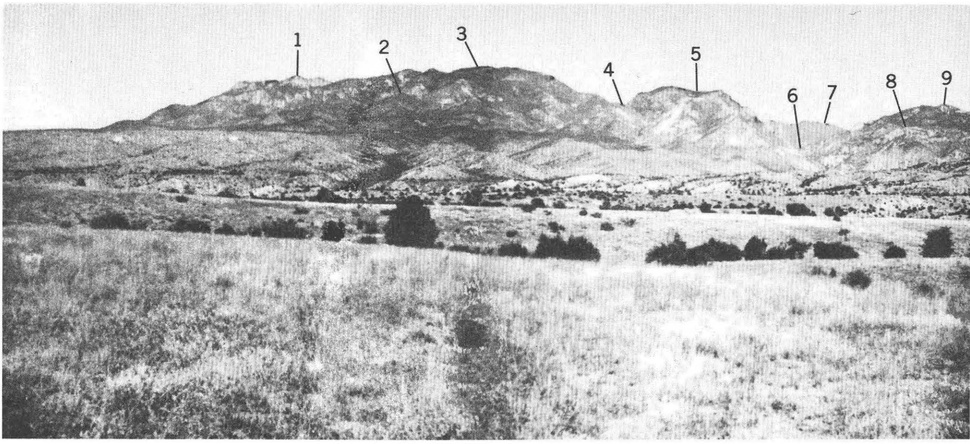
STUDIES RELATED TO WILDERNESS
PRIMITIVE AREAS

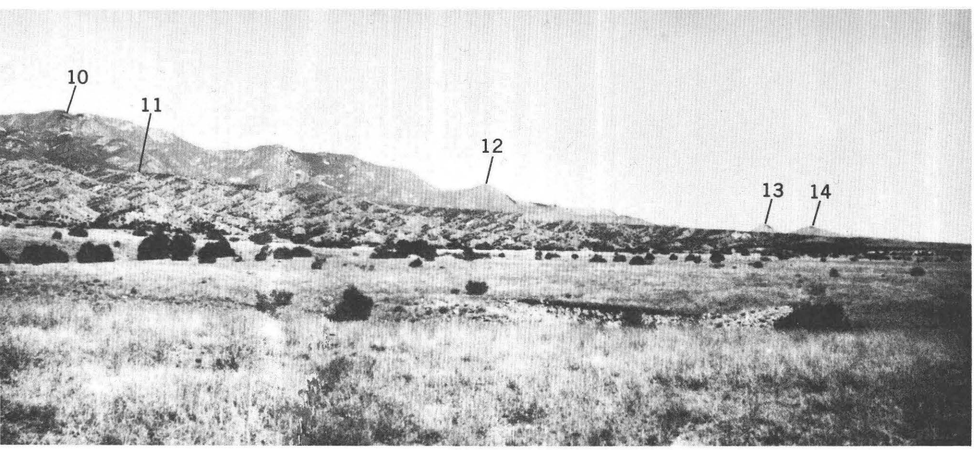
GILA PRIMITIVE AREA AND GILA WILDERNESS, NEW MEXICO

GEOLOGICAL SURVEY BULLETIN 1451

MINERAL RESOURCES OF THE GILA PRIMITIVE AREA AND GILA WILDERNESS, NEW MEXICO



Gila Wilderness looking northeast from Leopold Vista, Catron County, N.
Sheridan Gulch, (5) Sheridan Mountain, (6) Big Dry Creek, (7) Black
(11) Little Dry Creek, (12) Haystack Mountain, (13) Shelley Peak, (14)
Bursum caldera, which passes through Nabours Mountain, Sheridan
Mountain are on the resurgent dome of the caldera.



Mex. (1) Nabours Mountain, (2) Wilcox Peak, (3) Holt Mountain, (4)
Mountain, (8) Crown Mountain, (9) West Baldy, (10) Sacaton Mountain,
Seventyfour Mountain. Most of view is of the ring dike zone of the
Mountain, and Haystack Mountain; Black Mountain and Sacaton

Mineral Resources of the Gila Primitive Area and Gila Wilderness, New Mexico

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and by RONALD B. STOTELMEYER *and* HENRY C. MEEVES, U.S. BUREAU OF MINES

STUDIES RELATED TO WILDERNESS—
PRIMITIVE AND WILDERNESS AREAS

GEOLOGICAL SURVEY BULLETIN 1451

An evaluation of the mineral potential of the area

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1979

UNITED STATES DEPARTMENT OF THE INTERIOR

CECIL D. ANDRUS, *Secretary*

GEOLOGICAL SURVEY

H. William Menard, *Director*

Library of Congress Cataloging in Publication Data
Main entry under title:
Mineral resources of the Gila Primitive Area and Gila Wilderness, New Mexico.
(Studies related to wilderness)
(Geological Survey Bulletin 1451)
Bibliography: p. 171
Supt of Docs. No.: I 19.3:1451
1. Mines and mineral resources—New Mexico—Gila Wilderness Area. 2. Mines and mineral resources—New Mexico—Gila Primitive Area.
I. Ratte, James Clifford, 1925- II. Series: United States Geological Survey Bulletin 1451.
QE75.B9 No. 1451 [TN24] [553'.09789'93] 557.3'08s 77-608348

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402
Stock Number 024-001-03186-8

STUDIES RELATED TO WILDERNESS
PRIMITIVE AREAS

In accordance with the provisions of the Wilderness Act (Public Law 88–577, September 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 provides that each primitive area 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 Gila Primitive Area and Gila Wilderness, N. Mex., as defined, and some bordering areas that may come under discussion when the area is considered for wilderness status.

CONTENTS

Page

Summary 1
Introduction 5
Location and accessibility 6
Map and aerial photograph coverage 8
Physical features in the study area 9
Previous geologic investigations 10
Present investigations 12
Availability of analytical data 13
Acknowledgments 13
Geologic appraisal 14
Regional geologic setting 14
Rocks in the Gila study area 17
Pre-Tertiary rocks 17
Tertiary rocks 17
Pre-caldera rocks 22
Rocks of the caldera-forming eruptions 23
Rhyolite of the Diablo Range 24
Bloodgood Canyon Rhyolite Tuff of Elston (1968) 25
Tuff of Apache Spring 25
Post-caldera rocks 27
Altered rocks 31
Description of altered-rock localities 32
Alum Mountain–Copperas Creek Area 32
Brock Canyon area 33
Holt Gulch–Wilcox Peak area 34
Indian Creek area 35
Structure 35
Description of structures possibly related to mineral deposits 35
Alum Mountain and Copperas Creek volcanic centers 35
Brock Canyon volcanic center 37
Wilcox Peak center, Lone Pine Hill intrusive, and Holt Gulch intrusive 37
Gila Cliff Dwellings and Bursum calderas 39
Fault patterns 41
Santa Rita–Hanover axis 44
Geophysical investigations in the Gila study area 45
Gravity investigation 45
Description of the gravity map 49
Magnetic investigation 51
Depth estimates 53
Magnetic anomalies and geologic structure 53
Description of individual magnetic anomalies 54
Relationship between geophysical and geochemical anomalies 58
Geochemical studies 58
Sampling procedures 58

Geochemical studies—Continued Page
Analytical procedures 64
Availability of geochemical sample data 65
Geochemical patterns 65
Beryllium, tin, and tungsten 66
Mercury, bismuth, antimony, and arsenic 71
Gold, silver, and tellurium 75
Copper, molybdenum, zinc, lead, and manganese 79
Mineral resources appraisal 86
Oil, gas, and coal 98
Geothermal energy 98
Metallic and nonmetallic mineral resources 99
Gila Primitive Area 99
Gila Wilderness 101
Mineral claim investigations 102
Mining history and production 102
Sampling and analytical results 104
Mines, prospects, and mineralized areas 105
Southern Mogollon mining district, samples 1–42 105
Wilcox mining district 116
Little Whitewater Creek area, samples 43–60 117
Holt Gulch area, samples 61–112 119
Big Dry Creek below Spider Creek, samples 113–166 124
Big Dry, Spruce, and Spider Creeks, samples 167–245 131
Haystack Mountain to upper Sacaton Creek, samples 247–283 and 287–288 138
Little Dry, Pine, and Sacaton Creeks area, samples 284—286 and 290–415 141
Sacaton Creek to Seventyfour Mountain, samples 416–471 152
Tract 8, Gila Primitive Area, samples 472–473 157
Gila Fluorspar (Brock Canyon) mining district, samples 475–494 ... 157
Sapillo (Meerschaum) mining district, samples 502–506 161
Alunogen (Alumina) mining district, samples 507–542 162
Scattered mining claims and mineralized areas 165
Gila Wilderness 165
Tract 6, Gila Primitive Area 166
Areas adjacent to the wilderness and primitive areas 166
Appraisal of findings 169
References cited 171
Index 223

ILLUSTRATIONS

[Plates are in pocket]

Page
FRONTISPIECE: Gila Wilderness looking northeast from Leopold Vista, Catron County, N. Mex.
PLATE 1. Generalized geologic and U.S. Bureau of Mines sample localities maps, Gila study area, southwestern New Mexico.
2. Residual gravity and aeromagnetic maps of the Gila study area, southwestern New Mexico.

Page

PLATE 3. Geochemical sample locality maps (eastern part and western part) of the Gila study area.

FIGURE 1. Map showing location of Gila study area in southwestern New Mexico 6
2. Photograph showing physiography of the Mogollon Mountains and surrounding region 7
3. Index map showing published topographic 7½ minute quadrangle maps of the Gila study area........ 8
4. Photograph northwestward along the crest of the Mogollon Mountains 10
5. Photograph northwest across Apache Creek to the headwaters of the Middle Fork of the Gila River 11
6. Map showing Gila study area relative to igneous rocks at margin of Colorado Plateaus structural province 15
7–13. Photographs:
7. Shelley Peak showing ash-flow tuffs 24
8. Columnar-jointed cliffs of Bloodgood Canyon Rhyolite Tuff 26
9. Cliffs of volcaniclastic member of the tuff of Apache Spring 27
10. Crossbedded fluvial conglomerate in tuff of Apache Spring ... 28
11. Sheridan Mountain plug dome 29
12. Cliffs of Gila Conglomerate 30
13. Ash-flow tuff sequence above volcanic complex of Brock Canyon 34
14. Aerial photograph showing fracture-controlled drainage pattern in Copperas Creek area 36
15. Compass rose diagram of lineament trends 37
16. Fault map of part of the Mogollon region, southwestern New Mexico 42
17. Photograph across Sycamore Canyon graben 44
18. Gravity profiles 48
19–22. Sample locality maps:
19. Stream sediment 60
20. Panned concentrate 61
21. Unaltered rock 62
22. Altered and mineralized rock histrograms 63
23–35. Maps and histograms showing distribution of samples containing selected elements:
23. Beryllium 68
24. Tin 72
25. Tungsten 74
26. Mercury 76
27. Bismuth and antimony 78
28. Arsenic 80
29. Gold 82
30. Silver 84
31. Tellurium 86
32. Copper 88
33. Molybdenum 90
34. Lead 92
35. Zinc 94

		Page
FIGURE	36. Histograms of manganese values	96
	37. Map showing areas of greatest mineral resource potential	100
	38. Maps of underground workings in the Gila study area outside the Gila Wilderness and Gila Primitive Area	108
	39. Maps of underground workings within the Gila Wilderness	112
	40. Maps of underground workings within the Gila Primitive Area	126
	41. Photograph of Hardscrabble prospects	129
	42. Map showing sample localities and claims in Big Dry, Spruce, and Spider Creeks area	132
	43. Photograph of Royal Gorge claims	135
	44. Map showing sample localities in Little Dry, Pine, and Sacaton Creeks area	142
	45. Photograph of Lone Pine mine area	150
	46. Photograph of dumps of Telluride group of claims, Lone Pine Hill area	152
	47. Panorama of Gila fluorspar district southeast from Watson Mountain	158

TABLES

		Page
TABLE	1. Tertiary volcanic rocks in the Gila study area	18
	2. Dry bulk densities of rocks from the Gila study area	47
	3. Magnetic properties of rocks from the Gila study area	52
	4. Correlation of geochemical anomalies with gravity and magnetic anomalies	59
	5. Analyses of geochemical samples having anomalous metal contents,	
	A. Unaltered rocks	178
	B. Altered and mineralized rocks.	181
	C. Stream sediments	187
	D. Panned concentrates	192
	6. Statistical summary of selected elements in the geochemical samples	194
	7. Analyses of samples from prospects, mines, and outcrops in the Gila Wilderness and vicinity, New Mexico	202
	8. Conversion of parts per million to percent and to ounces per ton and vice versa	105
	9. Analytical data for Copperas Creek-Alum Mountain area	163

STUDIES RELATED TO WILDERNESS–PRIMITIVE AND WILDERNESS AREAS

MINERAL RESOURCES OF THE GILA PRIMITIVE AREA AND GILA WILDERNESS, CATRON AND GRANT COUNTIES, NEW MEXICO

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SUMMARY

A mineral survey of the Gila Primitive Area and the Gila Wilderness and vicinity in southwestern New Mexico was made by the U.S. Geological Survey and the U.S. Bureau of Mines in 1968–71. The Gila Wilderness, established by the U.S. Forest Service in 1924, was the first area in the United States to be administered as wilderness. The Gila Wilderness consists of approximately 685 square miles (1,780 km^2) in the Mogollon Mountains and adjacent areas at the headwaters of the Gila River. The Gila Primitive Area consists of nine separate tracts totaling about 210 square miles (550 km^2) adjoining the wilderness; the largest of these tracts, about 150 square miles (390 km^2), is east of the Gila Wilderness. The total area included in the mineral survey is about 970 square miles (2,500 km^2).

The purpose of the mineral survey of the Gila Primitive Area is to appraise the mineral resources potential as one aspect of studies to determine the suitability of the area for inclusion in the National Wilderness Preservation System. An appraisal of mineral resources of the wilderness is required by the Wilderness Act of 1964.

The mineral survey was conducted by means of reconnaissance geologic, geochemical, and geophysical surveys by the U.S. Geological Survey, and by a search of existing official mining claim records and sampling of mines and prospects by the U.S. Bureau of Mines.

Geologically, the area studied is in the southern part of the Datil volcanic area, which covers roughly 10,000 square miles (26,000 km^2) at the southeastern corner of the Colorado Plateaus structural province (Cohee and others, 1961). The Gila Primitive Area and Wilderness are in a mountainous part of the volcanic area that is bounded by structural blocks formed by faulting during the development of the Basin and Range structural province in late Tertiary time. The rocks exposed in the study area are nearly all volcanic igneous rocks of Oligocene and Miocene age. The aggregate exposed thickness of lava flows, ash-flow tuffs, and shallow intrusive bodies is at

least 6,000 feet (1,800 m). Older volcanic rocks of Laramide age (late Mesozoic–early Tertiary) that are exposed along the front of the Pinos Altos Range southeast of the study area indicate that such rocks probably underlie parts of the study area. A small block of Paleozoic sedimentary rocks occurs over an area of about one-half square mile (1.3 km^2) in the main tract of the Gila Primitive Area (M. J. Aldrich, Jr., 1976, fig. 2); otherwise no pre-Tertiary bedrock was observed in the study area. However, 4,000–5,000 feet (1,200–1,500 m) of Paleozoic strata and minor outcroppings of Precambrian rocks occur in the geologic section in the Silver City area, just south of the study area, which suggests that such rocks probably extend locally beneath the primitive area and wilderness. Gila Conglomerate and surficial deposits overlie the Tertiary volcanic rocks in part of the study area.

The Datil volcanic field represents a caldera complex, and as such it shows an eruptive sequence that fits a pattern familiar from the study of other caldera complexes. Early eruptions in the sequence produced volcanoes of andesitic lavas and breccias that can be observed only locally within the primitive area and wilderness. Succeeding activity was characterized by violent eruptions that produced widespread sheets of ash-flow tuff. The great volumes of material involved and the rapidity with which the tuff was erupted caused collapse of source areas of the ash-flow tuff, creating large subsidence calderas, two of which, the Gila Cliff Dwellings and Bursum calderas, are largely within the Gila study area. The ash-flow tuff deposits were followed by comparably voluminous effusions of viscous flow-banded rhyolite that accumulated in coalescing domes and flows above the ring fractures of the caldera structures. These silicic eruptions gave way to basaltic volcanism, and extensive shield volcanoes formed over a large part of the study area. The volcanic eruptions took place between about 40 and 20 million years ago. Toward the end of this period, the area was broken by extension faults related to the development of the Basin and Range structural province. Northwest-trending faults have modified most of the constructional volcanic features and account for the northwest grain that dominates the present physiography.

Certain parts of the study area have a significant minerals resource potential for base and precious metals and for fluorspar. There is no significant potential within the area for mineral fuels, but a possible geothermal energy resource, represented by a zone of thermal springs near Gila Hot Springs, is virtually unexplored. More than 90 percent of the Gila Primitive Area and Wilderness has no evidence of significant mineral deposits in surface rocks, and the thick cover of mid-Tertiary volcanic rocks presents a formidable obstacle to exploration for mineral deposits beneath that cover.

At least two ages of mineralization are indicated within the study area. A probable Oligocene age is represented by hydrothermally altered and weakly mineralized rocks at Alum Mountain, along Copperas Creek, and in Brock and Brushy Canyons in the southeastern part of the study area. A younger age is represented by the gold, silver, and copper deposits of the Mogollon district, where veins cut volcanic rocks of Miocene age. Gold, silver, tellurium, copper, lead, zinc, and fluorspar minerals that occur within the study area all along the southwest flank of the Mogollon Mountains from the Mogollon district to the Gila River may be part of the same Miocene mineralization.

The main areas of minerals potential evident in the surface rocks occur along the fringes of the wilderness and primitive area. Of the nine tracts of primitive area (fig. 3), the southwestern edge of tract 1, the adjoining parts of tracts 2 and 3 in the Alum Mountain–Copperas Creek area, tract 7 in the Big Dry Creek–Little Dry Creek area, and tract 8 in the Seventyfour Mountain area have significant potential for important mineral discoveries. Although tract 9 of the primitive area is adjacent to an important mineral exploration target within the Gila fluorspar district, there is less potential for mineral deposits within tract 9 itself.

The part of the present wilderness having the greatest evidence of mineral potential is the Spider–Spruce–Big Dry Creeks area, where numerous weakly mineralized structures, in an area of very difficult access, deserve further exploration. Other mineralized areas inside the wilderness that have a significant minerals potential are all near the boundaries of the wilderness, mainly from Whitewater Creek to Seventyfour Mountain and in the Alum Mountain–Copperas Creek area. That portion of the Gila Wilderness near the southern margin of the Bursum caldera from Big Dry Creek to Haystack Mountain is of particular interest for the number of copper occurrences present, as well as for the presence of gold, tellurium, silver, and fluorspar.

In addition to the evidence of mineral deposits in surface rocks, there exists a very significant potential for unexposed ore deposits in the subvolcanic zone of the middle Tertiary volcanic rocks as well as in rocks of Laramide age or older that may underlie the middle Tertiary volcanic rocks throughout the Gila Primitive Area and Wilderness. This potential is largely unassessable by the methods of this study, except as can be inferred from the geologic and structural setting of the area and from the gravity and aeromagnetic surveys that indicate subsurface rock masses having different physical properties.

The mineral resources potential of the study area has been appraised using the following information: regional geologic setting, geochemical sampling, geophysical character of the rocks, history of exploration and production, and sampling of mines and prospects. More than 2,500 geochemical samples of stream sediment and rocks were collected and more than 500 samples from mines and prospects were assayed.

From the perspective of regional structures and mineralization patterns, the following points tend to focus attention on the greater than average mineral potential of parts of the Gila Primitive Area, Gila Wilderness, and adjoining areas: (1) The area is located in a region of abundant fracture systems whose diverse trends give intersections of regional significance. Intersections of fracture systems are favored targets for mineral exploration because they can provide the "plumbing systems" for mineralizing fluids. One of these fracture systems includes the controversial Texas Lineament, whose importance in localizing major ore deposits in southwestern New Mexico and Arizona has been widely discussed. (2) The position of the study area at the northeastern extension of a copper province in Arizona and southwestern New Mexico that includes more than 70 percent of all past production and present reserves of copper in the United States. This metal province includes the deposits at Morenci, Ariz., and at Santa Rita and Tyrone, N. Mex., having a combined production and reserves valued at more than $5 billion, all within 50 miles (80 km) of the study area. (3) The possibility that intrusive igneous rocks of Laramide age, like those that contain the disseminated copper deposits of Santa Rita, Morenci, and Tyrone, may be present beneath the middle Tertiary volcanic rocks that blanket the study area. If sedimentary formations of pre-Tertiary age exist beneath the volcanic rocks, they too may be mineralized. The thick overburden of nonmineralized mid-Tertiary volcanic rocks will greatly retard the discovery and development of such blind ore deposits within most of the study area, except where the young volcanic rocks may be thinnest, as along the southern and western margins of the study area.

Within the study area, extensive areas of hydrothermal alteration and weak mineralization are found to be almost continuous along the front of the Mogollon Mountains from the Mogollon mining district to the Gila River, and in an extensive area around Alum Mountain and Copperas Creek. Geochemical sampling shows that these same areas have anomalous concentrations of a number of metals including beryllium, mercury, bismuth, antimony, arsenic, gold, silver, tellurium, copper, molybdenum, lead, zinc, and manganese.

Geophysical data support the noteworthy mineral potential of certain parts of the study area. The southwestern edge of the study area is the site of an elongate sharply crested positive gravity anomaly that trends northwestward for more than 25 miles (40 km) from the volcanic complex of Brock Canyon at the south edge of the wilderness at the Gila River. The anomaly appears to have a residual peak amplitude of at least 27.5 milligals. The anomaly is interpreted as the expression of a tilted structural block of dense pre-Tertiary rocks, although an alternate interpretation that it is due to a small batholithic body of intermediate to mafic composition cannot be ruled out entirely. Later work, not included in this report, indicates that this anomaly may be continuous with a gravity high of similar magnitude over the Silver City Range and Pinos Altos Range southeast of the study area, and by analogy suggests the possible presence of Paleozoic carbonate rocks and Laramide intrusive rocks in the shallow subsurface along the Mogollon Mountains front.

A gravity high also coincides in part with the proposed northward extension of the Santa Rita–Hanover axis (M. J. Aldrich, 1976, fig. 2), which has been defined as a pre-Miocene topographic and structural high that has localized or been localized by the Laramide porphyry stocks at Santa Rita and Hanover-Fierro (Elston, Coney, and Rhodes, 1968, 1970). The Alum Mountain and Copperas Creek mineralized areas are on the western flank of this gravity anomaly.

Several magnetic anomalies that are associated with geochemical anomalies in the study area are interpreted as the possible expression of shallow intrusive bodies that could be mineralized.

Although 80–90 percent of the study area has no mining claims or other evidence of prospecting activities, thousands of mining claims have been located within the study area, principally adjacent to the boundaries of the primitive area and wilderness from the northwest corner of the wilderness south of the Mogollon mining district to the Gila fluorspar district at the Gila River, and in the Alum Mountain–Copperas Creek area. Sixteen patented mining claims, including 10 in the wilderness and 1 in tract 7 of the primitive area, and 2 patented mill sites are within the study area. Past mineral production from the area includes 58,700 tons of fluorspar, an estimated 1,000 tons of meerschaum, a few hundred ounces of gold and silver, and a few tons of copper, lead, zinc, and tellurium ore. In addition, a small tonnage of clay was mined adjacent to tract 1 of the Gila Primitive Area along Copperas Creek, and a low-grade deposit of alum at Alum Mountain is an aluminum resource.

U.S. Bureau of Mines sampling of mines and prospects indicates that no major metallic mineral resources are known in the study area, although the Uncle John mine on Big Dry Creek, within the Gila Wilderness, contains small indicated and inferred reserves of copper-lead-zinc-cadmium ore.

Present economic mineral resources within the study area are confined largely to fluorspar, which was being mined or actively developed adjacent to the wilderness in the Gila fluorspar district and in Little Whitewater Creek at the time of these investigations. Almost all of the past fluorspar production of 58,700 tons has been from mines outside the present primitive area and wilderness, mainly from the Gila fluorspar district but also from the Little Whitewater Creek area. About 1,000 tons of fluorspar has been shipped from the Gold Spar mine on Rain Creek, just west of the wilderness boundary. High-grade fluorspar also occurs on and near Seventyfour Mountain just inside the wilderness, but the potential for this area seems to be limited because the veins are narrow and the access is difficult. Further production of fluorspar, probably from small-scale operations, can be expected from the area within and adjacent to the primitive area and wilderness from Little Whitewater Creek to the Gila River.

The meerschaum in the Gila Primitive Area north of Sapillo Creek has little commercial potential because the veins are discontinuous and narrow and the grade is low.

Although past production of mineral commodities—except for fluorspar—has been negligible, the combined geologic, geochemical, and geophysical factors indicate a considerable likelihood for the presence of important mineral deposits containing gold, silver, tellurium, copper, molybdenum, lead, or zinc adjacent to and within the Gila Primitive Area and Wilderness. Areas of highest potential are in the mineralized zone bordering the wilderness between the Mogollon mining district and the Gila fluorspar district, and the Alum Mountain–Copperas Creek area. The parts of the Gila Primitive Area that show strong evidence of mineral deposits are the western part of tract 1 and adjoining parts of tracts 2 and 3 in the Alum Mountain–Copperas Creek area, and tracts 7 and 8 along the southwestern side of the wilderness. A potential for metallic ore deposits also exists for the Spider Creek–Spruce Creek–Big Dry Creek area within the northwestern part of the Gila Wilderness.

INTRODUCTION

This report considers the geology and mineral resources of the Gila Wilderness, the several parts of the Gila Primitive Area, and adjoining lands in the Gila National Forest, Catron and Grant Counties, southwestern New Mexico (fig. 1). Together, these areas constitute the Gila study area. (fig. 2, pl. 3)

The mineral resources of the Gila Primitive Area and Gila Wilderness were surveyed together because the location and geology of the areas are interrelated.

In 1924 the Gila Wilderness was designated by the U.S. Forest Service as the first wilderness area in the United States, largely through the efforts of Aldo Leopold, a dedicated conservationist and an official of the U.S. Forest Service. A monument commemorating the establishment of the Gila Wilderness and Leopold's part in it stands alongside U.S. Highway 180, several miles south of Glenwood, before a magnificent view of the Mogollon Mountains within the wilderness. (See frontispiece and pl. 3.) This tract of 438,626 acres (180,000 hectares) was administered by the Forest Service as a roadless area in which commercial usage was limited to grazing and horse pack trips, until 1964, when with passage of the Wilderness Act, it became a part of the National Wilderness Preservation System. Only 266 acres (110 hectares) of private land are within the wilderness.

The Gila Primitive Area consists of a main area east of the wilderness and eight smaller tracts that fringe the wilderness, for a total of 132,788 acres (54,000 hectares), including 3,158 acres (1,300 hectares) of private land. These tracts are numbered 1–9 in figure 3. In addition, 61 patented mining claims (1,252 acres; 510 hectares) within tract 3 of the primitive area (fig. 3) were purchased by the Forest Service in 1969. Another 50,000 or so acres (20,000 hectares) of contiguous National Forest were studied at the request of the Forest Service. Together, the wilderness and primitive area are nearly 900 square miles (2,300 km^2), and the total study area about 970 square miles (2,500 km^2) in extent.

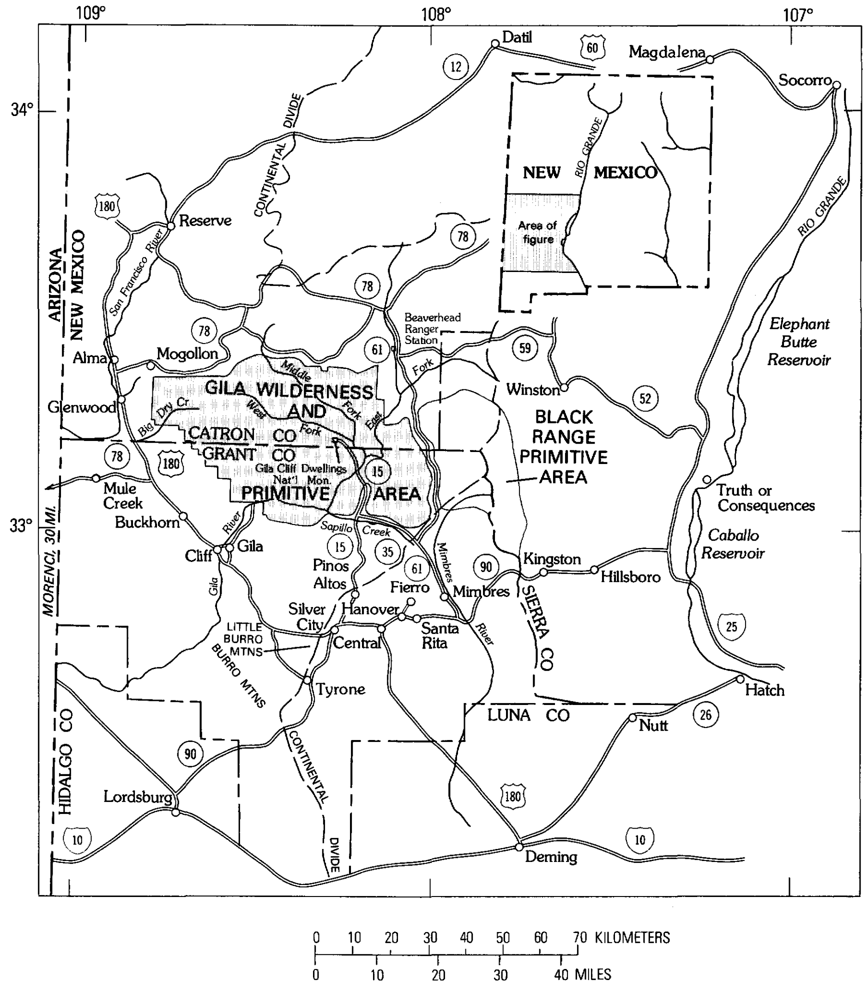


FIGURE 1.—Location of Gila study area in southwestern New Mexico. Shading indicates Gila Wilderness and Primitive Area.

LOCATION AND ACCESSIBILITY

The location of the Gila study area in southwestern New Mexico is shown in figure 1. Silver City is the nearest population center. Access from Silver City to the Gila study area is largely by way of U.S. Highway 180 and New Mexico Highways 15, 61, and 35, and by secondary roads leading from these highways (pl. 3). The Gila Cliff Dwellings National Monument is reached by New Mexico Highway 15, a paved road through a mile-wide corridor between tract 1 and tracts 2 and 3 of the Gila Primitive Area. A rough jeep trail extends about 5 miles (8 kilometers) west from New Mexico Highway 15 into the Pinos Altos Range

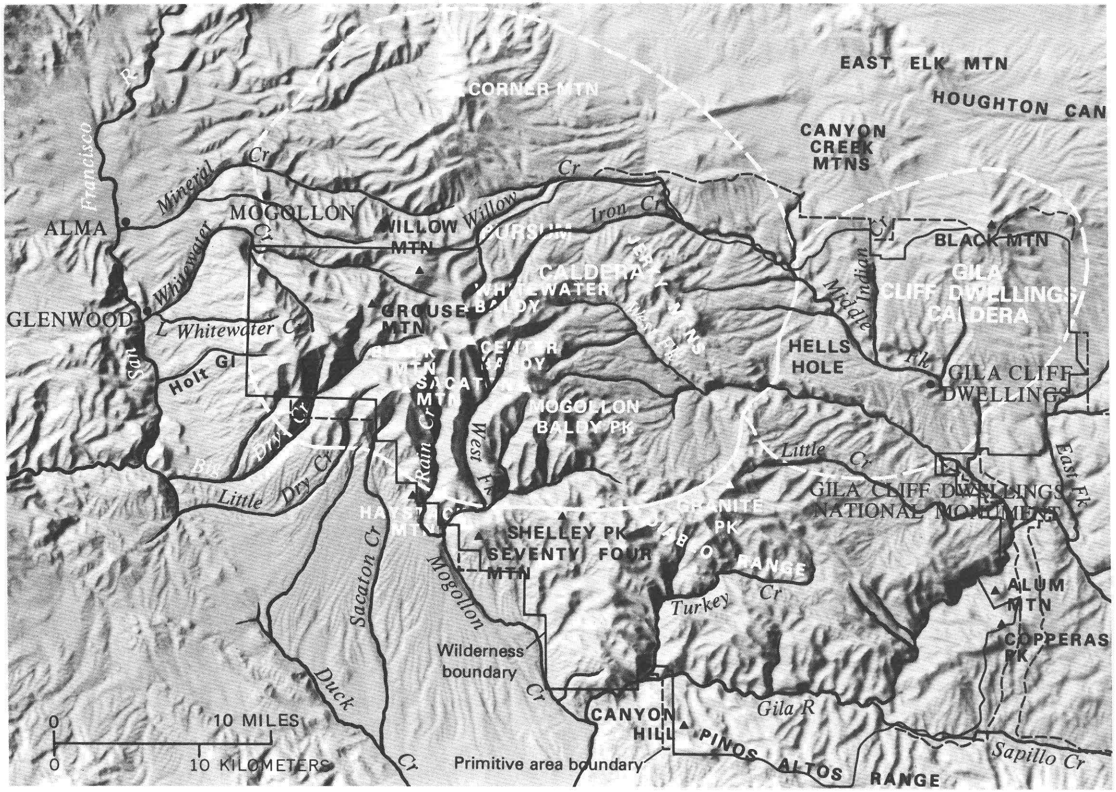


FIGURE 2.—Physiography of the Mogollon Mountains and surrounding region showing the approximate outlines of the Bursum and Gila Cliff Dwellings (GCD) calderas, two volcanic subsidence structures that are largely within the Gila study area. Outlines of the Gila Wilderness (solid line) and Primitive Area (dashed line) are also shown.

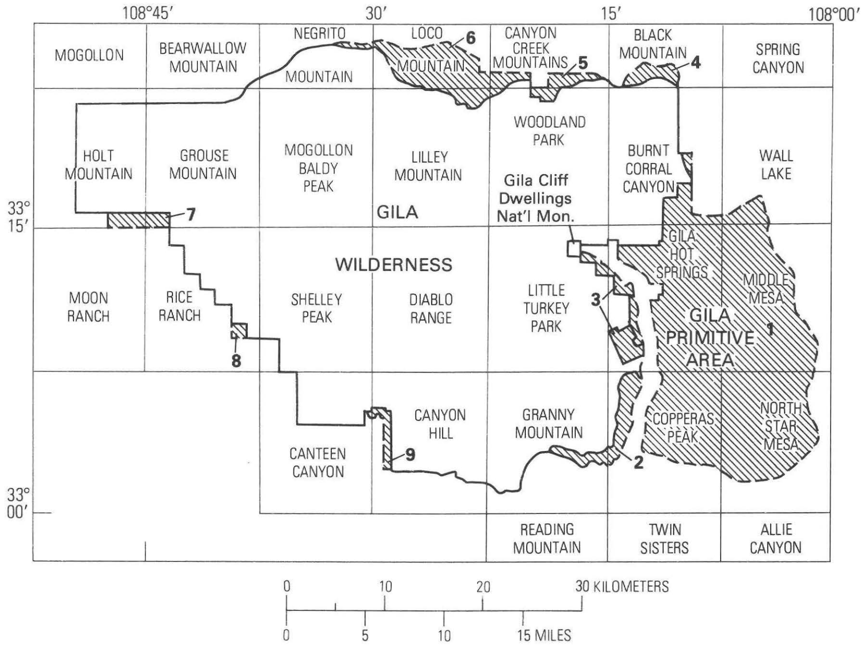


FIGURE 3.—Index to published topographic $7\frac{1}{2}$ minute quadrangle maps of the Gila study area. Numbered tracts 1 through 9 (shaded) identify the Gila Primitive Area.

and affords access to part of the study area south of the mouth of Sapillo Creek (pl. 3). A graded road from the town of Gila serves the Gila fluorspar district and provides access to the wilderness on the Gila River. Other graded roads afford entry to the study area at several places along the southwestern edge of the study area between the Gila River and Little Dry Creek. Northwest of Big Dry Creek, a gravel road goes to Sheridan corral, a major trail head for wilderness travel. A paved road from Glenwood to the mouth of Whitewater Canyon, at The Catwalk, provides another major entry into the western part of the wilderness. New Mexico Highway 78 leads to points of entry along the northwestern border of the wilderness from Mogollon to Willow Creek, and graded dirt and gravel roads border the study area on the north and east (fig. 1; pl. 3).

MAP AND AERIAL PHOTOGRAPH COVERAGE

The entire study area is covered by recent $7\frac{1}{2}$ minute U.S. Geological Survey topographic quadrangle maps having a scale of 1 inch equals 2,000 feet (600 m) (fig. 3). The area also is covered by the Clifton, Arizona-New Mexico 1°×2° topographic sheet of the U.S. Geological Survey at a scale of 1 inch equals 4 miles (6.4 km), and by various planimetric maps, available from the U.S. Forest Service, showing trails and other features. Black and white aerial photographs of the study area at various scales can be obtained from the U.S. Geological Survey or U.S. Forest Service, and color aerial photographs at an original scale of 1 inch equals one-fourth mile (0.4 km) are available from the Forest Service.

Silver City, the seat of Grant County, is the main business center of the region, and is the location of the administrative headquarters of the Gila National Forest. Silver City also is the center of an extraordinarily rich mining industry represented by the Santa Rita, Tyrone, Hanover, Fierro, Central, and other mining districts. Other towns adjacent to the study area include Mimbres, Gila, Cliff, and Glenwood. Reserve, the seat of Catron County, is the center of a lumbering industry. Pinos Altos, north of Silver City, and Mogollon, northeast of Glenwood, are old mining towns that are experiencing some revival of mineral exploration interest in recent years.

PHYSICAL FEATURES IN THE STUDY AREA

The Gila study area is in a mountainous region that includes most of the headwater drainage of the Gila River. The Mogollon Mountains (fig. 4) dominate the southwestern half of the study area; broadly defined, they form a northwest-trending mountain mass approximately 40 miles (65 km) long and 15 miles (25 km) wide. Locally designated ranges within the Mogollon Mountains include the Jerky Mountains, Diablo Range, and Pinos Altos Range (pl. 3). Northeast of the Mogollon Mountains, the upper forks of the Gila River have incised spectacular canyons into a plateaulike area of relatively subdued topography that characterizes the northeastern half of the study area (fig. 5). The steep southwestern wall of the Mogollon Mountains, from Mogollon to the Gila River, is cut by gorges with precipitous walls 2,500–3,000 feet (750–900 m) high in many places; the canyons of Whitewater Creek, Big Dry Creek, Rain Creek, West Fork Mogollon Creek, and the lower Gila River canyon are especially impressive. The drainage off the crest of the Mogollon Mountains shows a radial pattern centered on Whitewater Baldy (fig. 2) and is related to the geologic structure of the Bursum caldera, to be discussed later in this report.

Maximum relief in the study area exceeds 6,000 feet (1,800 m); elevations range from about 4,750 feet (1,400 m) in the Gila River canyon at the mountain front to 10,892 feet (3,240 m) on the crest of the Mogollon Mountains at Whitewater Baldy. Willow Mountain, Center Baldy, Mogollon Baldy Peak, Grouse Mountain, Sacaton Mountain, and other points in the Mogollon Mountains rise above 10,000 feet (3,000 m). Much of the central and eastern parts of the study area rise to broad flat divides at 7,500–8,500 feet (2,250–2,550 m) along the West and Middle Forks of the Gila, and less than 7,000 feet (2,100 m) along the East Fork and southward to Sapillo Creek.

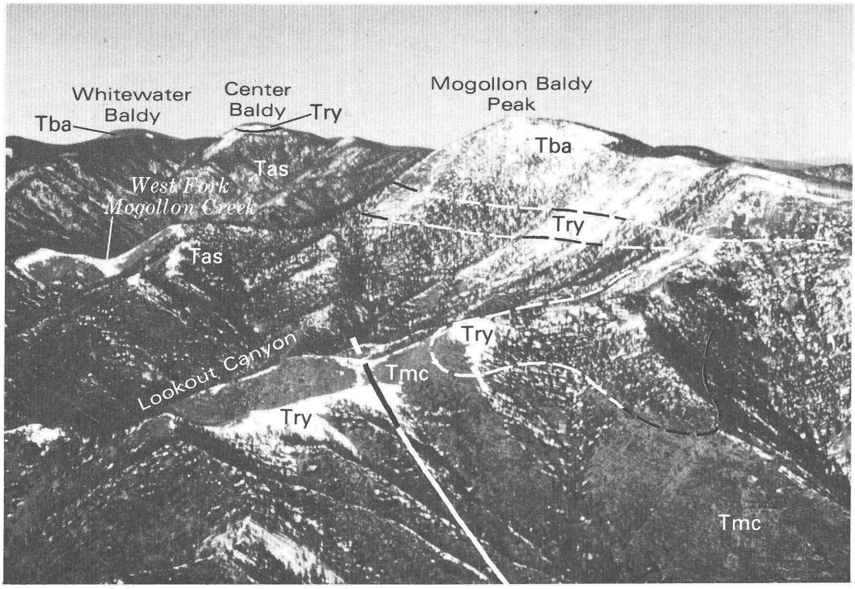


FIGURE 4.—View northwestward along the crest of the Mogollon Mountains. Ash-flow tuff of Apache Springs (Tas) is exposed within the Bursum caldera along the West Fork of Mogollon Creek, and is overlain by Mineral Creek Andesite (Tmc), flow-banded rhyolite and associated pyroclastic rocks (Try), and late andesitic flows (Tba).

All of the study area is in the Gila River drainage which flows to the Pacific Ocean. However, a drainage divide between Little Dry and Sacaton Creeks separates streams east of the divide, which flow more or less directly into the Gila River, from those in the northwest part of the area, which flow into the San Francisco River, a major tributary that joins the Gila River in Arizona. Most of the streams in the region flow intermittently; perennial flow occurs only in the Gila River and in the major canyons of some of its tributaries.

PREVIOUS GEOLOGIC INVESTIGATIONS

Although numerous reports have been published on various aspects of the geology and mineral deposits of this region, there is little detailed information specifically on the geology of the study area. A stratigraphic succession in the volcanic rocks of this region was first established by Ferguson (1927) in the Mogollon mining district. An unpublished reconnaissance of the area between Mogollon and the Gila fluorspar district and a more detailed geologic map of the Gila fluorspar district were prepared by C. P. Ross (written commun., 1945), and Ross' manuscript was utilized in preparing this report. Other reconnaissance geologic maps cover the Mogollon 30-minute quadrangle (Weber and Willard, 1959b) and the Alum Mountain 30-minute quadrangle (Willard

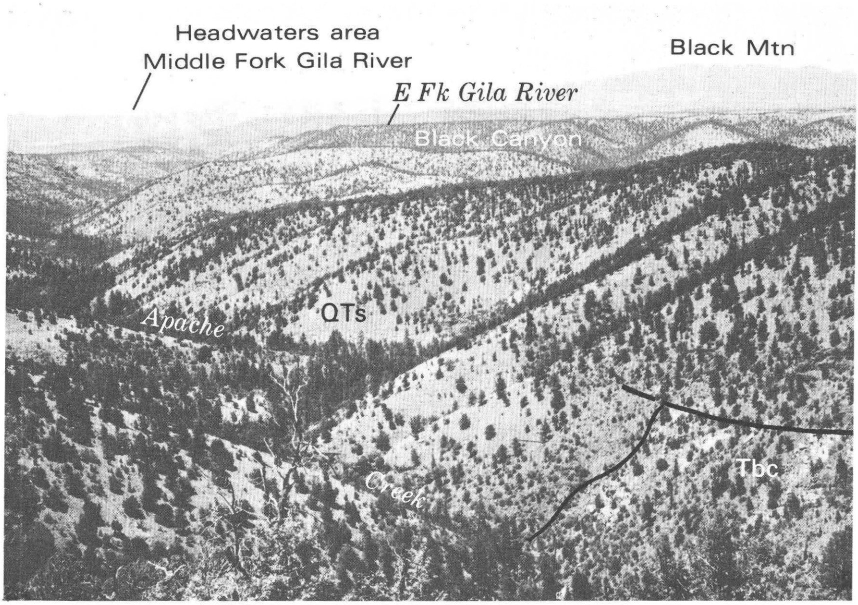


FIGURE 5.—View northwest across Apache Creek to the headwaters of the Middle Fork of the Gila River. Foreground is largely Gila Conglomerate (QTs); Bloodgood Canyon Rhyolite Tuff of Elston (1968) (Tbc) is exposed along a fault in lower right corner of photograph.

and others, 1961). More recently, columnar sections, stratigraphic correlation charts, diagrammatic maps and sections, geochronologic, gravity, and magnetic data pertinent to this study have been published by Elston (1965b, 1968, 1970); Elston, Coney and Rhodes (1968, 1970); Elston, Bikerman, and Damon (1968); Elston and others (1973) and Elston and Northrup (1976) A reconnaissance geologic map of the Mogollon Mountains accompanies the Ph.D dissertation of R. C. Rhodes (1970). Other published reports that are pertinent to this geologic investigation are cited in this report.

Some of the mineral deposits and mining districts within and adjacent to the study area have been described in various reports. During World War II, the fluorspar mines and prospects in the area were studied in detail by the U.S. Bureau of Mines (Rothrock, and others, 1946). The U.S. Bureau of Mines later examined other fluorspar deposits in Little Whitewater Creek (Sur, 1947) and the Gila fluorspar district (Russell, 1947), and prepared a summary of New Mexico fluorspar deposits (Williams, 1966). Tin deposits in the Taylor Creek district north of the main Gila Primitive Area, were described by Volin and others (1947), and tellurium resources in New Mexico, including tellurium in the Lone Pine district, near Gila Primitive Area tract 7, were discussed by Everett

(1964). The alum deposits near Alum Mountain were described by Hayes (1907), and the Taylor Creek tin deposits were described by Fries (1940). Northrop (1959) reviewed the literature on sepiolite in the meerschaum deposits near the south end of tract 1 of the Gila Primitive Area, and native tellurium from the Lone Pine district was described by Ballmer (1932) and Crawford (1937). The mineral deposits of western Grant County, New Mexico, were reviewed by Gillerman (1964), and the mineral resources of the Black Range Primitive Area, which adjoins the Gila study area on the east, were appraised by Ericksen, Wedow, and others (1970).

PRESENT INVESTIGATIONS

This is a joint report of investigations conducted separately by the U.S. Bureau of Mines and the U.S. Geological Survey. The Bureau of Mines conducted a search of courthouse records in Catron, Grant, and Socorro Counties (Catron County was formed from Socorro County in 1921) during the winters of 1968–70, and mining claim data on approximately 4,000 claims were obtained. The mining claim data, which include location, claimant, and other filing data, was presented earlier (Ratté and others, 1972a, table 8) and is not repeated here. Bureau of Mines field investigations during the field seasons of 1968–70 totaled approximately 19 man-months. An effort was made to locate all claims and workings in the study area and to obtain samples for assay from veins, mineralized zones, alteration zones, and dumps; 563 samples were collected and analyzed. Most of the Bureau of Mines work was accomplished by horseback packing, and the services of local packers and guides were indispensable in locating and identifying many obscure and overgrown claims and diggings.

The Geological Survey spent about 2 man-years between 1968 and 1971 on its field investigations. Although horses and helicopter support were used in parts of the area, most of the work was done by foot traversing. These investigations include geologic mapping, geochemical sampling, and geophysical surveys. A reconnaissance geologic map was prepared in order to assess the geologic environment and tectonic setting, and individual geologic structures were examined for evidence of mineralization; a geochemical survey was made to locate unusual concentrations of elements that might indicate the presence of buried or otherwise unknown mineralized areas; and aeromagnetic and gravity surveys were made to provide additional information for interpreting the geology of the study area.

This report supersedes an earlier manuscript (Ratté and others, 1972a) which was open filed prior to public hearings in Silver City and Albuquerque, N. Mex., in December 1972, on a U.S. Forest Service proposal for new boundaries to the Gila Wilderness. The revisions in this published report do not change the general conclusions of the open-file report with respect to the mineral resources and mineral resource potential of the study area. However, field checking in the study area in the fall of 1972 and newly acquired gravity data have led to significant revisions in the volcanic stratigraphic sequence and in the interpretation of the major gravity anomaly that parallels the southwestern margin of the study area. The reconnaissance geologic map at a scale of 1 inch equals 1 mile (1.6 km) that accompanied the open file report has been published separately in color (Ratté and Gaskill, 1975), and a smaller scale generalized geologic map is included in the present report.

AVAILABILITY OF ANALYTICAL DATA

Only those analytical data which seemed to us to be most significant to this mineral appraisal have been included in this report (tables 5A–D, 7, 9). However, the complete analyses of more than 2,500 geochemical samples are available (Ratté and others, 1972b).

ACKNOWLEDGMENTS

Many people helped to make our study easier. We particularly thank Richard C. Johnson, U.S. Forest Service Supervisor of the Gila National Forest, and William M. Lukens, U S. National Park Service, Superintendent of the Gila Cliff Dwellings National Monument, and their staffs for their wholehearted support, and Jack M. Foster, Fire Control Officer, Gila National Forest for cooperative arrangements on helicopter use.

We also acknowledge the counsel and assistance of many of our colleagues in the Bureau of Mines and the Geological Survey. J. R. Stahl and J. J. Tonso provided able summer assistance with the Bureau of Mines, and K. C. Watts, P. W. Schmidt, Randolph Koski, John Wells, Jay James, and James Lessman labored long and cheerfully for the Geological Survey. Supplemental gravity traverses were made in the spring of 1970 by Douglas Krohn, graduate student at the University of New Mexico. All analyses of geochemical samples and spectrographic analyses for the Bureau of Mines were made in the laboratories of Field Services Section of the Geological Survey or in mobile field laboratory facilities provided by that unit. Semiquantitative spectrographic analyses were made by R. N. Babcock, G. W. Day, A. Farley, D. J. Grimes, R. T. Hopkins, E. L. Mosier, J. M. Motooka, D. Siems, and K. C. Watts. Other chemical analyses were by R. N. Babcock, L. W. Bailey, R. R. Carlson, C. H. Chlumsky, R. D. Culbertson, C. A. Curtis, J. V. Desmond, J. L. Finley, J. Fowlkes, J. G. Frisken, J. R. Hassemer, T. Heinz, J. D. Hoffman, M. Horodyski, E. R. Iberall, C. L. Jacobson, V. James, K. Kulp, R. W. Leinz, S. McDanal, A. L. Meier, L. J. Miller, D. J. Murrey, S. L. Noble, R. M. O'Leary, J. H. Reynolds, M. S. Richard, D. P. Ritz, T.

Roemer, T. Stein, Z. C. Stevenson, A. Toevs, R. B. Tripp, S. I. Truesdell, R. Vaughn, L. A. Vinnola, and A. W. Wells. Mineral separates for isotopic age analysis were prepared by B. T. Brady.

The geologic work was aided by field excursions and discussions with W. E. Elston and R. C. Rhodes, University of New Mexico, and Peter J. Coney, Middlebury College. Both the Bureau of Mines and the Geological Survey are indebted to the New Mexico Bureau of Mines and Mineral Resources, Don H. Baker, Jr., Director, for assistance during this study; particularly to Mrs. L. A. Branvold for atomic absorption analyses and to Dr. R. H. Weber for mineral identifications of some Bureau of Mines samples. W. Kelley Summers made available to the Geological Survey unpublished information on geothermal resources. H. I. Ashby, mineral examiner, U.S. Forest Service, provided valuable information relating to his investigations of mineral claims within the study area.

GEOLOGIC APPRAISAL

The geologic appraisal of the mineral resources of the Gila study area is based mainly on three considerations: (1) the regional geologic setting, (2) the geologic history of the study area, particularly of the structural development and igneous activity, and (3) the distribution of altered and mineralized rocks, and of metallic elements as determined by geochemical sampling of rocks and stream sediments.

REGIONAL GEOLOGIC SETTING

The Gila study area is near the southeastern corner of the Colorado Plateaus structural province, in a mountainous region where Tertiary volcanic rocks cover the transition between flat-lying sedimentary rocks of the plateaus province and tilted and deformed rocks in the Basin and Range structural province to the south. The volcanic cover in the study area is part of the Datil volcanic field, one of several major areas of Tertiary and Quaternary volcanic rocks that occur at the margins of the Colorado Plateaus province (fig. 6). The volcanic rocks of the study area probably are underlain by several thousand feet of Mesozoic and Paleozoic sedimentary rocks, and by Precambrian basement rocks, where such rocks have not been replaced by batholithic intrusions, which have been proposed to underlie much of the mid-Tertiary volcanic field (Elston, Rhodes, Coney, and Deal, 1976, p 3).

Paleozoic rocks near Silver City, about 15 miles (25 km) south of the eastern part of the study area, have a maximum thickness of 3,000 feet (900 m) (Jones and others, 1967, p. 8–9) and apparently thin westward to about 1,000 feet (300 m) at Morenci, Ariz., 30 miles (50 km) west of the study area (Lindgren, 1905, p. 5–9). The Paleozoic rocks probably also

FIGURE 6.—Location of the Gila Primitive Area and Wilderness with respect to the Quaternary-Tertiary volcanic rocks (QTv) at the southeast corner of the Colorado Plateaus structural province, and to the chain of uplifts of pre-Laramide age that define the Deming axis and approximate position of the Texas lineament. Outline of Colorado Plateaus from Hunt (1956, fig. 1); outline of volcanic fields from Cohee and others, (1961); Deming axis and chain of uplifts from Turner (1962, fig. 1).

thin northward; at least pre-Pennsylvanian rocks, which are about 1,500 feet (450 m) thick in the Silver City area, are believed by Foster (1964) to pinch out within approximately 10 miles (16 km) north of the study area. The Paleozoic section consists of fossiliferous carbonate and clastic rocks representing each period of the Paleozoic Era from Cambrian through Permian. Numerous disconformities within the section and lithologic compositions indicate that the Paleozoic sediments were deposited in shallow seas that advanced across and withdrew from the region many times during the Paleozoic Era.

Mesozoic strata also are very thin in the region immediately adjoining the study area. Triassic and Jurassic strata are absent and the northern limit of Lower Cretaceous rocks was interpreted by Kottlowski (1965a, fig. 10) to have been near the southern edge of the study area. Upper Cretaceous rocks are widespread in the Silver City region where they are as much as 2,000 feet (600 m) thick (Kottlowski, 1965a, fig. 11; Foster, 1964), but may have been largely removed by erosion from beneath the study area as was postulated for the Pinos Altos and Black Ranges north and east of Silver City (Jones and others, 1967, p. 33).

The early tectonic history of this region is obscure, but detailed geologic studies in the Santa Rita and Morenci mining districts, adjacent to the Gila study area, have shown no evidence of pre-Laramide folding and faulting (Jones and others, 1967, p. 112–113; Lindgren, 1905, p. 9). Rather, pre-Laramide tectonic activity in the vicinity of the study area apparently was confined to epeirogenic movements consisting of broad uplifts and depressions, such as the Burro uplift just south of the study area (fig. 6), where a core of Precambrian rocks is overlain by Upper Cretaceous rocks (Elston, 1968).

The major geologic structures now evident in southwestern New Mexico and adjacent areas date mainly from the Laramide orogeny of Late Cretaceous and early Tertiary age, during which widespread faulting and folding, and igneous intrusion and volcanism took place throughout the Cordilleran region of the western United States. These events were followed by renewed volcanism and subsequent tensional faulting during the development of the Basin and Range structural province starting in middle Tertiary time.

Possibly of great significance to mineral resource potential is the position of the Gila study area along the west to northwest zone of faulting and geologic and topographic discontinuity known as the Texas Lineament (Hill, 1902; Ransome, 1915), which trends roughly along the southern edge of the Colorado Plateaus. The general northerly trend of Basin and Range structures north and south of this zone appears to be deflected to a northwesterly direction along the Texas Lineament zone. If the Texas Lineament represents a major fracture zone or other tectonic discontinuity in the earth's crust (Baker, 1933, 1935; Moody and Hill, 1956; Albritton and Smith, 1957; Muehlberger and Wiley, 1970) then it could have had extraordinary influence on the localization of intrusive igneous rocks and possible associated ore deposits in this region On the other hand another school of thought denies the usefulness in ore finding of such vague features as the Texas Lineament, which is specifically denigrated in a recent paper on the subject of lineaments as "ineffective guides to ore deposits". (Gilluly, 1976, p. 1509–1511).

ROCKS IN THE GILA STUDY AREA

The rocks exposed in the Gila study area are almost entirely volcanic rocks of middle to late Tertiary age, except where such rocks are overlain by younger conglomerates or are covered by surficial deposits. Precambrian rocks similar to those that crop out in the Big and Little Burro Mountains near Tyrone, about 20 miles south of the study area (Gillerman, 1952, fig. 1), are presumed to underlie the volcanic rocks of the study area but no outcrops have been found. Also, on the basis of data from adjacent areas (Kottlowski, 1965a), 2,000–3,000 feet (600–900 m) of Paleozoic strata is estimated to underlie parts of the study area. The Paleozoic rocks apparently thin to the north and west away from the Silver City area. Outcrops of Paleozoic rock within the study area are known only from the southeastern part of tract 1 of the Gila Primitive Area (M. J. Aldrich, Jr., 1976, fig. 2). Limestone boulders containing chert lenses have been reported to us, by prospectors, to occur at two localities (Big Dry Creek above Spruce Creek, and near the foot of the Seventyfour Mountain trail in Mogollon Creek), but we were not able to verify these reports. Outcrops of Mesozoic strata are not known within the study area.

PRE-TERTIARY ROCKS

Syrena Formation.—A faulted block of Paleozoic carbonate rocks about one-half mile long by one-quarter mile (0.8×0.4 km) wide was discovered by M. J. Aldrich (1976) near the southeastern corner of tract 1 of the Gila Primitive Area (pl. 1) since the fieldwork for this report. These rocks, which crop out on a ridge in upper Turkey Cienega Canyon in the North Star Mesa 7½ minute quadrangle, are fossiliferous and have been correlated with the Pennsylvanian Syrena Formation by Aldrich.

TERTIARY ROCKS

The major rock units in the volcanic section in the Gila study area are listed in table 1. Most of the units are shown on the generalized geologic map that accompanies this report (pl. 1), but a few of them are shown only on the larger scale more detailed reconnaissance geologic map that has been published separately (Ratté and Gaskill, 1975). The Tertiary rocks exposed in the Gila study area are mostly extrusive volcanic rocks or their shallow intrusive equivalents. Some volcaniclastic sediments are interlayered with the volcanic rocks, and thick deposits of fluvial conglomerate and finer grained stream-deposited sediments cover large tracts in the eastern part of the study area and along the western and southwestern margins of the area (pl. 1).

The extrusive volcanic rocks consist mainly of lava flows of silicic to mafic composition and sheets of silicic ash-flow tuff. The source vents

TABLE 1.—*Tertiary volcanic units in the Gila study area*

Stratigraphic unit and thickness in feet[1]	Description
Late post-caldera rocks	
Alkali olivine basalt flows .... (0–200)	Dark-gray to black, massive to vesicular; cap Gila Conglomerate in southeastern corner of study area; probably correlate with basalt flows 10–15 miles (25–40 km) to east in Mimbres River valley, which have given a K–Ar whole rock age = 6.3±0.4 m.y. (Elston, Bikerman, and Damon, 1968, p. A–iv–5).
Younger andesitic and latitic lava flows (0–2,000+)	Includes the Bearwallow Mountain Andesite and Wall Lake Latite of Elston (1968), Double Springs Andesite of Elston (in Rhodes, 1970), and Last Chance and Mogollon Andesites of the Mogollon mining district (Ferguson, 1927); the typical andesitic rocks are in dark-brown brecciated flows, locally vesicular to amygdaloidal, with sparse altered pyroxene and olivine phenocrysts; latitic flows tend to be dark gray and more massive, and may contain light-green pyroxene phenocrysts and conspicuous quartz xenocrysts; the Last Chance Andesite has given a K–Ar whole rock age = 25.0±0.5 m.y. and the Bearwallow Mountain Andesite = 20.6±0.5 m.y. (Elston and others, 1973, table 2).
Early post-caldera rocks	
Moat-fill sediments .. 0–200+)	Volcaniclastic sediments containing blocks of the "younger rhyolite." lavas and fragments of pumice reworked from pyroclastic deposits associated with the "younger rhyolite" flows.
Lithophysal rhyolites (0–800+)	Flows and domes of felsitic to porphyritic flow-banded rhyolite in the Rocky Canyon, Beaver Creek, and Indian Creek areas; lithophysae or "stone bubbles" are common and may contain cassiterite, fluorite, garnet, and the rare minerals bixbyite and pseudobrookite (Fries and others, 1942); these rhyolites probably correlate, at least in part, with the Taylor Creek Rhyolite of Elston and others, 1973, table 2, which has given a K–Ar sanidine age = 24.0±0.5 m.y.
Younger rhyolite flows and domes .. (0–3,000+)	Mainly flow-banded, spherulitic to porphyritic rhyolite and associated pyroclastic and volcaniclastic rocks, include the Fanney Rhyolite of the Mogollon mining district (Ferguson, 1927) and part of the Jerky Mountains Rhyolite of Elston (1968, p. 237); also includes the biotitic and hornblendic flows and breccias of the latite of Nabours Mountain (Rhodes, 1970).
Porphyritic latite of Willow Creek .. (0–200+)	Gray to pinkish-gray medium to coarsely porphyritic lava flows; contain rimmed feldspar and black biotite phenocrysts.
Mineral Creek Andesite .... (0–1,000+)	Numerous thin flows and flow breccia units, generally tens of feet thick; dark-reddish-brown rocks are commonly vesicular or amygdaloidal, and some flows have a distinctive coarse diabasic texture.

See footnote at end of table.

TABLE 1.—*Tertiary volcanic units in the Gila study area*—Continued

Stratigraphic unit and thickness in feet[1]	Description
Early post-caldera rocks—Continued	
Rhyolite of Sacaton Mountain .... (0–1,300+)	Mainly light-colored quartz-feldspar porphyritic lava flows; locally, as on Sacaton Mountain (pl. 1), several thin flows of variable color and texture are present beneath more typical thick quartz-feldspar porphyry flows; feldspar phenocrysts commonly altered and leached with only skeletal remains.
Rocks of the caldera-forming eruptions	
Tuff of Apache Spring .... (0–2,500+)	Ash-flow tuff member—mainly densely welded reddish-brown to gray rhyolitic to quartz latitic welded tuff with abundant quartz, sanidine, plagioclase, and biotite phenocrysts and minor sphene and pyroxene; equivalent to Apache Spring Quartz Latite of Elston (1968) and Rhodes (1970); K–Ar age of biotite from sample along Bursum road at northwest edge of study area = 27.3±0.8 m.y. (Elston, Bikerman, and Damon, 1968, p. A–iv–5).
	Volcaniclastic member—fluvial conglomerate and landslide debris from wall of Bursum caldera; interlayered with and overlying the ash-flow tuff member. Probably includes both caldera-fill and moat-fill deposits.
	Collapse of Bursum caldera initiated either by eruption of Bloodgood Canyon Rhyolite Tuff of Elston (1968) or by early eruptions of Tuff of Apache Spring.
Bloodgood Canyon Rhyolite Tuff of Elston (1968) ..... (0–1,000+)	Ash-flow tuff with abundant quartz and sanidine (variety moonstone) phenocrysts; minor yellow sphene and rare biotite; sample from East Fork of Gila River within study area has given K–Ar ages of biotite = 26.2±1.5 m.y. and of sanidine = 25.3±1.5 m.y. (Bikerman, 1972, p. 11). This ash-flow tuff is at least 1,000 ft (300 m) thick within the Gila Cliff Dwellings caldera which may be the source area of either the Bloodgood Canyon or of one of the older ash-flow tuff sheets of this volcanic sequence.
Rhyolite of the Diablo Range .... (0–1,500+)	Flows and domes of light-gray to chalky white flow-banded rhyolite and associated pyroclastic and volcanistic rocks; 0–5 percent sanidine (variety moonstone) and quartz phenocrysts as much as one-half centimeter and larger; minor sphene and rare biotite.
Pre-caldera rocks	
Dacitic intrusive rocks of Holt Gulch .... (0–800+)	Propylitically altered fine-grained massive rocks that have a microgranitic texture; restricted to Holt Gulch area at western edge of study area. Age relations uncertain.

TABLE 1.—*Tertiary volcanic units in the Gila study area*—Continued

Stratigraphic unit and thickness in feet[1]	Description
Pre-caldera rocks—Continued	
Younger pre-caldera and other volcanic rocks, undivided	
[2]Andesitic flows and breccias of Murtocks Hole ... (0–600)	Thin andesitic and basaltic lava flows and flow breccia along and adjacent to the Gila River canyon; includes a thin discontinuous layer of sanidine-bearing crystal-poor tuff.
[2]Tuff of Shelley Peak .... (0–700)	Densely welded to partially welded phenocryst-rich ash-flow tuff; phenocrysts include plagioclase, biotite, green pyroxene and locally quartz and sanidine in reddish-brown to pink matrix; eutaxitic white pumice locally.
[2]Tuff of Davis Canyon .... (0–300)	Pumice-rich, eutaxitic partially welded ash-flow tuff with sparse small quartz and sanidine (moonstone) phenocrysts in light-gray to white matrix.
[2]Tuff of Fall Canyon .... (0–500)	Phenocryst-rich partially welded ash-flow tuff with quartz, sanidine, plagioclase, and biotite phenocrysts; sericitized sanidine commonly has a silky sheen.
Cooney Quartz Latite Tuff .... (0–2,000+)	Densely welded to partially welded ash-flow tuff; abundant plagioclase and biotite phenocrysts; in the Whitewater Creek area, unit as mapped includes small outcrops of Whitewater Creek Rhyolite, Houston Andesite, Cranktown Sandstone, and Pacific Quartz Latite. Biotite–K–Ar age of 32±1.5 m.y. (Bikerman, 1972, p. 12).
Latitic and andesitic lava flows of Gila Flat .... (0–600+)	Gray porphyritic latite flows with phenocrysts of plagioclase and minor biotite and light-green pyroxene, and xenocrysts(?) of quartz, are most typical; also plagioclase, black pyroxene andesitic flows; K–Ar ages of biotite and sanidine from quartz latite vitrophyre = 29.6±1.1 m.y. and 29.3±1.1 m.y., respectively (R. F. Marvin, written commun., 1972). Interlayered locally with the ash-flow tuffs of the pre-caldera volcanic rocks. Equivalent in part to the latite member of the Alum Mountain Formation of Elston, Coney, and Rhodes (1968, p. 266, 268).
Volcanic complex of Alum Mountain .. (0–1,400+)	Andesitic flows, flow breccia, and bedded volcaniclastic and pyroclastic rocks cut by small rhyolitic to dacitic intrusive bodies; confined as inliers within younger rocks; includes the hydrothermally altered and mineralized rocks of the Alum Mountain-Copperas Creek area. K–Ar age of potassic feldspar from an aplitic dike that cuts these rocks = 29.7±1.0 m.y. (R. F. Marvin, written commun., 1972). Largely equivalent to the porphyritic andesite member of the Alum Mountain Formation of Elston, Coney, and Rhodes (1968, p. 266, 268).
Volcanic complex of Brock Canyon .... (0–1,200+)	Altered and unaltered latitic and andesitic lava flows, volcanic breccias, and possible intrusive rocks; host to quartz-fluorspar veins of Gila fluorspar district; K–Ar biotite ages of fresh latitic

TABLE 1.—*Tertiary volcanic units in the Gila study area*—Continued

Stratigraphic unit and thickness in feet[1]	Description
Pre-caldera rocks—Continued	
	lavas near Clum mine = 31.0±1.1 m.y. and 32.7±1.1 m.y. (R. F. Marvin, written commun., 1972); zircons from altered rock in Brushy Canyon give a fission-track age of 30.2±5.3 m.y. (C. W. Naeser, written commun., 1973). This zircon age supersedes that in an earlier report (Ratté and others, 1972) which listed a preliminary Eocene age of 49±2 m.y. for the altered rock in Brushy Canyon.
Ash-flow tuffs of Rocky Canyon .... (0–600+)	Silicic compositionally zoned ash-flow tuff sheet; present only in southeast corner of study area; lower cooling unit, about 400 ft thick, largely vapor phase, partially welded tuff with thin zones of densely welded tuff; contains sparse quartz, sanidine, plagioclase, and biotite phenocrysts with accessory amphibole, sphene, zircon, and apatite; upper cooling unit is mainly densely welded tuff with abundant plagioclase and biotite phenocrysts; may correlate with Caballo Blanco Tuff of Elston (1957) or Caballo Blanco Tuff Member of the Datil Formation of Ericksen and others (1970), which has a K–Ar age of sanidine = 29.8±0.8 m.y. (Elston, Bikerman, and Damon, 1968, p. A–iv–5), or may correlate with Kneeling Nun Rhyolite Tuff or Kneeling Nun Tuff Member of the Datil Formation of Ericksen and others (1970) which has a K–Ar age of biotite = 33.4±1.0 m.y. (McDowell, 1971).
Andesitic flows and breccias of Turkey Cienega Canyon .. (0–400+)	Purplish-gray and reddish-gray volcanic breccia and dark-gray fine-grained to porphyritic lava flows with sparse pyroxene (both clinopyroxene and hypersthene in some rocks) and olivine phenocrysts, partly altered to iddingsite; andesites are continuous with andesite of Mimbres River-McKnight Mountain area (Ericksen and others, 1970, pl. 1).

[1] Feet divided by 3.05 equal meters.
[2] Unit mapped separately by Ratté and Gaskill (1975).

for most of the volcanic rocks are probably located within the study area, but some of the older ash-flow tuff sheets may have been erupted from vents outside the study area.

For purposes of description, the rock units are here grouped as pre-caldera rocks, caldera-forming rocks (that is, rocks related to caldera-forming eruptions), and post-caldera rocks, with reference to the Bursum and Gila Cliff Dwellings calderas. The Bursum caldera, which is located in the western half of the study area (pl. 1), has an east-west diameter of about 25 miles (40 km) and is the dominant volcanic structure within the study area. The Gila Cliff Dwellings caldera, which adjoins the Bursum caldera on the east, is a somewhat smaller structure whose origin by collapse is still conjectural. As a working hypothesis in this report, it is considered that the Bursum caldera formed as the result of collapse in the crust above a magma chamber during the eruption of the tuff of Apache Spring, and that earlier eruptions of the Bloodgood Canyon Rhyolite Tuff of Elston (1968) may have caused collapse of the Gila Cliff Dwellings caldera. Alternatives to this hypothesis are presented in appropriate sections of this report.

The volcanic rocks are all of Tertiary age, and mainly middle-late Tertiary as indicated by isotopic and fission track dating (table 1). Most of the volcanic rocks described here have been considered part of the Datil Group or Formation (Winchester, 1921; Tonking, 1957; Elston, Coney, and Rhodes, 1968, 1970; Ericksen and others, 1970). Because of the incomplete knowledge of the volcanic stratigraphy and correlation of units in different parts of the Mogollon volcanic province, the volcanic stratigraphic nomenclature used here is a mixture of formal and informal names derived largely from the volcanic section in the Mogollon mining district (Ferguson, 1927) and new names proposed by Elston, Coney, and Rhodes (1968, 1970), and informal names for units that were described for the first time during this study.

PRE-CALDERA ROCKS

Rocks formed prior to the development of the Bursum and Gila Cliff Dwellings calderas include two sequences of silicic ash-flow tuffs that are separated by and in part interlayered with a complex of intermediate to mafic composition volcanic rocks, which are distributed around several volcanic centers. These pre-caldera rocks occur mainly along the west and southwest margins and in the southeast part of the study area (pl. 1). They have a maximum exposed thickness between 2,000 and 3,000 feet (600–900 m) at any one locality where they are not repeated by faulting. They are probably all of Oligocene age, with ages ranging from about 28–34 m.y. (table 1). A possible Eocene age for altered rocks of the complex of Brock Canyon, reported earlier by Ratté and others (1972a), has been revised; the recalculated fission-track age of zircons from these rocks indicates a late Oligocene age, which is in agreement with other age data for the complex (table 1; C. W. Naeser, written commn., 1973).

The oldest pre-caldera rocks are the andesitic lava flows and breccias of Turkey Cienega Canyon and the overlying rhyolitic ash-flow tuffs of Rocky Canyon (table 1). These rocks are overlain by the volcanic complexes of Alum Mountain and Brock Canyon, which are related to volcanic centers in the Alum Mountain–Copperas Creek area and the Brock Canyon-Brushy Canyon area (pls. 1, 3). Andesitic and latitic rocks of both centers have been altered extensively by hydrothermal fluids and later supergene solutions, and are at least weakly mineralized. Small silicic and intermediate composition intrusives cut the rocks of the complex of Alum Mountain, and some of them are altered and mineralized. Quartz-fluorite veins in the complex of Brock Canyon at the south edge of the study area along the Gila River constitute the Gila fluorspar district.

Latitic and andesitic lava flows of Gila Flat unconformably overlie altered rocks of the Alum Mountain volcanic complex. However, the unconformity apparently represents only a short time interval as indicated by preliminary isotopic dating, which shows the age of an aplite dike that cuts altered rocks beneath the unconformity to be indistinguishable from the age of latitic rocks above the unconformity, both about 29 m.y. old (table 1).

Above and intertonguing with the intermediate lavas of Gila Flat is a younger pre-caldera sequence of silicic ash-flow tuffs (fig. 7) that includes the Cooney Quartz Latite Tuff, tuff of Fall Canyon, tuff of Davis Canyon, and tuff of Shelley Peak. Only the Cooney Tuff is shown separately on plate 1; the other ash-flow tuff sheets make up most of the unit of pre-caldera volcanic rocks, undivided (table 1), which is mapped mainly northwest from the Gila River along the edge of the study area (pl. 1). Also included locally in this composite unit are andesitic lavas of Murtocks Hole and Bloodgood Canyon Tuff, where their outcrops are too small to be shown at the scale of this map; and possibly some post-caldera rocks, where the geologic relations were too complex to be resolved in this resource appraisal.

The dacitic intrusive rocks of Holt Gulch at the western edge of the study area may also be part of the pre-caldera volcanic terrane, but only the position of this intrusive body beneath post-caldera andesite and rhyolite can be confirmed at this time. A preliminary fission track age of 22.7±2.3 m.y. for zircons from this rock (C. W. Naeser, written commun., 1973) can be considered only as a minimum age at this time because of the possibility that the zircons were annealed during the intrusion of younger rhyolite dikes and plugs which cut the dacitic rocks in the Holt Gulch–Wilcox Peak area.

ROCKS OF THE CALDERA-FORMING ERUPTIONS

Ash-flow tuff calderas are volcanic subsidence structures that are formed by collapse of the earth's crust above a shallow magma reservoir as the result of very rapid eruption of large volumes of gas-rich pumice and ash. The crust collapses because the magma reservoir is emptied by eruption of magma more rapidly than new magma can replenish the reservoir and maintain support of its roof. After caldera collapse, renewed magmatic pressure or other forces may elevate the subsided caldera block to form a resurgent dome within the caldera (Smith and Bailey, 1969).

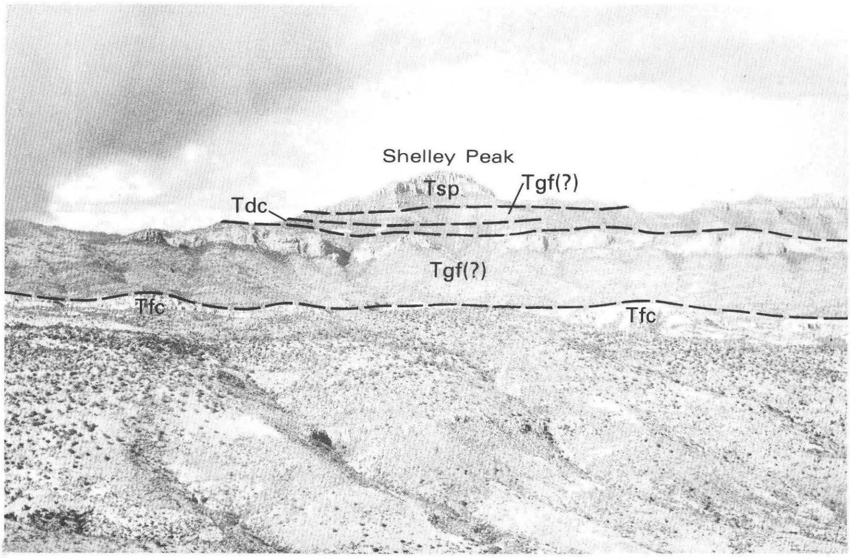


FIGURE 7.—Shelley Peak as viewed from mesa southwest of Mogollon Creek, looking into head of Fall Canyon drainage. Tsp, ash-flow tuff of Shelley Peak; Tdc, ash-flow tuff of Davis Canyon; Tfc, ash-flow tuff of Fall Canyon. Ash-flow tuffs are separated by latitic and andesitic flows of Gila Flat(?) [Tgf(?)]. Base of tuff of Fall Canyon is uncertain because of complexly faulted terrane in foreground, which is greatly foreshortened in photograph.

The Bloodgood Canyon Rhyolite Tuff of Elston (1968) and the tuff of Apache Spring are caldera-forming ash-flow tuffs related to the Gila Cliff Dwellings and Bursum calderas. Also included with the caldera-forming rocks here are the rhyolite flows and domes of the Diablo Range, which probably were erupted from the same magma chamber as the caldera-forming ash-flow tuffs.

RHYOLITE OF THE DIABLO RANGE

The rhyolite of the Diablo Range consists mainly of flows and domes of light-gray to chalky-white flow-banded rhyolite and associated pyroclastic and volcaniclastic rocks as much as 1,500 feet (450 m) thick. It occurs mainly north of the Gila River in the Diablo Range, where it is in the walls of both the Bursum and the Gila Cliff Dwellings calderas (pl. 1). In most places, the rhyolite overlies either the andesitic flows and breccias of Murtocks Hole or the tuff of Shelley Peak in the younger sequence of pre-caldera ash-flow tuffs (table 1). In some places, this unit also includes a layer of rhyolite welded tuff, as thick as 500 feet (150 m) in the upper parts of Sycamore Canyon and Turkey Creek in the Diablo Range. The welded tuff is mineralogically identical to the Bloodgood Canyon Rhyolite Tuff of Elston (1968), and it either may be an ash-flow tuff layer within the rhyolite of the Diablo Range, as mapped here (pl. 1), or it may be correlative with the Bloodgood Canyon Tuff, in which case the rhyolite lava flows above the welded tuff layer are part of the post-caldera younger rhyolite flows and domes (table 1). The solution of this stratigraphic problem was beyond the scope of this study. East of Davis Canyon (pl. 1) a rhyolite dike that is connected to the main mapped body of the rhyolite of the Diablo Range has yielded a zircon fission track age of 27.6±4.5 m.y. (C. W. Naeser, written commun., 1973) and K–Ar isotopic ages of 27.6±0.9 m.y., and 26.2±0.9 m.y. for biotite and sanidine respectively (R. F. Marvin, written commun., 1974). Rhyolite domes on lower Davis Canyon and lower Rough Canyon probably are approximately the same age.

BLOODGOOD CANYON RHYOLITE TUFF OF ELSTON (1968)

The Bloodgood Canyon Rhyolite Tuff is a major rhyolite ash-flow tuff sheet that was named for outcrops in Bloodgood Canyon (Elston, 1968) on the north side of Granite Peak in the east-central part of the study area (pl. 1). Densely welded Bloodgood Canyon Tuff is at least 1,000 feet (300 m) thick and possibly 2,000 feet (600 m) thick within the Gila Cliff Dwellings caldera, where it is exposed in spectacular columnar-jointed cliffs in the canyons of the West Fork and Middle Fork of the Gila River (fig. 8). Southeast of the Gila Cliff Dwellings caldera an outflow sheet of Bloodgood Canyon Tuff, 400–800 feet (120–240 m) thick in the walls of the Gila River Canyon, thins eastward as it laps onto older rocks, but it is present in discontinuous exposures to the eastern edge of the study area at Rocky Canyon (Ratté and Gaskill, 1975), where it is about 100 feet thick. Along the steep walls of the Gila River canyon and its tributaries, the Bloodgood Canyon Tuff map unit (pl. 1) includes some older and younger rocks, mainly the andesitic flows and breccias of Murtocks Hole and tuff of Shelley Peak beneath the Bloodgood Canyon and andesitic and basaltic rocks above it (Ratté and Gaskill, 1975).

Bloodgood Canyon Tuff unconformably overlies pre-caldera rocks along and east of the Gila River; to the west the tuff commonly lies on an irregular topography on the rhyolite of the Diablo Range or on the tuff of Shelley Peak. K–Ar dating indicates a late Oligocene or early Miocene age for Bloodgood Canyon Tuff (table 1).

TUFF OF APACHE SPRING

The tuff of Apache Spring (table 1) is a major ash-flow tuff deposit of rhyolitic to quartz latitic composition that is confined to the Bursum caldera, at least within the area mapped (pl. 1). The formation consists of two informal members—an ash-flow tuff member and a volcaniclastic member. The ash-flow tuff member is mostly densely welded tuff at least

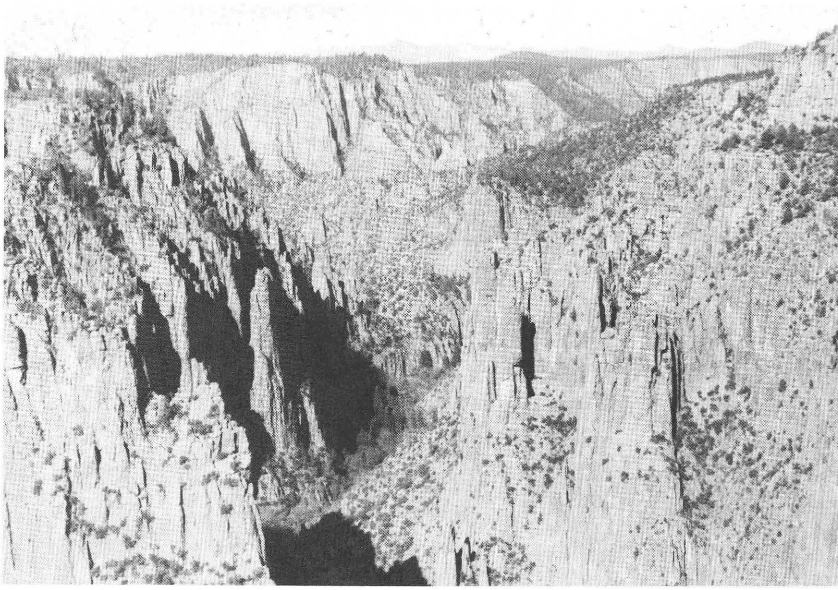


FIGURE 8.—Columnar-jointed cliffs of densely welded Bloodgood Canyon Rhyolite Tuff of Elston (1968) along West Fork of Gila River.

3,000 feet (900 m) thick, and its base is not exposed. In contrast to the Bloodgood Canyon Tuff of Elston (1968), the tuff of Apache Spring contains several percent of foreign lithic fragments, and feldspar and mafic phenocrysts (table 1) are weakly but pervasively altered in most places.

The volcaniclastic member of the tuff of Apache Spring (fig. 9) contains crossbedded fluvial conglomerate (fig. 10) and landslide breccia deposits as much as several hundred feet thick in the canyon of Rain Creek at the southern margin of the Bursum caldera (pl. 1). The landslide deposits include slabs of andesite and rhyolite hundreds of feet long and several feet to tens of feet thick, as well as finer debris that is mixed with pyroclastic materials of the ash-flow tuff eruptions. These deposits are interlayered with densely welded tuff of the ashflow tuff member. Monolithologic breccias of Bloodgood Canyon Tuff that locally overlie the tuff of Apache Spring also are included in the volcaniclastic member. These breccias form wedge-shaped layers as much as 300 feet (100 m) thick adjacent to the eastern wall of the Bursum caldera at Hells Hole (pl. 1).

Although the tuff of Apache Spring and the Bloodgood Canyon Tuff of Elston (1968) are not exposed in a simple stratigraphic relationship within the study area, inclusions of Bloodgood Canyon Tuff in the tuff of Apache Spring and the structural relationships at the wall of the

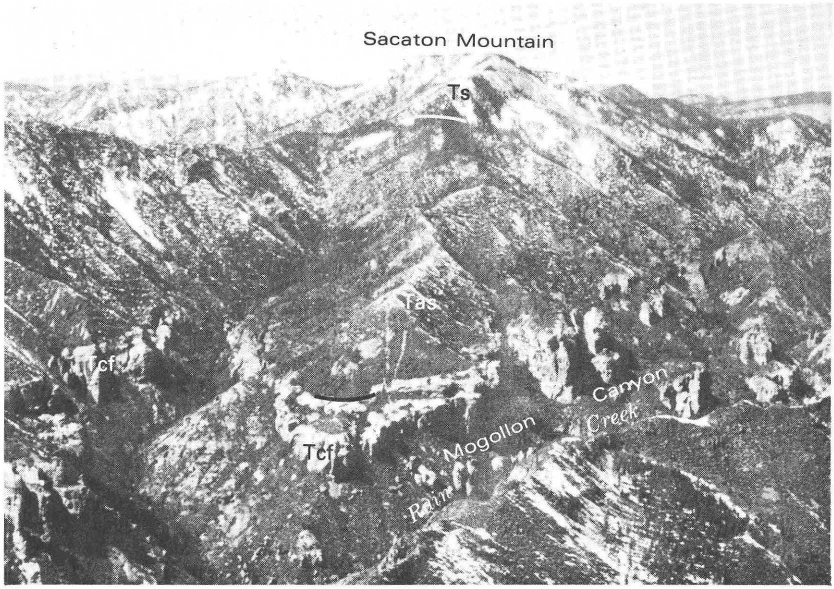


FIGURE 9.—Cliffs of the volcaniclastic member (Tcf) of the tuff of Apache Spring on west side of Rain Creek. Ts, rhyolite of Sacaton Mountain; Tas, tuff of Apache Spring, which also occurs in the canyon bottom beneath the volcaniclastic member.

Bursum caldera, to be described in the structure section of this report, indicate that the tuff of Apache Spring is the younger of these two ash-flow tuff deposits (Ratté and Gaskill, 1973). Previously it was thought that the tuff of Apache Spring was older than the Bloodgood Canyon Tuff on the basis of isotopic dating (Elston, Bikerman, and Damon, 1968, p. A–iv–5; Elston and others, 1973, table 1), but additional isotopic and fission track ages from these ash-flow tuffs overlap within the statistical uncertainty of the results (R. F. Marvin and C. N. Naeser, written commun., 1973), leading us to conclude that the ages of the tuffs are probably too nearly the same to be differentiated by K–Ar and fission track dating techniques (Ratté and Gaskill, 1973).

POST-CALDERA ROCKS

Post-caldera rocks include rhyolites, latites, and andesites that, in part, are related to the caldera cycle of volcanism (early post-caldera rocks) and younger latitic to basaltic lava flows and sedimentary rocks that are believed to be related more to basin-and-range tectonism and associated volcanism (late post-caldera rocks).

The early post-caldera rocks probably were erupted mainly from the ring fracture zone of the Bursum caldera; they accumulated largely within the moat between the topographic wall and central dome and may have completely buried the resurgent dome. These rocks include the

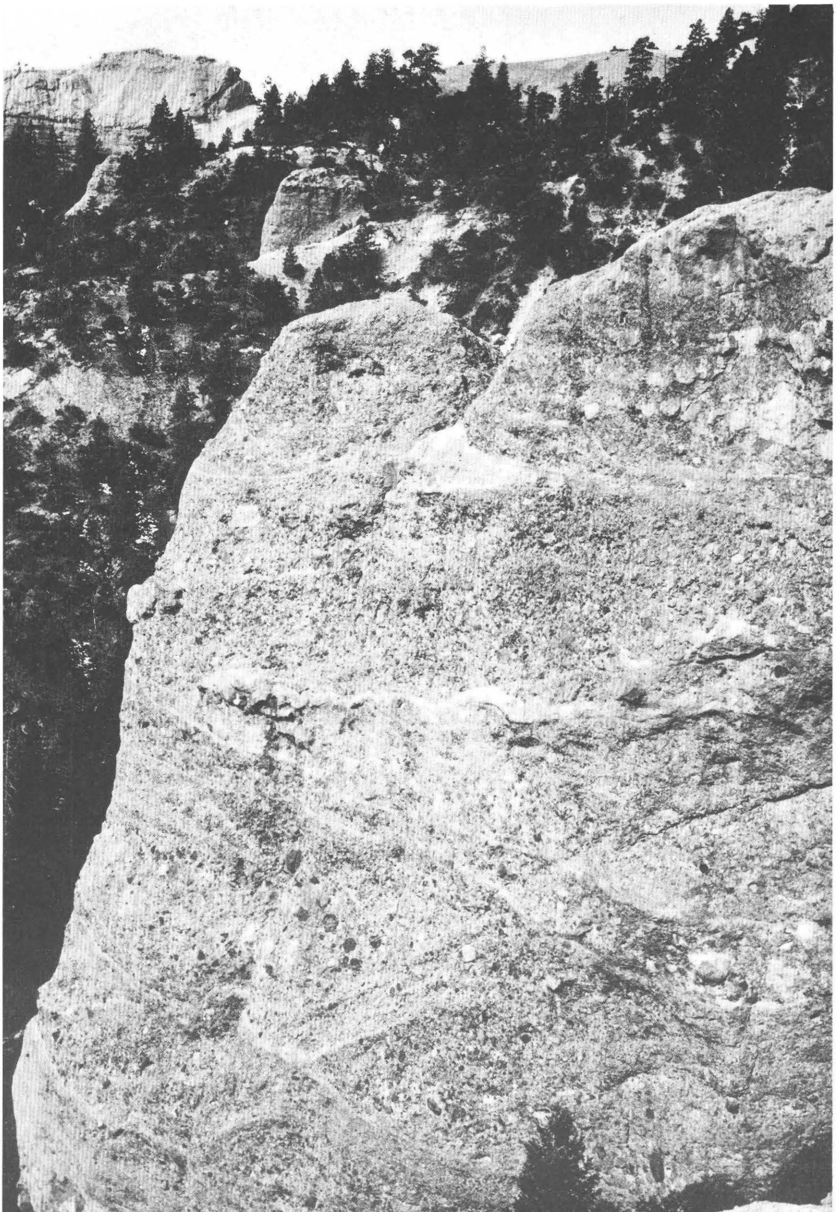


FIGURE 10.—Crossbedded fluvial conglomerate of the volcaniclastic member of the tuff of Apache Spring. View of north wall of tributary canyon west of Rain Creek on the north side of Haystack Mountain.

rhyolite of Sacaton Mountain, which seems to have preceded resurgence, the Mineral Creek Andesite, porphyritic latite flows of Willow Creek, and the younger rhyolite flows and domes (table 1). The younger rhyolite flows and domes were erupted from numerous intrusive centers along the ring fracture zone of the Bursum caldera near Nabours and Holt Mountains, Wilcox Peak, Sheridan Mountain (fig. 11), Seventyfour Mountain, and within the Mogollon mining district.

Late post-caldera volcanic rocks complete the geologic section in many parts of the study area (pl. 1). Locally, the late latitic to basaltic lavas seem to represent several formations (table 1), but where the lavas are not separated by intervening rhyolitic pyroclastic and volcaniclastic rocks, the individual units are largely indistinguishable. Mafic lava flows are at least 2,000 feet (600 m) thick on Black Mountain at the northeastern boundary of the wilderness and exceed 1,000 feet (300 m) in thickness along the crest of the Mogollon Mountains and along the canyons of the Gila River (pl. 1). According to preliminary isotopic dating, the mafic lavas represent andesitic volcanism over a time span of about 5 m.y. from about 20 to 25 m.y. ago (Elston and others, 1970, table 1).

Lithophysal rhyolites (table 1) are interlayered with the lower part of the mafic lava flows in the northeastern part of the study area. The rhyolites represent flows around local vents, as in the Indian Creek area,

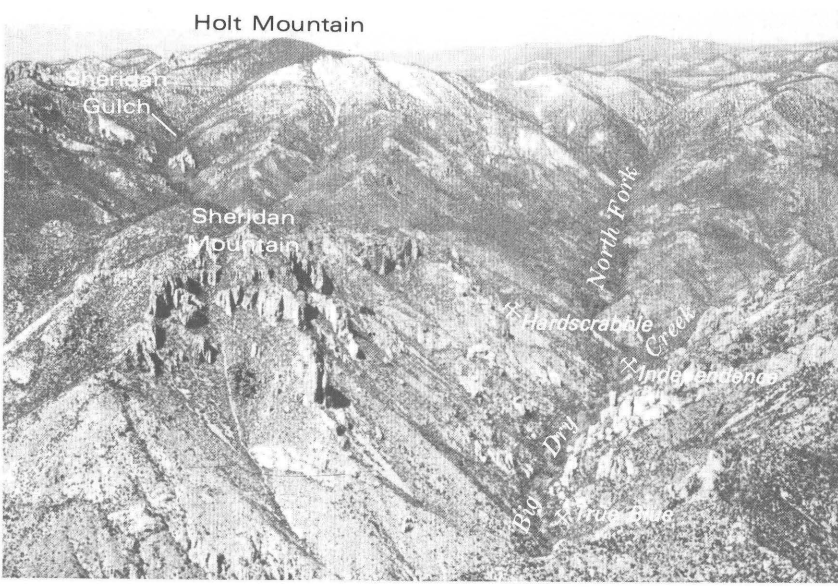


FIGURE 11.—Sheridan Mountain plug dome of flow-banded rhyolite and approximate location of prospects along Big Dry Creek.

where the rhyolite is extensively altered and hematite stained, and includes part of the tin-bearing rhyolites of the Taylor Creek district, which is just beyond the northeast corner of the study area. These rhyolites are much more extensive to the east in the Black Range (Ericksen and others, 1970); they have a K–Ar sanidine age of 24.0±0.5 m. y. (Elston and others, 1970 table 1) in the Taylor Creek area.

The sedimentary rocks of the late post-caldera section are mainly Gila Conglomerate, which consists of fine to coarse bouldery conglomerate (fig. 12) that commonly can be correlated with a local source. The conglomerate is as much as 800–1,000 feet (240–300 m) thick in the Sapillo Creek graben in the eastern part of the study area (pl. 1), and is several hundred feet thick along the East and West Forks of the Gila River. Andesitic flows at or near the base of the conglomerate along Sapillo Creek (pl. 1) give a whole-rock K–Ar age=20.6±0.5 m.y. (Damon, 1970, p. A–vi–6), and alkali olivine basalt near the top of the conglomerate in the Mimbres River drainage east of the study area has given a K–Ar whole-rock age=6.3±0.4 m.y. (Elston, Bikerman, and Damon, 1968, p. A–iv–5). Pediment gravels and minor other recent alluvial deposits are included in this map unit. Alkali olivine basalt flows, which cap the conglomerate in the southeastern corner of the study area (pl. 1), are the youngest volcanic rocks within the area, and probably correlate with the 6.3-m.y. basalt along the Mimbres River.

