses 1/												
	(percent)				(ppm)								
Sample	Mg (.02)	Fe (.05)	Ca (.05)	Ti (.002)	V (10)	Ni (2)	Cr (5)	Ba (10)	Sr (100)	B (10)	Pb (10)	Mn (10)	Be (1)
					Pan concentrates								
Z002	2.0	>20.0	0.5	>1.0	>1,000	300	700	100	N	N	10	2,000	N
Z003	2	>20	.7	>1	>1,000	300	1,000	100	N	N	L	2,000	N
Z004	1.5	>20	.5	>1	>1,000	150	1,000	100	N	N	L	2,000	N
Z007	3	>20	1.5	>1	>1,000	300	1,000	150	N	N	10	2,000	N
Z010	3	>20	1	>1	>1,000	500	1,500	300	N	N	10	2,000	N
Z012	5	20	1.5	>1	>1,000	300	1,000	300	N	N	15	2,000	N
Z016	1	20	.7	>1	>1,000	150	700	150	N	N	15	1,500	N
Z017	3	20	1	>1	>1,000	300	700	100	N	N	L	1,500	N
Z019	3	>20	.7	>1	>1,000	500	700	150	N	N	L	2,000	N
Z021	2	>20	.7	>1	>1,000	200	700	300	N	N	10	2,000	N
Z042 3/	.7	2	1.5	.3	50	30	70	700	700	L	10	300	L
Z043	.7	15	1	>1	300	70	300	300	150	N	10	700	N
Z044	.5	15	.7	>1	500	70	300	150	50	20	L	1,000	N
Z046 3/	1.5	1.5	1	.3	30	50	30	300	300	L	L	300	N
Z047	1	7	3	.7	150	70	300	500	700	N	L	1,000	1
Z048	.7	20	.7	>1	300	100	700	150	70	15	N	1,000	N
Z049	.7	10	2	.7	150	50	70	500	300	20	L	1,000	N
Z052	1.5	15	2	>1	200	100	1,500	300	200	15	L	1,500	N
Z055	1	7	3	.7	150	100	300	700	500	L	N	1,000	N
Z057	.7	15	1	>1	300	100	700	300	100	15	N	1,000	N
Z059	.7	7	2	1	150	70	200	500	300	L	N	700	N
Z061	.7	15	1	>1	300	100	700	200	200	L	N	1,000	N
Z064	.7	10	1.5	1	200	100	300	700	300	10	15	1,000	N
Z066	.5	7	1	1	150	30	200	300	300	N	N	700	N
Z068	.7	20	1	>1	500	150	500	300	150	20	N	1,000	N
Z070	1	15	2	>1	300	150	1,000	500	300	10	L	1,000	N
Z270	.5	20	.7	>1	700	70	300	100	50	20	L	1,500	N
Z534	1.5	10	2	.5	100	100	50	1,000	1,000	20	50	1,000	2
Z539 4/	.2	2	1.5	.3	100	70	70	700	700	15	20	1,000	L
Z540 4/	1	2	2	.3	100	100	200	500	500	L	15	700	L
Z575	2	1.5	1.5	.3	70	70	100	500	500	10	15	500	1
Z576	1	2	3	.2	70	30	70	500	700	10	15	1,000	L
Z584	.7	15	1	.5	200	50	150	1,000	700	15	20	500	N
Z585	1.5	3	2	.5	100	100	150	200	300	10	15	1,000	1
Z594	L	5	.07	.5	100	20	50	2,000	700	20	L	20	N
Z665 5/	.7	15	1	1	300	50	100	200	N	10	70	1,000	2
Z666 6/	2	15	2	.7	300	150	200	200	100	10	20	700	L
Z667	3	10	3	.5	300	150	300	150	100	L	10	700	N
Z675	1.5	15	2	>1	300	100	150	300	L	L	10	1,000	N
Z676 7/	1	20	1	>1	300	100	100	300	N	15	L	1,000	N
Z677 7/	1.5	15	1.5	1	300	150	150	500	100	10	L	700	N
Z693	2	10	3	.5	300	150	200	300	200	L	10	1,000	N
A002	2	20	1	>1	>1,000	150	700	150	N	N	30	2,000	N
A004	2	20	.5	>1	>1,000	200	700	100	N	L	10	1,500	N
A007	2	20	.5	>1	>1,000	200	1,000	150	N	L	L	1,500	N
A008	1.5	20	.7	>1	>1,000	150	700	150	N	N	20	1,500	N
A014	1	20	.5	>1	>1,000	150	500	50	N	N	L	1,500	N
A015	2	20	1	>1	>1,000	150	500	150	N	N	L	1,500	N
A018	5	15	1.5	>1	>1,000	200	1,000	100	N	N	L	1,500	N
A027	3	20	.7	1	>1,000	200	1,000	200	N	N	20	1,000	N

1/ Also looked for spectrographically but not found except as noted were: Au(10), As(200), Sb(100), W(50), Mo(5), Sn(10), Bi(10), Cd(20), and Ag(0.5).