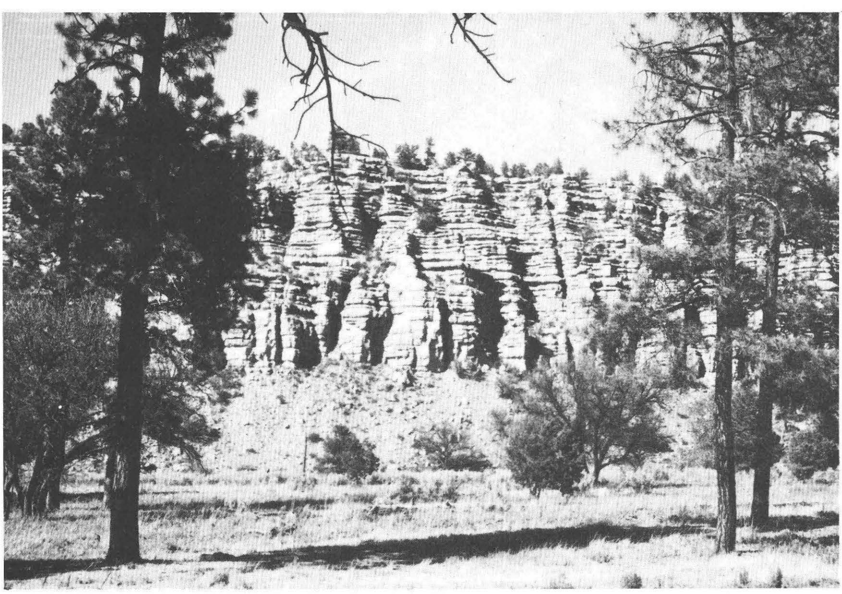


FIGURE 12.—Cliffs of the Gila Conglomerate at the southern edge of tract 1 of the Gila Primitive Area on the north side of Sapillo Creek east of Lake Roberts.

Near the junction of New Mexico Highways 15 and 35 at Sapillo Creek, the sedimentary rocks include tuffs, tuff breccia and tuffaceous sediments that may represent pyroclastic deposits associated with a quartz latite dome complex mapped with the flows of Gila Flat (table 1) rather than the younger Gila Conglomerate in which the valley of Sapillo Creek is cut east of the highway junction. Local derivation of the Gila Conglomerate from older volcaniclastic deposits may explain an apparent gradation between similar deposits of different ages in this area.

ALTERED ROCKS

The rocks associated with, overlying, or otherwise surrounding an ore deposit may be altered in their mineral composition by the same solutions that formed the ore deposits (primary or hypogene alteration) and by later ground-water solutions (secondary or supergene alteration). Thus, altered rocks are a well-established guide that is used to explore for ore deposits. Some of the most common alteration minerals that are associated with ore deposits in volcanic rocks are clays, quartz and other silica forms, sericite, alunite, chlorite, calcite, and feldspars. Altered rocks containing these minerals in the Gila study area occur principally in the Alum Mountain–Copperas Creek area at the eastern edge of the Gila Wilderness, the Brock Canyon area along the Gila River at the southern edge of the wilderness, the Lone Pine Hill area east of Little Dry Creek, the Holt Gulch–Wilcox Peak area along the southwestern margin of the study area, and near the headwaters of Indian Creek along the northern edge of the study area north of Gila Primitive Area tract 5 (fig. 3). The altered rocks in the Alum Mountain–Copperas Creek area are mainly in tracts 1, 2, and 3 and in the corridor between tracts 1 and 2, and partly in the adjoining wilderness. The Holt Gulch–Wilcox Peak altered rocks are partly within the western part of the wilderness. The other areas of altered rocks listed above are adjacent to, but almost entirely outside, the present boundaries of the wilderness and primitive areas. In addition, pervasive alteration to clays, chlorite, and calcite (propylitic alteration) is widespread in the Cooney Quartz Latite Tuff south of the Mogollon district in the northwest corner of the study area and in rocks correlated with the Cooney Quartz Latite Tuff in the vicinity of Rain Creek along the southwest edge of the study area (pl. 1). Also, weakly altered rhyolite occurs along northwest-trending faults and fractures in the rhyolite of the Diablo Range (table 1) between Manzanita Creek and Turkey Creek within the wilderness north of the Gila River (pl. 1).

The oxidation of andesitic lavas and breccias during volcanic extrusion commonly produces secondary minerals such as celadonite, a blue-green iron-rich micaceous mineral that is commonly mistaken for secondary copper minerals. Mineral claims along Turkey Creek north of the Gila River apparently were located on this erroneous basis.

DESCRIPTION OF ALTERED-ROCK LOCALITIES

ALUM MOUNTAIN-COPPERAS CREEK AREA

The altered rocks in this area are confined to two inliers of andesitic and latitic lava flows, flow breccia, and bedded volcaniclastic and pyroclastic rocks that are cut by small silicic intrusive bodies, all of which belong to the volcanic complex of Alum Mountain (table 1). The inliers are surrounded mainly by the unaltered latitic and andesitic lava flows of Gila Flat (table 1) and younger rocks (pl. 1). Although additional data are needed, the unconformity between the altered and unaltered rocks probably represents only a short time interval, as indicated by the concordance of isotopic ages of quartz latite from the lava flows of Gila Flat above the unconformity and by an aplite dike that cuts the rocks of the complex of Alum Mountain beneath the unconformity.

The silicic intrusive bodies consist of small rhyolitic and quartz monzonitic dikes and sills, a few meters thick, and of several larger bodies, mostly in the Copperas Creek inlier. The largest is an altered rhyolite dike(?) more than a half mile (1 km) long and several hundred yards (meters) wide, which is exposed in roadcuts along New Mexico Highway 15, about one-half mile (1 km) north of Sapillo Creek. This fine-grained fluidal rhyolite contains sparse feldspar phenocrysts in a bleached, argillized matrix with disseminated pyrite and specularite. Tiny seams and veinlets of quartz and specularite crisscross the rock. Several smaller rhyolite dikes and sills, a few yards (meters) or less thick, have pyritic and argillized borders a few inches (centimeters) wide, which suggests either that the flow of post-rhyolite solutions was controlled by the contacts of the intrusive bodies or that the solutions were derived from the intrusive rhyolite. Other rhyolite bodies are not so altered, but consist of gray fluidal aphanitic rhyolite with scattered white clay pseudomorphs of feldspar phenocrysts less than one-fourth inch (2–4 mm) long.

The altered rocks in the Alum Mountain inlier probably are controlled primarily by a volcanic vent at Alum Mountain. In the Copperas Creek inlier, local fracture control is more evident, but the silicic intrusions associated with the altered rocks there suggest a relationship to shallow intrusive or venting activity. All rock types in the complex of Alum Mountain seem to have been susceptible to alteration in one place or another, but the most intense and widespread alteration commonly is localized where bedded tuffs and volcaniclastic rocks are most abundant. This may reflect (1) greater accumulation of pyroclastic materials near eruptive centers that localized the processes of solfataric alteration and (2) greater susceptibility of highly porous and permeable clastic rocks to the altering solutions.

Quartz, opal, and clays seem to be the most abundant alteration minerals in surface exposures. Halloysite (endellite) from a claypit in lower Copperas Creek, and alunite in the Alum Mountain area have been reported by Elston and others (1969, p. 52, 53). However, only kaolinite was identified in the few samples that we collected from the claypit. Pyrite seems to be confined largely to the more silicified ribs and pipes, which represent the channelways for altering solutions. Where pyrite or other, unidentified, metallic minerals are present, the silica is usually dark gray to blue gray.

Some silicified knobs consist of honeycombed breccia with concentric platy structure that suggests the orifices of thermal springs. The general aspect of the altered areas is that of an extinct solfatara and hot-spring field, similar, on a smaller scale, to the present activity at Yellowstone National Park, Wyo.

Supergene alteration by descending meteoric waters has caused widespread solution and redeposition of materials in the weathering environment of both inliers, and some of the resulting mineral products account for the name and economic interest in the Alum Mountain area. Unusually thick deposits of hydrated aluminum sulfates, mainly halotrichite and alunogen, have been prospected for alum (Hayes, 1907). Until recently, however, these deposits have been more interesting for their mineralogy and origin than as an economic source of aluminum or its salts, but new processes in use in U.S.S.R. (Patterson and Dyni, 1973, p. 39) and currently being investigated in the United States could change the economic status of this aluminum resource in the near future. The origin of the aluminum sulfate deposits has been discussed by Blake (1894) and Hayes (1907) and will be considered further in the economic geology section of this report. Hayes (1907, p 218–219) interpreted the altered rocks at Alum Mountain to be intrusive; our reconnaissance indicates that the only intrusive bodies exposed at the present surface are small dikes and sills, but the primary alteration probably resulted from hydrothermal solutions given off by a larger intrusion beneath this volcanic center.

Brock Canyon area

Pervasively altered rocks occur in the volcanic complex of Brock Canyon on both sides of the Gila River at the southern edge of the study area (pl. 1). The altered rocks are outside the present wilderness and primitive area boundaries but could project beneath the boundaries, particularly at the northern edge of the altered area.

The volcanic complex of Brock Canyon consists of altered and unaltered lava flows, volcanic breccia, and possible intrusive or protusive rocks (table 1), which are unconformably overlain by silicic ash-flow tuffs on the north (fig. 13) and are overlapped by Gila Conglomerate on the south. The exact position of the unconformity and the age of the altera-

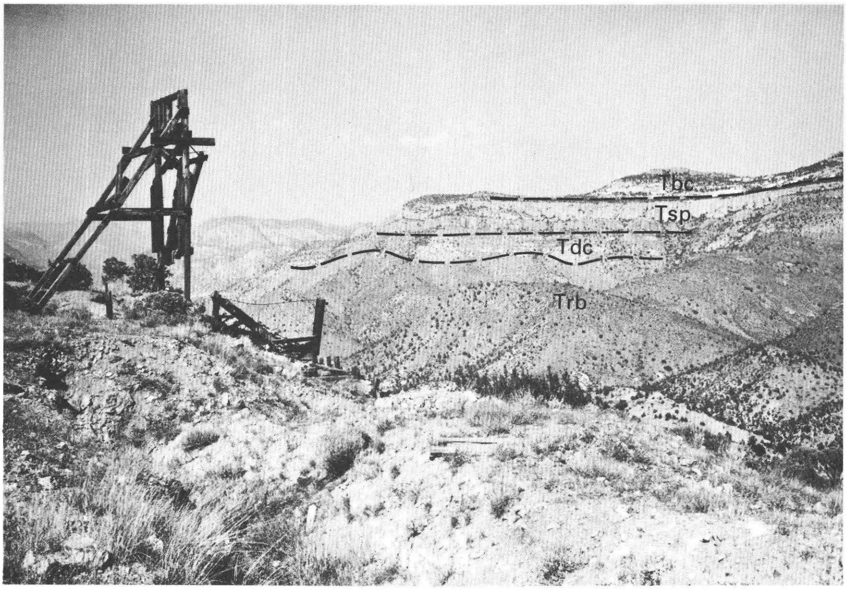


FIGURE 13.—Ash-flow tuff sequence above volcanic complex of Brock Canyon (Trb) includes ash-flow tuff of Davis Canyon (Tdc), ash-flow tuff of Shelley Peak (Tsp), and Bloodgood Canyon Rhyolite Tuff of Elston (1968) (Tbc). View northeastward across Brushy and Brock Canyons from the Clum shaft.

tion are at present in doubt. The rocks of the complex are widely altered to clays and sericite with locally intense silicification and pyritization commonly related to fault or fracture control. Quartz-fluorite veins, which cut both the altered and unaltered rocks of the complex of Brock Canyon, constitute the Gila fluorspar district and probably represent a younger mineralization than the widespread altered rocks. K–Ar biotite ages from unaltered latitic lava flows of the complex and a fission-track age of zircon in the altered rock (table 1) indicate a late Oligocene or younger age of alteration.

HOLT GULCH–WILCOX PEAK AREA

The intrusive dacitic rocks in Holt Gulch and younger rhyolite in the Wilcox Peak area and locally elsewhere, as at Lone Pine Hill east of Little Dry Creek (pls. 1, 3), are extensively and pervasively altered. It is not clear whether these altered rocks represent one or two ages of alteration. The rhyolite is commonly bleached, silicified and argillized, and brightly stained by iron oxides. The altered rhyolite on a hill near Chipmunk Spring along the wilderness boundary east of Red Colt Canyon (pl. 3), contains fracture fillings, vug linings, and pods of pure dickite (a variety of kaolin-clay) as much as 2–3 feet (60–90 cm) wide. Dacitic rocks adjacent to, and cut by, the rhyolite are pervasively propylitized, with chlorite, epidote, pyrite and fine clays being the most abundant alteration minerals.

Indian Creek area

Lithophysal rhyolite (table 1), exposed near the head of Indian Creek at the northeast edge of the study area, is considerably argillized, silicified, and iron stained. The alteration of the rhyolite and its vuggy lithophysal structure are considered to be evidence of its proximity to an extrusive vent.

STRUCTURE

The major structural elements of the Gila study area are the result of constructional volcanism and volcano-tectonic processes in middle Tertiary time, modified and complicated by tensional faulting during the development of basin-and-range structure in late Tertiary time. The study area is part of the region that has been described as the surface expression of a large pluton (Elston, Rhodes, Coney and Deal, 1976; Elston, Rhodes, and Erb, 1976). The likelihood that an extensive batholith underlies the Datil volcanic area (Cohee and others, 1961) is supported by the presence of a regional gravity low, north and west of the study area (Woollard and Joesting, 1964), and by analogy with the gravity low beneath the San Juan Mountains, Colo., which has been interpreted as the probable expression of a concealed batholith (Plouff and Pakiser, 1972). Such a hypothetical batholith provides a setting conducive to the existence of metallic mineral deposits (Elston, 1973, p. 478), and local structures within the Gila study area will be described in this context.

DESCRIPTION OF STRUCTURES POSSIBLY RELATED TO MINERAL DEPOSITS

Structures that might be important in the localization of mineral deposits in the Gila study area include volcanic centers at Alum Mountain–Copperas Creek, Brock Canyon, and in the Wilcox Peak area; the Holt Gulch intrusive; the resurgent Bursum caldera; north-south faults that extend southward from the Mogollon mining district; the northwest trending faults that determine the structural grain in much of the study area; and the Santa Rita–Hanover axis of Elston (1968, pl. 1; Aldrich, 1976, fig 2; pl. 1, this report).

ALUM MOUNTAIN AND COPPERAS CREEK VOLCANIC CENTERS

Recognition of the Alum Mountain center is based mainly on the distribution of altered volcanic rocks within the Alum Mountain inlier (pl. 1), a large part of which is in Gila Primitive Area tract 3 (pls. 1, 3). The most intensely altered rocks occur on Alum Mountain, a volcanic vent area, which is outlined by the Gila River on the west and deep canyons in the altered rocks on the north and south. The highly argillized and silicified rocks represent the solfataric type of alteration commonly associated with volcanic vent activity. The presence of a silicic intrusive body beneath the Alum Mountain volcanic center is inferred to be the source of the altering solutions, but at the surface, only one small dacitic intrusive was mapped within the inlier.

The latitic lava flows of Gila Flat and younger rocks unconformably overlie an apparent rough topography near this volcanic center.

The Copperas Creek inlier, which overlaps tracts 1 and 2 (pl. 1; fig. 3), has a structure that is similar to that of the Alum Mountain inlier, except that a specific volcanic center is not so readily identified. The altered rocks have the same solfataric character as those around Alum Mountain, but they are more widely scattered and seem to be associated with numerous small silicic intrusive bodies, both altered and unaltered. The

FIGURE 14.—Aerial photograph showing fracture-controlled drainage pattern in rocks of the volcanic complex of Alum Mountain as exposed in the Copperas Creek inlier. Tva, volcanic complex of Alum Mountain; Tvi, silicic intrusive rocks; Tgf, latite and andesite flows of Gila Flat; QTs, sedimentary rocks, mainly Gila Conglomerate.

Copperas Creek inlier also is characterized by a unique polygonal topography and drainage pattern (fig. 14), which probably is structurally controlled by the many siliceous fracture fillings and pipes that cut the more-or-less argillized volcanic rocks. Whereas the few faults and shears that are shown on the geologic map (pl. 1) trend mainly northwest to west, measured lineaments from the aerial photograph in figure 14 show much more diverse trends within the Copperas Creek inlier (fig. 15). Insufficient study was made for this report to appraise the structural significance of the pattern of lineaments, but the possibility of buried intrusive rocks of another volcanic center should be an incentive to additional investigations of the structure in the Copperas Creek inlier.

BROCK CANYON VOLCANIC CENTER

The Brock Canyon volcanic center is exposed at the mouth of the Gila River canyon, at the southern edge of the wilderness, as a result of uplift and tilting on frontal faults along the Mogollon Mountains and Pinos Altos Range (pl. 1; figs. 2, 3). The diversity of andesitic and latitic lava flows, breccias, volcaniclastic rocks, and probable shallow intrusive rocks that constitute the volcanic complex of Brock Canyon, combined with the intense localized rock alteration around Brock and Brushy Canyons (pl. 1), serve to identify this area as a volcanic center. Lavas and breccias of the complex commonly dip much more steeply than the younger lava flows and tuffs that unconformably overlie them. The complex of Brock Canyon, like the Alum Mountain center, is about 30 m.y. old.

Several small to large fluorite-quartz-calcite veins cut the rocks of the Brock Canyon center and make the Gila fluorspar district. The veins dip steeply and strike mainly about north or northwestward, rarely northeastward (Rothrock and others, 1946; Gillerman, 1964; Williams, 1966). The fluorspar veins are younger than the altered rocks of the volcanic center and they cut both altered and unaltered country rock. The possibility that the altered rocks of this volcanic center are an aspect of more significant intrusive activity and mineralization at depth gives the complex of Brock Canyon an appreciable mineral deposit potential beyond that represented by the known fluorspar veins.

WILCOX PEAK CENTER, LONE PINE HILL INTRUSIVE, AND HOLT GULCH INTRUSIVE

Wilcox Peak, which is south of Holt Gulch along the western boundary of the wilderness (fig. 3; pl. 1), is the location of one of several patches of altered rock that probably represent small rhyolitic plugs, which may once have fed rhyolite flows or domes like those that occur all along the southwest border of the study area (pl. 1). Quartz-fluorite veins and quartz veins containing some base and precious metals have been pros-

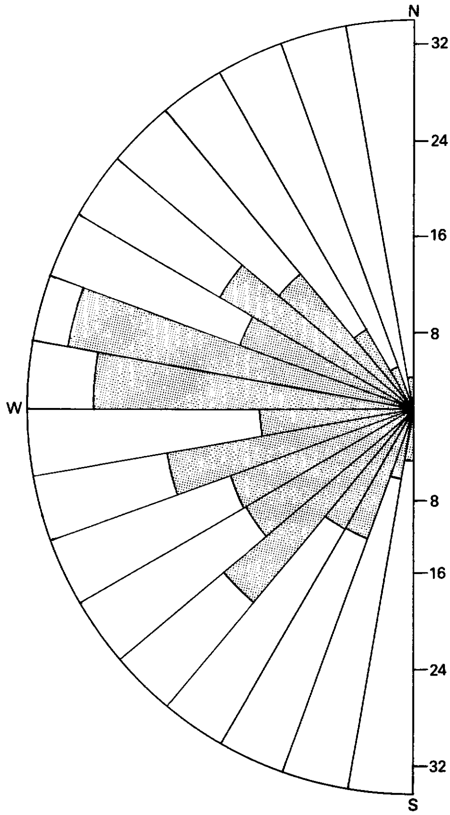


FIGURE 15.—Compass rose diagram of lineament trends in the Copperas Creek inlier. Radial scale: 1 inch equals 20 lineaments (1 cm=8 lineaments); 289 lineaments measured.

pected in and adjacent to the bleached, silicified, and argillized rhyolite. Lone Pine Hill, just outside the southeast corner of primitive area tract 7, is another plug or dikelike body of rhyolite, which contains gold and tellurium and satellitic fluorite veins.

The Holt Gulch intrusive, which adjoins the Wilcox Peak center on the north, is cut by rhyolite dikes, which may be related to the rhyolite on Wilcox Peak. Contacts between the Holt Gulch dacitic rock (table 1) and adjacent volcanic units are largely obscured by talus; therefore the intrusive interpretation is based mainly on the massive outcrop character and microgranular texture of the rock. The dacite is pervasively propylitized and is host to several fluorspar- and small sulfide-bearing quartz veins. The propylitic alteration may be related to cooling of the intrusive or to later alteration by fluids from the adjacent rhyolite of the Wilcox Peak center.

GILA CLIFF DWELLINGS AND BURSUM CALDERAS

The two largest volcanic structures in the study area are the Gila Cliff Dwellings and Bursum calderas (pl. 1), which were described first by Elston (1968, p. 235–237) and Rhodes (1970). These volcano-tectonic subsidence structures were the source areas of the Bloodgood Canyon Tuff of Elston (1968) and the tuff of Apache Spring, (table 1) and perhaps for some of the older ash-flow tuffs. Subsidence of the calderas was caused by the rapid expulsion of magma from shallow reservoirs to form the ash-flow tuffs and resultant loss of support for the thin crustal rocks above the reservoir. Later resurgence of the magma beneath the Bursum caldera most likely accounts for the present topographic and structural dome that marks the caldera site and for the weak but pervasive sericitic alteration of the tuff of Apache Spring within the Bursum caldera. If resurgence of the Gila Cliff Dwellings caldera has occurred, it cannot be documented at this time.

Ore deposits and hydrothermal systems of ore-forming potential seem to be associated with resurgent calderas more commonly than with other types of calderas, according to Smith and Bailey (1969, p. 614, 642); examples include resurgent calderas in the San Juan Mountains, Colo. (Steven and Ratté, 1965; Lipman and Steven, 1970; Lipman and others, 1973), Valles caldera, New Mexico (Smith and Bailey, 1969, p. 642–643), and others.

The Bursum caldera is the dominant topographic and structural feature in the western part of the study area (pl. 1; fig. 2). This volcano-tectonic structure formed first as a subsidence caldera about 25 miles (40 km) in diameter, most of which is within the Gila Wilderness. Collapse of the caldera was initiated during or prior to eruption of the tuff of Apache Spring, which apparently accumulated largely within the subsiding caldera; at least there are no documented occurrences of the tuff of Apache Spring outside the caldera within the study area. Several hundred feet of alluvial and chaotic colluvial (landslide) deposits are interlayered with the lower part of the ash-flow tuffs within the southwestern margin of the caldera, indicating subsidence of the caldera during the Apache Spring eruptions (pl. 1, table 1). The caldera was further filled with the porphyritic rhyolite flows of Sacaton Mountain (table 1) after the ash-flow tuff eruptions had ceased. Subsidence probably occurred along a zone of ring fractures whose approximate location is shown on plate 1, except where the topographic wall of the caldera is indicated along the eastern side of the caldera. By definition, the topographic wall is formed by retreat of the original structural caldera wall by mass wasting processes and thus lies somewhere outside the structural wall. Steeply dipping depositional contacts between caldera-fill deposits and pre-caldera rocks are the principal features that identify the structural wall of the Bursum caldera.

Subsequent to collapse, the Bursum caldera was domed by resurgent uplift, and renewed eruptions from the ring-fracture zone produced lava flows and domes of flow-banded rhyolite (younger rhyolite flows and domes, table 1) which may have completely buried the resurgent dome. Later uplift of the Mogollon Mountains, on basin-and-range faults, and erosion have exposed the roots of some of the rhyolites, as along the southwestern part of the ring-fracture zone from upper Mogollon Creek to Little Whitewater Creek, and in the Mogollon mining district (pl. 1, fig. 3).

In the Spruce Creek-upper Big Dry Creek area (pls. 1, 3) the Bursum caldera is cut by several northeast-trending faults which seem to define a graben across the crest of the resurgent dome. These northeasterly faults are locally offset along northwesterly faults, and northwest-trending shear zones are common along Big Dry Creek below Spruce Creek. Faults and shear zones of both sets show base and precious metal minerals in quartz veins a few inches to about 3 ft wide (a few centimeters to more than a meter).

Thus there is abundant evidence of mineralization along the ring-fracture zone of the Bursum caldera from the Mogollon mining district to the Lone Pine mine east of Little Dry Creek. Mineralized faults and shear zones in the Spruce Creek-Big Dry Creek area may be related to resurgent doming of the caldera or to later faulting, or both.

The Gila Cliff Dwellings caldera is expressed mainly by the thick sections of Bloodgood Canyon Tuff of Elston (1968) exposed in the canyons of the Middle and West Forks of the Gila River (pl. 1); it is not as well defined structurally or topographically as the Bursum caldera. However, some details of a Gila Cliff Dwellings caldera topographic wall have been mapped south of its intersection with the eastern margin of the Bursum caldera (Ratté and Gaskill, 1975), and further evidence for the form of the Gila Cliff Dwellings cauldron is afforded by the residual gravity field in the cauldron area, to be discussed in the following section of this report.

Alternative interpretations of the thick block of rhyolite tuff within the Gila Cliff Dwellings caldera are possible: (1) the caldera is the eruptive source of the Bloodgood Canyon Tuff of Elston (1968), (2) the Bloodgood Canyon Tuff, which is older than the Tuff of Apache Spring (Ratté and Gaskill, 1973), was erupted as the early rhyolite ash-flow tuff facies from the Bursum caldera and filled a preexisting subsidence structure, the Gila Cliff Dwellings cauldron, which was formed in response to the eruption of one of the older ash-flow tuff sheets now evident in the walls of the Gila Cliff Dwellings and Bursum calderas. The latter hypothesis is supported by the unaltered character of the Bloodgood Canyon Tuff and the lack of appreciable lithic debris within it.

The Gila Cliff Dwellings caldera shows little evidence of resurgence and the minor hydrothermal alteration related to the caldera rocks seems to be associated with post caldera geothermal action.

FAULT PATTERNS

Fault trends within the Gila study area and surrounding region are shown in figure 16. Four major directions of faulting can be distinguished: north-south, northwest, northeast, and approximately east-west. The northwest trend is dominant within the study area, but faults that represent each of the other main directions are also present. Mineralized faults and veins belonging to each of the major fault directions occur both in the study area and in other parts of the region portrayed in figure 16.

Within the study area and throughout much of the adjacent area, faults are datable only as Oligocene or younger because pre-Oligocene rocks are not exposed. Because faults from each of the four trends locally cut Gila Conglomerate within the study area, they are thought to be related mainly to late Tertiary basin and range extensional faulting, but evidence from the nearby Silver City–Santa Rita area (Jones, Hernon, and Moore, 1967, p. 12, 112–125) documents Late Cretaceous-early Tertiary (Laramide) movement on some of the major northwest- and northeast-trending faults where they are intruded by dated Laramide age plutons. Many of the faults in the study area may likewise have had Laramide movement. Fracture zones of any direction, insofar as they may have been factors in localizing intrusive activity of either Laramide or mid-Tertiary age, are an important consideration in an appraisal of mineral resource potential.

Northwest-trending faults in the study area are particularly concentrated along the Mogollon Mountain front (pl. 1), and this zone seems to be continuous with the Mimbres fault zone from the Santa Rita area (fig. 16). The occurrence of numerous base and precious metal prospects, fluorspar deposits, and geochemical and geophysical anomalies, to be discussed in succeeding sections of this report, make the northwest structural zone an attractive exploration target area.

Along the Gila River canyon, the northwest fault system can be seen to comprise a series of narrow horsts and grabens, commonly 2–3 miles (3–5 km) wide; examples include the Sapillo Creek graben, Sycamore Canyon graben (fig. 17), and Gila Hot Springs graben (pl. 1). The faults are nearly all steep normal faults, where observed, with dominant dip-slip movement and displacements generally of a few tens of yards (m) but as much as 400–500 yards (m). Westward from the Gila River, many of the northwest-trending faults are increasingly more difficult to trace through the massive accumulations of flow-banded rhyolite.

The pattern of intersecting north-south and east-west faults in the Mogollon mining district at the northwest corner of the study area (pl. 1; fig. 16) may represent a local structural situation along the ring-fracture zone of the Bursum caldera. Wisser (1960) related the Mogollon structure to a major anticline. As we interpret the geologic relations within the

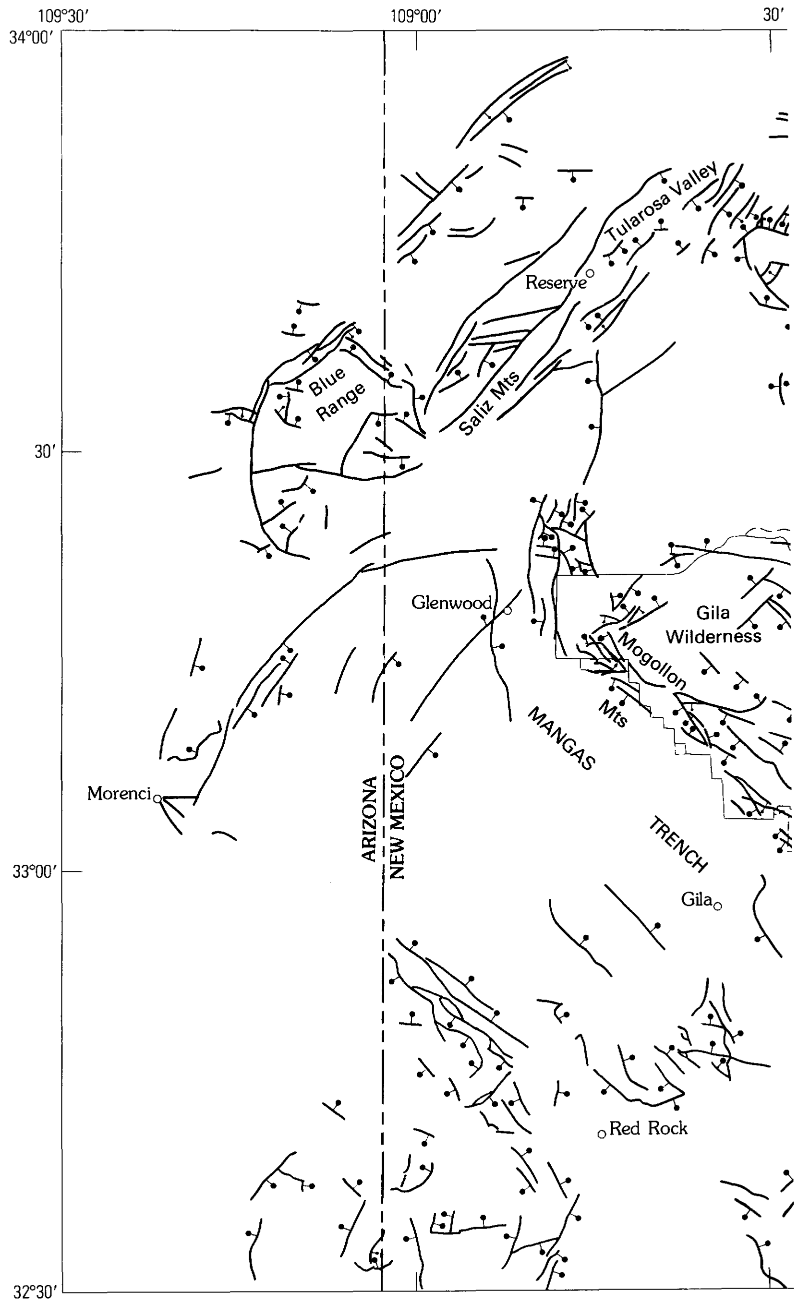
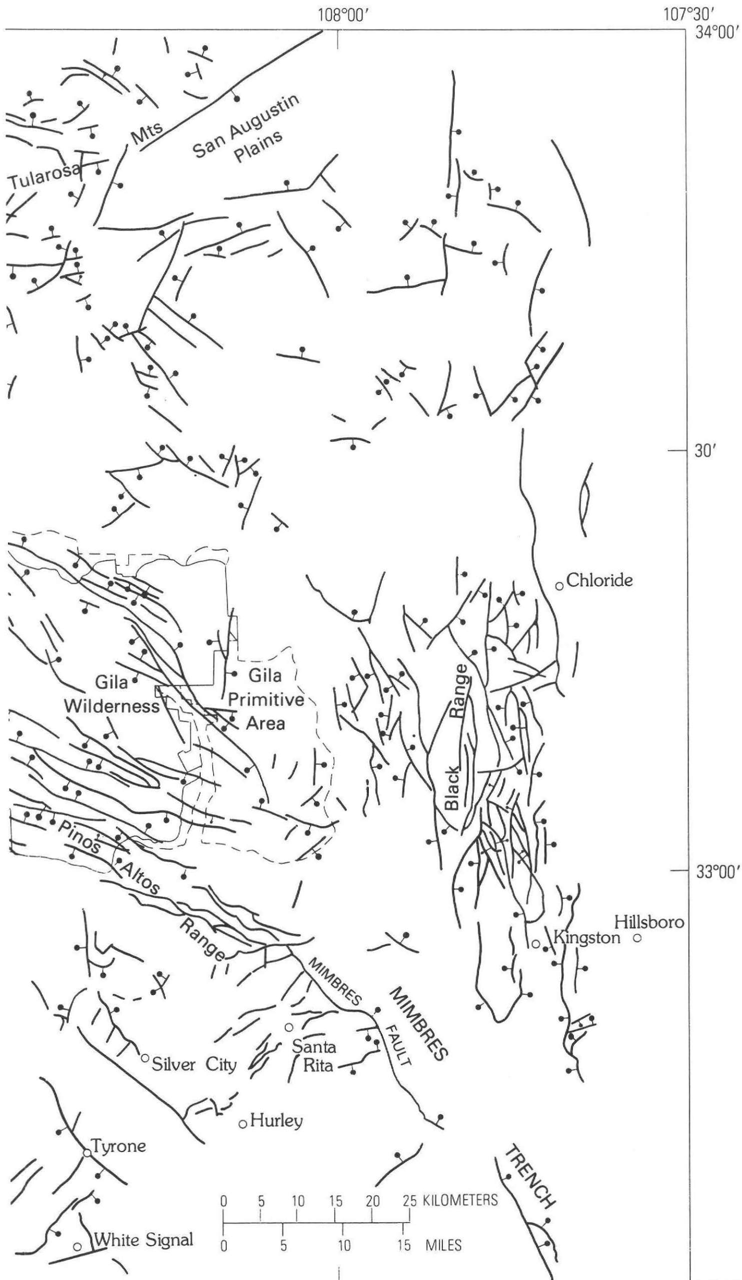


FIGURE 16.—Fault map of the Mogollon region, southwestern New Mexico, by S. S. Hart



showing the boundaries of the Gila Wilderness and Primitive area. Compiled from various sources.

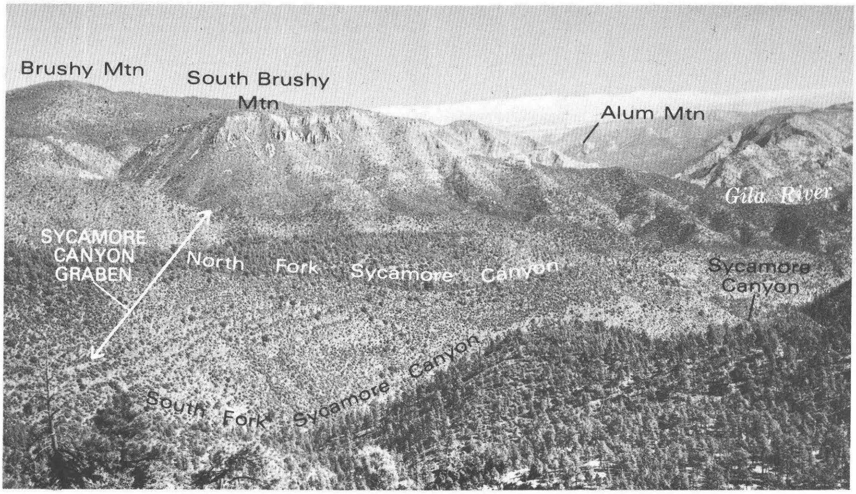


FIGURE 17.—Bloodgood Canyon Rhyolite Tuff, which forms the cliffs of south Brushy Mountain, has been displaced down about 1,000 feet (300 m) within the Sycamore Canyon graben. View northward from Granny Mountain west of the Gila River.

district, the anticlinal structure could be the result of doming above an intrusive within the caldera ring-fracture zone. In addition, the southward extension of north-south faults from the Mogollon district toward an intersection with northwest-trending structures in the vicinity of Holt Gulch and Wilcox Peak (pls. 1, 3) further enhances the favorability of the mineral resource potential of that area.

SANTA RITA–HANOVER AXIS

The mineralized Santa Rita and Hanover stocks (Jones, Hernon, and Moore, 1967, p. 125–129) lie along a Cretaceous structural(?) high, named the Santa Rita–Hanover axis by Elston, Coney, and Rhodes (1968, pl. 1; 1970, p. 75–76) and investigated by Aldrich (1976). This axis seems to be the same feature described by Jones, Hernon, and Moore (1967, p. 134) as a pre-Miocene topographic high extending northward from the Chino mine area at Santa Rita. The restricted distribution of some ash-flow tuff units either east or west of the axis is attributed to the axis having acted as a barrier between separate eruptive sources in Oligocene time (Elston, 1968, p. 235). The subsurface continuation of the axis and the possible control of the axis on the emplacement of other mineralized porphyries of Laramide age northward toward the study area have been discussed by Elston, Coney, and Rhodes (1970, p. 75) and Aldrich (1976). Gravity and magnetic anomalies, discussed in the next section of this report, and the inlier of Paleozoic carbonate rocks discovered by M. J. Aldrich (1976) near the eastern edge of the primitive area (tract 1) add credence to previous suggestions that some kind of buried structure exists northward along the projected Santa Rita–Hanover axis (pl. 1). However, we know of no evidence to suggest a mineral deposit target directly related to the axis in the study area.

GEOPHYSICAL INVESTIGATIONS IN THE GILA STUDY AREA

Both aeromagnetic and gravity surveys were made as part of the mineral appraisal of the Gila Wilderness and adjoining Gila Primitive Area. Eaton and Peterson were responsible for the geophysical work and for preparation of this part of the report.

The purpose of most exploration geophysical surveys is to locate and characterize rock bodies that do not crop out at the surface or to define the extent and physical properties of subsurface bodies that are only partially exposed. A geophysical anomaly that cuts across the surface boundaries of rock units of differing lithologies suggests the presence of a buried body of more or less uniform physical characteristics; similarly an anomaly that cuts across the structural grain in an area of more or less uniform lithology indicates the presence of a concealed crosscutting body that has physical properties that contrast with those of the surface rocks.

Gravity and magnetic anomalies may be caused directly by deposits of metallic ores under special circumstances. Generally, however, gravity and magnetic methods are used in mineral evaluation work primarily as reconnaissance tools to locate geologic settings that may be favorable for the occurrence of ores. Thus, the study of geophysical anomalies in this investigation was for the purpose of locating possible buried plutons or buried tracts of pre-Laramide rocks that might be hosts for ore deposits. Localities where the convergence of geophysical, geochemical, and geological data collectively point toward the possibility of ore occurrences (table 4) are discussed in this section.

GRAVITY INVESTIGATION

Collection and reduction of data.—The gravity maps (pl. 2A and fig. 18) were prepared from data gathered by both the U.S. Geological Survey and the U.S. Army (TOPOCOM). About 115 of the U.S. Geological Survey stations, most of them in rugged terrain, were reached by helicopter and another 25 by automobile. Forty stations, all in the south western part of the mapped area within or southwest of the Mangas trench, were occupied by U.S. Army personnel. All stations were tied to a U.S. Army (TOPOCOM) gravity base station at Truth or Consequences, N. Mex. (R. B. Beruff, oral commun., 1970).

Elevation control was taken from published topographic maps of the

U.S. Geological Survey. Readings were made at bench marks, and other surveyed points, at which the elevation is known to better than 1.0 foot, and at spot elevations, where the control may have been determined photogrametrically and may be no better than ±10 feet with a resulting maximum error of 0.6 mGal (milligals) due to elevation error. The gravity meter used was a LaCoste-Romberg geodetic model capable of an accuracy of at least 0.02 mGal under the conditions obtaining.

A value of 2.67 g/cm^3 (grams per cubic centimeter) was used in reducing the data. This value is commonly employed in the reduction of regional gravity data for several reasons. First, it is a good approximation to the average density of most basement rocks in many regions of the world. Second, its uniform application as a standard value allows the direct comparison of gravity maps from different regions and also facilitates regional compilations based on the pulling together of individual local surveys such as this one. Because basement rocks with densities close to 2.67 g/cm^3 are exposed in the mountain ranges immediately south of the study area (Silver City Range and Pinos Altos Range), and because there is considerable structural relief on the basement rocks of this region, we chose to follow the standard procedure of reducing the gravity data with this density. It should be noted, however, that if there are prominent topographic features in an area caused largely from surface rocks whose average density differs greatly from that of the basement, systematic error can creep into the reduced gravity values. Such error may lead to the enhancement or reduction of actual anomaly values and, in extreme cases, can lead even to the creation of artificial anomalies.

From an unpublished gravity survey in eastern Arizona, approximately 80 km away, we determined that the average in situ bulk density of a thick section of Tertiary volcanic rocks, similar to that of the Gila Wilderness area in both composition and age, is 2.45 g/cm^3. Thus one might expect that for those Bouguer anomalies associated with large mountain masses carved from rocks of the volcanic section, there will be a tendency toward enhancement of gravity lows and reduction of gravity highs. The Arizona results are substantiated by laboratory measurements of rocks from the Gila study area (table 2). Of the 15 rock units sampled, the only ones that have mean densities in hand specimen appreciably above 2.45 g/cm^3 are lavas of intermediate to mafic composition, which are subordinate inivolume to less dense silicic lavas and tuffs in the greater part of the study area.

Terrain corrections were made for all gravity stations to a distance of 167 km by a method developed by Plouff (1966). For those stations in, or closely adjacent to, areas of rugged relief inner zone corrections were made by hand out to a distance of 2.6 km; beyond that, they were calculated by digital computer to a distance of 167 km. For stations in areas of gentle relief corrections were applied only for the terrain more

TABLE 2.—*Dry bulk densities of rocks from Gila study area*

Map unit	Number of specimens	Range of densities observed	Mean density	Standard deviation
Gila Conglomerate	(1)	(1)	(1)	(1)
Basaltic and andesitic lavas	30	2.28–2.81	2.61	0.12
Flow-banded rhyolite, undivided	13	2.20–2.40	2.31	.07
Mineral Creek Andesite	4	2.39–2.78	2.67	.19
Rhyolite of Sacaton Mountain	7	2.45–2.56	2.49	.05
Tuff of Apache Spring	16	2.11–2.54	2.35	.15
Bloodgood Canyon Rhyolite Tuff	16	1.94–2.50	2.34	.18
Tuff of Shelley Peak	7	1.97–2.39	2.17	.14
Tuff of Davis Canyon	3	1.94–2.16	2.08	.12
Tuff of Fall Canyon	1	---	2.17	---
Cooney Quartz Latite Tuff	13	2.20–2.56	2.41	.12
Latitic and andesitic flows of Gila Flat	6	2.39–2.63	2.57	.09
Dacitic intrusive of Holt Gulch	1	---	2.56	---
Volcanic complex of Alum Mountain	26	2.23–2.72	2.52	.12
Volcanic complex of Brock Canyon	2	2.47–2.49	2.48	---
Older andesites, undivided[2]	8	2.56–2.79	2.64	.09

[1]No data are available for the density of this formation in the Gila study area.

[2]Includes Mineral Creek Andesite, latitic and andesitic flows of Gila Flat, volcanic complex of Alum Mountain, and includes other rocks of intermediate composition.

than 2.6 km from the station. Values of the terrain corrections ranged from 0.50 to 37.06 mGal. The maximum inner zone correction (0–2.6 km) was 26.37 mGal. These large terrain corrections indicate that complete Bouguer gravity values are necessary for meaningful and interpretable results in this region. For stations along the crest of the study area, it was important that individual terrain corrections be carried out to great distances (>60km).

Figure 18 is a complete Bouguer gravity map of the Gila study area showing the distribution of gravity stations occupied. Because there is a strong and systematic gravity gradient extending across the area from the southwest corner to the center of the north edge of the map, it was thought important to remove the effects of this gradient. This was done by digitizing and smoothing the topography of a large region (approximately 1°20′ square) enclosing the study area. By assuming that isostatic compensation is realized here, as it is elsewhere in the Cordilleran region of the Western United States, the regional topography was used to calculate the regional gravity field by the method of Mabey (1966). This regional field was subtracted from the observed Bouguer gravity field of figure 18 to produce the residual Bouguer gravity field of plate 2A.

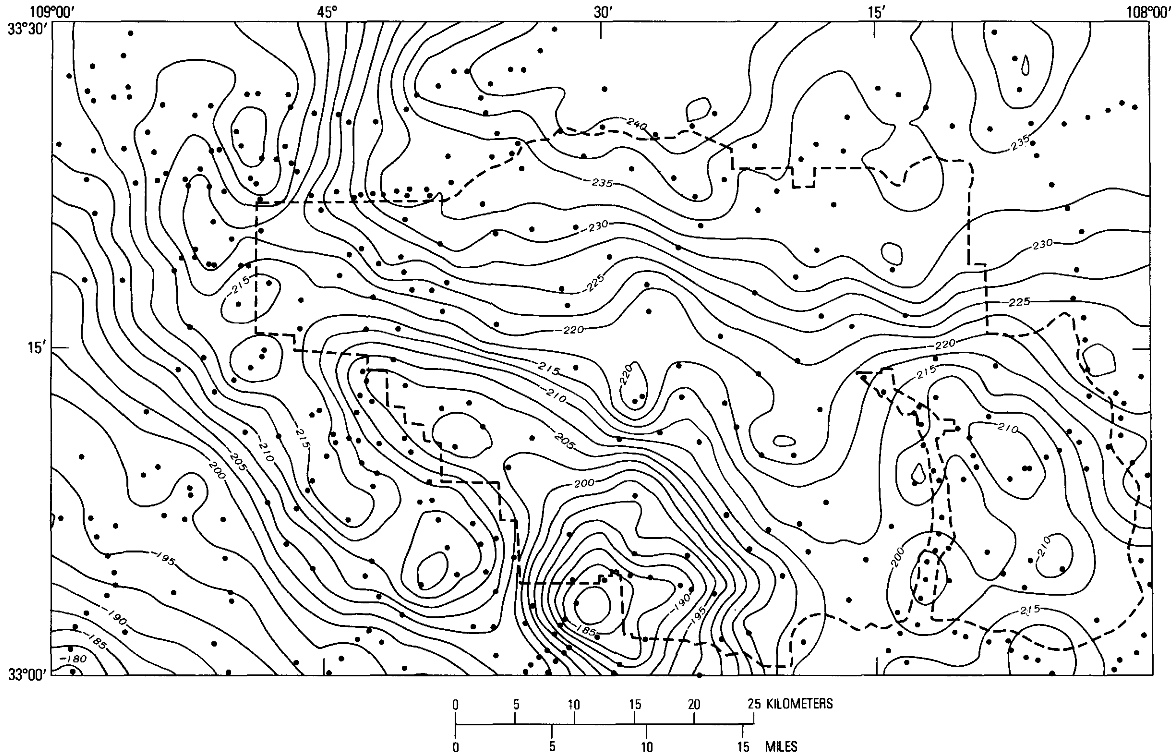


FIGURE 18.—Observed complete Bouguer gravity field of the Gila study area (dashed lines). Dots show locations of gravity stations. Contour interval, 2.5 mGal.

DESCRIPTION OF THE GRAVITY MAP

Some of the most conspicuous residual gravity anomalies in and adjacent to the Gila study area are numbered 1–7 on the residual gravity map (pl. 2*A*). Anomaly 1 is a broad, low-amplitude, composite anomaly in the southeastern part of the study area. It represents a generalized gravity high with a closure slightly greater than 10 mGal over an area where older andesitic and latitic lavas predominate. The older lava flows and overlying tuffs generally dip gently northeastward beneath younger basaltic flows and Gila Conglomerate. A small block of Paleozoic carbonate rock (pl. 1) crops out near the southeastern corner of anomaly 1*A*, where Aldrich (1976) has projected the Santa Rita–Hanover Axis of Elston and others (1968). A gravity nose and subsidiary closure at 1*B* in the southwestern part of anomaly 1 coincide with the two inliers of the volcanic complex of Alum Mountain and thus are associated with older, altered and weakly mineralized volcanic rocks in the Alum Mountain and Copperas Creek areas. The central part of anomaly 1, designated as 1*C*, is associated with weak geochemical anomalies noted in table 4. Anomaly 1 may indicate a structurally elevated tract of dense older volcanic and (or) sedimentary rocks, such as Paleozoic carbonate rocks, but its significance specific to mineral resource potential is otherwise obscure.

Anomaly 2 probably is the most important gravity feature in the study area with respect to mineral deposit potential. In general, anomaly 2 defines a continuous gravity ridge along the southwest front of the Mogollon Mountains with subsidiary highs along its crest at 2*A*, 2*B*, and 2*C*, and a subordinate prong at 2*D*. The maximum at 2*A* occurs over the volcanic complex of Brock Canyon. From a residual high value greater than 27.5 mGal near Brock Canyon, the anomaly continues with diminishing amplitude to the northwest for 45 km, nearly to the town of Glenwood where it has a value of approximately− 2.5 mGal (anomaly 2*C*) over the intrusive rocks of Holt Gulch. An elongate closed gravity low, anomaly 6, over Gila Conglomerate and other sedimentary rocks in the Mangas trench, flanks anomaly 2 on the southwest.

Anomaly 2 represents a significant density contrast between the consolidated rock beneath the valley fill of the Mangas trench on the southwest and those of the mountains that border the trench on the northeast. The anomaly is interpreted as the gravity expression of an uplifted elongate fault block, which is underlain by pre-Tertiary rocks and is tilted northeastward along a steeply dipping fault that bounds the Mogollon Mountains on the southwest. The pre-Tertiary rocks provide a density contrast with both the Tertiary volcanic rocks and the sedimentary fill in the adjacent Mangas trench. This interpretation differs from an earlier one (Ratté and others, 1972a, p. 157), in which anomaly 2 was related to the inferred presence of an elongate batholith of intermediate to mafic composition and of unknown age. Extension of our gravity survey has shown that gravity values over the Pinos Altos Range (pl. 3) and the Silver City Range to the southeast are similar to the maximum values measured over outcrops of the Brock Canyon complex. In addition, the gravity relief between the Pinos Altos and Silver City ranges and the alluvial valleys adjacent to them is similar to that between maximum values along the Mogollon Mountain front and the Mangas trench. The Silver City Range consists mainly of Paleozoic and Precambrian rocks, and therefore it seems reasonable that the gravity ridge along the southwest edge of the Gila study area may be underlain by similar pre-Tertiary rocks. Calcite veins as much as several meters wide, observed in faults along the Mogollon front, could have been derived from the Paleozoic carbonate rocks of such a block. Furthermore, although many metal prospects and geochemical anomalies along this zone represent a primary mid-Tertiary mineralization, they might also reflect secondary mobilization of older mineral deposits formed by Laramide intrusions into older rocks. Such remobilization could have occurred during intrusions of Tertiary rhyolite into the ring fracture zone of the Bursum caldera and elsewhere along the northwest-trending structural zone.

The residual gravity contours in the vicinity of anomaly **3** suggest a possible configuration for the Gila Cliff Dwellings caldera that differs from that shown on the previously published geologic map (Ratté and Gaskill, 1975) based on geology alone. Removal of the regional gravity gradient has considerably enhanced the apparent gravity expression of the northern part of the cauldron beneath Black Mountain. Anomaly **3** is a small gravity low of about 5–7 mGal, which is centered on the south flank of the basaltic shield volcano at Black Mountain and opens westward into a broad gravity low associated with the Bursum caldera. This outline of the Gila Cliff Dwellings caldera is intermediate between our earlier suggested configurations (Ratté and others, 1972a, Ratté and Gaskill, 1975) and the outline of even greater diameter suggested by Rhodes (1976, p. 105–106, fig. 2; Elston and others, 1976, fig. 9). As drawn here, the Gila Cliff Dwellings cauldron margin is the approximate locus of the young rhyolite accumulations at Indian Creek and Beaver Creek. Weak geochemical anomalies for several elements are associated with the young rhyolites and occur elsewhere along the cauldron margin as proposed on plate 2*A* (table 4).

Anomaly **4** is a more or less equidimensional gravity low that has a total relief of 18 mGal. It coincides with the Bursum caldera, and is believed to represent both the thick block of intracaldera rhyolite ash-flow tuff, which originally subsided to form the caldera, and an inferred igneous stock or cupola beneath the resurgent dome of the caldera. Some of the local gravity relief within anomaly **4** may reflect the sharp topographic relief of rocks whose bulk densities are less than the reduction density, but calculations indicate that the errors created by this disparity in densities are less than 5 mGal. Anomaly **5**, also within the caldera, is a shallow gravity trough that appears to coincide with an infaulted block, which is interpreted as a crestal graben on the resurgent dome of the Bursum caldera.

Anomaly **6** is a closed gravity low over the relatively low density Gila Conglomerate and other sedimentary rocks in the Mangas trench (pl. 2*A*). A relative gravity relief of 11±mGal over the trench suggests a thickness of perhaps 600–700 meters of low-density valley-fill sediments along the northeastern side of the trench, if one assumes a density contrast of 0.45 g/cm³. This value has proved to be applicable in many other parts of the Basin and Range province.

Anomaly **7** is a steep, south-plunging gravity nose on the west side of the Bursum caldera. The anomaly also is the site of mid-Tertiary silver, gold, and copper deposits in the Mogollon mining district. The eastern margin of the anomaly has a gradient that reflects the lateral density contrast between the relatively light volcanic and inferred intrusive rocks within the Bursum caldera and denser basement rocks to the west, in the caldera wall. The western side of the anomaly reflects the density contrast between these basement rocks and their overlying Tertiary volcanic section, and the lighter valley-fill sediments of the Gila Conglomerate to the west. The full length of anomaly **7**, from south to north, marks the inferred locus of relatively shallow pre-Tertiary rocks in the northwestern part of the study area, thus sharply delimiting the area where possible pre-Tertiary mineral deposits may be readily accessible. West of anomaly **7**, the pre-Tertiary rocks are probably more deeply buried, and east of the anomaly, within the caldera, they may be deeper still, or largely destroyed by the mid-Tertiary volcanism and related plutonism.

MAGNETIC INVESTIGATION

In March 1968, an aeromagnetic survey was flown over a broad region which included the Gila study area (U.S. Geological Survey, 1972a), the Blue Range Primitive Area, New Mexico and Arizona (Ratté and others, 1969; Eaton and Ratté, 1969), and the Black Range Primitive Area, New Mexico (Ericksen and others, 1970). The survey was flown at a constant barometric elevation of 10,500 feet (3,200 m) and a flightline spacing of 1 mile (1.6 km). The data are presented here as an aeromagnetic map of the study area (pl. 2*B*) on which anomalies **A** through **G** are believed to be the ones most likely to have possible mineral deposit significance. Magnetic properties of about 140 rock samples (table 3) were measured in the laboratory to aid in the interpretation of the aeromagnetic map.

TABLE 3.—*Magnetic properties of rocks from the Gila study area*

[Magnetic susceptibility in electromagnetic units per cubic centimeter; remanent magnetism in electromagnetic units. k_n, M_n, and Q_n, normal mean; k, M, and Q, antilogarithm of mean log-normal distribution. Koenigsberger ratio is the ratio of remanent to induced magnetizations of the sample. Declination (D), in degrees, measured clockwise from north; inclination (I), in degrees, measured positive downward from horizontal. Both declination and inclination relate to total magnetization, not to remanent or induced magnetization alone. None of the samples were demagnetized except for those from the volcanic complex of Brock Canyon]

Map unit	Number of samples	Magnetic susceptibility (in emu/cm³)		Remanent magnetism (in emu)		Koenigsberger ratio[1]		Total magnetization			
		$k \times 10^2$	$k_n \times 10^2$	$M \times 10^2$	$M_n \times 10^2$	Q	Q_n	$M \times 10^2$	$M_n \times 10^2$	Decl.	Incl.
Basaltic and andesitic lavas[2]	30	0–40.8		0.8–590.0		1.0–830.5		0.8–589.7		---	+63–64
Flow-banded rhyolite, undivided	10	0.8	1.5	13.2	40.6	32.2	78.5	11.7	40.5	194	−67
Younger rhyolite[3]	3	0–1.2		.4–19.6		173.0–180.0		.9–19.6		---	+
Mineral Creek Andesite[3]	2	11.4–16.0		20.1–52.4		3.4–6.4		24.0–46.4		---	+ and −
Rhyolite of Sacaton Mountain	5	1.6	1.9	36.0	42.1	43.3	63.2	35.8	42.1	311	−17
Tuff of Apache Spring	13	.5	2.5	1.7	4.6	6.8	15.1	1.4	3.5	160	−37
Bloodgood Canyon Rhyolite Tuff[4]	12	1.3	2.1	1.1	5.2	1.6	5.8	1.5	5.4	136	+32
Tuff of Shelley Peak	7	1.6	2.5	7.5	8.4	9.4	33.4	6.3	7.3	180	−47
Tuff of Davis Canyon[3]	3	0		3.6–4.2		---	---	3.7–4.2		---	+
Tuff of Fall Canyon	1	---	0	---	2.7	---	---	---	2.7	---	−35
Cooney Quartz Latite Tuff	13	.8	6.1	3.1	9.1	7.9	20.4	2.9	7.7	169	−26
Latitic and andesitic flows of Gila Flat	6	12.3	15.2	13.2	19.1	2.1	2.7	17.4	22.3	75	+66
Volcanic complex of Alum Mountain	25	4.6	9.6	9.1	17.6	3.9	9.0	9.6	16.3	136	−34
Volcanic complex of Brock Canyon:[2 3]											
Biotite latite flows	2	---	---	56.0–323.0		---	---	---	---	---	--
Andesitic flow[5]	1	---	---	2.8–4.5		---	---	---	---	---	--
Altered flows[5]	2	---	---	.1–17.3		---	---	---	---	---	--
Older andesites, undivided	8	7.8	10.4	7.6	10.4	1.9	4.6	12.5	14.1	292	+68

[1]Ratio of remanent to induced magnetizations of the sample.
[2]Ranges indicated for several different stratigraphic units.
[3]Too few samples for significant means, therefore only ranges stated.
[4]All samples display reversed remanent magnetization.
[5]Several cores measured from a single oriented sample.

A local magnetic anomaly is the result of lateral variations in rock magnetic properties. It may thus be caused by laterally juxtaposed rock bodies of differing character, separated by vertical or sloping boundaries, or by pronounced topography. During this investigation, all anomalies were screened for topographic components by overlaying a transparent copy of the aeromagnetic map on a regional topographic map, and by comparing in detail the magnetic analog records with radar altimeter records along each flight line. These methods confirm that the magnetic field in the study area is strongly influenced by topography. The reader should keep in mind that the location of all magnetic anomalies shown on plate *2B* are shifted slightly south of their source rocks owing to the dipole nature of the magnetic field and its low inclination at these latitudes.

DEPTH ESTIMATES

Calculations of the depth to the top of a rock mass causing a magnetic anomaly were made by applying the method of Vacquier and others (1951) to the analog records. This method is based on the assumption that the anomaly-producing body is a right rectangular prism with considerable vertical extent relative to its depth of burial. Although of value in estimating depths to crystalline basement beneath broad sedimentary basins, its application in volcanic terranes of pronounced topographic relief is hazardous for two reasons: (1) an individual anomaly is rarely sufficiently isolated so that its various parameters are unaffected by the magnetic field of adjoining bodies of rock or topographic eminences, and (2) volcanic rocks locally possess very intense magnetizations and thus produce notable anomalies even if their vertical extent is not very great. An experienced interpreter usually can recognize the latter effect and take it into account when estimating depths. The usual procedure is to use a depth index based on horizontal tabular bodies. Several of the anomalies studied during the present investigation are estimated to have sources at the surface, yet the geologic mapping and geochemical sampling failed to reveal any evidence of related intrusive bodies, and thus the anomalies may reflect local thickening of the surface units.

In the section on the interpretation of individual anomalies, depths of anomaly sources are intentionally stated in ranges or in quantitatively vague terms, except for those anomalies believed to be relatively free of interference from nearby sources, those whose continuous analog records were free from instrumental noise, and those whose configuration was such as to suggest a body of appreciable vertical extent.

MAGNETIC ANOMALIES AND GEOLOGIC STRUCTURE

A correspondence between some of the structural features and magnetic anomalies in the Gila study area is readily apparent from a comparison of plates 1 and 2*B* and figure 16. As emphasized by lines bounding the anomalies on plate 2*B*, most of the magnetic anomalies parallel major fault directions in the region, particularly in the northwest and northeast directions. Insofar as faulting has controlled physiographic development in the region, topography has influenced the magnetic trends also. Some anomalies, such as A and F (pl. 2*B*), however, do not relate to topography; they appear to follow west-northwest and west trends, which are major fault directions (fig. 16).

The magnetic expression of the Gila Cliff Dwellings caldera is subtle, at best. As outlined on plate 2*B*, the caldera coincides with part of a broad and irregular magnetic low that is disrupted on the northeast by magnetic highs over young basaltic rocks, particularly at Black Mountain. The magnetic pattern within the Bursum caldera, on the other hand, is marked by a notable concentration of short wavelength, high amplitude anomalies. This pattern is similar to that within the rectilinear vent zone and probable caldera complex in the Black Range Primitive Area, immediately east of the Gila study area (Ericksen and others, 1970, p. 44). In both places, the magnetic anomalies occur over topographic highs carved from moderately to highly magnetic rocks, and it is difficult to determine the extent to which the magnetic field is influenced by the caldera and related structures, and by the topography, which is itself an expression of the caldera. By far the highest part of the Gila study area lies near the center of the Bursum caldera but the magnetic trends in this area cut across the crest of the Mogollon Range.

The magnetic expression of an ash-flow tuff related caldera depends on a number of factors, including the magnetic properties of the rocks filling the caldera and those in its wall, as well as its level of erosion. Of 12 calderas studied in the San Juan volcanic field, Colorado, some have pronounced magnetic expression and others seem to have none whatsoever (Eaton and others, 1972).

DESCRIPTION OF INDIVIDUAL MAGNETIC ANOMALIES

In addition to the general magnetic trends and anomalies that may be related to caldera structures, 19 other anomalies were studied in further detail (shaded on pl. 2*B*). Those are considered most likely to have potential economic significance are designated by a letter in plate 2*B* and in the following discussions. An anomaly was considered to be significant if: (1) its configuration suggested a body with at least moderate vertical extent; (2) it did not correlate well with the surface geology in terms of either the properties of the surface rocks or the estimated depth to source; (3) it seemed to correlate strongly with geochemical anomalies; or (4) it correlated well with gravity anomalies. Special weight was given to criterion 3. Lows as well as highs were studied because of the observation of Brant (1966) that Laramide porphyry intrusives in the southwest generally are characterized by relatively weak magnetism and appear as magnetic lows against the background of their enclosing rocks.

Anomaly A is a strong magnetic high in the southeastern part of the mapped area (pl. 2*B*), with an amplitude of about 340 gammas. Its peak is centered on Sapillo Creek at the junction of State Highways 15 and 35. Although its long axis is parallel to, and in most places coincident with, the course of Sapillo Creek, it has no apparent relationship to the local topography. The western end parallels the canyon of the Gila River and coincides approximately with gravity anomaly 2D when allowance is made for the inclination of the earth's magnetic field. The peak of anomaly A coincides roughly with gravity anomaly 1B. The depth to the top of the anomaly source is estimated to be about 600 m below the surface near the highway junction. Farther west, near the Gila River canyon, the source is apparently shallower. The source of these anomalies is both denser and more magnetic than its surroundings and could be a large intrusive body.

The eastern part of magnetic anomaly A consists of the main peak and a north-trending spur with a subsidiary peak value of 677 gammas. The north flank of the main peak and the northern spur cover most of the exposed parts of the volcanic complex of Alum Mountain, and the main peak of the anomaly, at A, coincides with outcrops of a large, altered rhyolite dike or other intrusion. Thus the source for the anomaly could be related to this complex and its associated hydrothermally altered and mineralized rocks. The possibility of this relationship is complicated by the magnetic properties of the Alum Mountain rocks (table 3), which indicate that they should produce a negative anomaly. However, a reversal of the earth's magnetic field, either during or after cooling of a buried intrusive, could produce contrasting magnetic expressions between genetically related intrusive and extrusive rocks as a result of differences in grain size and cooling histories, assuming strikingly different *Q* values for the two. The alternative is a buried rock mass of different age, unrelated to the mineralized complex of Alum Mountain. Because the Alum Mountain area may have been a recurrent volcanic and intrusive center, and because of the geochemical anomalies associated with it, magnetic anomaly A warrants further evaluation of its possible economic potential, no matter which of the preceding interpretations should prove to be correct.

Anomaly B is a northwesterly trending magnetic high with a nose that trends more westerly at the southern edge of the Gila fluorspar district. It coincides with the southern end of the axis of gravity anomaly 2A. The anomaly is cut off on the south at the edge of the aeromagnetic map, but within the area shown on plate 2*B*, it has an amplitude of about 150 gammas. Anomaly C is a northeast-trending magnetic low with a closure of about 100 gammas, which includes a sharp local depression of about

65 gammas near its northeast end. Anomalies B and C are considered together because they both overlap portions of the exposed part of the volcanic complex of Brock Canyon and the associated Gila fluorspar district. The westward-trending nose of anomaly B conforms quite well with the southern margin of intensely altered rocks of the volcanic complex, which in turn correspond with the southeast bulge of the magnetic low, anomaly C. We offer the interpretation that the relatively weakly magnetic, altered rocks of the complex (table 3) account for the southeastward bulge of anomaly C, and the more highly magnetic, unaltered rocks of the Brock Canyon assemblage (table 3) are at least partly responsible for anomaly B. Unaltered intrusive (?) rocks, which probably correlate with the volcanic complex of Brock Canyon, occur along the trend of anomaly B to the southeast (T. L. Finnell, oral commun., 1976). The magnetic properties of these rocks are unknown, but the depth to the source of anomaly B is estimated to be within 100 m of the surface, which suggests that the anomaly is related to the exposed rocks.

The depth to a source for anomaly C has not been calculated, but the form of the anomaly suggests that altered rocks of the volcanic complex of Brock Canyon may extend beneath the younger unaltered volcanic rocks west of the Gila River, and the magnetic minimum at the northeast end of anomaly C could represent a buried plug or vent area of altered rocks. The magnetic map in this area supports the geologic, geochemical, and gravity evidence for an important mineral resource exploration target in the Brock Canyon area in addition to the known fluorspar resource.

Geochemical anomalies for several elements correlate with a pair of northwest-trending, elongate magnetic lows, anomalies D and E, which lie along or near the crest of positive gravity anomaly 2B. The correlation becomes stronger northwestward. The possibility of a genetic relationship between the magnetic, gravity, and geochemical anomalies deserves further study.

Magnetic anomaly F is a magnetic high that trends east-west across the grain of the surface geology and coincides with gravity anomaly 2C, the crest of which bulges locally in the western part of magnetic anomaly F. The northwest corner of magnetic anomaly F and the axis of gravity anomaly 2C is underlain by the intrusive rocks of Holt Gulch, which have normal remanent magnetization. The source of the magnetic anomaly seems to be in the shallow subsurface, and could readily be this intrusive rock. The fact that the anomaly crosscuts the surface geology lends credence to this argument. Anomaly F has a stronger association with anomalous concentrations of metals than any other magnetic anomaly. It is thus regarded as a target of prime interest.

Anomaly G lies outside the area that was mapped geologically during this study, but it has potential significance because of its close proximity to the Mogollon mining district. It has an amplitude of about 600 gammas, making it one of the strongest magnetic highs on the map. Although the anomaly shows an inverse correlation with topography in its northeastern part, there is no correlation between the two proceeding southwestward. The top of the source appears to range in depth from the shallow subsurface to about 500 m, depending on the location of the analyzed profiles. The southeast side of anomaly G coincides with the projected inner edge of the Bursum caldera ring-fracture zone and thus may be related to a magnetic contrast between the thick basaltic andesite beneath the anomaly and rhyolite tuffs and intrusions within the ring fracture zone and on the resurgent dome of the caldera. Geochemical anomalies identified with magnetic anomaly G (table 4) are associated with the Mogollon mining district at the southwest end of the anomaly.

Anomaly H is an elongate magnetic high with an amplitude of about 350 gammas that cuts north-northeastward across the regional grain, roughly coincident with the northward spurs of positive gravity anomaly 2A. It is underlain predominantly by the extrusive-intrusive rhyolite complex of the Diablo Range and the Bloodgood Canyon Rhyolite Tuff of Elston (1968), but throughout its length are scattered exposures of lava flows that are tentatively correlated with the andesite and latite flows of Gila Flat. Although preliminary calculations suggest that the magnetic contrast between the rhyolites and the Gila Flat flows (table 3) is sufficiently great for a thickness of as little as 300 m of Gila Flat rocks to account for the anomaly, the depth to the top of the magnetic body, estimated at 900 m, would seem to eliminate the flows of Gila Flat as the causative body. Alternatively, the location of this magnetic anomaly and coincident gravity ridge suggests that the anomaly is related to a structurally high basement block or hidden intrusion that forms a septum between the Bursum and Gila Cliff Dwellings calderas. Because the anomaly shows only a very weak correlation with geochemical anomalies, its economic potential is not considered to be very great.

Anomaly I is a gentle-flanked magnetic high with about 75 gammas of local relief. It occurs over a plateau underlain mainly by Gila Conglomerate and late andesitic rocks with minor Bloodgood Canyon Rhyolite Tuff. The source depth is about 350–400 m. Thermal springs issue locally from the Bloodgood Canyon Rhyolite Tuff in this area, which is crossed by several faults of the Gila Hot Springs graben. Altered rocks occur nearby. This anomaly may deserve further geophysical and geochemical study with respect to its economic potential. Possibly its source is a deep intrusive body.

RELATIONSHIP BETWEEN GEOPHYSICAL AND GEOCHEMICAL ANOMALIES

The coincidence of geophysical and geochemical anomalies may be a more useful guide to mineral exploration than either type of anomaly used alone. In table 4 an attempt is made to correlate the aerial extent of gravity and magnetic anomalies with various geochemical anomalies that are discussed in more detail in the succeeding section of this report. The correlations are highly subjective at this point, and the areal correlation cannot be translated to a genetic correlation without considerable further study. For example, the apparent correlation of a geochemical tin anomaly (fig. 24) with gravity anomaly 2D (pl. 2A) is most certainly fortuitous in that the tin anomaly is related to panned concentrates of gravels from the Gila River. However, this is an extreme example, and many of the stronger correlations bear a considerably greater chance of a genetic relationship between the geochemical and geophysical anomalies.

GEOCHEMICAL STUDIES

A reconnaissance geochemical sampling program was conducted to supplement the geologic studies in appraising the mineral resource potential of the Gila study area Geochemical studies are used to define areas of greater than average mineral resource potential by detecting trace amounts of metals dispersed around mineral deposits. Elements that prove to be useful in this manner are called indicator elements, and they may differ from one deposit to another. Primary dispersion patterns may have the form of halos surrounding veins or other types of ore bodies; secondary dispersion patterns may be revealed in the sediments of streams that drain a mineralized area. Geochemical studies are intended to test the relative favorability of an area and are not used for economic appraisal of a given deposit. Specific samples to be used in estimating grade and tonnage of individual veins or deposits were taken by the engineers of the U.S. Bureau of Mines and are discussed in a subsequent section of this report.

It is important to consider that the geochemical anomaly maps (figs. 23–35) and table 5 (in back of report) include only the U.S. Geological Survey sample data and that some of the metal anomalies are greatly enhanced by including the U.S. Bureau of Mines sample data that are presented separately in the following section of this report.

SAMPLING PROCEDURES

About 1,550 stream-sediment samples (figs. 19, 20) and more than 1,000 rock samples (figs 21, 22) were collected for analysis (table 5) from all over the study area. Stream-sediment samples consist of the finest

TABLE 4.—*Correlation of geochemical anomalies with gravity and magnetic anomalies*

[XXX=strong correlation; XX=moderate correlation; X=weak correlation; ---, indicates lack of correlation]

Gravity anomaly No.	Altered or mineralized rocks	Ag	Au	Te	Cu	Mo	Pb	Zn	As	Bi	Hg	Be	Sn	W
Gravity anomalies														
1A–C--	---	X	X		X	X	---	---	---	---	---	---	X	---
1B-----	XXX	XX	XX	XXX	X	XXX	XX	X	XX	XXX	XXX	---	X	X
2A-----	XXX	X	X	X	---	XXX	---	---	XX	---	XX	---	---	XXX
2B-----	XX	XXX	XXX	XXX	XXX	XXX	·XXX	X	XX	XXX	XXX	XX	X	XX
2C-----	XXX	XX	XXX	XXX	XXX	XX	XX	XXX	XXX	XX	XX	X	X	XX
3-------	X	X	X	X	---	---	X	---	X	---	X	X	X	X
5-------	---	XXX	XXX	---	---	X	X	X	XX	X	X	XX	X	XX
7-------	XX	XXX	XXX	X	X	X	X	---	XXX	X	XX	XX	X	---
Magnetic anomalies														
A[1]-----	XXX	X	X	XXX	X	XXX	XX	X	XX	XXX	XXX	---	X	---
B–C[2]--	XXX	X	X	X	---	XXX	---	---	XX	---	XX	---	---	XX
D–E[3]--	X	XXX	XXX	XXX	XX	XXX	XX	XX	XX	XXX	XXX	XX	X	XX
F------	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XX	XX	X	X	XX
G[4]-----	XX	XXX	XX	X	X	X	XX	XX	XXX	X	X	X	X	---

[1]Includes both the northern and western extensions of magnetic anomaly A.
[2]Includes northern flank of anomaly B, extending onto northeast flank of magnetic low north-northwest of B.
[3]Includes only the northwest end of anomaly D.
[4]Geochemical samples were collected only at the southwest end of the anomaly.

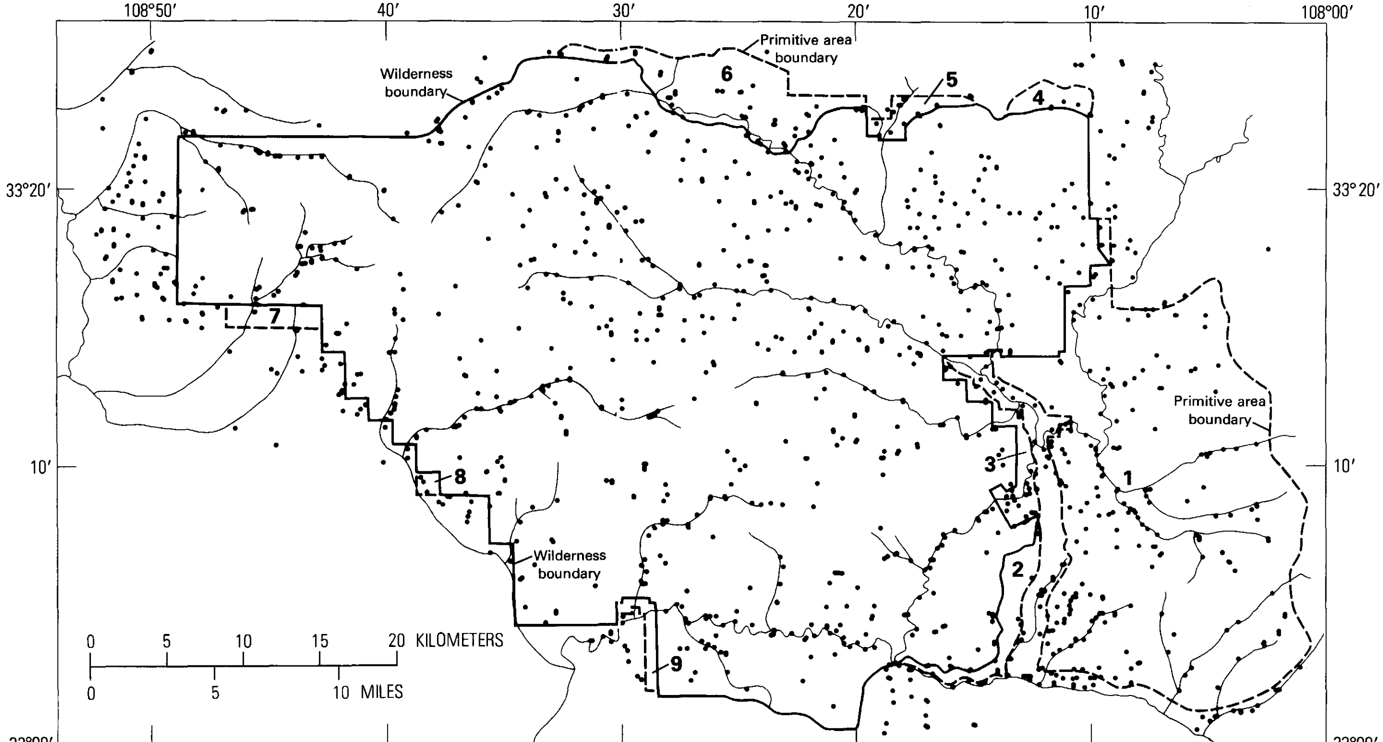


FIGURE 19.—Distribution of stream-sediment sample localities (dots) in the Gila study area—panned-concentrate localities not included.

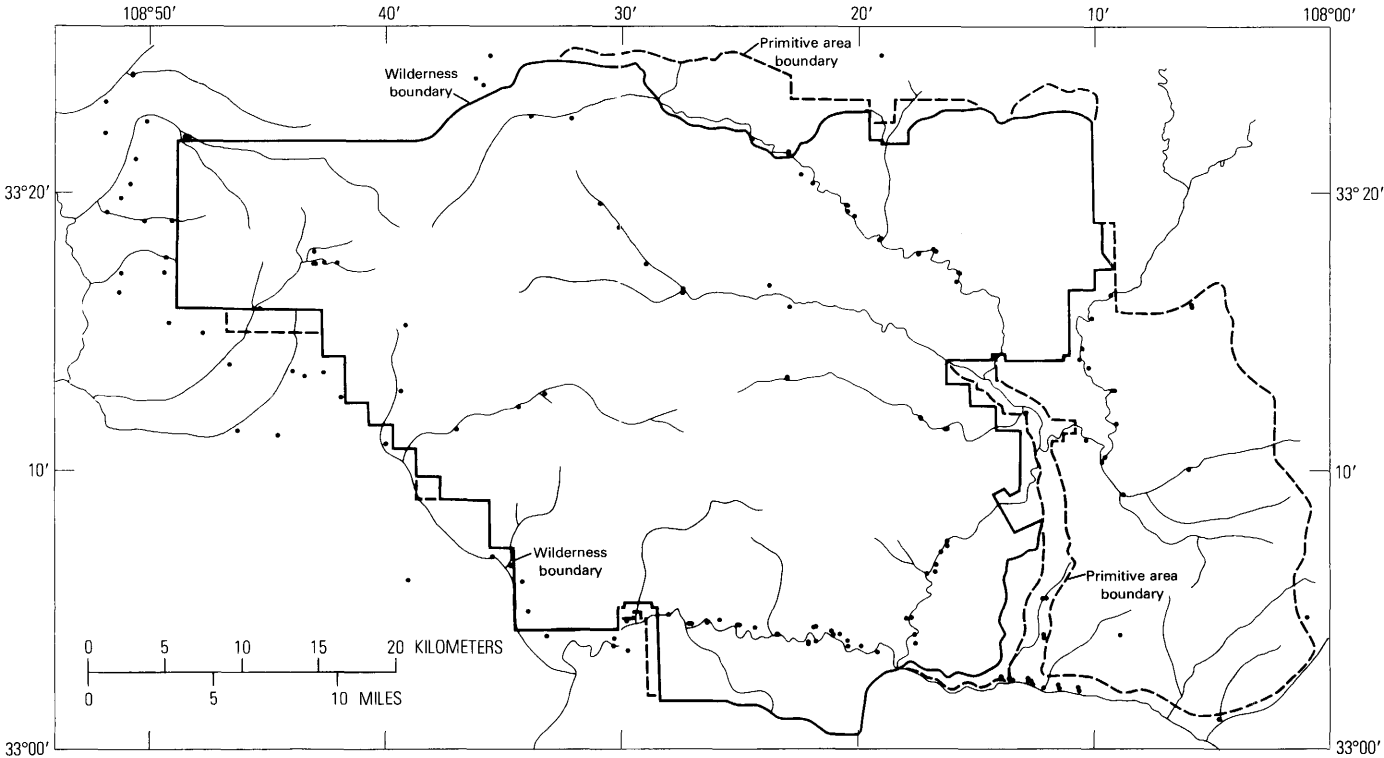


FIGURE 20.—Distribution of localities (dots) where panned concentrates of stream sediments were collected in the Gila study area.

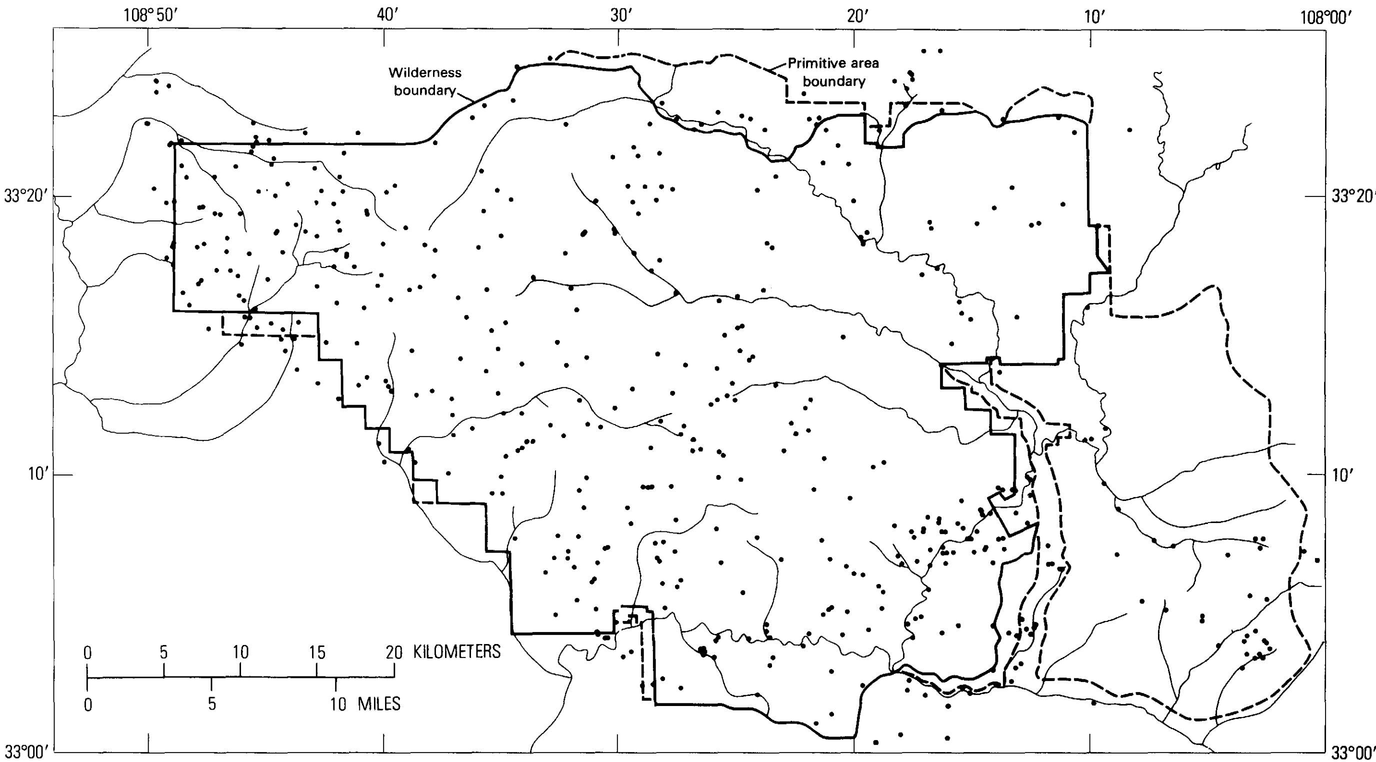


Figure 21.—Distribution of unaltered-rock sample localities (dots) in the Gila study area.

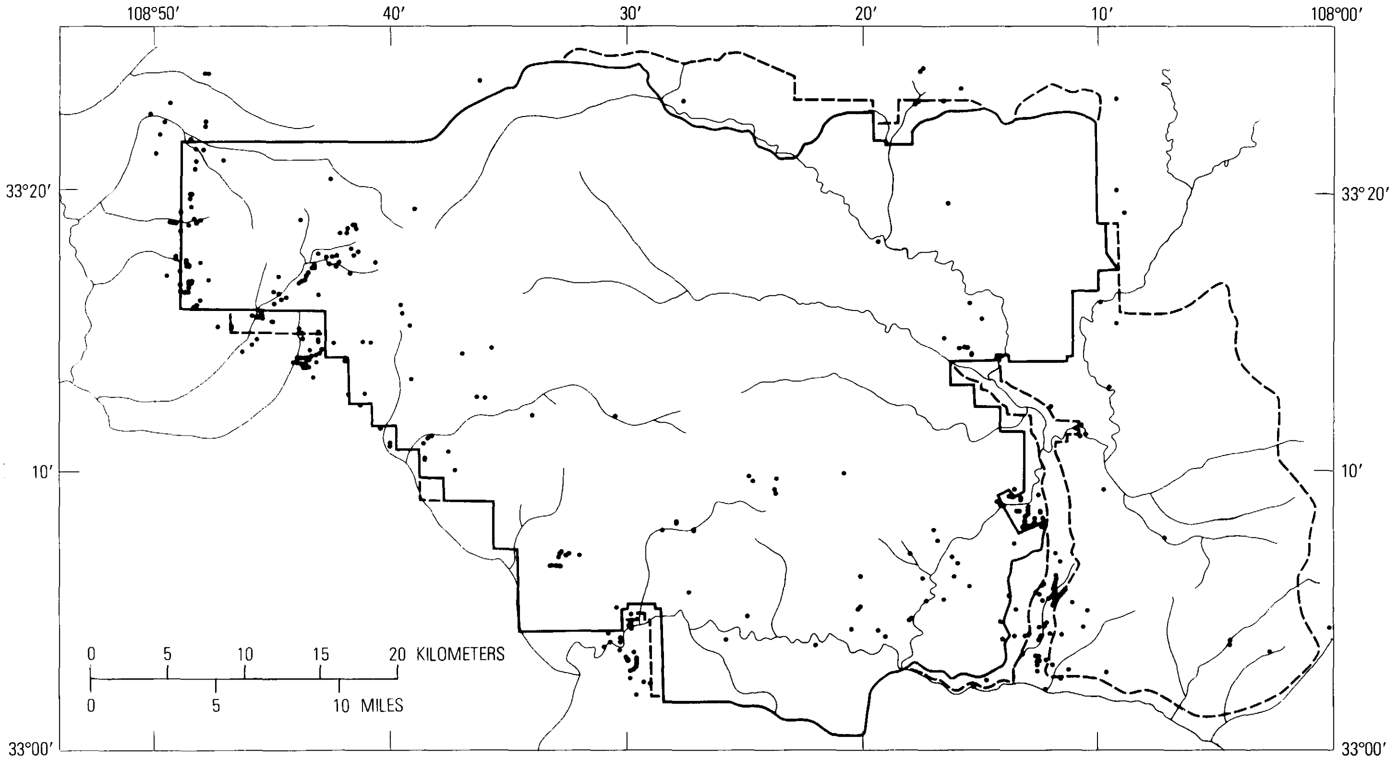


FIGURE 22.—Distribution of altered- and mineralized-rock sample localities (dots) in the Gila study area.

alluvium available, which commonly was sieved to minus-80 mesh at the sample site if dry material was available. In the larger streambeds, an attempt was made to collect the fines from beneath boulders and to collect comparable material for each sample. However, this ideal could not always be achieved because of the highly variable character of the sediment in different parts of a streambed and the lack of appreciable fine sediment in many steep-walled tributary canyons. Along the major streams, and at some other localities where water was available, some of the stream sediment was panned to obtain a heavy mineral concentrate; panned samples total about 175 (fig. 20).

About 500 samples were taken of relatively fresh rock from the many different volcanic formations in the study area and about an equal number were taken of altered and mineralized rocks from veins, faults, and altered areas.

The density of sample localities shown in figures 19–22 is clearly higher in areas of altered and mineralized rocks, and thus for statistical purposes the data are biased toward mineralized samples.

ANALYTICAL PROCEDURES

All samples were analyzed by semiquantitative spectrographic methods for 30 metallic elements in addition, gold and tellurium were measured by atomic absorption spectrometry, mercury by a mercury detector, and arsenic by the Gutzeit colorimetric method.

Sample preparation was tailored to sample type. Stream-sediment samples were sieved to minus-80 mesh and a split for mercury analysis was taken prior to high-speed grinding to avoid loss of mercury. Panned concentrates of stream sediments were handled in several ways; the heavy minerals of some samples were further concentrated in heavy liquid separations and magnetite removed with a hand magnet. For other samples, only the magnetite was removed, and some were not modified by further treatment. Some paired samples, including a magnetic and nonmagnetic fraction of the same original sample, were analyzed. The panned concentrates were collected more for qualitative estimates of the distribution of gold and tin than for quantitative geochemical comparisons, and thus are not always included in the statistical treatment of the geochemical data. Rock samples were coarse crushed to $\frac{1}{4}$-inch size and a split taken for slow grinding of a sample for mercury analysis. The remaining sample was ground to a fine pulp for spectrographic and other chemical analysis. Samples were scanned for radioactivity with a scintillation counter, but no anomalous radioactivity was detected in any samples from the study area

The reliability of the analytical data is of course a major factor in its use Although some of the analytical data presented here are probably not adequate for detailed geochemical work, they are believed to be useful as a reconnaissance tool to differentiate areas with anomalous metal concentrations from those containing only background concentrations. Certain limitations are pointed out below.

Analytical error may be significant in the semiquantitative spectrographic data, where the analytical work has been spread over a period of 3 years and involved several analysts working at different times and with different instruments. Some analyses made in the early stages of the study and repeated later do not compare well where the values are near the limits of detection In addition, only a small quantity of the sample is used for any given spectrometric analysis, and inhomogeneities in the sample give a further source of error. Semiquantitative spectrographic analyses are reported in a series of steps; the reported step in the six-step series, 0.1, 0.15, 0.2, 0.3, 0 5, 0.7, 1.0 and so forth, includes the quantitative value approximately 30 percent of the time, which is a measure of the precision of the nanalysis.

The lower limits of detection reported in the atomic absorption analyses for gold and tellurium (0.02 ppm (parts per million) and 0.2 ppm respectively) have proved to be too low to be reproducible, and the analytical data have been interpreted accordingly.

Some stream-sediment samples, particularly panned concentrates, contained insufficient material for optimum gold and tellurium analyses. For these, different detection limits are indicated in the table of analyses; thus, gold, detected but not measurable, in a 10-gram sample is reported as (0.02)L, whereas gold, detected but not measurable, in a 5-gram sample is reported as (0.04)L, and so forth.

AVAILABILITY OF GEOCHEMICAL SAMPLE DATA

Analytical data on selected metals for those samples that are believed to contain anomalous concentrations of metals above certain threshold values are given in table 5*A–D* of the present report. The rest of the data on all of the more than 2,500 geochemical samples are available elsewhere (Ratté and others, 1972b).

GEOCHEMICAL PATTERNS

In the Gila study area, as elsewhere, certain trace metals are known to be concentrated in some igneous rock types in preference to others; thus chromium, cobalt, nickel, and copper are more abundant in basaltic rocks than in rhyolitic rocks, and conversely beryllium and tin are more abundant in rhyolitic rocks. High copper values, therefore, may signal only the presence of basaltic rocks, rather than a copper deposit. Even though the distribution pattern of a metal indicates that anomalous concentrations of the metal cut across rock type, it does not necessarily indicate a minable ore body of that metal, or any other metal. On the other hand, an indicator element or combination of indicator elements may lead to the discovery of an ore deposit of one or more of the indicator elements, or to a deposit of another metal that is less mobile than the indicator elements with which it is associated. It is also possible that anomalous values related to noneconomic veins or other mineralized structures may represent leakage above a larger deposit that is not otherwise represented at the surface.

The following groups of commonly associated elements are possible indicators of ore deposits in the Gila study area: (1) beryllium, tin, and tungsten; (2) mercury, bismuth, antimony, and arsenic; (3) gold, silver, and tellurium; and (4) copper, molybdenum, lead, zinc, and manganese. Analyses of these elements are summarized in table 6 in back of report.

BERYLLIUM, TIN, AND TUNGSTEN

Beryllium, tin, and tungsten commonly are associated in the geologic environment, and they occur in greater abundance in silicic, rather than mafic, igneous rocks.

Beryllium.—Beryllium is of interest in the resource appraisal of the Gila study area not only because of its possible role as an indicator element of polymetallic ore deposits, but also because the world's largest known resources of beryllium occur in rhyolite tuffs associated with topaz-bearing rhyolite at Spor Mountain, Utah (Shawe, 1968, p. 1148). Similar rhyolitic rocks are present in the Mogollon volcanic area where tin- and topaz-bearing rhyolites have been described by Fries (1940), Fries, Schaller, and Glass (1942), and Ericksen and others (1970, p. 36; 72–74).

In the Gila study area, geochemical samples containing 5 ppm or more beryllium (tables 5, 6) are related to the distribution of flow-banded rhyolite throughout the study area. At the 7-ppm level, however, beryllium is found to be concentrated in the younger rhyolitic rocks and stream-sediment samples from the northeastern part of the area, and in mineralized or altered rocks from the northwestern part of the area (fig. 23). The beryllium content of all the geochemical samples is much below ore grade.

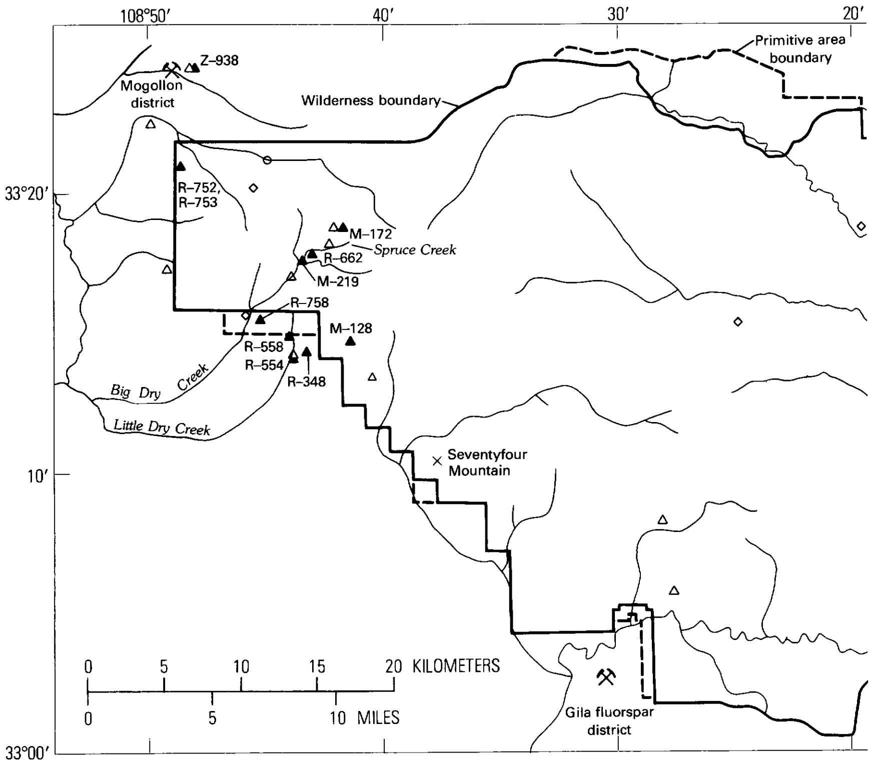
In the Indian Creek area, the distribution of altered and unaltered rhyolite suggests a local vent; lithophysal rhyolite in this area contains fluorite and crystals of the rare minerals bixbyite, $(Mn,Fe)_2O_3$, and pseudobrookite, $Fe_2O_3 \cdot TiO_2$, which also are found in the tin- and topaz-bearing rhyolites east of the study area. The rare minerals in the rhyolite of Indian Creek were confirmed by X-ray (Sherman Marsh, oral commun., 1969); topaz has not been identified in rhyolite within the study area. The highest beryllium content from the Indian Creek area is 20 ppm in samples of rhyolitic tuff.

The beryllium content of samples of vein materials in the Mogollon district and in the Spruce Creek, Big Dry, and Little Dry Creek areas indicates that beryllium is associated with mineralized rocks as well as with unaltered rhyolites in the northwestern part of the study area. The highest beryllium values were found in samples of the outcrop of the Little Fanney vein in the Mogollon district (30 ppm, Be) and in a small shear in the rhyolite of Sacaton Mountain west of Little Dry Creek (50 ppm, Be). Anomalous beryllium values are notably absent, however, in the other major areas of mineralization in the Gila fluorspar district, Alum Mountain, and Copperas Creek areas. U.S. Bureau of Mines samples (table 7) confirm this distribution pattern—38 samples containing 7-100 ppm beryllium are distributed from Seventyfour Mountain northwest to the Mogollon district. Different ages of mineralization may account for these differences in beryllium distribution.

Tin.—Tin is of interest in the Gila study area because rhyolites in the area are similar to, and locally continuous with, the tin-bearing rhyolites in the Taylor Creek tin district, less than 3 miles (5 km) east of the northeast corner of the study area. Also, tin is a mineral commodity for which the United States is largely dependent upon foreign resources, and the Taylor Creek district is one of the few in the United States where tin has been mined as a primary mineral product, albeit on a negligible scale. Most large economic tin deposits are placers or eluvial deposits because in most lode deposits, cassiterite, the only important ore mineral of tin, is very sparsely disseminated in the host rock. Natural concentrations of cassiterite, based on its high specific gravity, may raise the tin content of stream gravels or residual weathered debris to ore grade.

The distribution of tin in geologic materials of the Gila study area, determined by geochemical sampling, is summarized in table 6. Tin was detected in a total of 360 samples, and was measurable in 226 of these samples analyzed by semiquantitative spectrographic methods having a lower detection limit of 10 ppm. Maximum tin values in the samples range from 30 ppm in the unaltered rocks to 200 ppm in panned concentrates of stream sediments. Only 2 samples of unaltered rock and 4 of altered rock contain more than 10 ppm tin; 21 samples of stream sediments contain 15 ppm or more tin.

The average abundance of tin in igneous rocks of the earth's crust is estimated to be 2–3 ppm, and in silicic igneous rocks to be 3–4 ppm (Wedepohl, 1969, chap. 50). The values, however, are weighted toward the composition of granitic plutonic rocks rather than rhyolitic volcanic rocks, and the tendency for tin to be enriched in the residual pneumatolytic and hydrothermal fluids of magmas suggests that average values for the tin content of rhyolitic rocks is somewhat greater than



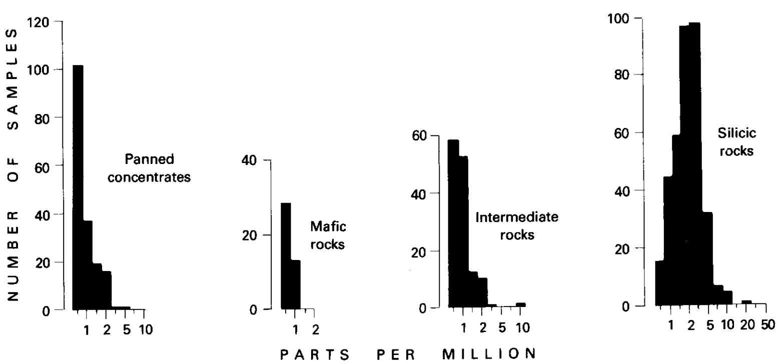
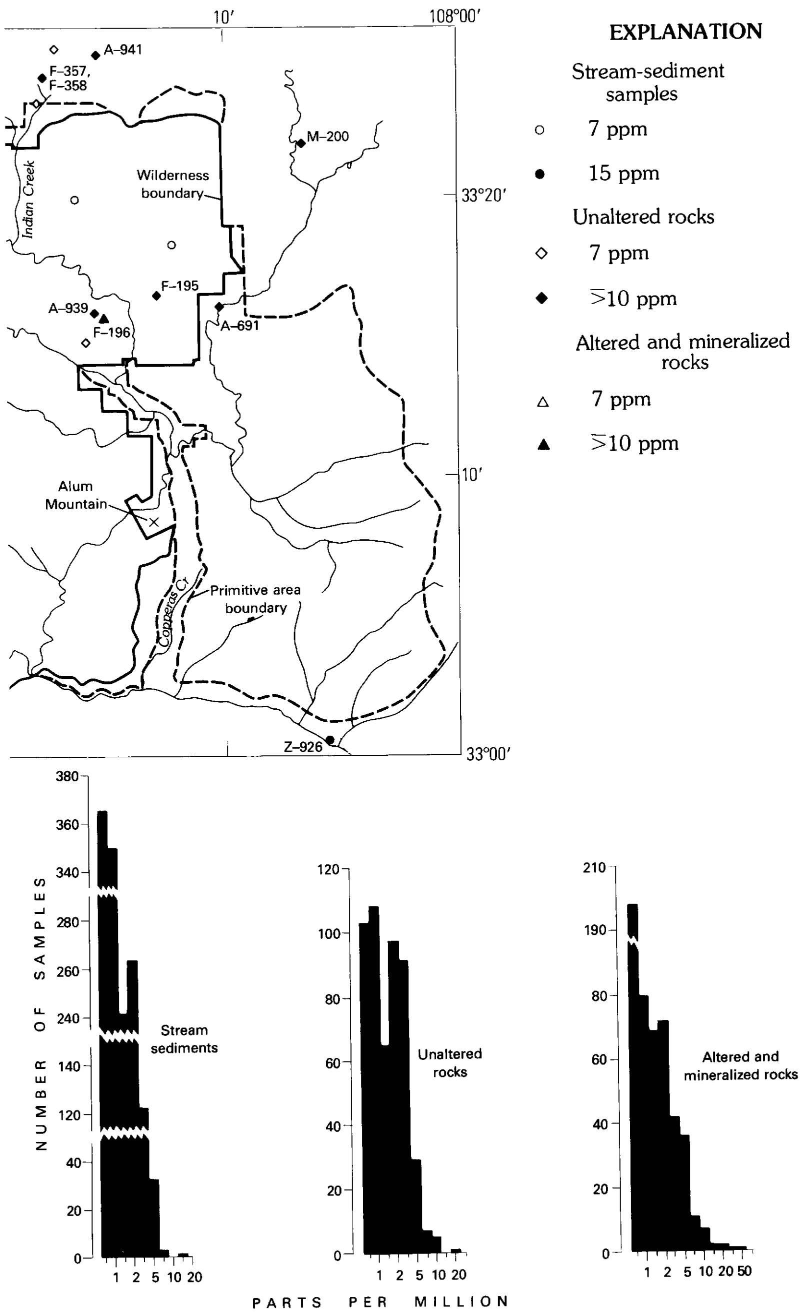


FIGURE 23.—Distribution of samples in the Gila study area having 7 ppm or sample and rock types. Sample numbers shown for highest values. Prefixes respectively, table 5 in back of report.



more beryllium. Histograms show distribution of beryllium values in different A-, F-, M-, R-, and Z- on map correspond to ACA, AFM, AMZ, AGR, and ABZ, the average reported for silicic igneous rocks. A threshold value of 10 ppm tin would seem to be reasonable in relation to the figures for average igneous rocks cited above, but fully a third of the unaltered felsic rocks sampled in the study area (table 6) show detectable tin at the 10-ppm level, and a map showing the distribution of all samples with tin greater than or equal to 10 ppm would serve only to outline the areas of rhyolitic rocks. Accordingly, we have chosen a threshold of 15 ppm for anomalous tin in rocks and stream-sediment samples in this area (fig. 24), except that the threshold for tin in panned concentrates is raised to 30 ppm on the basis of the tin distribution in those samples as shown by the histogram on figure 24.

It is noteworthy that the altered and mineralized rocks have a lower tin content than the unaltered rocks in most parts of the study area. Only four altered or mineralized rock samples were found to contain 15 ppm or more tin; and three of the four are from the Alum Mountain altered and mineralized area (fig. 24). Thus it seems that tin either is not an important trace element in most mineralized rocks in the study area, or its value as an indicator element is diluted by the relatively high background of tin in the rhyolitic rocks of the area.

Stream-sediment samples containing 15 ppm or more tin and panned concentrates with 20 ppm or more tin show a distribution pattern (fig. 24) related largely to the outcrops of tin-bearing rhyolite (pl. 1). Our samples do not indicate the presence of commercial tin deposits in the study area, and the values we obtained are generally lower than those reported by Ericksen and others (1970) for samples in and adjacent to the Taylor Creek district. We found no evidence of veins or other tin lodes in the study area. The most reliable indication of the submarginal tenor of this weak tin mineralization comes from the Taylor Creek district, where the placer and lode deposits have been intensively studied by Volin and others (1947) and by Fries (1940). According to these earlier investigations, the placer deposits, which have been found only adjacent to the bedrock outcrops, generally average less than 0.05 lb (pounds) tin per yd^3 (cubic yard) of gravel, and large portions average less than 0.005 lb/yd^3. The best placer deposit sampled in previous studies contains about 4,000 yd^3 of gravel that averages about 2 lb/yd^3. Lodes in the Taylor Creek district, which consist of cassiterite in widely spaced stringers and veinlets and disseminated in rhyolite, would require mining by bulk methods. In the areas sampled in previous studies, no sizable deposit was found to contain as much as 1 lb of tin per ton. Total tin production from the district has been about 11 tons of concentrates. The potential for significant future tin production from the Taylor Creek district and adjacent areas is probably related to lode tin, particularly where primary cassiterite has been secondarily concentrated by precipitation from colloidal solutions to form wood tin in porous and permeable facies of the host rhyolite. Such deposits are currently being explored and worked on a small scale in the Boiler Peak area, which is about 10 mi (15 km) east of the northeast corner of the study area. No such secondary concentrations of tin were recognized within the study area.

Tungsten.—Tungsten could be an indicator of deposits of other metals in the study area, but tungsten deposits are unlikely. Its usefulness as an indicator element is inhibited here by the lower detection limit of 50 ppm of the semiquantitative spectrographic method, relative to its average abundance in crustal rocks of 0.5 to 2 ppm. Tungsten was detected in 42 samples in the study area, mainly in the altered rocks, but was measurable in only 10 samples, 9 with 50 ppm and 1 with 200 ppm (table 6). Samples with detectable or measurable tungsten came mainly from the mineralized areas in Big Dry, Spruce, and Little Dry Creeks, Minton Canyon, and the Gila fluorspar district, and from scattered fault and vein samples in the eastern part of the wilderness (fig. 25).

MERCURY, BISMUTH, ANTIMONY, AND ARSENIC

Mercury, bismuth, antimony, and arsenic are similar elements geochemically because they tend to form sulfides rather than occurring in the more common rock-forming minerals. Also, they are present in amounts averaging only a few tenths of a part per million in igneous rocks, except for arsenic, which averages about 6 ppm in rhyolitic glasses (Wedepohl, 1969, chap. 33; 1970, chaps. 51, 80, 83). Mercury, antimony, and arsenic, and probably also bismuth, are common in volcanic exhalations and around hot springs.

There is little possibility that economic deposits of these metals alone are present in the study area, but their common association with metallic ore deposits, either as trace constituents or as major elements of ore minerals, accounts for their value as indicator elements.

Mercury.—The mercury content of geochemical samples in the study area is shown in table 6 and in histograms in figure 26. The high sensitivity of the mercury detector into the parts-per-billion range enabled the mercury in nearly every sample to be measured. The distribution of samples containing 0.25 ppm or more mercury largely mimics the sample locality map for mineralized and altered rocks (fig. 22), and brings out a minor concentration of mercury in samples along the Gila Hot Springs graben (pl. 1*A*). The distribution of samples containing 0.4 ppm or more mercury is shown in figure 26, where the samples high in mercury are concentrated mainly in the areas of mineralized and intensely altered rocks. Mercury is being deposited in many modern hot-spring environments (Wedepohl, 1970, chap. 80) and in some of the areas of altered rock in the study area, particularly in the Copperas

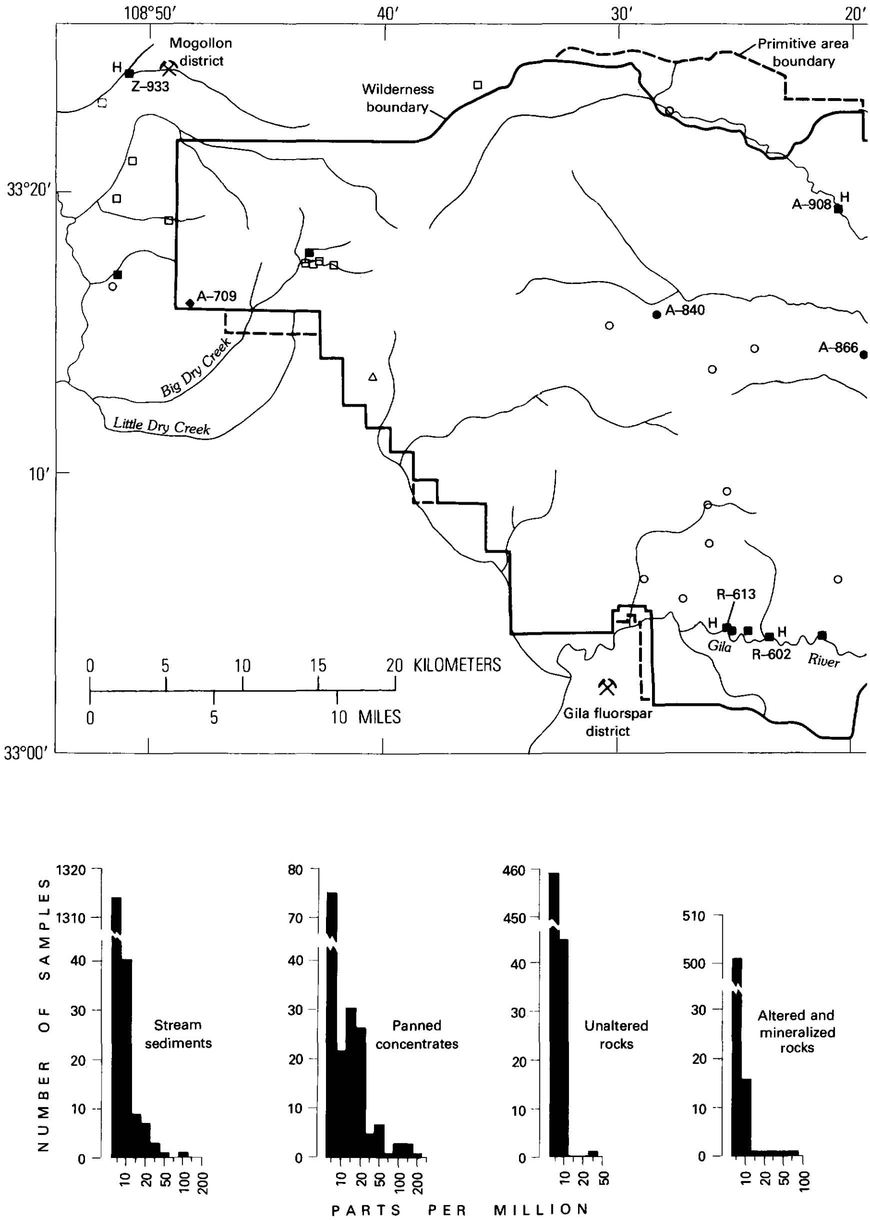
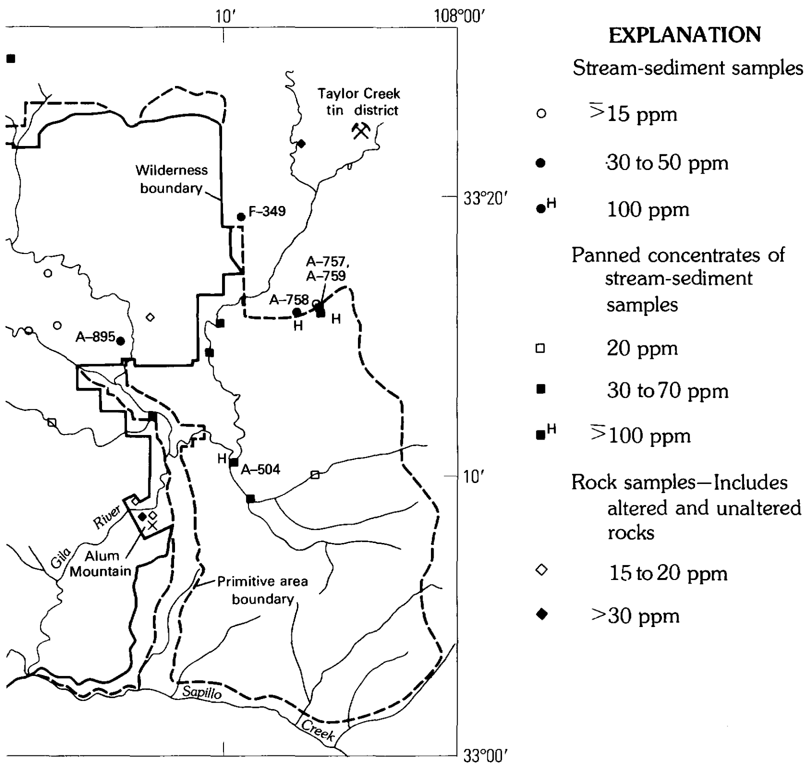


FIGURE 24.—Distribution of geochemical samples within the Gila study area having 15 ppm or more tin. Histograms show distribution of tin values in different sample and rock types. Sample numbers shown for highest values only. Prefixes A-, F-, and R- on map correspond to ACA, AFM, and AGR, respectively, table 5.



Creek and Alum Mountain inliers, silicified pipelike structures with porous breccia probably were the orifices of paleo-hot springs. Although mercury may be concentrated in the vent areas of volcanic centers not necessarily associated with ore deposits, the highest mercury contents in samples from the study area are associated with mineralized structures in the Gold Hill area and in the Lone Pine district, showing the possible usefulness of this element as an indicator of mineralization.

Bismuth.—The abundance of bismuth in average igneous rock is only a few tenths parts per million, considerably less than its lower limit of detection (10 ppm) by the semiquantitative spectrographic method. Bismuth was detected in about 80 geochemical samples in the study area, but was present in measurable amounts in only 4 samples of rocks that were not visibly altered or mineralized (table 6). Bismuth was not detected in samples from the Gila fluorspar district, but its presence in the Copperas Creek–Alum Mountain area and in the areas of strongest mineralization in the northwestern part of the study area (fig. 27) show that it is related to mineralization and should be an even more useful indicator mineral if a more sensitive analytical method were utilized.

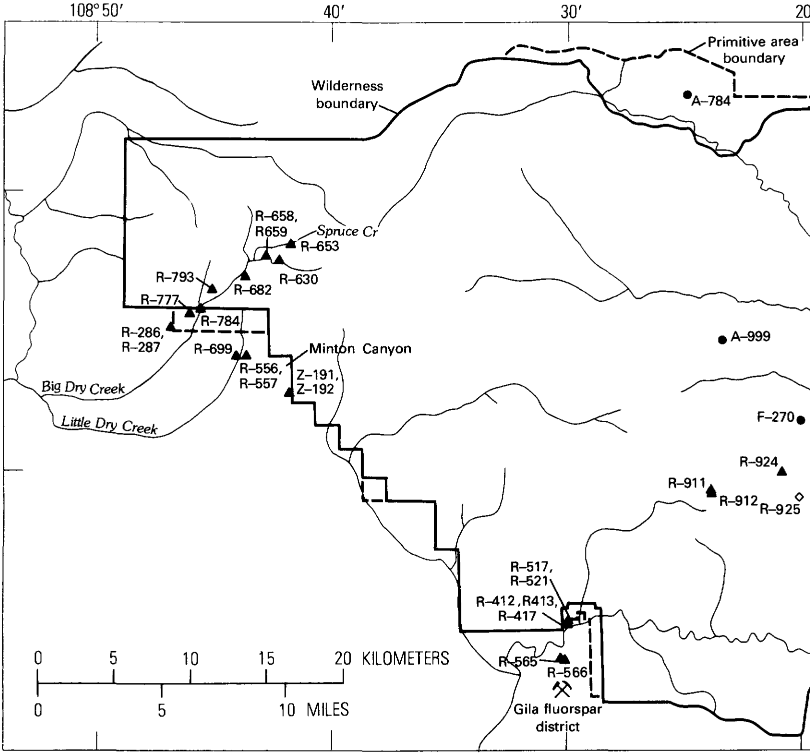
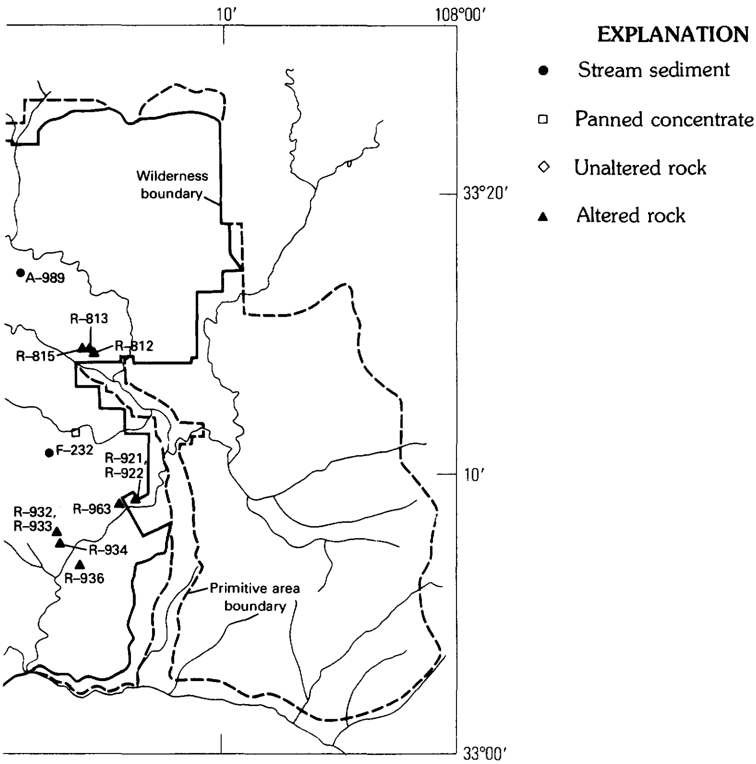


FIGURE 25.—Distribution of detectable tungsten at 50 ppm in geochemical ACA, AMF, and AGR,

Antimony.—Inasmuch as the lower limit of detection of antimony by the semiquantitative spectrographic method is 100 ppm, compared to the average antimony content of igneous rocks of about 0.2 ppm, antimony was measurable in only two samples (table 6). One of the samples was from the Watson Mountain mine in the Gila fluorspar district, and the other from a prospect pit on a siliceous pyritic fault zone near the head of the ridge between the North Fork and Big Dry Creek (fig. 27). A number of other samples originally were reported to have detectable antimony but, where checked, the values were found to be questionable. Antimony, like bismuth, might be a more useful indicator element in this area if measured by a more sensitive method.

Arsenic.—The abundance of arsenic in igneous rocks ranges mainly from 1 to 6 ppm but is as much as 12 ppm in some glassy rocks (Wedepohl, 1969, chap. 33). The distribution of arsenic values in the geochemical samples is tabulated in table 6. Regardless of sample type, samples with 15 ppm or more arsenic are restricted almost entirely to the



samples from the Gila study area. Prefixes A-, F-, and R- on map correspond to respectively, table 5.

known areas of major mineralization and alteration (fig. 28). Because arsenic may be deposited in volcanic sublimates and from hot springs, its presence may be accounted for locally by a proximity to volcanic vents. Here, however, arsenic appears to be a significant indicator of mineralization.

GOLD, SILVER AND TELLURIUM

Gold, silver, and tellurium are common associates in epithermal precious metal deposits.

Gold.—The range of gold values in geochemical samples of the study area is summarized in table 6, and the samples with greatest gold contents are located in figure 29. Although gold was reported down to a lower detection limit of 0.02 ppm, if a 10-gram sample was analyzed, analytical error and sampling error combine to make values below 0.05 ppm particularly questionable, and values between 0.05 and 0.1 ppm are not consistently reproducible. Nearly all of the reliable anomalous gold

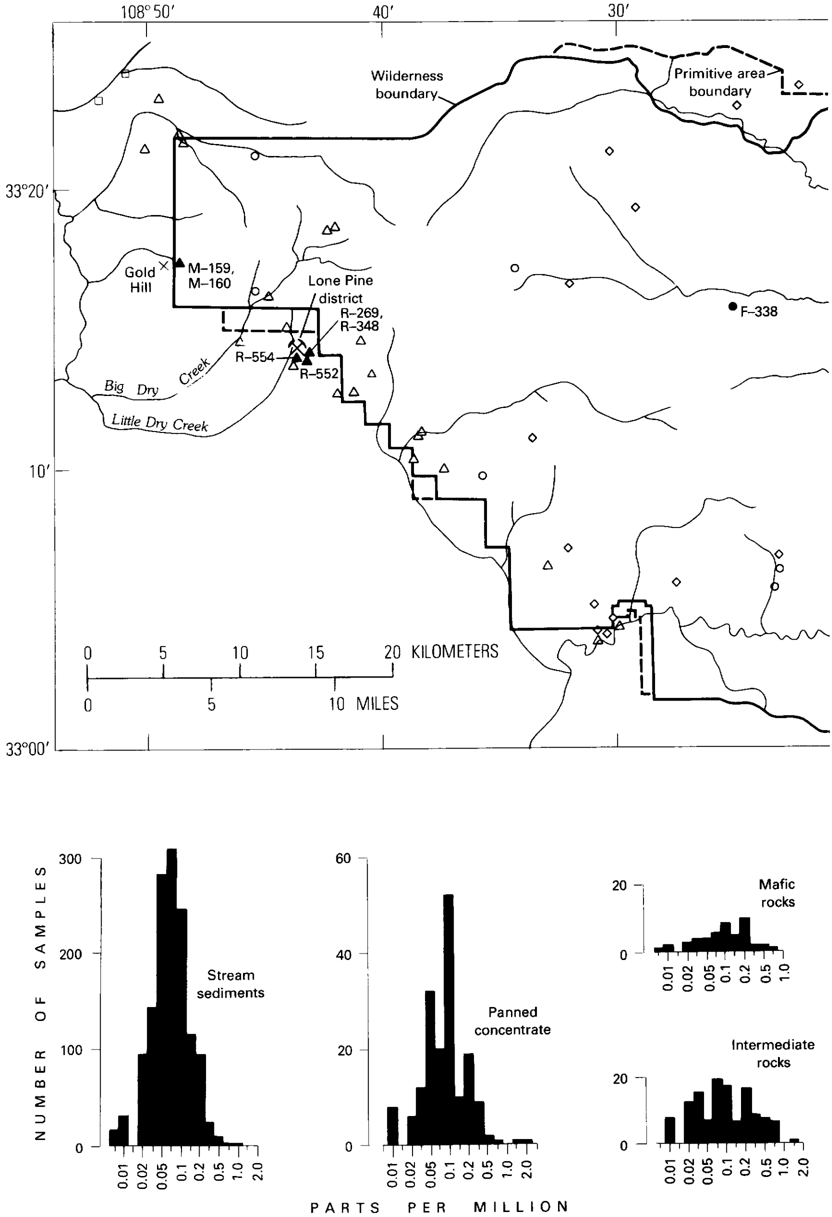
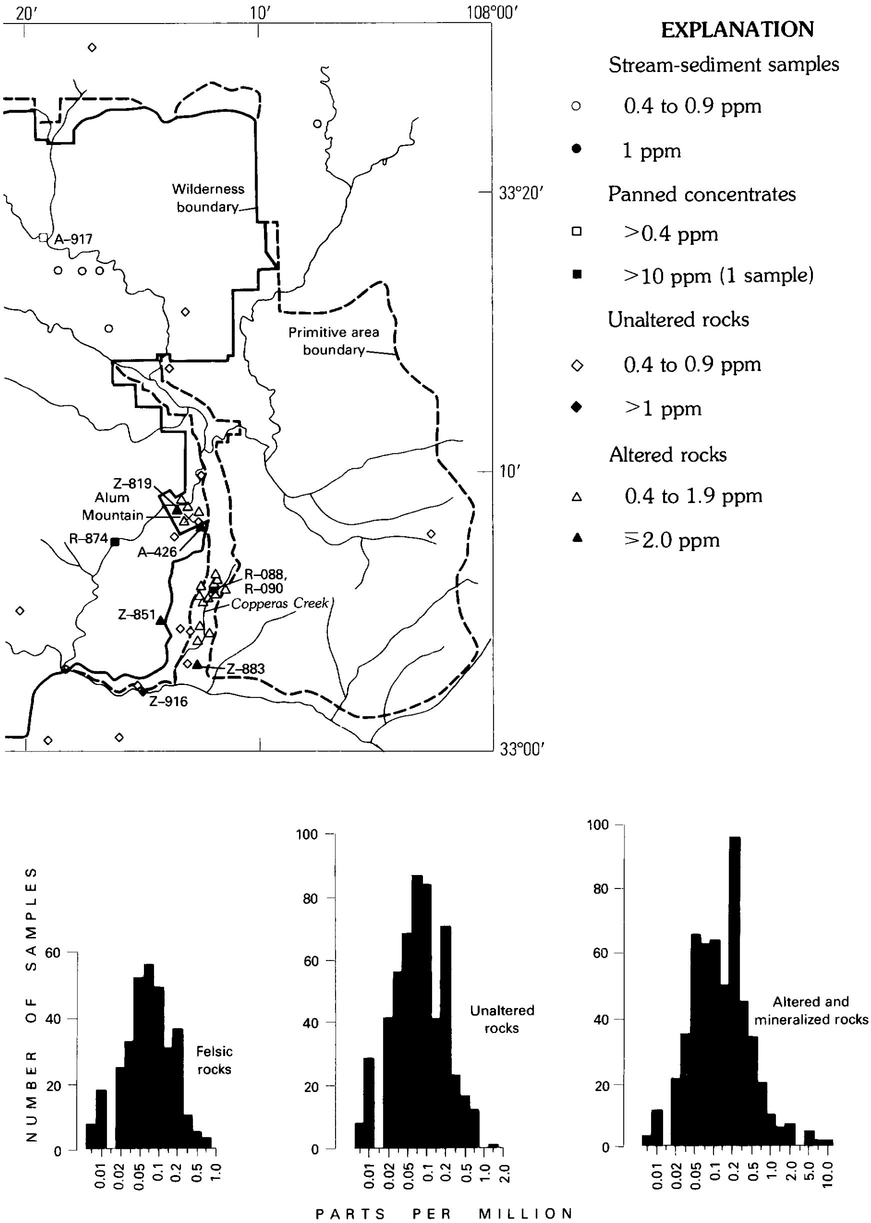


FIGURE 26.—Distribution of samples containing 0.4 ppm or more mercury. Sample numbers shown for higher values. Prefixes A-, F-, M-, R-, and Z-



Histograms show distribution of mercury in different sample and rock types.
on map correspond to ACA, AMF, AMZ, AGR, and ABZ, respectively, table 5.

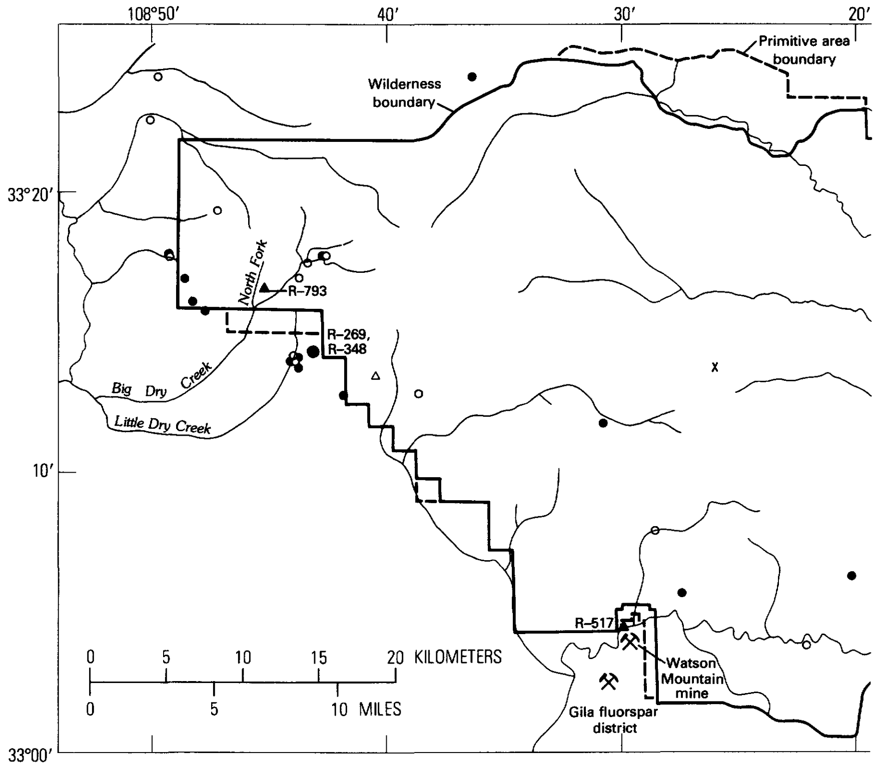
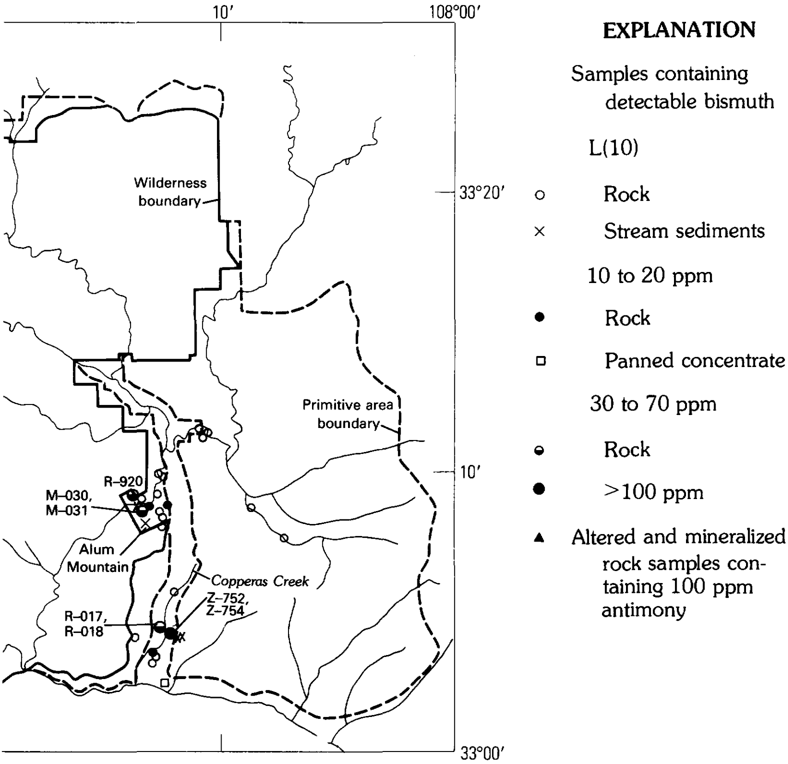


FIGURE 27.—Distribution of samples with detectable bismuth at 10 ppm or
Prefixes M-, R-, and Z- on map correspond

values are related to the mineralized and altered rock sample set, largely in the northwestern part of the study area (fig. 29). The four highest values obtained were in samples from veins in the Holt Gulch–Gold Hill area and in the Lone Pine district.

Silver.—Very little silver was found in the geochemical samples, except in the mineralized and altered rocks (table 6), where it is particularly prevalent in the northwestern part of the area (fig. 30). In the eastern part of the study area trace amounts of silver were detected in a number of samples of silicic rocks which lack visual evidence of alteration or mineralization. Some of these were collected near minor faults having no noticeable vein. There seems to be no further evidence of significant mineralization associated with these trace amounts of silver.

Tellurium.—Tellurium is an important indicator element in the Gila study area because it is associated with the known mineralized and altered rocks throughout the area. Values reported as less than 0.5 ppm are not considered to be reliable, and values between 0.5 and 1.0 ppm also may not be reproducible. Finely dispersed organic matter or other



more, and antimony at 100 ppm. Sample numbers shown for higher values.
to AMZ, AGR, and ABZ, respectively, table 5.

foreign material gave interference in the measurement of tellurium in over 100 stream sediment samples, but it is unlikely that any important tellurium concentrations were missed in the eastern part of the study area because of this factor. Tellurium not only is associated with mineralized rocks, but itself has been the object of extensive exploration in the Lone Pine district, where our geochemical samples showed as much as 3,000 ppm tellurium (tables 5*B* and 6). Tellurium was reported in analyses of panned concentrates, stream sediments, and a few rocks that were not visibly altered, but nearly all such occurrences are within the areas of known mineralization and alteration (fig. 31). Outside the Lone Pine district maximum values are 3–4 ppm in the Alum Mountain–Copperas Creek area and 2.5 ppm in the Gila fluorspar district.

COPPER, MOLYBDENUM, LEAD, ZINC, AND MANGANESE

Copper, molybdenum, lead, zinc, and manganese are the base metals most likely to be found in important mineral deposits in the Gila study area.

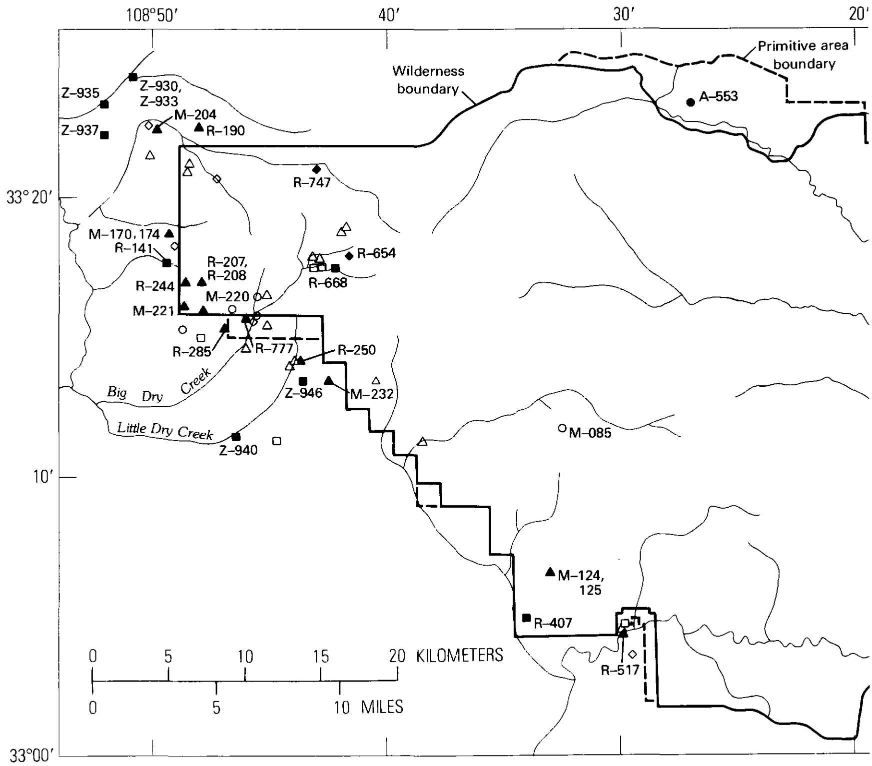
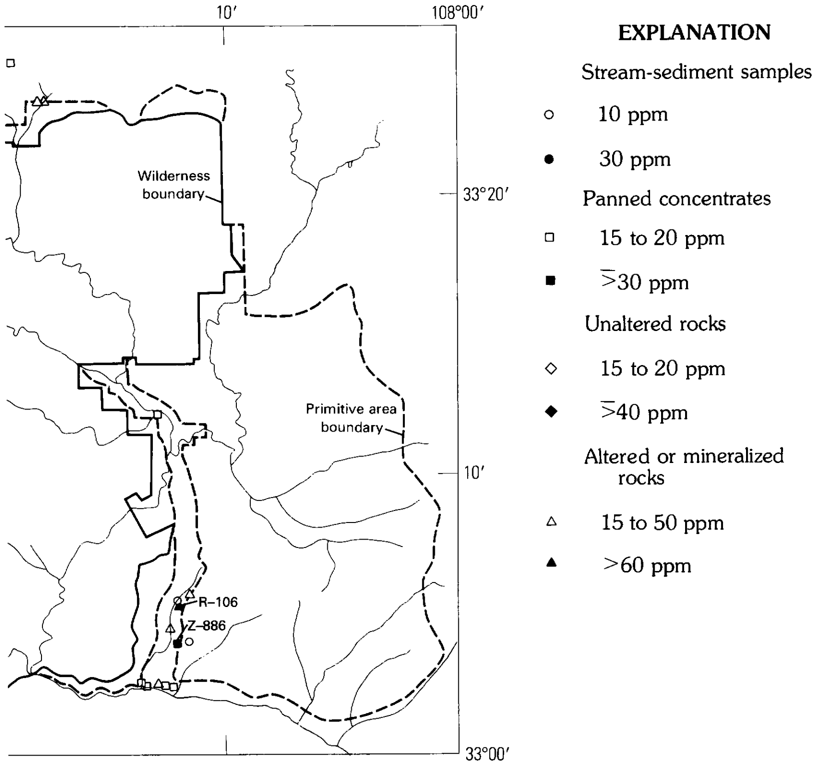


FIGURE 28.—Distribution of arsenic in geochemical samples of the Gila study
map correspond to AMZ, AGR,

Copper.—The frequency distribution of copper values in the geochemical samples of the study area is tabulated in table 6 and shown by histograms in figure 32. For unaltered rocks, the histograms show a bimodal distribution of copper values which reflects the relative abundance of copper (geometric mean, 30–40 ppm) in intermediate and mafic rocks, compared with felsic rocks (geometric mean, 5 ppm). The copper values are as high as 100 ppm in the unaltered rocks.

The major features of interest in the copper distribution are: (1) the many high copper values in geochemical samples of mineralized and altered rocks from Big Dry Creek to Haystack Mountain, and to a lesser extent in the Alum Mountain–Copperas Creek area; (2) the absence of anomalous copper values in the Gila fluorspar district; and (3) the presence of a belt of anomalous copper values in stream sediment samples in the western part of tract 1 of the Gila Primitive Area, which does not seem to be explained by the distribution of mafic volcanic rocks. Other drainages in and adjacent to tract 1 contain the same or similar rock formations but do not show such high copper values. The south-



area. Sample numbers shown for higher values. Prefixes M-, R-, and Z- on the
and ABZ, respectively, table 5.

western part of this belt includes the relatively high copper values in altered and mineralized rock samples in the Alum Mountain–Copperas Creek area (fig. 32).

Molybdenum.—Perhaps more than any other element considered here, molybdenum is associated with known areas of mineralized and altered rocks. The distribution of values in the various types of geochemical samples is shown in table 6, and the location of samples containing 7 ppm or more molybdenum is shown in figure 33. Samples having the highest molybdenum values are concentrated in the Little Dry Creek–Big Dry Creek area within the wilderness, and primitive area tract 7, as well as along the edge of the study area; near the wilderness boundary between Whitewater and Little Whitewater Creeks; and in the altered rocks of the volcanic complex of Brock Canyon in the Gila fluorspar district (fig. 33) where four samples contained 100 ppm or more molybdenum, including one with 5000 ppm. Little significance is attributed to the isolated samples of unaltered rocks and stream sediments with slightly anomalous values that are found elsewhere.

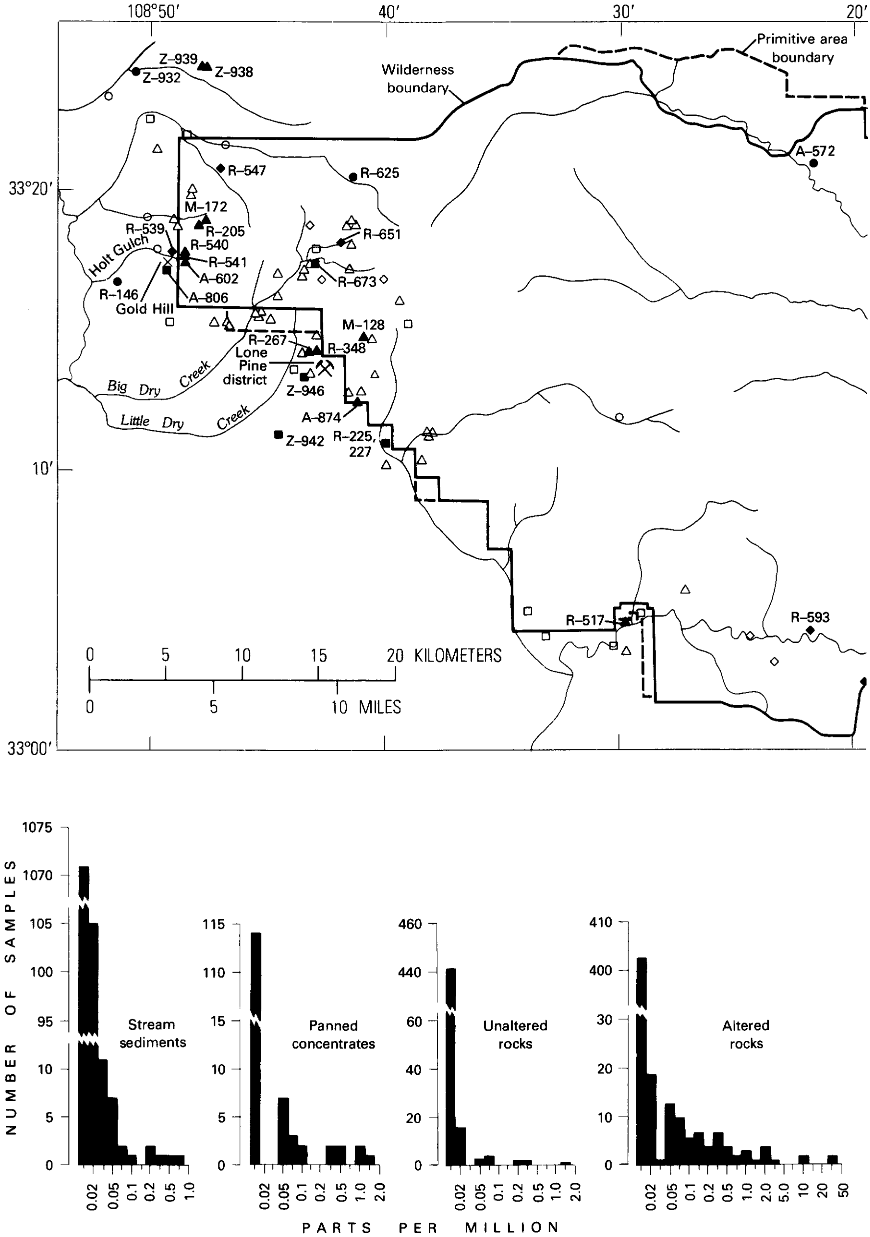
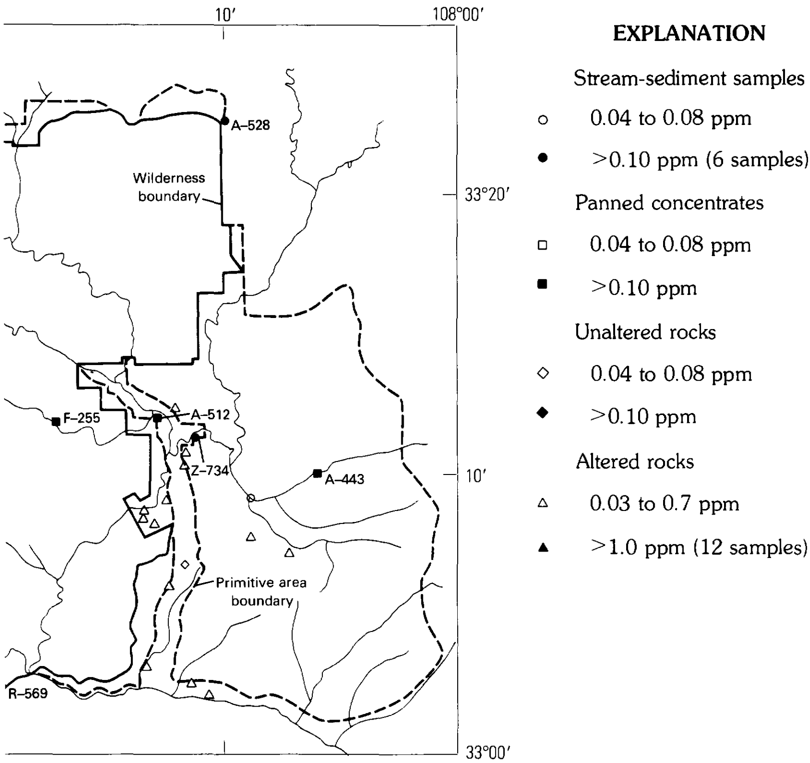
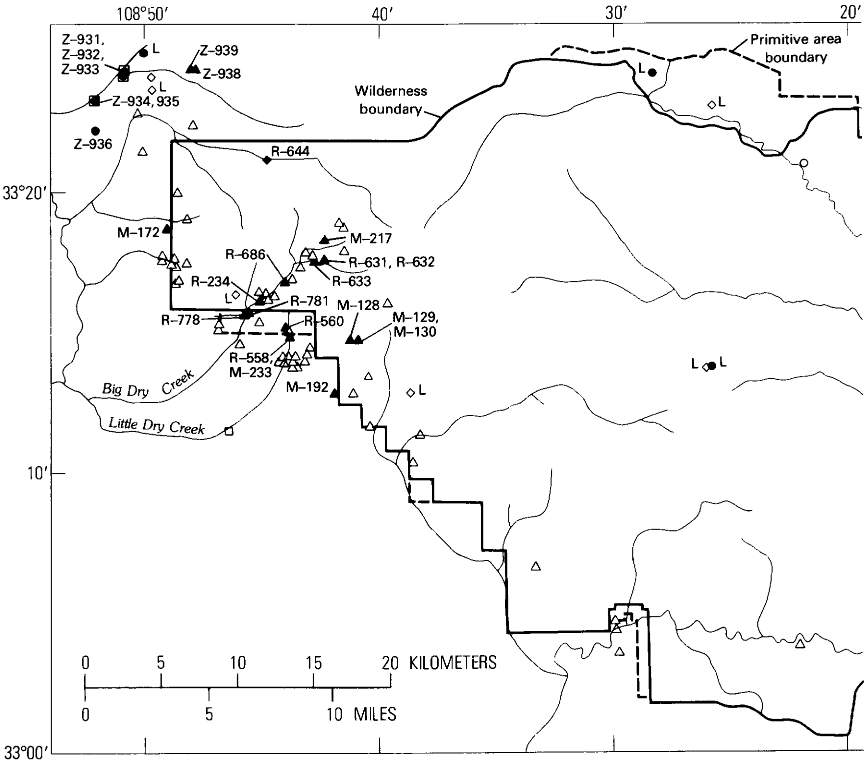


FIGURE 29.—Distribution of gold values in the Gila study area. Histograms show distribution of gold values in different sample and rock types. Sample numbers shown for higher values. Prefixes A-, F-, M-, R-, and Z- on map correspond to **ACA**, **AMF**, **AMZ**, **AGR**, and **ABZ**, respectively, table 5.



Lead.—Lead is known to be concentrated preferentially in the more silicic igneous rocks, and this fact is borne out by the geochemical samples in the study area. Lead in unaltered rocks ranges from a geometric mean of about 12 ppm in rocks classed as mafic to about 24 ppm in the more silicic rocks (table 6). Thus many of the unaltered rock samples and stream-sediment samples that contain lead at 70 ppm or more may merely reflect the lead normally present in highly silicic rhyolitic rocks in this area, as for example in the samples between lower Turkey Creek and the Gila River (fig. 34). Otherwise lead is concentrated mainly in the northwestern part of the study area in mineralized and altered rocks, particularly from Big Dry Creek to Haystack Mountain. A minor concentration of lead occurs in the Alum Mountain area, and several stream sediment samples with moderately high lead values are in the belt of anomalous copper-bearing stream sediment samples in the western part of tract 1 of the primitive area. Lead seems not to be an indicator element in the Gila fluorspar district.

Zinc.—Zinc has a lower detection limit of 200 ppm by the semiquantitative spectrographic method, which limits the usefulness of this method in detecting subtle zinc anomalies. Table 6 summarizes the geochemical data on zinc from the study area, and figure 35 shows the



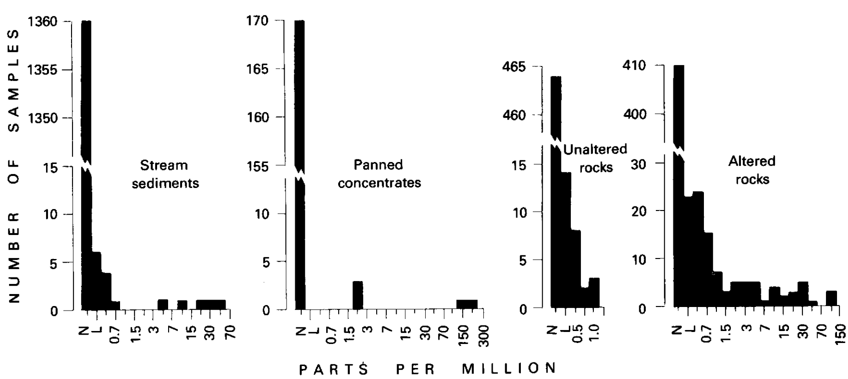
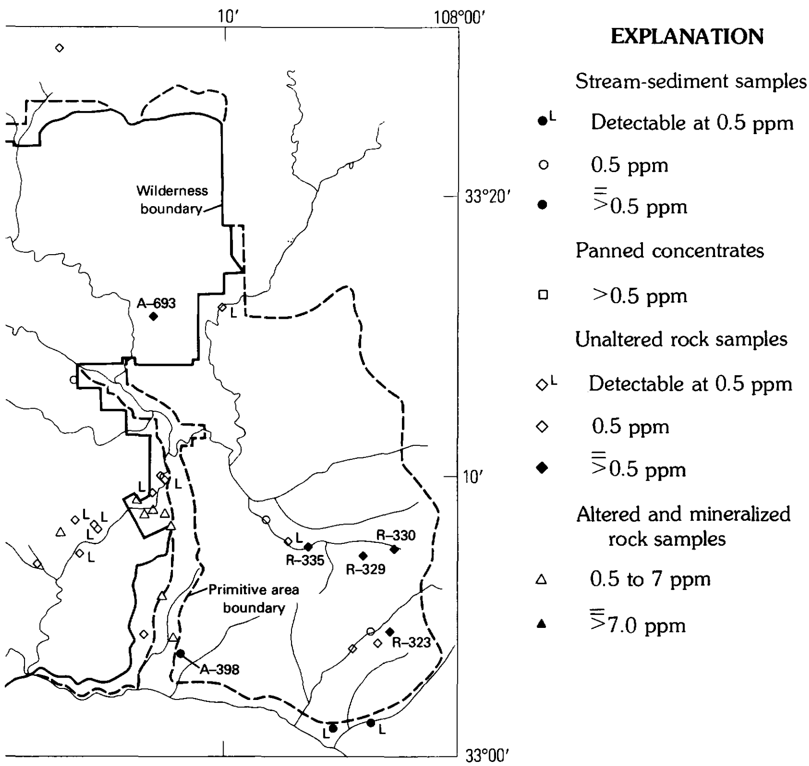


FIGURE 30.—Distribution of geochemical samples with detectable silver in the Gila study area. Histograms show distribution of silver values in different sample and rock types. Sample numbers shown for higher values. Prefixes A-, M-, R-, and Z- on map correspond to ACA, AMZ, AGR, and ABZ, respectively, table 5.



locations of samples having the highest zinc values. The greatest concentrations of zinc are in the mineralized and altered rocks in the Big Dry Creek and Little Dry Creek areas.

Six of the geochemical samples contain 20–200 ppm cadmium. This metal is produced as a byproduct of zinc ores, and the samples from the study area in which cadmium was measured were all rich in zinc or lead.

Manganese.—The range of manganese values in the geochemical samples is shown in table 6. Among the mineralized and altered rocks are many high manganese values, but there are many very low ones also, so that sample set has the lowest geometric mean of any of the sample groups (fig. 36). The high manganese values in the mineralized and altered rocks are clustered predictably in the main mineralized and altered areas, but manganese in stream sediment samples is highest where copper is also high, in the belt along the western side of tract 1 of the Gila Primitive area (fig. 32).

The geochemical character and geographic limits of the many local areas of previously known mineralization in the Gila study area are

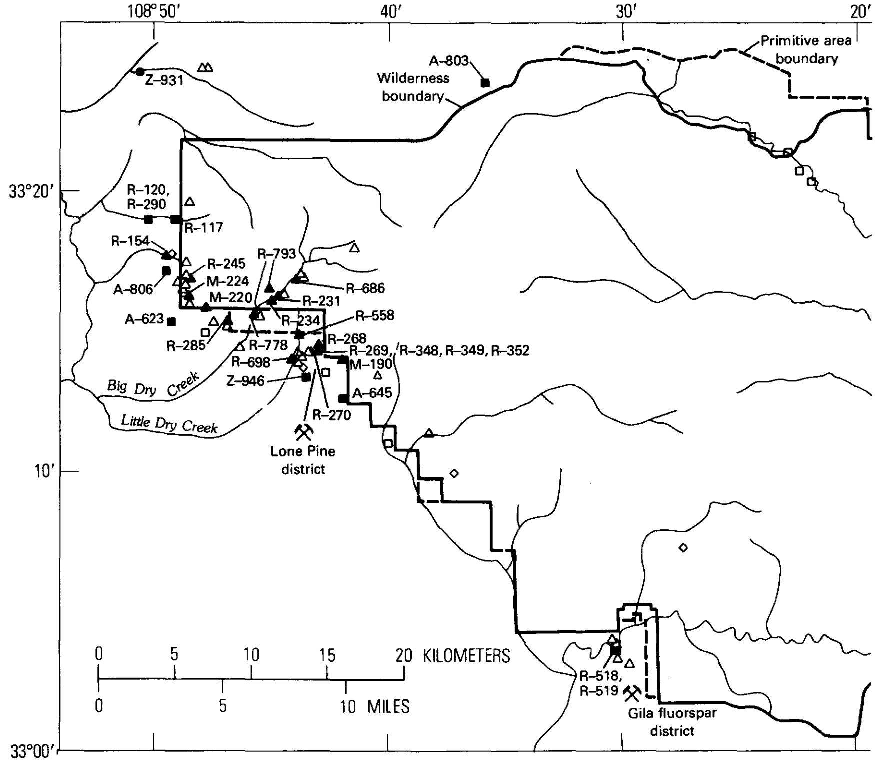
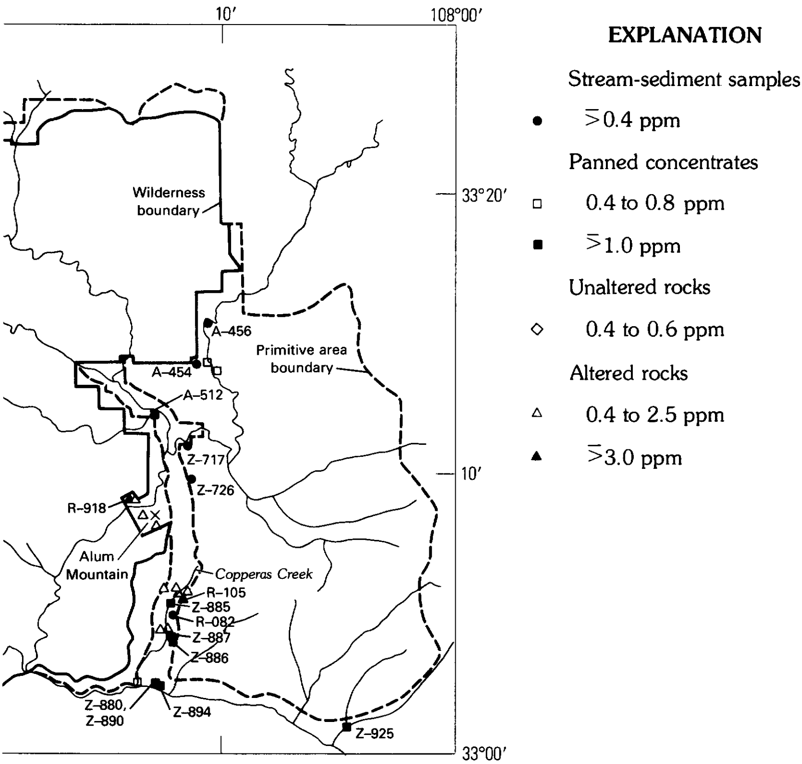


FIGURE 31.—Distribution of geochemical samples with 0.4 ppm or more
Prefixes A-, M-, R-, and Z- on map correspond

believed to have been more clearly defined by the reconnaissance geochemical survey (fig. 36). Combined with other geological and geophysical indicators, the geochemical anomalies indicate more specific targets for further mineral exploration. However, with the possible exception of the unexplained copper and manganese anomalies in the northern and western parts of tract 1 of the primitive area, no new areas of mineral deposits potential seem to have been revealed by the geochemical sampling program.

MINERAL RESOURCES APPRAISAL

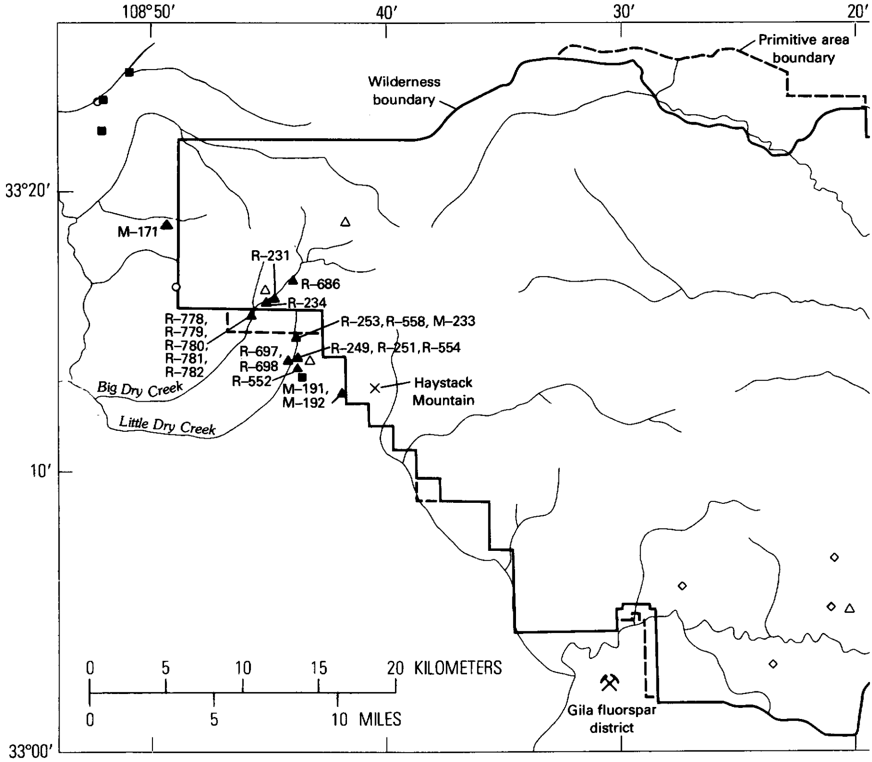
In a broad sense, the study area seems to be a prime target for metallic and nonmetallic minerals exploration. It is within a major volcanic field near the intersection of regional tectonic trends; major deposits of copper, gold, silver, lead, zinc, iron, and manganese are nearby; and evidence of hydrothermal alteration and mineralization is widespread. On the other hand, these and other factors indicate that the study area is



tellurium in the Gila study area. Sample numbers shown for higher values.
to ACA, AMZ, AGR, and ABZ, respectively, table 5.

not a likely site for mineral fuel resources of coal, oil, gas, or uranium. A potential may exist for developing geothermal energy resources within the study area. The main regional factors that enhance the possibilities for metallic mineral resources of the study area include: (1) its location in one of the four major areas of igneous rocks at the margin of the Colorado Plateaus structural province; (2) its position on and adjacent to major structural trends, which comprise several intersecting fracture systems; (3) its position within several so-called metal or metallogenic provinces.

A spatial association of ore deposits with the Tertiary volcanic areas at the margins of the Colorado Plateau (fig. 6) was recognized by Butler (1929) and more recently has been emphasized by Noble (1970, p. 1607), who noted this feature in considering metal provinces of the Western United States as follows: "The combined metal provinces of the Western United States make a crude raylike pattern around the Colorado Plateau, localized at four thick piles of Tertiary volcanic rocks." Whether the ore deposits occur in these areas because they are derived from the



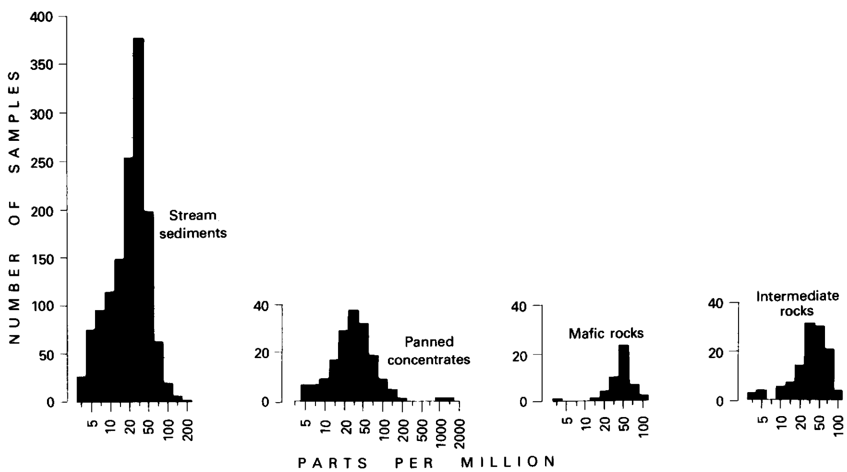
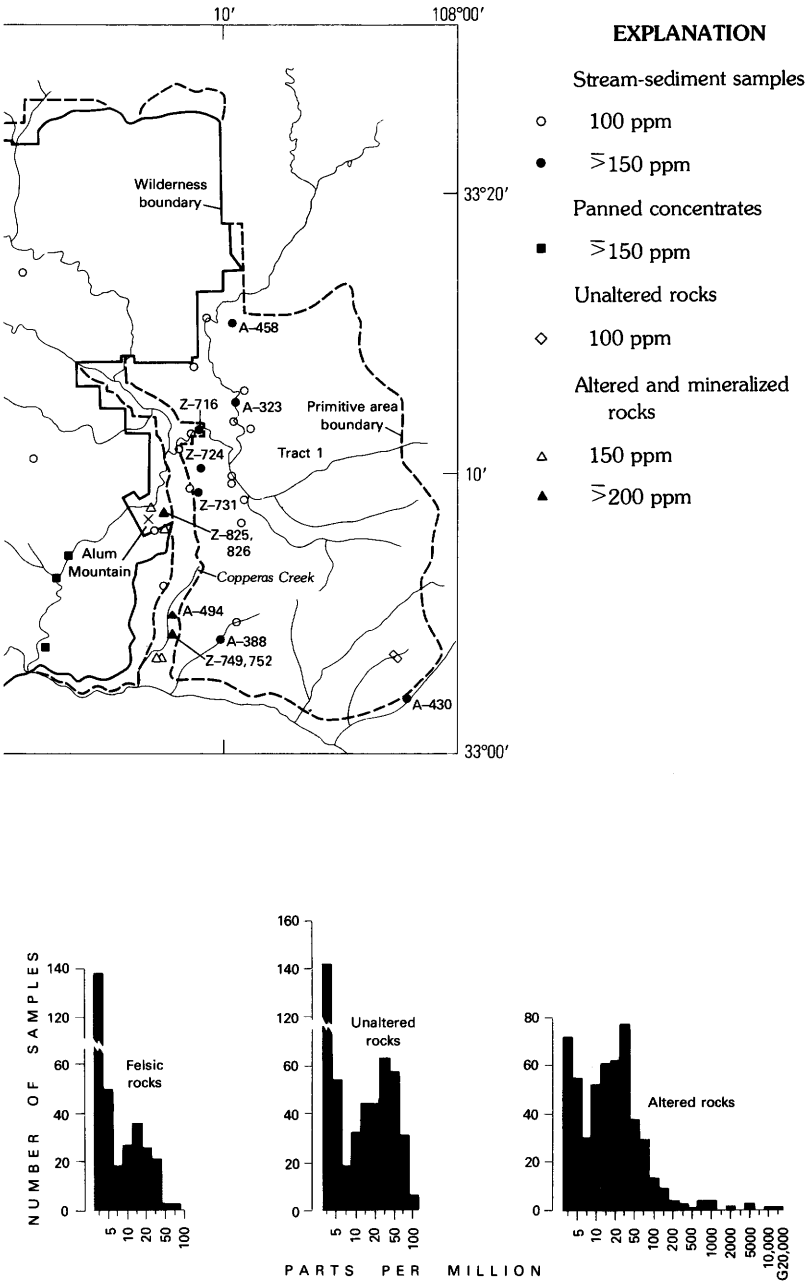


FIGURE 32.—Distribution of copper in geochemical samples in the Gila study rock types. Sample numbers shown for higher values. Prefixes A-, M-, R-,



area. Histograms show distribution of copper values in different sample and and Z- on map correspond to ACA, AMZ, AGR, and ABZ, respectively, table 5.

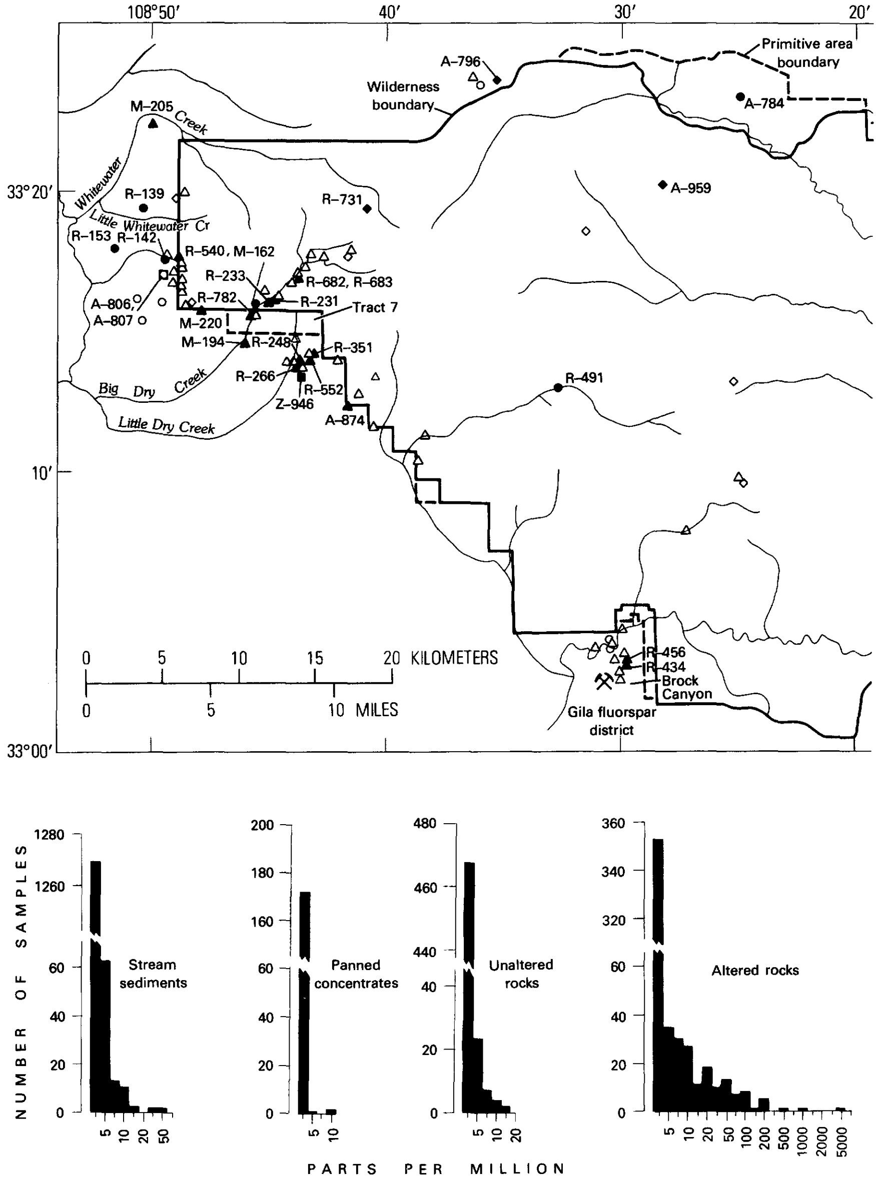
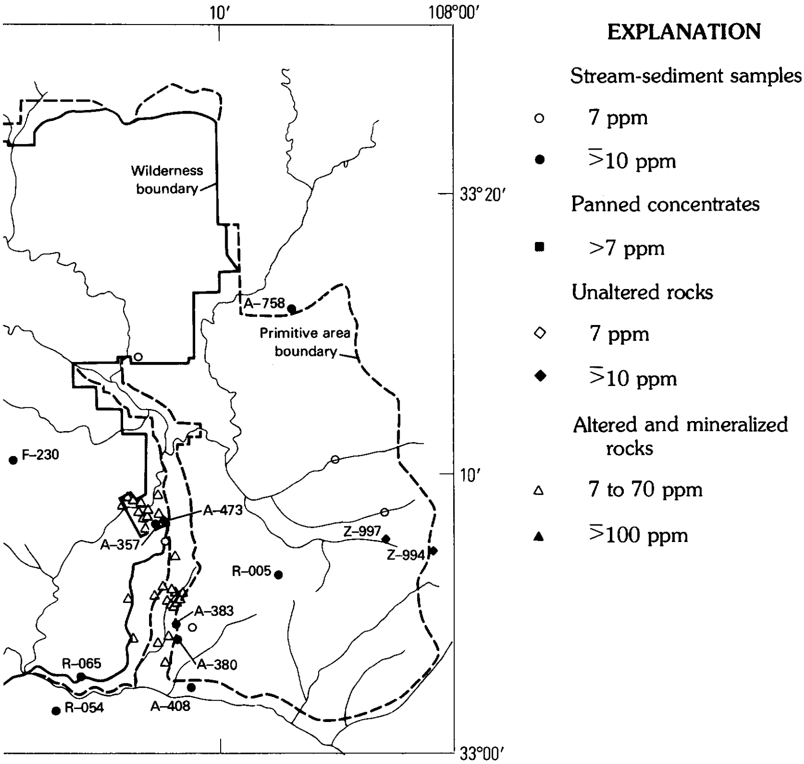


FIGURE 33.—Distribution of geochemical samples in the Gila study area that contain 7 ppm or more molybdenum. Histograms show distribution of molybdenum values in different sample and rock types. Sample numbers shown for higher values. Prefixes A-, F-, M-, R-, and Z- on map correspond to ACA, AMF, AMZ, AGR, and ABZ, respectively, table 5.



igneous magmas that fed the volcanic areas, or because of the tangential orogenic belts that bound the Colorado Plateau (Schmitt, 1966, p. 21) or some other process, related or unrelated to the origin of the plateau, is not yet understood. The ore deposits are of more than one age and, in fact, many of the deposits are older than the middle to upper Tertiary volcanic rocks that predominate in the main volcanic areas. This fact suggests that there is a more fundamental control on ore deposition than the igneous rocks themselves. Whatever the cause, the associative relationship cannot be ignored as a first-order criterion for recognizing this area as one of greater-than-average mineral resource potential.

Structural intersections are of basic importance in localizing ore deposits, and extraordinary significance is accorded to them in many minerals exploration programs. Particular attention has been given by some students of ore deposits to the large-scale orogenic or tectonic features that are believed to cut deeply into the earth's crust, and thereby provide access for rising igneous magmas that may themselves be the source of ore materials, or tap more directly theoretical sources of metals

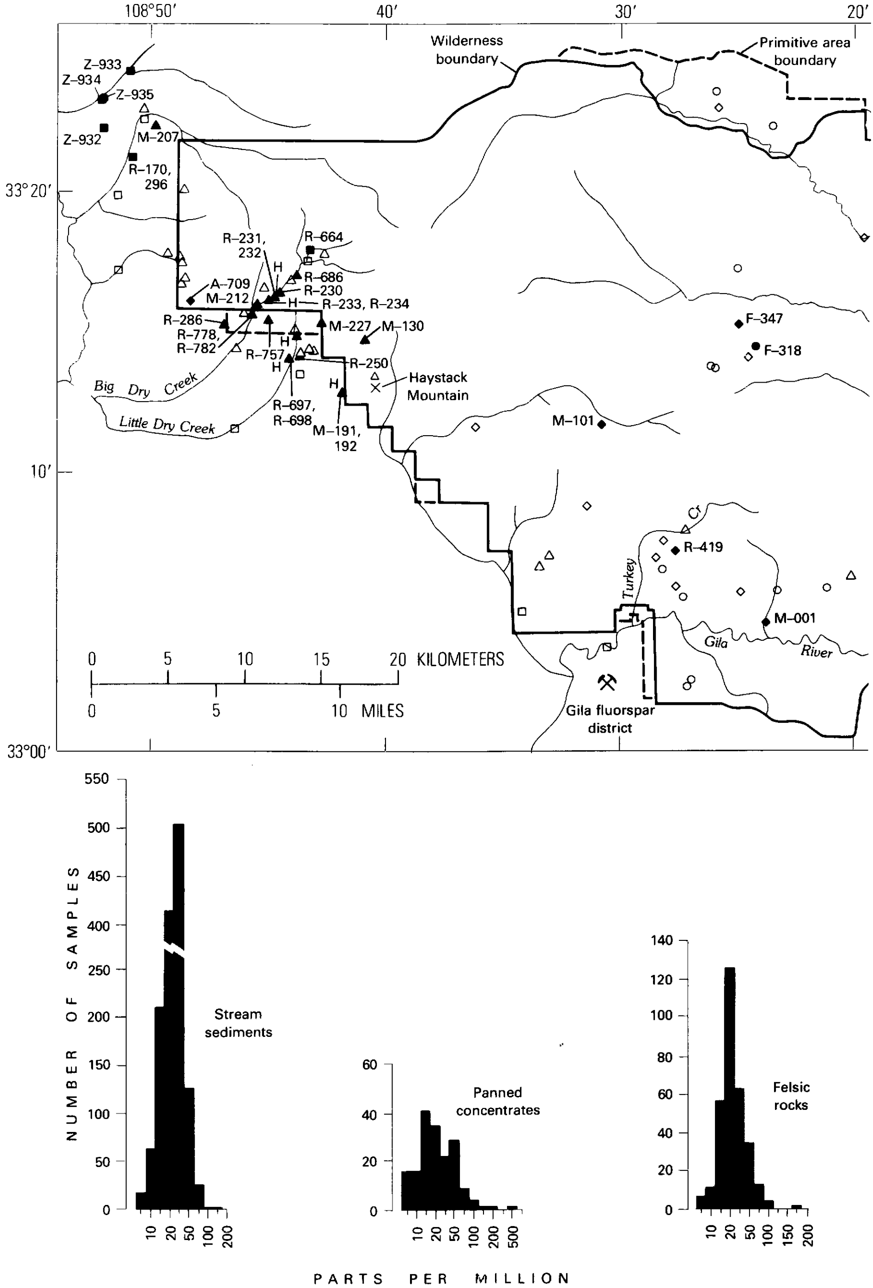
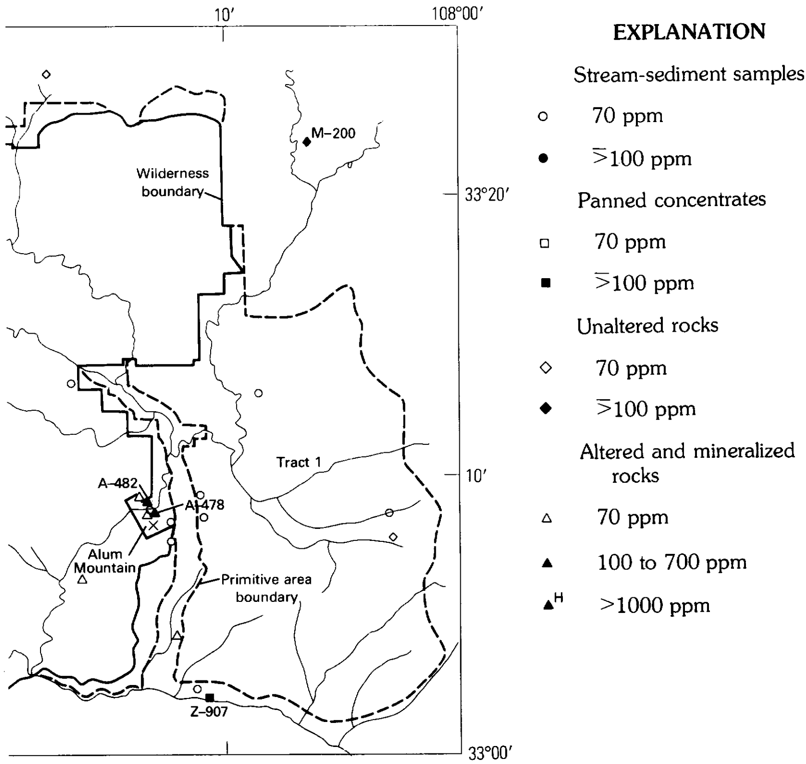
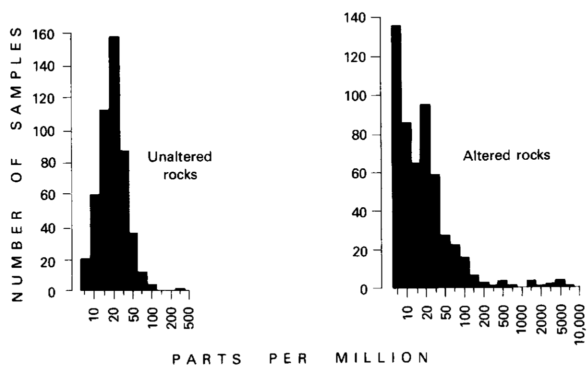


FIGURE 34.—Distribution of geochemical samples in the Gila study area in different sample and rock types. Sample numbers shown for some of higher AMZ, AGR, and ABZ, respectively, table 5.





containing 70 ppm or more lead. Histograms show distribution of lead values values. Prefixes A-, F-, M-, R-, and Z- on map correspond to ACA, AMF,

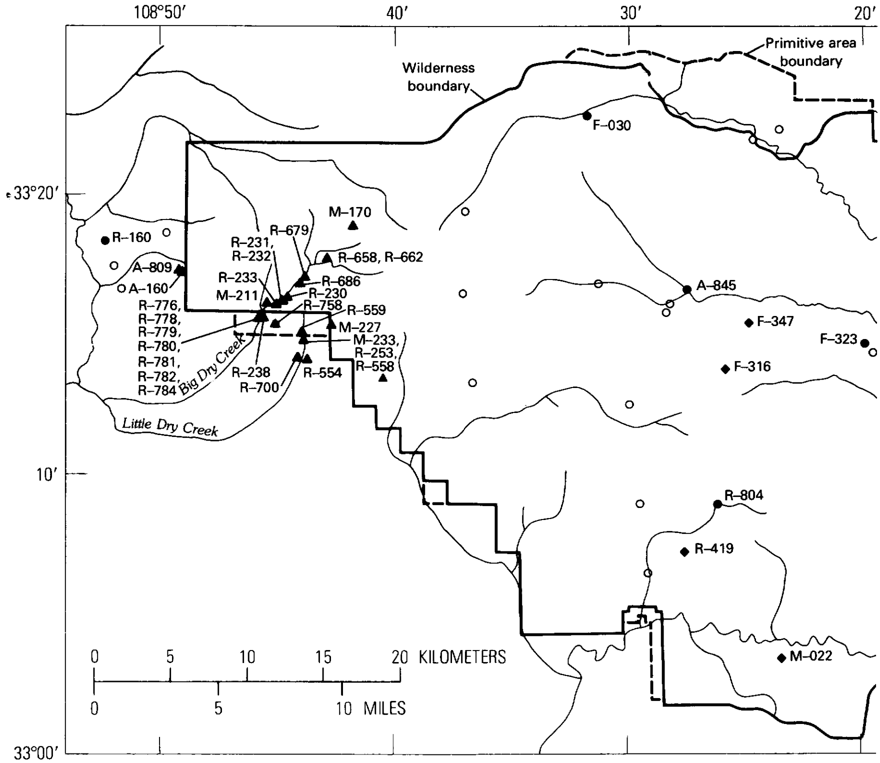
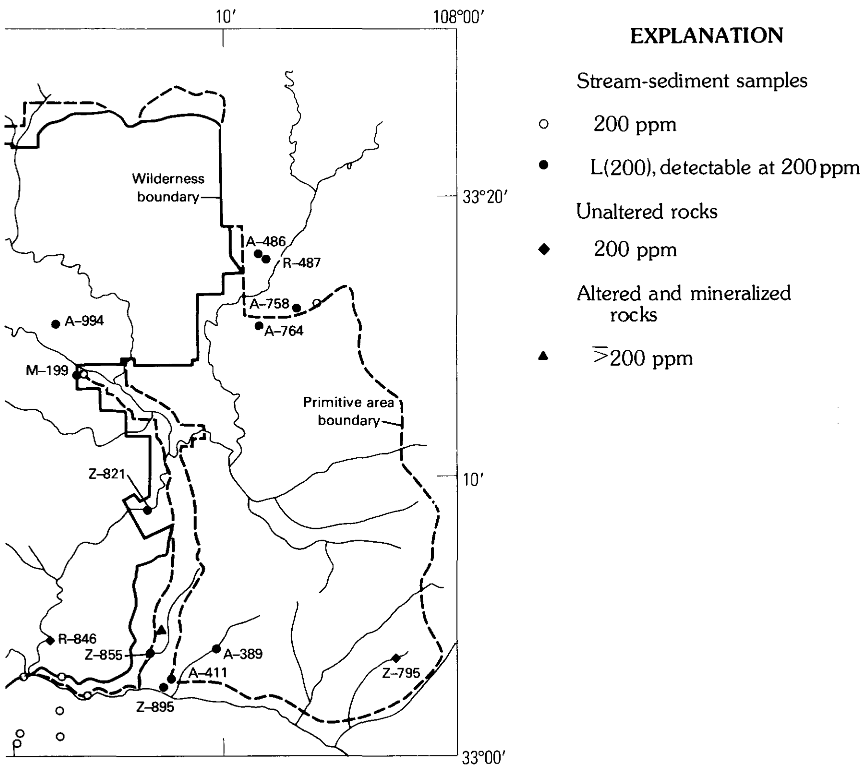


FIGURE 35.—Distribution of zinc-bearing samples in the Gila study area. correspond to ACA, AMF, AMZ,

in the earth's mantle (Kutina, 1969). That many ore districts occur at "crossroads" where orogenic belts intersect (Billingsley and Locke, 1941) is a familiar thesis in the ore-finding profession. The Gila study area is within a region of multiple structural intersections of fracture systems of diverse trends. Structural lineaments, or trends, in or adjacent to the study area have been described by Mayo (1958) and Schmitt (1959), both of whom attach special significance to the Texas Lineament, which they infer to more or less bound the Mogollon volcanic area on the south. The Texas Lineament is a controversial major transcurrent feature of the earth's crust that trends about east-west from the Trans-Pecos region of West Texas to the Transverse Ranges of the California coastal region and has even been projected eastward to the northern coast of Brazil (Baker, 1933, 1935). Some of the evidence related to this inferred structure is discussed with reference to the regional geologic setting of the study area in preceding pages of this report. Six structural lineaments in the Mogollon region were recognized by Mayo (1958, figs. 2, 3): the nearly east-west Texas Lineament zone; a northwest-trending,



Sample numbers shown for higher values. Prefixes A-, F-, M-, R-, and Z- on map AGR, and ABZ, respectively, table 5.

southwestern New Mexico belt; northeast-trending Santa Rita and Morenci belts; and north-south Pelloncillo and Cordilleran Front belts. Although Mayo indicated that the southwestern New Mexico belt is obscure in the Datil volcanic field in the Mogollon region, little detailed information was available when he made his study; subsequent work including the present studies show that northwest-trending faults predominate in the southwestern part of the Datil field including the study area. Morenci, Mogollon, Santa Rita, Tyrone, and Magdalena are major ore-producing districts in the vicinity of the Gila study area that are located at multiple lineament intersections, according to Mayo (1958, p. 1174).

The concept of metallogenic or metallographic provinces (Burnham, 1959, p. 2–6) implies that metals, singularly or in combinations of elements having similar chemical and physical properties, occur in belts and provinces with abnormal concentrations of metal or metals of similar origin. A prime example is the southwest copper province in Arizona and southwestern New Mexico (Schmitt, 1959). Metal provinces, as used

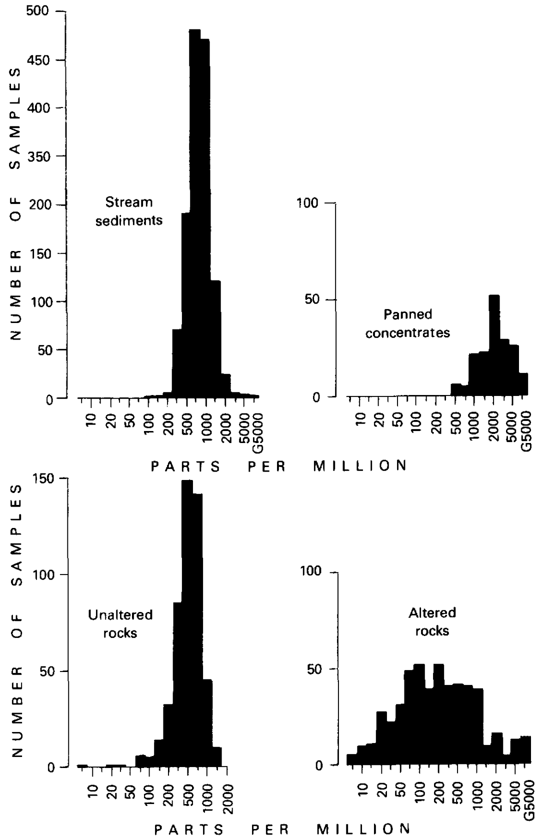


FIGURE 36.—Histograms of manganese values in samples from the Gila study area.

by Noble (1970, p. 1607), are areas containing concentrations of a particular metal, or metals, without regard to origin, in contrast to metallogenic provinces which contain concentrations with related origins. The Gila study area is within the northeast extension of a multimetal province that includes major production and reserves of lead, zinc, molybdenum, silver, gold, and copper (Noble 1970, figs. 1, 3–10). A separate copper province map by Noble shows that the study area is within an open-ended rectangular area that contains approximately 72 percent of the past copper production and future reserves of the Western United States (Noble, 1970, fig. 3, p. 1614). The importance of copper in the total mineral picture of this area is increased because major amounts of other metals, such as gold and molybdenum, might occur as byproducts.

In most of the study area, only the upper volcanic levels are exposed, whereas most large ore deposits, particularly the disseminated copper and molybdenum deposits, form in lower volcanic levels; that is, in the intrusive zone beneath extrusive volcanic rocks. For example, the major areas of mineralized and altered rocks in the Gila study area are seen where the middle Tertiary volcanic rocks are tilted up along the front of the Mogollon Mountains, exposing the root zone of the intrusive rhyolites. Similarly altered and mineralized areas should be expected at comparable volcanic levels in other parts of the study area, particularly where the caldera ring-fracture zones intersect major tectonic trends.

Implicit in this discussion is the need to assess the probability of mineral deposits that may be buried beneath the mid-Tertiary volcanics now exposed over most of the study area. Such deposits could have the form of disseminated mineralization in intrusive bodies of Laramide age, or in veins and replacement deposits in older volcanic rocks and Paleozoic rocks. Present geologic and geophysical exploration techniques are not adequate to assure us a thorough look through the mask of younger volcanic rocks, particularly in a reconnaissance study such as this, and our appraisal must involve the general geologic history of the study area and its surroundings, supplemented by geophysical and geochemical studies. From the regional point of view, we know that major disseminated copper deposits occur in Late Cretaceous–early Tertiary (Laramide) stocks at Santa Rita, Hanover-Fierro, Tyrone, and Morenci, all within 50 miles of the study area. These deposits, and associated vein and metasomatic deposits of lead, zinc, and iron, were once buried by younger volcanic rocks like those that now cover most of the study area, and thus similar mineralized bodies may occur beneath the middle Tertiary volcanic rocks within the study area. The Santa Rita and Hanover-Fierro stocks may have been intruded along the crest of a Cretaceous structural high (Santa Rita-Hanover axis of Elston, 1968, pl. 1) that may project northward beneath the eastern part of the study area.