3/ Mo detected but less than 5 ppm.

5/ 15 ppm Sn.

7/ Sn detected, but less than 10 ppm.

primitive area, Greenlee County, Ariz., and Catron County, N. Mex.

undetermined amount of the element is present above the number shown; L indicates that an undetermined for but not found. Analysts: semiquantitative spectrographic analyses by D. J. Grimes, R. T. Hopkins, Jr., by Gary Dounay, M. J. Horodyski, K. R. Murphy; gold analyses by W. L. Campbell, R. W. Leinz,

	Semiquantitative spectrographic analyses--Continued (ppm)								Chemical analyses 2/	(ppm)		
Sample	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Zn (200)	Sc (5)	Co (5)	Hg (.02)	As (10)	Au (.02)	Map Coordinate (plate 2)
					Pan concentrates							
Z002	L	30	150	>1,000	L	300	30	100	0.09	N	N	H-5
Z003	10	30	150	1,000	L	300	30	150	.30	N	N(.1)	H-5
Z004	10	30	150	700	20	200	20	100	.15	N	N(.04)	H-5
Z007	N	20	150	300	L	300	20	100	.22	L	N(.2)	G-5
Z010	L	15	150	300	L	300	20	150	.17	L	N(.1)	G-5
Z012	L	30	150	200	L	200	30	150	.60	L	N(.2)	F-5
Z016	N	15	150	200	L	500	20	100	.09	L	N(.1)	D-6
Z017	L	15	100	150	L	200	20	150	2	N	N(.04)	E-7
Z019	L	50	150	300	L	300	30	200	.11	N	N	D-7
Z021	10	100	150	>1,000	100	500	30	150	.03	20	N	D-8
Z042	L	15	30	70	30	N	7	20	.1	L(.1)	N	H-5
Z043	N	30	30	300	N	N	15	70	.08	L(.1)	N(.04)	H-5
Z044	N	30	30	300	N	N	15	150	.04	L(.1)	N	H-5
Z046	L	10	30	50	N	N	7	20	.04	L	N	H-5
Z047	N	20	30	200	N	N	10	30	.04	L(.1)	N	H-6
Z048	N	70	30	300	N	N	20	200	L	L(.1)	N	H-5
Z049	N	15	30	200	N	N	10	30	.06	L(.1)	N	H-6
Z052	N	15	30	300	N	N	30	70	.04	L(.1)	N	H-6
Z055	N	15	30	150	30	N	15	50	L	L	N	I-6
Z057	N	20	30	200	N	N	20	150	.06	L(.1)	N	I-6
Z059	N	15	30	200	20	N	15	30	L	L	N	I-6
Z061	N	20	30	150	N	N	15	150	L	L	N	I-6
Z064	N	15	30	150	N	N	15	70	.06	L	N	J-6
Z066	N	10	30	100	N	N	15	20	L	L	N	J-6
Z068	N	50	50	300	N	N	30	150	.04	L	N	J-6
Z070	N	20	50	300	N	N	15	100	.06	L	N(.04)	J-6
Z270	N	70	30	200	L	N	20	200	.21	L	N	F-12
Z534	20	70	50	500	70	N	15	N	.09	L	N	I-5
Z539	10	15	30	150	20	N	7	20	.02	N	N	L-6
Z540	10	15	20	150	N	N	30	30	.01	N	N	L-6
Z575	10	15	10	200	30	N	7	15	.02	L	N	L-6
Z576	10	15	20	150	N	N	10	15	.02	10	N	M-6
Z584	10	15	50	200	30	N	10	15	.10	.1	.05	M-6
Z585	15	30	20	300	N	N	20	20	.05	L	N	M-6
Z594	L	20	70	150	20	N	7	N	.65	L	N	K-2
Z665	100	100	30	>1,000	100	300	15	20	.4	L	N(.1)	J-2
Z666	30	30	30	700	20	N	30	30	.22	N	N	J-2
Z667	15	30	30	200	N	N	30	30	.12	N	N	J-3
Z675	30	20	30	200	L	N	30	50	.2	N	N	L-4
Z676	30	20	30	300	N	N	30	70	.4	N	N	L-3
Z677	20	15	30	150	N	N	30	50	.26	N	N	K-3
Z693	L	15	30	70	N	N	30	50	.1	N	N	M-6
A002	L	30	70	150	30	500	30	150	.85	N	L	J-6
A004	L	50	100	500	20	300	30	150	.28	10	N(.03)	J-6
A007	L	30	100	300	20	300	20	150	.26	N	N	J-6
A008	N	20	100	150	30	500	20	150	.35	N	N	K-5
A014	L	30	100	>1,000	20	300	20	100	.26	L	.1	K-6
A015	L	20	150	200	20	300	30	70	.22	10	N(.1)	K-5
A018	L	50	70	300	30	200	50	100	.26	10	N(.4)	L-6
A027	L	10	150	100	20	200	20	70	.21	10	N(.4)	H-5