The relative importance of different factors in determining the localization of major mineral deposits is a controversial subject, and this fact points up the limitations in the present state of the art and science of minerals exploration. However, each of the approaches discussed in the preceding paragraphs indicates that the Mogollon volcanic area has a much greater than ordinary mineral potential on a regional basis.

In summary, whereas virtually no reserves of mineral resources of present economic value can be measured over 90 percent of the study area, the potential for discovery of such resources at accessible depth somewhere in the study area seems good. Minable fluorspar deposits, anomalous concentrations and noneconomic deposits of gold, silver, lead, zinc, copper, tellurium, tin, meerschaum, alum, and clay are known within the study area, and possible buried ore deposits could contain these and other commodities.

OIL, GAS, AND COAL

The study area has not attracted exploration for fossil fuels in the past, and there is no reason to encourage such exploration. The section of Paleozoic and Mesozoic sedimentary rocks adjacent to the study area is thin, and pervasive igneous activity throughout the area has resulted in complex volcano-tectonic structures that are not encouraging mineral fuels targets. Isopachous and facies maps by Kottlowski (1965a, figs. 2, 10, 11) show the possible projection of 2,000–3,000 feet (600–900 m) of Paleozoic strata and little or no Cretaceous strata beneath the study area. Pre-Pennsylvanian rocks, about 1,800 feet (550 m) thick in the Silver City area, are believed to pinch out less than 30 miles (50 km) north of Gila Hot Springs (Foster, 1964). The nearest oil tests are located about 40 miles (65 km) north and 50 miles (80 km) east of the study area, and the nearest reported occurrence of coal is in the Engle field, 50 miles (80 km) east of the study area in Sierra County (Kottlowski, 1965b, p. 114).

GEOTHERMAL ENERGY

A northwest-trending belt of thermal springs within the complex arcuate Gila Hot Springs graben (pl. 1) indicates a possible geothermal energy resource in the Gila study area. Many of the springs toward the southeast end of the belt are on private land, but within the wilderness thermal waters issue from three openings at The Meadows, four openings above Big Bear Creek, and three openings just inside the wilderness boundary, all along the Middle Fork of the Gila River. One other site of thermal waters within the wilderness which was reported (Ratté and others, 1972a) as an unverified site along upper Mogollon Creek is a warm spring about 2 miles above the mouth of Turkey Creek in sec. 3, T. 14 S., R. 16 W. (Summers, 1968, p. 6), as verified by T. Bornhorst (oral commun., 1976). Two other springs within the graben are in tract 1 of the Gila Primitive Area on the north side of the East Fork of the Gila River above Lyons Lodge. The thermal waters range in temperature from less than 90°F (32°C) to more than 150°F (68°C) (W. K. Summers, written commun., 1970; Renner and others, 1975, p. 44).

Gila Conglomerate and other porous rocks within the Gila Hot Springs graben conceivably might be suitable reservoirs for a possible steam field were they properly situated with respect to heat source, ground water, impermeable cap, and other requirements. However, the Gila Conglomerate, though several hundred feet thick in parts of the graben, is above the water table along most of the Middle Fork, and outcrops of basalt and Bloodgood Canyon Rhyolite Tuff of Elston (1968) beneath the conglomerate in several places from the mouth of the West Fork to the mouth of the East Fork indicate that there is no great thickness of conglomerate below the water table in that part of the graben. Seemingly, therefore, the Gila Conglomerate in the Gila Hot Springs graben is not a suitable reservoir rock for a significant geothermal steam field, particularly within the confines of the Gila study area. However, other rocks in the volcanic section beneath the Gila Conglomerate might provide the necessary reservoir, and the exploration necessary for even a preliminary evaluation of this potential energy resource has not been done.

The most recent silicic volcanic activity known in the study area dates from early Miocene time, on the order of 20 m.y. ago. Present estimates suggest that the residual heat related to a cooling magma body of that age would not be sufficient to sustain more than a relatively low temperature geothermal heat source (R. L. Smith, oral commun., 1973). However, the science and technology of geothermal energy is at a very early stage of development, and thermal anomalies such as those in the Gila study area will be investigated more intensively in the future.

METALLIC AND NONMETALLIC MINERAL RESOURCES

Evidence of significant mineral deposits is confined largely to the periphery of the study area, from the south end of the Mogollon district at Whitewater Creek to the Gila River, but important mineral targets also cross the wilderness and primitive area boundaries in the Alum Mountain and Copperas Creek areas and penetrate the most rugged part of the wilderness along Big Dry Creek to its headwaters in the Spruce Creek–Spider Creek area (fig. 37).

GILA PRIMITIVE AREA

Several areas of potential economic interest for minerals are located in the Gila Primitive Area as determined by the combined evidence of geological, geochemical, and geophysical investigations. Primitive area tracts 1–3 include parts of the Alum Mountain and Copperas Creek altered and mineralized inliers (pl. 1), which represent important targets for metallic mineral exploration. Elsewhere, tract 1 is largely devoid of surface evidence of significant mineral deposits, although meerschaum was once produced from the Salt Creek area north of Sapillo Creek (Northrop, 1959, p. 455), and scattered metal values, mainly in stream-sediment samples along Apache Creek, are slightly higher than background. Tracts 4, 5, and 6, along the northern edge of the wilderness, and adjacent parts of the study area show little surface evidence of significant mineral deposits; scattered metal values in these areas are above arbitrary threshold values, but most of the anomalous values are related to domal rhyolite lavas in the vicinity of Indian Creek (pl. 1) and probably represent no more than minor concentrations of relatively mobile metals near volcanic vents. Tract 7 includes numerous

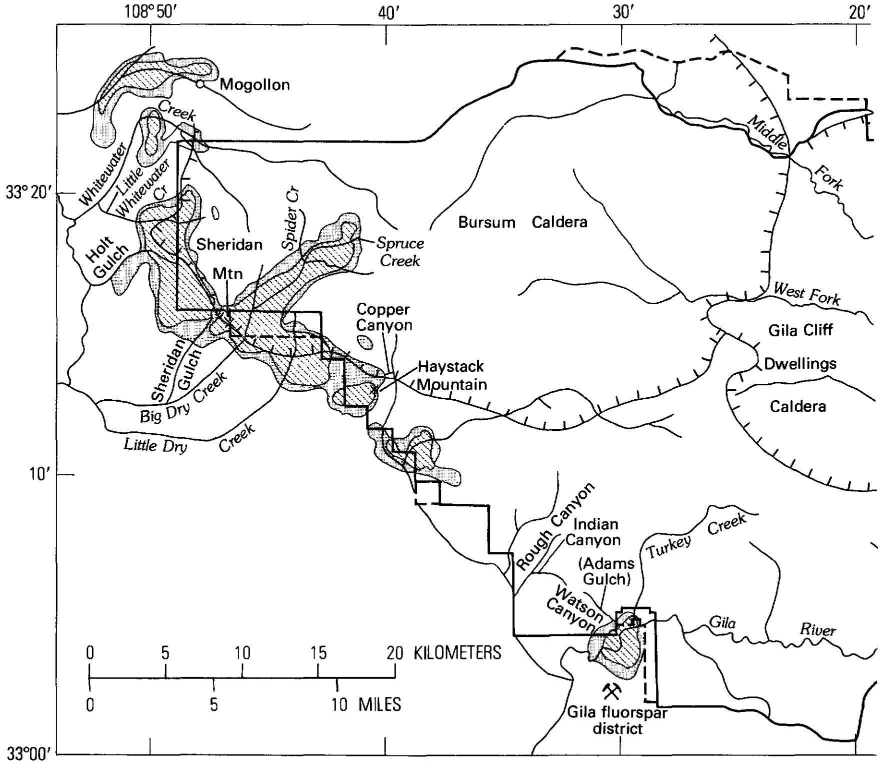


FIGURE 37.—Areas of greatest mineral resource potential in the Gila study area determined on the basis of selected metal anomalies.

mineralized structures along Big Dry and Little Dry Creeks; it is part of one of the more heavily mineralized areas in the zone of mineralization that extends along the range front from the Mogollon district to the Gila River. Tract 8 is part of the same zone, and the northern part contains small mineralized structures bearing fluorite, barite, manganese, and traces of other metals; more than 90 percent of tract 8 is covered by alluvial deposits that could be masking additional mineralized structures. Tract 9 is adjacent to the Gila fluorspar district, which is one of the main targets for exploration for fluorite and metallic mineral deposits in the study area. Although most of tract 9 is outside the area of altered and mineralized rocks of the fluorspar district, strong calcite veins as much as several feet wide were observed along faults within the primitive area and wilderness west of Turkey Creek and north of Watson Canyon (Adams Gulch) and Indian Canyon (pl. *1B*), and the mineralized rocks of the fluorspar district could extend beneath adjacent parts of the primitive area. In summary, most of tract 1 of the Gila Primitive Area and tracts 4, 5, and 6 show only slight evidence or no evidence of significant

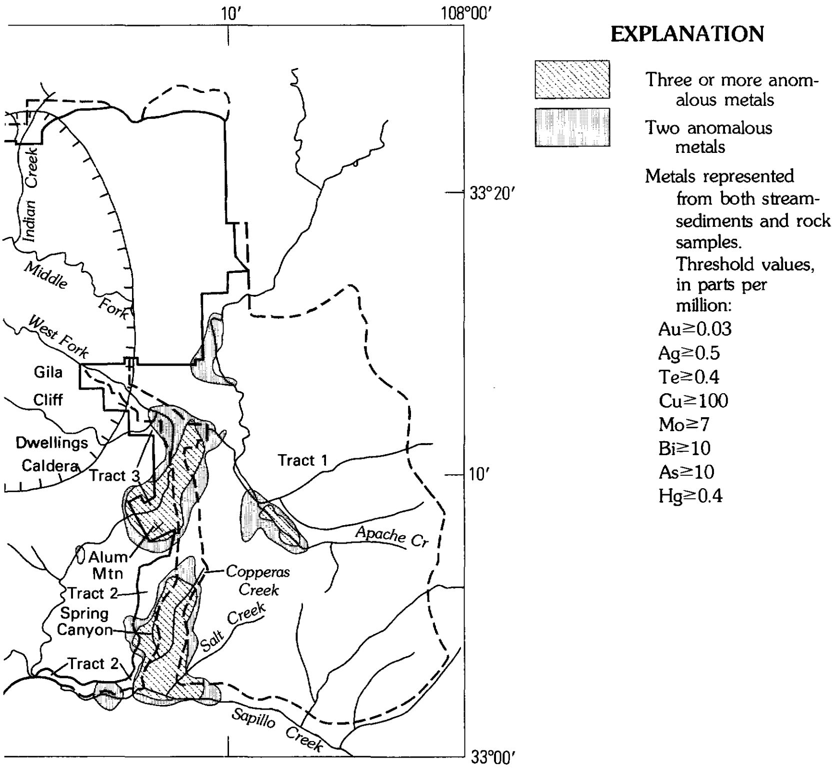


FIGURE 37.—Continued.

mineral deposits in the surface rocks. However, the western part of tract 1 and all of tracts 2, 3, 7, and 8 show abundant signs of mineralization (including aluminum resources of Alum Mountain), and have had some past minerals exploration and minor production. The mineralized areas in and adjacent to tracts 2, 3, 7, 8, and 9 are potential exploration targets for major mineral deposits.

GILA WILDERNESS

The greatest apparent potential for mineral resources in the present (1972) Gila Wilderness is the possible occurrence of mineral deposits of Laramide age beneath the cover of middle Tertiary volcanic rocks or deposits related to subvolcanic intrusive rocks of middle-late Tertiary age. Such potential cannot be assessed adequately merely by examining the surface geology, and a more detailed geophysical and geochemical study is needed to isolate specific exploration targets. In the near-surface environment, our studies indicate that possibly significant mineral resources within the wilderness are confined mainly to the Big

Dry–Spider–Spruce Creeks area, and in certain areas along the present wilderness boundary adjacent to primitive area tracts 1, 2, 3, 7, 8, and 9, particularly from Little Dry Creek to Haystack Mountain.

The Big Dry Creek drainage contains the greatest concentration of mineralized structures within the wilderness, with shows of copper, lead, zinc, gold, and silver. However, except in the Uncle John mine at the southern edge of the wilderness, the veins are weak and sparsely mineralized. The general area of the Uncle John mine—which is adjacent to both the rhyolite center of Sheridan Mountain, along the ring fracture zone of the Bursum caldera, and the northeast-trending faults of the proposed apical graben of the Bursum resurgent dome—is a target which warrants further exploration.

The areas of greatest interest near the wilderness margins are:

1. That part of the complex of Alum Mountain that extends into the wilderness west of the Gila River and Alum Mountain, and some weakly mineralized faults exposed along the Gila River Canyon between Alum Mountain and the mouth of Sapillo Creek.
2. Along the faults at the range front south of the Mogollon district from Whitewater Creek to Holt Gulch and around to Sheridan Gulch. Most of the mineralized or potentially mineralized faults are within a mile inside the wilderness boundary. Calcite veins, as much as 10 feet or more wide, occupy range-front faults in this vicinity; a few of these veins dip beneath the wilderness area, and the traces of some cut back and forth across the zigzag wilderness boundary. The fluorspar deposit at the Huckleberry property in Little Whitewater Creek (pl. 3) appears likely to extend beneath the present wilderness.
3. Mineralized faults at the edge of the wilderness from north of Haystack Mountain to Seventyfour Mountain. These include mainly the Fairview and Alexander prospects northwest of Haystack Mountain, prospects in Copper Canyon north of Haystack Mountain, and flourspar viens on Seventyfour Mountain.

Zeolite-cemented, reworked tuffaceous silt and sandstone occur in the southeastern corner of the Gila Wilderness in thin beds mapped with the Gila Conglomerate along Spring Canyon north of Sapillo Creek (pl. 1). Although certain members of the zeolite group of minerals are valuable because of their ion-exchange capacities, the observed beds do not contain sufficient pure zeolite to be of economic value.

MINERAL CLAIM INVESTIGATIONS

MINING HISTORY AND PRODUCTION

Mineral development in the Gila Primitive Area and Gila Wilderness dates from discoveries in 1875 of gold and silver in the Mogollon district northwest of the wilderness and of meerschaum at the Sapillo district in the southwest corner of tract 1 of the Gila Primitive Area (pl. 1*B*). In 1879, gold was discovered on Little Dry Creek near the present wilderness boundary in what is now known as the Wilcox mining district. In the 1880's additional minor gold discoveries were made in the district, and tellurium was discovered at the head of Pine Creek. Also in that decade, claims for aluminum salts were located at Alum Mountain in the Alunogen district, and the first mining of fluorspar in New Mexico began at the Foster mine near a point where the Gila River leaves the Gila Wilderness. In the 1920's fluorspar claims were located in the Little Whitewater Creek area. Excluding the Mogollon district and the 61 claims on Alum Mountain that were purchased by the Forest Service, there are 16 patented mining claims in the area studied. These include 10 in the wilderness, 1 in tract 7 of the Gila Primitive Area, and 5 within 1 mile of the primitive area or wilderness (pl. 1*B*). A list of mining claims within the Gila study area was compiled by Stotelmeyer and Meeves (Ratté and others, 1972a, table 8) but is not included in this report.

From about 1909 to 1916, the miners and merchants of the Mogollon area published "The Mogollon Mines," a yearly magazine issued to promote the mines and prospects of the Mogollon and Wilcox mining districts. R. S. Allen was editor. During the wilderness investigation, prospects mentioned by him were examined near Whitewater Creek, Whitewater Campground, Little Whitewater Creek, Holt Gulch, Wilcox Peak, Big Dry Creek, and Little Dry Creek. Samples taken by the Bureau of Mines did not substantiate assay widths nor values reported by Allen.

Significant mineral production from the Gila study area has been limited to some widely scattered fluorspar mines and the meerschaum deposits in the Sapillo district. Recorded metal production from the study area has been very minor; sorted-ore shipments totaled 61.5 tons, of which 5 tons were tellurium ore. Gold and silver production was listed at less than 100 ounces. Small, unrecorded amounts of gold, silver, and other metals probably were recovered from some of the other deposits in the study area and were sold to merchants, banks, and mining companies in nearby districts.

Total recorded output of fluorite in and near the Gila study area was about 58,700 tons from 20 operations. This included about 29,000 tons from the Clum mine and about 4,000 tons from the Foster mine (both in the Gila fluorspar district), 1,100 tons from the Gold Spar mine on Rain Creek, and 8,800 tons from the Little Whitewater Creek area. With the exception of about 250 tons from the Seventyfour Mountain area, all of the fluorspar production was from operations outside the Gila Primitive Area and Gila Wilderness. Approximately 1,000 tons of meerschaum is estimated to have been produced in the Sapillo district in the early 1900's.

An oil and gas lease (No. 036863 A–E) was issued in 1958 for parts of secs. 30 and 31, T. 12 S., R. 14 W., in the Little Creek area in the interior of the wilderness west of the Gila Cliff Dwellings (pl. 3) The lease was issued to Rev. J. H. Blackstone of Glendale, Calif.; it was terminated on January 31, 1962, because there had been no significant development for oil and gas.

At the time of the investigation, mining activity in the area was limited to prospecting, locating of claims, assessment work, transferring of claim ownership, consolidating fluorite claims, and rehabilitating the Clum fluorspar mine and preparing for renewed mining at the Huckleberry property in Little Whitewater Creek. There were no producing properties in the area.

SAMPLING AND ANALYTICAL RESULTS

A total of 573 samples was taken by U.S. Bureau of Mines engineers from veins, mineralized zones, altered zones, and dumps. For the most part, samples were taken to obtain representative portions of the material making up the deposit. Locally, however, selected samples or specimens were taken to obtain the maximum values present in the deposit. This was done on the premise that if assays of the richest material are low, the deposit has little mineral potential. Such selected samples are qualified as such in the text of the report.

The samples listed in table 7 (in back of report) were analyzed for 30 elements by semiquantitative spectrographic analysis and for tellurium by atomic absorption. All samples were fire assayed for gold and silver, and chemical analyses were made on samples which spectrographically showed elements in concentrations above those generally found in igneous rocks. In addition, all samples were scanned for radioactivity.

Assay values were considered negligible or of no significance when they were below the following values: 0.03 oz of gold per ton, 0.70 oz of silver per ton, 0.10 percent copper, 0.40 percent lead, 0.35 percent zinc, and 80 ppm (0.008 percent) tellurium. At mid-1971 prices, each of those values was worth about $1.00 per ton. Fluorite values below 20 percent are considered of no economic consequence. (See table 8 for conversion of parts per million to percent and to ounces.) Width of mineral deposit is an additional economic consideration, and even a relatively high combination of reported values does not necessarily indicate ore if the deposit is too narrow.

In the descriptions that follow, the sample results are used to determine the economic feasibility of individual mines and prospects. Although few of the mines or prospects investigated appear to represent an important mineral deposit, it is not contradictory to conclude that, collectively, the many small veins and prospects may indicate a high potential for undiscovered deposits in certain areas. The analytical data from the Bureau of Mines samples were intended primarily to assess the economic potential of specific deposits, and are not included with the

TABLE 8.—*Conversion of parts per million to percent and to ounces per ton and vice versa*

[Conversion factors: 1 pound avoirdupois equals 14.583 ounce troy; 1 part per million (ppm) equals 0.0001 percent equals 0.0291667 ounce troy per short ton equals 1 gram per metric ton; 1 ounce per ton (gold or silver) equals 34.286 ppm equals 0.0034286 percent]

Parts per million to percent to ounces per ton			Ounces per ton to percent to parts per million		
Ppm	Percent	Ounces per ton	Ounces per ton	Percent	Ppm
0.01	0.000001	0.0003	0.01	0.00003	0.3
.02	.000002	.0006	.02	.00007	.7
.05	.000005	.0015	.05	.00017	1.7
.10	.00001	.003	.10	.00034	3.4
.20	.00002	.006	.20	.00069	6.9
.30	.00003	.009	.30	.00103	10.3
.40	.00004	.012	.40	.00137	13.7
.50	.00005	.015	.50	.00171	17.1
.60	.00006	.017	.60	.00206	20.6
.70	.00007	.020	.70	.00240	24.0
.80	.00008	.023	.80	.00274	27.4
.90	.00009	.026	.90	.00309	30.9
1.0	.0001	.029	1.0	.00343	34.3
10.0	.001	.292	10.0	.03429	342.9
20.0	.002	.583	20.0	.06857	685.7
50.0	.005	1.458	50.0	.17143	1,714.0
100.0	.01	2.917	100.0	.34286	3,429.0
500.0	.05	14.583	500.0	1.71	17,143.0
1,000.0	.10	29.167	1,000.0	3.43	34,286.0
10,000.0	1.00	291.667	10,000.0	34.29	342,857.0

geochemical data considered in the previous sections of this report. Nevertheless, the distribution of Bureau of Mines samples taken from known mineralized areas (pl. 3) reinforces the broader geochemical patterns presented previously.

MINES, PROSPECTS, AND MINERALIZED AREAS

U.S. Bureau of Mines personnel examined 10 areas where claim locations notices were evident, including the Gila Wilderness and the nine tracts designated as Gila Primitive Area, plus those adjacent areas where any type of mineral exploration activity was thought to have taken place (pl. 1*B*). Approximate locations of the mines, prospects, and mineralized areas that were investigated are shown by sample numbers on the figures of the report. The results of analyses are shown in tables 7 and 9.

Most of the samples taken were of altered volcanic rocks, largely andesites and rhyolites, or from structures within these rocks. Because of the high degree of alteration, most rocks could not be accurately identified in the field.

SOUTHERN MOGOLLON MINING DISTRICT

Samples 1–42

The southern part of the Mogollon (Cooney) mining district, adjacent to and partly within the northwest corner of the wilderness, is herein designated as the southern Mogollon district (secs. 3, 4, 8, 9, T. 11 S., R. 19 W.; pl. 3), to distinguish it from the main part of the district. Gold-silver ore, containing minor copper and lead, was first shipped from the Mogollon district in 1879, and peak output was in 1913. Since World War II, mining has been sporadic, and in 1972 there was no active mining in the district. Total production from the district has been about $25 million (Anderson, 1957, p. 32), but very little came from the southern Mogollon district.

Assay values, with a few notable exceptions, are generally negligible in samples 1–42 from mines and prospects in the southern Mogoll9n district. Outside the wilderness, at the Kordic prospect on Silver Creek (fig. 38*A*), a 3-foot (1-m) quartz vein and a 4-foot (1.3-m) manganese showing were sampled. Samples 8 and 9 (table 7) contained >5,000 ppm manganese.

A cluster of claims lies north of Whitewater Creek outside the northwest corner of the wilderness, mainly in secs. 3, and 4, T. 11 S., R. 19 W. The principal claims, previously known as the Iron group, have been relocated under various names over the years and currently are known as the Dripping Gold group. Some ore may have been produced from the claims, but if so the production data have been included with that for the whole district. A selected sample (No. 17, table 7) from the dump of a shaft on the Iron Bar prospect (fig. 38*C*), which is on the southern extension of the Queen fault (pl. 1), assayed 0.40 oz gold and 14.38 oz silver per ton. Samples 15 and 16 represent 15 feet (4.5 m) of fault gouge and 10 feet (3 m) of iron-stained rock at a winze, respectively, in an adit that intersects the shaft (fig. 38*C*), and sample 14 was taken across 5 feet (1.5 m) of breccia near the mouth of a lower adit (fig. 38*B*) on the Iron Bar claim. Sample 16 contained 1.39 oz silver per ton, which was the highest value obtained.

About 2,000 feet (600 m) west of the Iron Bar workings, a 150–foot (46 m) adit was driven northward toward a west-trending fault at the base of the rhyolite cliffs upslope, where Ferguson (1927, p. 87) reported massive psilomelane along the fault. Sample 18, which represents a 6–foot (2 m) chip sample across brown manganiferous veinlets $\frac{1}{8}$–4 inches (<1–10 cm) wide in the last 40 feet (12 m) of the adit, contained 0.97 percent manganese. Only traces of silver, gold, and tellurium were detected in sample 19 from a prospect pit in altered Cooney Quartz Latite Tuff northwest of sample 18.

Within the wilderness, the Lauderbaugh prospect, which is probably covered by the Oak Grove and Arthur K claims, on the South Fork of Whitewater Creek is on a N. 70° E. fault zone in Cooney Quartz Latite Tuff about 875 yards (800 m) down canyon from the southern extension of the Queen fault (pl. 1). The Oak Grove adit (fig. 39*A*) was driven about 50 yards (46 m) along the fault; a chip sample from a 10–inch (25–cm) fluorite vein in the adit contained 20.3 percent fluorite, but gouge and quartz seams (samples 26–30, 32, 33) were virtually barren of other metals. Two pits, probably on the same structure, on opposite sides of the South Fork (samples 34, 35) assayed traces of gold and silver.

Between the main forks of Whitewater Creek, less than one-half mile (1 km) northwest of the Lauderbaugh prospect, samples 24 and 25 were taken from two steeply dipping quartz veinlets in two small prospect pits in Cooney Quartz Latite Tuff. Sample 24 assayed 0.08 oz gold, 1.12 oz silver, and 1.08 percent copper per ton, but the mineralized rock was not observed to extend beyond the prospect pits.

Also within the wilderness, claims have been located for manganese on the north slope of Whitewater Creek in sec. 11, T. 11 S., R. 19 W., according to a local resident. A claim corner and several calcite veins as much as several feet wide, but no workings, were located. An outcrop and quartzose float was sampled (No. 3) and found to contain 19.73 percent manganese and 0.118 percent tungsten (WO_3). However, tungsten is commonly concentrated in hypogene manganese oxides (Hewett and Fleischer, 1960, p. 28) and thus is not indicative of a tungsten deposit.

Several other prospects were sampled in the southern Mogollon district, both within and outside the northwest corner of the wilderness. Claims near the head of Silver Creek (secs. 4, 5, 6, T. 11 S., R. 18 W.) show no evidence of significant mineralization, and samples 1 and 2, across a brecciated zone in rhyolite near the Deloche trail on the north slope of Whitewater Creek, within the wilderness, also are virtually barren. Other barren prospects were sampled (4–6) on the Black Jack and adjacent claims in a tributary gulch about one-fourth mile (400 m) above the mouth of Deloche Canyon (sec. 1, 2, T. 11 S., R. 19 W.) outside the wilderness. Sample 4 consisted of quartz stringers and dump material from an L-shaped trench on the north side of the gulch; sample 5 was from the dump of an inaccessible 50–foot (15–m) shaft; and sample 6 was a 4-foot (1.2-m) sample across the face of a 20-foot (6-m) adit that was driven N. 60° w. on several small quartz stringers in rhyolite.

Three calcite veins were sampled north of the wilderness. Sample 11 was taken across a 25-foot (7.5-m) vein that trends N. 10° W., and sample 12 was from a 4-foot (1.2-m) calcite-cemented breccia zone that strikes N. 30° W.; both samples were from a pit near the Lime Kiln patented claim on the South Fork of Silver Creek (sec. 3, T. 11 S., R. 19 W.). Sample 13 is from a 20-foot (6-m) prospect trench along a 30-foot (9-m) calcite vein trending N. 10° E. on the north slope of Whitewater Creek, about a mile (1.6 km) south of the Lime Kiln claims. None of these samples contained significant metal values.

In the vicinity of the Whitewater picnicground, 1.5 miles (2.4 km) west of the wilderness (pl. 1*B*), samples (21–23) from a prospect pit on a 7-foot (2-m) fracture zone in copper-stained andesite contained as much as

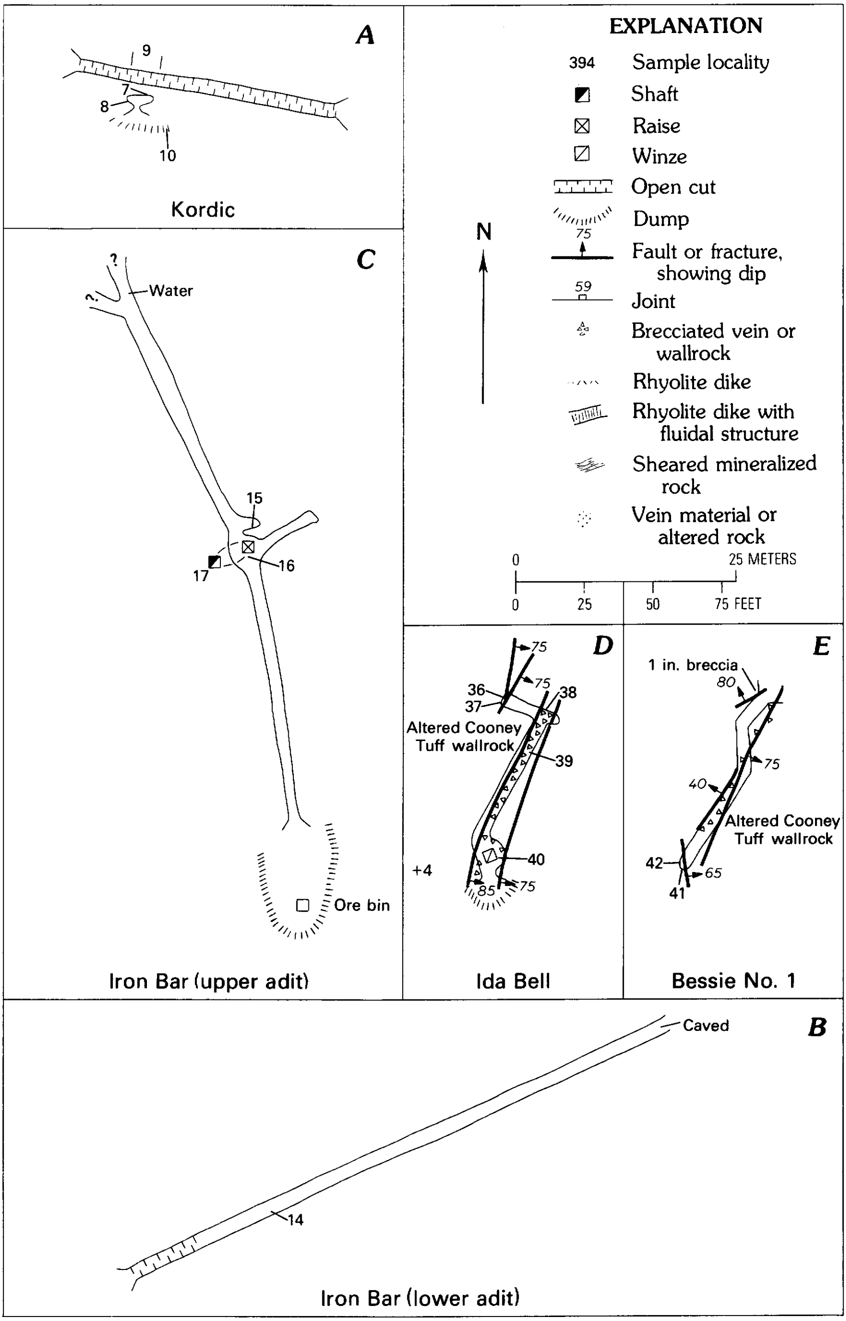


FIGURE 38.—Underground workings within the Gila study area but outside the Gila Primitive Area and Gila Wilderness.

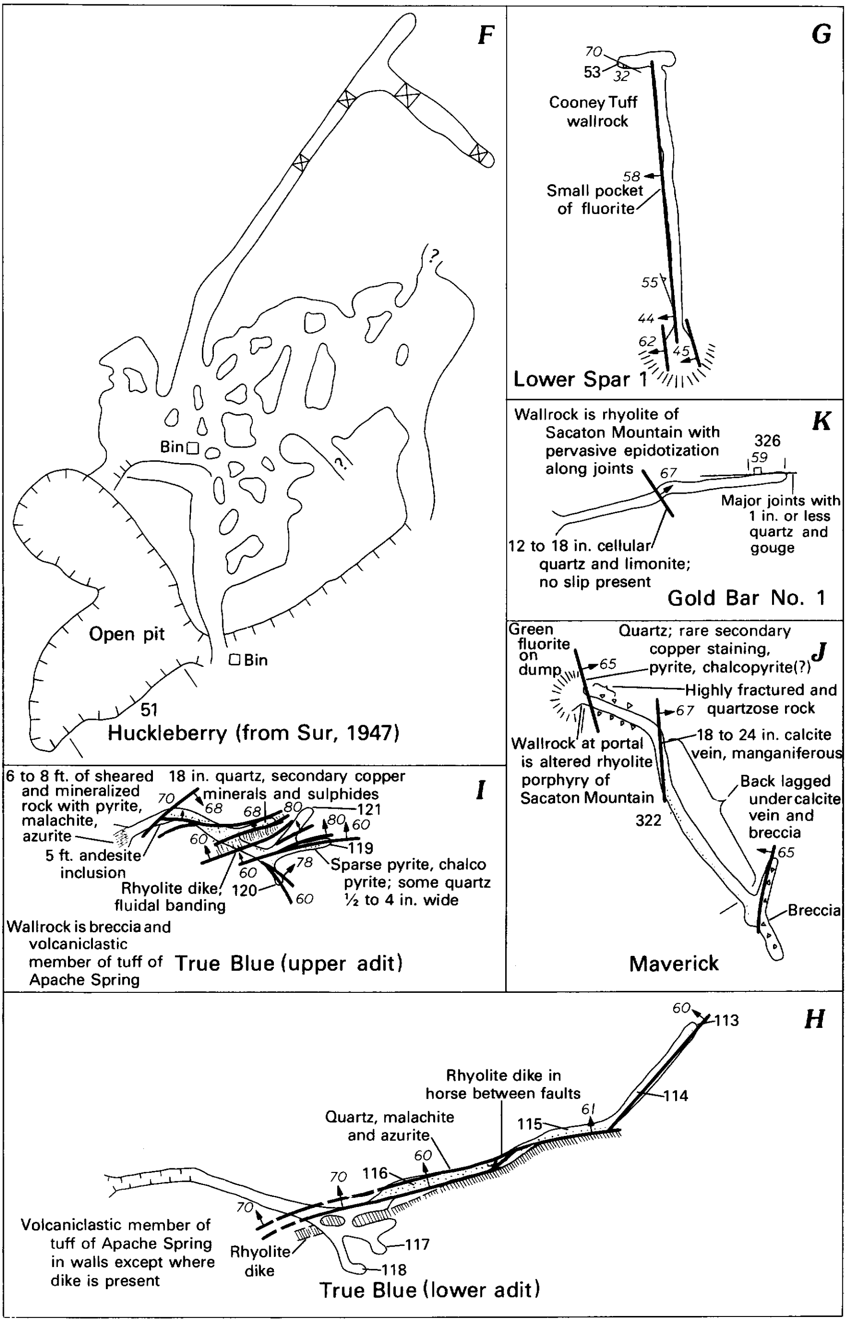


FIGURE 38.—Continued.

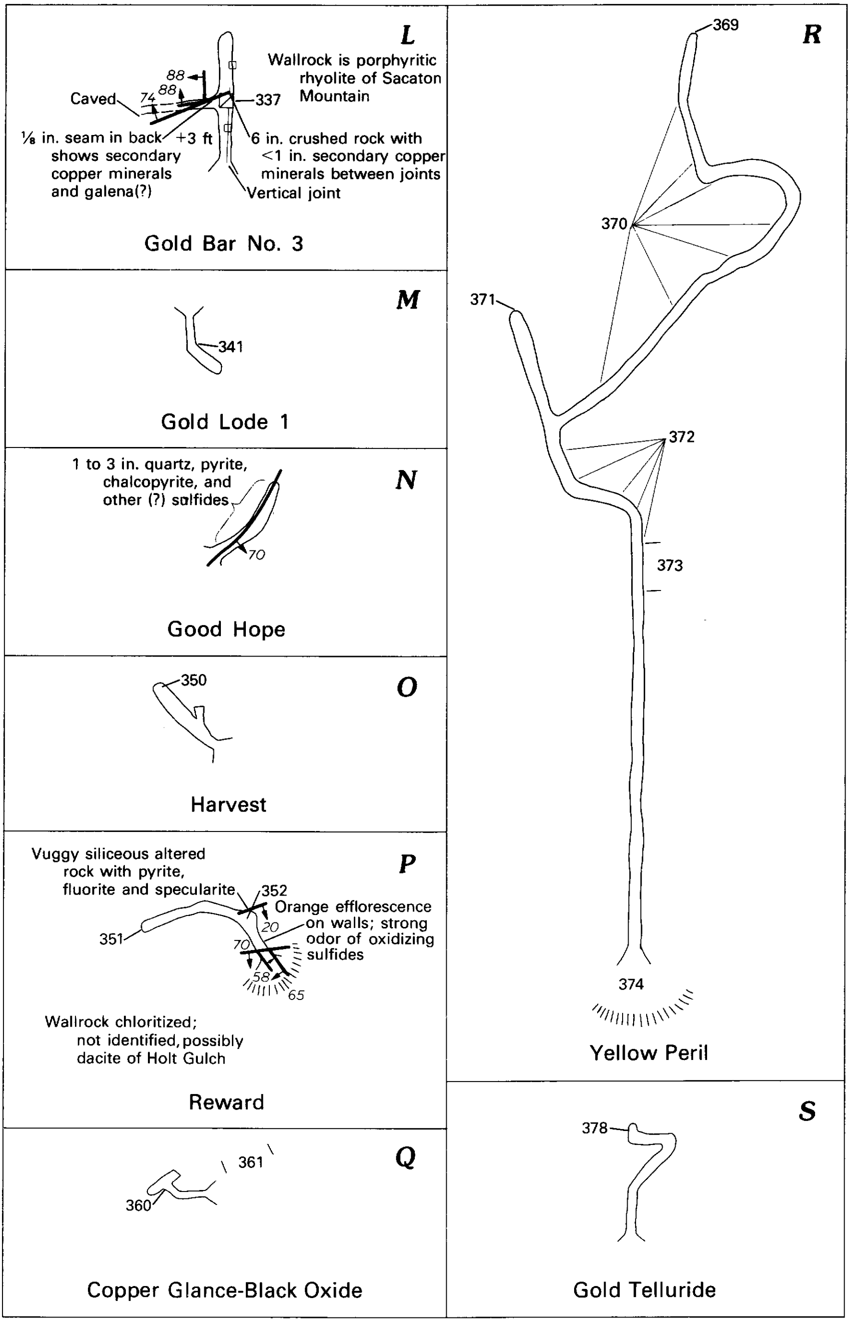


FIGURE 38.—Continued.

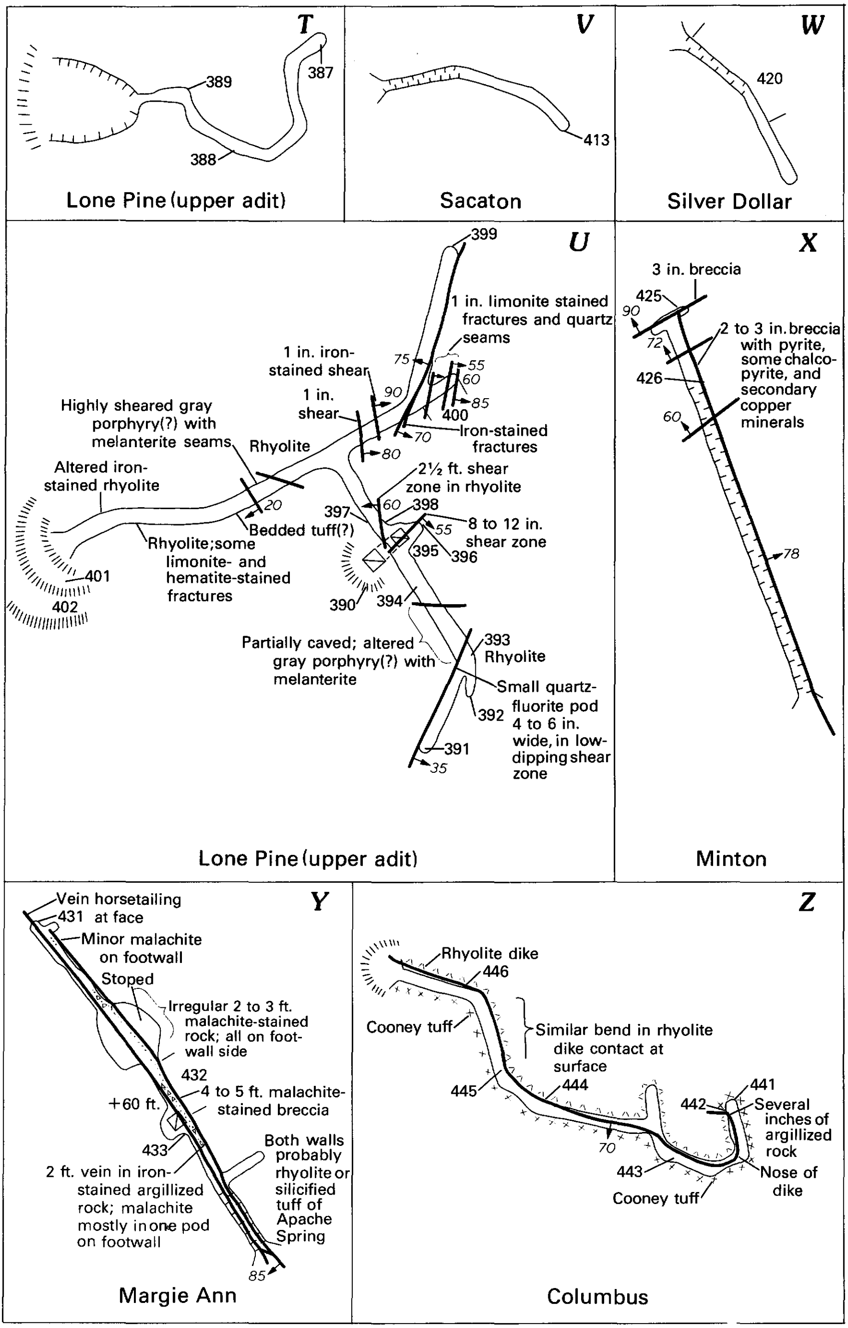


FIGURE 38.—Continued.

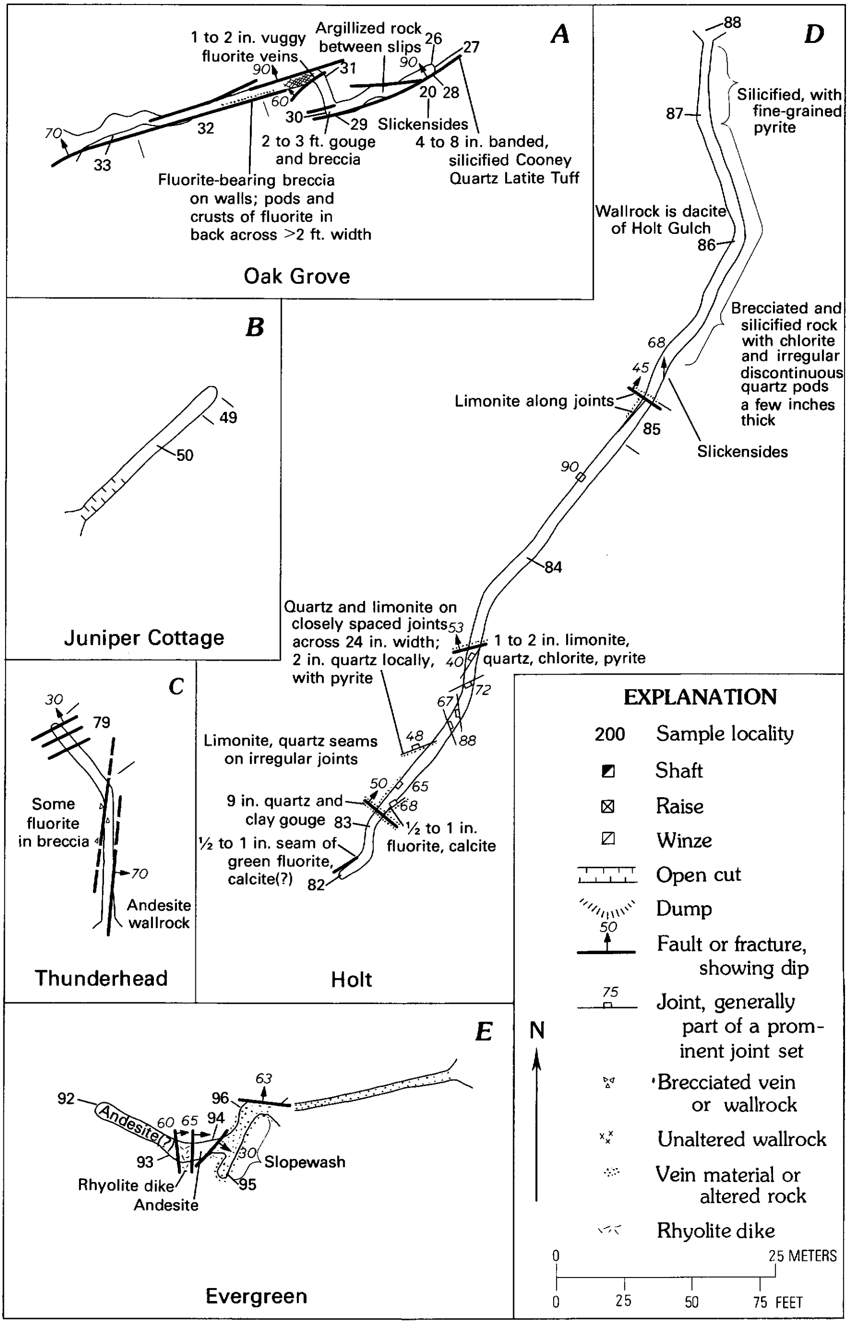


FIGURE 39.—Underground workings within the Gila Wilderness.

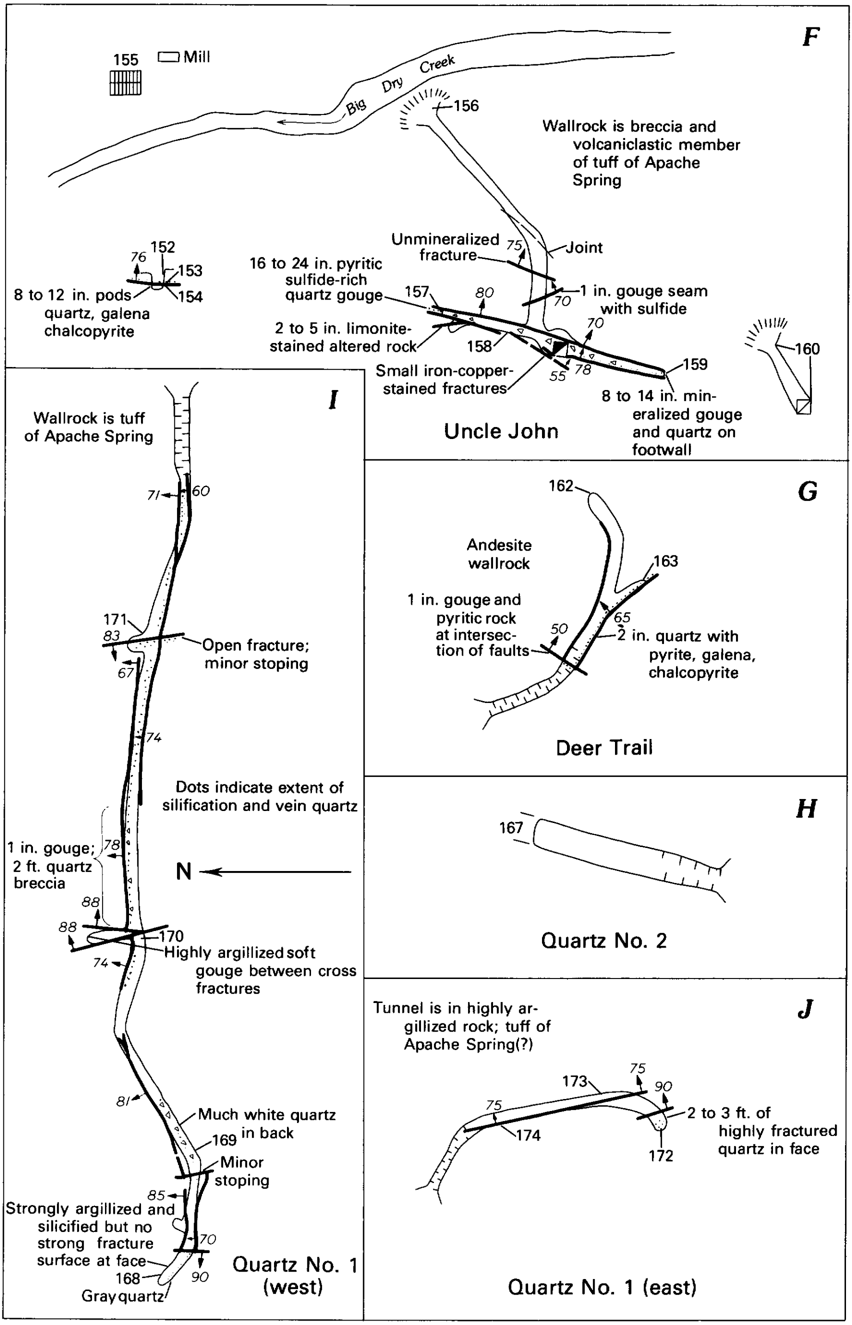


FIGURE 39.—Continued.

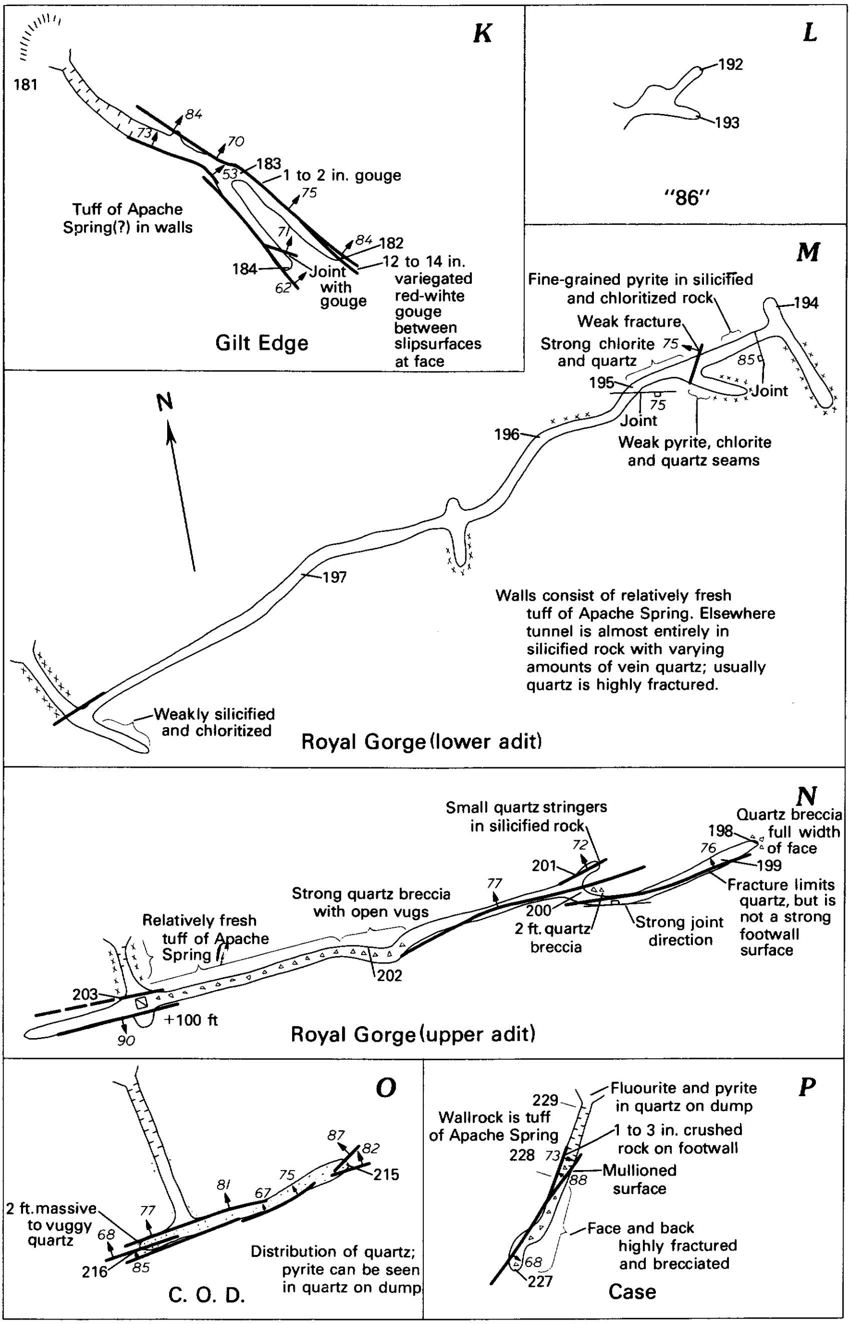


Figure 39.—Continued.

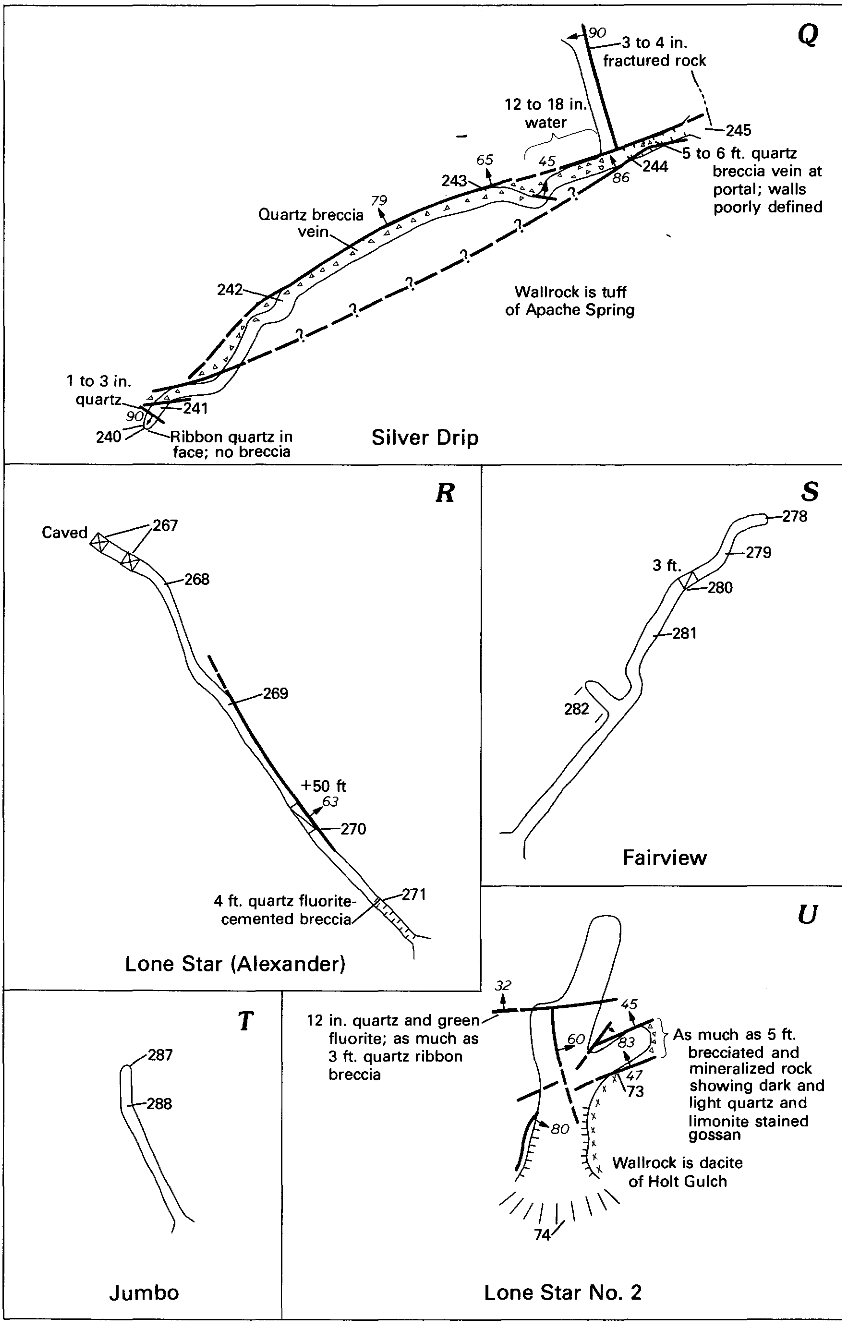


FIGURE 39.—Continued.

0.11 percent copper (sample 23), very low gold values, and traces of silver. About 1 mile (1.6 km) south of the picnicground and three-quarters of a mile (1.2 km) west of the wilderness, the Ida Bell and Bessie No. 1 prospects probably were first located (prior to 1909) as the Wall Street claim, relocated as the Bessie group in 1931, and as the Ida group in 1938 and again in 1970. The Ida Bell adit (fig. 38*D*) was driven on a 5- to 15-foot (3- to 4.5 m) wide zone of brecciated and silicified Cooney Quartz Latite Tuff lying between slip surfaces that strike N. 10° E.–N. 10° W. and dip 75°–85° E. Two smaller shears of similar trend were intersected by a short crosscut into the footwall of the main structure. Samples 36–40 across quartz vein material and silicified rock showed negligible mineral values. The Bessie No. 1 adit (fig 38*E*) is on a similar silicified breccia zone on the south side of the gulch between the Bessie No. 1 and Ida Bell. The breccia zone in the Bessie No. 1 strikes about N. 45° E. and dips 75° SE. Samples 41 and 42, at the face, also lacked significant metal values.

Additional prospects on the steep slopes east of the Whitewater picnicground (pl. 3*A*) include three prospect pits and a 20-foot (6-m) prospect adit driven along the contact between Cooney Quartz Latite Tuff and a rhyolite dike about 5 feet (1.5 m) wide. The adit and the two pits are on or adjacent to a west-northwest-trending fault zone that is occupied in part by an andesitic dike at least 10 feet (3 m) thick. U.S Geological Survey samples AMZ–201 to–208, from this area, show traces of gold, silver, tellurium, molybdenum, arsenic, and lead (table 5*B*).

Placer claims have been located at various times along Whitewater Creek in the vicinity of Whitewater picnicground. The Confidence and Black Bird patented mill sites, 17.07 and 23.1 acres (7 and 9.4 hectares respectively, are in this area. During these studies, tailings and gravels around the Confidence mill ruins were being reworked on a small scale for placer gold and for mercury that had been used in previous amalgamating operations.

WILCOX MINING DISTRICT

Approximately 1,500 mining claims have been located over the years in the Wilcox mining district. The claims straddle the western boundary of the wilderness for a distance of approximately 5 miles (8 km) and the southwestern boundary for more than 10 miles (16 km) and include two blocks of claims within the western part of the wilderness (pl. 1*B*). A panoramic view of part of the district is shown in the frontispiece. There are 16 patented mining claims and 2 patented millsites in the district. The millsites and 10 of the claims are within the wilderness; 5 of the claims are adjacent to tract 7 of the primitive area, and 1 claim extends into the primitive area.

Thirty-six groups of mines or prospects were examined and 431 samples were taken in the district. Mineral production from the district is known to be at least 10,912 tons of fluorite, 1.23 oz gold, 19.0 oz silver, 50 tons of copper ore, 5 tons of copper-silver ore, 1.5 tons of copper-lead-zinc ore, and 5 tons of tellurium ore.

Geologically, the mineralization in most of the Wilcox district seems to be controlled by north- and northwest-trending fracture zones, by rhyolitic intrusions in the ring-fracture zone of the Bursum caldera, and by the northeast-trending fractures on the resurgent dome of the Bursum caldera in the upper Big Dry Creek area (pl. 1).

LITTLE WHITEWATER CREEK AREA

Samples 43–60

The Little Whitewater Creek area occupies secs. 21, 28, and 29, T. 11 S., R. 19 W., in the northern part of the Wilcox district. Prospects and mine workings were examined at Deer Park Canyon, Little Whitewater Creek, and Shelton Canyon, and 18 samples were taken. With the exception of fluorite values in five samples from workings outside the wilderness, assay values were negligible.

Recorded production for the area includes 8,800 tons of fluorspar, probably all of which was from the Huckleberry mine, and very small amounts of gold and silver from the Horse Shoe group of claims, which may be within the wilderness.

Four largely inaccessible workings were examined in Deer Park Canyon (pl. 1B) about one-half mile (0.8 km) inside the wilderness. They are located along a faulted and silicified contact zone, which is probably partly intrusive, between Cooney Quartz Latite Tuff, and younger rhyolite lavas, and which seems to be a southern extension of the Queen fault zone from the Mogollon district. Siliceous ribs mark the contact zone north of Deer Park Canyon, but to the south the contact is occupied locally by a calcite vein 10 feet (3 m) wide. One of the workings is a 20-foot (6-m) open cut that is connected to an adit that bears N. 60° E. for 15 feet (4.5 m) and then N. 60° W. for 6 feet (1.8 m). samples 43 and 44 were taken from a 5-foot (1.5-m) fault zone in the face of this adit, and from a 3-inch (7.6-cm) quartz stringer at the portal. Sample 45 was cut across a silicified zone in a 12-foot (3.6-m) adit that bears S. 60° W. Sample 46 was from the dump of a 10-foot (3-m) filled shaft, and sample 47 from the dump of a 70-foot (21.3-m) caved adit. The assays show only negligible mineral values.

Most of the mine workings and prospects in Little Whitewater Creek are outside the wilderness. The Huckleberry fluorspar mine (fig. 38*F*) on the north side of the canyon is the largest mine in the Wilcox district and is only about one-fourth mile (400 m) west of the wilderness boundary. Felix F. Menges, Glenwood, N. Mex., and Arment Menges of

Reserve, N. Mex., were the claimants in 1972, at which time the mine was being developed under lease to Ira Young of Winston, N. Mex.

According to Sur (1947, p. 3) the Huckleberry property had produced about 7,300 tons of fluorspar up to 1945. Probably later production of about 1,500 tons also was from this property. The mine is the largest fluorspar deposit in Catron County and has accounted for 78.5 percent of the county's production (Williams, 1966, p. 14).

The Huckleberry property was drilled and examined by the Bureau of Mines in 1944. Exploration disclosed a nearly horizontal 6-foot (1.8-m)-thick ore body, 180 feet (55 m) by 420 feet (130 m) in extent, of which about half had been mined (Rothrock and others, 1946, p. 46). A short distance southeast of the present open pit, specimens of fluorspar (sample 51) were taken along an outcrop to determine if minerals other than fluorspar were present. The sample assayed 0.01 oz gold and 0.20 oz silver per ton.

Two adits in the gulch below the mine were examined. Figure 38*G* shows the longer of the two adits, slightly more than 100 feet (30.5 m); sample 53, across a 2-foot (6-m) vein in the face, contained 40.5 percent fluorite. The second adit extends 30 feet (9 m) along a N. 35° E. bearing; it cuts 6 inches (15 cm) of fault gouge that trends N. 60° W. and dips 25° SE. Sample 54 of the gouge showed negligible assay values.

Sample 52 from a 3-foot (1-m)-wide fluorspar-bearing vein is exposed in a shallow prospect pit on the canyon wall east of the Huckleberry mine.

The Huckleberry fluorspar deposit appears to be controlled by the intersection of two faults with a rhyolite dike, which probably is an offshoot from the mass of younger rhyolite to the east. The major ore shoot developed in the mine is at the intersection of a northerly trending fault, which dips 55° W. in the gulch below the open cut, an unusually low dipping fault that strikes about N. 30° E. and dips 15° SE., and the rhyolite dike, which dips moderately northward. The nearly horizontal ore body may continue across the wilderness boundary, only a few hundred yards to the east. Fluorite is not confined to the Huckleberry mine but is found in minor quantities in cross fractures along the outcrop of the rhyolite dike and in shears in the next major gulch north of the Huckleberry mine.

The 70-foot (21-m) Juniper Cottage adit (fig. 39*B*), which cuts probably the same rhyolite dike as the one at the Huckleberry mine, is the largest working inside the wilderness on Little Whitewater Creek. Sample 49 was taken from a 6-inch quartz vein near the face. Another sample (50) was cut across 4 feet of altered rhyolite in the back. Both samples contained only minor metal values.

Six prospect pits south of Little Whitewater Creek are located near an irregular cliff that is referred to as Jay Bird dike on many claim location notices. Sample 55 was taken from a brecciated zone in one of the pits. Sample 56 consists of brecciated altered volcanic rock from the other five pits. Both samples assayed only traces of gold and silver.

A caved adit bearing N. 35° E. is located within the wilderness about a mile (1.6 km) upstream from the Huckleberry mine. Bacause floods had washed away all traces of the dump, it was not possible to estimate the extent of the working. Sample 48, of development rock from around the portal, assayed 0.01 oz gold and 0.49 oz silver per ton.

Several prospects were examined in Shelton Canyon about a half mile (0.08 km) west of the wilderness boundary. They include the White Flag and Silver Boe group of claims. A 30-foot (9-m)-long trench, bearing N. 30° W. on the Silver Boe No. 1 claim, crosses a 2-foot (0.6– m) quartzose fracture zone; sample 57 from the zone contained 42.14 percent fluorite. At the Silver Boe No. 2 prospect, a 40-foot (12-m)-long trench exposes a N. 10° W.-striking fluorspar-quartz vein about 3½ feet (1 m) wide. Sample 58, from this vein, showed high-grade fluorite (76.5 percent). Downgulch 100–200 yards (90–180 m) from this trench are an inclined shaft 20 feet (6 m) deep, on the east side of the gulch, and a 20-foot (6-m) adit and prospect pit, on the west side. These prospects show several small fluorite-bearing fractures, the largest of which is a 4- to 6-inch (10- to 15-cm) fluorite vein on the footwall of a north-trending fault. Samples 59 and 60 from a pit on a weak fracture in altered volcanic rock on the south side of the canyon show very low values of gold, silver, lead, and zinc.

HOLT GULCH AREA

Samples 61–112

The Holt Gulch area is south of the Little Whitewater Creek area, in secs. 32 and 33, T. 11 S., R. 19 W. and in secs. 4, 5, 8, and 9, T. 12 S., R. 19 W. It straddles the western boundary of the wilderness for a distance of nearly 3 miles (5 km). Access to the area, as far as the wilderness boundary, is by two ranch roads that begin at the Smith Ranch in Pleasanton. The important geologic features in this area include the dacitic intrusive rocks of Holt Gulch and many dikes and irregular intrusions of rhyolite on and adjacent to Wilcox Peak. The dacite of Holt Gulch is propylitically altered, whereas many of the rhyolitic rocks are silicified and argillized. The mineralization in this area may be associated with both the dacite and the rhyolite, or entirely with the rhyolite intrusions.

Fifty-two samples were taken from nine workings or groups of workings in the area. Eight samples contained significant (more than 20 percent) fluorite, but only one of these samples (78) was from within the wilderness. Five samples assayed relatively high in gold and silver; two of these (70 and 72) were from the Lone Star claims within the wilderness. The assay values for the five samples follow:

Sample No.	Gold (oz/ton)	Silver (oz/ton)	Sample width (ft)	(m)
69	0.02	16.16	4.0	(1.2)
70	1.30	7.90	.2	(.06)
72	.38	.92	—	—
73	.40	.56	4.0	(1.2)
74	.25	.20	—	—

The Holt Gulch area is just west of the wilderness, in SE ¼ sec. 32, T. 11 S., R. 19 W. Three workings were examined in a tributary arroyo north of Holt Gulch where the jeep road crosses the gulch. A major fault is inferred to follow the arroyo (pl. 1). A 10-foot (3-m) adit has been driven in limonitic material along a N. 35° W. shear zone, about 800 feet (250 m) above the mouth of the arroyo on the west side. Sample 61 was taken from the altered rock, which is exposed for 300 feet (100 m) or more along the arroyo bank. Iron (20.0 percent) is the only element in significant amounts in the analyses.

On the opposite side of the same arroyo, there is a newly discovered fluorspar showing that has been claimed by Felix Menges. The fluorspar is in a 10- to 20-foot (3- to 6-m)-thick rhyolitic dike that strikes about north up the east slope of the arroyo. A 125-foot (38-m)-long trench 2.5 feet (0.8 m) wide and 2 feet (0.6 m) deep was dug along the lower part of the north wall of the dike. Sample 62 was taken of development rock from the trench. One end of the outcrop has been blasted to expose fresh vein material. Sample 63 was chipped for 4 feet (1.2 m) along the north wall of the blasted area and sample 64 for 10 feet (3 m) along the east wall. Fluorite values were 30.2 percent, 24.2 percent, and 28.1 percent respectively.

An irregular 100-foot (30-m)-long trench on the Moose group of claims, about one-fourth mile (400 m) down Holt Gulch from the arroyo with the fluorspar prospects, seems to have been dug in landslide debris. Samples 65 and 66 from white to red silicified rock in the trench have negligible assay values. Sample 67, from a mafic dike a short distance northeast of the trench, is also barren.

The Red Shaft lies about one-half mile (800 m) west of the wilderness boundary, in sec. 5, T. 12 S., R. 19 W. A 400-foot (120-m) shaft is rumored to have been sunk by a man named Hofus in an effort to locate the source of rich float. A shallow depression and a large dump of weathered material are all that remain of the workings. Sample 68 of material from the dump assayed a trace of gold and 0.16 oz silver per ton. The shaft is approximately on the projected trace of a fault along the range front in this area.

About 1,000 feet (300 m) east of the Red Shaft, on the Liberty Bell No. 1 mining claim of Felix Menges, a prospect pit was dug on the intersection of two quartz veins. One of the veins is nearly vertical and strikes N. 50° E.; and the other strikes N. 15° W. and dips 65° NE. Sample 69 across the veins contained 0.02 oz gold and 16.2 oz silver per ton, and 52.6 percent fluorite. This sample assayed the highest silver value of 52 samples taken between Holt Gulch and Goddard Canyon.

The Lone Star group of claims is in Holt Gulch and Goddard Canyon, in secs. 4 and 5, T. 12 S., R. 19 W., within the wilderness. Three openings were sampled on the Lone Star No. 2 claim above a fork of Goddard Canyon. Near the center of the claim a trench exposes a 3.3-foot (1-m)-wide quartz vein, which strikes N. 45° E., and dips 75° NW. Sample 70 taken along a 2-inch (5-cm)-wide band on the hanging wall of the vein contained 1.30 oz gold and 7.90 oz silver per ton. Sample 71, across the vein, contained 0.02 oz gold and 0.44 oz silver per ton; a sample taken earlier by the U.S. Forest Service at the same locality assayed 0.8 oz gold per ton. Sample 72, of development rock, assayed 0.38 oz gold and 0.92 oz silver per ton.

An adit and a 30-foot (9-m) inclined shaft partially filled with water are northeast of the trench (fig. 39*U*). Sample 73 was cut along the northeast wall of the adit; the true width of mineralization represented by the sample could not be ascertained. Assay values of 0.40 oz gold and 0.56 oz silver were obtained. Sample 74, from the dump, contained 0.25 oz gold and 0.20 oz silver per ton.

At the northeast end of the Lone Star No. 2 claim a 12-foot (3.6-m)-long trench has been excavated S. 60° E. along a 1.5-foot (0.5-m)-wide quartz vein that dips 50° NE. Sample 75 from the trench returned very low gold and silver values.

A prospect was examined on the south slope of Holt Gulch a short distance within the wilderness. An 8-foot (2.4-m)-wide siliceous zone, locally called the Juniper vein, trends N. 85° E. dips 75° N., and is exposed in a 20-foot (6-m)-wide trench. Samples 76 and 77 from the siliceous zone assayed only very low values in gold and silver.

A 7-foot (2.1-m)-wide vein of fluorspar crops out several hundred feet (a few hundred metres) up the north slope of Holt Gulch at a point about one-fourth mile (400 m) within the wilderness. The vein strikes N. 25° W., and dips 30° NE. Sample 78, across the vein, contained 43.8 percent fluorite. The width and grade of this vein suggest that the property may have potential as a producer of fluorspar. It is believed that the property is the Lone Star No 7 described by Rothrock, Johnson, and Hahn (1946, p. 46), but the section number is different from the one they cited.

The Thunderhead workings are near the creek level of Holt Gulch about three-fourths of a mile (1.2 km) within the wilderness. Figure 39*C* shows the most extensive working, an 80-foot (24-m) adit. The back of the working was dangerously loose and parts are caved so that only a small area could be sampled. Sample 79 was taken from quartz seams $\frac{1}{4}$– 3 inches (less than 1 to 8 cm) in width exposed in the back. Ten feet (3 m) above the main portal is a 6-foot (1.8-m) adit in a cemented breccia zone. Sample 80 was taken across the zone, and sample 81 was taken from a 4-inch (10-cm) quartz veinlet. Assay values of the three samples were of no significance.

The Holt tunnel (fig. 39*D*) is the largest mine working in the Holt Gulch area. The generally straight trend of the adit and the absence of a significant vein indicate that the tunnel was driven in the south bank of Holt Gulch to explore the downward continuation of the outcrops on Gold Hill, the ridge area south of Holt Gulch. Analyses of seven chip samples (82–88) from fractures and shear zones along the crosscut showed no significant mineral concentrations other than gold assays of 0.03 oz and 0.04 oz per ton in samples 82 and 83, respectively.

Three zones of altered and iron-stained volcanic rock were sampled in a fork of Goddard Canyon across the ridge that lies south of Holt tunnel. The area, which is in the wilderness, was probably first claimed in 1893, when two of the Iron Clad claims were located. O. B. Bishop located a new group of Iron Clad claims in the same area in 1922.

Sample 89 was taken in an altered zone at the discovery site of the Lone Star 3 claim which originally may have been part of the Iron Clad group. Assays show traces of gold and silver.

Near the head of the canyon, an old working that was called the Wilcox is now covered by one of the Texas claims. Sample 90 was taken from the dump near an inaccessible 30-foot (9-m) inclined shaft but no important mineral deposit was indicated.

Sample 91 was taken across an iron-stained quartz vein that is up the canyon about one-fourth mile (400 m) from the Wilcox working. The sample assayed extremely low gold and silver values.

A group of prospects on the east and west slopes of Wilcox Peak probably marks the location of the Evergreen claims. The prospects are about one-fourth mile (400 m) inside the wilderness. Caving and erosion have obscured the portal of the largest working, a 150-foot (46-m) adit (fig. 39*E*) that was driven along a zone made up of fault gouge and loosely cemented breccia. Five chip samples (92–96) taken at different locations along the drift assayed almost negligible values.

Two prospects were examined near the top of Wilcox Peak. Sample 97 was taken across a quartz vein that is exposed in a pit on the north side of the ridge, and sample 98 was taken of the leached and iron-stained development rock from a 20-foot (6-m) trench on the south side. Assay values were nil. Samples 99 and 100, which represent quartz and specularite veinlets and dump material near two caved shafts on the west side of the peak, contained negligible values.

An occurrence of disseminated pyrite and native sulfur in cracks and fissures is exposed a short distance inside the wilderness on the rhyolite cliffs in upper Goddard Canyon. The area is covered by the Wilcox claims located by James T. Kelley of Pleasanton, N. Mex. A 15-foot (4.5-m) chip sample of the mineralized material assayed only traces of gold and silver. The claimant excavated a diamond-drill station into the cliff base and reportedly drilled a 15-foot (4.5-m)-deep hole. Chips of unweathered rock from the station were combined in sample 102, which contained only very minor metal values.

The Goddard fluorspar claims are just west of the wilderness boundary. On the Goddard No. 1, sample 103 was taken across a 12-inch (30-cm) quartz-fluorspar vein that is exposed in a 6-foot (1.8-m)-deep prospect pit. Just south of the pit, a 20-foot (6-m)-long trench has exposed the vein, which is nearly 4 feet (1.2 m) wide at this point (samples 104 and 105). A probable continuation of the vein crops out in the creek bottom, where 2 feet (0.6 m) of it protrudes out of the stream gravels. Fluorite analyses were 31.9 percent, 62.7 percent, and 41.6 percent respectively for samples 103, 105, and 106. Sample 104 was not analyzed for fluorite. Under favorable market conditions, the Goddard Canyon fluorspar showings may warrant further exploration and development.

A 125-foot (38-m)-long trench, 10 feet (3 m) wide and 4 feet (1.2 m) deep with a bearing of N. 30° W., was found just inside the wilderness on the divide between Goddard Canyon and the north fork of Red Colt Canyon. Sample 107, of altered rock exposed in the trench, assayed 0.02 oz gold and 0.38 oz silver per ton.

The south fork of Red Colt Canyon dissects an intensely leached and altered zone just outside the wilderness boundary. Sample 108 was taken across a brecciated zone that is exposed in a small prospect pit. Assay results were 0.015 oz gold and 0.29 oz silver per ton.

A northwest-trending 20-foot (6-m) cut was found near the top of peak 6881, which is the prominent peak on the north slope of Goat Corral Canyon. The working appears to be about on the wilderness boundary line. A grab sample (109) of oxidized volcanic rock from the cut contained a trace of gold and minor silver values. Altered rhyolite on peak 6881 also contains fracture fillings and vug linings of greenish clay identified by X-ray as nearly pure dickite (R. Van Loenen, oral commun., 1971). Massive dickite-bearing pods 2–3 feet (0.6–0.9 m) wide were observed at a few places. This material might represent a minor economic mineral resource.

In the bottom of the canyon east of peak 6881 and a short distance within the wilderness, a 20-foot (6-m) cut has exposed a blue-tinted quartz vein that has a north-south strike. A 2-foot (0.6-m) sample (110) was chipped across the vein, and a grab sample (111) was taken from the cut. Assay values from both samples were negligible.

A 15-foot (4.5-m) adit in S Dugway Canyon, just south of the wilderness boundary, was driven on a 6-inch (15-cm) quartz vein that strikes S. 60° E. A chip sample (112) contained no minable values.

BIG DRY CREEK BELOW SPIDER CREEK

Samples 113–166

Five mineralized areas were examined in the canyon of lower Big Dry Creek above and below Johnson Cabin at the mouth of the North Fork of Big Dry Creek. Mining-claim coverage is mainly in sec. 7, T. 12 S., R. 18 W., and in secs. 12, 13, and 14, T. 12 S., R. 19 W. The area extends northward across tract 7 of the Gila Primitive Area into the wilderness. Access is by U.S. Forest Service trails that begin at Sheridan corral (pl. 3). Horses can be ridden to the Uncle John mine, but parts of the rugged canyon can be reached only on foot.

Of the five areas, one is outside the primitive area and wilderness, two are within the primitive area, and two are within the wilderness. Of nine samples taken from the area outside, four contained copper values ranging from 0.61 to 2.15 percent, lead from 0.14 to 2.10 percent, and zinc from 0.07 to 0.18 percent. Forty-five samples were taken from prospects and workings within the Gila Primitive Area and Gila Wilderness. Gold values were mostly traces, and the highest recorded value was 0.14 oz gold per ton. Assay results gave mostly very low values for silver; six samples contained more than 1.00 oz/ton, and the highest value obtained was 3.94 oz/ton. Five samples contained more than 0.5 percent copper; six have more than 2.0 percent lead; and four have more than 2.0 percent zinc.

The main mineralized structures are downcanyon from Johnson Cabin at the True Blue, Hardscrabble, and Independence properties. All are along the margins of the Sheridan Mountain rhyolite plug dome, and they are closely associated with a swarm of rhyolite dikes and related fractures. The Uncle John prospect above Johnson Cabin is on a strong northeast-trending fault zone that may be near the southwest end of the Spruce Creek graben of the Bursum resurgent dome. A number of mineralized faults, mainly of northeast to northwest trend, are exposed between the Uncle John mine and Spider Creek (pl. 1), in the canyon of Big Dry Creek. They show minor sulfides, and a little fluorite was noted in fractures in the west canyon wall at the top of a 10- to 15-foot (3- to 4.5-m) waterfall just above the Pilgrim Camp area. The Pilgrim Camp is a name given locally to a camping area below the mouth of Spider Creek.

The True Blue property, also called the Copper-Gold group, is developed by two adits along a rhyolite dike, (fig. 38*H*, *I*) on the east bank of Big Dry Creek about 1,500 feet (450 m) south of the primitive area boundary. Nine chip samples were taken from mineralized areas and from fracture zones in the two workings. Four of the samples contained the following values:

Sample No.	Percent				Width, in feet(m)
	Copper	Lead	Zinc	Vanadium	
114	0.93	1.24	0.18	---	3.5 (1.1)
115	2.15	.14	.14	---	4.5 (1.4)
116	.70	.26	.11	---	6.9 (2.1)
117	.61	2.10	.07	0.30	2.3 (0.6)

The Independence workings are within tract 7 of the Gila Primitive Area on the east slope of Big Dry Creek about one-fourth mile (400 m) downstream from Johnson Cabin. The area is claimed as the Seminole group by Dan Watkins of Cliff, N. Mex.

The portal of the Independence No. 1 adit (fig. 40*B*) is nearly obscured by brush, and most of the dump has been washed away. Samples 130 to 138 were taken across quartz stringers and fracture zones in the 350-foot (110-m) adit. In addition, samples 128 and 129 were taken of dump material. A winze about 100 feet (30 m) from the portal (fig. 40*B*) was filled with water. Three other workings follow a rhyolite dike that extends southeasterly upslope from the main adit. The lowest working is a 40-foot (12-m) adit that bears S. 75° E.; because of the dangerous conditions in it, the only sample taken (127) was from a muck pile within the adit. The middle working (Independence No. 3 adit, fig. 40*A*) consists of a crosscut and drift about 100 feet (30 m) long. A chip from the northeast face and loose material from the drift floor make up sample 126. The uppermost of the Independence workings include a small open cut and an 8-foot shaft, which expose a 1.2-foot (36-cm)-wide quartz vein from which sample 125 was taken. Assay values from all the Independence samples were negligible with respect to minable material, except for minor showings of silver and zinc.

Southeast of the Independence, a trench has exposed a 4-inch (10-cm) quartz stringer (122) that strikes S. 60° E. A 1-foot (0.3-m) quartz vein that strikes N. 65° E. And dips 75° NW. was sampled (123 and 124) in a prospect pit downstream from the portal of the main Independence adit. Assay values were very small.

The Hardscrabble workings are within the Gila Primitive Area on the west wall of the canyon of Big Dry Creek (figs. 11, 41). They line up with the Independence workings east of Big Dry Creek and probably are on the same structural zone; both are associated with rhyolite intrusive bodies, which may be related to the Sheridan Mountain rhyolite plug dome. A diamond drill hole was found at creek level between the two sets of workings, but no information on the drill hole was obtained.

The main Hardscrabble adit (fig. 40*C*) is a 60-foot (18-m) drift on a 2- to 3-foot (0.6- to 9-m) quartz vein (samples 140–142). Above the adit, a

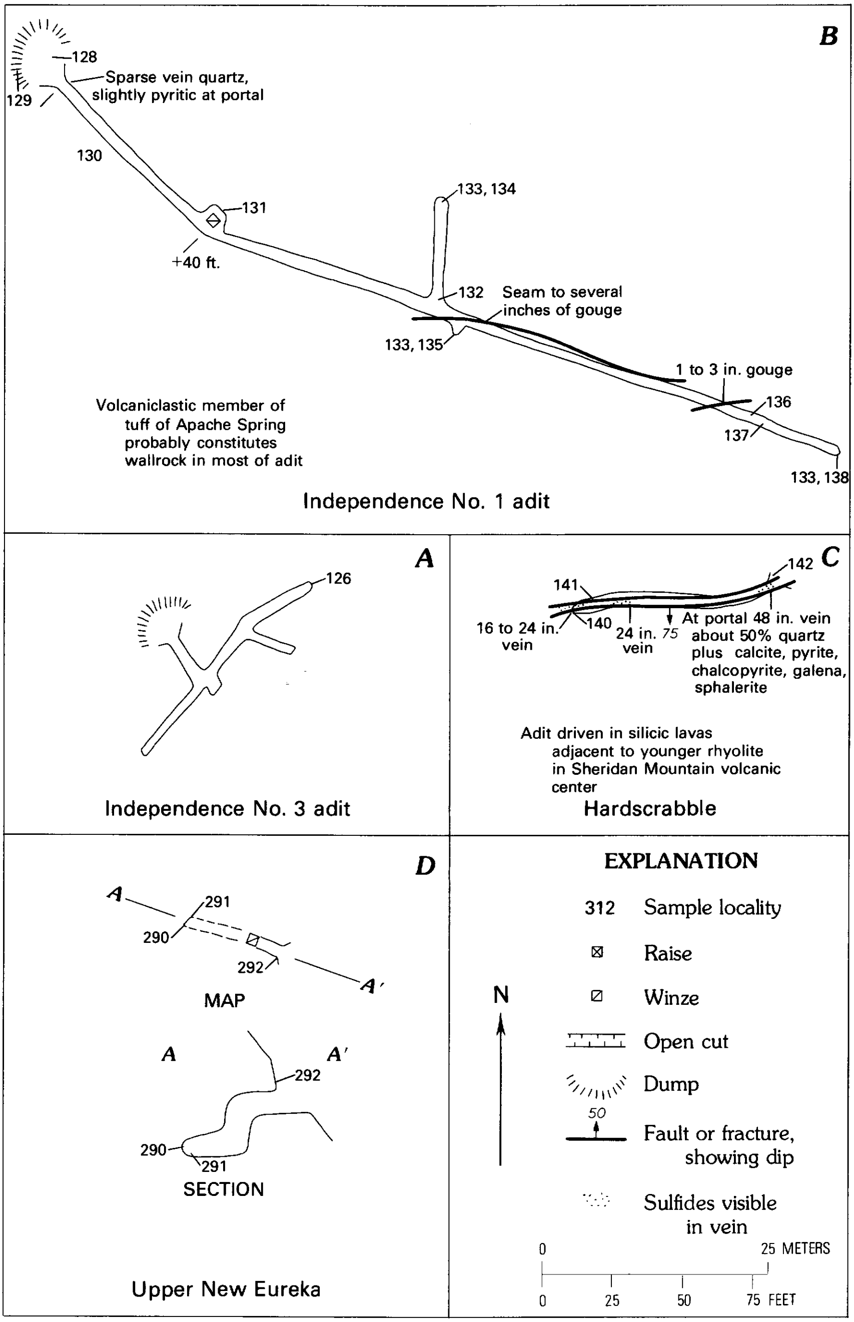


FIGURE 40.—Underground workings within the Gila Primitive Area.

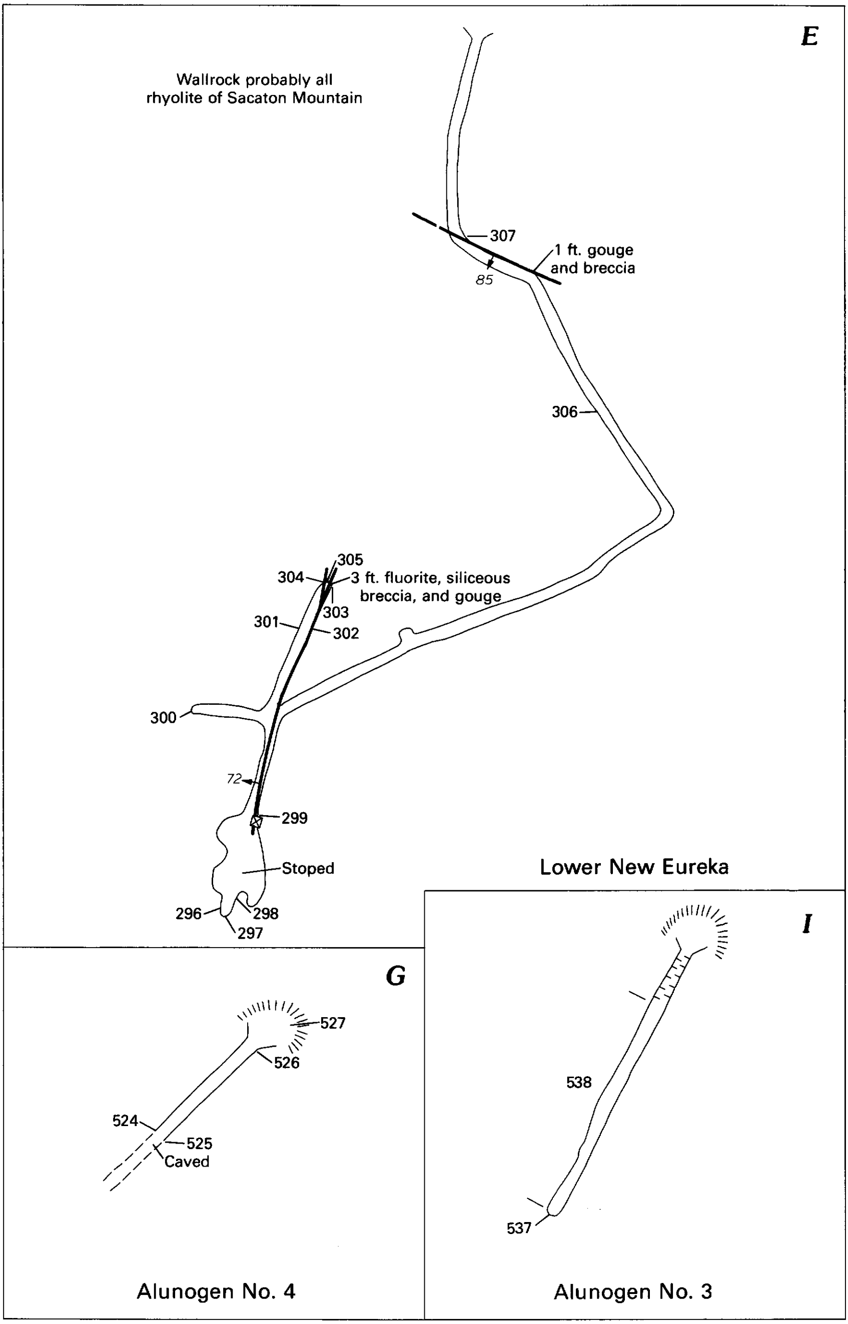


FIGURE 40.—Continued.

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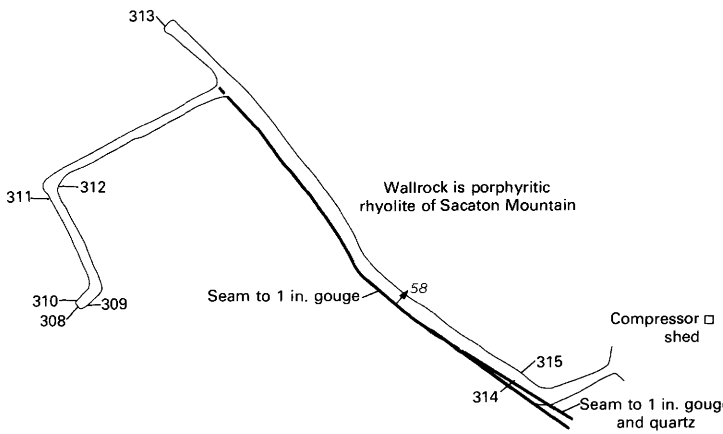

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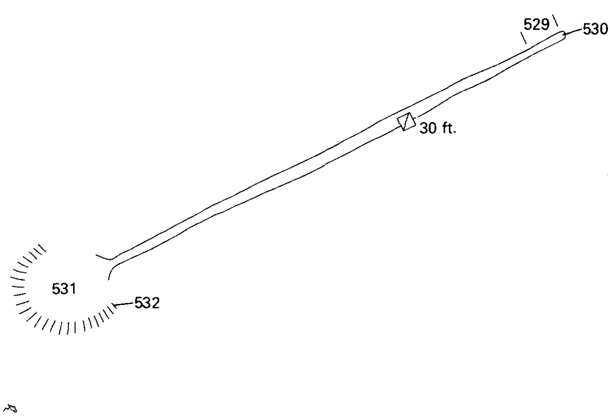


Alunogen No. 2

FIGURE 40.—Continued.

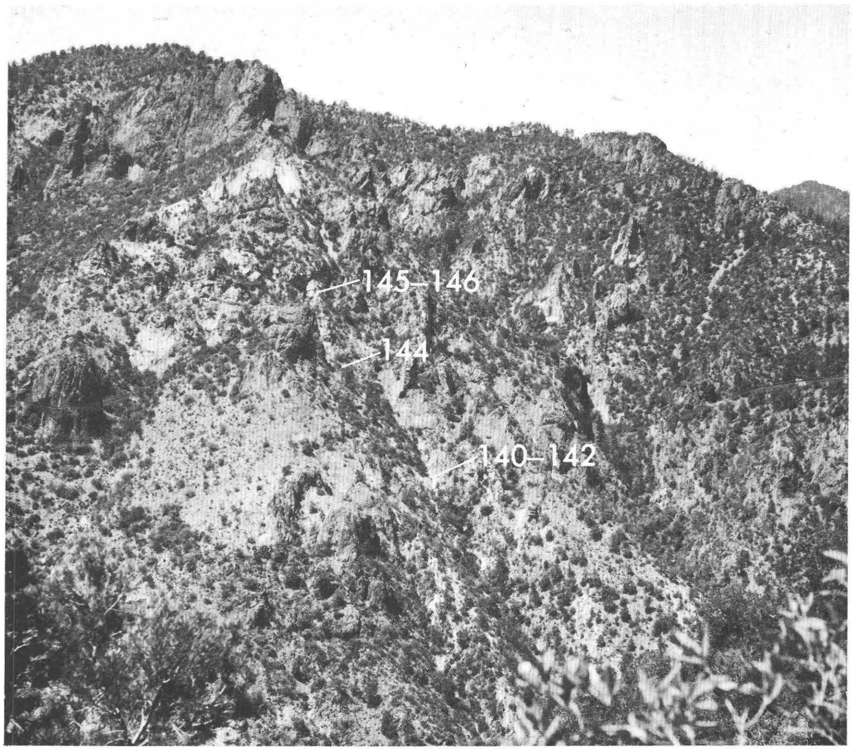


FIGURE 41.—View of Hardscrabble prospects looking west across Big Dry Creek from Independence mine area. Samples 140–142 at main 60-foot (18-m) adit; 144 at collar of 30-foot (9-m) shaft, and 145–146 in 20-foot (6-m) trench.

3-inch (7.5-cm)-wide quartz vein was sampled (144) at the collar of a 30-foot (9-m) shaft, and a 10-inch (25-cm)-wide quartz vein is exposed in a nearby trench (samples 145, 146). Analyses of these samples show notable values in silver, lead, zinc, copper, and fluorite, and minor gold and cadmium.

A 6-inch (15-cm) quartz vein in andesitic rock was sampled (143) in a pit that is a short distance north of the Hardscrabble vein. Metal values were low except for copper (0.87 percent) and zinc (0.63 percent). A prospect along the trail from the Hardscrabble to Johnson Cabin was examined, but only low metal concentrations were detected in sample 147 from the face of the pit.

Several claims have been located in the Johnson Cabin area over the years, but no production has been recorded. The claims straddle the boundary between the primitive area and the wilderness. A shallow pit at the base of the bluff behind the cabins, an iron-stained quartz outcrop along Big Dry Creek, and a 10-foot (3-m) cut on the east slope of the

North Fork were examined, and samples 148–150 were taken across quartzose exposures in each working, but no appreciable metal values were obtained. In addition, traces of tellurium, lead, and zinc were found in development rock (USGS samples AMZ–211, 212, table 5*B*) from a pit west of the North Fork on the Big More 1 claim, which was located July 17, 1968, by Dan Watkins, Ed Samora, and R. W. Mathis.

The Uncle John mine (fig. 39*F*), which is about one-half mile (800 m) upstream from Johnson Cabin, is one of the major prospects in the Gila Wilderness and one of several prospects examined along this part of Big Dry Creek. Located in 1884, the Uncle John mine was also known as the Lead Bullion (1917), Gimey (1919), and Complex (1930). The Bureau of Mines conducted a reconnaissance investigation of the property in 1950, which disclosed a noteworthy tonnage of indicated and inferred reserves of copper-lead-zinc ore. Production from the property has been minor.

Figure 39*F* shows the sample localities at the Uncle John mine. Ten samples (152-161) were taken: three in the main adit, three from a 15-foot (4.5 m) opencut, two from dumps, one from some bagged concentrates at the site of a small mill, and one from a quartz vein exposed about 100 yards (91 m) upstream from the portal of the main adit. Gold values from all samples were negligible, but six of the samples contained significant values as follows:

Sample No.	Locality	(oz/ton) Silver	Percent Copper	Lead	Zinc	Cadmium	Width in feet
153	Open cut	0.70	0.15	0.44	1.30	---	0.5
154	....do	1.06	.44	9.90	9.01	0.72	.5
155	Mill concentrates	2.37	.70	8.94	8.79	.06	---
156	Main adit dump	1.35	.76	5.76	3.47	.03	---
157	Main adit	3.94	.59	7.10	7.95	.06	3.0
158	....do	.60	.20	3.80	.30	---	2.5

About 1,500 feet (450 m) downstream from the Uncle John mine, a 10-foot (3-m) adit was driven N. 75° E. on a 6- to 15-inch (15- to 38-cm)-wide silicified band of altered volcanic rock. Assay values from a 1.3-foot (30-cm) chip sample (151) were of no significance.

A 110-foot (33-m) adit, thought to be the Deer Trail tunnel, is shown on figure 39*G*. The prospect is about one-half mile (0.8 km) within the wilderness near the center of sec 7, T. 12 S., R. 18 W. Samples 162 and 163, taken across 2.3 feet (0.7 m) and 3 feet (0.9 m) of quartz, assayed traces of gold and silver. Galena, sphalerite, chalcopyrite, and pyrite occur in a 2-inch (5-cm)-wide quartz vein along the footwall, which strikes N. 40° E. and dips 65° NW.

A 10-foot (3-m) adit in an area known as Pilgrim Camp is in a quartz vein that bears N. 40° E. and dips 70° SE. The prospect is about 1 mile (1.6 km) within the wilderness in the extreme northeast corner of sec. 7, T. 12 S., R. 18 W. Sample 164 was taken across 2.5 feet (0.8 m) of quartz in the back. A 30-foot (9-m) channel sample (165) was taken of altered rock adjacent to the vein. About one-half mile (800 m) upstream, a 2-foot (0.6-m) chip sample (166) was taken from an altered area. Assay results on the three samples showed 0.10 percent and 0.15 percent copper, and 0.03 and 0.05 percent molybdenum in samples 164 and 165, respectively, and 0.04 percent molybdenum in sample 166. Low-grade lead and zinc values were found in sample 164.

BIG DRY, SPRUCE, AND SPIDER CREEKS

samples 167–245

The area of claims and prospects near the headwaters of Big Dry Creek is about 2–4 miles (3–6 km) inside the western part of the Gila Wilderness (fig. 42). Mining claim coverage is mainly in secs. 32, 33, 34, T. 11 S., R. 18 W., and in secs. 3, 4, and 5, T. 12 S., R. 18 W.

Seventy-nine samples were taken from about 50 mines, prospects, and mineralized areas. Six samples assayed more than 0.10 oz of gold per ton: 169 (0.11 oz), 180 (0.31 oz), 200 (0.12 oz), 204 (0.18 oz), 235 (0.20 oz), and 236 (0.36 oz). None of the samples assayed in excess of 1.00 oz silver per ton, and only five contained significant (more than 20 percent) fluorite.

The area includes six patented mining claims, and two patented millsites; dozens of other claims have been located in the district over the years. However, no production has been recorded for the area, and there was no mining activity at the time of the investigation.

The northeast-trending faults in this area have been described earlier as defining a complex graben on the crest of the resurgent dome of the Bursum caldera (pl. 1A). The major mineralized structures in the graben are the Royal Gorge and Gold Link faults, both of which contain strong quartz breccia veins, commonly 5–10feet (1.5–3 m) wide. The Camp Creek fault, which trends west-northwest, likely offsets the Royal Gorge fault, and the quartz breccia near the intersection of the two faults is at least 20 feet (6 m) wide. Traces of metals in gossan and quartzose vein materials at the intersection of the Royal Gorge and Camp Creek faults are listed in table 5*B*, samples AGR–647, 658–662, and AMZ–214 (pl. 3*A*). South of the Camp Creek fault, only mildly chloritized rock and disseminated pyrite were seen associated with the quartz vein material. North of the Camp Creek fault the inferred continuation of the Royal Gorge fault and vein is marked by a narrow zone of oxidized outcrops formed by weathering of disseminated pyrite along the fault zone. The Silver Drip tunnel, south of upper Big Dry Creek, also is along a strongly silicified structure that may be part of the Spruce Creek graben, but the fault was not traced far from the tunnel site.

The six patented mining claims in the upper Big Dry Creek area are the Homestake, Quartz No. 2, Quartz No. 1, Mountain View, Royal

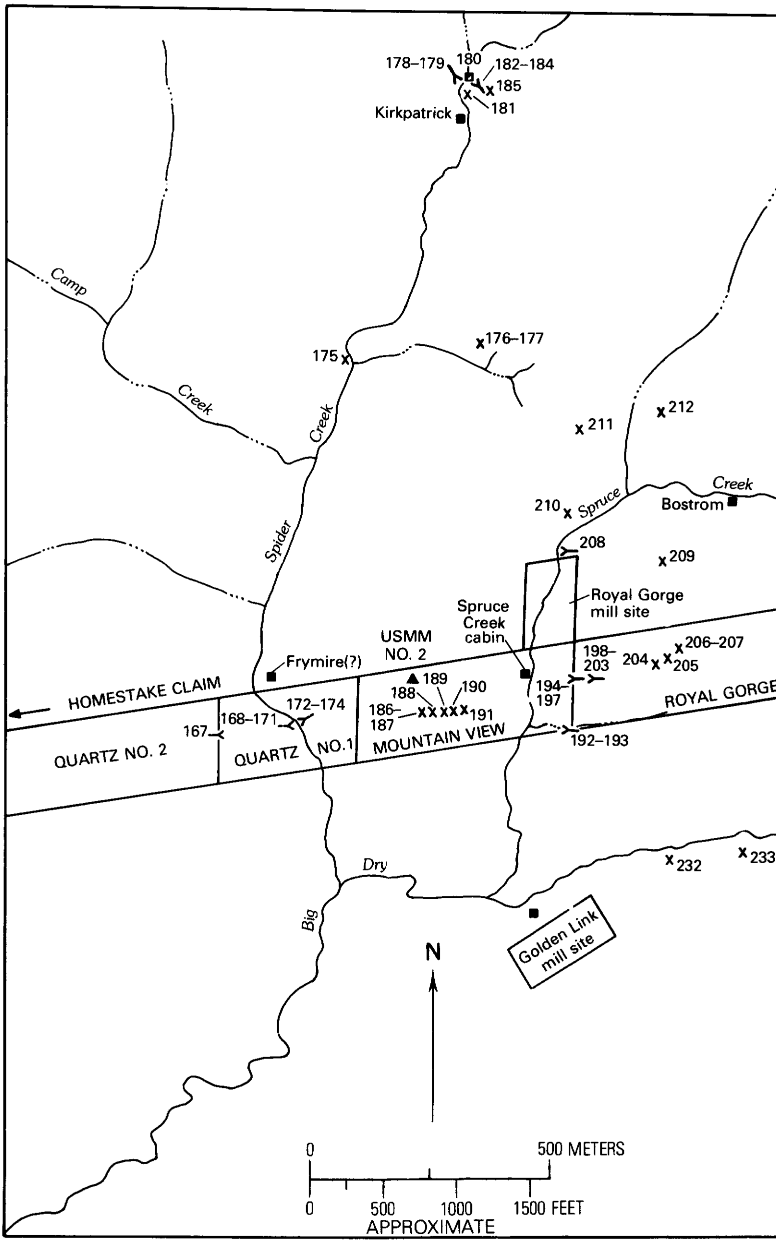
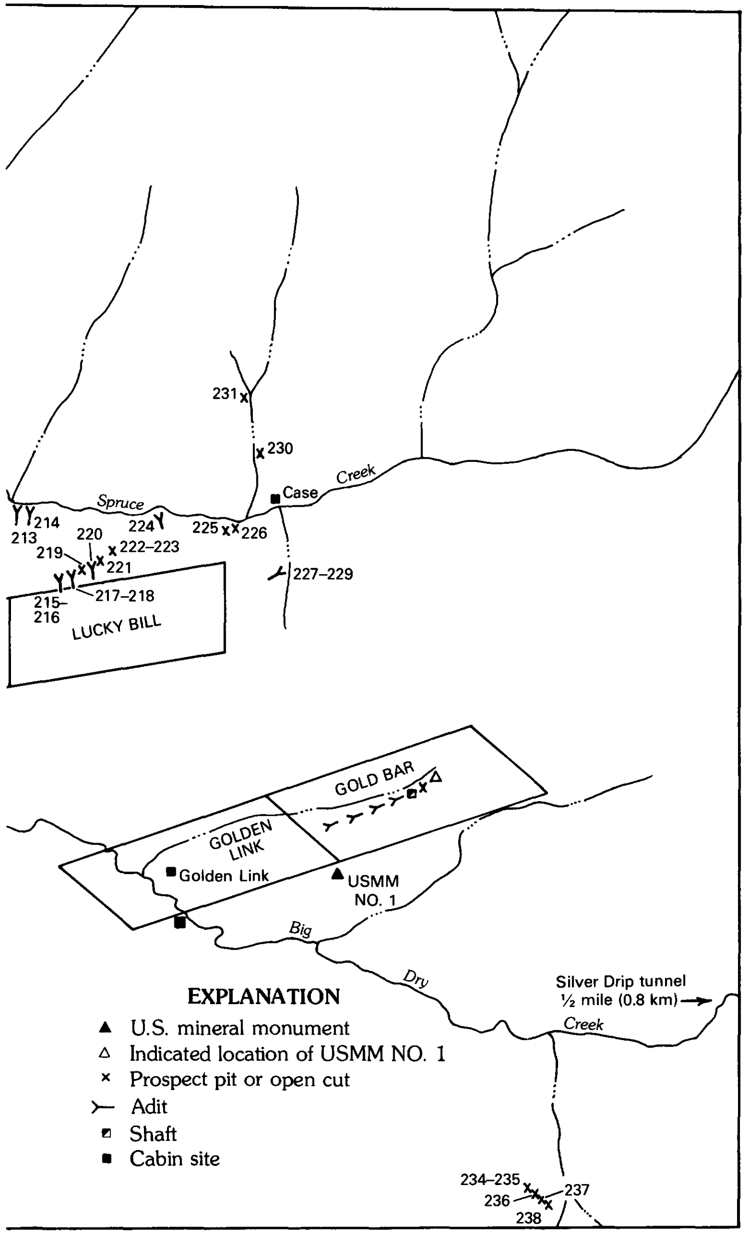


FIGURE 42.— Sketch map from aerial photograph showing sample localities



and patented claims in the Big Dry, Spruce, and Spider Creeks area.

Gorge, and Lucky Bill (fig. 42). At the time of this investigation, the patents were owned by the Frymire estate, Mrs. Ruth Ann McBride of Silver City, executrix. The Golden Link and the Gold Bar patented claims (fig. 42) were owned by the United States Smelting Refining and Mining Co., which did not grant permission to examine the properties. No evidence of workings was found on the Homestake and Lucky Bill claims. One 70-foot (21-m) adit was found on the Quartz No. 2 (fig. 39*H*). Sample 167, taken across a 10-foot (3-m)-wide quartz vein in the face, assayed extremely low values in gold and silver. Four samples (168–171) were taken from a 350-foot (107-m) adit (fig. 39*I*) along a quartz vein on the west side of Spider Creek on the Quartz No. 1 claim. Assay values for gold ranged from 0.02 to 0.11 oz/ton. On the same claim on the east side of Spider Creek, a 100-foot (30-m) adit (fig. 39*J*) follows a quartz vein that is 4–5 feet (1.2–1.5 m) wide. Samples 172–174 across the vein contained low gold and silver values.

Fluorspar-bearing quartz veins are exposed in four caved adits and an open cut near the center of the Mountain View claim (fig. 42). Samples 186–191 were taken across the veins, which have an aggregate width of about 5 feet (1.5 m). Gold values in these samples ranged from 0.01 to 0.08 oz/ton, silver values from 0.13 to 0.43 oz/ton, and fluorite values from 3.50 to 31.81 percent.

The Royal Gorge adits (fig. 43), on the east wall of Spruce Creek Canyon, are the most extensive workings on these patented claims. The lower adit (fig. 39*M*) is a 300-foot (91-m) drift on a 3- to 5-foot (1- to 1.5-m)-wide quartz vein that strikes N. 70° E. The upper adit (fig. 39*N*) is a 300-foot (91-m) drift on a quartz vein as much as 8 feet (2.4 m) wide that strikes N. 75° W. Samples 194–197 were taken in the lower adit, and samples 198–203 from the upper adit. Assay results were 0.01–0.12 oz gold and from traces to 0.61 oz silver per ton.

On the patented claims some of the mine workings had been driven entirely in quartz, and the maximum vein width could not be determined.

A prospect on Spider Creek, about one-half mile (0.8 km) upstream from the Quartz No. 1 claim, was examined, and quartz specimens (sample 175) were collected from a small pit on the west bank of the creek and from a 12-foot (3.6-m) trench on the east bank. Assay values were insignificant.

Samples 176 and 177, of iron-stained brecciated material, were taken from a prospect pit on a tributary of Spider Creek about 1,000 feet (300 m) N. 30° E. of sample locality 175. Gold and silver values were negligible.

Four workings were found at the Kirkpatrick prospect, which is near the forks of Spider Creek about one-half mile (0.8 km) upstream from sample locality 175. The west adit is caved, but the size of the dump

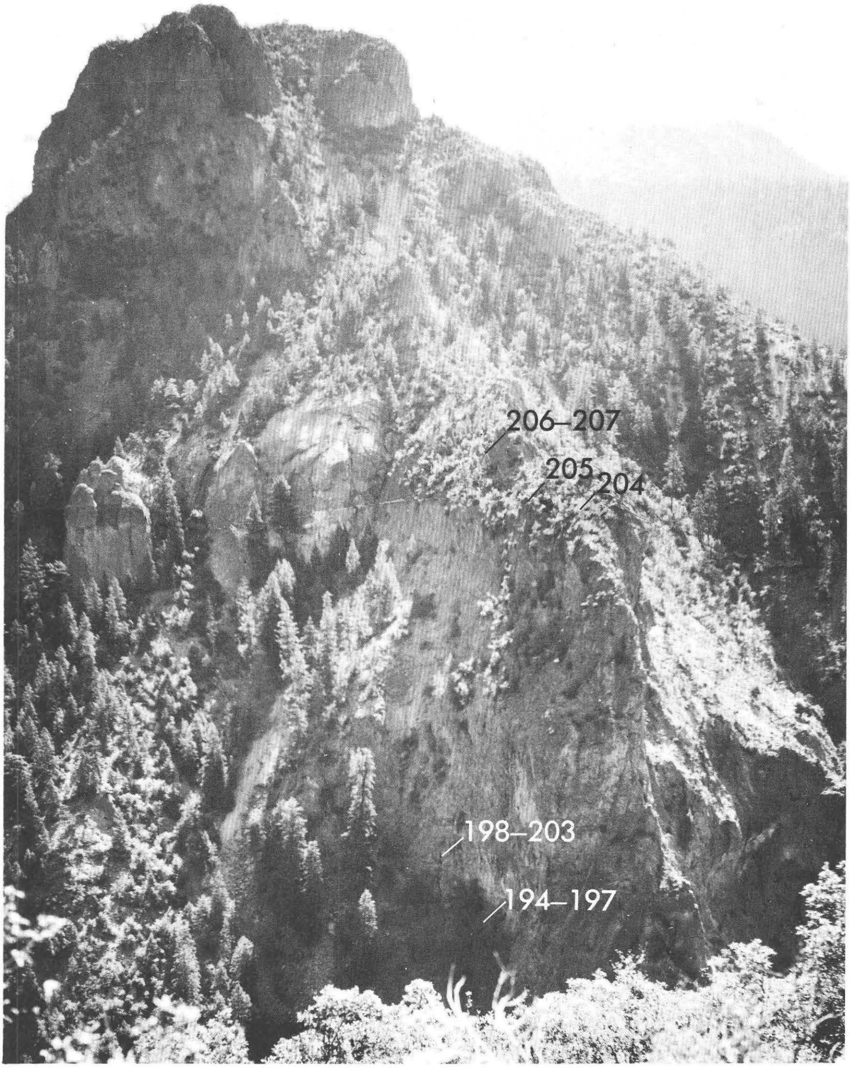


FIGURE 43.—View of the area of the Royal Gorge patented claim on east side of Spruce Creek, looking eastward from USMM No. 2 on ridge west of Spruce Creek. Numbers denote sample sites.

indicates about 200 feet (60 m) of workings. Sample 178 was taken from the dump, and quartz specimens were collected near the caved portal to make up sample 179. This working probably was on the old Captain Ab claim. The other three showings are on the east bank of the creek. The lowest working is a caved shaft where a 1.3-foot (0.4-m)-wide quartz vein is exposed. Sample 180, taken across the vein, assayed 0.31 oz gold per ton. The middle excavation, known as the Gilt Edge (fig. 39*K*), is a 150-foot (4.5-m) adit that was driven S. 50° E. on a 1-foot (0.3-m)-wide vein of quartz (samples 181–184). Above the Gilt Edge adit, a 12- by 4-foot (3.6- by 1.2-m) trench exposes 4 feet (1.2 m) of altered rock (sample 185). Except for 180, samples 178–185 showed only low-grade amounts of gold and silver.

Fourteen prospect sites were examined in the vicinity of Spruce Creek, outside the patented claims area (fig. 42), and are described as follows:

192–193 .... The "86" prospect consists of an adit (fig. 39*L*) that exposes two quartz veins 16 and 10 inches (41 and 25 cm) wide. Samples 192 and 193 were taken from stopes that extended 12 feet (3.6 m) and 5 feet (1.5 m), respectively, above the roof. No significant mineral values were detected in the analyses.

208 .... An adit 6 feet (1.8 m) long was driven east on the Camp Creek fault. Sample 208 assayed minor amounts of gold and silver.

209 .... An excavation on an open fissure, probably the Camp Creek fault, that bears N. 80° E. The walls of the fissure are lined with a crust of calcite and fluorspar. A sample of the material indicated no important mineral occurrences.

210 .... A 6-foot (1.8-m)-wide zone of quartz and fluorspar stringers crops out for 100 feet (30 m) and strikes N. 65° E. A chip sample across the zone assayed negligible gold and silver values.

211 .... A prospect pit 4 feet (1.8 m) square exposes an 8-inch (20-cm)-wide quartz-fluorspar vein that bears N. 85° W. and dips 80° SE. A chip sample across the vein assayed 0.04 oz gold and 0.06 oz silver per ton. A panned sample showed a few gold colors.

212 .... A 20-foot (6-m) trench at this locality bears N. 80° E. Fluorspar, as much as 2 inches (5 cm) thick, lines the walls of the trench. A chip sample of the fluorspar and of a fracture zone in the face of the trench contained no significant metal concentrations.

213–214 .... Two 15-foot (4.5-m) adits about 150 feet (45 m) apart are on the south bank of Spruce Creek. The west adit was driven S. 15° E. on a 1.3-foot (0.4-m) quartzose zone. The east adit bears S. 50° W. on a 4-foot (1.2-m) zone with quartz veins. Assay results of the two samples were negligible.

215–223 .... Six workings occur high on the south slope of Spruce Creek, apparently 100–200 feet (30–60 m) north of the Lucky Bill patented claim. The largest working, the C. O. D. prospect (fig. 39*O*), consists of a 70-foot (21-m) crosscut to a 100-foot (30-m) drift that was driven along a 2-foot (0.6-m) quartz vein that strikes N. 65° E. Samples 215 and 216 were taken across the vein in each face. The second working is an excavation that has exposed a quartz-fluorspar vein 2–3 feet (0.6–0.9 m) wide (samples 217 and 218). The third showing is a filled 10- by 6-foot (3- by 1.8-m) prospect pit; sample 219 was taken from the dump. The fourth working is a 20-foot (6-m) adit that was driven on a 1-foot (0.3-m) fault zone that strikes S. 60° W. and dips 70° NW. Sample 220 was taken across the fault zone. Sample 221 was taken from the small dump of a caved adit. The eastern-most working is a 27-foot (8-m) cut that bears S. 30° W. The cut has exposed a 6-inch (15-cm)-wide fracture zone dipping 70° NW and a 3-foot (1-m)-wide quartz-fluorspar vein (samples 222 and 223, respectively). Values of the eight samples ranged from 0.005 to 0.06 oz gold, and from traces to 0.64 oz silver per ton. Sample 223 contained 23.34 percent fluorite.

224 .... A 20-foot (6-m) adit was driven N. 20° E. along a zone of silicified rock. A chip sample contained only traces of gold and silver.

225 .... A prospect pit on the creek bank was sunk on a 2-foot (0.6-m)-wide quartz vein that strikes N. 80° E. A chip sample of the quartz contained nothing of significant mineral value.

226 .... A 10- by 10-foot (3- by 3-m) pit was sunk to a depth of 10 feet (3 m) in a fracture zone that strikes N. 45° E. A sample taken across the east face of the pit contained traces of gold and silver.

227–229 .... A 70-foot (21-m) adit that bears S. 20° W. is thought to be the Case mine (fig. 39*P*). Samples taken from quartz-fluorspar showings gave no important mineral values.

230 .... A 3-foot (1-m)-wide fracture zone containing quartz and fluorspar is exposed in a pit. The zone strikes N. 75° E. A chip sample contained 27.00 percent fluorite and assayed 0.04 oz gold and 0.37 oz silver per ton.

231 .... A 2-foot (0.6-m)-wide quartz-rich zone, exposed in a cliff face, strikes N. 25° W. A chip sample did not contain significant mineral values.

On Big Dry Creek, at the foot of the trail from Spruce Creek, the inferred southwest extension of the Gold Link fault zone is marked by narrow calcite veins and pyritic and chloritic altered rocks. Traces of gold, silver, and molybdenum are present in samples AGR–637 and 639 from this area (table 5*B*). About one-fourth mile (800 m) above the mouth of Spruce Creek, two workings along an ill-defined portion of this fault zone were examined (fig. 42). Samples 232 and 233 of silicified rock were taken from these small filled pits. Assay values in both samples were almost nil.

Four prospects were examined near the Silver Drip Trail on the headwaters of upper Big Dry Creek (fig. 42) and are described as follows:

234–235 .... An open cut, 20 feet (6 m) long and 10 feet (3 m) wide, exposes a 4-foot (1.2 m) width of breccia that contains a 1-inch (2.5 cm) seam of fault gouge. Sample 234 of the gouge assayed 0.07 oz gold and 0.25 oz silver per ton. Chip sample 235 across the breccia contained 0.20 oz gold and 0.44 oz silver per ton.

236 .... Several quartz stringers bearing N. 25° W. are exposed in a shallow prospect pit. A sample of quartz from the stringers assayed 0.36 oz gold and 0.58 oz silver per ton.

237 .... A shallow 20-foot (6-m)-long trench exposes a number of narrow quartz stringers at this locality. A random chip sample assayed 0.05 oz gold and 0.21 oz silver per ton.

238 .... Low gold and silver values were recorded for a 1-foot (3-m) chip sample taken from a quartz-cemented breccia exposed in a small prospect pit at this site.

Three showings were sampled on prospects known as the Silver Drip Cabin claim and the Silver Drip tunnel. The prospects are within the wilderness in the central part of sec. 3, T. 12 S., R. 18 W., and are described as follows:

239	Near the ruins of Silver Drip cabin, a quartz-cemented breccia zone is exposed in a discovery trench. A random chip sample assayed 0.08 oz gold and 0.38 oz silver per ton.
240–244	The 250-foot (75-m) adit (fig. 48Q) at this locality is the only underground working that was found on the property. The drift has a general bearing of S. 65° W., and it was driven entirely in siliceous vein material. Five chip samples taken across the quartz at various places along the drift assayed 0.01–0.02 oz gold, and 0.07–0.24 oz silver per ton and 5.70–18.60 percent fluorite.
245	The Silver Drip vein is 2 feet (0.6 m) wide in the creek bed below the adit. A chip sample contained 13.90 percent fluorite. About 100 yards (100 m) downgulch from the Silver Drip vein a 2-foot (0.6-m) fault zone with silicified rock and gouge trends east and dips 74° S. Traces of gold and tellurium were found in sample AMZ–213 (pl. 3A, table 5B).

HAYSTACK MOUNTAIN TO UPPER SACATON CREEK

samples 247–283 and 287–288

The Haystack Mountain-upper Sacaton Creek area, in secs. 15, 22, 23, 26, and 27, T. 12 S., R. 18 W., is wholly within the wilderness near its southwestern boundary. Game trails are the only means of access to the area, and travel is extremely difficult.

Forty-one samples from three groups of workings assayed from traces to 0.03 oz gold per ton except for sample 275, which contained 0.20 oz/ton. Twelve samples assayed in excess of 1.00 oz silver per ton, including three of definite economic interest: Nos. 254 (16.46 oz/ton), 259 (23.80 oz/ton), and 260 (11.02 oz/ton). Also, the following seven samples contained more than 1.0 percent copper: Nos. 253 (2.70 percent), 254 (1.77 percent), 258 (28.28 percent), 259 (4.99 percent), 260 (19.06 percent, 263 (2.52 percent), and 265 (1.96 percent). Only one sample (No. 250) contained significant flourite.

Two patented mining claims in the area are owned by A. J. Thompson and R. L. Senn of Socorro, N. Mex. Several tons of copper-silver ore have been produced from these claims. Numerous other claims have been located in the area through the years, but there was no prospecting or mining activity in the area at the time of this investigation.

The Haystack Mountain area is along the southern margin of the Bursum caldera, in a zone of complex intrusion and faulting (pl. 1). The noteworthy gold, silver, and copper values in this area are largely localized in a zone northeast of Haystack Mountain where rhyolitic rocks intruded caldera-fill conglomerate and breccia.

Eight mineralized showings were examined in the vicinity of Haystack Mountain (pl. 1*B*). Workings in this area are identified by sample numbers in the descriptions that follow.

247 .... A grab sample was taken from a dump near a 20-foot (6-m)-long filled trench that is on the southeast slope of Haystack Mountain. Assay results were negligible.

248–249 .... A 70-foot (21-m)-long trench, also on the southeast slopes of Haystack Mountain, has been excavated to a depth of 8 feet (2.4 m) in silicified rock. Samples of development rock contained slight amounts of gold, silver, copper, lead, and zinc.

250–251 .... An 80-foot (24-m)-long cut was excavated on small fluorspar veins that strike N. 45° W. on the Lakeview claim. Sample 250 was taken from two of the veins with widths of 4 and 7 inches (10 and 18 cm). Chip sample 251 was taken across a fracture zone. Except for 79.45 percent fluorite in sample 250, there were no values of consequence.

252–255 .... A caved adit on patented ground was driven S. 15° E. for an undetermined distance. A 2.5-foot (0.8-m) channel sample (252) was cut across a fracture zone at a point 6 feet (1.8 m) inside the adit, and a chip sample (253) was taken from 6 inches (15 cm) of gouge at the same point. At the portal, sample 254 was taken from a 10-inch (25-cm)-wide copper-bearing quartz vein and sample 255 from a 2-inch (5-cm)-wide band of fault gouge. The principal values are 2.70 percent copper contained in sample 253 and 16.46 oz silver per ton plus 1.77 percent copper in sample 254.

256–259 .... At this locality, also on patented ground, a room has been cut into the side of a cliff and a shaft sunk from it. The shaft is caved to within 10 feet (3 m) of the collar. The size of the dump indicates that more than 500 feet (150 m) of underground exploration has been done. Samples were taken from a 3-inch (7.5-cm) seam of fault gouge (256), from several quartz and calcite stringers (257), and from a 1-inch (2.5-cm) seam of fault gouge (258). The principal values from the three samples were 4.23 oz silver per ton and 2.83 percent copper in sample 258. Mineral specimens selected from the dump (sample 259) assayed 23.80 oz silver per ton and 4.99 percent copper. Hand sorting the several hundred tons of material from the dump might yield a few tons of shipping ore.

260 .... On the Big Butte claim, a 25-foot (8-m) adit was driven N. 15° W. along a 1-inch (2.5-cm) veinlet of chalcocite. A sample taken along the veinlet over the length of the drift contained 11.02 oz silver per ton and 19.06 percent copper.

261–264 .... Three prospect pits were found at the base of the bluffs on the north slope of Copper canyon, which is on the northeast side of Haystack Mountain. At one pit, sample 262 was chipped from a 1.5-foot breccia zone and channel sample 261 was taken down the face of the dump. Narrow quartz veins, 6 (15 cm) and 10 inches (25 cm) wide, were sampled (263 and 264) in the other two pits. The only significant value contained in the four samples was 2.52 percent copper (sample 263) from the 6-inch (15 cm) vein.

265 .... A 30-foot (9-m) adit was driven N. 30° W. on narrow quartz stringers. A sample of quartz chipped from the stringers and picked from development rock assayed 3.17 oz silver and 0.03 oz gold per ton, and 1.96 percent copper.

Three workings were sampled on a prospect known as the Lone Star or Alexander mine. The property is a little more than a mile (1.6 km) within the wilderness, in NW ¼ sec. 26, T. 12 S., R. 18 W. Access is by foot from Minton Canyon between Cherry Canyon and Sacaton Creek, across a high ridge that extends south from Sacaton Mountain. The workings are identified by sample numbers in the following descriptions.

267–271 .... The main adit of the property (fig. 39R) was driven N. 35° W. for some 200 feet (60 m) along a fault zone in the porphyritic rhyolite flows of Sacaton Mountain. The fault shows pronounced iron staining and red fault gouge several feet thick at some spots. Collapsed timber and caving ground prevented examination of the two raises, the face, and a winze for a determination of the true vein width. A composite sample (267) was taken of vein quartz from around the two raises. Four chip samples (268–271) were taken across 1- and 2-foot (0.3- and 0.6-m) widths of vein quartz along the drift. Gold and silver values ranged from traces to 0.01 oz/ton and from traces to 1.50 oz/ton, respectively.

266 .... East of the main adit, there is a 37-foot combined trench and caved adit that bears N. 20° W. The working is on a 20-inch (50-cm) fracture zone containing quartz veinlets. A chip sample across the zone contained extremely low amounts of gold and silver.

272 .... A pit above the main adit exposes a 6-foot (1.8-m) fracture zone containing quartz veinlets. Insignificant gold and silver values were contained in a chip sample.

A prospect, known as the Fairview mine and four other workings nearby, is at an elevation of 9,400 feet, about three-fourths of a mile (1.2 km) within the wilderness in SE ¼ sec. 22, T. 12 S., R. 18 W. The workings are identified by sample numbers in the following descriptions.

278–282 .... The Fairview mine is a 150-foot (45-m) adit (fig. 39S) that was driven N. 35° E. on a 3- to 6-inch (7.5–15 cm) quartz vein. Five chip samples were taken across the vein at various places along the drift. Sample 280 contained the highest values: 0.03 oz gold and 1.96 oz silver per ton. Sample 281 contained 1.76 oz silver per ton.

275–277 .... About 150 feet (45 m) southeast of the Fairview portal, a 1-inch (2.5-cm) quartz stringer is exposed in a 35-foot (11-m) vertical cut that was excavated in the cliff face. A 10-inch (25-cm) chip sample (276) was taken from a fracture zone in the upper part of the cut, and samples 275 and 277 were taken from the stringer in the lower part. Assay results follow.

Sample No.	Gold (oz/ton)	Silver (oz/ton)	Width of sample, in feet (cm)
275[1]	0.20	2.90	0.1 (3)
276	.01	2.00	.8 (24)
277	.01	2.80	.2 (6)

[1]Semiquantitative spectrographic analysis of sample 275 showed 70 ppm or approximately 2 oz gold per ton.

273–274 .... On the Fairview No. 2 claim, south of the Fairview No. 1, a 2-inch (5-cm) quartz stringer was sampled in a pit (273) and at an outcrop (274). Gold and silver values were negligible.

283 .... Southwest of the Fairview prospect, a pit 5 feet (1.5 m) deep was sunk on a 6-foot (1.8 m) breccia zone. Copper-stained specimens contained 0.24 percent copper.

287–288 .... A 60-foot (18-m) adit was driven N. 25° W. on fault breccia (fig. 39*T*) along Sacaton Creek. It is in NW¼ sec. 15, T. 12 S., R. 18W., about 1½ miles (2.4 km) north-northwest of the Fairview prospect. A 2.5-foot (0.8 m) chip sample (287) and a 4-foot (1.3-m) chip sample (288) were taken across the back. Significant assay values were 0.78 oz silver per ton in 287, and 0.03 oz gold per ton in 288.

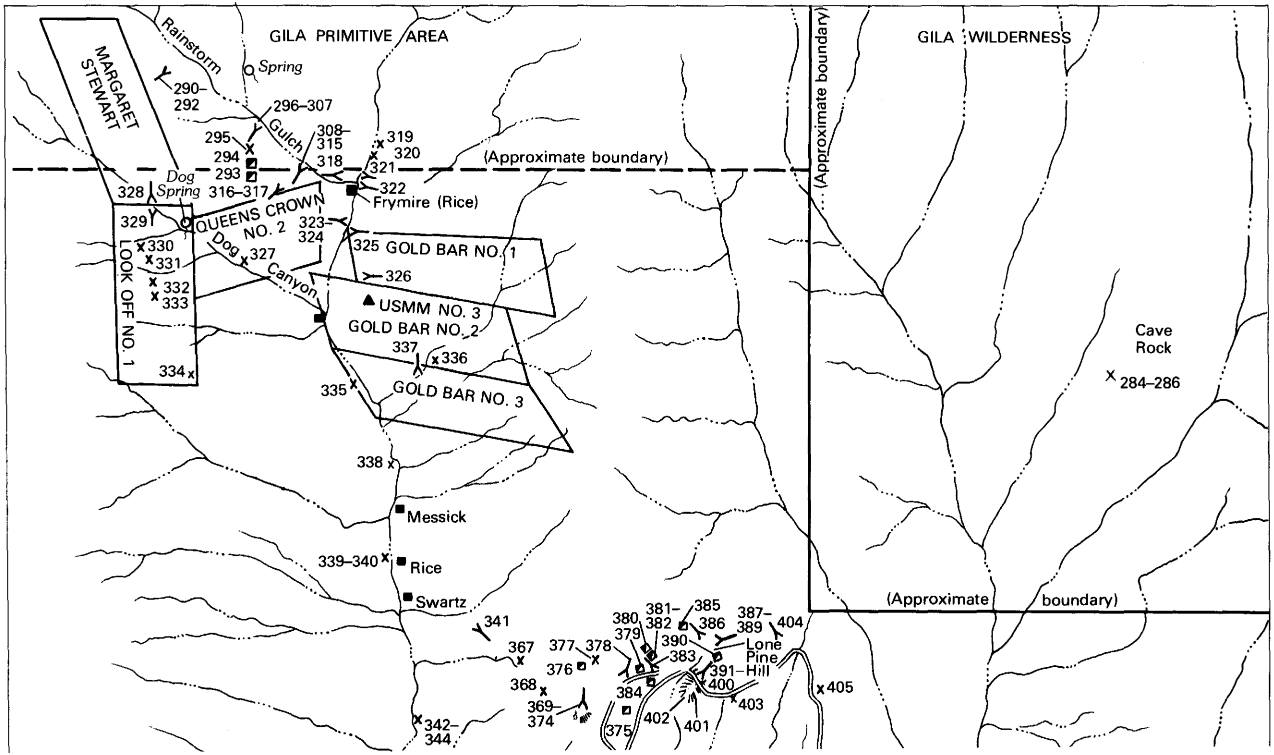
LITTLE DRY, PINE, AND SACATON CREEKS AREA

samples 284–286 and 290–415

Most of the Little Dry, Pine, and Sacaton Creeks area (fig. 44) is just south and west of the wilderness boundary. One working is within the wilderness, and six were examined within tract 7 of the Gila Primitive Area. The area is mainly in secs. 19, 20, 29 and 30, T. 12 S., R. 18 W.

Six patented mining claims and numerous unpatented claims have been located within the area. On existing maps the patented claims are shown to be in the Gila Primitive Area in sec. 17 and in the Gila Wilderness in sec. 8, T. 12 S., R. 18 W. However, errors were made in the original surveys, and all but one of the patented claims (the Margaret Stewart) are actually south of the primitive area in sec. 20. Some maps show two patented millsites adjoining the patented mining claims. The mill sites were never patented, however, and the area is covered by the Maverick and May Apple unpatented mining claims.

The greatest concentration of mineralized structures in the study area, including nearly all the significant occurrences of copper, lead, and zinc, as well as noteworthy gold, silver, tellurium, and molybdenum values, and known fluorspar resources, is located between the rhyolite intrusive centers at Sheridan Mountain and Seventyfour Mountain (pl. 1). This zone of rhyolite intrusions and the associated extensive northwest-trending faults and fractures along the present wilderness boundary compose one of the three or four areas with a major potential for important mineral deposits within the study area, on the basis of surface evidence of mineralization.


GILA PRIMITIVE AREA
GILA WILDERNESS
(Approximate boundary)
(Approximate boundary)
(Approximate boundary)
MARGARET STEWART
Rainstorm Gulch
Spring
Dog Spring
Dog Canyon
QUEENS CROWN NO. 2
LOOK OFF NO. 1
GOLD BAR NO. 1
GOLD BAR NO. 2
GOLD BAR NO. 3
USMM NO. 3
Frymire (Rice)
Messick
Rice
Swartz
Lone Pine Hill
Cave Rock
284–286
290–292
293
294
295
296–307
308–315
316–317
318
319
320
321
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323–324
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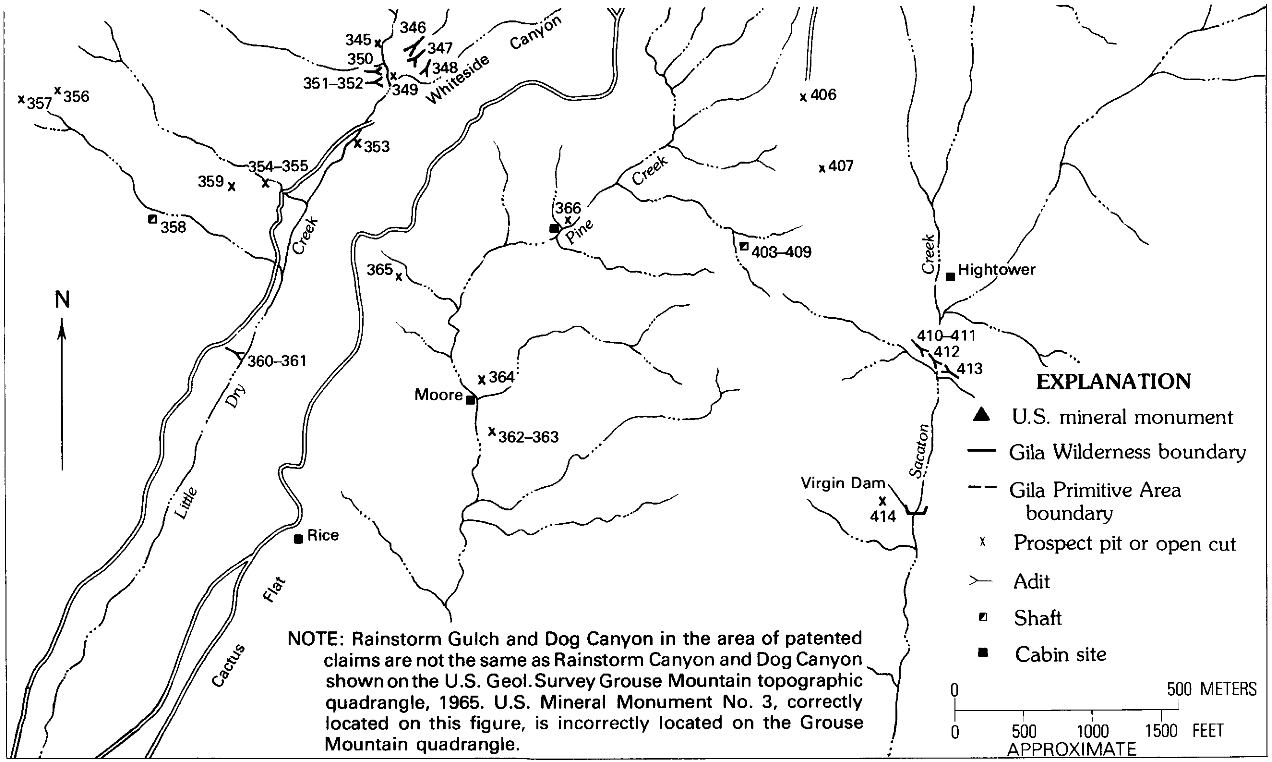


FIGURE 44.—Sketch map from aerial photograph showing sample localities and patented claims in the Little Dry, Pine, and Sacaton Creeks area.

Eighty-five samples were taken from six areas of prospecting activity. Only one of the samples assayed high in gold; a specimen sample (376) from a dump contained 1.28 oz gold per ton. Four samples contained more than 4.00 oz silver per ton: sample 296 (5.68 oz/ton), 297 (4.92 oz/ton), 316 (4.37 oz/ton), and 337 (22.17 oz/ton). The high silver value of sample 337 was from a vein less than 4 inches (10 cm) wide; this sample also contained significant values in copper (2.40 percent), lead (3.72 percent), and zinc (2.40 percent). In the Lone Pine Hill area, four of thirty-seven samples contained more than 1,000 ppm (0.10 percent) tellurium: sample 376 (4,560 ppm), 379 (1,130 ppm), 398 (3,500 ppm), and 402 (2,730 ppm). The only other sample containing high metal values is 335, taken across a 3-inch (7.5-cm) vein; it assayed 2.64 percent lead and 10.10 percent zinc. Eight samples (295, 301, 338, 356, 362, 363, and 414) contained significant fluorite. The only recorded production is a small amount of silver mined in 1941 from the Maverick prospect. At the time of the wilderness investigation, there was no mining activity in the area other than claim assessment work.

Eleven localities were examined in the Rainstorm Gulch area (fig. 44). The workings are identified by sample numbers in the descriptions that follow:

290–292 .... The Upper New Eureka prospect, within tract 7 of the Gila Primitive Area, (fig. 40*D*) is developed by a split-level adit that was driven 40 feet (12 m) N. 70° W. along a quartz vein 8–18 inches (20–50 cm) wide. The highest values obtained on assay of three chip samples were 0.02 oz gold and 0.44 oz silver per ton.

293–307 .... The main workings of the prospect known as the Lower New Eureka mine are shown on figure 40E. Twelve chip samples were taken at various places across quartz veins, quartz-fluorspar veins, fracture zones, and gouge seams 4 inches (10 cm) to 3 feet (1 m) wide. The highest metal values are from the New Eureka adit: 5.68 oz silver per ton in sample 296 (width of 1.2 ft (0.4 m)), and 4.92 oz silver and 0.08 oz gold per ton in sample 297 (width of 6 in. (15 cm)). Samples 299, 303, 305, and 306, also from the adit, assayed from 0.92 to 1.99 oz silver per ton. On the slope above the New Eureka adit are two caved shafts. Sample 293 from the dump of the south shaft assayed 0.02 oz gold and 1.4 oz silver per ton. Sample 294 was taken across a 2.5-foot (0.8-m) vein that is exposed on the rim of the north shaft. About 50 feet (15 m) north of the north shaft a 4-foot (1.3-m) chip sample (295) across quartz-fluorspar veinlets contained 33.27 percent fluorite.

308–315 .... At the Regal prospect (fig. 40*F*) a 220-foot (66-m) adit that bears N. 45° W. connects with a 120-foot (36-m) crosscut. The property evidently is just south of the Gila Primitive Area boundary. Eight chip samples were taken across narrow (1 foot (0.3 m) or less wide) shear zones, zones of quartz-fluorspar veinlets, and gouge seams. Gold values range from traces to 0.01 oz/ton, and silver values from 0.06 to 0.35 oz/ton. A 3-foot (1-m) chip sample (308) contained 38.57 percent fluorite. According to the claimant, the adit had been driven to cut mineralized rock cropping out on the hillside above.

316–317 .... Above and southwest of the Regal portal, a 25-foot (7.5-m) adit was driven S. 60° W. on a 3-foot (1-m) breccia zone containing quartz stringers. Of the two chip samples taken, sample 316 contained 4.37 oz silver per ton.

318 .... Near the mouth of Rainstorm Gulch just south of the primitive area boundary, a 15-foot (4.5-m) adit was driven N. 40° W. on a 3-foot (1-m) shear zone. A sample across the zone yielded traces of gold and silver.

319–320 .... Two shallow prospect pits are located just inside the primitive area on the east bank of Little Dry Creek. The pits expose a 4- to 6-inch (10- to 15-cm) quartz vein that bears N. 60° E. and dips 80° SE. Two chip samples gave assay values of no significance.

321 .... A 15-foot (4.5-m) adit was driven S. 55° E. on a 2-inch (5-cm) quartz stringer approximately on the primitive area boundary. A 3-foot (1-m) chip sample across the face assayed negligible values, except for minor zinc.

322 .... A 125-foot (38-m) adit was driven S. 35° E. (fig. 38*J*) a short distance south of the primitive area, probably on the Maverick prospect. The workings were partially caved and were in a dangerous condition. A sample of loose material from the floor of the drift gave very low assay values for gold and silver. Manganese assayed 2.80 percent.

Sixteen prospects and mine workings were examined in the Dog Canyon–upper Little Dry Creek area (fig. 44). In the descriptions that follow, the workings are identified by sample numbers.

323–324 .... On the west bank of Little Dry Creek, downstream from Rainstorm Gulch, a 10-foot (3-m) adit bears N. 70° W. and is thought to be the May Apple prospect. Chip samples were taken across a loosely cemented 2.6.foot (0.9-m) wide breccia in the face and across a 1.7 foot (0.5.m) thick calcite lens on the left side of the portal. Assays showed very low gold values and traces of silver.

325–326 .... Two short adits near the west end of the Gold Bar No. 1 patented claim cut a number of quartz veinlets that assayed very low gold and silver values. The adit nearest the northwest corner of the claim is about 25 feet (8 m) long and bears S. 70° E.; the second adit (fig 38*K*), about 400 feet (120 m) southeast of the first and about 300 feet (100 m) above Little Dry Creek, is about 90 feet (27 m) long and bears N. 80° E. About 100 yards (meters) southwest of the second adit, an iron-stained fracture zone as much as 14 inches (35 cm) wide trends N. 45° E. and dips 70° NW. A 5-foot (1.5-m) prospect adit was dug where a 6-inch (15-cm) iron-stained breccia contains fluorspar and sulfides. Copper, lead, and traces of other metals are shown in sample AMZ–233 (pl. 3*A*, table 5*B*).

327 .... Approximately 800 feet (250 m) up Dog Canyon, on the Queens Crown No. 2 patented claim, a 10-foot (3-m) prospect exposes a north-trending quartz vein 6 inches (15 cm) wide. A chip sample across the vein contained negligible values.

328 .... A 20-foot (6-m) adit, driven north from Dog Canyon, is the only working found on the Margaret Stewart patented claim. A 4-foot (1.3-m) chip sample taken across several quartz stringers in the face did not contain significant mineral values.

329–334 .... Six workings were sampled on the Look Off No. 1 patented claim. A caved adit, probably the discovery working, was driven south from Dog Canyon. Sample 329 was taken near the portal across a 2-foot (1.3-m) fracture zone that contains quartz veins and stringers. On the slope above the adit, four prospect pits expose a quartz vein 1.2–4.0 feet (0.4–1.3 m) wide. Four chip samples (330–333) were taken from the veins. In the southeast corner of the claim, sample 334 was taken across 4 feet (1.3 m) of altered volcanic rock that is exposed in a shallow pit. Assay values of the six samples ranged from traces to 0.03 oz gold and from traces to 1.01 oz silver per ton.

335–337 .... Two adits were examined on the Gold Bar No. 3 patented claim. On the west bank of Little Dry Creek, a 10-foot (3-m) adit was driven on a 3-inch (7.5-cm) mineralized quartz vein that strikes S.70° W. and dips 60° SE. Sample 335 of the mineralized material contained 10.10 percent zinc, 2.64 percent lead, 0.84 oz silver per ton, and 0.05 percent molybdenum. The deposit would not be economically minable because of the narrow width of the vein. Near the central part of the northern boundary of the claim, a 40-foot (12-m) adit (fig. 38*L*) was driven north to crosscut a 1- to 4-inch (2.5. to 10-cm) wide mineralized quartz stringer. Sample 337 of the mineralized material contained 0.07 oz gold and 22.17 oz silver per ton; 2.40 percent copper, 3.72 percent lead, and 2.40 percent zinc. The values have little direct significance for mining in view of the very narrow width of the vein. A crosscut from the adit was timbered shut; no estimate could be made of the extent of workings behind the timber. About 150 feet (45 m) east of the Gold Bar No. 3 prospect, a cut was excavated on a 4-foot (1.3-m) siliceous zone containing numerous quartz stringers. The working is the only one that was found on the Gold Bar No. 2 patented claim. The strike of the zone is N. 80° E., and it dips 70° N. Sample 336 contained very low values of gold, silver, copper, lead, and zinc.

338–340 .... Two prospect pits were sampled south of the Gold Bar No. 3 claim. Sample 338, across a quartz-fluorspar showing in one pit, contained 22.12 percent fluorite. Samples 339–340, across 2 and 3.5 feet, (0.6 and 1.2 m) of altered volcanic rock in the other pit, were virtually barren.

Prospects and small mine workings that were examined in the lower Little Dry Creek area below Swartz cabin (fig. 44) are identified by sample numbers in the descriptions that follow:

342–344 .... The Rice prospect, a pit in the bank of Little Dry Creek, is located about 1,000 feet (300 m) downstream from Swartz cabin. The three varieties of altered volcanic rock sampled did not show economic mineralization.

345 .... About 500 feet (150 m) downstream from the Rice prospect, the trail crosses the caved part of an old adit on the west bank of

Little Dry Creek. A 6-foot (1.8-m) chip sample of altered rock was taken near the adit. Assay results were negligible.

346–349 .... Three adits were driven in intensely altered gossanlike rock along the north side of lower Whiteside Canyon. Sample 346 was taken across the face of a 40-foot (12-m) adit that bears N. 75° E. Sample 347 was taken across the back of another adit that extends N. 75° E. along the edge of a rhyolite dike. Sample 348 was chipped from along the wall of the Good Hope adit (fig. 38*N*). Sample 349 was collected from loose altered rock at the mouth of Whiteside Canyon. Gold values of the four samples ranged from traces to 0.04 oz/ton and silver values from traces to 0.22 oz/ton.

350–352 .... The Little Dry Creek trail crosses the dump of one of two short adits opposite the mouth of Whiteside Canyon. The Harvest prospect (fig. 38*O*) was driven 30 feet (9 m) N. 45° W. in altered rock containing disseminated pyrite. Sample 350 was taken across the back. The Reward prospect (fig. 38*P*) is a partially caved working that was driven in a fault zone containing disseminated pyrite. Sample 351 was taken across the face, and sample 352 was taken from a muck pile within the working. The highest assay values were 0.14 percent molybdenum in sample 350 and 0.10 percent copper in sample 352.

353 .... A chip sample was taken across 4 feet (1.3 m) of strongly pyritized rock in a prospect pit 1,000 feet (300 m) south of the mouth of Whiteside Canyon. Assay results were insignificant.

354–359 .... Five workings were found above the road on the west slope of Little Dry Creek and on top of the divide between Little Dry Creek and Red Hair Canyon to the west. A 3-foot (1-m) chip sample (354) and a grab sample (355) were taken at a 35-foot (11.5-m) cut where iron-stained rock is exposed. A 12-foot (4-m) silicified zone exposed in a shallow trench contains numerous fluorspar veinlets that assayed 59.08 percent fluorite (sample 356). Sample 357, from the walls of an adjacent pit, gave low silver and gold values. Secondary copper minerals were noted coating the fracture surfaces of altered rhyolite in the area. Sample 358—which consists of andesite with coatings of malachite, azurite, and chrysocolla from the dump of a small caved shaft, probably the Copper Glance—assayed 10.25 percent copper. There is probably less than one-half ton of such material on the dump. Chip sample 359, from altered rock in a small pit northeast of the shaft, contained no significant metal values.

360–361 .... The southermost working that was examined on Little Dry Creek is a 20-foot (6-m) adit (fig. 38*Q*) with a west bearing. Sample 360 was chipped for 3 feet (1 m) across an exposure of volcanic glass, and 361 was cut from a shear zone near the portal of the adit. Assay results were negligible.

Several prospects were examined along the headwaters of Pine Creek in SE ¼ sec. 29, T. 12 S., R. 18 W. The area investigated is about one-half mile (800 m) southwest of the wilderness boundary, and can be reached by a truck road that crosses the Burrell ranch and ends at Moore Cabin. Workings are identified by sample numbers (fig. 44).

362–363 .... According to Rothrock and others (1946, p. 48), 9 tons of fluorspar have been shipped from the prospect known as the Blue Rock mine, which is claimed by J. F. Moore of Gila, N. Mex. The working is a 35-foot (10.5-m) trench that bears N. 70° E. Chip samples 362 and 363 were taken across a 6-foot (1.8-m) quartz-fluorspar vein and an adjacent 7-foot (2-m) brecciated zone. The samples assayed 30.94 and 49.91 percent fluorite, respectively.

364 .... A 4-foot (1.2-m) random chip sample, taken across the structure to test for minerals other than fluorite, showed no significant metal concentrations.

365 .... A 1.2-foot (30-cm) pyrite-bearing quartz vein striking N. 25° W. is exposed in a small prospect pit. A chip sample across the vein contained very low gold and silver values.

366 .... Negligible gold and silver values were obtained from a 2-foot (0.6-m) chip sample of altered rock that is exposed in a small pit at this locality.

408–409 .... An 8-inch (20-cm) seam of fault gouge striking S. 55° E. is exposed in a 10-foot (3-m) prospect shaft. Sample 408 was taken of the gouge, and sample 409 was chipped across 2 feet (0.6 m) of altered volcanic rock near the fault zone. Assay values were not significant.

The Lone Pine Hill area (fig. 44, 45) is at the head of Pine Creek about one-fourth mile (400 m) southwest of the wilderness boundary. Most of the workings are in NE ¼ sec. 29, T. 12 S., R. 18 W. A rough, steep road on the ridge between Little Dry and Pine Creeks extends to the workings.

John Lambert and Dan Lannon discovered tellurium in the district in September 1889, and recorded the Tellurium claim in 1893. Over the years, claims in the area have been relocated under various names. Most of the area is now claimed by Lee Rice of Oracle, Ariz.

Ballmer (1932) reported that native tellurium occurs in small irregular, ovoid bodies; the maximum size reported was 18mm long and 8mm wide. Native gold, pyrite, and bismuthinite accompany the tellurium. Crawford (1937) reported that the ore mineral was a mixture of tellurium and bismuthinite.

Production from the area has been about 5 tons of tellurium ore which contained some gold (Everett, 1964, p. 13). Workings and prospects are identified by sample numbers in the description that follows:

341 .... On the south slope of an east tributary to Little Dry Creek, a 25-foot (8-m) adit (fig. 38*M*) was driven S. 25° E. on a zone of pyritized rock. A 3-foot (1-m) chip sample across the face assayed insignificant gold and silver values.

367 .... A chip sample from a shallow pit in iron-stained rock in the western part of the Lone Pine area yielded very low gold and silver values.

368 .... A chip sample from a 6-foot (1.8-m) pit in a fracture zone showing specular hematite gave no significant metal values.

369–374 .... The Yellow Peril or Stirrup prospect consists of 300 feet (100 m) of adit (fig. 38*R*) that was driven in a general northerly direction in intrusive rhyolite. Samples 369–373 were chipped from various fractures and alteration zones in the working. Sample 374 was taken from the dump. The highest value obtained was 10 ppm tellurium. Aluminum sulfate as much as several inches thick crusts part of the walls.

375 .... A 30-foot (9-m) shaft was sunk on a highly silicified outcrop resembling jasperoid and containing numerous quartz stringers. A sample from the dump contained 131 ppm tellurium.

376 .... A selected specimen sample from the dump of a 40-foot (12-m) shaft contained 1.28 oz gold per ton and 4,560 ppm tellurium. This is the third highest gold value and the highest tellurium value obtained in the wilderness investigation.

377–379 .... Three small prospects were sampled a short distance east of sample 376. A 10-foot (3-m) shallow caved cut exposes 6 inches (15 cm) of a quartz vein across which sample 377 was chipped. Sample 378 was taken across several quartz veinlets in the face of a 50-foot (15-m) adit at the Gold Telluride prospect (fig. 38*S*). Sample 379 was from the dump of an inaccessible 25-foot (7.5-m) shaft and from mineralized rock around the portal of a flooded adit connecting with the shaft. Tellurium values were 9.5 ppm, 5 ppm, and 1,130 ppm in samples 377, 378, and 379, respectively.

380–384 .... A caved adit and three shafts were dug on what probably was the original Tellurium property (fig. 46). Sample 380 was from the dump of the topmost shaft, which is about 20 feet (6 m) deep. Sample 381 and specimen sample 382 were taken from the dump of a second shaft, which is just above the adit. The size of the dump at the caved adit represents several hundred feet (a few hundred meters) of underground workings; sample 383 was a grab from this dump. Sample 384 was taken from the dump of a third shaft, which is more than 100 feet (30 m) deep. Assay values for gold and silver were negligible except for sample 380 which yielded 0.22 oz gold and 0.52 oz silver per ton. Tellurium values were 15 ppm, 80 ppm, 134 ppm, 7.5 ppm, and nil, respectively. Molybdenum assays (footnotes, table 7) were 0.04 and 0.06 percent in samples 381 and 382, respectively.

385–386 .... Sample 385 was taken across a 3-foot (1-m) shear zone at the collar of a caved shaft, and sample 386 was taken from the small dump of a caved adit. Assay results were of no significance.

387–402 .... The Lone Pine tellurium mine consists of an upper adit (fig. 38*T*), a lower adit (fig 38*U*), and two lower levels (the 45-foot (13.5-m) and 160-foot (48-m) levels) that were inaccessible at the time of the investigation. A small tonnage of gold ore was supposedly shipped from the property in the 1930's, and about 3 tons of high-grade tellurium ore was recovered during shaft sinking; in 1961, 2 tons of tellurium ore was recovered during scavenging work in the shaft (Everett, 1964, p. 13, 14). Minnesota Mining & Manufacturing Co. did some drilling on the property in 1961–62 to test its potential as a tellurium producer, but only spotty showings of native tellurium were found. Drilling data were not made available to the Bureau of Mines, but hole loca-

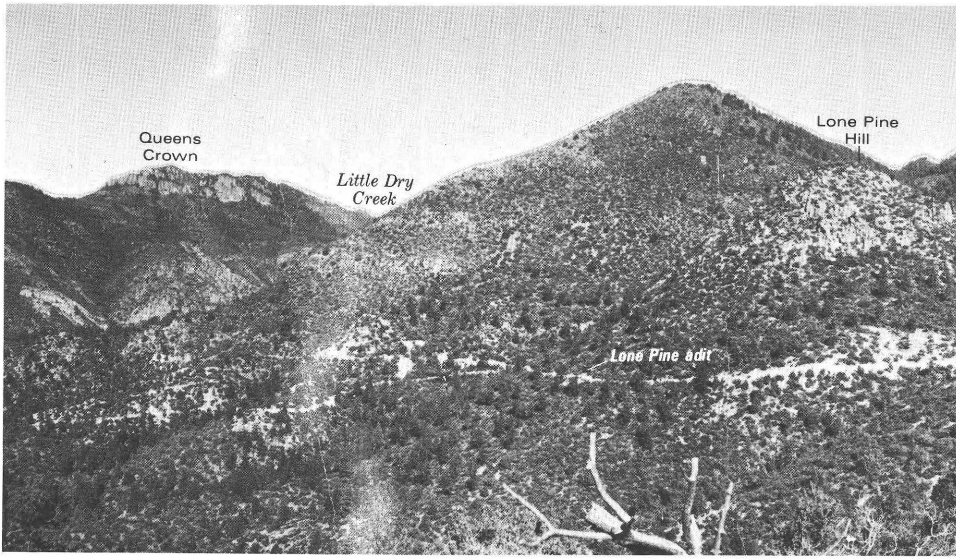


FIGURE 45.—Panoramic view of the Lone Pine mine area. West Baldy and view to west and in front of Cave Rock probably

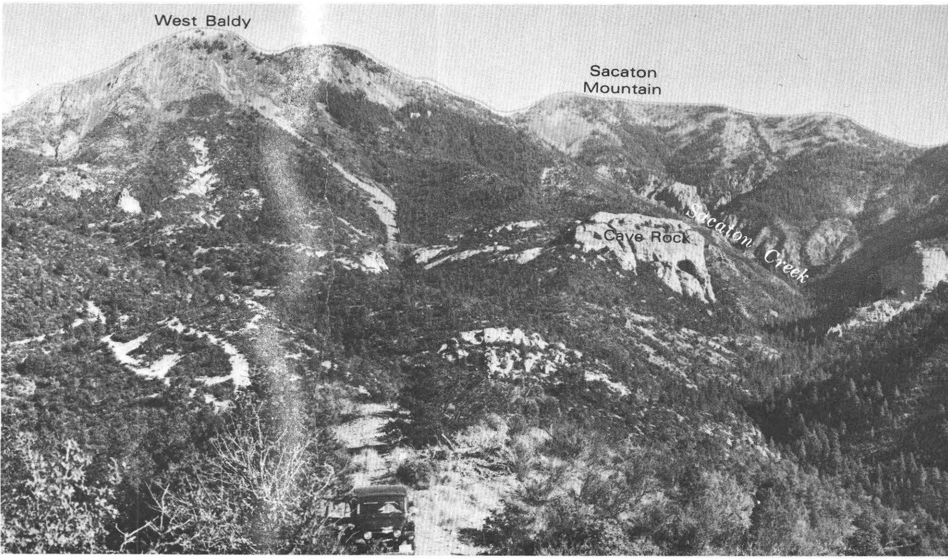
tions are shown in Everett's report. Chip samples 387–389, taken across quartz veins in the upper adit, assayed negligible values. Samples 391–400 were taken at various places in the lower adit, and sample 401 and a selected sample (402) were taken from its dump. The samples with significant metal values follow:

Sample No.	Gold (oz/ton)	Copper (percent)	Tellurium (ppm)	Width, in feet(m)
395	--	--	99	3.5 (1.1)
396	--	--	244	3.0 (.9)
397	0.03	--	620	1.0 (.3)
398	.80	--	3,500	2.0 (.6)
401	.04	--	--	-- --
402	.20	0.14	2,730	-- --

The mineralized fractures and discontinuous shears in the Lone Pine mine appear to be within rhyolite intrusive rock (fig. 38*U*).

403–405 .... Three other workings were sampled in the vicinity of the Lone Pine mine. Sample 403 was a grab from a small dump. Sample 404 was a 3-foot (1 m) chip sample from the face of a 20-foot (6-m) adit that has been driven N. 5° E. along a fault zone containing quartz stringers. Sample 405 was a chip from a fault zone that is exposed in a 10-foot (3-m) trench. Assay results were of no consequence, except for 118 ppm tellurium in sample 404.

406–407 .... Samples 406 and 407 were taken from the dumps of two prospect pits southeast of the Lone Pine mine. The only significant values



Sacaton Mountain are on the resurgent dome of the Bursum caldera; rest of is all within the moat area of the resurgent caldera.

were 7.77 percent manganese and 0.26 percent copper in sample 406.

284–286 .... The Cave Rock claims are about 1,500 feet (450 m) south of Cave Rock, a prominent feature between the forks of upper Sacaton Creek (fig. 45). An L-shaped cut was found about 2,000 feet (600 m) inside the wilderness. Assay values from samples of quartz vein, altered rock, and the dump were negligible.

410–413 .... Three prospects examined along Sacaton Creek, south of the wilderness boundary, include a 30-foot (9-m) adit on a fault or shear along a rhyolite dike that strikes N. 50° W. (samples 410, 411), a 70-foot (21-m) adit bearing northwest, and a 75-foot (23-m) adit bearing southeast, all of which may be on the same structure as the rhyolite dike. Quartz veinlets and a fractured quartz vein from the two adits (412, 413) did not contain significant metal values (fig. 38*V*). However, these are apparently the main workings of the Sacaton mine described by Williams (1966, p. 17) and Rothrock, Johnson, and Hahn (1946, p. 47–48). Rothrock estimated that about 400 tons of 50–55 percent fluorspar had been produced from fluorspar veins in the Sacaton area prior to 1943.

414 .... An open cut 150 feet (45 m) long exposes two 6-inch (1.5-cm) fluorspar veins that strike N. 35° W. A sample across 18 inches (45 cm) of the vein zone contained 76–77 percent fluorite. This may be one of the Sacaton fluorspar workings described by Rothrock, Johnson, and Hahn (1946).

415 .... A sample from a shallow caved shaft 100 feet (30 m) west of Virgin dam contained only trace metal values.

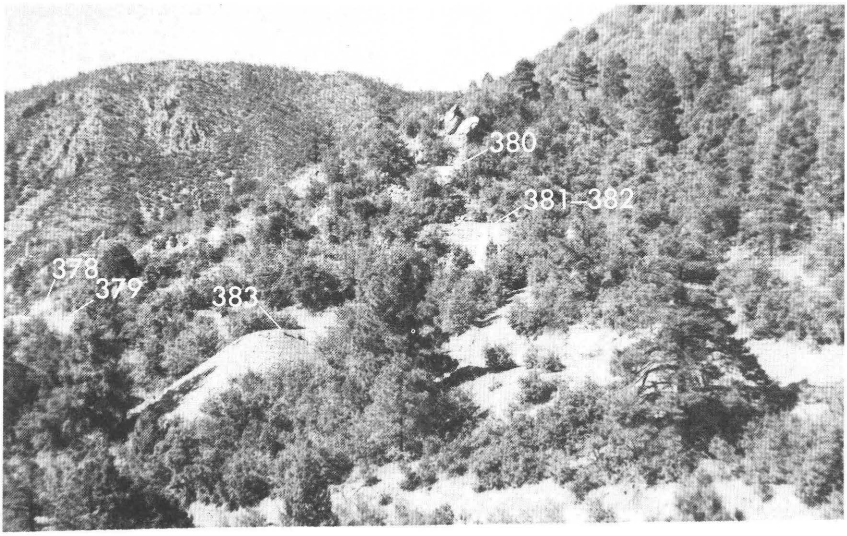


FIGURE 46.—Dumps of Telluride group of claims, Lone Pine Hill area. Numbers denote sample localities. View northwest from Lone Pine tunnel.

SACATON CREEK TO SEVENTYFOUR MOUNTAIN

samples 416–471

An area about 1 mile (1.6 km) wide that extends for about 6 miles (10 km) southeast from Sacaton Creek to Seventyfour Mountain includes many small fluorspar mines and metal prospects. Fifty-six samples were collected in this area. The most significant metal values and fluorspar occurrences are summarized below.

Sample No.	Gold (oz/ton)	Silver (oz/ton)	Copper (percent)	Lead (percent)	Width (ft)
421	0.01	0.49	1.47	0.46	1.5
424	.01	Trace	1.26	.04	4.0
425	.03	.21	.18	.02	.8
426	.03	.41	6.68	.92	(1)
427	.01	Trace	2.20	.04	(1)
428	.01	.33	4.40	.08	(1)
429	Trace	.34	.98	.08	3.0
431	.01	Trace	.28	.06	4.0
432	1.36	.10	8.82	1.04	.3
433	.04	3.66	7.05	.06	3.0
434	.01	Trace	1.17	.04	(1)
437	.03	Trace	----	----	4.0
439	.12	.36	.04	.22	4.0

[1]Selected grab sample.

The following samples contained flourite in excess of 20 percent:

Sample No.	Flourite (percent)	Width (ft)
Outside the wilderness		
416	58.73	3.0
417	40.39	8.0
418	26.39	5.0
419	38.35	Grab
422	49.06	4.0
423	57.26	1.0
437	23.87	4.0
454	21.07	3.1
457	70.28	3.0
458	27.65	2.0
459	50.96	—
461	95.20	—
462	29.75	.7
Inside the wilderness		
463	88.90	7.0
464	72.38	—
465	97.16	.7
467	48.44	1.2
468	79.38	2.2
469	56.77	2.5

Six areas of mining or prospecting activity were examined near Minton Canyon between Sacaton Creek and Cherry Canyon (pl. 1*B*). Only one of the workings (sample 427) is within the wilderness. These areas are identified by sample numbers in the following descriptions.

416–419 .... These workings are probably on the Wytcherly prospect described by Williams (1966, p. 18) who reported that 512 tons of fluorspar were mined in 1939 and 10 tons in 1942. The main working is a 350-foot (105-m) trench that exposes a fluorspar vein as much as 8 feet (2.4 m) wide (samples 417–419). North of the main trench, a 3-foot (1-m) fluorspar vein (316) is exposed in a 60-foot (18-m) cut. Fluorite assays ranged from 26.39 to 58.73 percent.

420–422 .... The Silver Dollar prospect consists of a 70-foot (21-m) adit (fig. 38*W*) and two open cuts. One of the cuts and the adit are on a fracture zone 2½–3 feet (1 m) wide that strikes N. 45° W. and 75°–80° NE. and cuts epidotized andesitic rocks. The zone pinches out to the northwest and was not seen beyond the adjacent gulch. Sample 420 was taken from the quartz, calcite, and fluorspar stringers exposed in the adit. About 100 feet (30 m) above the adit, a 20-foot (6-m) open cut shows copper minerals (principally malachite) on one of the walls. A random chip sample of material next to the wall and specimens from the dump were combined to make up sample 421, which contained noteworthy values in copper and lead. The third working is a 50-foot (15-m) cut that exposes a fluorspar vein 1–4 feet

(0.3–1.3 m) wide (sample 422). About one-fourth mile (400 m) above the Silver Dollar prospect the gulch bends sharply along a brecciated fault zone as much as 8 feet (2.4 m) wide, which trends about N. 10° W. and dips 65° SW. Veinlets of fluorite 1–2 inches (2.5–5 cm) wide occur along the fracture zone and cross fractures contain fluorite veins as much as 8 inches (20 cm) wide. No evidence was seen to indicate that this area had been staked or prospected.

423 .... The Hightower, Jr., prospect is a 40-foot (12-m) trench along a 6-foot (1.8-m) fracture zone that strikes northwest. The zone contains abundant fluorspar. Williams (1966, p. 18) reported no production.

424–426 .... The Minton, or Deadman, prospect consists of a shaft of unknown depth and a 150-foot (45-m) adit that is partially caved 30 feet (9 m) from the portal (fig. 38*X*). Samples from the dump, a cross fault near the face, and muck from the caved part of the adit contained noteworthy values in copper and lead and minor gold.

427 .... About one-fourth mile (400 m) east of the Minton prospect and just within the wilderness, a 75-foot (23-m) shaft, now inaccessible, was sunk on a 3-foot (1-m) copper-bearing quartz vein that strikes N. 29° W. and dips 80° NE.

428–429 .... Three workings were sampled on the Foster prospect, just south of the wilderness boundary. Specimen sample 428 was taken from the dump of an inaccessible shaft that had been sunk on a 6-foot (1.8-m) fracture zone having a N. 10° W. strike. In addition to copper and other metals the sample contained 500 ppm molybdenum

Six prospect sites, identified by sample numbers in the following descriptions, were examined on Foster Mountain at the head of Cherry Canyon (pl. 3). All the prospects are just outside the wilderness in sec. 3, T. 13 S., R. 18 W. Access is by horse or foot from a truck road that ends at the lower part of the canyon.

430 .... A sample from the dump of a small caved shaft on the ridge between Minton and Cherry Canyons contained no significant values.

431–435 .... The main workings of the Margie Ann mine (fig. 38*Y*) consist of a northwest-trending adit 150 feet (45 m) long, a 60-foot (18-m) winze that was sunk from the adit, two exploration levels of unknown extent that were driven from the winze, and a small stoped area. This may be the Tennessee mine referred to on claim locations recorded in the late 1800's. Sample 431 was taken across altered rock in the face of the adit, and sample 432 was from a high-grade copper-bearing quartz vein exposed along the east wall of the adit. Sample 433 was taken across a small lens containing copper, silver, and gold, which is exposed above the winze.

An inaccessible shaft on the slope below the Margie Ann workings is estimated to be 70 feet (21 m) deep. Sample 434, from the dump, contained some copper. Sample 435 was taken from some quartz-fluorspar veins (as much as 12 inches (30 cm) wide) that crop out in the arroyo wall above the forks of Cherry Canyon. A small dump was noted, but floods had destroyed any mine workings. Assay results showed only small amounts of fluorite.

436 .... A small pit on the east side of the arroyo bottom exposes 2 feet (0.6 m) of silicified material containing fluorspar.

437 .... A 4-foot (1.3-cm) fluorspar-bearing fracture zone, at the forks of Cherry Canyon, strikes N. 45° W.

438 .... In the first drainage west of Cherry Canyon, an L-shaped excavation exposes clay containing very narrow quartz stringers. Quartz chipped from the stringers assayed traces of gold and silver.

439–447 .... The workings on lower Cherry Canyon are thought to be on the Columbus group of claims. The main working is a 200-foot (60-m) adit that was driven in a general southeast direction along the hanging wall contact of a rhyolite dike that dips about 70° SW. (fig. 38Z). Samples 441–446 were taken across quartz veins and fractures 4 inches (10 cm) to 2 feet (0.6 m) wide in the adit. No significant metal values were detected. Fragments of altered rock (sample 447) were taken from a 15-foot (4.5-m) adit above the main adit; assay results were negligible.

On the Chance claim, west of the Columbus adit, a 30-foot (9-m) trench was dug in the canyon wall. Sample 439, across 1.3 feet (0.4 m) of vein quartz exposed in the trench, contained noteworthy gold and silver values, but sample 440, from the dump, had only minor metal values.

Several prospects, identified by sample numbers in the following descriptions, were examined on the mountain slopes north of the Sacaton landing strip on Rain Creek Mesa. Three of the workings (samples 448–450) are about one-fourth mile (400 m) within the wilderness; the others are south of the wilderness boundary. The workings are reached by trails from the east end of the landing strip.

448–449 .... These showings are on a peak 1 mile (1.6 km) north of the east end of the landing strip. Random chip samples 448 and 449 were taken from what appears to be a gossan and from a zone of silicified rock. Extremely low gold and silver values were found in the samples.

450–456 .... Seven prospects were examined along a southeast-trending fault(?) and rhyolite dike system north of the landing strip. The western workings are at the head of each of three small gulches. In the west gulch, a 3-foot (1-m) quartz vein exposed in a 20-foot (6-m) trench and a 1.3-foot (0.4-m) quartz vein in a small pit were sampled (450–451). In the middle gulch a selected sample (452) of loose material was taken from two small cuts in an 8-foot (2.4-m) fracture zone. Sample 453 was taken from the dump of a 10-foot (3-m) shaft in the east gulch. No significant assay values were found.

Three showings were sampled on the mountain slope just north of the Sacaton landing strip. Sample 454 was taken across a quartz-fluorspar vein in a small prospect pit, and samples 455 and 456 were taken in two trenches where parallel quartz veinlets are exposed. The only significant value was 21.07 percent fluorite in sample 454.

Five localities were examined on the slopes of Rain Creek. Three of the sites (samples 457, 458, and 459) are just west of the wilderness boundary, one (461–462) is south of the wilderness, and the fifth (460) is just within the wilderness. About 1,000 tons of fluorspar has been produced in the area.

459 .... The major fluorspar occurrence in the Rain Creek area is the Gold Spar mine, which has been described in detail by Williams (1966, p. 55–59). The mine is claimed by Lee Rice of Oracle, Ariz. Total production is reported to have been 922 tons. The underground workings shown by Williams were inaccessible at the time of the wilderness investigation. A composite grab sample (459) from ore stockpiles contained 50.96 percent fluorite.

457 .... About one-half mile (400 m) upstream from the Gold Spar mine, sample 457 was taken across the outcrop of a 2-foot (0.6-m) quartz-calcite-fluorspar vein that may be the continuation of the Gold Spar vein. The sample contained 27.65 percent fluorite.

458 .... Slightly less than one-fourth mile (400 m) upstream from the Gold Spar mine, sample 458 was taken from a 3-foot (1-m) fluorspar vein exposed in a 15-foot (4.5-m) trench. The sample contained 70.28 percent fluorite.

460 .... A claim notice for the White Frog No. 1 claim was found along the West Fork trail at a point just within the wilderness. An outcrop of olive-green volcanic glass may have been the reason for locating the claim. Sample 460 did not contain significant mineral concentrations.

461–462 .... The workings of the Master claim, which was mistakenly located on private ground, consist of two short caved adits that were probably driven on narrow fluorspar veins. Sorted fluorspar ore (461) contained 95.20 percent fluorite. Development rock from the shorter adit (sample 462) contained only 29.75 percent fluorite. Recorded production is 9 tons.

463 .... A nearly vertical 7-foot (2.3-m) zone of fluorspar veins strikes N. 15° E. on the north slope of Mogollon Creek about 1 mile (1.6 km) within the wilderness. Sample 463, across the vein, contained 88.90 percent fluorite. Difficult access probably accounts for the lack of workings on the property.

464–466 .... Three fluorspar prospects, the Rainbow, Fairview, and Seventyfour, are all within the wilderness on Seventyfour Mountain and can be reached on foot or by horseback from the vicinity of the 74 Ranch on Mogollon Creek. The Rainbow prospect on the northwest slope of the mountain was described by Williams (1966, p. 59–60) as consisting of three narrow (1–3 feet (0.3–1 m) wide) fissure veins of fluorspar that can be traced for only short distances on the surface. The fluorspar occurs as fissure fillings along cross fractures in a rhyolite dike. The property is credited with a production of 250 tons, but production from the Fairview and Seventyfour Mountain prospects may have been included in this figure. At the time of the wilderness study the workings consisted of two caved adits and a 50-foot (15-m) open cut. Sample 464 of stockpiled ore contained 72.38 percent fluorite. The open cut exposes 1.1 feet (0.3 m) of gouge and 4 inches (10 cm) of fluorspar along the walls. Sample 466 of gouge contained low fluorite (4.93 percent), but the fluorspar lining the walls (sample 465) yielded 97.16 percent fluorite.

467–468 .... The Fairview prospect, high on the southwestern slope of Seventyfour Mountain, also has been described by Williams (1966, p. 60). No courthouse data on the property were found, and no production has been recorded. Samples across the outcrop of a 1.2-foot (0.4-m) fluorspar vein exposed in a 25-foot (7.5 m) trench showed 48.44 and 79.38 percent fluorite, respectively.

469 .... At what is presumed to be the Seventyfour Mountain prospect described by Williams (1966, p. 59), fluorite veins are in Cooney Quartz Latite Tuff, the ash-flow tuff adjacent to the footwall of a 30-foot (9-m)-wide rhyolite dike, and in a crossfault that offsets the dike. Sample 469 taken across a vein that is partly exposed in a 75-foot (23-m) open cut contained 56.77 percent fluorite.

470–471 .... About 3,000 feet (1 km) southeast of the fluorspar prospects on Seventyfour Mountain, a 6-inch (15-cm) quartz vein in a prospect pit and a 5-foot (1.8-m) shear zone with quartz stringers gave no significant assay values.

TRACT 8, GILA PRIMITIVE AREA

samples 472–473

Two prospects were sampled in the northern part of tract 8 of the Gila Primitive Area just south of the wilderness boundary (pl. 1*B*). The area can be reached on foot or by horseback from the 74 Ranch on Mogollon Creek below the mouth of Rain Creek.

On the Black Eagle claim, a silicified zone about 100 feet (30 m) long and 25 feet (7.5 m) wide contains veinlets as much as 3 inches (7.5 cm) wide of barite and pyrolusite. Sample 472 from the veinlets contained 4.70 percent manganese and 2.60 barium.

In an arroyo about 1,700 feet (0.5 km) east of the Black Eagle prospect, a 5- by 10-foot (1.5- by 3-m) trench was dug along a fault zone that strikes S. 60° w. Fluorspar and quartz veinlets with some manganese minerals (pyrolusite) are exposed in the cut. Sample 473 contained 0.03 ounce of gold per ton, 44.38 percent fluorite, and low manganese (0.28 percent).

GILA FLUORSPAR (BROCK CANYON) MINING DISTRICT

samples 475–494

The Gila fluorspar (Brock Canyon) mining district (fig. 47) is in a mineralized area along the Gila River, just south of the wilderness boundary, about 5 miles (8 km) upstream from the town of Gila. The

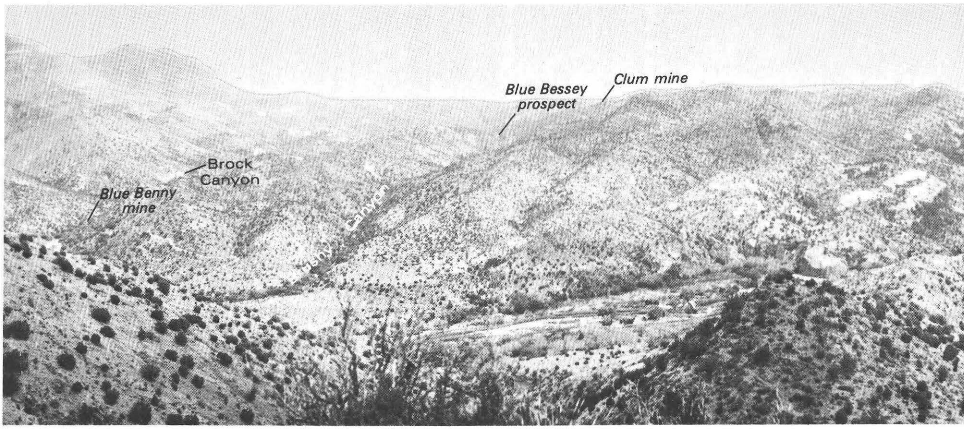


FIGURE 47.—Panorama of Gila fluorspar

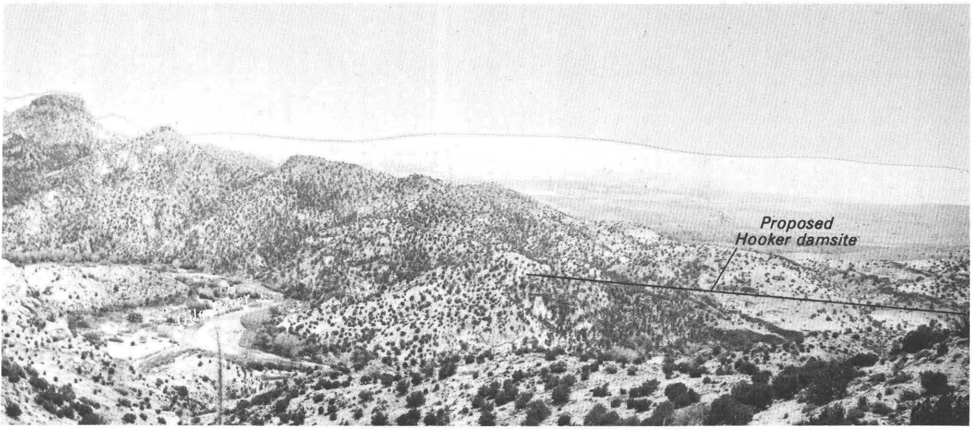
district is mainly in secs. 21, 28, 29, 32, and 33, T. 14 S., R. 16 W., and in secs. 3 and 4, T. 15 S., R 16 W.

According to Gillerman (1964, p. 170), the earliest reported fluorspar production in New Mexico was from the Foster mine (pl. 1B) in the early 1880's. Output was used as a flux in the silver-lead smelters in Silver City. Mining and prospecting were conducted in the district intermittently up to the present, but the principal production was during World Wars I and II. During World War II, the government constructed the present road to service the mines, and the Bureau of Mines examined various properties in the district. These investigations were summarized by Russell (1947). During the production period of the early 1940's, a fluorspar mill was placed into operation at Gila by Metal Reserves Co. The government fluorspar program was terminated at the end of World War II, and activities in the district ceased except for occasional small shipments. By 1970, rising prices had stimulated new exploration in the district, and the Clum mine was being reopened when this investigation was made.

Williams (1966, p. 38) reported total fluorspar production of 47,586 tons for the Gila district. Of this amount, about 29,000 tons was from the Clum mine, 4,000 tons from the Foster, and the remainder was mainly from the Green Spar, Watson Mountain, Blue Benny, and Victoria (Providence?) mines. Minor fluorspar production was recorded for the Blue Bessey, Blue Spar, Gila Montes, and Last Chance. All the properties are outside the wilderness.

The site of the proposed Hooker dam is shown in figure 47. The reservoir would inundate a number of fluorspar deposits.

Eight localities were examined in this investigation, which was limited to prospects and workings within or fairly close to the Gila Primitive



district southeast from Watson Mountain.

Area and Gila Wilderness. All mines and prospects are within the volcanic complex of Brock Canyon, which was described in an earlier section of the report.

The Cedar Hill prospect is on the north side of the Gila River in NW$\frac{1}{4}$ sec 29, T. 14 S , R. 16 W. (pl. 4*A*). The main showing was described by Williams (1966, p. 41–42). Fluorspar occurs with quartz in a 1- to 4-foot (0.3- to 1.3-m)-wide vein over a strike length of 250 feet; the vein is adjacent to a northwest-trending rhyolite porphyry dike about 20 feet (6 m) wide. Sample 475, taken across a 1-foot (0.3-m)-wide section of the vein exposed in a pit, contained 63.84 percent fluorite. Sample 476 was taken across an exposure of several veinlets of fluorspar 0.3–1.5 feet (9–45 cm) wide in a pit that is about 1,000 feet (300 m) southeast of the main workings. The sample contained 44.66 percent fluorite. The proposed Hooker reservoir would inundate these workings.

Northeast of the Cedar Hill workings, sample 477 taken across an area of leached volcanic rock showed no significant metal values.

The Last Chance prospect, west of the Gila River, was described by Rothrock and others (1946, p. 88–89) and by Williams (1966, p. 46). Forty tons of fluorspar reportedly was shipped during exploration work, about 1943. Samples 478 and 479, from two outcrops near the workings, were checked for minerals other than fluorspar, but assay values were negligible. The Last Chance workings also would be inundated by the proposed Hooker reservoir.

A 12-foot (3.6-m) fracture zone containing quartz stringers is located on private land near the mouth of Turkey Creek. Sample 480, taken across the zone, showed no assay values of significance.

Sample 481 was taken across a high-grade fluorspar vein, 2.5 feet (0.8 m) wide, that strikes N. 85° W. and dips 30° N. at the Watson

Mountain mine about one-half mile (1 km) south of the primitive area boundary and east of the Gila River. The sample, which is from a prospect pit, contained 92.96 percent fluorspar. The Watson Mountain mine previously was examined by the U.S. Bureau of Mines in 1943, and no fluorspar reserves were established (Russell, 1947). About 250 tons of metallurgical fluorspar has been produced from the mine (Williams, 1966, p 48), which would be flooded by the proposed Hooker reservoir.

The property at present known as the Blue Benny, at the mouth of Brock Canyon, produced 236 tons of fluorspar in 1944–45 (Williams, 1966, p. 41). Samples 482–487, from various workings at the Blue Benny mine, showed no significant mineral values except for fluorspar as follows:

Sample No.	Locality or source	Width, in ft	(m)	Fluorite (percent)
482	20-ft open cut and adit	1.0	(.3)	33.25
483	Piles of screen rejects	Grab	—	5.74
484	17-ft trench	1.0	(.3)	50.89
485	Shaft collar	3.0	(.9)	44.17
486	50-ft trench	1.0	(.3)	62.23
487	Outcrop	2.0	(.6)	30.10

In Brock Canyon, about one-fourth mile (400 m) from the mouth of Crow Canyon (pl. 4B), a short adit was driven N. 75° E. in a highly altered and leached zone. A sample, from the face, yielded extremely low gold and silver values.

The property known as the Blue Bessey mine is near the head of Brock Canyon. Production of fluorspar has been minor. A sample across the vein, just above waterline near the bottom of an inclined, 25-foot (7.5-m) shaft, contained 50.40 percent fluorite.

A zone of altered rock in the Spar Canyon area is covered by the Nina group of 16 claims. A sample across 9 feet of the zone, where alteration was intense, indicated no significant mineral potential.

An andesite dike makes a strong northwest-trending topographic lineament where it crosses Cave Canyon within the wilderness, south of the Gila River. Sample 491, of andesite and altered rhyolite at the dike contact, gave very low gold and silver values. Sample 492 across an 80-foot (24-m) fault zone at the forks of Cave Canyon contained comparably low metal values.

On the south bank of the Gila River opposite the mouth of Hidden Pasture Canyon, a 25-foot (7.5-m) fault zone strikes N. 40° E. Claim staking in the area in 1955 was probably for uranium. Sample 493, taken across the zone, contained no significant mineral values.

Several claims were located on calcite veins on the north bank of the Gila River west of Hidden Pasture Canyon. The calcite occurrences in places are stained green by algae, and prospectors apparently mistook the coloration to be a mineral of interest. Sample 494 of the material contained nothing of economic value.

SAPILLO (MEERSCHAUM) MINING DISTRICT

samples 502–506

Meerschaum was discovered in the Sapillo mining district near Salt Creek (pl. 1*B*) in 1875; this was the first reported occurrence in the United States (Northrop, 1959, p. 454). Another discovery was made later at the Dorsey mine in the Bear Creek (Juniper) district 12 miles (19 km) to the south. Both deposits were discussed by Sterrett (1908, p. 466–473), but most of his work was on the Dorsey occurrence. Meerschaum is a rare, very lightweight, white, tough, clay material that can be carved and shaped. Because of its absorbent and insulating qualities it has been used over the years mainly in making pipes for smokers. The meerschaum in the Sapillo district forms steeply dipping narrow veins that pinch and swell to as much as 3 feet (1 m) wide in Gila Conglomerate and basaltic andesite. Impurities include considerable quartz and calcite. The deposits are low grade and are scattered widely in narrow veins that require underground mining methods; thus it is unlikely that the meerschaum in this area has any appreciable economic potential. However, the meerschaum will probably continue to be of interest to mineral collectors and to those who might investigate it for scientific purposes.

Various claims in the Sapillo district were consolidated under ownership of the Meerschaum Co. of America in 1905 (Bush, 1915, p. 941–943). The company went into receivership in 1912 and was reorganized as American Meerschaum and Pipe Co. with a factory at Ogdenburg, N.Y.; Windsor Trust Co. was probably the legal agent. Evidently the operations again went into receivership in 1914. An estimated 1,000 tons of meerschaum was mined and manufactured into finished products. The only other production from the district was about 1,000 pounds shipped in 1943 for use in pipe liners and radio insulators (Northrop, 1959, p. 455).

Several inaccessible mine workings, including three shafts, are located in Meerschaum Canyon, a short drainage that is just east of Salt Creek. The diggings are in the vicinity of Meerschaum spring (sec. 28 T.14 S., R. 13 W.). From mining claim data, it is thought that the shafts are Sapillo No. 3, Sapillo No. 2, and the Meerschaum, at sample localities 502, 503, and 504, respectively. Three specimen samples were taken from outcrops of veins as much as 7 inches (17.5 cm) wide, and one was from a pile of meerschaum near the No. 2 shaft, in which the blocks of meerschaum indicated a vein width of at least 3 feet (1 m) at depth. The samples were not analyzed for metal content.

A caved adit estimated to have been about 300 feet (90 m) long is located east of Meerschaum Tank on Salt Creek. Sample 506 was taken from a dump of altered volcanic rock. Assay values were of no significance.

ALUNOGEN (ALUMINA) MINING DISTRICT

samples 507–542

The Alunogen district includes the Copperas Creek and Alum Mountain areas in the southeastern part of the area studied. The narrow corridor that contains the highway to Gila Cliff Dwellings National Monument crosses mining claims in secs. 4, 9, 17, 20, and 29, T. 14 S., R. 13 W., in Copperas Creek and passes just east of the block of 61 patented mining claims over Alum Mountain. Some of the claims in the district are in tract 1 of the Gila Primitive Area, some are in Tract 2, and others are in the Gila Wilderness. The only known mineral production from the district is a small tonnage of clay that was mined in Copperas Creek. Although claim staking was extensive recently in the Copperas Creek area, assessment work was the only mining activity noted during the investigation.

Analyses of various samples from the Copperas Creek–Alum Mountain area are shown in table 9.

Claim locations in Copperas Creek can be attributed to the widespread hydrothermally altered rocks, which include clay deposits and may be associated with metallic mineral deposits. Under the auspices of the Area Redevelopment Act, the clay potential of the district was investigated by the U.S. Bureau of Mines in 1963. A small tonnage of clay was mined for the manufacture of brick at a plant in Silver City, N. Mex. The plant discontinued operation in 1965. At the present time, there is no market for the apparently limited amount of clay.

No samples were taken to evaluate the quality of the clay, but 15 samples (507–521) were taken from several localities to check for possible metal values in the altered rocks. Traces of metals were detected, but assay results showed nothing approaching economic significance.