2/ Sensitivity limit for gold is 0.02 ppm for normal 10 gram sample. Where insufficient sample was available, the sensitivity limit ranges up to 0.1 ppm.

4/ Mo detected but less than 5 ppm; Bi detected but less than 10 ppm.

6/ 10 ppm Sn.

TABLE 5.—*Analyses of pan-concentrate samples from the Blue Range primitive*

Semiquantitative spectrographic analyses 1/

Sample	Mg (.02) (percent)	Fe (.05) (percent)	Ca (.05) (percent)	Ti (.002) (percent)	V (10) (ppm)	Ni (2) (ppm)	Cr (5) (ppm)	Ba (10) (ppm)	Sr (100) (ppm)	B (10) (ppm)	Pb (10) (ppm)	Mn (10) (ppm)	Be (1) (ppm)
					Pan concentrates--Continued								
A029	2.0	20.0	0.7	>1.0	>1,000	150	500	200	N	N	50	1,500	N
A032	3	20	1	1	>1,000	150	1,000	150	N	N	10	1,000	N
A034	5	15	1	>1	>1,000	150	700	150	N	N	L	1,000	N
A037	3	15	1	>1	>1,000	150	1,000	150	N	N	L	1,000	N
A039	1.5	20	.3	>1	>1,000	100	500	150	N	N	10	1,000	N
A042	2	20	.7	>1	>1,000	100	700	200	N	N	70	1,500	L
A044	3	15	2	1	1,000	200	500	150	N	N	L	1,000	N
A046	3	>20	1	>1	>1,000	500	1,000	150	N	N	L	2,000	N
A050	1.5	>20	.5	>1	>1,000	150	700	100	N	N	L	2,000	N
A052	3	>20	.7	>1	>1,000	500	1,500	100	N	N	L	2,000	N
A054	3	>20	1	>1	>1,000	500	2,000	200	N	N	20	3,000	N
A056	3	20	1.5	>1	>1,000	300	1,000	200	N	N	L	2,000	N

area, Greenlee County, Ariz., and Catron County, N. Mex.—Continued

	Semiquantitative spectrographic analyses--Continued (ppm)								Chemical analyses 2/ (ppm)			
Sample	Nb (10)	Y (5)	Cu (2)	Zr (10)	La (20)	Zn (200)	Sc (5)	Co (5)	Hg (.02)	As (10)	Au (.02)	Map Coordinate (plate 2)
					Pan concentrates--Continued							
A029	L	20	150	200	20	300	15	50	.06	L	N(0.1)	H-5
A032	N	20	150	150	L	L	20	100	.40	10	N(.4)	H-5
A034	N	20	150	100	L	L	20	100	.07	N	N(.1)	G-5
A037	N	30	150	300	L	L	30	100	.14	40	N(.1)	F-5
A039	L	15	150	200	L	200	20	200	.18	N	N	E-6
A042	20	150	150	>1,000	50	300	20	100	.75	N	N(1)	F-5
A044	N	20	150	150	L	L	30	150	.14	N	N(.1)	E-6
A046	L	30	150	200	L	300	30	150	.19	L	N(.4)	E-6
A050	L	30	150	300	L	300	20	100	.06	L	N(.1)	D-7
A052	L	100	150	300	L	300	30	150	.04	L	N(.4)	D-7
A054	L	200	150	>1,000	L	300	20	200	.18	N	N(.01)	D-8
A056	L	100	150	500	20	500	30	100	.11	L	N(.8)	D-8

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