The area of sample 508 consists of deeply weathered and altered volcanic flows containing veins of white calcite. The sites of several exploratory drill holes were located, and bulldozer cuts crisscross the altered bedrock in many places within a 1,000-foot (300-m) radius of the sample site. The sample was from dump material and from the face of a 10-foot (3-m)-long cut that was excavated on a 12-inch (25 cm)-wide calcite vein striking N. 50° W. Other than calcite, no mineral concentrations were detected. Exploration in the area probably was done to uncover clay deposits, but was unsuccessful.

TABLE 9.—*Analyses (in percent) of various samples from the Copperas Creek–Alum Mountain area, Grant County, N. Mex.*

Sample No.	Acid soluble SO_3	Acid soluble Al_2O_3	Ga	Sample No.	Acid soluble SO_3	Acid soluble Al_2O_3	Ga
507	0.27	0.72	0.0016	529	32.81	11.82	.0017
509	1.88	.70	.0018	530	12.57	4.71	.0017
510	1.48	2.01	.0017	531	11.34	4.43	.0015
516	7.55	2.74	.0017	532	21.45	9.80	.0032
517	.36	.47	.0017	533	2.17	1.48	.0036
518	1.73	.60	.003	534	7.39	2.10	.0015
519	1.22	.45	.0014	535	2.57	.88	.0031
520	.27	.77	.0015	536	21.27	6.97	.0016
522	4.30	1.42	.0075	537	6.88	2.47	.0014
523	3.48	1.70	.0032	538	22.23	6.12	.003
524	13.69	4.01	.0018	539	2.92	.98	.0019
525	5.21	2.17	.0017	540	4.89	2.78	.0035
526	4.46	1.49	.0017	541	2.48	1.12	.0018
527	1.22	.73	.003				

The main clay deposit, shown as a gravel pit on most maps, was examined to determine if minerals other than kaolinite were present. Sample 514 was of iron-stained float scattered about the pit, and sample 515 was a composite of the various alteration products exposed in the face of the principal mining bench. No exploitable minerals were found. Since the wilderness investigation, the U.S. Forest Service has bulldozed the benches to approximate the original surface contours.

Above the benches of the clay pit a 33-foot (10-m)-long adit, the longest found in Copperas Creek, was driven S. 30° E. into a silicified outcrop. A sample (516) of fractured and iron-stained rock in the first 15 feet (4.5 m) of the adit contained no significant assay values.

Near the highway, about 500 feet (150 m) south of the clay pit, an adit was driven N. 55° E. for 10 feet (3 m) into intensely oxidized rock. Sample 513 yielded no economic mineral concentrations.

Three locations were sampled near the head of Copperas Creek. Sample 521 consisted of chips of hematite-stained rock, chips from a mafic dike in the arroyo, and material from a siliceous breccia containing opal, red hematite, and oolitic black hematite. Other samples in the Copperas Creek area are from exposures of altered rocks in roadcuts (samples 507 and 509) and prospect pits (samples 510–512 and 517–520). No significant mineral values were indicated in sample analyses.

The Alum Mountain area is along the Gila River 2–3 miles (3–4.8 km) south of the mouth of the East Fork. Most claims are in secs. 19, 20, 29, and 30, T. 13 S., R. 13 W.; access is by horse trail. In the period 1889–1892, the claims on Alum Mountain were located for alum (aluminum sulfate), and subsequently 61 of these were patented. The block of 61 claims was purchased by the U.S. Forest Service in 1969, and the area thereby became part of the Gila National Forest.

The Alum deposits remain as a potential aluminum resource that has not been fully explored. Four short adits are the extent of the workings, and only test shipments of alum were made. No production was reported by Blake (1894, 1895) or by Hayes (1907) who studied the deposits. Sulfur is a possible byproduct of any aluminum recovery process for these deposits.

Analyses of alum rock containing 18–32 percent alumina have been reported by Hayes (1907, p. 219); analyses of alumina, sulfate, and gallium in samples collected during this investigation are listed in table 9. However, these samples were collected to determine other metal values as well as for optimum alumina content. Gallium was considered to be of special interest because it is commonly associated with ores of aluminum. The only other metals found in significant amounts in the samples were copper (0.18 percent in sample 530); gold (0.28 oz/ton in 528); and silver (3.60 oz/ton in 534).

Sample 522 was collected from an alum prospect near the head of Alum Canyon, within the wilderness. Alunogen, a hydrous aluminum sulfate, occurs as crusts locally 1 foot (0.3 m) thick or thicker, under overhanging cliffs near the prospect. Sample 523 was taken from outcrops on the summit of Alum Mountain.

About 3/4 mile (1.2 km) upstream from the mouth of Alum Canyon, Alunogen tunnel No. 4 (fig. 40*G*) was driven for at least 100 feet (30 m) into the east side of Alum Mountain on a bearing of S. 45° W. The adit has caved to within a foot of the roof about 50 feet (15 m) from the portal. Samples 524–527, all of alum rocks, showed no significant metal values other than aluminum and a trace of copper in sample 524.

Alunogen tunnel No. 2, the longest of four adits in the Alum Mountain district (fig. 40H), was driven from the east bank of Alum Creek on a bearing of N. 65° E. About 125 feet (35 m) from the portal, a winze, now inaccessible, was sunk 30 feet (9 m). Sample 529 is a composite of the crust of alunogen and halotrichite lining the adit, as much as 12 inches (30 cm) thick; sample 530 consists of alum-bearing rock from the face; sample 531 is a dump sample; and sample 532 is part of the alunogen crust as much as 6 feet thick that covered the face of the cliff into which the adit had been driven. Other than 0.18 percent copper in sample 530, no metal concentrations were detected.

Fractures in a leached and silicified zone, composing a ridge that runs easterly from Alunogen tunnel No. 2, were stained with iron and manganese oxides. Sample 528 of these mineralized areas contains relatively high gold (0.28 oz/ton) and silver (0.36 oz/ton) values.

Sample 533 is from the dump of a 12-foot (3.6-m)-square, 8-foot (2.6-m)-deep shaft near the mouth of Alum Canyon. Assay results were negligible. Sample 534 represents a breccia zone of alum-bearing rock in a matrix of soft clay from high on Alum Mountain; it contained 3.06 oz silver per ton, and 0.04 oz gold per ton.

Alum-bearing samples 534–539, from outcrops and float and from Alunogen Tunnel Nos. 1 and 3 (fig. 40*I*) on the north slope of Alum Mountain, contained only traces to very low values in gold and silver. On the north side of the Gila River, on Alunogen claims 30 and 35, samples from a discovery pit (540) and caved shaft (541) showed negligible metal values. Sample 542, from an area of red altered rocks north of the mouth of Alum Canyon, was virtually barren of metal values.

SCATTERED MINING CLAIMS AND MINERALIZED AREAS

Scattered mining claims have been located at various places in the Gila Wilderness, in tract 6 of the Gila Primitive Area, and in bordering areas. None of the examined localities contained indication of significant mineral deposits.

GILA WILDERNESS

Fifteen samples were taken at nine localities in the Gila Wilderness; these are identified by sample numbers in the following descriptions.

289 .... A sample from an isolated zone of altered tuff north of Windy Gap near the head of Little Dry Creek.

246 .... Sample of a thin film of mineral matter on the floor of a cave about 5 miles (8 km) above the mouth of the West Fork of Mogollon Creek.

474 .... The sample is from an area of amygdaloidal andesite along an east fork of Fall Canyon. Almond-shaped amygdales as much as 4 inches (10 cm) in diameter are lined mainly with quartz crystals; these do not represent a significant gem stone potential.

495–496 .... Samples of greenish-gray altered andesitic lavas along the Turkey Creek trail in the vicinity of Brush and Sycamore Canyons are representative of altered rocks on the Golden Eagle claims, located in 1967, and the Bighorne claim group.

497–498 .... Samples from a 15-foot (4.5 m) trench and a silicified zone in Miller Spring Canyon, which were the only indications found to represent mineralization covered by the Iron Circle and Iron Major claims located in 1944.

543–546 .... Samples from a small area of altered rock in Gila Conglomerate, intruded by one or more basaltic dikes in Adobe Canyon, just north of Gila Cliff Dwellings National Monument. According to local residents, mining claims located in Adobe Canyon at various times were for clay, but none was ever shipped. Samples collected during this investigation represent quartz and calcite float, a calcite vein 1–3 feet (0.3–1 m) wide that can be traced for more than ¼ mile (400 m) on a N. 75° W. bearing, and a mafic dike.

566 .... Sample taken from the top of an amygdaloidal basalt flow and a 50-foot (15-m)-thick sandy conglomerate on top of the basalt, downstream from the junction of Cub Creek and the West Fork of the Gila River, where the Millionaire claims are believed to be located. No evidence of minerals was seen here, nor near the head of Cub Creek, where the Montoya group of claims has been described.

571	The Cindy Lou prospect was sampled from a pit in pink iron-stained rhyolite on the ridge between Center Baldy and Whitewater Baldy at an elevation of 10,400 feet (about 3,500 m).
572–573	Samples are from a 15-foot (4.5-m) adit driven N. 15° E. on a quartz-cemented breccia about 100 yards (meters) from Spruce Creek Saddle at the head of Spruce Creek.

A search was made for evidence of mineral resources or prospecting on claims in a number of other areas, but no samples were collected. At Turkeyfeather Pass, in the headwaters of the West Fork of the Gila River, a reddish-brown vesicular basalt flow covers the area in the vicinity of the recorded claims. Other claims were examined on the West Fork near the mouth of White Rocks Canyon (sec. 17, T. 12 S., R. 14 W.), but no evidence of mineral resources was found. Records indicate that the 60 Fortune claims may have been located near the mouth of Sapillo Creek, but we found no evidence of prospecting in that area. A search also was made for possible workings in an area of altered rhyolite that extends southeastward from Rough Canyon across Indian Canyon in sec. 1, T. 14 S., R. 17 W. A rancher reported having seen men digging high on the east slope of Rough Canyon in the 1930's or 1940's. A cache of dynamite was found in the area during this investigation, but no prospect was found.

TRACT 6, GILA PRIMITIVE AREA

Sample locality 565 is near Trotter Cabin on Middle Fork Gila River. Volcanic rocks in the area were randomly sampled at three places, and the samples were combined. Perlite was the principal material noted, but the grade is considered too low for profitable mining.

Mining claims have been located on upper Middle Fork of the Gila River near the mouth of Iron Creek. The area claimed was a northerly striking silicified zone in rhyolite, several hundred feet long. The zone contains numerous east-trending quartz veinlets and masses of popcorn-shaped quartz and chert nodules. Some iron staining was noted. Sample 567 from the zone did not reveal any mineral concentration.

AREAS ADJACENT TO THE WILDERNESS AND PRIMITIVE AREA

According to claim records mining claims have been located at various times in or near the area north of the Snow Creek road and south of lower Sapillo Creek. No field evidence of any of the recorded claims was found, and only one unrecorded claim at a prospect pit was noted in the field investigation.

A claim notice for the Beautiful Bonnie No. 3 claim, located in September 195?, was found near a prospect pit on the ridge east of Sheep Corral Canyon in sec. 17, T. 15 S., R. 14 W. No record of these claims was found at the courthouse. The pit had been sunk in soft rhyolite tuff that appears to cover several square miles in this vicinity. No mineral potential was detected in the analysis of sample 499 taken of this tuff.

Sample 500 was taken from an oxidized zone north of the corrals where the Snow Creek road crosses Sheep Corral Canyon. The zone is 10 feet (3-m) wide and is laced by quartz stringers as much as ½ inch (1.2 cm) wide. A random chip sample assayed insignificant values. Some maps show a shaft symbol southeast of the sample locality; the symbol should be that of a building inasmuch as a ranch house is at the site.

Sample 501 was collected from rhyolite tuff in an area along the Snow Creek road, about 3½ miles (5.6 km) from New Mexico Highway 15 (formerly Highway 25). No trace of mine workings was found, although claim descriptions place several mining claims in this location. The claims may have been for pumice, although no economic deposits of this construction material were noted in the area.

Several mining claims were located near the Outer Loop road north of Rocky Canyon Campground at the eastern edge of the primitive area. Black perlite was sampled at locality 547. It is 3 feet (1 m) wide where exposed and appears to trend N. 75° W. The perlite is of low quality and only a small tonnage is indicated. Sample 548 was taken along 20 feet (6 m) of iron-stained clay in a roadcut. The silver assay was 0.38 oz/ton, but the mineralized area is too small to indicate a potentially valuable mineral deposit. Six prospect pits in flow-banded rhyolite are clustered in an area about 100 feet (30 m) square; sample 549 showed no indication of valuable minerals.

Sample 550 gives no evidence of mineral deposits in the vicinity of a group of claims near the Black Canyon Campground in sec. 12, T. 13 S., R. 12 W.

The western part of the Taylor Creek tin mining district was investigated to determine if the tin deposits extend into the Beaver Creek area west of Wall Lake. We conclude that economically minable deposits may exist as far as Beaver Creek, but there is no indication of exploitable tin deposits farther west within the primitive area or wilderness.

The Taylor Creek district is one of the few areas in the United States where tin has actually been produced, other than as a byproduct. However, production has been slight, amounting to only about 11 tons of concentrates (Anderson, 1957, p. 31). Both low-grade lode and placer deposits occur over an area of about 450 mi^2 (1,200 km^2), mostly on the west slope of the Black Range east of the area considered in this report. The lack of water in most of the district probably has been a critical factor preventing development of the richer deposits.

As part of the strategic-minerals program, the U S. Bureau of Mines sampled the district in 1939 and resampled part of it in 1942 and 1943. In summarizing the exploration project, Volin and others (1947), reported that no sizable lode deposit had been found that contained as much as 1 lb tin per ton. The best placer deposit sampled contained about 2 lb tin per cubic yard.

During the present investigation, only the western part of the Taylor Creek district was examined. Samples were taken at outcrops and prospects not sampled during the 1939–43 Bureau of Mines investigations. The mining claims shown on plate 1B are only the westernmost of the thousands of claims located at various times in the district.

The largest, and most western, excavation found was the opening reported as Adit 8 by Volin and others (1947, p. 22). It was driven 150 feet (45 m) into the east bank of Beaver Creek. Trenches were excavated for a distance of 200 feet (60 m) uphill from the portal of the adit. No important tin deposit was found.

The Utah 1 discovery outcrop was examined on the north bank of Taylor Creek. Sample 551 is from numerous quartz veinlets intersecting in an area 20 feet (6 m) square, and sample 552 is from four flat-lying, parallel quartz veins striking N. 40° E. The veins are ¼–4 inches (0.6–10 cm) wide over a vertical distance of 6 feet (1.8 m). No mineral deposit is indicated by the sample analyses.

A placer sample (553) was taken in a tributary arroyo 1,000 feet (300 m) northwest of Wall Lake Campground on Taylor Creek, also in section 9. The mouth of the arroyo is in the campground. Erosion had produced a 30-inch (75-cm)-high terrace in the gravels of the stream bed, and the placer sample was taken from this exposure in a channel cut 15 inches (40 cm) wide and 6 inches (15 cm) deep. Bedrock was not reached. The concentrates (553B) assayed the highest tin (0.046 percent) of the three placer samples taken in the district. Considering that this was a concentrate assay, the tin, because of its low tenor, cannot be profitably recovered. Richer pockets may occur on bedrock, however. The zirconium content was high as would be expected in a gravity-process concentrate.

Samples 554–559 are from prospect pits in rhyolite and capping gravels on Kemp Mesa at the western edge of the area of known tin deposits. Although sample 557, from an 8-inch (20-cm) zone of cassiterite and specularite-bearing stringers, contained anomalous tin (0.049 oz/ton) none of the tin samples are sufficiently high grade to be mined.

Sample 560, from quartz veinlets in a weak altered zone in a prospect pit on the west slope of Wolf Hollow, about 2½ miles (4 km) north of Black Mountain, contained no significant metal values.

Samples 561–564 are from quartz veins and altered rock in an area of weak to intensely altered rhyolite near the junction of Indian Creek and Bull Pass Canyon, just north of primitive area tract 5. None of the samples contained significant metal values. The Hope group of 28 claims was located in this area in 1954, and 9 of the claims were relocated in 1955. A shallow bulldozed bench about 50 feet (15 m) in diameter, north of the Loco Mountain road (sample 561), probably is the discovery site for the Hope No. 1 claim. In the southern part of this area, no evidence of prospecting was found other than claim corners.

Sample 568 is from a 4-foot (1.3-m)-square pit on a quartz vein that is exposed for about 0.2 mile (300 m) along the road to Mogollon, west of primitive area tract 6. The sample was barren of metal values. A further examination of the entire area drained by Willow Creek gave no indication of mineralized rock that might be providing gold or tin to possible placer deposits on lower Willow Creek, where some placer mining claims have been located in the past.

The two Higgins claims, located in 1954, cover a small area of altered rock on Indian Creek, north of Willow Creek and the wilderness. The altered rock does not extend into the wilderness, and samples 569 and 570, from two prospects on fractured rock, had no appreciable metal values.

APPRAISAL OF FINDINGS

Mineral deposits occur in the Gila Wilderness, segments of the Gila Primitive Area, and contiguous areas where past claim locating activities were most intense, as shown on plate *1B*. Some of these deposits could possibly be developed under present economic conditions; additional engineering and geologic studies are necessary to determine mining feasibility. Extensive surface and subsurface exploration may discover minable deposits at depth in the various areas of altered rocks. Any significant rise in the prices of gold, silver, or fluorite may prompt increased exploration and reopening of some of the old mines. Future metallurgical techniques could make exploitation of some of the low-grade deposits economical.

Samples taken by the U.S. Bureau of Mines from localities in the study area on the north slope of Whitewater Creek, and at the junction of the South Fork and Whitewater Creek, gave assays as high as 19.73 percent manganese in a specimen of float, 14.38 oz silver, and 0.40 oz gold per ton and 1.08 percent copper. Although veins associated with the samples are not of an economically minable width, they have a potential for mineral development.

Along the western boundary of the wilderness, between Deer Park Canyon and S Dugway Canyon, samples assayed a maximum of 1.3 oz gold per ton and 16 oz silver per ton. These represented sample widths of 2 inches (5 cm) and 4 feet (1.3 m), respectively. The occurrences are just inside the designated wilderness, as is a significant outcrop of fluorspar in Holt Gulch (sample 78). Other potentially important deposits of fluorspar occur just outside the wilderness in Little Whitewater Creek and Holt and Goddard Canyons.

Base-metal veins cropping out along Big Dry Creek are 1,000 feet (300 m) south of tract 7 of the primitive area, one-fourth mile (400 m) south of Johnson Cabin within tract 7 of the primitive area, and at the Uncle John mine about a mile (1.6 km) inside the wilderness. Assays of samples showed lead and zinc tenors in excess of 9 percent each, copper at a maximum of 2.15 percent, and cadmium tenors as high as 0.72 percent. Gold and silver are associated with the deposits. These are marginal deposits because of the narrowness of the veins; additional exploration might expose larger mineralized bodies.

The area of the patented claims at the headwaters of Big Dry Creek contains wide quartz veins of low-grade gold content. The exposures sampled are not economically minable at present gold prices, but high-grade pockets occur. A maximum assay of 0.36 oz gold per ton was obtained from quartz stringers in a prospect near the Silver Drip Trail.

Assays indicate a potential for minable deposits of metals, including tellurium, from veins in the Little Dry Creek–Pine Creek area. The area of greatest potential extends about 2,000 feet (600 m) into tract 7 of the primitive area. Of note in the Little Dry Creek mineralized zone is the presence of intense oxidation effects including limonitic boxwork and pseudomorphs of sulfides. Small amounts of tellurium in gold ores commonly affect gold-metallurgy processes adversely, but in the Pine Creek area, tellurium occurs in amounts of sufficiently high grade to constitute a tellurium resource. The highest tellurium assay in the bulk samples was 0.46 percent; one hand specimen assayed 0.75 percent tellurium. A selected sample also assayed 1.28 oz gold per ton. A sample assaying 22.17 oz of silver per ton was taken from a very narrow (1- to 40-inch (2.5cm- to 1-m)) vein on the patented claims.

Fluorite was the principal product from small mines operated at various times in a mineral belt extending from Pine Creek to Seventyfour Mountain on both sides of the wilderness boundary. Metals, particularly copper and silver, were produced from small operations including those in the patented claims on Haystack Mountain. In that vicinity, a 1-inch (2.5-cm)-wide vein assayed 19.06 percent copper over a strike length of 25 feet (7.5 m). A specimen sample in the same general area assayed 23.80 oz silver per ton. Semiquantitative spectrographic analysis of a sample from a quartz stringer in a prospect northwest of Haystack Mountain showed a gold content of 70 ppm or about 2 oz/ton. In the Minton Canyon–Cherry Canyon area, a sample from a 4-inch (10-cm)-wide vein assayed 8.82 percent copper, 1.36 oz gold per ton, and 1.04 percent lead. A sample across a 3-foot (1-m)-wide lens of copper minerals assayed 7.05 percent copper and 3.66 oz silver per ton.

Although there are no proved or measured reserves, the presence of anomalous amounts of copper in samples taken throughout the mineral belt from Big Dry Creek to Seventyfour Mountain suggests the possibility of deposits at depth. Minable resources of fluorite also occur in this area.

Fluorite deposits along the Gila River, south of the wilderness and primitive area boundaries, have a potential for at least some future production, and hydrothermally altered volcanic rocks and anomalous metal values in the same area indicate the possibility of a metal deposit at deeper levels.

Meerschaum veins and potentially minable aluminum resources occur in the area between Sapillo Creek and the Gila River near Alum Mountain. Other metal anomalies, including gold, silver, and copper, also occur in the Alum Mountain area.

Streambeds in the area studied have been prospected for gold and tin placer deposits. However, the stream gradient is too steep and the canyons too narrow for important deposits to have been formed in the interior of the area. Reportedly, some pockets were worked along the bottom of Dog Canyon in the Little Dry Creek patented-claim vicinity. Placers in the Holt Gulch area were never successfully exploited, probably because of the lack of water.

There will probably be continued efforts to mine the tin deposits near Wall Lake, but the potentially exploitable resources extend westward only to Beaver Creek; that is, a few miles east of tract 4 of the primitive area.

Sand and gravel, pumicite, perlite, scoria, and obsidian occur here and there within the study area, but are remote from potential markets, and the economics of extraction probably will defer profitable mining of these materials for the forseeable future.

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TABLE 5–7

TABLE 5.—*Analyses of geochemical samples*

[Analyses are in parts per million. The threshold values in parts per million (ppm) used to determine anomalous values are as follows: Ag, L(0.5); Be, 7; Bi, L(10); Cd, L(10); Cu, 100; Mn, 1,500 (not included for panned concentrates); Mo, 7; Pb, 70; Sb, L(100); Sn, 15, except 30 for panned concentrates, W, L(50); Zn, L(200) for rocks, 200 for stream sediments, and not included for panned concentrates; Au, 0.05; Hg, 0.4; Te, 0.5; As, 10, except 15 for panned concentrates. Symbols used in the tables are the following: L, detected but not measurable at the level of detection; N, not detected; B, blank, indicating that the sample was not analyzed for all of the elements included in the table; H, interference in the analysis that raised doubts concerning the reported value; G, greater than the maximum

Sample	T. R. S.	Ag (.5)	Be (1)	Bi (10)	Cu (5)	Mn (20)	Mo (5)	Pb (10)	Sn (10)	Zn (200)	Au (.02)	Te (.2)	Hg (.01)	As (10)
ABZ-779	13-12-31	L	3	L	10	300	N	30	N	N	N	L	0.28	N
ABZ-782	13-13-24	N	N	L	30	1,000	N	L	N	N	N	L	.10	N
ABZ-786	13-13-17	L	3	L	5	700	N	30	N	N	N	L	.14	N
ABZ-787	13-13-17	N	2	L	7	700	N	15	N	N	N	L	.22	N
ABZ-787B	13-13-17	B	B	B	B	B	B	B	B	B	B	B	.50	B
ABZ-791	13-13-20	N	L	L	15	1,000	N	L	N	N	N	L	.04	N
ABZ-803	13-13-29	N	2	N	30	500	7	20	N	N	N	L	.22	N
ABZ-803B	13-13-29	B	B	B	B	B	B	B	B	B	B	B	.55	B
ABZ-845B	14-13-19	B	B	B	B	B	B	B	B	B	B	B	.65	B
ABZ-858	14-13-19	.5	L	N	20	700	L	30	N	N	N	L	.30	N
ABZ-858B	14-13-19	B	B	B	B	B	B	B	B	B	B	B	.75	B
ABZ-876	14-13-30	N	2	N	20	300	L	20	N	N	N	L	.80	N
ABZ-876B	14-13-30	B	B	B	B	B	B	B	B	B	B	B	.45	B
ABZ-916	14-14-36	N	L	N	70	500	5	15	N	N	N	L	1.60	N
ABZ-954	14-12-26	N	L	N	100	1,000	N	15	N	N	N	B	.05	N
ABZ-975	14-12-25	N	L	N	100	1,500	N	L	N	L	N	L	.10	N
ABZ-994	13-11-31	N	3	N	50	300	10	30	N	N	N	L	.04	N
ABZ-996	13-12-36	N	3	N	10	500	L	30	N	N	.02	L	.50	N
ABZ-997	13-12-35	N	2	N	70	700	15	70	N	N	.02	L	.28	N
ACA-473	13-13-30	N	N	N	30	L	10	30	N	N	N	L	.06	N
ACA-691	12-13-10	L	20	N	L	200	N	15	N	N	L	L	.32	N
ACA-692	12-13- 8	.5	5	N	5	300	N	20	N	N	L	L	.22	N
ACA-693	12-13- 8	1	5	N	L	L	N	N	20	N	L	L	.40	N
ACA-697	10-14-21	.5	7	N	L	700	L	50	10	N	L	.2	.60	N
ACA-704	10-15-34	N	1	N	30	500	N	15	N	N	L	L	.40	N
ACA-706	12-13-30	N	2	N	30	500	N	20	N	N	L	.2	.70	N
ACA-709	12-19- 9	N	1	10	7	30	7	100	30	N	L	L	.22	N
ACA-896	12-18-22	N	2	N	5	300	N	20	10	N	L	L	.09	10
ACA-899	11-13-29	N	L	N	50	700	N	15	N	N	L	L	.10	10
ACA-939	12-14-11	N	10	N	5	700	N	30	L	N	L	L	.06	L
ACA-941	10-14-28	N	10	N	L	700	N	30	10	N	L	L	.03	L
ACA-953	11-16-29	N	2	N	L	300	7	20	10	N	L	L	.03	L
ACA-959	11-16-15	N	3	N	L	500	10	30	L	N	L	L	.04	L
AGR-026A	14-14-36	B	B	B	B	B	B	B	B	B	B	B	.75	B
AGR-027A	15-14- 8	B	B	B	B	B	B	B	B	B	B	B	.50	B
AGR-059A	15-14-11	B	B	B	B	B	B	B	B	B	B	B	.50	B
AGR-132	11-19-21	N	1	N	20	500	7	30	N	N	L	L	.11	N
AGR-157	11-19-33	N	3	N	7	700	N	30	N	N	L	L	.16	20
AGR-264	12-18-29	N	2	N	15	200	N	10	N	N	L	1	.08	N
AGR-304	13-13-17	.5	3	L	5	700	N	20	10	N	.02	L	.10	N
AGR-305	13-13-17	N	3	L	L	700	N	20	L	N	L	L	.12	N
AGR-312	14-13- 4	N	2	N	30	300	N	20	L	N	.06	L	.15	N
AGR-313	11-19-32	N	L	10	5	20	N	15	L	N	L	.4	.18	N
AGR-314	11-19- 6	N	2	L	L	300	N	20	L	N	L	L	.12	N
AGR-315	11-19-27	N	2	L	10	300	N	20	L	N	L	L	.10	N
AGR-316	10-19-31	N	2	L	5	500	N	20	L	N	L	L	.14	N
AGR-317	10-19-31	.5	1	L	L	300	N	15	L	N	L	L	.15	N
AGR-318	10-19-31	L	3	N	L	150	N	15	L	N	L	L	.18	N
AGR-319	10-19-32	L	3	N	5	200	N	15	N	N	L	L	.19	N
AGR-323	14-12-23	.7	3	N	L	200	N	30	N	N	L	L	.09	N
AGR-325	14-12-23	.5	1	N	L	200	N	20	L	N	L	L	.12	N
AGR-326	14-12-22	.5	1	N	L	500	N	20	L	N	L	L	.11	N
AGR-329	13-12-34	1	2	N	5	500	N	20	L	N	L	L	.10	N
AGR-330	13-12-36	.7	2	N	L	200	N	30	10	N	L	L	.07	N
AGR-335	13-12-32	1	1	N	15	500	N	15	N	N	L	L	.09	N
AGR-339	14-13-29	N	1	L	L	150	N	15	L	N	L	L	.13	N
AGR-341	12-17-31	L	3	L	L	200	N	30	L	N	L	L	.14	N
AGR-353	13-17-11	N	1	N	5	1,500	N	15	L	N	L	.2	.40	N
AGR-354	13-17-11	N	2	N	L	1,500	L	30	L	N	L	L	.30	N
AGR-357	13-17-15	N	2	N	L	1,500	L	20	10	N	L	L	.24	N

having anomalous metal contents

measurable value, which for Bi=1,000 ppm; Cu=20,000 ppm; Mn=5,000 ppm; Pb=20,000 ppm; Zn=10,000 ppm. Numbers in parentheses beneath the elements in the column heads indicate the sensitivity of the method used. Analytical techniques: for gold and tellurium, atomic adsorption; arsenic, Gutzeit method; mercury by mercury detector; and all others semiquantitative spectrographic method. Localities are designated with reference to Township, south (T), Range, west (R), and Section (S). Sample numbers ending in A or B, as ABZ-787B, indicate that a repeat analysis was made for one or more elements in that sample. Elements determined but not found in anomalous amounts or considered as not significant in this study include: Fe, Mg, Ca, Ti, B, Ba, Co, Cr, La, Nb, Ni, Pd, Pt, Sr, U, V, Y, Zr. The analytical values for these elements are available elsewhere (Ratté and others, 1972b)]

Sample	T. R. S.	Ag (.5)	Be (1)	Bi (10)	Cu (5)	Mn (20)	Mo (5)	Pb (10)	Sn (10)	Zn (200)	Au (.02)	Te (.2)	Hg (.01)	As (10)
AGR-358	13-17-15	N	L	N	70	1,500	L	15	N	N	L	L	0.20	N
AGR-363	13-17-22	N	L	N	50	1,500	L	15	N	N	L	L	.18	N
AGR-410	14-16-17	N	1	N	15	500	L	15	N	N	L	L	.80	N
AGR-411	14-16-16	N	1	N	L	150	N	15	L	N	L	L	.60	N
AGR-419	13-16-36	N	2	N	L	700	L	300	L	L	L	.4	.26	N
AGR-439	14-16-20	N	1	N	5	1,500	N	10	N	N	L	L	.20	N
AGR-440	14-16-20	N	1	N	20	1,500	N	10	N	N	L	L	.54	N
AGR-442	14-16-20	N	1	N	10	1,500	N	15	N	N	L	L	.44	N
AGR-516	14-16-28	N	L	N	5	500	N	15	N	N	L	L	.03	20
AGR-539 1/	11-19-32	N	2	N	7	300	N	20	N	N	.30	L	.03	L
AGR-547 1/	11-19-15	N	2	N	L	300	5	15	L	N	1.50	L	.03	20
AGR-551	11-19-23	N	3	N	N	300	N	20	N	N	.06	L	.07	L
AGR-569 1/	14-14-31	N	N	N	50	1,000	N	10	N	N	.26	L	.02	L
AGR-593 1/	14-15-23	N	N	N	50	1,000	N	L	N	N	.28	L	.03	L
AGR-624	11-18-16	N	1	N	L	300	N	20	N	N	L	L	.05	10
AGR-644	11-18- 7	1	2	N	30	700	N	20	N	N	.02	L	.03	10
AGR-651 1/	11-18-33	N	1	N	L	500	N	20	N	N	.18	L	.02	L
AGR-654	11-18-34	N	2	N	5	500	N	15	L	N	L	L	.07	40
AGR-671	12-18- 9	N	1	N	L	700	N	20	N	N	.06	L	.02	10
AGR-692	12-19-11	L	3	N	10	700	5	20	N	N	L	L	.06	L
AGR-701	12-18-19	N	2	N	L	200	N	20	L	N	L	L	.01	10
AGR-709	12-17- 6	N	5	N	L	300	N	30	10	N	L	L	.01	10
AGR-711	12-18- 2	N	2	N	L	300	N	20	10	N	.06	L	.01	L
AGR-731	11-18-23	N	1	N	N	700	10	20	N	N	L	L	.03	L
AGR-739	11-19-24	N	7	N	L	500	N	20	N	N	L	L	.03	L
AGR-747	11-18-17	N	2	N	L	500	N	30	N	N	L	L	.22	80
AGR-776	12-19-14	N	2	N	L	500	N	20	N	N	L	L	.03	20
AGR-783	12-19-13	N	7	N	L	300	N	15	L	N	L	L	.02	L
AGR-788	12-19-11	N	2	N	L	500	N	30	L	N	L	L	.03	10
AGR-789	12-19-13	N	1	N	5	500	N	20	N	N	L	L	.02	10
AGR-811	11-19- 6	N	2	N	20	300	N	20	N	N	L	L	.07	20
AGR-814	12-14-19	N	7	N	20	300	N	15	N	N	L	L	.07	L
AGR-836	13-15-17	N	5	N	15	300	7	15	N	N	L	L	.05	L
AGR-846	14-14-21	N	5	N	15	700	N	20	N	L	L	L	.03	N
AGR-898	14-15- 1	N	L	N	100	1,000	N	10	N	N	L	L	.03	N
AGR-925 2/	13-15-24	N	3	N	15	500	N	15	N	N	N	L	.04	N
AGR-971	14-15-13	N	L	N	50	700	N	20	N	N	L	L	.65	N
AGR-988	14-15-13	N	L	N	100	700	N	20	N	N	L	L	.14	N
AGR-992	14-15- 3	N	L	N	50	700	N	10	N	N	L	L	.45	N
AMF-073	12-15-17	N	7	N	L	500	5	30	10	N	L	L	.02	L
AMF-158	12-15-20	N	2	N	7	500	N	70	N	N	L	L	.06	N
AMF-195	12-14-11	N	10	N	N	300	N	15	N	N	L	L	.07	N
AMF-239	13-15- 3	N	2	N	5	1,500	N	30	10	N	L	L	.06	L
AMF-276	11-14-30	N	3	N	L	500	N	70	N	N	L	L	.07	L
AMF-277	11-14-30	N	3	N	L	500	N	70	N	N	L	L	.04	L
AMF-300	12-15-29	N	3	N	L	500	7	30	10	N	L	L	.03	L
AMF-316	12-15-30	L	2	N	10	500	L	50	10	L	L	L	.14	N
AMF-347	12-15-17	N	3	N	5	500	L	100	10	L	L	L	.08	N
AMF-353	11-14-17	N	7	N	L	700	N	30	N	N	L	L	.08	N
AMF-354	11-14- 3	N	7	N	10	1,000	L	50	10	N	L	L	.10	N
AMF-357	10-14-28	N	10	N	5	1,000	L	50	10	N	L	L	.18	N
AMF-358	10-14-28	N	10	N	7	700	L	70	10	N	L	L	.28	N
AMF-360	11-15- 5	N	2	N	L	500	N	30	N	N	L	L	.60	N
AMF-363	12-16- 6	N	1	N	20	700	N	10	N	N	L	L	.80	N
AMF-366	11-16-22	N	L	N	30	700	N	15	N	N	L	L	.40	N
AMF-367	11-16- 9	N	L	N	20	700	N	15	N	N	L	L	.40	N
AMF-368	11-15- 6	L	2	N	5	700	N	70	L	N	L	L	.30	N
AMZ-001	14-15-16	N	2	N	15	700	N	100	10	N	L	L	.09	N
AMZ-003	14-15- 8	N	2	N	30	700	N	70	10	N	L	L	.11	N
AMZ-008	14-16-12	N	2	N	30	700	N	70	N	N	L	L	.07	N

1/ Au = L(0.02) on repeat analysis.

2/ W = 70 ppm

TABLE 54.—*Analyses of geochemical samples having anomalous metal contents in unaltered rocks*

Sample	T. R. S.	Ag (.5)	Be (1)	Bi (10)	Cu (5)	Mn (20)	Mo (5)	Pb (10)	Sn (10)	Zn (200)	Au (.02)	Te (.2)	Hg (.01)	As (10)
AMZ-009	14-16-12	N	L	N	100	700	N	50	N	N	L	L	0.40	N
AMZ-021	14-15-28	N	L	N	100	1,000	N	20	N	N	.04	L	.12	N
AMZ-022	14-15-28	N	L	N	50	1,000	N	N	N	L	L	L	.11	N
AMZ-029	13-13-30	N	L	N	50	700	N	10	N	N	L	L	.75	N
AMZ-070	14-16- 2	N	1	N	30	700	N	70	N	N	L	L	.12	N
AMZ-073	13-16-35	N	2	N	30	500	N	70	10	N	L	L	.18	N
AMZ-101	13-16- 5	N	2	10	30	700	N	100	10	N	L	L	.12	N
AMZ-105	13-17- 4	N	2	N	15	700	N	70	L	N	L	L	.09	N
AMZ-106	13-16-29	N	2	N	10	1,000	N	70	N	N	L	L	.11	N
AMZ-108	14-16- 6	N	L	N	30	700	N	20	N	N	L	L	.40	N
AMZ-111	14-17- 1	N	1	N	15	200	N	30	L	N	L	L	.12	10
AMZ-150	11-19- 8	N	2	N	5	500	N	20	N	N	N	L	.13	N
AMZ-163	12-18-21	N	2	N	30	100	N	30	N	N	N	L	.22	N
AMZ-185	11-19-33	N	2	N	5	200	15	20	N	N	N	.2	.16	L
AMZ-189	13-17-17	N	2	N	L	300	N	30	N	N	N	.6	.30	L
AMZ-200	11-12- 5	N	10	N	10	200	N	100	50	L	L	L	.26	L

TABLE 5B.—*Analyses of geochemical samples having anomalous metal contents in altered and mineralized rocks*

Sample	T. R. S.	Ag (.5)	Be (1)	Bi (10)	Cu (5)	Mn (10)	Mo (5)	Pb (10)	Sn (10)	W (50)	Zn (200)	Au (.02)	Te (.2)	Hg (.01)	As (10)
ABZ-701	13-13- 4	N	N	L	30	700	N	10	N	N	N	N	L	0.13	N
ABZ-702	13-13- 3	N	N	L	5	2,000	N	L	N	N	N	N	L	.15	N
ABZ-704	13-13- 3	N	L	L	15	150	N	30	N	N	N	N	L	.06	N
ABZ-749	14-13-20	N	L	L	300	150	N	20	N	N	N	N	L	.12	N
ABZ-750	14-13-20	N	L	15	30	100	7	30	N	N	N	N	L	.65	L
ABZ-751	14-13-20	L	L	15	70	50	7	L	N	N	N	N	L	.35	N
ABZ-752	14-13-20	.5	L	200	200	50	7	70	N	N	N	N	L	.70	L
ABZ-753	14-13-20	L	L	L	30	200	10	L	N	N	N	N	.8	.28	N
ABZ-754	14-13-20	N	L	50	50	50	10	20	N	N	N	N	L	.28	N
ABZ-778	13-12-31	L	3	L	15	300	L	20	N	N	N	N	L	.15	L
ABZ-792	13-13-20	N	L	L	20	70	7	50	N	N	N	N	L	.22	N
ABZ-794	13-13-29	N	L	L	5	50	7	L	N	N	N	N	L	.10	N
ABZ-795	13-13-29	N	L	N	15	15	5	10	N	N	N	N	L	1.40	N
ABZ-805	13-13-30	N	L	N	10	70	7	L	N	N	N	N	L	.18	N
ABZ-809	13-13-30	N	L	N	20	70	7	15	N	N	N	N	L	.15	N
ABZ-811	13-13-30	N	L	N	10	L	10	15	N	N	N	N	L	.18	N
ABZ-814	13-13-30	N	L	N	10	70	30	L	N	N	N	N	L	.16	N
ABZ-818	13-13-30	N	1	N	20	70	70	N	N	N	N	N	L	.90	N
ABZ-819	13-13-30	N	L	N	30	50	7	L	N	N	N	N	L	2	N
ABZ-822	13-13-19	L	L	L	30	15	10	30	N	N	N	N	L	.60	N
ABZ-823	13-13-19	N	L	15	30	20	5	10	N	N	N	N	L	.80	N
ABZ-824	13-13-29	N	L	L	50	15	7	20	N	N	N	N	L	1.40	N
ABZ-825	13-13-29	N	L	L	200	30	20	30	N	N	N	N	L	.70	10
ABZ-826	13-13-29	.5	L	N	700	50	N	N	N	N	N	N	L	.70	N
ABZ-827	13-13-32	N	L	N	30	70	7	L	N	N	N	N	L	.10	N
ABZ-829	14-13- 8	N	L	N	50	150	7	L	N	N	N	N	L	1.10	N
ABZ-832	14-13- 8	.7	3	N	15	100	30	L	N	N	N	N	L	.35	N
ABZ-833	14-13- 8	N	L	N	7	70	N	L	N	N	N	N	L	.40	N
ABZ-834	14-13- 8	N	L	N	7	70	N	L	N	N	N	N	L	.40	N
ABZ-835	14-13-20	N	1	N	30	100	7	20	N	N	N	N	L	.90	N
ABZ-851	14-14-13	N	L	N	7	15	L	20	N	N	N	N	L	2	N
ABZ-856	14-13-19	N	L	N	15	50	L	L	N	N	N	N	L	.08	10
ABZ-869	14-13-29	N	L	L	150	20	L	20	N	N	N	N	L	.14	N
ABZ-870	14-13-29	N	L	10	150	100	L	15	N	N	N	N	L	.35	N
ABZ-871	14-13-30	N	2	N	15	150	L	20	N	N	N	N	L	1.40	N
ABZ-881	14-13-29	N	2	N	5	1,000	L	L	N	N	N	N	L	1.00	N
ABZ-882	14-13-29	N	L	N	7	1,500	L	L	N	N	N	N	L	1.20	N
ABZ-883	14-13-29	N	L	N	5	70	L	30	N	N	N	N	L	2.10	N
ABZ-938	10-19-28	100	30	N	30	200	N	10	N	N	N	1.20	2.5	.15	N
ABZ-939	10-19-28	100	7	N	20	100	N	L	N	N	N	1.90	.7	.10	N
ABZ-944	12-18-29	.7	2	N	30	150	N	30	N	N	N	N	N	.04	N
ABZ-945	12-18-29	N	3	N	70	300	7	30	N	N	N	N	L	.08	N
ACA-425	13-13-29	L	L	N	150	50	10	L	N	N	N	N	L	.75	N
ACA-426	13-13-29	N	L	L	150	70	5	L	N	N	N	N	L	2.40	N
ACA-427	13-13-19	N	2	N	70	50	7	L	N	N	N	N	L	.50	N
ACA-428	14-13-23	N	N	N	100	300	N	L	N	N	N	N	L	.35	N
ACA-468	13-13-29	N	L	20	15	20	15	20	N	N	N	N	L	.03	N
ACA-472	13-13-29	N	L	N	20	30	N	20	N	N	N	N	.6	.18	10
ACA-476	13-13-30	N	N	N	30	70	7	N	N	N	N	N	L	.13	N
ACA-478	13-13-30	N	L	10	70	20	N	150	15	N	N	N	L	.16	N
ACA-480	13-13-19	N	L	10	150	15	L	30	N	N	N	N	L	.22	N
ACA-482	13-13-19	N	L	L	30	10	N	150	N	N	N	N	L	.06	N
ACA-494	14-13-17	N	L	N	500	700	L	20	N	N	N	N	L	.07	N
ACA-499	14-13-26	N	L	N	100	700	N	20	N	N	N	N	L	.04	N
ACA-602	12-19- 4	3	1	N	50	500	30	30	N	N	N	9	L	.05	10
ACA-615	12-19- 9	N	L	N	50	70	10	100	N	N	N	L	.6	.80	N
ACA-620	12-19-16	N	L	N	50	10	30	30	N	N	N	L	.6	.20	L
ACA-653	13-18-11	.7	2	N	5	100	50	15	N	N	N	L	L	.10	N
ACA-672	12-18-29	N	L	N	15	2,000	N	15	N	N	N	.04	L	.10	N
ACA-795	10-14-33	N	7	N	5	300	5	50	10	N	N	L	L	.18	N

TABLE 5B.—*Analyses of geochemical samples having anomalous metal contents in altered and mineralized rocks*—Continued

Sample	T. R. S.	Ag (.5)	Be (1)	Bi (10)	Cu (5)	Mn (10)	Mo (5)	Pb (10)	Sn (10)	W (50)	Zn (200)	Au (.02)	Te (.2)	Hg (.01)	As (10)
ACA-796	10-17-33	N	L	10	5	30	30	L	N	N	N	L	L	L	N
ACA-797	10-17-33	N	L	L	5	50	70	30	N	N	N	L	L	.03	10
ACA-809	12-19- 5	N	2	N	70	1,000	N	20	N	N	500	L	L	.05	N
ACA-810	12-19- 4	N	7	N	70	700	20	15	N	N	200	.02	L	.02	N
ACA-831	13-16-26	N	7	N	30	500	L	15	N	N	N	L	L	.14	N
ACA-874	13-18- 3	.7	3	N	15	50	150	15	N	N	N	2.10	L	1.80	N
AGR-017	14-13-17	N	L	70	50	70	N	30	N	N	N	L	.4	.40	N
AGR-018	14-13-29	N	L	N	10	3,000	N	L	N	N	N	L	L	.28	N
AGR-019	14-13-29	N	L	N	15	3,000	N	15	N	N	N	L	L	.16	N
AGR-022	13-13- 3	N	L	N	10	15	N	L	N	N	N	N	L	.50	N
AGR-083	14-13- 8	N	L	N	30	15	7	15	N	N	N	L	.4	.11	L
AGR-084A	14-13- 8	B	B	B	B	B	B	B	B	B	B	B	B	.40	B
AGR-085	14-13- 9	N	N	N	50	10	5	L	N	N	N	L	1.5	.17	L
AGR-086	14-13- 8	N	1	L	20	30	5	10	N	N	N	L	L	.40	L
AGR-087	14-13- 8	N	1	N	15	30	7	20	N	N	N	L	.4	.18	L
AGR-088	14-13- 8	N	L	N	7	100	N	N	N	N	N	L	L	2	L
AGR-088A	14-13- 8	B	B	B	B	B	B	B	B	B	B	B	B	4.50	B
AGR-089	14-13- 8	N	1	N	30	50	10	15	N	N	N	L	L	.28	L
AGR-089A	14-13- 8	B	B	B	B	B	B	B	B	B	B	B	B	.50	B
AGR-090	14-13- 8	N	N	N	30	10	7	L	N	N	N	L	.3	4	L
AGR-090A	14-13- 8	B	B	B	B	B	B	B	B	B	B	B	B	4.50	B
AGR-091	14-13- 8	N	1	N	20	30	7	N	N	N	N	L	.5	.40	L
AGR-091A	14-13- 8	B	B	B	B	B	B	B	B	B	B	B	B	.80	B
AGR-092	14-13- 9	N	N	N	50	20	5	L	N	N	N	L	L	.70	L
AGR-092A	14-13- 9	B	B	B	B	B	B	B	B	B	B	B	B	.80	B
AGR-093A	14-13- 4	B	B	B	B	B	B	B	B	B	B	B	B	.40	B
AGR-094	14-13- 4	N	L	N	30	20	N	L	N	N	N	L	.4	.50	L
AGR-095	14-13- 8	N	2	N	20	20	10	10	N	N	N	L	.2	.26	L
AGR-096	14-13- 8	N	N	N	30	30	5	N	N	N	N	L	.5	.45	L
AGR-096A	14-13- 8	B	B	B	B	B	B	B	B	B	B	B	B	.40	B
AGR-097	14-13- 8	N	N	N	50	10	50	N	N	N	N	L	L	.35	L
AGR-099	14-13-20	N	2	L	7	200	10	30	N	N	N	L	L	.20	L
AGR-100	14-13- 9	N	N	N	30	70	N	N	N	N	N	L	.5	1.10	L
AGR-101	14-13- 9	N	N	N	20	30	10	N	N	N	N	L	.6	.18	15
AGR-103	14-13- 9	N	N	N	10	30	20	N	N	N	N	L	.7	.24	L
AGR-105	14-13- 9	N	N	N	100	20	7	10	N	N	N	L	4	.18	L
AGR-106	14-13- 8	N	N	N	100	20	20	10	N	N	N	L	.4	.22	150
AGR-108	14-13-17	N	N	30	30	70	5	30	N	N	200	L	1	.16	10
AGR-109	14-13-17	N	N	N	10	200	N	15	N	N	N	L	2.3	.14	L
AGR-110	14-13-17	N	L	L	50	100	5	15	N	N	L	L	2.3	.22	L
AGR-111	14-13-17	N	L	N	50	200	N	20	N	N	N	L	1.4	.18	20
AGR-131	11-19-20	N	L	N	5	2,000	N	N	N	N	N	L	L	.18	L
AGR-154	11-19-32	N	L	10	50	100	N	70	N	N	N	L	4.6	.14	L
AGR-155	11-19-32	N	N	N	10	10	20	10	N	N	N	L	L	.35	N
AGR-176	11-19- 5	N	2	N	15	300	15	30	N	N	N	L	L	.07	10
AGR-190	11-19- 4	.7	5	N	30	150	N	10	N	N	N	.02	L	.20	80
AGR-197	11-19-28	L	3	N	20	150	N	15	N	N	N	L	L	.10	N
AGR-204	11-19-29	.5	2	N	10	100	N	15	N	N	N	L	L	.07	N
AGR-205	11-19-29	N	2	N	L	3,000	N	10	N	N	N	3.50	L	.10	10
AGR-207	12-19- 3	N	2	N	L	3,000	N	20	N	N	N	.02	L	.10	80
AGR-208	12-19- 3	N	2	N	L	5,000	N	15	N	N	N	L	L	.10	100
AGR-212	12-19- 9	N	L	N	50	70	N	20	N	N	N	L	2	.10	10
AGR-214	12-19- 9	N	L	N	70	1,500	N	15	N	N	N	L	.3	.05	N
AGR-215	12-19- 8	N	1	N	10	200	10	15	N	N	N	L	.8	.03	N
AGR-221	12-19- 9	N	1	N	20	150	10	L	N	N	N	L	L	.40	N
AGR-223	13-18-11	N	2	N	L	G	N	10	N	N	N	L	.3	.08	10
AGR-224	12-18-11	N	L	N	15	5,000	N	10	N	N	N	L	L	.06	N
AGR-228	12-18- 7	L	1	N	15	100	N	10	N	N	N	L	.3	.05	N
AGR-230	12-18- 7	.5	2	N	20	150	10	150	N	N	200	L	2	.04	10
AGR-231	12-18- 7	3	1	N	1,000	700	100	7,000	N	N	2,000	.04	11	.40	N

TABLE 5B.—*Analyses of geochemical samples having anomalous metal contents in altered and mineralized rocks*—Continued

Sample	T. R. S.	Ag (.5)	Be (1)	Bi (10)	Cu (5)	Mn (10)	Mo (5)	Pb (10)	Sn (10)	W (50)	Zn (200)	Au (.02)	Te (.2)	Hg (.01)	As (10)
AGR-232	12-18- 7	1.5	2	N	20	1,000	5	700	N	N	500	L	1.5	0.10	N
AGR-233 3/	12-19-12	2	2	N	20	1,000	200	5,000	N	N	5,000	L	.6	.05	N
AGR-234 4/	12-19-12	100	1	N	2,000	300	10	G	N	N	G	L	4	.20	N
AGR-238	12-19-13	.7	3	N	30	2,000	N	500	N	N	200	.10	.6	.20	N
AGR-242	12-19- 4	.7	2	N	20	700	70	100	N	N	N	L	1.2	.60	N
AGR-243	12-19- 4	L	2	N	20	300	N	20	N	N	N	L	.4	.05	N
AGR-244	12-19- 4	.5	N	20	30	70	N	100	N	N	N	L	2.2	.05	80
AGR-245	12-19- 4	N	L	L	30	30	N	100	N	N	N	L	3	.05	N
AGR-246	12-19- 4	L	N	N	50	100	20	N	N	N	N	L	1.4	.07	L
AGR-247	12-19- 4	N	N	N	10	L	N	50	N	N	N	L	.7	.10	N
AGR-248	12-18-29	.5	1	N	20	70	100	N	N	N	N	L	.4	.20	L
AGR-249	12-18-29	N	2	N	1,000	100	N	20	N	N	N	L	1.8	.30	N
AGR-250	12-18-29	N	2	L	70	70	10	150	N	N	N	L	1.2	.10	80
AGR-251	12-18-29	N	2	10	150	70	70	100	N	N	N	L	2	.10	L
AGR-253	12-18-20	5	3	N	2,000	2,000	N	1,500	N	N	300	L	.8	.09	N
AGR-259	12-18-29	N	N	10	50	100	20	50	N	N	N	L	2.5	.09	N
AGR-260	12-18-30	N	1	N	15	70	5	L	N	N	N	L	2	.09	10
AGR-263	12-18-29	N	2	N	70	100	20	20	N	N	N	L	.9	.04	N
AGR-266	12-18-29	1	L	L	15	70	200	50	N	N	N	L	L	.50	L
AGR-267	12-18-20	N	2	N	5	70	N	10	N	N	N	36	.9	.04	N
AGR-268	12-18-20	L	1	L	L	150	N	20	N	N	N	L	6	.05	N
AGR-269	12-18-20	5	1	G	20	50	30	100	N	N	N	L	3,000	5.10	N
AGR-270	12-18-20	N	2	10	20	70	50	100	N	N	N	L	800	.09	N
AGR-278	13-17- 7	N	L	N	L	70	N	30	N	N	N	.30	2.1	.06	N
AGR-283	12-19-15	N	2	N	10	1,500	N	20	N	N	N	.04	1.4	.04	N
AGR-285	12-19-14	1	2	N	10	70	10	30	N	N	N	.04	3	.09	60
AGR-286	12-19-14	.7	2	N	5	100	N	150	N	50	N	.08	.6	.10	10
AGR-287	12-19-14	.5	2	N	5	100	N	100	N	50	N	.04	1.2	.08	10
AGR-344	13-17-18	N	5	N	15	100	N	50	N	N	N	.08	L	.11	N
AGR-345	13-17-18	.7	5	N	10	150	15	50	L	N	N	.20	L	.42	N
AGR-347	13-17-18	N	L	N	N	20	N	N	N	N	N	.02	L	.41	N
AGR-348	12-18-20	7	10	300	30	150	20	100	N	N	L	32	1,000	G	N
AGR-349	12-18-20	N	3	L	10	1,500	5	20	10	N	L	.02	3.6	1.80	N
AGR-350	12-18-20	N	3	N	70	500	70	20	N	N	L	L	.8	.16	N
AGR-351	12-18-20	N	2	N	30	150	200	10	N	N	N	.02	.6	.22	N
AGR-352	12-18-20	N	1	N	20	50	10	20	L	N	N	.02	4	1.20	N
AGR-377	13-17- 4	N	1	N	50	1,500	N	20	N	N	N	L	L	.24	N
AGR-412	14-16-21	N	1	N	50	200	L	20	N	L	N	.20	L	.20	N
AGR-413	14-16-21	N	2	N	30	300	L	15	N	L	N	.10	L	.28	N
AGR-417	14-16-21	N	2	N	20	1,000	N	10	N	50	N	.30	L	.18	N
AGR-428	14-16-34	N	1	N	L	500	N	2	N	N	N	L	.2	.60	N
AGR-433	14-16-28	N	1	N	5	50	15	30	N	N	N	L	L	.30	N
AGR-434	14-16-28	N	1	N	5	70	100	20	N	N	N	L	2	.26	N
AGR-438	14-16-28	N	L	N	L	20	10	20	L	N	N	L	L	.24	N
AGR-444	14-16-28	N	L	N	L	20	10	10	N	N	N	L	1	.36	N
AGR-445	14-16-21	N	L	N	L	20	7	30	N	N	N	L	1	.30	N
AGR-446	14-16-28	N	2	N	5	30	7	10	N	N	N	L	.2	.36	N
AGR-450	14-16-20	N	2	N	20	200	N	20	N	N	N	L	L	.52	N
AGR-453	14-16-29	N	1	N	15	150	7	10	N	N	N	L	L	.15	N
AGR-456	14-16-28	.7	2	N	10	70	5,000	15	L	N	N	.10	.2	.28	N
AGR-514	13-16-34	N	5	L	50	1,000	L	20	N	N	N	N	L	.04	N
AGR-515	14-16-28	N	L	N	L	50	10	15	N	N	N	L	.2	.03	L
AGR-517 5/	14-16-21	5	5	N	70	200	10	50	N	200	N	1.40	.2	.50	100
AGR-520	14-16-21	N	2	N	7	200	N	15	N	N	N	.10	L	1	10
AGR-521	14-16-21	N	3	N	10	500	N	15	N	L	N	.10	L	.22	20
AGR-522	14-16-21	N	2	N	10	300	N	10	N	N	N	.16	L	.05	20
AGR-523	14-16-21	N	2	N	7	500	N	L	N	N	N	.14	L	.09	10
AGR-524	14-16-16	L	2	N	10	200	N	20	N	N	N	.30	L	.20	10
AGR-536	11-19-32	2	1	N	7	70	70	10	N	N	N	L	L	.02	L
AGR-538	11-19-32	.5	2	N	7	200	50	15	N	N	N	L	L	.04	L

3/ Cd = 30 ppm.

4/ Cd = G(500)

5/ Sb = 100 ppm.

TABLE 5B.—*Analyses of geochemical samples having anomalous metal contents in altered and mineralized rocks*—Continued

Sample	T. R. S.	Ag (.5)	Be (1)	Bi (10)	Cu (5)	Mn (10)	Mo (5)	Pb (10)	Sn (10)	W (50)	Zn (200)	Au (.02)	Te (.2)	Hg (.01)	As (10)
AGR-540	12-19- 4	2	L	N	30	200	500	100	N	N	N	11	L	0.06	L
AGR-541	12-19- 4	N	2	N	30	1,000	N	L	N	N	N	2.6	L	.03	L
AGR-552	12-18-29	.5	1	N	200	100	100	10	N	N	N	L	.3	4.50	L
AGR-553	12-18-29	N	2	N	L	300	50	20	N	N	N	L	.2	.02	L
AGR-554	12-18-29	.7	15	N	10,000	5,000	10	70	N	N	200	L	1	7	40
AGR-555	12-18-29	N	N	N	20	15	15	L	N	N	N	L	.4	.07	10
AGR-556	12-18-29	.7	5	N	50	100	15	70	N	L	N	.38	.8	.05	L
AGR-557	12-18-29	N	7	N	15	100	7	20	N	L	N	L	.2	.03	L
AGR-558 6/	12-18-20	30	50	N	300	1,000	70	G	N	N	G	L	7	.12	L
AGR-559	12-18-19	.5	3	N	5	500	N	100	N	N	500	L	L	1.30	L
AGR-560	12-18-19	20	2	N	5	200	N	15	N	N	N	L	L	.80	L
AGR-561	12-18-19	.5	2	N	5	300	N	15	N	N	N	L	L	.09	L
AGR-565	14-16-28	N	L	N	20	300	20	30	N	L	N	L	.5	.01	L
AGR-566	14-16-28	N	2	N	30	700	5	15	N	L	N	.02	L	.03	L
AGR-567	14-16-33	N	1	N	5	500	50	30	N	N	N	L	.2	.03	10
AGR-568	14-16-33	N	1	N	L	100	7	15	N	N	N	L	L	.01	L
AGR-637	12-18- 5	.5	5	N	L	2,000	10	20	N	N	N	L	L	.05	10
AGR-639	12-18- 5	L	2	N	10	1,000	L	20	N	N	N	.08	L	.01	L
AGR-647	11-18-32	.5	1	N	5	300	15	15	N	N	N	L	L	.03	20
AGR-653	11-18-34	L	3	N	7	1,500	N	30	N	L	N	L	L	.10	L
AGR-655	11-18-33	N	1	L	5	100	5	70	10	N	N	L	L	.05	L
AGR-657	11-18-33	N	2	10	L	150	7	70	L	N	N	L	L	.03	10
AGR-658	11-18-33	N	5	N	15	2,000	N	15	N	50	200	L	L	.05	20
AGR-659	11-18-33	.5	2	N	5	100	N	15	N	50	N	L	L	.02	20
AGR-660	11-18-33	N	1	N	L	1,500	N	15	N	N	N	L	L	.03	40
AGR-661	11-18-33	N	5	N	7	G	N	N	N	N	N	L	L	.04	10
AGR-662	11-18-33	N	15	N	10	5,000	N	L	N	N	200	L	L	.02	10
AGR-675	12-18- 5	N	2	L	N	5,000	N	N	N	N	N	L	L	.01	L
AGR-677	12-18- 5	N	3	N	L	500	N	20	N	N	N	.16	L	.03	10
AGR-678	12-18- 5	N	2	N	L	300	15	15	10	N	N	.02	.2	.01	L
AGR-679	12-18- 5	N	1	N	50	700	N	20	N	N	200	L	L	.02	L
AGR-681	12-18- 5	N	2	N	5	200	50	100	10	N	N	L	1.5	.03	10
AGR-682	12-18- 5	1	7	N	7	200	1,000	50	10	L	N	.12	2.5	.04	10
AGR-683	12-18- 5	L	2	L	7	200	200	20	10	N	N	L	1.8	.02	L
AGR-685	12-18- 6	N	3	N	5	700	N	20	N	N	L	L	L	.02	L
AGR-686	12-18- 6	20	2	N	5,000	200	30	500	N	N	200	L	13	.03	10
AGR-696	12-18-30	L	1	N	L	200	N	20	N	N	N	L	L	.06	10
AGR-697	12-18-30	1	2	15	700	300	7	1,500	10	N	N	L	.3	.01	20
AGR-698	12-18-30	1	3	15	5,000	100	5	1,500	N	N	N	L	4	.07	L
AGR-699	12-18-30	.5	3	15	20	200	N	30	N	50	N	L	1	.09	20
AGR-700	12-18-30	L	2	N	15	2,000	N	50	N	N	200	L	L	.02	L
AGR-706	12-18- 3	N	3	N	5	500	N	L	N	N	N	.06	L	.03	L
AGR-712	12-18-12	.5	3	N	L	200	N	15	N	N	N	.14	L	.05	L
AGR-718	12-18-13	N	2	N	L	500	N	10	N	N	N	.28	L	.02	L
AGR-727	12-18-20	N	1	N	L	500	N	30	10	N	N	.06	L	.05	L
AGR-741	11-19-10	N	2	N	N	5,000	N	N	N	N	N	L	L	.03	L
AGR-752	11-19-16	N	10	N	L	G	N	L	N	N	N	L	L	.05	40
AGR-753	11-19-16	N	10	N	L	2,000	N	N	N	N	N	L	L	.08	L
AGR-754	11-19- 9	N	5	N	L	5,000	N	L	N	N	N	L	L	.07	20
AGR-755	11-19- 9	N	1	N	100	3,000	N	N	N	N	N	L	L	.02	L
AGR-757	12-19-13	N	5	N	5	G	N	300	N	N	N	L	L	.03	20
AGR-758	12-19-13	N	10	N	L	G	N	50	N	N	200	L	L	.03	10
AGR-759	12-19-13	1.5	L	N	L	300	N	30	N	N	N	.04	L	.04	10
AGR-760	12-19-13	1.5	1	N	7	300	20	50	N	N	N	.04	L	.02	20
AGR-777	12-19-14	N	2	N	7	300	N	70	N	50	N	L	L	.02	80
AGR-778	12-19-13	30	5	N	1,000	500	15	5,000	N	N	2,000	.50	18	.03	L
AGR-779	12-19-13	1	5	N	150	1,000	10	500	N	N	700	.50	.4	.01	L
AGR-780 7/	12-19-13	5	1	N	700	2,000	50	3,000	N	N	2,000	L	.8	.05	20
AGR-781 7/	12-19-13	15	1	N	700	5,000	50	5,000	N	N	3,000	.02	.6	.09	10
AGR-782 8/	12-19-13	3	1	N	300	2,000	100	3,000	N	N	5,000	.04	.9	.05	20

6/ Cd = 200 ppm.

7/ Cd = 50 ppm.

8/ Cd = 100 ppm.

TABLE 5B.—*Analyses of geochemical samples having anomalous metal contents in altered and mineralized rocks*—Continued

Sample	T. R. S.	Ag (.5)	Be (1)	Bi (10)	Cu (5)	Mn (10)	Mo (5)	Pb (10)	Sn (10)	W (50)	Zn (200)	Au (.02)	Te (.2)	Hg (.01)	As (10)
AGR-784	12-19-13	1	5	N	100	2,000	N	200	N	L	500	0.02	L	0.07	10
AGR-792	12-18- 6	N	3	N	L	100	N	15	N	N	N	.08	L	.07	L
AGR-793[9]	12-19-12	5	N	N	150	100	10	70	N	L	N	L	3	.09	40
AGR-810	12-18-20	N	2	N	70	100	5	15	N	N	N	L	1.4	.10	L
AGR-812	12-14-23	N	L	N	15	30	N	N	N	L	N	L	L	.06	N
AGR-813	12-19-23	N	L	N	7	70	N	N	N	L	N	L	L	.08	N
AGR-815	12-14-22	N	1	N	50	70	N	L	N	L	N	L	L	.08	N
AGR-835	13-15-17	N	3	N	5	100	7	20	N	N	N	L	L	.06	L
AGR-838	13-15-17	N	5	N	20	300	7	15	N	N	N	L	L	.06	N
AGR-862	14-14-16	N	1	N	5	1,500	N	L	N	N	N	L	L	.03	N
AGR-911	13-15-21	N	5	N	7	200	L	10	N	L	N	L	L	.06	N
AGR-912	13-15-21	N	3	N	5	100	5	10	N	L	N	L	L	.02	N
AGR-918	13-13-19	N	N	N	L	30	20	L	N	N	N	L	4	.10	L
AGR-919	13-13-19	N	1	N	50	20	5	20	N	N	N	L	2	.08	10
AGR-920	13-13-19	N	1	70	10	20	5	70	20	N	N	L	1	.07	10
AGR-921	13-13-19	L	N	20	15	100	N	20	N	L	N	L	1.8	.07	L
AGR-922	13-13-19	N	N	N	20	100	10	15	N	L	N	L	.3	.11	L
AGR-924	13-15-13	N	5	N	15	200	N	20	N	L	N	L	L	.04	N
AGR-932	13-14-27	.5	2	N	20	2,000	N	L	N	L	N	L	L	.08	N
AGR-933	13-14-27	.5	1	N	20	500	N	N	N	L	N	L	L	.07	N
AGR-934	13-14-34	N	1	N	20	150	N	N	N	L	N	L	L	.07	N
AGR-936	14-14- 3	N	L	N	10	50	N	N	N	L	N	L	L	.03	N
AGR-963	13-14-24	N	2	N	15	200	N	15	N	L	N	L	L	.09	L
AGR-965	13-14-24	N	L	N	30	20	7	10	N	N	N	L	L	.10	N
AGR-966	13-14-24	L	1	N	70	100	50	10	N	N	N	L	L	.09	N
AGR-970	14-14-18	N	L	N	70	1,000	N	N	N	N	N	L	L	.45	N
AGR-972	14-15-13	N	L	N	150	1,000	N	30	N	N	N	L	L	.40	N
AGR-979	14-15- 1	N	2	10	50	200	N	50	L	N	N	L	L	.18	N
AGR-980	14-14- 6	N	3	15	100	500	N	70	L	N	N	L	L	.12	N
AMF-196	12-14-14	N	10	N	L	20	N	N	N	N	N	L	L	.12	N
AMF-355	11-14- 3	N	5	N	15	150	N	30	N	N	N	L	L	.60	15
AMF-361	10-14-33	N	7	N	L	500	N	50	10	N	N	L	L	.30	N
AMZ-010	14-16-12	N	7	10	20	500	N	70	10	N	N	.16	L	.09	N
AMZ-011	14-16-12	N	2	10	30	700	N	50	N	N	N	L	L	.07	N
AMZ-030	13-13-30	N	N	50	15	N	20	150	70	N	N	L	2	.20	N
AMZ-031	13-13-30	L	N	30	10	10	15	70	10	N	N	L	L	.25	N
AMZ-032	13-13-19	N	N	N	100	50	L	N	L	N	N	.08	L	.60	N
AMZ-033	13-13-19	N	N	N	30	15	L	N	N	N	N	.02	.2	.70	N
AMZ-034	14-13-29	N	2	N	50	30	N	50	N	N	N	L	L	.40	10
AMZ-043	14-15-23	L	2	L	15	700	N	70	10	N	N	L	L	.12	N
AMZ-079	13-16-36	N	2	N	10	50	15	70	L	N	N	L	.5	.09	N
AMZ-083	14-14- 3	N	2	N	15	700	N	70	L	N	N	L	L	.18	N
AMZ-115	14-17- 1	N	1	N	10	500	N	70	10	N	N	L	L	.12	N
AMZ-118	14-17- 1	L	2	N	10	700	N	70	L	N	N	L	L	.07	N
AMZ-125	14-17- 1	N	L	N	L	2,000	N	10	N	N	N	L	L	.45	100
AMZ-128	12-18-22	10	20	N	5	100	N	N	N	N	N	2	L	.30	N
AMZ-129	12-18-22	30	2	N	30	150	N	70	N	N	N	.25	L	.55	N
AMZ-130	12-18-22	30	1	N	100	200	N	150	N	N	L	.85	L	.45	N
AMZ-131	13-17- 7	.7	L	N	30	500	30	20	N	N	N	L	L	.35	10
AMZ-132	13-17- 7	.5	2	N	20	50	20	N	N	N	N	.04	L	.40	L
AMZ-133	13-17- 7	N	2	N	30	70	L	10	N	N	N	.30	L	.90	20
AMZ-137	14-16-16	N	L	N	5	5,000	N	N	N	N	N	L	L	.09	L
AMZ-138	14-16-16	N	L	N	15	5,000	N	N	N	N	N	.02	L	.09	N
AMZ-139	14-16-16	N	N	N	5	2,000	N	N	N	N	N	L	L	.05	N
AMZ-140	14-16-16	N	N	N	5	5,000	N	N	N	N	N	L	L	.05	N
AMZ-144	11-19- 6	L	2	N	20	300	N	100	N	N	N	N	2	.30	10
AMZ-145	11-19- 5	N	3	N	5	200	N	20	N	N	N	N	L	.55	L
AMZ-146	11-19- 4	N	2	N	10	300	N	30	N	N	N	N	L	.45	N
AMZ-147	11-19- 4	N	3	N	70	300	N	30	N	N	L	N	L	.11	N
AMZ-149	11-19- 9	N	2	N	5	150	N	20	N	N	N	N	L	1.60	N
AMZ-151	11-19- 7	.7	2	N	5	150	N	20	N	N	N	.06	L	.85	20
AMZ-152	11-19-21	N	2	N	5	100	N	20	N	N	N	.06	L	.28	L
AMZ-153	11-19-21	.5	2	N	L	200	N	50	N	N	N	.02	.2	.20	10
AMZ-154	11-19-21	2	2	N	L	150	50	70	N	N	N	.50	.2	.15	10
AMZ-155	11-19-21	N	2	N	L	1,000	N	30	N	N	N	N	.4	.18	N

9/ Sb = 100 ppm.

TABLE 5B.—*Analyses of geochemical samples having anomalous metal contents in altered and mineralized rocks*—Continued

Sample	T. R. S.	Ag (.5)	Be (1)	Bi (10)	Cu (5)	Mn (10)	Mo (5)	Pb (10)	Sn (10)	W (50)	Zn (200)	Au (.02)	Te (.2)	Hg (.01)	As (10)
AMZ-156	11-19-21	N	2	N	L	300	N	30	N	N	N	0.15	0.4	0.22	N
AMZ-157	11-19-21	N	2	N	L	200	N	30	N	N	N	N	.6	.28	L
AMZ-158	11-19-28	N	2	N	5	200	N	30	N	N	N	N	.4	.16	10
AMZ-159	12-19- 4	N	2	N	50	700	10	20	N	N	N	.15	1.2	7.50	L
AMZ-160	12-19- 4	N	1	N	70	500	N	20	N	N	N	N	.4	G	L
AMZ-161	12-19- 4	.7	1	N	50	1,000	N	30	N	N	N	N	.2	1.60	L
AMZ-162	12-19- 4	L	2	N	L	200	200	L	N	N	N	N	L	.35	L
AMZ-164	12-18-21	N	5	N	50	1,000	N	L	N	N	N	N	L	.18	N
AMZ-165	13-18-11	N	5	N	L	200	N	10	N	N	N	N	.2	.18	N
AMZ-169	11-19-29	.5	5	N	10	500	5	20	N	N	N	.35	L	.26	L
AMZ-170	11-19-29	N	1	N	50	5,000	5	20	N	N	200	N	L	.16	50
AMZ-171	11-19-29	N	L	N	200	1,500	N	15	N	N	N	N	N	.26	N
AMZ-172	11-19-29	15	20	N	N	700	N	15	N	N	N	1.20	N	.23	N
AMZ-174	11-19-29	N	7	N	30	1,000	N	20	N	N	N	.06	L	.35	80
AMZ-176	11-19-29	N	2	N	20	200	N	15	N	N	N	N	.2	.40	N
AMZ-180	11-19-29	N	3	N	7	200	N	10	N	N	N	N	L	.50	N
AMZ-182	11-19-32	N	3	N	N	5,000	N	15	N	N	N	N	1.8	.13	L
AMZ-183	11-19-33	N	2	N	N	300	20	10	N	N	N	N	2	.20	N
AMZ-184	11-19-33	.5	L	N	30	700	20	20	N	N	N	N	.2	.30	N
AMZ-186	11-19-33	N	L	N	70	50	50	20	N	N	N	N	L	.20	10
AMZ-188	13-17-17	N	2	N	5	500	N	30	N	N	N	N	.2	.45	L
AMZ-190	12-18-28	N	2	N	5	200	20	20	N	N	N	N	4.8	.20	10
AMZ-191	12-18-33	N	3	N	1,000	1,000	N	200	N	50	N	.04	.4	.24	L
AMZ-192	12-18-33	30	1	10	G	1,500	N	5,000	N	50	N	.04	.6	.50	N
AMZ-193	12-19-23	N	2	N	30	G	N	70	N	N	N	N	.6	.22	10
AMZ-194	12-19-24	.5	N	N	70	70	100	20	N	N	N	N	.2	.80	20
AMZ-195	12-19-24	N	3	N	100	300	N	50	N	N	N	N	.2	.16	L
AMZ-200	11-12- 5	N	10	N	10	700	N	100	50	N	L	L	.8	.26	L
AMZ-201	11-19- 6	N	1	N	20	G	N	10	N	N	N	L	.4	.20	L
AMZ-202	11-19- 5	N	2	N	15	70	N	20	N	N	L	L	.8	.30	40
AMZ-203	11-19- 5	N	5	N	15	G	N	30	N	N	L	L	.8	.13	L
AMZ-204	11-19- 5	N	7	N	30	1,500	50	100	N	N	N	L	.6	.22	60
AMZ-205	11-19- 5	N	5	N	70	2,000	100	50	N	N	L	L	1	.08	10
AMZ-206	11-19- 5	N	5	N	30	100	N	10	N	N	L	L	.8	.15	L
AMZ-207	11-10- 5	2	3	N	100	500	30	200	N	N	L	L	1	.08	10
AMZ-208	11-19- 5	N	2	N	50	500	L	20	N	N	L	L	.8	.05	L
AMZ-209	12-19- 4	N	N	N	70	20	L	50	N	N	L	L	.8	.24	40
AMZ-210	12-19- 4	N	N	N	15	10	N	L	N	N	L	L	.8	.15	10
AMZ-211	12-19-12	N	L	N	30	20	L	L	N	N	300	L	.8	.24	40
AMZ-212	12-19-12	N	1	N	20	G	L	300	N	N	L	L	.6	.04	L
AMZ-213	12-18- 3	N	2	N	5	200	N	20	N	N	L	L	.8	.06	L
AMZ-214	11-18-32	N	5	N	15	100	N	10	N	N	L	.50	.6	.13	L
AMZ-215	11-18-33	3	5	N	20	200	N	30	N	N	L	.30	.8	.12	40
AMZ-216	11-18-28	N	3	N	20	70	N	20	N	N	L	L	.6	.16	10
AMZ-217	11-18-33	10	7	N	20	200	N	100	N	N	N	.80	1	.15	40
AMZ-218	12-18- 5	N	1.5	N	10	G	N	N	N	N	N	.60	.8	.07	10
AMZ-219	12-18- 5	N	10	N	20	G	N	N	N	N	N	L	.6	.11	L
AMZ-220	12-19-15	N	N	10	100	30	100	50	N	N	N	L	60	.60	80
AMZ-221	12-19- 9	N	L	N	20	30	L	50	N	N	N	L	.8	.35	200
AMZ-222	12-19- 9	N	N	N	20	10	L	30	N	N	N	L	.8	.26	10
AMZ-223	12-19- 9	N	3	N	100	30	L	L	N	N	N	L	.8	.50	40
AMZ-224	12-19- 9	N	L	N	30	100	30	L	N	N	N	L	7	.22	10
AMZ-225	12-19- 9	N	N	N	20	20	N	70	N	N	N	L	1	.11	L
AMZ-226	12-19- 9	N	N	N	L	L	20	N	N	N	N	L	1	.10	L
AMZ-227	12-18-16	N	5	N	50	1,000	N	500	N	N	3,000	L	.4	.14	L
AMZ-228	12-18-20	N	3	N	30	700	N	30	N	N	N	L	.8	.08	L
AMZ-229	12-18-20	N	5	N	15	700	N	50	N	N	N	L	.8	.82	10
AMZ-230	14-16- 7	N	L	N	15	G	N	N	N	N	N	L	.6	.07	L
AMZ-231	14-16- 7	N	3	N	50	1,000	N	20	N	N	N	L	.4	.05	L
AMZ-232	12-18-33	N	2	N	10	700	N	20	N	N	N	L	.8	.08	60
AMZ-233	12-18-20	10	1.5	N	5,000	1,000	N	2,000	N	N	500	L	1.2	.35	L

TABLE 5C.—*Analyses of geochemical samples having anomalous metal contents in stream sediments*

Sample	T. R. S.	Ag (.5)	Be (1)	Cu (5)	Mn (20)	Mo (5)	Pb (10)	Sn (10)	Zn (200)	Au (.02)	Te (.2)	Hg (.01)	As (10)
ABZ-708	13-13-11	N	N	30	1,500	N	15	N	N	N	L	0.06	N
ABZ-711	13-13-14	N	L	100	1,000	N	15	N	N	N	H	.06	N
ABZ-712	13-13-23	N	L	100	700	N	30	N	N	.04	H	.06	N
ABZ-713	13-13-14	N	2	100	700	N	20	N	N	N	H	.02	N
ABZ-715	13-13- 4	N	L	100	700	N	20	N	N	N	L	.03	N
ABZ-716	13-13- 4	N	2	150	1,000	N	30	N	N	N	L	.04	N
ABZ-717	13-13- 9	N	2	100	700	N	30	N	N	.02	.4	.04	N
ABZ-718	13-13- 9	N	1	100	700	N	30	N	N	N	L	.06	N
ABZ-724	13-13-16	N	2	150	1,000	N	50	N	N	N	L	.07	N
ABZ-726	13-13-16	N	1	70	1,500	N	30	N	N	N	.4	.06	N
ABZ-727	13-13-16	N	1	100	1,000	N	50	N	N	N	L	.01	N
ABZ-731	13-13-21	N	L	150	1,000	N	70	N	N	N	L	.04	N
ABZ-734	13-13- 4	N	2	30	500	N	30	N	N	.45	.3	.02	N
ABZ-772	13-13-25	.5	1	50	700	N	30	N	N	N	H	.08	N
ABZ-798	13-13-32	N	L	70	300	7	70	N	N	.02	H	.06	N
ABZ-802	13-13-20	N	L	50	1,500	N	20	N	N	N	H	.05	N
ABZ-804	13-13-29	N	L	100	300	N	30	N	N	N	H	.08	N
ABZ-820[10/]	13-13-30	N	L	50	300	5	50	N	N	.03	H	.10	N
ABZ-821	13-13-19	N	L	70	1,500	5	70	N	300	.02	H	.03	N
ABZ-830	14-13- 8	N	L	100	1,000	N	30	N	N	.03	H	.07	N
ABZ-843	14-13-20	N	L	70	1,500	N	30	N	N	.02	H	.02	N
ABZ-854	14-13-19	N	L	50	700	N	30	N	200	.02	L	.03	N
ABZ-855	14-13-19	N	L	70	1,000	N	30	N	300	N	H	.03	N
ABZ-895	14-13-32	N	L	30	2,000	N	15	N	500	N	H	.07	N
ABZ-906	14-13-34	N	L	30	2,000	N	30	N	N	.03	L	.02	N
ABZ-912	14-14-35	N	L	30	300	N	20	N	200	.02	H	.04	N
ABZ-920	15-12- 2	L	L	15	300	N	20	N	N	N	L	.03	N
ABZ-926	15-12- 9	N	15	20	500	N	30	N	N	N	L	.07	N
ABZ-927	15-12- 9	L	L	10	700	L	20	N	N	N	L	.01	N
ABZ-929	10-19-30	L	L	15	700	N	20	N	N	N	L	.04	L
ABZ-931	10-20-36	.7	1	20	500	N	20	N	N	N	.4	.13	N
ABZ-932	10-20-36	50	3	20	700	N	70	N	N	.20	L	.18	N
ABZ-934	11-20- 1	5	1	100	1,000	N	150	N	N	.04	L	.15	N
ABZ-936	11-20- 1	10	L	30	500	N	30	N	N	N	L	.04	N
ABZ-947	12-18-29	N	1	70	1,500	N	70	N	N	N	L	.06	L
ABZ-957	14- 7-23	.5	1	20	500	N	30	N	N	N	L	.06	N
ABZ-974	14-12-13	N	L	70	1,500	N	30	N	N	N	L	.04	N
ACA-310	12-13-31	N	L	30	1,500	N	30	N	N	N	H	.04	N
ACA-311	12-13-19	N	L	15	1,500	7	30	N	N	N	H	.03	N
ACA-312	12-13-19	N	L	20	2,000	N	30	N	N	N	H	.02	N
ACA-313	12-13-31	N	L	30	2,000	N	50	N	N	N	H	.02	N
ACA-316	12-13-26	N	L	50	2,000	N	10	N	N	N	H	.01	N
ACA-317	12-13-26	N	L	30	1,500	N	15	N	N	N	H	.02	N
ACA-318	12-13-26	N	L	30	1,500	N	L	N	N	N	H	.01	N
ACA-319	12-13-26	N	L	100	3,000	N	L	N	N	N	H	.02	N
ACA-320	12-13-35	N	L	30	2,000	N	70	N	N	N	L	.02	N
ACA-321	12-13-25	N	L	20	1,500	N	20	N	N	N	L	.01	N
ACA-323	12-13-35	N	L	150	3,000	N	L	N	N	N	L	.02	N
ACA-324	13-13- 2	N	L	100	3,000	N	L	N	N	N	L	.03	N
ACA-325	13-13- 2	N	L	100	2,000	N	10	N	N	N	L	.04	N
ACA-326	13-12-19	N	L	70	1,500	N	15	N	N	N	H	.02	N
ACA-344	13-12-26	N	3	30	500	7	70	N	N	N	L	.04	N
ACA-345	13-12-26	N	2	20	700	7	50	N	N	N	L	.04	N
ACA-351	13-13-29	N	L	50	300	N	70	N	N	N	H	.06	N
ACA-357	13-13-29	N	L	50	500	10	30	N	N	N	L	.04	N

10/ Bi = L(10).

TABLE 5C.—*Analyses of geochemical samples having anomalous metal contents in stream sediments*—Continued

Sample	T. P. S.	Ag (.5)	Be (1)	Cu (5)	Mn (20)	Mo (5)	Pb (10)	Sn (10)	Zn (200)	Au (.02)	Te (.2)	Hg (.01)	As (10)
ACA-363	13-13-28	N	1	30	700	N	70	N	N	N	H	0.02	N
ACA-376	14-13-16	N	L	30	300	7	30	N	N	N	L	.05	N
ACA-379[11/]	14-13-21	N	L	30	500	N	15	N	N	N	L	.07	10
ACA-380[11/]	14-13-21	N	L	50	150	15	50	N	N	L	.2	.15	N
ACA-383	14-13-16	N	L	70	500	10	50	N	N	N	L	.04	N
ACA-388	14-13-22	N	L	200	1,500	N	30	N	N	N	L	.05	N
ACA-389	14-13-22	N	L	50	3,000	N	30	N	300	N	H	.07	N
ACA-392	14-13-22	N	L	70	2,000	N	10	N	N	N	L	.04	N
ACA-398	14-13-28	20	L	50	700	5	20	N	N	N	L	.10	N
ACA-404	14-13- 8	N	L	30	500	N	15	N	N	N	L	.05	10
ACA-408	14-13-33	N	L	20	1,500	15	70	N	N	N	L	.04	N
ACA-409	14-13-34	N	L	30	500	N	15	N	N	N	L	.04	10
ACA-411[12/]	14-13-32	N	L	50	1,500	N	L	N	700	N	H	.06	N
ACA-412	14-13-33	N	L	30	1,500	N	30	N	N	N	L	.03	N
ACA-413	14-13-26	N	L	100	3,000	N	L	N	N	N	H	.02	N
ACA-414	14-13-26	N	L	30	1,500	N	20	N	N	N	H	.05	N
ACA-415	14-13-14	N	L	100	1,000	N	30	N	N	N	H	.02	N
ACA-419	14-13-25	N	L	70	1,500	N	20	N	N	N	L	.02	N
ACA-420	14-13-25	N	L	50	1,500	N	20	N	N	N	L	.01	N
ACA-421	14-13-25	N	L	70	1,500	N	30	N	N	N	L	.04	N
ACA-422	14-13-26	N	L	50	1,500	N	30	N	N	N	L	.01	L
ACA-423	14-13-35	N	L	50	1,500	N	30	N	N	N	L	.03	N
ACA-430	14-12-36	N	L	150	700	N	20	N	N	N	L	.04	N
ACA-438	13-12- 9	N	2	70	700	7	30	N	N	N	L	.04	N
ACA-448	12-13-25	N	1	20	1,500	L	30	N	N	N	L	.03	N
ACA-453	12-13-21	N	L	70	2,000	L	20	N	N	N	L	.03	N
ACA-454	12-13-21	N	L	100	2,000	N	30	N	N	N	.4	.02	N
ACA-456	12-13-15	N	L	70	1,500	N	30	N	N	N	.4	.04	N
ACA-457	12-13-10	N	L	100	1,500	N	30	N	N	N	L	.03	N
ACA-458	12-13-14	N	L	150	2,000	N	30	N	N	N	L	.02	N
ACA-460	12-13-10	N	1	70	1,500	N	30	N	N	N	L	.02	N
ACA-461	12-13-11	N	1	70	1,500	5	30	N	N	N	.3	.02	N
ACA-464	12-13- 2	N	1	70	1,500	N	30	N	N	N	L	.04	N
ACA-465	12-12-27	N	L	30	1,500	N	30	N	N	N	B	.03	N
ACA-466	14-13-36	N	L	30	1,500	N	50	N	N	N	L	.04	N
ACA-486	11-13-36	N	1	5	2,000	N	30	N	300	L	L	.03	N
ACA-487	11-13-36	N	2	5	2,000	N	30	N	300	L	L	.06	N
ACA-523	11-13- 4	N	1	50	1,500	N	50	N	N	L	L	.18	N
ACA-527	11-13- 3	N	2	30	1,500	N	50	N	N	L	L	.10	N
ACA-528	11-13- 2	N	1	30	1,000	N	50	N	N	.20	L	.06	N
ACA-529	11-13- 2	N	1	30	1,500	N	30	N	N	L	L	.10	N
ACA-533	11-13- 1	N	1	30	1,500	N	30	N	N	L	L	.12	N
ACA-539	12-14-13	N	2	15	1,500	N	20	N	N	L	L	.05	N
ACA-549	11-14- 4	N	L	50	1,500	N	20	N	N	L	L	.08	N
ACA-553	11-15- 6	N	2	5	700	N	30	N	N	L	L	L	30
ACA-556	11-16- 2	N	1	20	700	N	20	20	N	L	L	.10	N
ACA-563	10-16-34	L	1	20	1,000	N	20	N	N	L	L	.06	N
ACA-567	11-15- 5	N	1	10	1,500	N	20	N	200	L	L	.03	N
ACA-572	11-15-11	N	2	30	1,000	N	50	N	N	.10	L	.10	N
ACA-573	11-15-11	.5	2	20	1,000	N	30	N	N	L	L	.08	N
ACA-607	12-19- 7	N	1	50	700	7	20	N	N	L	L	.03	N
ACA-610	11-19- 2	N	2	20	1,500	N	30	N	N	L	L	.20	N
ACA-624	12-19-16	N	2	30	700	N	30	N	N	L	L	.10	10
ACA-628	12-19-15	N	2	30	1,500	L	30	N	N	L	L	.10	L
ACA-631	12-18-21	N	5	30	1,500	N	30	N	N	L	L	.07	N
ACA-635	12-18-28	N	3	20	1,500	N	50	N	N	L	L	.05	N
ACA-659	13-17-28	N	2	20	1,500	N	20	N	N	L	L	.05	N
ACA-663	13-17-21	N	2	50	1,500	N	50	N	N	L	L	.09	N
ACA-670	13-17-19	N	2	20	1,500	N	20	N	N	L	L	.05	L
ACA-674	11-13-14	N	1	30	1,500	N	50	N	N	L	L	.10	N

11/ Bi = L(10).

12/ Cd = 20 ppm.

TABLE 5C.—*Analyses of geochemical samples having anomalous metal contents in stream sediments*—Continued

Sample	T. R. S.	Ag (.5)	Be (1)	Cu (5)	Mn (20)	Mo (5)	Pb (10)	Sn (10)	Zn (200)	Au (.02)	Te (.2)	Hg (.01)	As (10)
ACA-675	11-13-11	N	2	30	1,500	N	50	N	N	L	L	0.10	N
ACA-743	14-16- 3	N	1	30	1,500	N	20	N	200	L	L	.15	N
ACA-745	14-16-10	N	2	15	1,000	N	20	15	N	L	L	.07	N
ACA-750	12-12- 8	N	2	7	1,500	5	30	15	200	L	L	.05	N
ACA-755	12-12-17	N	2	10	1,500	5	30	N	L	L	L	L	N
ACA-756	12-12- 8	N	2	10	1,000	7	20	N	N	L	L	L	N
ACA-758	12-12- 8	N	2	20	G	10	20	100	1,000	L	L	.02	N
ACA-764	12-13-13	N	N	30	5,000	N	20	N	700	L	L	.05	N
ACA-768	10-13-36	N	1	50	1,500	N	30	N	N	L	L	.13	N
ACA-769	10-12-31	N	2	50	1,500	5	30	N	N	L	L	.06	N
ACA-771	10-13-26	N	1	50	1,500	N	30	N	N	L	L	.28	N
ACA-772	10-13-26	N	1	50	1,500	N	50	N	N	L	L	.22	N
ACA-773	10-13-27	N	2	50	1,500	N	50	N	N	L	L	.20	N
ACA-776	10-13-28	N	1	50	1,500	N	50	N	N	L	L	.22	N
ACA-777	10-13-32	N	2	50	1,000	N	50	N	N	B	L	.40	N
ACA-784[13]	10-15-32	N	1	50	1,000	10	50	N	N	L	L	.13	N
ACA-786	10-15-31	N	2	30	1,000	N	70	N	N	L	L	.10	N
ACA-787	11-15- 3	N	2	20	1,500	N	70	N	200	L	L	.10	N
ACA-788	11-15- 3	N	2	15	700	N	70	N	N	L	L	.05	N
ACA-801	10-17-34	N	L	30	1,500	N	30	N	L	L	L	.05	N
ACA-802	10-17-34	N	L	10	1,000	7	15	N	L	L	L	.06	N
ACA-807	12-19- 5	N	1	50	500	10	20	N	N	L	L	.06	N
ACA-815	14-16-24	N	3	15	700	N	30	15	N	L	L	.12	N
ACA-825[14]	13-16-15	N	3	L	1,000	5	15	10	N	L	L	.12	N
ACA-829	13-16-26	N	1	30	1,500	N	15	N	N	L	L	.07	N
ACA-833	12-17- 2	N	3	30	1,000	N	30	N	L	B	L	.65	N
ACA-837	12-16- 4	N	L	50	1,000	N	15	N	200	B	L	.13	N
ACA-839	12-16-11	N	1	20	1,500	N	20	N	200	B	L	.15	N
ACA-840	12-16-11	N	2	5	2,000	N	15	50	200	B	L	.24	N
ACA-845	12-16- 1	N	L	30	1,500	N	15	N	300	L	L	.10	N
ACA-865	12-14-18	N	1	5	1,000	N	15	10	200	B	L	.11	N
ACA-866	12-14-18	N	1	L	700	N	15	30	N	B	L	.09	N
ACA-867	12-14-17	N	1	20	1,000	N	15	15	N	B	L	.07	N
ACA-893	11-14-31	N	2	10	1,500	N	30	10	N	B	L	.14	N
ACA-894	11-15-36	N	2	15	1,500	N	20	L	N	B	B	B	N
ACA-895	12-14-13	N	N	20	G	N	20	30	N	L	L	.05	L
ACA-972	12-14-13	N	N	15	5,000	N	15	N	N	L	L	.09	L
ACA-989[13]	11-14-32	N	2	100	1,000	N	50	N	N	B	B	.40	N
ACA-990	11-14-33	N	2	70	1,000	N	50	15	N	B	B	.40	N
ACA-992	11-14-34	N	2	70	700	N	30	L	N	B	B	.40	N
ACA-994	12-14- 9	N	L	50	5,000	N	15	20	300	L	L	.05	L
ACA-999[13]	12-15-15	N	3	30	700	N	30	N	N	L	L	.08	N
AGR-005	14-12- 6	N	L	30	300	50	20	N	N	L	L	.16	N
AGR-028	15-14- 8	N	L	50	1,500	N	20	N	200	L	.2	.16	L
AGR-029	15-14- 8	N	L	50	1,500	N	20	N	200	L	.2	.15	L
AGR-033	14-14-33	N	L	50	1,500	N	15	N	N	L	L	.12	L
AGR-036	14-14-29	N	L	20	700	N	20	N	N	L	L	.45	L
AGR-039	14-14-29	N	L	50	1,500	N	15	N	200	L	L	.10	L
AGR-046	14-14-28	N	L	30	1,500	N	20	N	L	L	L	.11	L
AGR-053	14-14- 3	N	L	50	1,000	N	20	N	200	L	L	.10	L
AGR-054	14-15- 3	N	L	30	1,000	10	15	N	L	L	L	.08	L
AGR-056	15-14-10	N	L	50	1,500	N	10	N	200	L	L	.11	L
AGR-058	15-14-15	N	L	50	2,000	N	20	N	200	L	L	.07	L
AGR-065	14-14-26	N	L	20	1,000	10	20	N	N	L	L	.10	L
AGR-068	14-14-34	N	L	20	1,500	N	30	N	N	L	L	.02	L
AGR-069	14-14-34	N	1	30	1,500	N	15	N	200	L	L	.08	L
AGR-070	14-14-34	N	L	50	1,500	N	20	N	L	L	L	.08	L
AGR-073	14-14-22	N	L	30	1,500	N	15	N	N	L	L	.10	L
AGR-075	14-14-22	N	L	20	1,500	N	20	N	L	L	L	.11	L
AGR-082	14-13-17	N	1	50	300	5	30	N	N	L	1	.25	L

13/ W = L(50).

14/ Sb reported as L(100) was not detected in a repeat analysis.

TABLE 5C.—*Analyses of geochemical samples having anomalous metal contents in stream sediments*—Continued

Sample	T. R. S.	Ag (.5)	Be (1)	Cu (5)	Mn (20)	Mo (5)	Pb (10)	Sn (10)	Zn (200)	Au (.02)	Te (.2)	Hg (.01)	As (10)
AGR-135	11-19-20	N	1	30	1,500	N	50	N	N	0.02	L	0.08	N
AGR-139	11-19-19	N	1	30	1,000	30	30	N	N	.02	L	.06	N
AGR-142	11-19-32	N	1	50	700	10	30	N	N	.02	L	.18	N
AGR-146	12-20-12	N	1	30	1,500	N	30	15	200	.70	L	.08	N
AGR-150	12-20- 1	N	1	15	1,500	N	30	N	200	.02	L	.03	N
AGR-153	11-20-36	N	2	20	700	15	30	N	N	N	L	.03	N
AGR-159	11-19-29	N	1	50	1,500	N	50	N	200	.02	L	.08	N
AGR-160	11-20-35	N	N	30	2,000	N	20	N	700	N	L	.06	N
AGR-181	11-19-12	N	5	30	1,500	N	50	N	N	.02	L	.40	N
AGR-183	11-19-12	N	3	15	1,500	N	30	N	N	L	L	.18	N
AGR-187	11-19-10	N	3	30	1,000	L	50	N	N	.06	L	.16	N
AGR-209	12-19- 3	N	3	30	1,500	N	20	N	N	L	L	.22	N
AGR-216	12-19- 9	N	2	100	300	5	30	N	N	L	L	.14	N
AGR-217	12-19- 8	N	2	70	1,500	5	30	N	N	L	L	.11	N
AGR-218	12-19- 8	N	2	50	700	7	20	N	N	L	L	.09	N
AGR-219	12-19-18	N	2	50	700	7	20	N	N	L	L	.15	N
AGR-227	13-18-11	N	2	30	1,000	N	30	N	N	.06	L	.20	N
AGR-236	12-19-13	N	2	15	1,000	L	30	N	N	L	L	.20	10
AGR-237	12-19-13	N	2	50	1,500	N	70	N	N	L	L	.18	N
AGR-279	13-17- 7	N	2	20	2,000	N	15	N	N	L	L	.15	N
AGR-359	13-17-15	N	1	70	1,500	N	20	N	N	L	L	.06	N
AGR-360	13-17-15	N	1	30	1,500	N	30	N	N	L	L	.10	N
AGR-361	13-17-15	N	1	70	1,500	N	30	N	N	L	L	.35	N
AGR-362	13-17-15	N	1	50	1,500	N	30	N	N	L	L	.24	N
AGA-364	13-17-22	N	1	30	1,500	N	15	N	N	L	L	.24	N
AGR-368	13-17-22	N	1	50	1,500	N	20	N	N	L	L	.10	N
AGR-373	13-17- 8	N	1	30	1,500	N	20	N	N	L	L	.15	N
AGR-374	13-17- 4	N	1	50	1,500	N	20	N	N	L	L	.15	N
AGR-375	13-17- 4	N	1	15	1,500	N	20	N	N	L	L	.18	N
AGR-376	13-17- 4	N	1	70	1,500	N	20	N	N	L	L	.35	N
AGR-378	13-17-17	N	1	30	1,500	N	30	N	N	L	L	.22	N
AGR-380	13-17-21	N	1	70	1,500	N	20	N	N	.02	.3	.40	N
AGR-383	13-17-27	N	1	30	1,500	N	20	N	N	L	L	.24	N
AGR-386	12-17-18	N	2	20	1,500	N	30	L	N	L	L	.20	N
AGR-390	13-17-36	N	1	50	1,500	N	20	N	N	L	.3	.18	N
AGR-391	13-17-36	N	1	50	1,500	N	20	N	N	L	.3	.30	N
AGR-395	14-17- 2	N	2	20	1,500	N	30	N	N	L	L	.11	N
AGR-396	14-17- 2	N	2	30	1,500	N	20	N	N	L	L	.20	N
AGR-461	14-16-20	N	1	20	300	7	20	N	N	L	L	.22	N
AGR-463	12-17-21	N	2	30	1,500	N	30	N	N	L	L	.20	N
AGR-468	12-17- 8	N	2	15	700	N	30	N	200	L	L	.11	N
AGR-485	12-17-33	3	2	50	1,500	N	30	N	200	L	L	.15	N
AGR-491	12-17-36	N	2	20	1,000	10	30	N	N	L	L	.12	N
AGR-498	13-16- 4	N	2	20	1,500	N	20	N	N	L	.2	.20	N
AGR-502	13-16- 4	N	2	15	1,500	N	20	N	200	L	L	.10	N
AGR-510	13-16-22	N	2	30	1,500	N	20	N	200	L	L	.12	N
AGR-518	14-16-28	N	2	20	500	7	30	N	N	L	.4	.12	L
AGR-618	11-18- 7	N	7	15	1,000	N	30	N	N	L	L	.28	L
AGR-625	11-18-15	N	1	7	1,000	N	20	N	N	.30	L	.08	L
AGR-693	12-19-11	N	2	20	700	N	30	N	N	L	L	.07	10
AGR-761	12-19-12	N	2	5	700	N	20	N	N	L	L	.90	10
AGR-787	12-19-12	N	2	30	1,500	10	50	N	N	L	L	.03	L
AGR-800	13-15-20	N	3	7	1,000	L	30	15	N	L	L	.02	L
AGR-804	13-15-19	N	2	10	5,000	N	20	20	500	L	L	.03	L
AGR-807	13-16-25	N	5	10	1,500	N	50	L	N	L	L	.06	L
AGR-809	13-16-36	N	3	15	1,500	N	30	L	N	L	L	.03	L
AGR-981	14-15-12	N	3	10	1,000	N	20	20	N	L	L	.15	N
AGR-985	14-15-12	N	2	15	700	N	70	N	N	L	L	.15	N
AGR-994	14-15- 3	N	2	15	700	N	50	N	N	L	L	.70	N
AGR-996	14-15-10	N	2	20	700	N	70	N	N	L	L	.30	N
AGR-997	14-15-10	N	1	20	500	N	20	N	N	B	L	.50	N
AMF-030	11-16-6	N	L	10	1,000	N	20	N	300	L	L	.03	L
AMF-060	11-18- 4	N	2	5	2,000	N	20	N	N	.02	.2	.02	L
AMF-065	11-16-11	N	1	20	1,500	N	20	N	N	.02	L	.13	L
AMF-077	12-15-22	N	7	15	1,000	5	30	N	N	L	L	.05	L

TABLE 5C.—*Analyses of geochemical samples having anomalous metal contents in stream sediments*—Continued

Sample	T. P. S.	Ag (.5)	Be (1)	Cu (5)	Mn (20)	Mo (5)	Pb (10)	Sn (10)	Zn (200)	Au (.02)	Te (.2)	Hg (.01)	As (10)
AMF-086	12-15-13	N	1	20	1,500	N	30	N	N	L	L	0.03	L
AMF-092	12-14-28	N	7	50	700	N	30	N	N	L	L	.05	L
AMF-093	12-14-22	N	2	10	700	N	70	N	N	L	L	.13	N
AMF-130	11-17-20	N	2	5	2,000	N	20	10	200	L	L	.03	L
AMF-137	11-17- 3	N	1	10	1,500	N	20	10	N	L	L	.05	L
AMF-146	12-16-17	N	3	7	1,500	N	15	10	N	L	.3	.05	L
AMF-147	12-16-16	N	3	L	1,500	N	20	10	N	L	.2	.04	L
AMF-150	12-16-15	N	3	L	1,500	N	10	N	N	L	L	.04	L
AMF-155	12-16-28	N	5	7	2,000	N	20	L	N	L	.3	.03	L
AMF-156	12-16-28	N	5	10	2,000	N	30	L	N	L	L	.04	L
AMF-190	12-14-20	N	2	30	1,500	N	30	N	N	B	B	.13	L
AMF-230	13-14- 8	N	3	50	700	10	30	N	N	L	L	.09	N
AMF-231	13-14- 8	N	2	100	1,000	N	30	N	N	B	B	.24	N
AMF-232[15]	13-14- 9	N	2	50	1,000	N	15	N	N	L	L	.08	N
AMF-249	12-15-26	N	5	15	2,000	N	15	N	N	L	L	.04	N
AMF-250	12-15-25	N	3	5	1,500	N	15	N	N	L	L	.05	N
AMF-270[15]	13-14- 6	N	5	L	700	N	10	N	N	L	L	L	N
AMF-309	12-16-16	N	3	50	1,500	N	20	20	N	L	.2	.02	L
AMF-310	12-16-15	N	2	5	1,500	N	15	10	N	L	L	.01	L
AMF-317[16]	12-15-30	L	3	15	700	L	70	15	N	L	B	.06	N
AMF-318	12-15-21	N	2	15	700	N	100	15	N	L	B	.08	N
AMF-321	12-15-30	N	2	15	500	N	70	10	N	L	L	.16	N
AMF-323	12-14-19	N	L	15	1,500	N	20	N	300	L	B	.20	N
AMF-325	12-14-15	N	1	15	700	N	30	N	N	L	B	.45	N
AMF-338	12-15- 8	N	2	5	500	N	30	10	N	L	B	1	N
AMF-349	13-14-19	N	2	20	2,000	N	30	30	L	L	B	.09	N
AMZ-012	14-16-12	N	2	30	1,000	N	70	20	N	L	L	.26	N
AMZ-013	14-16-36	N	2	30	700	N	70	N	N	L	L	.20	N
AMZ-014	14-16-36	N	2	30	700	N	70	10	N	L	L	.20	N
AMZ-015	14-16-36	N	2	30	700	N	70	10	N	L	L	.20	N
AMZ-016	14-16-23	N	2	30	700	N	70	10	N	L	L	.24	N
AMZ-017	14-16-23	N	2	20	700	N	70	10	N	L	L	.18	N
AMZ-078	13-15-31	N	2	15	1,000	N	50	20	L	L	L	.15	N
AMZ-085	13-16- 6	N	2	10	700	N	50	N	N	L	L	.05	10
AMZ-196	12-14-27	.5	3	L	700	N	70	N	N	N	.2	.02	L
AMZ-197	12-14-27	N	2	5	1,000	N	50	N	200	N	.2	.03	N
AMZ-199	12-14-27	N	2	5	2,000	N	50	10	300	N	.2	.03	N

15/ W = L(50).

16/ Bi = L(10).

TABLE 5D.—*Analyses of geochemical samples having anomalous metal contents in panned concentrates*

Sample	T. R. S.	Ag (.5)	Be (1)	Bi (10)	Cu (5)	Mo (5)	Pb (10)	Sn (10)	Au (.02)	Te (.2)	Hg (.01)	As (10)
ABZ-879	14-13-31	N	L	N	30	N	20	N	0.02N	L	0.09	15
ABZ-880	14-13-31	N	L	N	70	N	15	N	.02N	.6	.16	15
ABZ-885	14-13- 8	N	1	N	100	N	10	N	.04N	4	.09	10
ABZ-886	14-13-20	N	1	N	70	N	20	N	.02N	3	.30	30
ABZ-887	14-13-20	N	L	N	100	N	20	N	.02N	1	.11	10
ABZ-890	14-13-32	N	1	10	100	N	20	N	.02N	3	.20	20
ABZ-894	14-13-32	N	1	N	70	N	20	N	.02N	1	.16	15
ABZ-907	14-13-34	N	1	N	50	N	100	N	.04N	L	.22	10
ABZ-925	15-12-10	N	2	N	70	N	20	10	.02N	1.5	.10	L
ABZ-930	10-20-36	2	1	N	200	N	70	20	.02N	.2	.34	20
ABZ-933	10-20-36	200	2	N	1,000	N	500	100	.10N	L	1.63	120
ABZ-935	11-20- 1	150	2	N	1,500	N	200	50	.02N	L	1.80	60
ABZ-937	11-20- 1	2	5	N	150	N	100	N	.10N	L	.31	40
ABZ-940	13-18-11	2	2	N	100	N	70	N	.04N	L	.39	50
ABZ-942	13-18- 7	N	2	N	50	N	50	N	.90	L	.10	20
ABZ-946	12-18-29	N	2	N	150	10	70	N	1.70	1.5	.14	40
ACA-443	13-12-17	N	L	N	15	N	N	20	.80	B	.08	10
ACA-451	12-13-22	N	2	N	30	N	20	N	.02N	.6	.10	10
ACA-452	12-13-22	N	L	N	70	N	10	N	.02N	.6	.06	L
ACA-455	12-13-22	N	L	N	15	5	N	30	.10N	B	.10	10
ACA-459	12-13-15	N	L	N	100	N	N	30	B	B	.10	10
ACA-504	13-13-11	N	L	N	20	N	N	150	.02N	B	.04	L
ACA-506	13-13-24	N	N	N	20	N	N	50	.02N	B	.04	L
ACA-512	13-13- 6	N	1	N	50	N	30	70	.30	1	.08	20
ACA-557	11-16- 2	N	L	N	30	N	10	15	B	B	.40	N
ACA-568	11-15- 4	N	1	N	20	N	30	L	.02L	.7	.05	N
ACA-575	11-15-14	N	2	N	15	N	20	N	.02L	.7	.09	N
ACA-579	11-15-10	N	2	N	20	N	20	N	.02L	.7	.05	N
ACA-582	11-15- 3	N	1	N	20	N	15	N	.02L	.8	.05	N
ACA-623	12-19-17	N	2	N	30	N	30	N	.06	1	.09	10
ACA-629	12-19-22	N	2	N	20	N	20	N	.02L	.8	.20	20
ACA-637	12-18-38	N	3	N	15	N	30	N	.02L	.8	.10	N
ACA-645	12-18-33	N	2	N	50	N	50	N	.02L	1.2	.10	N
ACA-678	11-15- 4	N	L	N	30	N	15	10	.06	B	.10	N
ACA-687	12-12- 8	N	L	N	30	N	15	50	B	B	.05	N
ACA-757	12-12- 8	N	1	N	30	N	20	100	B	B	.05	N
ACA-759	12-12- 8	N	1	N	30	N	30	200	.02L	B	.07	N
ACA-791	11-14- 5	N	1	N	50	N	30	50	B	B	B	L
ACA-803	10-17-34	N	1	N	100	N	15	15	.02L	1.4	.05	N
ACA-806	12-19- 5	N	2	N	50	10	30	N	.30	1	.05	N
ACA-908	11-15-24	N	N	N	15	N	15	150	.02L	L	.09	L
ACA-917	11-14-29	N	1	N	7	N	20	N	.02L	L	.80	L
AGR-117	11-19-29	N	1	N	30	N	50	20	.02L	2	.05	N
AGR-120	11-19-30	N	2	N	30	N	50	15	.02L	2	.05	N
AGR-122	11-20-24	N	2	N	70	N	70	20	B	B	.10	L
AGR-141	11-19-32	N	1	N	100	N	50	15	B	B	.20	40
AGR-148	12-20- 1	N	2	N	70	N	30	30	B	B	.20	N
AGR-170	11-19- 7	N	2	N	50	N	100	20	B	B	.20	L
AGR-225	13-18-11	N	2	N	20	N	30	N	.40	.8	.09	N
AGR-261	12-18-30	N	2	N	30	N	20	N	.40	B	.10	N
AGR-281	11-19- 6	N	2	N	20	N	70	10	.06	B	.20	N
AGR-290	11-19-30	N	N	N	20	N	30	15	.02L	2.2	.05	N
AGR-294	12-20- 1	N	1	N	30	N	70	15	B	B	.08	N
AGR-296	11-19- 7	N	L	N	20	N	150	20	B	B	.10	N

TABLE 5D.—*Analyses of geochemical samples having anomalous metal contents in panned concentrates*—Continued

Sample	T. R. S.	Ag (.5)	Be (1)	Bi (10)	Cu (5)	Mo (5)	Pb (10)	Sn (10)	Au (.02)	Te (.2)	Hg (.01)	As (10)
AGR-407	14-17-14	N	N	N	20	N	70	N	0.04	B	0.10	30
AGR-415	14-16-21	N	L	N	30	N	30	N	.04	B	.11	20
AGR-519	14-16-28	N	2	N	15	N	70	10	.04	.4	.12	L
AGR-584	14-15-24	N	N	N	30	N	15	50	.02L	L	.04	L
AGR-602	14-15-21	N	N	N	50	N	15	150	.02L	L	.22	L
AGR-607	14-15-20	N	N	N	30	N	10	30	.02L	L	.02	L
AGR-610	14-15-20	N	N	N	30	N	15	30	.02L	L	.02	L
AGR-613	14-15-20	N	N	N	70	N	30	100	.02L	L	.04	L
AGR-664	11-18-32	N	1	N	7	N	100	50	.04	L	.10	10
AGR-666	12-18- 4	N	2	N	5	N	50	20	.02L	L	.03	20
AGR-668	12-18- 4	N	2	N	7	N	50	20	.02L	L	.30	80
AGR-673	12-18- 5	N	2	N	10	N	70	20	.10	L	.05	10
AGR-674	12-18- 5	N	2	N	5	N	50	20	.02L	L	.05	20
AGR-843	14-14-21	N	N	N	150	N	15	N	L	L	.24	N
AGR-850	14-14-16	N	N	N	100	N	30	N	.02L	L	.22	L
AGR-861	14-14- 4	N	N	N	150	N	10	N	.04L	L	.13	N
AGR-864	14-14- 3	N	N	N	100	N	20	N	.04L	L	.11	N
AGR-869	13-14-34	N	N	N	150	N	15	N	B	B	.28	N
AGR-874	13-14-34	N	N	N	50	N	15	N	.02L	L	G	N
AMF-235[17/]	13-14- 3	N	2	N	15	N	10	N	.02L	L	.11	L
AMF-255	13-14- 4	N	1	N	15	N	15	20	.10	L	.03	L
AMF-256	13-14- 4	N	1	N	30	N	N	50	.04L	L	.07	L

17/ W = L(50).

TABLE 6.—*Statistical summary of selected elements in the geochemical samples*

[F, numerical frequency; CF, cumulative frequency, in percent; GM, geometric mean; NC, not computed; ---, no values. Tabulations include 34 samples of altered rock that were not included in the computations of the geometric mean. Totals may include rocks from the Gila Conglomerate or sediments interlayered with the volcanic igneous rocks, and thus igneous rock columns, when summed may be less than totals]

Values (ppm)	Unaltered rocks								Altered and mineralized rock		Stream sediments		Panned concentrates	
	Felsic		Intermediate		Mafic		Total							
	F	CF	F	CF	F	CF	F	CF	F	CF	F	CF	F	CF
							Beryllium							
N	---	---	2	1.65	4	8.33	6	1.2	49	9.40	14	1.02	52	29.71
L	14	4.35	50	42.97	29	68.75	93	20.2	149	38.00	351	26.53	49	57.71
1.0	40	16.77	47	81.81	15	100.00	102	40.9	80	53.40	349	51.87	37	78.85
1.5	53	33.23	11	90.90	---	---	64	53.9	69	66.50	241	69.38	19	89.71
2.0	87	60.25	9	98.34	---	---	96	73.5	72	80.30	263	88.49	16	98.85
3.0	88	87.58	1	99.17	---	---	89	91.5	42	88.50	122	97.36	1	99.42
5.0	29	96.59	---	99.17	---	---	29	97.4	36	95.50	32	99.69	1	100.00
7.0	6	98.45	---	99.17	---	---	6	98.7	11	97.50	3	99.91	---	---
10	4	99.69	1	100.00	---	---	5	99.8	7	98.90	---	99.91	---	---
15	---	99.69	---	---	---	---	---	99.8	2	99.30	1	100.00	---	---
20	1	100.00	---	---	---	---	1	100.0	2	99.60	---	---	---	---
30	---	---	---	---	---	---	---	---	1	99.80	---	---	---	---
50	---	---	---	---	---	---	---	---	1	100.00	---	---	---	---
GM-------	2.1	---	NC	---	NC	---	1.5	---	1.1	---	1.2	---	NC	---
							Tin							
N	203	63.04	117	96.69	46	99.96	366	74.4	477	91.50	1,286	93.46	73	41.71
L	74	86.02	4	100.00	2	100.00	80	90.9	24	96.30	28	95.49	2	42.85
10	43	99.37	---	---	---	---	43	99.6	16	99.20	41	98.47	22	55.42
15	---	99.37	---	---	---	---	---	99.6	1	99.40	9	99.12	31	73.14
20	1	99.68	---	---	---	---	1	99.8	1	99.60	7	99.63	27	88.56
30	1	100.00	---	---	---	---	1	100.0	---	99.60	3	99.85	5	91.42
50	---	---	---	---	---	---	---	---	1	99.80	1	99.92	7	95.42
70	---	---	---	---	---	---	---	---	1	100.00	---	99.92	1	95.99
100	---	---	---	---	---	---	---	---	---	---	1	100.00	3	97.70
150	---	---	---	---	---	---	---	---	---	---	---	---	3	99.41
200	---	---	---	---	---	---	---	---	---	---	---	---	1	100.00
GM-------	NC	---	NC	---	NC	---	Nc	---	NC	---	NC	---	NC	---

								Tungsten								
N	321	99.70	121	100.00	48	100.00	490	99.8	486	93.30	1,369	99.88	174	99.43
L	1	100.00	---	---	---	---	1	100.0	25	4.80	5	100.00	1	100.00
50	---	---	---	---	---	---	---	---	9	1.70	---	---	---	---
70	---	---	---	---	---	---	---	---	---	1.70	---	---	---	---
100	---	---	---	---	---	---	---	---	---	1.70	---	---	---	---
150	---	---	---	---	---	---	---	---	---	1.70	---	---	---	---
200	---	---	---	---	---	---	---	---	1	.20	---	---	---	---
GM-------	NC	---	NC	---	NC	---	NC	---	NC	---	NC	---	NC	---
								Mercury								
N	---	---	---	---	---	---	---	---	---	---	1	0.10	---	---
L	7	2.10	---	---	1	2.00	8	1.6	3	0.50	17	1.30	---	---
.01	18	7.60	8	6.10	2	6.10	28	6.7	11	2.60	31	3.60	8	4.60
.015	---	7.60	---	6.10	---	6.10	---	6.7	---	2.60	---	3.60	---	4.60
.02	25	15.20	13	16.00	3	12.20	41	14.7	21	6.50	96	10.60	6	8.10
.03	33	25.20	16	28.20	4	20.40	53	25.2	35	13.00	143	21.00	12	14.90
.05	53	41.30	7	33.60	4	28.60	64	37.8	66	25.20	281	41.40	32	33.30
.07	57	58.70	20	48.90	6	40.80	83	54.1	63	36.90	309	63.90	20	44.80
.1	50	73.90	18	62.60	9	53.20	77	69.2	64	48.80	245	81.70	52	74.70
.15	31	83.30	7	67.90	5	69.40	43	77.7	50	58.10	117	90.30	10	80.50
.2	37	94.50	17	80.90	10	89.80	64	90.2	95	75.90	96	97.30	19	91.40
.3	10	97.60	9	87.80	2	93.90	21	94.4	45	84.00	24	99.00	9	96.60
.5	5	99.10	8	93.90	2	98.00	16	97.6	34	90.50	10	99.80	2	97.70
.7	3	100.00	7	99.20	1	100.00	12	99.8	20	94.20	1	99.90	1	98.30
1.0	---	---	---	99.20	---	---	---	99.8	10	96.00	1	100.00	---	98.30
1.5	---	---	1	100.00	---	---	1	100.0	6	97.10	---	---	1	98.90
2.0	---	---	---	---	---	---	---	---	7	98.40	---	---	1	99.40
3.0	---	---	---	---	---	---	---	---	---	98.40	---	---	---	99.40
5.0	---	---	---	---	---	---	---	---	5	99.40	---	---	---	99.40
7.0	---	---	---	---	---	---	---	---	2	99.70	---	---	---	99.40
10.0	---	---	---	---	---	---	---	---	---	99.70	---	---	---	99.40
G10.0	---	---	---	---	---	---	---	---	2	100.00	---	---	1	100.00
GM-------	.06	---	.09	---	.09	---	.07	---	.13	---	.06	---	.08	---
								Bismuth								
N	308	95.60	121	100.00	47	97.90	476	96.9	429	87.60	1,371	99.00	174	99.00
L	11	99.00	---	---	1	100.00	12	99.4	28	93.30	4	100.00	---	99.00
10	3	100.00	---	---	---	---	3	100.0	13	95.90	---	---	1	100.00

TABLE 6.—*Statistical summary of selected elements in the geochemical samples*—Continued

Values (ppm)	Unaltered rocks								Altered and mineralized rock		Stream sediments		Panned concentrates	
	Felsic		Intermediate		Mafic		Total							
	F	CF	F	CF	F	CF	F	CF	F	CF	F	CF	F	CF
							Bismuth--Continued							
15	---	---	---	---	---	---	---	---	8	97.60	---	---	---	---
20	---	---	---	---	---	---	---	---	3	98.00	---	---	---	---
30	---	---	---	---	---	---	---	---	2	98.40	---	---	---	---
50	---	---	---	---	---	---	---	---	2	98.80	---	---	---	---
70	---	---	---	---	---	---	---	---	2	99.20	---	---	---	---
100	---	---	---	---	---	---	---	---	---	99.20	---	---	---	---
200	---	---	---	---	---	---	---	---	1	99.60	---	---	---	---
300	---	---	---	---	---	---	---	---	1	99.80	---	---	---	---
G1,000	---	---	---	---	---	---	---	---	1	100.00	---	---	---	---
GM-------	NC	---	NC	---	NC	---	NC	---	NC	---	NC	---	NC	---
							Antimony							
N	320	99.40	120	100.00	48	100.00	488	99.6	500	96.40	1,374	100.00	175	100.00
L	2	100.00	---	---	---	---	2	100.0	16	99.80	---	---	---	---
100	---	---	---	---	---	---	---	---	2	100.00	---	---	---	---
GM-------	NC	---	NC	---	NC	---	NC	---	NC	---	NC	---	NC	---
							Arsenic							
N	193	60.00	87	71.90	39	81.30	319	66.2	282	54.10	983	71.50	63	36.20
L	117	96.30	30	96.90	9	100.00	147	96.7	144	81.90	383	99.40	66	74.20
10	6	98.20	3	99.20	---	---	9	98.6	51	91.50	8	99.90	25	88.60
15	---	98.20	---	99.20	---	---	---	98.6	2	91.90	---	99.90	3	90.30
20	4	99.40	1	100.00	---	---	5	99.6	16	95.00	---	99.90	8	94.80
30	---	99.40	---	---	---	---	---	99.6	---	95.00	1	100.00	2	96.00
50	1	99.70	---	---	---	---	1	99.8	11	97.10	---	---	4	98.30
70	1	100.00	---	---	---	---	1	100.0	10	99.10	---	---	2	99.40
100	---	---	---	---	---	---	---	---	3	99.60	---	---	1	100.00
150	---	---	---	---	---	---	---	---	1	99.80	---	---	---	---
200	---	---	---	---	---	---	---	---	1	100.00	---	---	---	---
GM-------	NC	---	NC	---	NC	---	NC	---	NC	---	NC	---	NC	---

Gold																
N	25	78.40	14	11.60	3	6.70	42	8.5	121	24.80	297	24.70	26	19.40
L	273	93.40	106	99.10	43	95.90	422	94.1	282	82.50	774	89.10	89	85.80
.02	14	97.80	---	99.10	---	95.90	14	97.6	19	86.20	105	97.80	---	85.80
.03	---	97.80	---	99.10	---	95.90	---	97.6	1	86.40	11	98.80	---	85.80
.05	2	98.40	---	99.10	---	95.90	2	98.2	13	89.00	7	99.30	7	91.00
.07	3	99.40	1	100.00	---	95.90	4	99.0	10	91.10	2	99.50	3	93.30
.1	---	99.40	---	---	---	95.90	---	99.0	6	92.40	1	99.60	2	94.80
.15	---	99.40	---	---	---	95.90	---	99.0	7	93.70	---	99.60	---	94.80
.2	1	99.60	---	---	1	97.90	2	99.4	4	94.60	2	99.80	---	94.80
.3	1	99.80	---	---	1	100.00	2	99.8	7	95.90	1	99.80	2	96.20
.5	---	99.80	---	---	---	---	---	99.8	4	96.80	1	99.90	2	97.70
.7	---	99.80	---	---	---	---	---	99.8	2	97.20	1	100.00	---	97.70
1.0	---	99.80	---	---	---	---	---	99.9	3	97.80	---	---	2	99.20
1.5	1	100.00	---	---	---	---	1	100.0	1	98.00	---	---	1	100.00
2.0	---	---	---	---	---	---	---	---	4	98.80	---	---	---	---
3.0	---	---	---	---	---	---	---	---	1	99.00	---	---	---	---
10	---	---	---	---	---	---	---	---	2	99.50	---	---	---	---
30	---	---	---	---	---	---	---	---	2	100.00				
GM-------	NC	---	NC	---	NC	---	NC	---	NC	---	NC	---	NC	---
Silver																
N	298	92.50	119	98.40	47	97.90	464	94.4	415	79.60	1,360	98.80	170	97.10
L	13	96.60	1	99.20	---	97.90	14	97.2	23	84.10	6	99.30	---	97.10
.5	6	98.50	1	100.00	1	100.00	8	98.9	24	88.60	4	99.60	---	97.10
.7	2	99.10	---	---	---	---	2	99.3	15	91.50	1	99.70	---	97.10
1.0	3	100.00	---	---	---	---	3	100.0	7	92.70	---	99.70	---	97.10
1.5	---	---	---	---	---	---	---	---	3	93.40	---	99.70	---	97.10
2.0	---	---	---	---	---	---	---	---	5	94.40	---	99.70	3	98.90
3.0	---	---	---	---	---	---	---	---	5	95.30	---	99.70	---	98.90
5.0	---	---	---	---	---	---	---	---	5	96.30	1	99.70	---	98.90
7.0	---	---	---	---	---	---	---	---	1	96.50	---	99.70	---	98.90
10.0	---	---	---	---	---	---	---	---	4	97.30	1	99.80	---	98.90
15.0	---	---	---	---	---	---	---	---	2	97.70	---	99.80	---	98.90
20	---	---	---	---	---	---	---	---	3	98.30	1	99.80	---	98.90
30	---	---	---	---	---	---	---	---	5	99.20	1	99.90	---	98.90
50	---	---	---	---	---	---	---	---	1	99.40	1	100.00	---	98.90
70	---	---	---	---	---	---	---	---	---	99.40	---	---	---	98.90
100	---	---	---	---	---	---	---	---	3	100.00	---	---	---	98.90
150	---	---	---	---	---	---	---	---	---	---	---	---	1	99.40
200	---	---	---	---	---	---	---	---	---	---	---	---	1	100.00
GM-------	NC	---	NC	---	NC	---	NC	---	NC	---	NC	---	NC	---

TABLE 6.—*Statistical summary of selected elements in the geochemical samples*—Continued

Values (ppm)	Unaltered rocks								Altered and mineralized rock		Stream sediments		Panned concentrates	
	Felsic		Intermediate		Mafic		Total							
	F	CF	F	CF	F	CF	F	CF	F	CF	F	CF	F	CF
								Tellurium						
N	---	---	---	---	---	---	---	---	2	0.04	---	---	1	0.90
L	311	96.50	115	96.70	44	93.60	470	96.4	337	65.80	1,147	96.50	86	76.30
.2	7	98.60	1	97.40	3	100.00	11	98.6	30	71.60	26	98.50	2	78.10
.3	---	98.60	---	97.40	---	---	---	98.6	10	73.60	13	99.50	---	78.10
.5	2	99.20	1	98.40	---	---	3	99.2	26	78.60	6	99.90	1	79.00
.7	1	99.60	2	100.00	---	---	3	99.8	44	87.00	---	99.90	10	87.60
1.0	1	100.00	---	---	---	---	1	100.0	19	91.00	1	100.00	6	93.50
1.5	---	---	---	---	---	---	---	---	7	92.60	---	---	3	95.70
2.0	---	---	---	---	---	---	---	---	19	95.90	---	---	3	97.90
3.0	---	---	---	---	---	---	---	---	4	96.70	---	---	2	99.20
5.0	---	---	---	---	---	---	---	---	7	98.10	---	---	1	100.00
7.0	---	---	---	---	---	---	---	---	3	98.70	---	---	---	---
10.0	---	---	---	---	---	---	---	---	1	98.90	---	---	---	---
15	---	---	---	---	---	---	---	---	1	99.10	---	---	---	---
20	---	---	---	---	---	---	---	---	1	99.30	---	---	---	---
70	---	---	---	---	---	---	---	---	1	99.50	---	---	---	---
700	---	---	---	---	---	---	---	---	1	99.70	---	---	---	---
1,000	---	---	---	---	---	---	---	---	1	99.90	---	---	---	---
3,000	---	---	---	---	---	---	---	---	1	100.00	---	---	---	---
GM-------	NC	---	NC	---	NC	---	NC	---	NC	---	NC	---	NC	---
								Copper						
N	7	---	1	0.80	---	---	8	1.8	9	1.70	---	---	---	---
L	131	---	2	2.50	1	2.10	134	28.9	63	13.80	26	1.90	---	---
5	50	---	4	5.80	---	2.10	54	39.9	55	24.40	74	7.30	7	4.00
7	18	---	---	5.80	---	2.10	18	43.6	30	30.10	96	14.30	7	8.00
10	27	---	5	9.90	---	2.10	32	50.1	52	40.10	113	22.50	9	13.10
15	36	---	7	15.70	1	4.20	44	59.0	61	51.80	149	33.40	17	22.90
20	26	---	14	27.30	4	12.50	44	68.1	62	63.60	252	51.60	29	39.40
30	21	---	32	53.70	10	33.30	63	80.9	77	78.40	377	79.00	38	61.10
50	3	---	31	79.30	23	81.30	57	92.5	38	85.90	198	93.50	32	79.40
70	3	---	21	96.70	7	95.80	31	98.7	29	91.40	62	98.00	19	90.30

100	---	---	4	100.00	2	100.00	6	100.00	13	93.90	20	99.50	9	95.40
150	322	---	---	---	---	---	---	---	9	95.60	6	99.90	5	98.30
200	---	---	---	---	---	---	---	---	4	96.40	1	100.00	1	98.90
300	---	---	---	---	---	---	---	---	3	97.00	---	---	---	98.90
500	---	---	---	---	---	---	---	---	1	97.20	---	---	---	98.90
700	---	---	---	---	---	---	---	---	4	98.00	---	---	---	98.90
1,000	---	---	---	---	---	---	---	---	4	98.80	---	---	1	99.40
1,500	---	---	---	---	---	---	---	---	---	98.80	---	---	1	100.00
2,000	---	---	---	---	---	---	---	---	2	99.20	---	---	---	---
3,000	---	---	---	---	---	---	---	---	---	99.20	---	---	---	---
5,000	---	---	---	---	---	---	---	---	3	99.70	---	---	---	---
7,000	---	---	---	---	---	---	---	---	---	99.70	---	---	---	---
10,000	---	---	---	---	---	---	---	---	1	99.90	---	---	---	---
G20,000	---	---	---	---	---	---	---	---	1	100.00	---	---	---	---
GM-------	5.0	---	32.2	---	41.5	---	9.8	---	22.5	---	22.1	---	30.8	---
Molybdenum														
N	266	82.60	91	76.50	47	97.90	404	82.6	312	59.80	1,247	90.60	172	98.30
L	34	93.20	17	90.80	---	97.90	51	93.1	41	67.60	37	93.30	---	98.30
5	13	97.20	9	98.30	1	100.00	23	98.0	35	74.50	63	97.90	1	98.90
7	4	98.50	2	100.00	---	---	6	99.0	30	80.10	13	98.80	---	98.90
10	3	99.60	---	---	---	---	3	99.6	27	85.40	11	99.60	2	100.00
15	2	100.00	---	---	---	---	2	100.0	11	87.80	3	99.90	---	---
20	---	---	---	---	---	---	---	---	18	90.80	---	99.90	---	---
30	---	---	---	---	---	---	---	---	10	92.90	1	99.90	---	---
50	---	---	---	---	---	---	---	---	13	95.40	1	100.00	---	---
70	---	---	---	---	---	---	---	---	7	96.60	---	---	---	---
100	---	---	---	---	---	---	---	---	8	98.30	---	---	---	---
150	---	---	---	---	---	---	---	---	1	98.40	---	---	---	---
200	---	---	---	---	---	---	---	---	5	99.40	---	---	---	---
300	---	---	---	---	---	---	---	---	---	99.40	---	---	---	---
500	---	---	---	---	---	---	---	---	1	99.60	---	---	---	---
700	---	---	---	---	---	---	---	---	---	99.60	---	---	---	---
1,000	---	---	---	---	---	---	---	---	1	99.80	---	---	---	---
1,500	---	---	---	---	---	---	---	---	---	99.80	---	---	---	---
2,000	---	---	---	---	---	---	---	---	---	99.80	---	---	---	---
3,000	---	---	---	---	---	---	---	---	---	99.80	---	---	---	---
5,000	---	---	---	---	---	---	---	---	1	100.00	---	---	---	---
GM-------	NC	---	NC	---	NC	---	NC	---	NC	---	NC	---	NC	---

TABLE 6.—*Statistical summary of selected elements in the geochemical samples*—Continued

Values (ppm)	Unaltered rocks								Altered and mineralized rock		Stream sediments		Panned concentrates	
	Felsic		Intermediate		Mafic		Total							
	F	CF	F	CF	F	CF	F	CF	F	CF	F	CF	F	CF
							Lead							
N	3	0.93	---	---	4	8.30	7	1.40	67	12.8	---	---	13	7.40
L	3	1.90	4	3.30	6	20.80	13	4.10	69	26.0	18	1.30	3	9.20
10	11	5.30	33	30.60	16	54.20	60	16.30	71	39.6	62	5.80	16	18.30
15	56	22.70	43	66.10	14	83.30	113	39.30	65	52.0	210	21.10	41	41.70
20	125	61.5	26	87.60	7	97.90	158	71.40	95	70.3	420	51.60	35	61.90
30	73	84.20	13	98.40	1	100.00	87	89.30	59	81.5	510	88.70	22	74.30
50	34	94.70	2	100.00	---	---	36	96.40	28	86.8	126	98.10	29	90.90
70	12	98.40	---	---	---	---	12	99.00	23	91.0	26	99.00	9	95.90
100	4	99.70	---	---	---	---	4	99.80	16	94.1	1	99.50	4	98.40
150	---	99.70	---	---	---	---	---	99.80	7	95.5	1	100.00	1	98.90
200	---	99.70	---	---	---	---	---	99.80	3	96.1	---	---	1	99.50
300	1	100.00	---	---	---	---	1	100.00	2	96.5	---	---	---	99.50
500	---	---	---	---	---	---	---	---	4	97.3	---	---	1	100.00
700	---	---	---	---	---	---	---	---	1	97.5	---	---	---	---
1,000	---	---	---	---	---	---	---	---	---	97.5	---	---	---	---
1,500	---	---	---	---	---	---	---	---	3	98.1	---	---	---	---
2,000	---	---	---	---	---	---	---	---	1	98.3	---	---	---	---
3,000	---	---	---	---	---	---	---	---	2	98.7	---	---	---	---
5,000	---	---	---	---	---	---	---	---	4	99.5	---	---	---	---
7,000	---	---	---	---	---	---	---	---	1	99.7	---	---	---	---
10,000	---	---	---	---	---	---	---	---	---	99.7	---	---	---	---
15,000	---	---	---	---	---	---	---	---	---	99.7	---	---	---	---
20,000	---	---	---	---	---	---	---	---	---	99.7	---	---	---	---
G20,000	---	---	---	---	---	---	---	---	2	100.0	---	---	---	---
GM-------	23.7	---	15.3	---	11.7	---	19.9	---	NC	---	23.9	---	22.1	---
							Zinc							
N	318	98.76	120	99.99	47	99.98	500	99.99	472	90.7	1,285	93.40	128	73.10
L	4	100.00	1	100.00	1	100.00	6	100.00	20	94.4	49	97.00	---	73.10
200	---	---	---	---	---	---	---	---	12	96.6	26	98.80	12	80.00
300	---	---	---	---	---	---	---	---	2	97.0	10	99.60	14	88.00
500	---	---	---	---	---	---	---	---	5	98.0	2	99.70	16	97.10

700	---	---	---	---	---	---	---	---	1	98.2	3	99.90	5	100.00
1,000	---	---	---	---	---	---	---	---	---	98.2	1	100.00	---	---
1,500	---	---	---	---	---	---	---	---	---	98.2	---	---	---	---
2,000	---	---	---	---	---	---	---	---	3	98.8	---	---	---	---
3,000	---	---	---	---	---	---	---	---	2	99.2	---	---	---	---
5,000	---	---	---	---	---	---	---	---	2	99.6	---	---	---	---
7,000	---	---	---	---	---	---	---	---	---	99.6	---	---	---	---
10,000	---	---	---	---	---	---	---	---	---	99.6	---	---	---	---
G10,000	---	---	---	---	---	---	---	---	2	100.0	---	---	---	---
GM-------	NC	---	NC	---	NC	---	NC	---	NC	---	NC	---	NC	---
Manganese														
N	---	---	---	---	---	---	---	---	1	0.20	---	---	---	---
L	1	0.30	---	---	---	---	1	0.2	5	1.10	---	---	---	---
10	---	.30	---	---	---	---	---	.2	10	3.10	---	---	---	---
15	---	.30	---	---	---	---	---	.2	11	5.20	---	---	---	---
20	1	.60	---	---	---	---	1	.4	28	10.10	---	---	---	---
30	1	.90	---	---	---	---	1	.6	22	14.80	---	---	---	---
50	---	.90	---	---	---	---	---	.6	31	20.70	---	---	---	---
70	6	2.80	---	---	---	---	6	1.8	49	30.10	---	---	---	---
100	3	3.70	2	1.70	---	---	5	2.9	52	40.00	1	0.10	---	---
150	14	8.10	---	1.70	---	---	14	5.7	39	47.60	1	.20	---	---
200	29	17.10	2	3.30	1	2.10	32	12.2	52	57.60	5	.50	---	---
300	72	39.40	10	11.60	3	8.30	85	29.6	41	65.40	70	5.60	---	---
500	102	71.10	44	47.90	3	14.60	149	59.8	42	73.40	191	19.50	6	3.40
700	81	96.30	41	81.80	20	56.30	142	88.8	41	81.40	481	54.40	5	6.30
1,000	8	98.70	16	95.00	21	100.00	45	98.0	39	88.90	470	88.60	22	18.90
1,500	4	100.00	6	100.00	---	---	10	100.0	10	90.60	121	97.40	23	32.00
2,000	---	---	---	---	---	---	---	---	16	93.80	24	99.10	52	61.70
3,000	---	---	---	---	---	---	---	---	5	94.80	5	99.50	29	78.30
5,000	---	---	---	---	---	---	---	---	13	97.30	4	99.80	26	93.10
G1,500	---	---	---	---	---	---	---	---	14	100.00	3	100.00	12	100.00
GM-------	402	---	596	---	740	---	468	---	[1]193	---	[1]790	---	[1] 2,000	---

[1]Geometric mean does not include G5,000 values.

TABLE 7.—*Analyses of samples from prospects, mines, and outcrops in the Gila*

Samples were analyzed by six-step semiquantitative spectrographic method for 30 elements; by fire assay for Au and Ag; by chemical analysis for Cu, Pb, Zn, and CaF_2; and by atomic absorption (AA) for Te. Numbers in parentheses indicate lower limits of sensitivity. Symbols used: ---, not determined; > more than number shown; < less than number shown; L, detected but below sensitivity limit; N, not detected; Tr, trace; P, width of sample taken perpendicular to strike; *, identifies remarks at the end of table; REO in remarks refers to total rare earth oxides. Location is shown by Township, Range, and Section; for example, T.11 S., R. 14 W., sec. 18 is shown as 11–14–18; all townships are south, and all ranges are west. Analyses for As, Bi, Cd, Nb, Sb, Sc, Sn, and W were insignificant except as shown in remarks at end of table. Spectrographic analyses by E. L. Mosier, K. C. Watts, G. W. Day, and E. Cooley, U.S. Geological Survey; fire assay and

	Chemical analyses						AA	Semiquantitative spectrographic analyses					
Sample	Ounces/ton		(percent)				(ppm)	(percent)				(ppm)	
	Au	Ag	Cu	Pb	Zn	CaF2	Te	Fe (.05)	Mg (.02)	Ca (.05)	Ti (.002)	Mn (10)	B (10)
1*	Tr	Tr	---	---	---	---	2.1	1.5	0.2	0.7	0.07	300	L
2*	Tr	Tr	---	---	---	---	N	1.5	.07	.1	.05	700	L
3*	0.005	Tr	---	---	0.048	---	N	1.5	.2	.15	.05	>5,000	N
4	.01	0.34	---	---	---	---	N	3	.07	.05	.1	1,000	N
5	.01	.33	---	---	---	---	.5	.7	.5	.2	.1	1,000	L
6	.01	.19	---	---	---	---	1.3	.7	.2	.1	.07	2,000	L
7*	.005	.06	---	---	---	---	N	1	.15	.15	.07	2,000	10
8*	.005	.46	0.03	---	---	---	1.3	1	.15	.1	.1	>5,000	L
9*	.01	.09	.03	---	---	---	.5	.7	.15	.07	.07	>5,000	L
10*	.01	.17	---	---	---	---	3.3	1	.1	.05	.07	>5,000	L
11*	.005	Tr	---	---	---	---	2.5	.3	.15	20	.02	5,000	N
12*	.01	Tr	---	---	---	---	.4	2	.2	7	.07	2,000	N
13	.005	.04	---	---	---	---	N	2	.3	7	.07	2,000	N
14*	.01	.10	---	---	---	---	N	5	1	.3	.3	700	N
15	.005	.19	---	---	---	---	2.5	2	1.5	.1	.1	2,000	10
16	.01	1.39	---	Tr	Tr	---	Tr	5	.2	.2	.1	2,000	20
17	.40	14.38	.031	Tr	Tr	---	1.4	7	.05	.07	.07	300	10
18*	.01	.05	---	.24	Tr	---	2.5	3	1	3	.3	>5,000	10
19	.01	.21	---	---	---	---	.6	3	.7	1	.3	1,000	10
20	.06	1.41	---	---	---	---	3.58	1.5	.2	.7	.05	1,000	15
21	.018	Tr	---	---	---	---	N	5	1	1.5	.3	1,000	L
22	.025	Tr	---	---	---	---	N	3	1	.7	.3	500	N
23	Tr	Tr	.11	---	---	---	N	2	.7	.3	.3	700	N
24	.08	1.12	1.08	---	---	---	N	2	1	2	.2	1,500	10
25	.005	.06	.088	---	---	---	N	2	.7	.1	.2	200	10
26	.01	Tr	---	---	---	---	.5	1.5	.5	.1	.2	1,500	20
27	.01	.35	---	---	---	---	1.2	.5	.3	.07	.1	700	10
28	.005	.08	---	---	---	---	1.5	.7	.15	.05	.07	500	L
29	.01	Tr	---	---	---	---	N	1	.3	1	.2	200	20
30	.005	.10	---	---	---	---	1.5	.7	.3	.1	.15	200	10
31	.005	.08	---	---	---	20.29	1	.5	.2	15	.07	150	L
32*	.01	Tr	---	---	---	---	.5	1	.2	7	.1	100	15
33	.02	.06	---	---	---	---	N	.7	.1	.2	.07	300	L
34	Tr	Tr	---	---	---	---	N	1.5	.5	.1	.15	300	20
35	Tr	Tr	---	---	---	---	N	2	.2	.07	.15	200	10
36	.005	Tr	---	---	---	---	N	1.5	.5	.1	.1	200	10
37*	.01	.30	.03	---	---	---	N	3	.5	.5	.3	500	10
38	.005	.32	---	---	---	---	N	.7	.2	.2	.1	150	L
39	Tr	.30	---	---	---	---	N	2	.7	.5	.3	700	L
40	.005	.24	---	---	---	---	N	2	.5	.1	.3	300	L
41	Tr	Tr	---	---	---	---	2	2	.7	.5	.15	500	10
42	Tr	.36	---	---	---	---	2.5	3	.7	1	.3	700	L
43	.005	.20	---	---	---	---	N	1	1	.3	.1	700	10
44*	.01	.11	---	---	---	---	.6	2	.2	.1	.3	200	10
45*	.01	.09	---	---	---	---	N	1	.1	1.5	.1	150	20
46	.01	.07	---	---	---	---	N	1	.1	.1	.1	150	30
47	.005	.10	---	---	---	---	.5	1.5	.5	.5	.2	1,000	15
48	.01	.49	---	---	---	---	.3	1	.03	.07	.05	300	L
49	.01	.33	---	---	---	---	1.1	1	.1	2	.07	300	L
50*	.01	Tr	---	---	---	---	1.7	1	.1	.7	.15	200	L
51*	.01	.20	---	---	---	21.80	3.1	1	.2	20	.1	200	L
52	.01	.28	---	---	---	35.32	2.85	2	.3	15	.15	1,000	L
53	Tr	Tr	---	---	---	40.54	.51	2	1	>20	.3	1,000	L
54	.02	Tr	---	---	---	---	.7	1	1	.1	.15	1,000	10
55	Tr	Tr	---	---	---	---	N	3	.7	1	.3	700	10
56	Tr	Tr	---	---	---	---	Tr	2	.1	.05	.15	500	10
57	.01	.30	---	.14	.20	42.14	N	1	.2	>20	.2	150	L
58	Tr	.22	---	---	---	76.51	1.8	.5	.2	>20	.05	15	N
59	Tr	.14	---	.06	---	---	.5	7	5	1.5	.5	700	L
60	.01	.38	---	.04	.015	---	.4	1	.5	2	.1	700	L

Wilderness and vicinity, New Mexico, collected by the U.S. Bureau of Mines

chemical analyses by C. O. Parker & Co., Denver, Colo.; tellurium determinations by New Mexico Bureau of Mines and Mineral Resources, Socorro, N. Mex. The sample site and sample types are coded as follows:

A. Prospect pit or open cut	D. Dump	a. Face	1. Channel
B. Adit	E. Stockpile	b. Back	2. Chip
C. Shaft or winze	F. Outcrop	c. Right side	3. Grab (various grids)
	G. Placer	d. Left side	4. Select
		e. Composite of irregular zones	5. Concentrate

Semiquantitative spectrographic analyses

Sample	Ba (20)	Be (1)	Co (5)	Cr (10)	La (20)	Mo (5)	Ni (5)	Sr (100)	V (10)	Y (10)	Zr (10)	Location	Site	Type	Width (feet)
	(ppm)														
1*	30	3	N	15	N	N	7	200	L	15	150	11-19-12	A,a	2	6
2*	50	1.5	N	20	N	N	10	N	10	20	100	11-19-12	F	2	3.5
3*	1,000	30	L	100	70	N	70	300	70	20	70	11-19-11	F,e	2	3.5
4	100	1.5	L	20	30	N	15	N	30	15	100	11-19- 2	A,e	2	
5	100	3	5	15	50	N	15	100	30	20	100	11-19- 1	D	1	10
6	100	2	N	L	50	7	5	L	30	20	70	11-19- 1	A,a	2	4
7*	500	3	L	10	50	10	7	100	50	20	100	11-19- 2	A,a	2	3
8*	3,000	100	20	N	N	N	30	3,000	70	15	70	11-19- 2	A,a	2	4
9*	1,500	3	30	N	30	N	30	1,500	150	20	50	11-19- 2	A,e	2	10
10*	1,000	5	7	10	30	5	15	1,000	70	20	70	11-19- 2	E	3	15
11*	70	N	N	10	N	N	N	500	L	10	10	11-19- 3	A,a	2	25
12*	300	3	5	20	N	N	20	200	30	15	70	11-19- 3	A,a	2	4
13	70	10	N	70	L	N	10	300	10	N	30	11-19- 3	A,e	3	
14	300	1	20	100	30	N	100	150	100	20	200	11-19- 4	B,b	2	5
15	200	5	L	30	30	10	10	N	100	30	200	11-19- 4	B,c	2	15
16	500	3	N	10	20	N	15	N	300	20	150	11-19- 4	B,e	2	10
17	200	5	N	20	N	7	10	N	200	20	100	11-19- 4	D	3	
18*	5,000	5	5	N	70	15	5	200	100	50	300	11-19- 4	B,b	2	6
19	1,000	1	5	5	30	N	10	N	100	20	300	11-19- 4	A,e	2	
20	100	100	N	N	30	N	15	N	20	30	50	11-19- 4	B,a	2	7
21	700	2	15	20	20	N	20	150	70	15	200	11-19- 6	A,a	2	4
22	700	1.5	L	N	30	N	L	150	30	15	200	11-19- 6	A,a	2	3
23	300	2	L	L	30	N	7	150	50	20	200	11-19- 6	D	3	
24	700	1.5	15	N	70	N	20	200	100	50	150	11-19- 4	B,b	2	0.1
25	700	2	20	10	50	N	20	100	70	30	200	11-19- 4	B,b	2	.1
26	500	3	5	10	50	20	15	L	50	50	150	11-19- 9	B,a	2	4
27	70	3	L	L	50	N	L	N	30	20	100	11-19- 9	B,c	2	1.3
28	70	1.5	5	10	20	5	5	N	50	15	70	11-19- 9	B,c	2	.8
29	150	2	7	N	50	L	10	L	30	50	150	11-19- 9	B,c	2	1.5
30	30	3	L	10	50	N	5	N	70	30	150	11-19- 9	B,c	2	.5
31	50	2	L	L	50	N	L	N	50	70	70	11-19- 9	B,c	2	.8
32*	200	2	5	10	70	50	10	100	30	70	100	11-19- 9	B,e	2	
33	N	1.5	5	10	N	5	5	N	50	20	70	11-19- 9	B,c	2	2
34	150	5	N	N	50	N	5	N	50	30	300	11-19- 9	A,a	2	7
35	100	2	N	N	N	N	5	N	50	10	100	11-19- 9	A,a	2	4
36	500	3	N	70	20	N	10	N	70	20	100	11-19- 8	B,a	2	.8
37*	700	3	10	100	20	N	20	N	70	20	20	11-19- 8	B,a	2	2
38	300	1.5	N	L	20	N	5	N	30	10	10	11-19- 8	B,b	2	2
39	150	5	10	10	20	N	15	N	50	20	20	11-19- 8	B,b	2	3
40	300	1.5	10	L	20	N	15	N	70	15	15	11-19- 8	C,a	2	2
41	150	2	5	5	30	N	15	N	50	20	200	11-19- 8	B,a	2	1.3
42	300	1.5	10	10	30	N	20	N	50	30	300	11-19- 8	B,a	2	2
43	200	7	10	15	50	N	20	L	15	30	100	11-19-21	B,a	2	5
44*	1,000	3	7	300	30	N	15	100	50	30	200	11-19-21	B,b	2	.2
45*	700	1	5	100	30	N	15	100	20	30	150	11-19-21	B,a	2	4
46	500	2	5	30	50	N	10	100	15	20	150	11-19-21	D	3	
47	300	3	10	30	50	N	15	L	50	30	150	11-19-21	D	3	
48	50	1	N	10	20	N	L	N	L	15	70	11-19-28	A,e	2	
49	300	3	5	10	20	7	5	100	30	50	70	11-19-28	B,c	2	.5
50*	500	2	L	10	20	10	L	200	30	30	200	11-19-28	B,b	2	4
51*	300	L	N	10	50	N	5	N	20	100	300	11-19-29	A,e	3	
52	1,000	1	7	N	50	20	5	N	50	200	500	11-19-29	A,a	2	3
53	500	2	5	10	70	N	10	N	100	150	300	11-19-29	B,a	2	2
54	300	5	7	10	50	N	7	N	70	30	200	11-19-29	B,a	2	.5
55	1,000	3	5	N	50	10	7	N	100	30	500	11-19-29	A,a	2	5
56	150	2	N	5	20	10	10	N	15	20	150	11-19-29	A,e	3	
57	150	1.5	5	L	50	N	L	100	30	100	100	11-19-29	A,a	2	1.9
58	100	N	N	L	50	N	L	100	10	200	150	11-19-29	A,a	2	3.5
59	500	1.5	30	50	N	N	30	200	150	20	150	11-19-29	D	3	
60	200	L	5	L	N	N	5	N	30	10	50	11-19-29	E	3	

TABLE 7.—*Analyses of samples from prospects, mines, and outcrops, in the Gila*

Sample	Chemical analyses						AA	Semiquantitative spectrographic analyses					
	Ounces/ton		(percent)				(ppm)	(percent)				(ppm)	
	Au	Ag	Cu	Pb	Zn	CaF2	Te	Fe (.05)	Mg (.02)	Ca (.05)	Ti (.002)	Mn (10)	B (10)
61	0.01	Tr	---	---	---	---	1.2	20	1.5	.3	.3	700	N
62	.005	Tr	---	---	---	30.23	N	2	.2	15	.07	300	N
63	.01	Tr	---	---	---	24.24	N	3	.3	10	.07	300	N
64	.005	Tr	---	---	---	28.09	2	2	.5	10	.15	200	N
65	.02	0.08	---	---	---	4.40	2.14	1.5	.07	1	.1	300	10
66*	.01	.15	---	---	---	1.16	2.8	1.5	.05	.3	.1	300	10
67	.01	.07	---	---	---	---	4.26	5	.05	.05	.2	200	L
68	Tr	.16	---	---	---	---	.58	7	.5	10	.2	300	10
69*	.02	16.16	---	---	---	52.60	Tr	5	1	10	.15	1,000	L
70	1.30	7.90	---	---	---	---	Tr	3	.5	.5	.15	500	N
71	.02	.44	0.031	Tr	Tr	---	5.6	5	2	2	.2	1,000	N
72	.38	.92	.062	0.16	Tr	---	N	2	.5	.7	.1	500	N
73	.40	.56	---	---	---	---	N	5	2	.7	.3	700	N
74	.25	.20	---	---	---	---	N	3	1.5	5	.2	700	N
75	.04	.22	---	---	---	---	N	3	1	.1	.2	500	L
76	.005	.22	.02	Tr	---	---	N	5	1	.5	.2	500	L
77	Tr	Tr	---	---	---	---	N	2	.7	.15	.15	200	N
78	.005	.08	---	---	---	43.82	4.08	2	1	>20	.15	1,500	L
79	Tr	.16	---	---	---	---	Tr	2	.5	7	.15	300	10
80	.005	Tr	---	---	---	---	N	1.5	.2	.07	.1	150	N
81	.005	.14	---	---	---	---	N	1.5	.2	.1	.1	150	N
82*	.03	.25	---	---	---	---	.12	3	1.5	2	.3	700	N
83	.04	.26	---	---	---	---	.5	3	1.5	2	.2	500	10
84	.01	.11	---	---	---	---	.36	3	1.5	3	.2	700	L
85	.01	.12	---	---	---	1.12	.12	3	1.5	7	.2	1,500	N
86	.01	.31	---	---	---	---	N	3	1.5	1.5	.3	700	L
87*	.01	.15	---	---	---	1.05	N	3	1	10	.15	700	N
88*	Tr	.26	---	---	---	---	N	2	.7	.5	.2	300	10
89	Tr	Tr	---	---	---	---	2	7	2	2	.5	1,000	10
90*	.01	.04	---	---	---	---	N	5	1	1	.3	500	20
91	Tr	.20	---	---	---	---	N	10	1.5	.05	.5	300	10
92	.005	.20	---	---	---	---	.8	7	1.5	.2	.5	700	N
93	.005	.04	---	---	---	---	2.1	7	1	.2	.5	700	N
94	.03	.10	---	---	---	---	.4	5	.5	.1	.5	100	N
95*	.03	.24	---	---	---	---	.3	5	.15	.1	.5	100	N
96*	.005	.10	---	---	---	---	.2	3	.3	.1	.3	200	N
97*	.02	.08	---	---	---	---	N	2	.2	.07	.2	50	15
98	.01	.30	---	---	---	---	2.5	10	.02	.07	.3	150	L
99	.01	Tr	---	---	---	---	N	7	1	.3	.3	700	10
100*	.03	.26	---	---	---	---	.5	5	.07	.15	.5	150	L
101	Tr	Tr	.02	Tr	---	---	2.2	10	.02	.05	.5	50	10
102*	.01	Tr	.03	---	---	---	4.2	15	N	.07	.3	200	10
103	.005	Tr	---	---	---	31.94	3.9	2	.15	15	.05	150	L
104	Tr	Tr	---	---	---	58.50	2.4	2	.5	>20	.1	200	L
105*	Tr	Tr	---	---	---	62.74	N	2	.2	>20	.1	150	N
106	.01	.10	---	---	---	41.64	1.1	3	.3	20	.07	200	N
107	.02	.38	---	---	---	---	1	5	.15	.05	.5	30	20
108*	.015	.29	---	---	---	---	.2	1.5	L	.05	.3	100	N
109*	Tr	.06	---	---	---	---	2	10	.07	.07	.5	50	L
110	.005	.14	---	---	---	---	N	5	1.5	1	.3	700	10
111	.005	.26	---	---	---	---	N	3	.07	.1	.3	150	N
112*	.01	.05	---	---	---	---	12.5	10	L	.05	.5	70	L
113	Tr	Tr	.025	.04	---	---	N	1	.5	.2	.15	150	10
114*	Tr	Tr	.93	1.24	.18	---	3	3	.7	.5	.3	1,000	L
115*	Tr	Tr	2.15	.14	.14	---	2.5	5	.7	.15	.5	1,000	L
116	Tr	Tr	.70	.26	.11	---	N	7	1	.7	.5	1,500	L
117*	.005	Tr	.61	2.10	.068	---	1.3	5	.7	.7	.5	1,500	10
118	Tr	Tr	.04	.04	.03	---	N	3	.7	.5	.3	1,000	L
119	Tr	Tr	.06	.10	.099	---	.5	2	.5	.7	.2	1,000	L
120	Tr	Tr	---	.02	.04	---	2.5	3	.5	1	.3	1,000	L
121*	Tr	Tr	.18	---	---	---	.7	1	.3	.2	.1	300	10
122	.005	.20	---	---	---	---	2.3	2	.5	.1	.1	500	L
123	Tr	.26	---	.04	---	---	4.4	15	.3	.7	.2	1,000	N
124	.005	.28	---	---	---	---	1.6	3	1	3	.2	1,000	L
125	Tr	.80	.041	.24	.15	---	.58	5	2	1	.3	700	10

Wilderness and vicinity, New Mexico, collected by the U.S. Bureau of Mines—Continued

Sample	Semiquantitative spectrographic analyses (ppm) Ba (20)	Be (1)	Co (5)	Cr (10)	La (20)	Mo (5)	Ni (5)	Sr (100)	V (10)	Y (10)	Zr (10)	Location	Site	Type	Width (feet)
61	200	1	70	50	N	N	30	100	200	10	70	11-19-32	F,e	2	
62	150	1.5	5	15	20	20	15	N	20	20	70	11-19-32	E	3	
63	100	1.5	7	15	20	30	15	L	15	10	100	11-19-32	A,d	2	4
64	200	L	L	15	30	5	10	L	15	15	150	11-19-32	A,a	2	10
65	150	L	N	5	30	N	50	N	20	20	200	12-19- 5	A,e	2	10
66*	150	1	N	N	30	N	7	N	15	20	200	11-19-32	A,e	2	15
67	300	L	N	20	N	7	15	200	200	20	100	11-19-32	A,e	3	
68	700	L	20	70	20	10	50	500	150	30	100	12-19- 5	D	3	
69*	700	1.5	10	30	30	150	20	N	100	70	150	12-19- 5	A,a	2	4
70	300	3	5	20	N	50	20	N	30	10	70	12-19- 4	A,d	1	0.2
71	2,000	L	7	30	30	10	20	150	200	20	200	12-19- 4	A,a	1	3.3
72	300	2	L	5	N	50	10	N	30	10	70	12-19- 4	D	3	
73	1,500	1	10	20	30	10	20	150	150	20	300	12-19- 4	B,c	2	4
74	1,000	L	7	10	20	30	15	200	100	20	200	12-19- 4	D	3	
75	700	1	7	20	N	50	15	N	100	15	200	12-19- 4	A,e	2	1.5
76	2,000	1	L	10	N	70	15	N	100	10	200	12-19- 4	A	3	
77	100	1	5	L	N	50	10	L	70	10	100	12-19- 4	A,a	2	4
78	500	L	5	20	50	N	7	150	150	100	100	12-19- 4	A,a	2	7
79	500	3	N	15	N	N	15	N	30	20	100	12-19- 4	B,e	2	
80	200	3	5	15	50	N	10	N	20	30	150	12-19- 4	A,a	2	2
81	150	2	L	L	N	N	7	N	10	15	100		A,a	2	.3
82*	700	L	30	100	20	30	50	200	100	20	200	12-19- 4	B,a	2	4
83	300	2	20	20	50	7	30	N	100	20	150	12-19- 4	B,b	2	1
84	300	1	30	20	30	70	30	200	150	20	150	12-19- 4	B,d	2	.1
85	300	1	30	20	50	10	30	300	100	30	150	12-19- 4	B,b	2	3
86	700	1	30	20	30	N	70	300	150	20	200	12-19- 4	B,b	2	4
87*	200	L	30	150	30	L	70	300	70	20	70	12-19- 4	B,b	2	.8
88*	1,500	1	5	5	30	100	7	100	50	30	300	12-19- 4	B,b	2	
89	300	2	10	50	30	20	20	100	200	30	300	12-19- 4	A	2	4
90*	500	1	20	50	20	300	20	100	100	30	300	12-19- 4	D	3	
91	500	L	5	150	20	7	10	N	300	20	500	12-19- 4	F	2	1.5
92	700	2	30	70	50	N	50	N	150	20	200	12-19- 4	B,a	2	3.5
93	500	2	30	50	30	N	50	N	150	20	200	12-19- 4	B,b	2	3
94	300	N	5	70	50	N	10	300	200	30	200	12-19- 4	B,c	2	P .2
95*	300	N	N	50	50	N	15	1,500	200	20	150	12-19- 4	B,a	2	2
96*	300	N	10	50	50	N	10	1,000	200	15	150	12-19- 4	B,a	2	2.5
97*	300	L	N	15	20	100	7	L	70	30	150	12-19- 4	A,a	2	1.5
98	700	L	10	50	70	10	20	1,500	200	30	200	12-19- 4	E	3	
99	300	1	50	30	20	15	30	L	100	20	150	12-19- 4	A,e	2	10
100*	100	L	5	20	N	N	15	N	50	10	300	12-19- 4	E	3	
101	500	N	15	100	30	20	50	500	300	N	300	12-19- 9	F,e	2	15
102*	200	N	70	70	N	20	100	200	70	10	200	12-19- 9	E	3	
103	150	1.5	5	30	20	15	15	100	15	50	70	12-19- 9	A	2	1
104	100	1	7	10	30	15	5	N	100	200	50	12-19-10	E	3	
105*	100	L	7	20	50	L	7	100	30	150	100	12-19-10	A,a	2	3.8
106	70	1.5	5	50	L	15	20	N	L	30	50	12-19-10	A,a	2	2
107	500	L	10	70	20	15	50	300	200	50	200	12-19- 9	A,e	2	40
108*	150	N	N	50	30	7	15	1,000	100	L	200	12-19-10	F	2	4
109*	200	N	N	70	L	100	5	200	100	20	700	12-19- 9	D	3	
110	300	1.5	20	50	20	N	30	300	150	20	150	12-19- 9	A,a	2	2
111	200	1	20	20	50	N	20	N	15	30	150	12-19- 9	E	3	
112*	700	N	50	70	20	50	50	700	150	30	300	12-19-15	B,d	2	.5
113	70	5	N	10	30	5	L	N	50	30	100	12-19-24	B,a	2	1
114*	300	3	10	15	30	N	20	L	70	50	200	12-19-24	B,b	2	3.5
115*	500	1	10	20	20	150	20	100	100	30	200	12-19-24	B,b	2	4.5
116	500	1.5	20	20	20	N	70	200	150	30	200	12-19-24	B,b	2	6.9
117*	200	1.5	10	20	50	100	20	N	5,000	100	300	12-19-24	B,b	2	2.3
118	300	3	7	15	50	N	10	N	70	100	300	12-19-24	B,c	2	1.5
119	200	3	5	20	30	10	15	L	50	70	20	12-19-24	B,a	2	2.2
120	200	2	7	15	50	7	15	100	70	100	100	12-19-24	B,a	2	2.5
121*	100	5	N	L	50	15	L	N	20	20	20	12-19-24	B,a	2	2.8
122	50	2	N	L	N	N	5	N	50	15	100	12-19-13	A,a	2	.3
123	200	1.5	15	15	10	50	50	N	30	20	100	12-19-13	A,a	2	1
124	500	3	15	70	30	N	50	100	100	50	150	12-19-13	A	2	4
125	500	2	5	50	20	N	10	N	50	50	500	12-19-13	A,e	2	

TABLE 7.—*Analyses of samples from prospects, mines, and outcrops, in the Gila*

Sample	Chemical analyses: Ounces/ton Au	Ag	Chemical analyses (percent): Cu	Pb	Zn	CaF2	AA (ppm): Te	Semiquantitative spectrographic analyses (percent): Fe (.05)	Mg (.02)	Ca (.05)	Ti (.002)	(ppm): Mn (10)	B (10)
126	Tr	Tr	0.02	Tr	0.20	---	Tr	5	2	1	0.5	1,500	L
127*	Tr	Tr	.041	Tr	.32	---	7.8	7	3	.2	.5	5,000	N
128	Tr	0.20	---	Tr	Tr	---	4.5	7	1.5	.7	.5	1,000	10
129	0.005	.34	---	0.10	.05	---	.9	2	.5	.2	.2	700	N
130	Tr	Tr	---	---	---	---	1.8	7	1.5	.7	.5	1,500	10
131	Tr	0.26	---	.04	.023	---	.6	3	1	1	.3	1,000	N
132	Tr	Tr	---	.03	---	---	.9	3	.7	.5	.3	700	N
133	Tr	.28	---	Tr	Tr	---	Tr	5	1	1	.2	1,000	10
134	.02	.26	---	---	---	---	2.5	5	1	.5	.2	700	10
135	.005	Tr	---	---	.22	---	N	3	1	.5	.2	700	10
136	Tr	.28	---	.05	.059	---	1	1.5	.1	1	.1	200	N
137	Tr	.24	---	.04	.05	---	.7	2	.5	.2	.2	500	L
138	.02	.22	---	---	---	---	N	3	.5	1	.15	700	10
139	Tr	.22	---	---	---	---	.6	3	.5	.7	.2	700	N
140*	.02	.26	.083	1.28	.25	2.99	1.3	10	3	5	.7	2,000	N
141*	.005	.04	.044	.36	.40	4.42	2.6	7	2	10	.5	2,000	N
142*	.02	.12	.085	.21	.41	2.80	2	10	2	5	.5	1,500	N
143*	.02	.38	.87	.17	.63	---	.4	10	3	.5	1	1,500	N
144*	.03	.13	.08	.05	.25	3.42	5	7	2	5	.5	2,000	N
145*	.14	1.80	.612	2.78	.74	30.80	10	.2	.15	20	.05	200	N
146*	.04	1.76	.27	.56	.30	43.68	4.2	3	.7	>20	.15	2,000	N
147*	.03	.27	---	---	.093	---	.5	7	1	.5	.5	2,000	L
148	Tr	.06	---	---	---	---	.3	2	.2	.05	.2	200	N
149	Tr	Tr	---	---	---	---	Tr	1	.2	.15	.15	700	10
150	Tr	.44	---	---	.007	---	1.4	2	.2	.5	.2	700	N
151	Tr	.16	---	---	.031	---	1.3	3	.5	.1	.2	700	N
152	Tr	.30	.005	.08	.02	---	2.3	1	.2	.05	.2	100	N
153*	Tr	.70	.15	.44	1.30	---	.6	2	.5	.05	.2	500	N
154*	Tr	1.06	.44	9.90	9.01	---	7.7	2	.1	1	.1	200	N
155*	.03	2.37	.70	8.74	8.79	---	14.3	7	1	.5	.2	200	N
156*	.01	1.35	.762	5.76	3.47	---	.6	3	.07	.5	.15	1,500	L
157*	.02	3.94	.587	7.10	7.95	---	35	2	.3	7	.2	500	L
158	.005	.60	.20	3.80	.30	---	2.8	1	.1	1	.15	100	N
159*	Tr	.18	.02	.66	.05	---	.6	2	.1	1	.2	100	N
160	Tr	.30	.03	.30	.24	---	.8	2	.1	.5	.5	700	N
161	Tr	.26	---	.32	---	---	.81	5	.3	.2	.5	1,000	L
162	Tr	Tr	---	---	---	---	1.2	2	.7	1	.2	500	L
163	Tr	Tr	---	---	---	---	1.5	3	.7	1.5	.5	1,500	L
164	.01	.26	.10	.06	.086	---	15.6	5	.2	.1	.2	200	L
165	Tr	Tr	.15	.06	---	---	9.4	3	.15	.2	.15	200	10
166	Tr	Tr	---	---	---	---	.5	.2	.02	.1	.1	100	L
167	.005	.14	---	---	---	---	N	1.5	.2	L	.1	150	15
168	.04	.26	---	---	---	---	.4	.7	.05	2	.02	150	L
169	.11	.45	---	---	---	---	1.2	.7	.05	3	.015	150	L
170	.03	Tr	---	---	---	---	.7	1	.3	.15	.07	200	L
171	.02	.12	---	---	---	---	.4	1.5	.15	.15	.07	200	L
172	.04	.26	---	---	---	---	1.4	1	.05	.3	.03	200	L
173	.015	.06	---	---	---	---	N	.7	.1	.07	.07	500	L
174	.005	.10	---	---	.044	---	N	1	.3	.2	.07	500	L
175	.01	.14	---	---	---	---	N	2	.1	.07	.2	200	L
176	.02	.24	---	---	---	---	.4	1	.05	.1	.07	70	L
177	.005	.30	---	---	---	---	1.4	1	.07	.1	.1	150	L
178	.005	.05	---	---	---	---	.4	1.5	.07	.7	.15	300	L
179	.005	.14	---	---	---	---	.4	1	.1	.02	.1	200	L
180	.31	.40	---	---	---	---	1.4	1	.15	.02	.07	500	L
181	.005	.18	---	---	---	---	1.3	1.5	.2	.7	.1	500	L
182	.005	.34	---	---	---	---	.8	1.5	.2	.1	.15	200	L
183	Tr	.30	---	---	---	---	.5	1.5	.15	.7	.1	500	L
184	.02	Tr	---	---	---	---	1.4	1.5	.2	.15	.1	500	L
185	.03	.11	---	---	---	---	N	1	.15	.02	.07	500	L
186	.01	.19	---	---	---	31.81	.4	1.5	.02	10	.01	700	L
187	.01	.43	---	---	---	19.40	.5	.7	.02	10	.02	300	L
188	.02	.34	---	---	---	21.59	N	.7	.02	15	.02	1,500	L
189	.03	.13	---	---	---	9.38	.4	1.5	.03	2	.15	150	L
190	.02	.18	---	---	---	16.92	N	.5	L	.3	.005	150	L

Wilderness and vicinity, New Mexico, collected by the U.S. Bureau of Mines—Continued

Semiquantitative spectrographic analyses

Sample	(ppm) Ba (20)	Be (1)	Co (5)	Cr (10)	La (20)	Mo (5)	Ni (5)	Sr (100)	V (10)	Y (10)	Zr (10)	Location	Site	Type	Width (feet)
126	500	3	10	20	150	N	30	N	70	100	500	12-19-13	B,a	2	3
127*	500	3	20	70	200	N	100	N	150	200	500	12-19-13	B	3	
128	1,000	3	10	20	70	30	20	100	100	70	500	12-19-13	D	3	
129	300	2	10	20	50	N	10	N	30	20	150	12-19-13	D	1	25
130	1,000	5	5	20	20	7	15	100	150	70	700	12-19-13	B,e	2	
131	500	5	5	L	50	15	5	100	70	70	200	12-19-13	B,d	2	1.5
132	500	1.5	10	30	20	10	20	100	50	30	150	12-19-13	B,e	2	
133	1,500	2	7	30	30	30	20	N	70	50	300	12-19-13	B,e	2	
134	300	3	10	70	30	15	30	L	100	70	200	12-19-13	B,a	2	4
135	300	2	7	50	30	10	20	N	70	30	200	12-19-13	B,a	2	4
136	1,000	1.5	N	L	N	N	5	100	20	20	100	12-19-13	B,b	2	2
137	1,000	1.5	5	15	20	7	10	100	30	20	150	12-19-13	B,b	2	0.9
138	1,500	1.5	5	30	50	70	15	N	70	30	200	12-19-13	B,a	2	4
139	200	2	5	10	N	5	15	100	30	20	150	12-19-13	D	1	15
140*	150	1	50	200	N	70	70	200	200	30	100	12-19-13	B,a	2	3
141*	500	1	30	200	N	50	70	300	150	30	70	12-19-13	B,a	2	2.2
142*	200	1	50	150	N	100	70	100	100	30	70	12-19-13	B,b	2	2
143*	500	2	50	300	20	10	100	300	200	50	150	12-19-13	A,a	2	.5
144*	500	1.5	30	150	20	30	7	200	150	50	150	12-19-13	C	2	.2
145*	70	.2	N	5	N	10	7	N	10	30	50	12-19-13	E	3	
146*	500	7	10	50	50	10	15	100	50	100	150	12-19-13	A,a	2	.8
147*	700	2	20	150	N	10	50	L	150	20	100	12-19-13	A	2	3
148	100	1	5	L	N	L	5	N	20	20	150	12-19-13	A,a	2	6
149	300	1	N	N	50	N	5	N	15	20	200	12-19-13	F,e	2	
150	300	1	5	L	20	N	5	N	30	20	100	12-19-12	A,a	2	4
151	700	1.5	10	10	30	N	15	N	70	50	200	12-19-12	A,a	2	1.3
152	300	1	N	L	10	30	5	N	50	50	150	12-19-12	A,d	2	2.5
153*	100	2	N	15	30	70	5	N	50	70	150	12-19-12	A,d	2	.5
154*	150	1	10	L	20	15	15	N	30	20	100	12-19-12	A,d	2	.5
155*	300	1	7	70	30	50	7	N	15	50	700	12-19-12	Concentrates		
156*	5,000	3	5	10	N	20	30	100	20	30	100	12-19-12	D	3	
157*	200	2	7	N	50	150	5	N	50	50	300	12-19-12	B,e	2	3
158	200	1.5	5	L	N	70	10	N	20	20	150	12-19-12	B,b	2	2
159*	500	1.5	N	L	N	150	5	N	50	30	100	12-19-12	B,a	2	2.5
160	1,000	1	5	L	50	N	5	N	50	50	200	12-19- 7	B,e	2	
161	500	2	5	20	20	N	15	100	100	100	700	12-18- 7	F,e	2	
162	300	N	10	30	20	N	15	N	150	15	100	12-18- 7	B,a	2	2.3
163	300	2	10	15	30	5	15	150	100	30	300	12-18- 7	B,a	2	3.5
164	30	1	20	30	30	500	50	N	100	10	100	12-18- 6	B,b	2	2.5
165	20	1.5	10	20	20	500	15	N	50	15	70	12-18- 6	B,b	2	3
166	N	1.5	N	10	N	500	L	N	L	30	100	12-18- 5	F	2	2
167	N	1.5	N	15	20	10	L	N	50	50	200	11-18-32	B,a	2	10
168	N	3	N	10	N	N	5	N	10	20	20	11-18-32	B,c	3	
169	N	5	N	10	N	N	5	N	15	20	20	11-18-32	B,b	2	5
170	70	3	L	10	N	N	5	N	20	50	100	11-18-32	B,b	2	5
171	50	7	5	15	20	20	7	N	50	30	70	11-18-32	B,b	2	5
172	20	1.5	N	10	N	N	7	N	15	15	30	11-18-32	B,a	1	4
173	70	5	L	10	N	N	7	N	30	20	70	11-18-32	B,b	2	4
174	50	5	5	10	N	L	7	N	50	50	100	11-18-32	B,b	1	5
175	300	L	5	15	50	N	5	N	70	30	300	11-18-32	A	3	
176	100	L	L	10	30	N	5	N	70	50	100	11-18-32	A,c	2	4
177	100	L	5	15	30	L	5	N	100	50	150	11-18-32	A,e	2	35
178	150	1.5	5	15	30	15	7	N	50	50	150	11-18-32	D	3	
179	100	1	5	15	20	N	7	N	70	50	100	11-18-32	F	2	2.5
180	70	2	7	15	50	N	10	N	50	100	150	11-18-32	C,d	2	1.5
181	100	3	5	15	30	5	10	N	50	70	100	11-18-32	D	3	
182	50	5	L	10	30	N	5	N	50	50	150	11-18-32	B,a	2	1
183	100	2	7	15	30	5	15	N	50	70	100	11-18-32	B,b	1	10
184	100	1.5	7	15	20	5	10	N	50	50	100	11-18-32	B,a	2	1.3
185	70	2	5	15	20	N	7	N	30	50	100	11-18-32	A,a	2	4
186	20	3	5	10	N	N	10	N	10	70	10	11-18-32	A,c	2	5
187	50	3	L	10	N	N	5	N	L	70	15	11-18-32	A,d	2	P .5
188	N	2	L	10	N	N	5	100	L	50	15	11-18-32	A,b	2	10
189	200	2	5	10	30	N	5	N	30	30	150	11-18-32	C	2	4
190	N	1	L	L	N	N	L	N	L	20	10	11-18-32	A,a	2	5

TABLE 7.—*Analyses of samples from prospects, mines, and outcrops, in the Gila*

Sample	Chemical analyses						AA	Semiquantitative spectrographic analyses					
	Ounces/ton		(percent)				(ppm)	(percent)				(ppm)	
	Au	Ag	Cu	Pb	Zn	CaF2	Te	Fe (.05)	Mg (.02)	Ca (.05)	Ti (.002)	Mn (10)	B (10)
191	0.08	0.22	---	---	---	3.50	N	2	0.02	0.7	0.1	200	L
192	Tr	Tr	---	---	---	---	N	2	.2	.1	.3	1,000	L
193*	Tr	.20	---	---	---	---	N	2	.2	.1	.2	1,000	L
194	.005	.10	---	---	---	---	.4	1.5	.02	1	.1	200	L
195*	.03	.06	---	---	---	---	N	1.5	.07	.5	.1	5,000	L
196	.04	.26	---	---	0.025	---	N	1.5	.05	1	.07	700	L
197	.04	.26	---	---	---	---	1.7	1	.02	.5	.03	300	L
198	.05	Tr	---	---	---	---	.4	.7	.02	.5	.05	100	L
199	.005	Tr	---	---	---	---	1.6	1.5	.07	.1	.1	200	L
200	.12	.38	---	---	---	---	.7	1	.05	.7	.07	200	L
201	.04	.16	---	---	---	---	.8	1	.05	.07	.07	1,000	L
202	.07	.26	---	---	---	---	.7	.5	.03	.2	.015	70	L
203	.09	.61	---	---	---	---	1	1	.03	.3	.015	150	L
204	.18	.20	---	---	---	---	1.1	.7	.07	L	.07	300	L
205	.09	.68	---	---	---	---	1.1	1	.1	.05	.07	3,000	L
206	.05	.75	---	---	---	---	.9	1	.05	L	.03	1,500	L
207	.04	Tr	---	---	---	---	.3	1	.05	L	.1	100	L
208	.005	.20	---	---	---	---	1.7	3	.3	.1	.2	500	L
209	.005	.20	---	---	---	4.30	1.4	2	.07	1.5	.2	200	L
210	.02	.08	---	---	---	9.48	.5	2	.03	5	.2	300	L
211	.04	.06	---	---	---	13.00	.4	1.5	.05	10	.2	200	L
212	.02	.08	---	---	---	1.28	1.7	2	.07	.1	.5	150	L
213	.01	.25	---	---	---	---	.4	2	.1	.1	.3	200	L
214	.01	.07	---	---	---	---	.8	2	.1	.1	.5	300	L
215	.02	.08	---	---	---	---	N	1.5	.1	.7	.1	200	L
216	.04	.10	---	---	---	---	N	.7	.02	1	.02	150	L
217	.05	.25	---	---	---	23.34	.6	1	.1	7	.07	500	L
218	.015	Tr	---	---	---	7.15	.9	1.5	.1	1.5	.1	300	L
219	.02	.64	---	---	---	---	N	1.5	.2	.15	.07	200	L
220	.04	.26	---	---	---	---	N	1.5	.03	2	.1	300	L
221	.06	.08	---	---	---	---	1.4	.7	.02	.7	.05	100	L
222*	.005	.14	---	---	---	2.14	N	1.5	.07	L	.15	1,000	L
223*	.04	.26	---	---	---	43.19	N	.7	.02	15	.03	200	L
224	Tr	Tr	---	---	---	---	1.4	2	.3	.1	.3	700	L
225	.005	.14	---	---	---	---	1.1	1.5	.07	.1	.1	300	L
226	.005	Tr	---	---	---	---	.6	1.5	.07	.07	.15	200	L
227	.005	Tr	---	---	---	---	.4	2	.3	.03	.15	300	L
228	.01	Tr	---	---	---	---	N	1.5	.2	1	.2	150	L
229	.02	.14	---	---	---	2.92	1.3	1.5	.1	.7	.1	100	L
230	.04	.37	---	---	---	27.00	N	.7	.05	.7	.03	200	L
231	.005	Tr	---	---	---	---	1.4	1.5	.2	15	.15	500	L
232	.01	.19	---	---	---	---	2.5	2	.2	.07	.2	500	L
233	.02	.18	---	---	---	---	N	.7	.05	L	.2	200	L
234*	.07	.25	---	---	---	---	N	1	.07	.05	.2	5,000	L
235	.20	.44	---	---	---	---	.4	1	.1	.05	.15	300	L
236	.36	.58	---	---	---	---	N	2	.07	.07	.1	200	L
237	.05	.21	---	---	---	---	N	1	.05	.05	.07	200	L
238	.005	Tr	---	---	---	---	.9	1	.2	2	.07	500	L
239	.08	.38	---	---	---	---	1.8	1	.05	.5	.1	500	L
240*	.01	.07	---	---	---	9.79	1.3	.7	.15	10	.1	1,500	L
241*	.01	.07	---	---	---	13.90	19.2	1	.3	20	.07	>5,000	L
242*	.02	.24	---	---	---	5.70	N	3	.5	3	.2	1,500	L
243*	.02	.24	---	---	---	18.60	1.5	.7	.2	20	.1	5,000	L
244*	.02	.16	---	---	---	18.44	N	.7	.1	15	.07	3,000	L
245*	.02	.24	---	---	0.015	13.90	N	.7	.1	5	.07	300	L
246	.01	Tr	---	---	---	---	N	3	1.5	.3	.3	500	20
247	.005	Tr	---	---	---	---	.3	3	.3	.2	.07	300	10
248*	.01	.60	0.25	0.16	.019	15.75	1.3	1	.1	10	.07	150	L
249*	.005	.22	.06	.05	---	---	1.1	5	.05	5	.05	150	L
250*	.01	.23	---	---	---	79.45	N	.2	.7	>20	.03	70	N
251*	.01	Tr	.026	.06	---	10.57	N	3	.5	7	.2	500	10
252	.005	.26	.025	.08	.026	---	3.2	7	1.5	2	.5	1,000	10
253	.01	.46	2.70	.04	---	---	N	5	1.5	3	.3	2,000	10
254	.01	16.46	1.77	.06	---	---	1	10	2	1	.5	1,000	L
255*	.01	Tr	.052	.05	---	---	.1	7	2	7	.3	1,500	15

Wilderness and vicinity, New Mexico, collected by the U.S. Bureau of Mines—Continued

Sample	Semiquantitative spectrographic analyses (ppm) Ba (20)	Be (1)	Co (5)	Cr (10)	La (20)	Mo (5)	Ni (5)	Sr (100)	V (10)	Y (10)	Zr (10)	Location	Site	Type	Width (feet)
191	150	1.5	5	10	20	N	7	N	20	15	100	11-18-32	A,a	2	5
192	300	2	7	20	70	5	15	N	50	70	200	11-18-32	B,a	1	1.3
193*	300	5	7	20	150	50	15	N	30	70	300	11-18-32	B,a	1	0.8
194	200	1.5	5	10	30	15	7	N	15	20	200	11-18-32	B,b	2	5
195*	200	7	5	10	50	N	7	N	15	20	150	11-18-32	B,b	2	5
196	150	5	5	L	20	5	7	N	10	15	200	11-18-32	B,b	2	5
197	50	3	L	10	N	15	5	N	10	10	50	11-18-32	B,d	2	P .1
198	70	1.5	L	10	N	15	5	N	10	15	50	11-18-32	B,a	2	3
199	100	1.5	5	15	N	L	10	N	20	30	100	11-18-32	B,c	2	P .2
200	70	2	5	10	N	50	10	N	10	15	50	11-18-32	B,d	2	P .2
201	50	1.5	5	15	N	5	7	N	20	50	70	11-18-32	B,d	2	P .3
202	30	2	L	L	N	N	5	N	10	10	30	11-18-32	B,b	2	5
203	70	1.5	5	10	N	N	7	N	10	15	50	11-18-32	B,e	2	8
204	70	3	L	10	N	N	L	N	15	15	70	11-18-32	A,a	2	5
205	150	5	10	15	N	10	10	N	20	30	100	11-18-32	A,a	2	6
206	100	7	5	15	N	L	7	N	L	20	50	11-18-32	A,c	2	10
207	100	1	N	20	N	5	5	N	15	30	100	11-18-32	A,d	2	6
208	300	1	7	20	100	10	10	N	70	70	300	11-18-32	B,e	2	
209	150	1	5	15	50	5	10	N	30	50	50	11-18-32	F	2	1.8
210	300	1.5	7	10	50	N	5	N	30	50	200	11-18-32	F	2	6
211	150	2	5	15	50	7	7	N	50	50	150	11-18-32	A,a	2	.7
212	300	1.5	5	10	70	N	L	N	70	50	300	11-18-32	A,a	2	5
213	300	1.5	5	20	70	N	15	100	50	70	300	11-18-33	B,a	2	1.3
214	500	2	5	15	100	15	15	100	50	70	500	11-18-33	B,b	2	4
215	100	2	5	15	30	N	7	N	30	50	100	11-18-33	B,a	2	2
216	30	15	N	10	N	N	5	N	L	15	50	11-18-33	B,a	2	2
217	50	1	L	10	50	10	5	N	50	70	70	11-18-33	A,a	1	2
218	150	1	10	15	50	7	7	N	50	70	100	11-18-33	A,a	1	3
219	70	2	L	15	N	N	7	N	15	30	70	11-18-33	D	3	
220	200	L	5	15	50	N	7	N	30	70	150	11-18-33	B,a	2	1
221	100	3	N	10	N	N	5	N	L	15	70	11-18-33	D	3	
222*	200	1.5	20	15	150	N	10	N	30	70	200	11-18-33	A,c	2	.5
223*	100	1	N	10	100	N	5	N	10	200	30	11-18-33	A,d	2	3
224	500	1	7	20	70	N	20	N	70	70	500	11-18-33	B,e	2	
225	200	5	L	10	50	L	5	N	20	20	300	11-18-33	A,a	2	2
226	300	1.5	L	L	70	N	5	N	30	30	200	11-18-33	A,e	2	
227	300	L	5	10	70	N	5	N	70	50	300	11-18-33	B,a	2	4
228	300	1.5	5	10	100	N	5	N	30	70	300	11-18-33	B,b	2	1.2
229	150	1	L	L	50	N	5	N	20	30	200	11-18-33	A,a	2	1
230	50	1	L	L	20	N	5	N	L	100	70	11-18-33	A,a	2	4
231	150	10	5	10	30	N	7	N	30	15	100	11-18-33	F	2	2
232	300	1.5	5	15	50	N	10	N	50	50	200	12-18- 5	D	3	
233	200	1	L	10	70	N	L	N	30	50	300	12-18- 5	A,a	2	3
234*	300	3	5	L	70	5	L	200	50	70	200	12-18- 4	A,a	2	.1
235	200	1.5	L	10	20	N	L	N	20	20	100	12-18- 4	A,a	2	4
236	70	1.5	L	L	30	N	L	N	20	30	200	12-18- 4	A,e	4	
237	50	1	L	L	20	N	5	N	15	20	70	12-18- 4	A,e	2	
238	70	1.5	5	15	30	5	10	N	30	30	70	12-18- 4	A,a	2	1
239	70	2	L	10	N	N	5	N	15	30	70	12-18- 3	A,e	2	
240*	70	3	L	10	N	N	5	N	15	30	100	12-18- 3	B,a	2	4
241*	50	7	L	L	N	N	5	200	15	50	50	12-18- 3	B,b	2	5
242*	300	2	15	30	20	N	20	100	70	30	150	12-18- 3	B,c	2	P .3
243*	70	5	5	10	N	N	L	200	30	50	70	12-18- 3	B,b	2	4
244*	70	3	L	10	N	N	5	200	30	50	50	12-18- 3	B,b	2	10
245*	150	2	5	10	20	L	5	N	20	30	70	12-18- 3	F	2	2
246	500	1.5	15	70	20	N	30	200	150	30	200	12-17-19	F,e	2	
247	100	L	5	10	N	N	10	N	70	N	50	13-18- 2	D	3	
248*	200	L	N	L	N	N	5	N	200	20	20	12-18-35	E	3	
249*	300	L	N	L	N	N	5	N	70	10	20	12-18-35	E	3	
250*	30	L	N	N	30	N	N	N	20	>200	70	12-18-34	A,a	2	5
251*	700	2	N	5	100	10	5	N	30	200	500	12-18-34	A,c	2	.7
252	700	3	20	15	30	N	30	300	100	50	100	12-18-26	B,a	1	2.5
253	500	7	20	15	50	N	20	500	200	30	100	12-18-26	B,d	2	.5
254	1,000	1.5	30	30	30	N	50	300	100	50	100	12-18-26	B,c	2	.9
255*	300	5	20	50	100	N	50	300	200	150	200	12-18-26	B,b	1	.2

TABLE 7.—*Analyses of samples from prospects, mines, and outcrops, in the Gila*

Sample	Chemical analyses						AA	Semiquantitative spectrographic analyses					
	Ounces/ton		(percent)				(ppm)	(percent)				(ppm)	
	Au	Ag	Cu	Pb	Zn	CaF2	Te	Fe (.05)	Mg (.02)	Ca (.05)	Ti (.002)	Mn (10)	B (10)
256*	Tr	0.14	0.237	0.06	---	---	1.6	7	1.5	7	0.2	2,000	10
257*	0.01	.13	.428	---	---	---	.1	7	2	7	.3	1,500	L
258*	.01	4.23	2.828	---	---	---	.4	7	1.5	3	.3	1,500	10
259*	.01	23.80	4.985	---	---	---	.2	7	1.5	1.5	.3	700	10
260*	.01	11.02	19.06	---	---	2.57	.2	5	1	10	.15	1,500	N
261	.005	.24	.005	.06	0.21	---	3.4	3	1	1.5	.5	700	L
262*	Tr	.16	.03	---	.015	---	1.6	5	2	1.5	.5	1,000	L
263*	.01	.16	2.52	---	---	---	1	2	.2	7	.2	500	L
264*	Tr	.26	.025	---	---	---	2.5	3	2	1	.5	1,000	L
265	.03	3.17	1.962	.08	---	---	N	3	.2	.5	.2	200	10
266	.01	Tr	---	---	---	---	.5	2	.3	2	.2	300	10
267*	Tr	.26	---	---	---	---	N	1	.3	.2	.2	300	10
268*	Tr	1.50	---	---	---	---	N	2	.3	.2	.2	700	30
269	.005	.30	.03	---	---	---	N	1	.15	.2	.15	150	L
270	.01	.30	.02	---	---	---	N	1	.15	.2	.2	700	L
271	.01	Tr	---	---	---	---	N	2	.2	.1	.15	300	10
272*	.005	.26	---	---	---	---	N	2	.1	.5	.3	500	L
273	.01	Tr	---	---	---	---	.5	3	.3	.2	.3	500	10
274	.005	.40	---	---	---	---	N	.5	.2	.2	1	200	L
275	.20	2.90	---	---	---	---	N	3	.3	.3	.3	300	10
276	.01	2.00	---	---	---	---	N	2	1	.1	.2	500	L
277	.01	2.80	---	---	---	---	N	3	.5	.5	.5	500	L
278	.01	Tr	Tr	---	---	---	N	3	.3	.2	.3	500	15
279	Tr	.62	---	---	---	---	N	1	.2	.5	.2	700	L
280	.03	1.96	.031	---	---	---	.1	2	.5	.3	.2	500	15
281	.01	1.76	.02	---	---	---	N	1	.2	.1	.2	1,000	L
282	.02	.06	---	---	---	---	N	3	.5	.15	.3	700	10
283*	.005	.10	.242	.06	.052	---	N	3	.5	.2	.2	500	10
284	.005	Tr	---	---	---	---	N	5	.2	.2	.3	100	10
285	Tr	Tr	---	---	---	---	N	5	.5	.3	.5	100	L
286	.005	Tr	---	---	---	---	.7	7	.7	.5	.5	200	10
287	.01	.78	---	---	---	---	N	1.5	.2	.3	.15	300	L
288	.03	.40	---	---	---	---	3.5	1	.1	.3	.15	300	L
289	Tr	Tr	---	---	---	---	N	.7	.05	.15	.07	300	10
290	.01	Tr	---	---	---	---	1.3	2	.15	.15	.3	700	L
291*	.02	.44	---	---	---	---	N	1.5	.1	.1	.3	300	L
292*	.01	Tr	---	---	---	---	1.3	2	.1	.07	.3	300	L
293*	.02	1.40	---	---	---	11.53	N	7	.15	10	.5	500	10
294	.01	.20	---	---	---	---	N	5	.1	.7	.5	300	L
295*	.01	Tr	---	---	---	33.27	N	3	.07	20	.3	200	L
296	.02	5.68	---	---	---	9.52	.5	3	.2	5	.5	1,500	L
297	.08	4.92	.03	.08	---	---	.9	1.5	.1	3	.15	300	L
298	.01	.33	.03	---	---	19.43	.3	1.5	.15	5	.1	1,000	L
299	.01	.95	---	---	---	14.90	.3	2	.2	10	.3	1,000	L
300	.01	.27	---	---	---	---	1.5	2	.2	.15	.3	300	L
301*	.01	.17	---	---	---	42.56	N	3	.7	10	.1	3,000	15
302	.01	.05	---	---	---	13.83	1.5	1.5	.07	20	.07	300	L
303	.01	1.99	---	---	---	---	1.8	1.5	.1	1.5	.15	1,000	L
304*	.01	.35	---	---	---	---	1	2	.2	1.5	.15	5,000	L
305	.01	1.30	---	---	---	17.71	3.3	2	.2	7	.2	700	L
306	.02	.92	---	---	---	---	N	1.5	.3	.3	.5	500	L
307	.01	Tr	---	---	---	---	N	1.5	.1	.2	.2	200	L
308*	Tr	.16	---	---	---	38.57	2	5	1.5	10	.5	3,000	N
309	.01	.06	---	---	---	---	.8	3	.3	.5	.5	1,000	L
310	.01	.13	---	---	---	---	.4	1.5	.3	.15	.2	700	L
311	.005	.21	---	---	---	---	1	3	1.5	.7	.2	1,500	L
312	.005	.12	---	---	---	---	N	2	.3	.3	.3	1,500	L
313*	.005	.32	---	---	---	---	1.0	3	.3	.2	.3	500	L
314	.01	.35	---	---	---	---	N	2	.3	.2	.3	500	L
315	.005	.16	---	---	---	---	N	2	.7	.2	.2	2,000	L
316*	.03	4.37	---	---	---	---	1.2	7	.3	7	.7	700	L
317	.02	.44	---	---	---	6.44	.9	5	.7	10	.3	1,500	L
318	Tr	Tr	---	---	---	---	6	3	.2	2	.3	500	10
319	.02	Tr	---	---	---	---	.3	.7	.03	.7	.015	300	L
320	.01	Tr	---	---	.015	---	.9	1	.1	.15	.2	300	L

Wilderness and vicinity, New Mexico, collected by the U.S. Bureau of Mines—Continued

Sample	Semiquantitative spectrographic analyses (ppm)											Location	Site	Type	Width (feet)
	Ba (20)	Be (1)	Co (5)	Cr (10)	La (20)	Mo (5)	Ni (5)	Sr (100)	V (10)	Y (10)	Zr (10)				
256*	500	7	20	30	70	N	30	500	300	70	150	12-18-26	C	2	0.3
257*	700	2	30	30	20	N	30	300	150	30	150	12-18-26	C,e	2	
258*	300	5	20	30	50	N	30	300	150	50	150	12-18-26	C,c	2	.1
259*	500	2	20	30	N	N	30	200	150	30	150	12-18-26	D	4	
260*	100	1.5	10	70	N	N	50	200	150	20	50	12-18-26 /	B,b	2	.1
261	700	1.5	10	30	50	N	30	300	50	50	150	12-18-26	D	1	20
262*	500	3	20	150	70	N	100	300	70	70	100	12-18-26	A,a	2	1.5
263*	300	7	N	10	100	N	10	200	30	200	100	12-18-26	A,a	2	.5
264*	700	2	20	150	20	N	100	300	70	20	150	12-18-26	A,a	2	.9
265	300	2	N	10	70	N	10	N	50	100	200	12-18-26	B,e	2	
266	300	2	N	N	50	5	10	N	30	70	300	12-18-26	B,b	2	1.8
267*	100	2	N	L	20	N	5	N	20	50	150	12-18-26	B,e	3	17
268*	150	2	5	L	20	N	5	N	20	50	150	12-18-26	B,b	2	1
269	100	1.5	N	L	L	N	5	N	20	30	150	12-18-26	B,b	2	1
270	150	2	5	L	N	N	5	N	20	20	150	12-18-26	B,b	2	1
271	200	2	N	5	30	N	10	N	20	70	200	12-18-26	B,b	2	2
272*	500	1	5	L	20	N	5	N	30	20	500	12-18-26	A,a	2	6
273	500	7	5	5	20	N	7	N	50	30	300	12-18-22	A,e	2	
274	150	2	N	L	N	N	5	N	20	10	100	12-18-22	F	2	.2
275	700	2	5	5	50	N	5	N	50	50	500	12-18-22	A,a	2	.1
276	300	2	5	L	N	N	5	N	20	20	150	12-18-22	A,a	2	.8
277	700	1.5	10	L	50	N	5	N	30	50	500	12-18-22	A,a	2	.1
278	700	5	10	20	70	10	10	N	30	70	500	12-18-22	B,b	2	.2
279	300	10	N	L	20	N	5	N	20	20	100	12-18-22	B,b	2	.5
280	300	20	5	10	50	N	10	N	30	50	200	12-18-22	B,e	2	
281	200	30	N	L	N	N	5	N	15	20	150	12-18-22	B,b	2	.5
282	500	7	10	30	100	N	15	N	50	70	300	12-18-22	B,c	2	.2
283*	500	2	7	10	30	10	15	N	70	30	200	12-18-22	D	4	
284	300	1	5	5	N	15	5	N	50	20	300	12-18-21	D	3	
285	700	1.5	5	15	30	N	7	N	150	30	300	12-18-21	A,c	2	1.5
286	1,000	1	10	30	50	5	15	200	150	50	500	12-18-21	A,e	2	36
287	200	1.5	N	10	70	N	L	N	20	70	300	12-18-15	B,a	2	2.5
288	150	2	L	10	50	N	L	N	20	30	300	12-18-15	B,b	2	4
289	70	7	N	10	50	N	L	N	20	20	50	12-18- 9	F	2	.5
290	200	5	5	10	70	N	L	N	50	100	500	12-18-19	C,a	2	1.6
291*	300	1.5	5	10	70	7	L	N	70	70	300	12-18-19	B,c	2	1
292*	200	2	5	10	70	N	L	N	70	150	500	12-18-19	F	2	.7
293*	500	7	5	10	70	N	L	N	100	150	500	12-18-19	D	3	
294	500	2	5	10	70	N	L	N	100	70	300	12-18-19	C,d	2	2.5
295*	300	1	L	10	50	N	L	N	70	150	200	12-18-19	F	2	4
296	700	3	5	N	50	10	5	100	100	70	500	12-18-19	B,a	2	1.2
297	300	3	7	L	50	N	L	N	50	50	200	12-18-19	B,a	2	1.2
298	200	1	5	L	50	N	L	N	30	30	100	12-18-19	B,b	2	1.9
299	300	5	5	L	70	N	L	N	50	100	300	12-18-19	B,b	2	1.3
300	300	L	7	L	50	N	5	N	70	30	300	12-18-19	B,a	2	1.4
301*	200	10	10	30	100	N	15	100	70	100	100	12-18-19	B,b	1	.3
302	150	1	5	10	50	N	5	N	30	150	70	12-18-19	B,b	2	1.1
303	200	1	7	L	50	N	5	N	30	30	100	12-18-19	B,a	2	2.4
304*	300	5	10	L	70	N	10	100	50	70	100	12-18-19	B,d	2	1
305	200	2	L	N	50	7	5	N	50	70	200	12-18-19	B,a	2	3
306	300	2	5	L	70	N	L	N	50	50	300	12-18-19	B,b	1	.5
307	200	1	5	L	50	N	L	N	50	30	150	12-18-19	B,b	2	1.6
308*	700	1	10	10	50	5	5	150	100	70	500	12-18-19	B,a	2	3
309	500	1.5	10	15	70	N	5	100	100	50	300	12-18-19	B,d	2	1.8
310	300	L	7	L	50	N	L	N	70	30	200	12-18-19	B,c	2	1
311	300	1	10	15	50	N	10	L	70	50	300	12-18-19	B,c	2	1
312	300	1	10	10	50	N	5	L	70	50	300	12-18-19	B,b	2	2
313*	500	1.5	10	10	70	N	5	L	70	50	300	12-18-19	B,a	2	1.4
314	300	2	7	L	70	N	5	100	70	50	300	12-18-19	B,b	1	.2
315	300	1	10	L	70	N	5	N	70	30	150	12-18-19	B,b	2	.5
316*	1,000	1.5	7	10	100	5	5	L	100	100	500	12-18-20	B,b	2	3
317	700	1	10	20	70	7	10	L	70	100	500	12-18-20	B,a	2	4
318	700	1.5	5	N	50	5	10	N	70	50	200	12-18-20	A,a	2	3
319	20	2	L	10	N	N	5	N	10	10	10	12-18-20	A,a	2	1
320	200	3	5	15	50	N	7	N	50	30	200	12-18-20	A,a	2	1

TABLE 7.—*Analyses of samples from prospects, mines, and outcrops, in the Gila*

Sample	Chemical analyses						AA	Semiquantitative spectrographic analyses					
	Ounces/ton		(percent)				(ppm)	(percent)				(ppm)	
	Au	Ag	Cu	Pb	Zn	CaF2	Te	Fe (.05)	Mg (.02)	Ca (.05)	Ti (.002)	Mn (10)	B (10)
321*	0.005	0.12	---	0.08	0.32	---	N	1.5	0.3	0.2	0.1	500	10
322*	.005	Tr	---	---	---	11.48	7.5	3	.5	10	.2	>5,000	L
323	.01	Tr	---	---	---	---	.6	2	.5	1	.3	2,000	10
324*	.005	Tr	---	---	---	1.17	N	0.7	.07	>20	.07	5,000	N
325	.005	Tr	---	---	---	---	6	5	1	1.5	.5	700	N
326*	.02	.22	---	---	.04	---	4.3	5	.7	1.5	.7	500	L
327*	.005	Tr	---	---	---	---	1	7	.15	.15	.7	500	L
328*	.02	.18	---	---	---	---	.6	5	1	2	.5	700	L
329*	.03	1.01	---	---	---	---	1.2	7	1	1	1	3,000	L
330	Tr	.12	---	---	---	7.00	N	2	.1	10	.15	300	L
331*	.005	.06	---	---	---	---	N	1.5	.1	.3	.2	300	10
332*	.02	.80	---	---	---	---	3.1	5	.05	.2	.2	1,000	L
333*	.01	.22	---	---	---	3.79	.8	7	.05	10	.07	5,000	15
334*	.01	Tr	---	---	---	---	.6	5	1	.3	.5	700	15
335*	.02	.84	0.078	2.64	10.10	4.76	2.8	2	.7	15	1	>5,000	N
336	.03	.17	.20	.32	.33	---	7	5	.5	.7	.5	700	L
337*	.07	22.17	2.40	3.72	2.40	---	54	7	.3	1.5	.3	500	L
338*	.02	.30	.016	.012	.010	22.12	2.9	3	.3	15	.15	1,000	L
339	Tr	.04	---	---	---	---	N	5	.7	1	.7	300	L
340	Tr	Tr	.008	---	---	---	N	5	.7	1	.5	300	L
341	.01	Tr	---	---	---	---	1	10	1	L	.3	300	10
342*	Tr	Tr	.003	---	---	---	.4	10	1.5	.7	.1	1,500	L
343	Tr	.06	---	---	---	---	N	5	.7	.7	.7	1,000	10
344	Tr	Tr	---	---	---	---	N	3	.3	.2	.5	2,000	L
345	.005	Tr	---	---	---	---	2.5	1.5	.2	.07	.15	100	10
346	.04	.22	---	---	---	---	.4	5	.5	.05	.15	200	L
347*	.02	.20	.07	---	---	---	.9	10	.5	.2	.2	700	10
348*	Tr	Tr	---	---	.06	---	N	15	1.5	.3	.1	5,000	10
349	.005	Tr	---	---	---	---	N	3	.7	L	.2	100	50
350*	.01	.24	---	---	---	---	.8	5	.2	.2	.1	150	20
351	.005	.04	.051	---	---	---	N	5	1	.05	.3	100	70
352*	.005	Tr	.102	---	---	---	2.6	7	.3	.05	.1	30	700
353*	Tr	.16	.010	---	---	---	1.7	7	2	.5	.5	1,000	15
354	.005	.32	Tr	---	---	---	.8	15	.5	.05	.3	150	50
355	.005	Tr	---	---	---	---	N	7	.7	L	.5	200	70
356*	.01	.23	---	.012	---	59.08	.9	3	1	>20	.15	500	N
357	.03	.21	---	---	---	---	.6	1.5	.1	.1	.05	500	10
358*	.02	.18	10.25	---	---	---	1.2	5	.5	1	.5	500	15
359*	.02	.06	---	---	---	---	N	1.5	.1	.3	.07	5,000	N
360*	.01	.27	---	---	---	---	.2	7	.3	1	.07	200	L
361*	Tr	.18	---	---	---	---	.38	1.5	.5	.7	.7	500	10
362	Tr	Tr	---	---	---	30.94	N	1.5	.5	10	.07	1,500	L
363*	Tr	Tr	---	---	---	49.91	6	3	1	10	.3	1,000	10
364*	Tr	Tr	---	---	---	1.47	.8	2	1	10	.2	200	L
365*	.01	.13	---	---	---	---	.4	15	.5	.1	.5	200	50
366	.005	Tr	---	---	---	---	6	2	.5	.05	.1	200	50
367*	.01	.13	Tr	---	.028	---	.8	15	.1	.1	.7	200	10
368*	.01	Tr	---	---	---	---	N	10	.1	.1	.5	100	L
369*	.005	Tr	---	---	---	---	.2	5	1	1	.5	300	20
370	.01	.11	---	---	---	---	N	2	.5	.5	.2	150	10
371*	Tr	Tr	---	---	---	---	10	5	1	.7	.5	300	L
372	.01	.11	---	---	---	---	4.69	1.5	.2	.05	.15	150	10
373*	Tr	.20	---	---	---	---	2.7	5	.07	.05	.5	70	10
374	.02	.06	---	---	---	---	.38	1.5	.15	.07	.15	100	10
375	.01	.07	---	---	---	---	131	1.5	.07	N	.3	30	N
376*	1.28	.40	---	---	---	---	4,560	3	.07	L	.1	50	10
377*	.005	Tr	---	---	---	---	9.5	2	.1	.05	.3	50	L
378*	Tr	Tr	---	---	Tr	---	5	7	.5	.1	.2	150	L
379*	.005	Tr	---	.05	---	---	1,130	3	.07	1	.1	50	10
380	.22	.52	---	---	---	---	15	1.5	.1	.05	.1	300	15
381*	.005	.34	---	---	---	---	80	2	.02	L	.07	70	20
382*	.02	.40	---	---	---	---	134	1	.03	.07	.1	70	L
383	.005	.30	---	---	---	---	7.5	2	.15	1	.15	150	L
384	Tr	.28	---	---	---	---	N	1.5	.2	.2	.1	150	10
385	.02	.30	---	---	---	---	N	5	.2	.05	.3	30	N

Wilderness and vicinity, New Mexico, collected by the U.S. Bureau of Mines—Continued

Semiquantitative spectrographic analyses

Sample	Ba (20)	Be (1)	Co (5)	Cr (10)	La (20)	Mo (5)	Ni (5)	Sr (100)	V (10)	Y (10)	Zr (10)	Location	Site	Type	Width (feet)
	(ppm)														
321*	200	50	L	N	20	N	7	N	20	20	100	12-18-20	A,a	2	3
322*	3,000	7	5	20	100	N	20	500	100	100	100	12-18-20	B,e	3	
323	300	7	10	10	100	N	30	N	20	70	300	12-18-20	B,a	2	2.6
324*	N	2	N	N	N	N	L	300	15	30	70	12-18-20	B,d	2	1.7
325	700	1	5	5	70	N	5	150	100	50	200	12-18-20	B,a	2	4
326*	700	7	7	20	100	5	10	L	70	70	300	12-18-20	B,b	2	4
327*	300	5	5	10	100	N	L	100	70	100	700	12-18-20	A,c	2	0.5
328*	1,000	3	7	10	100	N	5	L	100	100	700	12-18-19	B,a	2	4
329*	1,500	2	15	30	100	N	10	100	100	100	700	12-18-19	B,b	2	4
330	150	5	5	10	70	N	5	150	30	70	200	12-18-19	A,a	2	1.5
331*	200	2	L	10	70	N	L	N	50	70	300	12-18-19	A,a	2	1.2
332*	300	2	5	10	50	N	5	N	70	50	200	12-18-19	E	3	
333*	300	15	L	N	50	N	5	300	70	100	70	12-18-19	A,a	2	3
334*	1,000	1.5	7	10	70	5	10	200	100	50	700	12-18-19	A,a	2	4
335*	700	7	70	N	200	1,000	L	500	50	200	700	12-18-20	B,c	2	.3
336	700	5	5	N	70	N	7	N	100	50	500	12-18-20	A,a	2	4
337*	700	5	10	15	70	N	7	100	150	70	300	12-18-20	B,c	2	.3
338*	200	2	5	20	50	30	15	N	50	200	150	12-18-20	A,e	2	3
339	300	1	15	30	20	N	30	200	200	20	300	12-18-20	A,a	2	2
340	300	L	15	50	30	N	30	200	200	20	300	12-18-20	A,a	2	3.5
341	1,000	1.5	N	30	70	15	10	N	70	50	500	12-18-20	B,e	2	3
342*	1,000	5	30	30	50	N	50	N	300	30	300	12-18-20	A,a	2	2.6
343	700	10	10	20	50	N	20	100	150	30	300	12-18-20	A,a	2	3
344	700	5	10	20	50	N	15	100	100	30	300	12-18-20	A,a	2	1.5
345	30	2	N	10	30	N	7	N	50	10	70	12-18-29	F	2	6
346	500	3	10	20	30	20	20	N	50	50	300	12-18-29	B,a	2	4
347*	500	2	20	70	N	20	50	100	150	100	150	12-18-29	B,a	2	3
348*	200	10	70	5	30	50	20	N	30	50	100	12-18-29	B,a	2	6
349	150	3	5	50	20	5	7	N	70	20	100	12-18-29	F	3	
350*	700	L	N	10	50	700	10	N	70	70	100	12-18-29	B,b	2	6
351	700	1	30	15	30	N	30	N	100	30	300	12-18-29	B,a	2	3
352*	200	2	30	50	70	5	50	N	70	20	50	12-18-29	B,c	3	
353*	500	N	20	20	30	N	30	300	300	20	100	12-18-29	A,a	2	4.5
354	700	1.5	20	70	30	30	50	100	200	30	200	12-18-29	A,a	2	3
355	700	N	30	50	20	15	50	N	150	20	200	12-18-29	F	3	
356*	200	L	10	70	50	50	20	100	150	200	100	12-18-30	A,e	2	2.5
357	100	1.5	N	10	20	N	10	N	70	20	70	12-18-30	A,a	2	4
358*	200	5	20	200	N	5	50	300	200	20	100	12-18-30	D	4	
359*	200	3	50	5	30	N	30	N	30	15	100	12-18-30	A,a	2	4
360*	20	2	N	L	30	N	L	1,500	10	20	100	12-18-30	B,a	2	3
361*	300	1.5	N	5	20	N	15	1,000	20	20	100	12-18-30	F	2	20
362	1,000	1.5	N	5	30	5	N	100	30	50	100	12-18-29	A,a	2	6
363*	300	1	10	5	30	N	N	100	50	100	100	12-18-29	A,c	2	7
364*	100	2	7	5	20	N	N	N	50	100	70	12-18-29	A	2	25
365*	300	1	7	15	15	150	10	L	150	15	200	12-18-29	A,a	2	1.2
366	300	3	5	N	30	N	15	N	15	20	100	12-18-29	A,a	2	2
367*	1,000	1	N	50	50	20	7	700	150	30	500	12-18-20	A,e	2	
368*	700	N	N	70	50	10	20	1,000	100	15	300	12-18-20	A,e	2	
369*	700	L	15	30	30	N	30	150	200	30	100	12-18-29	B,a	4	2.5
370	150	2	15	7	30	N	20	100	50	20	150	12-18-29	B,e	2	
371*	700	2	20	30	30	5	30	N	150	50	200	12-18-29	B,a	4	2.5
372	150	2	L	5	70	15	15	N	20	50	200	12-18-29	B,e	2	
373*	300	L	30	50	20	10	70	500	200	10	100	12-18-29	B,c	2	P .5
374	150	1.5	L	5	30	N	15	N	30	15	100	12-18-29	D	3	
375	100	L	N	20	50	70	7	N	70	20	200	12-18-29	D	3	
376*	50	2	5	N	20	200	7	N	30	15	70	12-18-20	D	3	
377*	150	L	N	10	20	5	5	500	70	10	70	12-18-20	A,a	2	.5
378*	300	2	10	10	20	20	30	N	150	20	100	12-18-20	B,e	2	
379*	70	1	N	N	70	200	7	N	50	100	50	12-18-20	B,e	3	
380	100	3	N	N	20	30	7	N	20	20	150	12-18-20	D	3	
381*	50	1	N	N	70	300	5	N	10	100	30	12-18-20	D	3	
382*	100	L	N	10	100	1,000	10	100	30	100	70	12-18-20	D	4	
383	200	2	N	N	30	50	7	N	20	50	300	12-18-20	D	3	
384	150	1	N	5	30	15	5	N	20	50	150	12-18-29	D	3	
385	150	1.5	N	15	30	7	10	N	100	20	200	12-18-20	C,c	2	1

TABLE 7.—*Analyses of samples from prospects, mines, and outcrops, in the Gila*

Sample	Ounces/ton		Chemical analyses (percent)				AA (ppm)	Semiquantitative spectrographic analyses (percent)				(ppm)	
			Cu	Pb	Zn	CaF2	Te	Fe (.05)	Mg (.02)	Ca (.05)	Ti (.002)	Mn (10)	B (10)
386	0.01	0.19	---	---	---	---	1.3	10	0.3	0.07	0.15	150	N
387*	.005	Tr	---	---	---	---	1.3	1	.3	.07	.1	200	L
388	.005	.16	---	---	---	---	8.4	.3	.1	.05	.1	100	10
389	.01	.07	---	---	---	---	4	5	.3	1.5	.3	300	10
390	.01	Tr	---	---	---	---	11.5	1	.1	.05	.15	200	L
391	.01	Tr	---	---	---	3.73	N	2	.7	.7	.3	700	10
392	.01	Tr	---	---	---	2.01	.17	1.5	.5	1	.15	300	10
393*	.01	.05	---	---	---	50.68	.16	3	.2	15	.07	30	N
394	.02	.36	---	---	---	---	23.5	1	.3	.3	.07	200	L
395	.02	.08	---	---	---	---	99	1	.15	1.5	.07	70	N
396	.02	Tr	---	---	---	---	244	.7	.05	.7	.07	50	L
397*	.03	.19	---	---	---	---	620	1.5	.03	.05	.07	70	L
398*	.80	.32	---	---	---	---	3,500	5	.03	.7	.07	100	L
399	.02	.12	---	---	0.044	1.87	N	3	.7	.7	.3	700	10
400	.01	.05	---	---	---	---	49	1	.1	.05	.1	70	10
401*	.04	.04	---	---	---	---	97	3	.5	.5	.2	500	10
402*	.20	.26	0.143	---	---	---	2,730	5	.07	.3	.07	150	10
403	.005	.16	---	---	---	---	N	2	.2	.05	.15	500	10
404*	.01	.19	---	---	---	---	118	3	.5	.05	.3	200	30
405	.005	.28	---	---	---	---	N	1	.3	.3	.1	150	10
406*	Tr	.22	.255	---	.055	---	.2	2	.3	.07	.05	>5,000	30
407	.01	.19	---	---	---	3.02	1.9	3	.5	>20	.15	300	15
408*	.01	.07	.024	---	---	---	1.8	.7	1.5	.15	.5	300	100
409	.01	.15	---	---	---	---	.58	5	.7	1	.2	200	20
410	.01	Tr	---	---	---	---	.4	3	.2	.3	.15	100	10
411*	.01	Tr	---	---	---	---	.2	3	.2	.05	.2	100	10
412	.005	Tr	---	---	---	---	N	3	.7	.15	.3	700	10
413*	.005	Tr	---	---	---	---	N	3	.7	.3	.3	200	15
414	.005	Tr	---	---	---	76.72	N	.7	.3	>20	.1	3,000	L
415	.005	Tr	---	---	---	---	.5	3	.7	2	.21	300	10
416	.01	Tr	.05	---	---	58.73	N	1.5	.5	>20	.1	200	L
417	.01	Tr	---	---	---	40.39	1.4	3	1	20	.2	300	L
418	.01	Tr	---	---	---	26.39	N	5	1	.5	.5	300	L
419	.01	Tr	---	---	---	38.35	N	.7	.2	20	.03	50	L
420*	.01	.11	.031	---	---	5.60	N	10	2	10	.2	1,500	L
421*	.01	.49	1.473	C.46	.061	---	N	15	3	2	1	1,500	10
422*	.02	Tr	.036	---	---	49.06	N	3	.7	>20	.3	200	10
423*	.01	Tr	.01	---	---	57.26	.1	5	.5	>20	.2	500	L
424*	.01	Tr	1.262	.04	---	---	.1	3	.3	.5	.2	300	10
425*	.03	.21	.18	.02	---	9.87	N	7	1.5	7	.3	1,500	L
426*	.03	.41	6.68	.92	---	---	.4	10	1.5	1	.3	1,000	L
427*	.01	Tr	2.204	.04	---	---	.3	10	1	1	.3	1,000	10
428*	.01	.33	4.40	.08	.31	---	.9	3	.15	.2	.1	200	10
429*	Tr	.34	.98	.08	---	---	N	1	.3	.1	.2	500	L
430	.01	Tr	Tr	---	---	---	.3	3	.15	.2	.15	150	10
431*	.01	Tr	.283	.06	---	---	N	5	1	.2	.15	5,000	15
432*	1.36	.10	8.82	1.04	.063	---	4.75	10	.2	.15	.07	1,500	10
433*	.04	3.66	7.05	.06	---	---	1	15	.5	.2	.1	1,500	10
434*	.01	Tr	1.17	.04	---	1.69	.6	5	.5	15	.15	1,000	N
435	.01	Tr	---	---	---	13.93	N	2	.2	10	.15	150	10
436	.01	Tr	---	---	---	18.83	N	1.5	.2	10	.1	300	10
437*	.03	Tr	---	---	---	23.87	N	2	.2	20	.1	200	L
438	Tr	Tr	---	---	---	---	.96	5	1.5	1	.3	1,500	10
439*	.12	.36	.041	.22	---	---	1.1	10	.3	.1	.15	1,000	L
440*	.02	.42	.031	.11	---	---	.3	5	.3	.15	.2	1,000	L
441	.01	.21	---	---	---	---	N	3	1	.3	.2	1,000	10
442	Tr	.20	Tr	---	---	---	.8	3	.7	.2	.3	700	N
443	Tr	.16	---	---	---	---	.5	2	1	.15	.2	1,000	10
444*	Tr	.20	---	---	---	---	N	3	1	.15	.2	500	10
445	Tr	.50	---	---	---	---	.4	2	.5	.05	.1	200	N
446	Tr	.30	---	---	---	---	.5	1	.7	.2	.1	500	N
447	.005	.18	.061	---	---	---	.9	2	.2	.3	.05	200	10
448*	.005	.52	---	---	---	3.57	.2	3	1	5	.15	2,000	20
449	.005	.12	---	---	---	---	.1	3	.3	.1	.2	700	L
450	.005	.14	---	---	---	---	.1	3	.2	.1	.2	200	10

Wilderness and vicinity, New Mexico, collected by the U.S. Bureau of Mines—Continued

Semiquantitative spectrographic analyses

Sample	(ppm) Ba (20)	Be (1)	Co (5)	Cr (10)	La (20)	Mo (5)	Ni (5)	Sr (100)	V (10)	Y (10)	Zr (10)	Location	Site	Type		Width (feet)
386	200	2	L	15	30	30	10	N	70	15	200	12-18-20	D	3		
387*	70	1.5	7	L	50	10	7	N	50	30	200	12-18-20	B,b	2		3
388	50	1.5	N	L	30	N	L	N	30	20	150	12-18-20	B,b	2		0.5
389	300	1.5	20	15	50	15	15	N	150	20	200	12-18-20	B,a	2		1.5
390	100	1.5	L	L	50	7	L	N	30	70	200	12-18-20	D	3		
391	300	1.5	50	10	70	N	50	200	70	30	300	12-18-20	B,a	2		3.5
392	300	1.5	20	5	70	N	30	100	70	30	150	12-18-20	B,e	2		
393*	100	1	30	7	50	100	20	N	50	100	70	12-18-20	B,b	2		.5
394	100	3	7	L	30	5	20	N	30	50	100	12-18-20	B,b	2		.8
395	30	3	N	5	20	N	15	N	20	70	150	12-18-20	B,e	2		3.5
396	N	1	5	L	30	10	10	N	30	30	70	12-18-20	B,a	2		3
397*	30	3	7	L	N	15	10	N	30	30	100	12-18-20	B,b	2		1
398*	200	1.5	20	L	70	30	30	N	70	30	100	12-18-20	B,b	2		2
399	500	3	30	15	50	7	50	N	70	50	200	12-18-20	B,e	2		
400	30	2	L	5	30	7	10	N	30	70	150	12-18-20	B,e	2		
401*	200	2	5	N	30	30	10	N	50	50	200	12-18-20	D	3		
402*	100	3	7	N	100	50	7	N	20	50	150	12-18-20	D	4		
403	150	1.5	N	N	20	N	7	N	30	50	200	12-18-29	D	3		
404*	20	1	N	5	100	30	7	N	30	20	500	12-18-29	B,e	2		3
405	150	5	N	N	30	100	5	N	15	50	100	12-18-28	A,a	2		8
406*	5,000	10	150	N	20	70	50	700	50	50	70	12-18-28	D	3		
407	200	1.5	N	15	70	10	10	N	70	50	100	12-18-28	A,e	3		
408*	1,000	2	N	50	50	100	5	100	200	20	200	12-18-29	C	2		.8
409	200	3	N	15	N	70	10	N	70	30	200	12-18-29	C	2		2
410	300	3	N	10	30	5	5	N	70	20	150	12-18-28	B,e	2		.3
411*	300	3	N	10	50	N	5	N	100	15	150	12-18-28	B,a	2		1.5
412	700	5	5	5	100	N	5	N	100	30	300	12-18-28	B,b	2		.3
413*	500	3	5	5	30	5	5	200	150	30	300	12-18-28	B,a	2		.5
414	300	1	5	5	50	N	L	150	100	70	30	12-18-33	A,a	2		1
415	500	3	10	20	N	N	20	N	70	20	70	12-18-32	D	3		
416	70	1.5	N	10	30	N	L	N	100	70	50	12-18-33	A,a	1		3
417	150	7	10	70	20	N	50	N	150	70	70	12-18-33	A	2		8
418	500	3	20	50	30	N	50	N	200	50	100	12-18-33	A,a	2		5
419	70	1	N	N	30	N	5	N	30	50	30	12-18-33	E	3		
420*	700	2	50	200	50	N	70	100	200	50	150	12-18-33	B,c	2		.2
421*	1,500	3	50	300	30	N	100	200	300	50	200	12-18-33	A,c	2		1.5
422*	700	1.5	10	150	100	N	30	100	150	>200	100	12-18-33	A,a	2		4
423*	300	1.5	5	30	70	N	5	100	150	>200	100	12-18-33	A,a	2		1
424*	1,000	1	N	5	30	100	5	100	50	20	300	12-18-33	D	4		
425*	1,000	5	20	20	50	N	15	100	150	100	300	12-18-33	B,a	2		.8
426*	1,500	2	15	20	30	10	10	150	150	50	200	12-18-33	A	3		
427*	2,000	2	15	20	20	10	15	150	150	30	200	12-18-34	D	4		
428*	500	3	N	20	N	500	10	N	20	20	100	13-18- 3	D	4		
429*	700	1.5	5	L	20	150	5	100	20	20	100	13-18- 3	E	3		
430	200	5	N	30	N	70	20	N	50	10	100	13-18- 3	D	3		
431*	1,500	7	5	50	100	N	20	100	100	70	150	13-18- 3	B,a	1		4
432*	300	10	N	10	N	70	5	N	700	50	70	13-18- 3	B,c	2		.3
433*	2,000	7	10	20	N	100	15	N	200	30	100	13-18- 3	B,b	2		3
434*	1,100	1.5	L	30	20	50	15	200	100	20	100	13-18- 3	D	4		
435	500	2	N	50	N	N	15	N	50	50	50	13-18- 3	F,e	2		
436	700	2	N	30	20	N	15	N	20	50	50	13-18- 3	D	3		
437*	200	2	N	30	20	150	10	N	30	50	20	13-18- 3	A,a	2		4
438	1,500	1	10	20	30	N	10	150	150	30	200	13-18- 3	F,e	2		
439*	700	5	5	N	20	10	5	N	100	30	100	13-18- 3	A,a	2		1.3
440*	1,000	3	5	N	20	5	7	100	70	20	100	13-18- 3	D	3		
441	1,000	2	5	5	30	N	7	150	100	20	150	13-18- 3	B,a	2		1
442	700	2	10	L	50	N	5	200	50	30	100	13-18- 3	B,a	2		1
443	1,000	3	5	L	70	N	5	N	30	50	150	13-18- 3	B,b	1		2
444*	1,000	2	5	N	70	N	7	100	150	30	100	13-18- 3	B,b	2		.8
445	1,500	1.5	5	L	30	N	5	N	20	20	100	13-18- 3	B,d	1	P	.3
446	1,000	1.5	N	L	50	N	L	N	50	20	100	13-18- 3	B,d	1	P	.3
447	200	2	N	N	50	N	7	N	30	15	70	13-18- 3	B,e	4		
448*	100	1	N	5	N	N	10	300	150	L	70	13-18- 2	F,e	3		
449	500	2	N	5	20	N	10	100	30	50	150	13-18- 2	F,e	2		
450	500	3	N	5	N	50	7	N	70	10	100	13-18- 2	A,a	2		3

TABLE 7.—*Analyses of samples from prospects, mines, and outcrops, in the Gila*

Sample	Chemical analyses: Ounces/ton		Chemical analyses: (percent)				AA (ppm)	Semiquantitative spectrographic analyses: (percent)				Semiquantitative spectrographic analyses: (ppm)	
	Au	Ag	Cu	Pb	Zn	CaF2	Te	Fe (.05)	Mg (.02)	Ca (.05)	Ti (.002)	Mn (10)	B (10)
451	0.005	0.14	---	---	---	---	7	2	0.15	0.1	0.07	200	10
452	.005	.20	---	---	---	---	0.1	1.5	.15	.1	.1	70	10
453*	.01	.27	---	---	---	---	.4	2	.07	.2	.03	50	L
454	.005	.06	---	---	---	21.07	6	1.5	.3	10	.15	100	10
455	.005	.16	---	---	---	5.70	N	2	.3	5	.2	200	10
456	.005	.16	---	---	---	3.78	N	1	.07	1	.02	70	10
457	Tr	.04	---	---	---	70.28	7.6	1	.3	>20	.05	100	L
458	.01	Tr	---	---	---	27.65	N	2	.3	15	.15	200	10
459	Tr	.34	---	---	---	50.96	.9	1	.3	>20	.07	1,500	N
460*	.01	.04	---	---	---	---	N	1	.2	2	.07	300	10
461	.01	Tr	---	---	---	95.20	N	.1	.05	>20	.02	70	N
462	.02	.12	0.031	---	---	29.75	N	3	.7	15	.2	500	10
463*	.005	Tr	---	---	---	88.90	.6	.5	.07	>20	.3	20	N
464*	.005	.18	---	---	---	72.38	.2	.3	.1	>20	.03	30	N
465*	.01	Tr	.014	---	0.011	97.16	1.1	.15	.05	>20	.01	15	N
466	.01	.03	---	---	---	4.93	N	3	.3	5	.3	200	15
467*	.01	.13	---	---	---	48.44	1	1.5	.15	>20	.03	100	10
468	.005	.40	---	---	---	79.38	.9	.3	.15	>20	.05	30	L
469*	.005	.24	---	---	---	56.77	N	.7	.3	20	.05	50	10
470	.02	Tr	---	---	---	---	N	1.5	.2	.5	.1	200	10
471	.01	.03	---	---	---	---	N	3	.5	.2	.2	700	10
472*	.01	Tr	---	---	---	---	N	1.5	.2	.2	.07	>5,000	10
473*	.03	Tr	.031	---	---	44.38	N	3	.2	20	.15	5,000	10
474	Tr	.14	---	---	---	---	N	2	.7	2	.1	200	30
475	.01	.09	---	---	---	63.84	1.1	.7	.2	>20	.05	50	L
476	.02	.22	---	---	---	44.66	1	1	.2	>20	.07	70	10
477	.005	.24	---	---	---	---	.2	.3	.15	1	.5	70	15
478	.01	.11	---	---	---	---	.2	2	.3	1.5	.1	200	10
479*	.01	.04	---	---	---	26.32	N	15	.15	20	.07	150	10
480*	.005	.20	.008	0.01	---	---	.44	3	.5	5	.15	1,000	10
481	.005	.40	---	---	---	92.96	.1	.2	.07	>20	.02	20	N
482*	.025	Tr	---	---	---	33.25	N	1.5	.1	7	.07	30	10
483	.01	.11	---	---	---	5.74	.36	.7	.2	2	.1	50	20
484	.01	.07	---	---	---	50.89	N	1.5	.15	20	.05	20	N
485	.01	Tr	---	---	---	44.17	.79	.7	.15	10	.07	30	N
486	.01	Tr	---	---	---	62.23	.8	.7	.1	20	.05	20	N
487	.02	Tr	---	---	---	30.10	N	1	.15	10	.07	30	N
488	Tr	.14	---	---	---	---	.9	3	.1	.1	.10	100	15
489	.01	.23	---	---	---	50.40	1	3	.7	20	.15	100	L
490	.005	.42	---	---	---	---	N	5	.5	2	.5	500	L
491*	.005	.14	---	---	---	---	1.1	10	5	5	>1	1,000	L
492*	.005	.40	---	---	---	---	.4	15	2	5	1	1,000	L
493*	Tr	.08	---	---	---	1.82	.9	10	3	15	1	500	L
494	Tr	.14	---	---	---	6.16	1	1.5	1	>20	.2	20	N
495*	Tr	.32	---	---	---	---	1.94	5	1.5	7	.5	700	L
496*	.02	.52	---	---	---	---	N	10	3	5	.7	1,000	L
497*	Tr	Tr	---	---	---	---	N	7	3	3	.5	700	10
498	.015	Tr	---	---	---	---	.2	1	.1	1	.03	300	20
499	.005	.28	---	---	---	---	N	2	.5	.2	.2	700	20
500*	.01	.13	---	---	---	---	N	10	1.5	2	.7	500	10
501*	.01	.33	---	---	---	---	.4	5	.7	.7	.50	1,000	10
506	Tr	Tr	---	---	---	---	.5	.5	.5	>20	.07	200	N
507	.005	Tr	---	---	---	---	N	3	.5	.5	.3	200	30
508*	.01	.13	---	---	---	---	N	2	.3	>20	.15	1,000	10
509	.01	.26	---	---	---	---	.8	10	.7	.15	.3	100	50
510*	.005	.14	---	---	---	---	2.9	10	.7	.2	.5	30	200
511	.01	.29	---	---	---	---	N	5	1.5	.5	.5	500	20
512	.01	.17	---	---	---	---	.5	5	1.5	.5	.3	200	L
513*	.005	.16	---	---	---	---	4.75	7	.2	.2	.5	50	L
514*	Tr	.18	.028	---	---	---	N	10	.3	.1	.3	200	L
515*	Tr	.10	.034	---	---	---	.2	2	.5	.5	.5	150	10
516*	Tr	Tr	---	---	---	---	N	5	.1	.05	.5	10	10
517*	.02	.48	---	---	---	---	N	2	.7	.1	.5	30	30
518	.005	.14	---	---	---	---	N	5	.1	.1	.7	50	L
519*	.005	.16	---	---	---	---	N	7	.2	.1	1	50	10

Wilderness and vicinity, New Mexico, collected by the U.S. Bureau of Mines—Continued

Sample	Semiquantitative spectrographic analyses (ppm) Ba (20)	Be (1)	Co (5)	Cr (10)	La (20)	Mo (5)	Ni (5)	Sr (100)	V (10)	Y (10)	Zr (10)	Location	Site	Type	Width (feet)
451	300	3	N	5	N	50	10	N	30	15	70	13-18-11	A,a	2	1.3
452	200	3	N	N	N	15	7	N	30	10	70	13-18-11	A,e	4	
453*	200	3	N	N	N	200	5	N	10	10	50	13-18-11	D	3	
454	700	3	N	N	30	7	5	N	70	50	200	13-18-11	A,e	2	3.1
455	1,000	3	N	N	30	N	7	100	100	30	100	13-18-11	A,e	2	
456	150	3	7	N	N	N	5	N	10	20	10	13-18-11	A,a	2	1.7
457	50	1	N	5	20	N	5	100	70	15	20	13-18-11	A,a	2	3
458	300	2	N	N	20	15	15	N	50	30	100	13-18-11	A,e	2	2
459	300	2	N	N	20	N	N	200	50	50	100	13-18-11	A,e	3	
460*	200	7	N	N	30	N	5	2,000	L	20	70	13-18-12	F,e	2	
461	20	N	N	N	70	N	N	100	N	100	10	13-18-13	E	3	
462	1,000	1.5	7	50	70	N	10	200	70	70	300	13-18-13	A,a	2	0.7
463*	10	L	N	N	20	N	N	N	30	200	10	13-17- 7	A,a	2	7
464*	20	L	N	N	30	N	N	100	15	150	50	13-17-18	E	3	
465*	N	N	N	N	30	N	N	100	15	200	20	13-17-18	A,e	2	.7
466	300	2	N	30	30	50	5	N	70	70	300	13-17-18	B,a	2	1.1
467*	150	1	N	10	30	20	5	100	100	150	50	13-17-18	A,a	2	1.2
468	100	1	N	5	50	N	N	200	30	15	70	13-17-18	A,a	2	2.2
469*	100	1	N	N	50	N	L	100	50	50	50	13-17-18	A,a	2	2.5
470	500	3	N	5	20	30	5	N	50	20	150	13-17-18	A,a	2	.5
471	1,000	1.5	5	5	30	N	10	N	70	30	200	13-17-18	F	2	5
472*	>5,000	30	15	20	30	15	20	700	70	20	50	13-17-19	F,e	2	
473*	2,000	5	5	20	30	N	15	150	100	70	70	13-17-19	A,a	2	5
474	200	1.5	10	50	N	N	50	100	50	N	70	13-17-23	F,e	2	
475	3,000	1	N	N	50	20	L	150	50	30	70	14-16-29	A,a	2	1
476	300	L	N	5	50	N	5	100	70	70	70	14-16-29	A,a	2	3
477	300	1	15	10	30	N	15	300	200	30	300	14-16-20	F,e	2	
478	500	1	5	5	N	N	10	N	50	L	100	14-16-21	F	2	3
479*	300	2	7	70	30	10	20	300	100	30	100	14-16-16	F	2	1
480*	>5,000	5	5	20	N	10	20	1,000	30	10	100	14-16-15	F,e	2	12
481	20	N	N	N	70	N	N	200	20	10	50	14-16-21	E	3	
482*	50	1	N	L	30	150	7	N	20	10	50	14-16-28	B,a	2	1
483	150	1.5	N	L	30	7	L	L	30	15	150	14-16-28	E	3	
484	50	N	N	L	30	10	L	100	30	20	50	14-16-28	A,a	2	1
485	70	L	N	N	20	5	L	100	30	15	70	14-16-28	C,a	2	3
486	30	N	N	L	20	L	5	100	30	15	30	14-16-28	A,a	2	1
487	200	L	N	L	30	10	5	150	30	30	70	14-16-28	A,a	2	2
488	300	1	7	5	N	30	7	N	30	L	100	14-16-28	B,a	2	2.5
489	500	L	10	20	70	N	10	150	200	30	100	14-16-33	C,b	2	3.5
490	1,000	L	5	5	30	N	5	700	200	20	200	15-16- 4	F,e	2	9
491*	1,000	N	70	500	20	N	100	1,000	300	50	200	14-16-26	F	2	22
492*	1,000	1	30	70	70	N	50	1,000	200	50	200	14-16-23	F	2	25
493*	1,000	L	30	70	70	N	30	1,000	200	50	300	14-16-14	F,e	2	
494	150	N	5	30	N	N	5	300	100	30	100	14-16-14	F,e	2	
495*	700	L	20	100	N	N	50	1,000	150	20	150	13-16-26	F,e	2	
496*	700	N	30	200	N	N	70	700	300	30	150	13-16-26	F,e	2	
497*	1,500	L	20	70	30	N	50	3,000	150	30	150	13-15-27	A,a	2	1.1
498	100	2	N	5	N	N	7	N	L	15	50	13-15-27	F,e	2	
499	150	5	5	10	30	N	7	N	15	70	300	15-14-17	A,a	2	5
500*	700	1	50	150	70	N	100	700	100	30	300	15-14-20	A,e	2	
501*	1,000	1	30	100	50	N	50	200	100	20	200	15-14-23	F,e	2	
506	100	L	N	10	N	N	5	150	10	10	20	14-13-28	D	3	
507	700	2	N	30	50	N	15	N	70	30	500	14-13-29	F,e	2	
508*	200	L	10	50	N	N	15	500	50	15	70	14-13-29	E	2	
509	700	1.5	7	50	50	N	15	500	200	20	150	14-13-29	F,e	2	
510*	1,500	L	N	100	50	L	10	500	150	30	200	14-13-29	D	3	
511	1,000	1.5	30	70	70	N	70	200	100	30	200	14-13-20	D	3	
512	500	2	30	50	20	10	50	100	70	20	150	14-13-20	D	3	
513*	700	N	10	100	70	20	20	700	150	30	150	14-13-20	B,b	2	3.5
514*	1,000	N	100	100	30	7	100	300	200	50	200	14-13-20	F,e	2	
515*	700	N	50	100	50	N	100	300	100	50	200	14-13-20	A,e	2	
516*	700	L	N	200	50	5	10	500	200	10	200	14-13-20	B,b	2	4
517*	1,000	L	N	50	50	N	7	300	150	30	300	14-13-20	D	3	
518	500	L	N	50	N	N	7	300	70	10	200	14-13-17	A,a	2	4
519*	500	1	N	150	70	5	15	700	200	30	500	14-13- 9	A,a	2	3.5

TABLE 7.—*Analyses of samples from prospects, mines, and outcrops, in the Gila*

Sample	Chemical analyses						AA	Semiquantitative spectrographic analyses					
	Ounces/ton		(percent)				(ppm)	(percent)				(ppm)	
	Au	Ag	Cu	Pb	Zn	CaF2	Te	Fe (.05)	Mg (.02)	Ca (.05)	Ti (.002)	Mn (10)	B (10)
520*	0.005	0.10	---	---	---	---	N	1.5	0.2	0.1	1	50	N
521*	.01	.09	---	---	---	---	N	5	.2	.5	.3	100	50
522	Tr	.12	---	---	---	---	.4	3	.05	.2	.5	30	10
523	Tr	Tr	---	---	---	---	N	2	.02	.1	.5	70	L
524	Tr	Tr	0.021	---	---	---	.6	10	.3	.05	.2	30	10
525	Tr	.04	---	---	---	---	.3	5	.5	.05	.3	20	15
526	.005	.04	---	---	---	---	N	5	.5	.05	.5	20	10
527	Tr	.10	---	---	---	---	N	5	.3	.1	.5	30	10
528*	.28	.36	---	---	---	---	N	20	.1	.2	.7	100	20
529*	Tr	.16	.042	---	---	---	.5	5	.02	.07	.05	20	N
530*	Tr	.14	.177	---	---	---	N	3	L	.07	.05	L	L
531	Tr	.10	---	---	---	---	N	.5	L	.1	.5	L	10
532	Tr	Tr	---	---	---	---	.3	.5	L	.1	.15	10	L
533	Tr	.04	---	---	---	---	N	7	.7	.5	.5	100	10
534	.04	3.06	---	---	---	---	N	1	L	.07	.5	10	30
535*	Tr	Tr	---	---	---	---	.9	1	L	.07	.5	15	15
536*	Tr	.20	---	---	---	---	.8	3	L	.05	.3	30	10
537	Tr	.06	---	---	0.026	---	.5	.7	.05	.07	.5	50	10
538*	Tr	.20	---	---	---	---	N	5	L	.05	.5	30	L
539*	.005	.19	---	---	---	---	5.37	10	.07	.07	.5	20	L
540*	Tr	Tr	---	---	---	---	.5	10	.02	.1	.3	100	10
541	Tr	.05	---	---	---	---	N	5	L	.2	.5	30	L
542*	.005	Tr	---	---	---	---	N	10	.5	1	.5	150	50
543	Tr	Tr	---	---	---	---	N	1	.2	1	.15	200	20
544*	Tr	Tr	---	---	---	---	N	.5	.1	5	.03	50	15
545*	Tr	.04	---	---	---	---	1.3	7	2	3	.5	100	L
546*	Tr	Tr	---	---	---	---	N	.3	.1	10	.05	50	L
547	Tr	Tr	---	---	---	---	.9	1	.07	.2	.1	500	15
548	Tr	.38	---	---	---	---	.2	1	.1	.3	.15	500	10
549*	Tr	Tr	---	---	---	---	N	1	.1	.1	.1	200	15
550*	.005	Tr	---	---	---	---	N	15	2	.5	>1	2,000	L
551	.01	Tr	---	---	---	---	1.4	2	.5	.7	.2	500	N
552	.01	Tr	---	---	---	---	N	2	.5	.7	.3	1,500	N
553A*	Tr	.20	---	---	---	---	.2	2	.3	.3	.3	700	15
553B*	Tr	.09	---	---	.03	---	N	10	.5	.3	1	3,000	10
554	.01	Tr	---	---	---	---	1.3	3	.7	.7	.3	500	L
555A*	.005	.34	---	---	---	---	.4	1.5	.2	.2	.1	200	15
555B*	.01	.15	---	---	---	---	N	3	.3	.3	.3	700	15
556A*	.005	.16	---	---	---	---	1.3	2	.7	1	.2	300	30
556B*	.005	.10	---	---	---	---	N	3	.5	.7	.3	1,000	20
557*	.005	Tr	---	---	---	---	.5	3	.15	.1	.1	700	10
558*	.005	Tr	---	---	.033	---	N	10	.2	.15	.1	1,500	15
559	.01	Tr	---	---	---	---	N	2	.5	1	.15	700	10
560	.005	Tr	---	---	---	---	.4	7	1.5	2	.7	700	N
561	.005	.06	---	---	---	---	N	1.5	.5	.7	.2	200	N
562	.005	Tr	---	---	---	---	.4	1	.05	.1	.1	150	N
563	.01	Tr	---	---	---	---	N	1	L	.05	.07	150	10
564	.005	Tr	---	---	---	---	3.5	1.5	.07	.1	.05	500	10
565	.01	.07	---	---	---	---	.44	1.5	.2	.5	.07	300	10
566	.005	.22	---	---	---	---	.35	3	1	7	.3	300	N
567	.01	.19	---	---	---	---	N	1	.1	.2	.05	300	N
568	.005	Tr	---	---	---	---	N	1	.05	.07	.03	100	N
569	.01	Tr	---	---	---	---	N	1.5	.03	.15	.15	200	10
570	.005	Tr	---	---	---	---	.3	1	.03	.1	.15	300	10
571	.01	.11	---	---	---	---	.57	1	.3	1	.07	300	N
572*	.01	.15	---	---	---	---	1.9	1.5	.2	.07	.07	700	10
573	.01	.05	---	---	---	---	N	.5	.02	.05	.01	100	L

Wilderness and vicinity, New Mexico, collected by the U.S. Bureau of Mines—Continued

Semiquantitative spectrographic analyses

Sample	(ppm)											Location	Site	Type	Width (feet)
	Ba (20)	Be (1)	Co (5)	Cr (10)	La (20)	Mo (5)	Ni (5)	Sr (100)	V (10)	Y (10)	Zr (10)				
520*	700	1	N	100	N	N	15	700	100	50	500	14-13- 9	A,e	2	10
521*	300	1.5	20	7	20	L	15	1,000	150	15	150	14-13- 4	F,e	2	
522	500	N	30	20	30	N	50	500	200	30	200	13-13-32	A,e	2	
523	700	N	L	50	30	10	7	500	150	10	200	13-13-30	F,e	3	
524	700	L	50	10	20	5	20	500	70	20	100	13-13-29	B,b	3	
525	500	L	20	15	30	L	15	200	100	20	150	13-13-29	B,b	3	
526	700	L	10	15	30	N	15	100	100	30	300	13-13-29	B,b	2	4
527	700	L	N	15	50	L	10	300	150	30	200	13-13-29	D	3	
528*	700	L	7	150	50	15	15	500	500	20	300	13-13-20	F,e	2	
529*	50	L	70	15	N	N	100	L	70	L	100	13-13-29	B,d	2	
530*	500	N	30	10	30	N	70	1,000	150	15	150	13-13-29	B,a	2	4
531	700	N	N	20	70	N	5	500	100	20	200	13-13-29	D	3	
532	150	L	20	15	N	N	30	150	50	10	100	13-13-29	F,e	2	
533	1,000	L	20	20	30	L	20	300	150	30	200	13-13-20	D	3	
534	700	N	N	70	30	N	L	500	70	10	200	13-13-19	F,e	2	
535*	500	N	N	70	50	7	10	500	100	20	200	13-13-19	F,e	2	
536*	500	L	30	50	20	5	50	300	70	20	150	13-13-30	B,e	2	
537	1,000	L	20	50	70	N	30	300	100	30	200	13-13-19	B,a	2	2.5
538*	500	L	50	30	20	5	70	200	70	30	200	13-13-19	B,e	2	
539*	1,000	L	N	150	50	10	10	500	150	100	200	13-13-30	F,e	2	
540*	700	N	5	100	20	20	20	500	200	20	150	13-13-19	A,e	3	
541	1,000	N	N	50	50	5	7	700	200	30	300	13-13-19	D	3	
542*	700	2	15	50	50	N	15	1,000	200	20	200	13-13-20	F,e	2	
543	500	1	5	20	30	N	20	150	20	20	100	12-14-23	A,e	2	
544*	150	L	L	10	N	N	300	L	L	L	20	12-14-23	F,e	2	
545*	1,000	1	50	300	150	N	100	1,000	100	50	300	12-14-23	F,e	2	
546*	20	L	N	10	N	N	L	L	15	L	20	12-14-23	F	2	3
547	70	2	N	10	70	N	7	N	10	50	150	14-11- 5	F,e	2	
548	70	2	N	10	50	N	5	N	10	50	150	14-11- 5	F,e	2	
549*	100	3	N	10	50	N	10	N	10	50	150	14-11- 5	A,e	3	
550*	1,000	1	70	70	50	N	100	500	200	50	200	13-12-12	F,e	2	
551	500	N	7	20	30	N	20	200	30	10	100	11-12- 9	F,e	2	20
552	700	N	7	10	20	N	15	100	20	10	100	11-12- 9	F,e	2	6
553A*	300	5	7	30	50	N	10	200	50	70	200	11-12- 9	G	1	2.5
553B*	300	3	10	70	100	L	7	150	100	100	1000	11-12- 9		5	
554	700	1.5	7	15	50	L	15	150	50	50	200	11-12- 5	D	3	
555A*	300	5	N	L	50	N	7	150	20	30	150	11-12- 5	A,d	3	1
555B*	500	3	7	30	70	L	10	200	70	70	300	11-12- 5		5	
556A*	500	3	7	30	50	N	10	300	50	50	150	11-12- 5	D	1	10
556B*	500	5	10	50	100	L	15	200	70	70	300	11-12- 5		5	
557*	70	3	N	10	50	N	7	N	N	70	100	11-12- 5	A,a	2	0.7
558*	70	3	N	15	70	N	7	N	50	>200	150	11-12- 5	A,a	2	.5
559	500	3	5	15	30	N	10	100	30	30	150	11-12- 5	D	3	
560	1,500	N	30	50	50	N	50	500	150	20	500	10-13-30	D	3	
561	1,000	5	L	L	50	N	10	1,000	30	20	150	10-14-29	D	3	
562	L	1.5	N	N	20	N	L	N	N	10	150	10-14-33	F,e	2	2
563	70	N	N	N	N	N	L	N	N	20	300	10-14-33	F,e	2	
564	50	3	N	10	L	N	L	N	N	N	100	10-14-33	F,e	2	
565	70	2	N	L	30	N	7	300	L	10	150	11-15- 6	F,e	2	
566	300	N(1)	30	15	20	N	30	300	70	15	150	11-16-27	F,e	2	
567	20	2	N	5	20	N	10	N100	L10	15	70	11-16- 2	F,e	2	
568	70	N	N	L	N	7	L	N	15	N	20	10-17-34	F,e	2	4
569	70	2	N	N	50	N	L	N	N	30	200	10-17-29	A,a	2	4
570	70	1	L	N	70	N	N	N	N	10	200	10-17-29	A,a	2	1
571	N	3	N	L	20	N	5	N	15	30	150	11-18-28	D,e	3	
572*	N	1.5	L	15	30	L	5	N	10	20	200	11-18-35	B,a	2	6
573	N	1	N	L	N	N	L	N	L	10	20	11-18-35	B,b	2	.5

TABLE 7.—*Analyses of samples from prospects, mines, and outcrops, in the Gila*

Footnote to Table 7 (all values are percent except Pt, which is in ounces per ton)

1. 0.002 Sn
2. 0.017 Sn
3. 19.73 Mn, 0.025 Cr, 0.094 W, 0.036 As, 0.20 Sb
6. 0.035 W
7. 0.006 Sb
8. 11.84 Mn, 0.018 Be, 0.70 Sr, <0.005 W, 0.056 As, 0.24 Sb, <0.001 Pt
9. 7.77 Mn, 0.41 Sr, 0.022 Sb
10. 0.94 Mn, 0.14 Sr, <0.005 W, 0.012 Sb, <0.001 Pt
11. 46.88 CaO, 0.053 Mn
12. 12.25 CaO
14. 0.013 Cr, 0.027 Ni
18. 0.97 Mn
32. 14.74 CaO
37. 0.011 Bi, <0.001 Cr
44. 0.029 Cr
45. 0.035 Cr
50. <0.005 W
51. 0.011 Y, <0.001 all other REO
66. 0.012 Y, <0.001 all other REO
69. 0.012 Mo
82. 0.005 Cr
87. 0.017 Cr
88. 0.008 Mo
90. 0.021 Mo
95. 0.21 Sr
96. 0.18 Sr
97. 0.008 Mo
100. 0.18 Sr
102. 0.015 Ni, 0.008 Sn
105. 0.014 REO
108. 0.12 Sr
109. <0.002 Bi, 0.012 Mo
112. 0.002 Bi
114. 0.009 Cd
115. 0.009 Mo
117. 0.003 Cd, 0.001 Mo, 0.168 V, 0.054 W, 0.008 As
121. 0.045 W
127. 0.014 Ni
140. 0.005 Ga, 0.003 Cd, 0.001 Cr
141. 0.002 Ga, 0.006 Cd, 0.001 Cr
142. 0.002 Ga, 0.016 Cd, 0.001 Cr, 0.016 Mo
143. 0.002 Ga, 0.001 Cr, 0.024 Ni, 0.73 Ti, <0.001 Pt
144. 0.003 Ga, 0.003 Cd, 0.001 Cr
145. 0.010 Ga, 0.031 Cd
146. 0.002 Ga, 0.004 Cd
147. 0.011 Cr, <0.005 W
153. 0.0014 Ga
154. 0.0018 Ga, 0.72 Cd
155. 0.057 Cd
156. 0.026 Cd
157. 0.061 Cd, 0.015 Mo
158. 0.004 Cd
159. 0.013 Mo
164. 0.035 Mo
165. 0.045 Mo
166. 0.038 Mo
195. 0.40 Mn
222. <0.001 REO
223. 0.029 REO
234. 0.32 Mn
240. 0.17 Mn, <0.005 W
241. 0.29 Mn
242. 0.56 Mn, <0.005 W
243. 0.36 Mn
244. 0.24 Mn
245. <0.005 W
248. <0.003 Bi
249. 0.009 Bi
250. 0.022 REO, principally Y
251. 0.016 REO, principally Y
255. <0.005 W, 0.011 REO
256. 0.055 V, 0.005 W
257. 0.013 W
258. <0.005 W
259. 0.023 W
260. 0.048 Bi
262. <0.001 Cr, 0.033 Ni, <0.001 Pt
263. <0.003 Bi, 0.031 Y
264. 0.001 Cr, 0.014 Ni, <0.001 Pt
267. <0.003 Bi, <0.002 Sn
268. 0.003 Sn
272. <0.002 Sn
283. 0.022 Bi
291. 0.001 Mo
292. 0.013 Y
293. 0.018 Y, 0.016 Sb
295. 0.045 Y, 0.003 Sb
301. 0.042 REO
304. 0.53 Mn
308. 0.37 Mn
313. <0.005 W
316. 0.026 REO
321. 0.005 Bi, 0.044 W
322. 2.80 Mn, 0.002 W, 0.021 Y
324. 0.26 Mn
327. 0.014 W, 0.013 REO
328. 0.012 Nb, 0.036 REO
329. 0.39 Ti, 0.014 W, 0.022 REO
331. 0.028 W
332. 0.033 W, 0.014 Sb
333. 0.96 Mn, 0.019 W, 0.011 Sb
334. 0.018 REO
335. 0.27 Ti, 0.008 Ga, 0.008 BeO, 0.020 Sr, 0.53 Mn, 0.026 Cd, 0.014 Co, 0.054 Mo, 0.109 REO

Wilderness and vicinity, New Mexico, collected by the U.S. Bureau of Mines—Continued

337. 0.012 Ga, 0.010 Cd, <0.005 W
338. 0.022 REO
342. 0.77 Ti, 0.039 V
347. 0.063 Sr, <0.005 W
348. 0.53 Mn, 0.002 Co
350. 0.14 Mo, 0.008 Sn
352. 0.34 B
353. 0.014 V, 0.034 W
356. 0.014 REO
358. 0.03 Cr
359. 1.38 Mn
360. 0.24 Sr
361. 0.19 Sr
363. 0.025 V
364. 0.004 V
365. 0.011 Mo
367. 0.10 Sr
368. 0.002 Bi, 0.12 Sr
369. 0.033 V
371. 0.025 V
373. 0.057 V
376. 0.020 Bi, 0.027 Mo
377. 0.002 Mo
378. 0.057 V
379. 0.043 Mo, 0.017 Y
381. 0.002 Bi, 0.043 Mo, 0.014 Y
382. <0.002 Bi, 0.055 Mo, 0.007 REO
387. 0.003 Sn
393. 0.017 Mo
397. 0.008 Bi, <0.005 W
398. 0.11 Bi, <0.005 W
401. 0.025 Bi
402. 0.10 Bi
404. 0.018 Nb, 0.002 Sn
405. 0.007 Mo
406. 7.77 Mn, 0.016 Co
408. 0.004 Mo
411. <0.005 W
413. 0.002 Sn
420. 0.001 Cr
421. 0.006 Bi, 0.093 Cr, 0.021 Ni, 0.047 V, 0.48 Ti, <0.001 Pt
422. 0.001 Cr
423. 0.009 REO
424. 0.003 Bi, 0.010 Mo
425. <0.005 W
426. 0.019 Bi
427. 0.005 W
428. 0.004 Bi, 0.05 Mo, <0.005 W
429. <0.003 Bi, 0.019 Mo
431. 0.54 Mn, 0.15 V, 0.007 W
432. 0.016 Bi, 0.15 V, <0.005 W
433. 0.006 Bi, 0.014 Mo, <0.005 W
434. 0.004 Bi, 0.005 W
437. 0.010 Mo
439. 0.029 W
440. 0.018 W
444. 0.025 V
448. 0.017 V
453. 0.026 Mo
460. 0.27 Sr
463. 0.08 REO
464. 0.032 REO
465. 0.012 Sr, 0.016 Y, 0.018 Ni
467. 0.014 REO
472. 2.60 Ba, 4.70 Mn, 0.029 W
473. 0.28 Mn, <0.005 W
479. <0.005 W
480. 0.74 Ba, 0.002 Sn, 0.039 Sr
482. 0.012 Mo
491. 0.51 Ti, 0.004 Co, <0.002 Cr, 0.026 Ni, 0.003 Sn, 0.024 V, 0.084 Sr, <0.001 Pt
492. 0.55 Ti, 0.092 Sr
493. 0.42 Ti, 0.09 Sr
495. 0.048 Cr, 0.076 Sr
496. <0.002 Cr, 0.047 V
497. 0.29 Sr
500. 0.004 Cr, 0.010 Ni
501. 0.015 Cr
508. 44.91 CaO
510. 0.072 B, <0.002 Bi, 0.019 Cr
513. 0.002 Bi, 0.027 Cr
514. 0.003 Bi, 0.005 Co, 0.034 Cr, 0.019 Ni, <0.001 Pt
515. 0.002 Bi, 0.014 Cr, 0.014 Ni
516. <0.005 Bi, 0.017 Cr
517. 0.002 Bi
519. 0.54 Ti, 0.005 Bi, 0.032 Cr
520. 0.59 Ti, 0.006 Cr
521. 0.16 Sr
528. 0.021 Cr, 0.095 V
529. 0.009 Co, 0.018 Ni
530. 63.40 SiO_2, 0.12 Sr
535. <0.002 Bi
536. 0.002 Bi
538. 41.60 CaO
539. 0.041 Cr
540. 0.013 Cr
542. 0.16 Sr
544. 8.52 CaO, 0.038 Ni
545. 0.009 Cr, 0.014 Ni, 0.072 Sr, 0.054 REO, <0.001 Pt
546. 20.00 CaO
550. 0.40 Ti, 0.002 Co, 0.018 Ni, <0.001 Pt
553A. 0.005 Sn
553B. 0.65 Ti, 0.046 Sn, 0.003 Nb, 0.018 REO
555A. 0.002 Sn
555B. 0.002 Sn, 0.004 Nb
556A. 0.003 Sn
556B. 0.002 Sn
557. 0.049 Sn
558. 0.004 Sn, 0.064 REO
572. <0.005 W

INDEX

[Italic page numbers indicate major references]

A

Page

Adams Gulch 100
Aeromagnetic map 51
Age, istope 25
 K-Ar sanidine 30
Alexander prospect 102, 140
Alluvial deposits 100
Alluvium 64
Alteration, hydrothermal 3, 86, 162, 171
 minerals 31
 rock 37
 supergene 33
Altered rock *31*, 70, 83, 105, 137
 molybdenum 81
 volcanic 119, 130, 162
Alum 4, 12, 97, 149, 163
Alum Canyon 164
Alum Mountain 32, 162
 aluminum salts in 103
 lead in 83
 mercury in 73
 tin in 70
Alum Mountain-Copperas Creek area 2, 31, 162
 copper in 81
 tellurium in 79
Alum Mountain volcanic complex 20, 23, 55, 102
Aluminum 101, *162*, 171
Aluminum salts, Alum Mountain 103
Aluminum sulfate. *See* Alum.
Alunite 31
Alunogen 164
Alunogen mining district 103, *162*
Alunogen tunnels 164
Analyses 64, *178*, *202*
 atomic absorption spectrometry *64*, 104
 chemical 104
 geochemical samples *178*
 Gutzeit colorimetric method *64*
 semiquantitative spectrographic *64*, 104, 170
Andesite 27, 57, 105, 116, 160
 basaltic 161
 Mineral Creek 18
 post caldera 23
Anomaly, artificial 46
 geochemical 4, 56, 58
 geophysical 45, 58
 gravity 4, 12, 44, 56
 magnetic 4, 44, *53*, 56
Anomaly A 51, 55
Anomaly B 51, 55
Anomaly C 51, 55
Anomaly D 51, 55
Anomaly E 51, 56
Anomaly F 51, 56

Page

Anomaly G 51, 57
Anomaly H 57
Anomaly 1 .... 49, 57
Anomaly 2 49
Anomaly 3 50
Anomaly 4 50
Anomaly 5 51
Anomaly 6 51
Anomaly 7 51
Antimony 3, *74*
 Gila Fluorspar district 74
 Watson Mountain mine 74
Apache Creek 99
Apache Spring, tuff of 19, *25*, 39
Appraisal, geologic *14*
Arsenic 3, *74*, 116
 measuring 64
Arthur K claim 106
Assaying 104

B

Barite 100, 157
Barium 157
Basalt flows, alkali olivine 18
Basaltic rocks 65
Batholith 35
Beryllium 3, 65, *66*
Bessie No. 1 prospect 116
Big Bear Creek 98
Big Butte claim 139
Big Dry Creek 2, 17, 40, 100, *124*, 131
 beryllium in 67
 copper in 80
 lead in 83
 molybdenum in 81
 tungsten in 71
 zinc in 85
Bismuth 3, 66, *73*
 Alum Mountain-Copperas Creek area 73
Bixbyite 66
Black Bird mill 116
Black Eagle claim 157
Black Mountain 29, 50, 54
Bloodgood Canyon 25
Bloodgood Canyon Rhyolite Tuff of Elston .. *19*, 22, 24, *25*, 39, 57, 98
Blue Benny mine 160
Blue Bessey mine 160
Blue Rock mine 148
Bouguer anomaly 46
Bouguer gravity field 47
Breccia 31, 33, 37

Breccia—Continued Page
andesitic ... 2
landslide ... 26
Brock Canyon ... 2, 31, 49, 159
Brock Canyon mining district. *See* Gila flourspar mining district.
Brock Canyon volcanic complex ... 20, *37*, 56
molybdenum in ... 81
Brushy Canyon ... 2
Bursum caldera ... 2, 21, 24, 25, 29, *39*, 50, 54, 117, 131, 138

C

Cadmium ... 85, 129
Calcite ... 31, 100, 102, 107, 117, 137, 162
Caldera, ash-flow tuff ... 23
Caldera complex ... 2
Caldera-forming rocks ... 21
Cambrian ... 15
Camp Creek fault ... 131, 136
Captain Ab claim ... 135
Cassiterite ... 67
Catwalk, The ... 8
Cave Rock claims ... 151
Cedar Hill prospect ... 159
Central mining district ... 9
Chalcocite ... 139
Chalcopyrite ... 130
Chance claim ... 155
Chino mine ... 44
Chloritic altered rock ... 137
Chromium ... 65
Cindy Lou prospect ... 166
Claims, mining ... 4, 12, 32, *102*
Clastic rocks ... 15
Clay ... 4, 31, 97, 162
Cliff ... 9
Clum mine ... 158
fluorite in ... 103
Cobalt ... 65
C.O.D. prospect ... 136
Colorado Plateau ... 14, 16, 87
Columbus claims ... 155
Confidence mill ... 116
Conglomerate, crossbedded flurial ... 26
Cooney mining district ... 105
Cooney Quartz Latite Tuff ... 20, 106, 116, 157
Copper ... 2, 51, 65, *80*, 96, 102, 116, 129, 164
Alum Mountain-Copperas Creek area ... 81
Big Dry Creek ... 80
Hanover-Fierro stocks ... 97
Haystack Mountain ... 80
Morenci stocks ... 97
Santa Rita stocks ... 97
Tyrone stocks ... 97
Copper Canyon ... 102
Copper-Gold group ... 124
Copperas Creek. *See* Alum-Mountain-Copperas Creek area.
Copperas Creek inlier ... 32, 36
mercury in ... 71
Cordilleran front belt ... 95
Cretaceous, late, fault ... 41
Upper, rocks ... 16

Page

D

Dacitic intrusive rocks ... 119
Datil Group ... 22
Datil volcanic field ... 1, 2, 14, 35, 95
Dating, isotopic ... 27, 29
K-Ar fission track ... 27
Davis Canyon, tuff of ... 20, 23
Deadman prospect ... 154
Deer Park Canyon ... 117
Deer Trail tunnel ... 130
Deposits, alluvial ... 39
chaotic colluvial ... 39
Depth estimates ... 53
Diablo Range ... 9, 24, 57
Dickite ... 123
Dike, quartz monzonitic ... 32
rhyolite ... 25, 32, 38, 55
Dispersion patterns ... 58
Dog Canyon ... 145
Dorsey mine ... 161
Drainage ... 9
See also Gila River drainage.
Dripping Gold group ... 106

E

East Fork, Gila River. *See* Gila River.
"86" prospect ... 136
Elevation, mountain ... 9
Elston ... 24
Endellite ... 33
Energy, geothermal ... 2, 87, *98*
Evergreen claims ... 122

F

Fairview prospect ... 102, 140, 156
Fall Canyon, tuff of ... 20, 23
Faults ... *41*, 54
Bursum caldera ... 40
Feldspars ... 31
Ferguson ... 10
Field investigations ... 12
Fierro mining district ... 9
Fluorite ... 100, 103, 117, 129, 134, 170
Clum mine ... 103
Gold Spar mine ... 103
Little Whitewater Creek ... 103
Fluorspar ... 2, 11, 97, 102, 117, 134, 152
Foster mine ... 103, 158
Holt Gulch ... 169
Huckleberry mine ... 102, 117
Little Whitewater Creek ... 103
Sapillo district ... 103
Fossil fuels ... 98, 103
Fossiliferous carbonate rocks ... 15
Foster mine, fluorite in ... 103
fluorspar in ... 103, 158
Foster Mountain ... 154
Fracture system ... 3, 94
Fracture zone ... 16, 117
ring ... 27, 29, 40, 57, 97, 117
Fractures, ring ... 2, 39

G

Galena ... 130

Page

Gallium 164
Gila 8
Gila Cliff Dwellings caldera 21, 24, *39*, 54
Gila Cliff Dwellings National Monument 2, 6, 162
Gila Conglomerate 2, 30, 41, 49, 57, 98, 161
Gila Flat 23
Gila fluorspar district 4, 8, 10, 23, 34, 37, 55, *157*
  antimony in 74
  molybdenum in 81
  tellurium in 79
  tungsten in 71
Gila Hot Springs 2
Gila Hot Springs graben 41, 57, 98
  mercury in 71
Gila River 1, 8, 30, 40, 98, 157, 166
Gila River Canyon 29, 37, 41, 102
Gila River drainage 10
Gilt Edge adit 136
Gimey mine. *See* Uncle John mine.
Glenwood 9
Goat Corral Canyon 123
Goddard Canyon 121
Gold 2, 51, *75*, 96, 116, *129*, 164
  assayed *105*
  Holt Gulch 78
  Little Dry Creek 103
  Lone Pine district 78
  measuring 64
  Mogollon district 102
  Wilcox Mining district 103
Gold Bar claim 134, 145
Gold Hill, gold in 78
  mercury in 73
Gold Link fault 131
Gold Spar mine 4, 156
  fluorite in 103
Gold Telluride prospect 149
Golden Link claim 134
Good Hope adit 147
Gossan 131
Graben, Bursum caldera 40
  Gila Hot Springs 41, 57, 98
  Sapillo Creek 30, 41
  Sycamore Canyon 41
Granitic Plutonic rocks 67
Gravel 171
Gravity data 46
Gravity maps 45, *49*

H

Halloysite 33
Hanover-Fierro stocks, copper in 97
Hardscrabble workings 125
Harvest prospect 147
Haystack Mountain 3, 102, *138*, 170
  copper in 80
  lead in 83
Hidden Pasture Canyon 160
Hightower, Jr. prospect 154
History, early tectonic 16
  mining *102*
Holt Gulch 31, 34, 102, *119*
  fluorspar in 169
  gold in 78
  intrusive rocks 19, 38, 56

Page

Holt Mountains 29
Holt tunnel 122
Homestake mining claim 131
Hooker Dam 158
Huckleberry mine, fluorspar in 102, 117

I

Ida Bell prospect 116
Igneous rocks 1, 65, 91
  intrusive 16
  silicic 83
Independence workings 125
Indian Canyon 100
Indian Creek 30, 35, 99
  beryllium in 66
Indicator elements 58, *66*
Intrusions, batholithic 14
Intrusive dactic rocks 34
Intrusive rhyolite 57, 97
Intrusive rocks 37, 56, 97
  Holt Gulch 19
  igneous 16
Iron 120
Iron Bar prospect 106
Iron Clad claims 122
Iron group 106

J, K

Jay Bird dike 118
Jerky Mountains 9
Johnson cabin 124
Juniper Cottage adit 118
Juniper vein 121

Kirkpatrick prospect 134
Knobs, silicified 33
Kordic prospect 106

L

Lakeview claim 139
Laramide (age) 2, 44, 97, 101
  See also late Mesozoic; early Tertiary.
Laramide intrusive rocks 4, 50, 54
Laramide orogeny 16
Last Chance prospect 159
Late Cretaceous (age) 16
Latite 27
  porphyritic, flows 29
  of Willow creek 18
Lauderbaugh prospect 106
Lava, domal rhyolite 99
Lava flows, andesitic 2, 18, 31, 37
  andesitic, Bloodgood Canyon Tuff 23
    Gila Flat 23
    Murtocks Hole 20, 23
    Turkey Cienega Canyon 20
  basaltic 27
  latitic 18, 27, 37
    Gila Flat 23
  mafic 17, 29
  silicic 17
Lead 2, 66, *83*, 96, 102, 116, *129*, 170
  Big Dry Creek 83
  Haystack Mountain 83
  Tract 1 83

Page
Lead Bullion mine. *See* Uncle John mine.
Lenses, chert 17
Liberty Bell No. 1 claim, silver in 121
Little Dry Creek 2, 100, *141*, 170
beryllium in 67
gold in 103
molybdenum in 81
tungsten in 71
zinc in 85
Little Fanney vein, beryllium in 67
Little Whitewater Creek 4, 102, *117*
fluorite in 103
fluorspar in 103
Location, Gila study area *6*
Lode tin 70
Lone Pine district 10
gold in 78
mercury in 73
tellurium in 79
Lone Pine Hill 31, 34, 38
tellurium in 144, 148
Lone Pine mine 149
Lone Star claim 120, 140
Look Off claims 146
Lower Cretaceous rocks 16
Lower New Eureka mine 144
Lucky Bill mining claim 134

M

Magma 39, 91
Magma reservoir 23
Manganese 3, 66, *85*, 100, 106, 157, 160
Tract 1 85
Mangas trench 49
Map, aeromagnetic 51
Gila study area *8*
gravity 45, 49
Bouguer 47
Margie Ann mine 154
Master claim 156
Maverick mining claim 141
May Apple mining claim 141
Meadows, The 98
Meerschaum 3, 12, 97, 99, 102, *161*, 171
Sapillo district 102
Meerschaum Canyon 161
Mercury 3, *71*, 116
Alum Mountain inlier 73
Copperas Creek inlier 71
Gila Hot Springs graben 71
Gold Hill 73
Lone Pine district 73
measuring 64
Mercury detector 64
Mesozoic sedimentary rocks 14
Mesozoic strata 16
Middle Fork Gila River. *See* Gila River.
Milton Canyon, tungsten in 71
Mimbres 9
Mimbres River 30
Mineral Creek Andesite 29
Mineralized rock 70, 80, 99, 139

Page
Mines 105
Alexander prospect 102, 140
Arthur K claim 106
Bessie No. 1 prospect 116
Big Butte claim 139
Black Bird mill 116
Black Eagle claim 157
Blue Benny 160
Blue Bessey 160
Blue Rock 148
Captain Ab claim 135
Cave Rock claims 151
Cedar Hill prospect 159
Chance claim 155
Cindy Lou prospect 166
Clum 103, 158
C.O.D. 136
Columbus claims 155
Confidence mill 116
Copper-Gold 124
Deadman prospect 154
Dorsey 161
Dripping Gold group 106
"86" prospect 136
Evergreen claims 122
Fairview prospect 102, 140, 156
Foster 103, 158
Gilt Edge adit 147
Gimey. *See* Uncle John mine.
Gold Spar 4, 156
Gold Telluride prospect 149
Golden Link claim 134
Good Hope adit 147
Harvest prospect 147
Hightower, Jr. prospect 154
Homestake 131
Huckleberry 102, 117
Ida Bell prospect 116
Independence workings 125
Iron 106
Iron Bar prospect 106
Iron Clad claims 122
Jay Bird dike 118
Juniper Cottage adit 118
Kirkpatrick prospect 134
Kordic prospect 106
Lakeview claim 139
Last Chance prospect 159
Lauderbaugh prospect 106
Lead Bullion. *See* Uncle John mine.
Liberty Bell No. 1 claim 121
Lone Pine 149
Lone Star claim 120, 140
Look Off 146
Lower New Eureka 144
Lucky Bill claim 134
Margie Ann 154
Master claim 156
Maverick claim 141
May Apple claim 141
Minton prospect 154
Moose group of claims 120
Mountain View claim 131
New Eureka adit 144

Mines—Continued | Page
Nina claims 160
Oak Grove claim 106
Pilgrim Camp adit 130
Quartz claims 131
Queen's Crown claims 145
Rainbow prospect 156
Regal prospect 144
Reward prospect 147
Rice prospect 146
Royal Gorge claim 133
Seventyfour Mountain prospect 156
Silver Boe 119
Silver Dollar prospect 153
Silver Drip Cabin claim 138
Uncle John 4, 102, 124, 130
Stirrip prospect 148
Thunderhead workings 121
True Blue property 124
Upper New Eureka prospect 144
Watson Mountain 74
White Flag 119
Yellow Peril prospect 149
Mining districts, Alunogen 103, 162
Brock Canyon. *See* Gila fluorspar mining district.
Central 9
Cooney 105
Fierro 9
Lone Pine 10, 73, 78, 79
Mogollon 29, 51, 57
See also Southern Mogollon mining district.
Morenci 16
Santa Rita 9, 16
Southern Mogollon 105
Taylor Creek 167
Tyrone 9
Wilcox 103, 116
Minton Canyon 153
Minton prospect 154
Miocene (age) 1, 25, 99
Mogollon 9
Mogollon Creek 156
"Mogollon Mines, The" 103
Mogollon mining district 2, 29, 51, 57, 67, 94, 102
beryllium in 67
gold in 102
silver in 102
See also Southern Mogollon mining district.
Mogollon Mountains 1, 5, 29, 40, 49, 97
Molybdenum 3, 66, *81*, 96, 116, 137
Moose group of claims 120
Morenci 3
Morenci belt 95
Morenci stocks, copper in 97
Mountain View mining claim 131
Murtocks Hole, andesitic lava flows 20

N, O

Nabours Mountain 29
New Eureka adit 144
New Mexico belt 95
Nickel 65
Nina claims 160
Oak Grove claim 106
Obsidian 171
Oligocene (age) 1, 22, 25, 34, 44
Oligocene, faults 41
Opal 33
Orogenic belts 91

P

Paleozoic age 15, 50, 97
Paleozoic rock, carbonate 4, 17, 44, 49
sedimentary 2, 14
Paleozoic strata 2, 98
Pelloncillo belt 95
Pennsylvania Syrena Formation 17
Perlite 166, 171
Permian 15
Photography, aerial 8
Pilgrim Camp adit 130
Pine Creek *141*, 170
tellurium in 103
Pinos Altos Range 2, 9
Plugs, rhyolitic 37
Pluton 35, 45
Post-caldera andesite 23
Post-caldera rhyolite 23
Post-caldera rocks *27*
Pre-caldera rocks 20, *22*
Precambrian (age) 2, 17, 50
Precambrian rocks 14
Pre-Miocene (age) 4, 44
Pre-Pennsylvanian rocks 15, 98
Pre-Tertiary (age) 4
Pre-Tertiary rocks *17*, 49
Province, metallogenic 95
metallographic 95
multimetal 96
Pseudobrookite 66
Pumicite 171
Pyrite 123, 130, 137
Pyroclastic rocks 24
Pyrolusite 157

Q

Quaternary volcanic rocks 14
Quartz 31, 37, 106, 118, *129*, 166
Quartz-fluorite veins 34, 37
Quartz mining claim 131
Quartzrose 131
Queen fault 106
Queen's Crown claims 145

R

Radioactivity 104
Rain Creek 4, 156
Rain Creek Mesa 155
Rainbow prospect 156
Rainstorm Gulch 144
Red Colt Canyon 123
Red Hair Canyon 147
Red Shaft 120
Regal prospect 144
Reserve 9

Page

Reward prospect 147
Rhyolite 27, 34, 38, 65, 105, 119
Diablo Range 19, *24*
extrusive 57
flow-banded 2, 66
lithophysal 18, 29, 66
Mogollon volcanic area 66
post-caldera 23
Sacaton Mountain 19
Rhyolite dike 118, 124, 159
Rhyolite domes 18, 29
Rhyolite flows 18, 29
Rhyolitic instrusions 117, 141
Rice prospect 146
Ring-fracture zone 27, 29, 40, 57, 97, 117
Rocky Canyon, ash-flow tuff of 21
Royal Gorge fault 131
Royal Gorge mining claim 133

S

Sacaton Creek *138*, *152*
Sacaton Landing Strip 155
Sacaton Mountain 29
beryllium in 67
Salt Creek 99
Sampling, geochemical 3, *58*
Sampling results *104*
Sand 171
Santa Rita 3, 44
Santa Rita belt 95
Santa Rita mining district 9
Santa Rita-Hanover axis of Elston 4, *44*, 49
Santa Rita stocks, copper in 97
Sapillo Creek 8, 55, 102
Sapillo Creek graben 30, 41
Sapillo mining district 102, 161
fluorspar in 103
meerschaum in 102
Scoria 171
Sedimentary rock 27, 30
Mesozoic 14
Paleozoic 14
Seminole group 125
Sepiolite 12
Sericite 31
Seventyfour Mountain 2, 17, 29, 102, 141, *152*
Seventyfour Mountain prospect 156
Shelley Peak, tuff of 20, 23
Shelton Canyon 117
Sheridan corral 8
Sheridan gulch 102
Sheridan Mountain 29, 124, 141
Silica 31
Siliceous pyritic fault zone 74
Silicic bodies, intrusive 32
Silicic rocks 78
igneous 67, 83
Sills 32
Silver 2, 51, 66, *78*, 96, 116, 121, *129*, 164
assayed *105*
Mogollon district 102
Silver Boe mines 119
Silver City 2, 6, 9
Silver City Range 4, 50

Page

Silver Dollar prospect 153
Silver Drip Cabin claim 138
Silver Drip Trail 137
Silver Drip tunnel 131, 138
Southern Mogollon mining district 105
Spar Canyon 160
Sphalerite 130
Spider Creek 3, 102, 124, *131*
Springs, thermal 33, 57, 98
minerals in 71
Spruce Creek 3, 40, 102, *131*
beryllium in 67
tungsten in 71
Stirrip prospect 148
Stream-sediment samples 70
Structures *35*
Studies, previous 10
Sulfate 164
hydrated aluminum 33
Sulfur 123, 164
Summary 1
statistical 194
Survey, aeromagnetic 3
gravity 3
Sycamore Canyon graben 41
Syrena Formation 17

T

Taylor Creek 10, 30
tin in 67
Taylor Creek mining district, tin in 167
Tectonism, basin-and-range 27
Tellurium 2, 10, 12, *78*, 116, 170
Alum Mountain-Copperas Creek area 79
assayed 105
Gila fluorspar district 79
Lone Pine district 79, 148
measuring 64
Pine Creek 103
Tertiary, early, faults 16, 41
late (age) 1, 35, 41, 101
middle (age) 16, 35, 101
volcanic rocks 2, 14, 17, 22, 46, 87, 97, 101
Texas Lineament 3, 16, 94
Thunderhead workings 121
Tin 10, 30, 65, *67*, 167, 171
Taylor Creek 67
Topography *9*
Tract 1, Gila Primitive area 2, 4, 85, 99
lead in 83
manganese in 85
Tract 2, Gila Primitive area 2, 5, 99
Tract 3, Gila Primitive area 2, 5, 99
Tract 4, Gila Primitive area 99
Tract 5, Gila Primitive area 99
Tract 6, Gila Primitive area 99
Tract 7, Gila Primitive area 2, 4, 5, 99
Tract 8, Gila Primitive area 5, 100
Tract 9, Gila Primitive area 2, 100
True Blue property 124
Tuff, of Apache Spring 19, *25*, 39
ash-flow 2, 17, 23, 44
Bursum caldera 40
Gila Cliff Dwellings 40

Tuff of Apache Spring—Continued Page
Rocky Canyon 21
Bloodgood Canyon, Rhyolite of Elston ... 19, *25*, 39
Cooney quartz latite 20, 23, 106, 116, 157
of Davis Canyon 20, 23
of Fall Canyon 20, 23
rhyolite 24, 40, 167
of Shelley Peak 20, 23
welded 24
Tungsten 66, *71*
Turkey Cienega Canyon 17
andesitic lava flows in 21
Turkey Creek 98, 100
Turkeyfeather Pass 166
Tyrone 3
Tyrone mining district 9
Tyrone stocks, copper in 97

U, V

Uncle John mine 4, 102, 124, 130
Upper Cretaceous rocks 16
Upper New Eureka prospect 144
Upper Sacaton Creek. *See* Sacaton Creek.
Vent, volcanic 35, 75
Volcanic complex, Alum Mountain 20
Brock Canyon 20
Volcanic eruptions 2
Volcanic field, Datil 14
Volcanic rock 97, 171
altered 119, 130, 162
Quarternary 14
Tertiary 14, 17

Page
Volcanic sublimates 75
Volcaniclastic rocks 24, 25, 28, 37
Volcanism 27
basaltic 2
Volcano-tectonic subsidence 39, 98
Volcanoes, shield 2

W

Wall Lake 171
Watson Canyon 100
Watson Mountain mine 160
antimony in 74
West Fork, Gila River. *See* Gila River.
White Flag mine 119
Whiteside Canyon 147
Whitewater Canyon 8
Whitewater Creek 3, 102, 169
molybdenum in 81
Whitewater picnicground 107
Wilcox mining district *116*
gold in 103
Wilcox Peak 29, 31, 34, *37*, 122
Willow Creek 8, 29

Y, Z

Yellow Peril prospect 149
Zeolite 102
Zinc 2, 66, *83*, 96, 102, 129
Big Dry Creek 85
Little Dry Creek 85
Zircon 22
Zirconium 168

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