UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of heavy-mineral-concentrate samples from the Lower Gila Box Wilderness Study Area (NM-030-023), Grant and Hidalgo Counties, New Mexico

By

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Open-File Report 87-294

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature. Any use of trade names is for descriptive purposes only and does not imply endorsement by the USGS.

1987

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STUDIES RELATED TO WILDERNESS

Bureau of Land Management Wilderness Study Areas

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and the U.S. Bureau of Mines to conduct mineral surveys on certain areas to determine their mineral values, if any. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a geochemical survey of the Lower Gila Box Wilderness Study Area (NM-030--23), Grant and Hidalgo Counties, New Mexico.

INTRODUCTION

In April 1985, the U.S. Geological Survey conducted a reconnaissance geochemical survey of the Lower Gila Box Wilderness Study Area (NM-030-023), Grant and Hidalgo Counties, New Mexico.

The Lower Gila Box comprises about 9.1 mi^2 (5,835 acres) in the northwestern part of Hidalgo County and southwestern part of Grant County, New Mexico, and lies about 22 mi northwest of Lordsburg (see fig. 1). Access to the study area is provided on the west by U.S. Route 70 and State Route 92, and on the east by U.S. Route 70 and a county gravel road.

The oldest rocks exposed in the Lower Gila Box WSA are early Tertiary andesites, consisting of andesite flows, flow-breccias, and localized andesite tuffs. Overlying the Tertiary andesites are the rhyolitic and latitic tuffs of the Datil Formation. These are interbedded with some tuffaceous sandstone and conglomerate. The cliffs of the Lower Gila Box are formed from Datil Formation tuffs and the older andesites. Younger basaltic andesites and volcanic conglomerates are exposed in the southeastern part of the WSA. Quaternary sediments include the Gila Formation, pediment and terrace gravels, and stream terrace gravels. The geology of the area has been mapped by Morrison (1965) and Elston (1960).

The topographic relief of the area is about 1000 ft with a maximum elevation of 4,782 ft on the summit of Canador Peak, about 300 yards outside the study area. The study area is comprised mainly of the curving canyon of the Gila River and the gentle surface of the Lordsburg Mesa to the south, which is cut in several localities by tributary canyons to the Gila River. The climate is arid.

METHODS OF STUDY

Sample Media

Heavy-mineral-concentrate samples provide information about the chemistry of certain minerals in rock material eroded from the drainage basin upstream from each sample site. The selective concentration of minerals, many of which may be ore related, permits determination of some elements that are not easily detected in stream-sediment samples.

Sample Collection

Samples were collected at 19 sites (fig. 2). Average sampling density was about 2.0 sites per mi^2. The area of the drainage basins sampled ranged from 0.2 mi^2 to 1 mi^2.

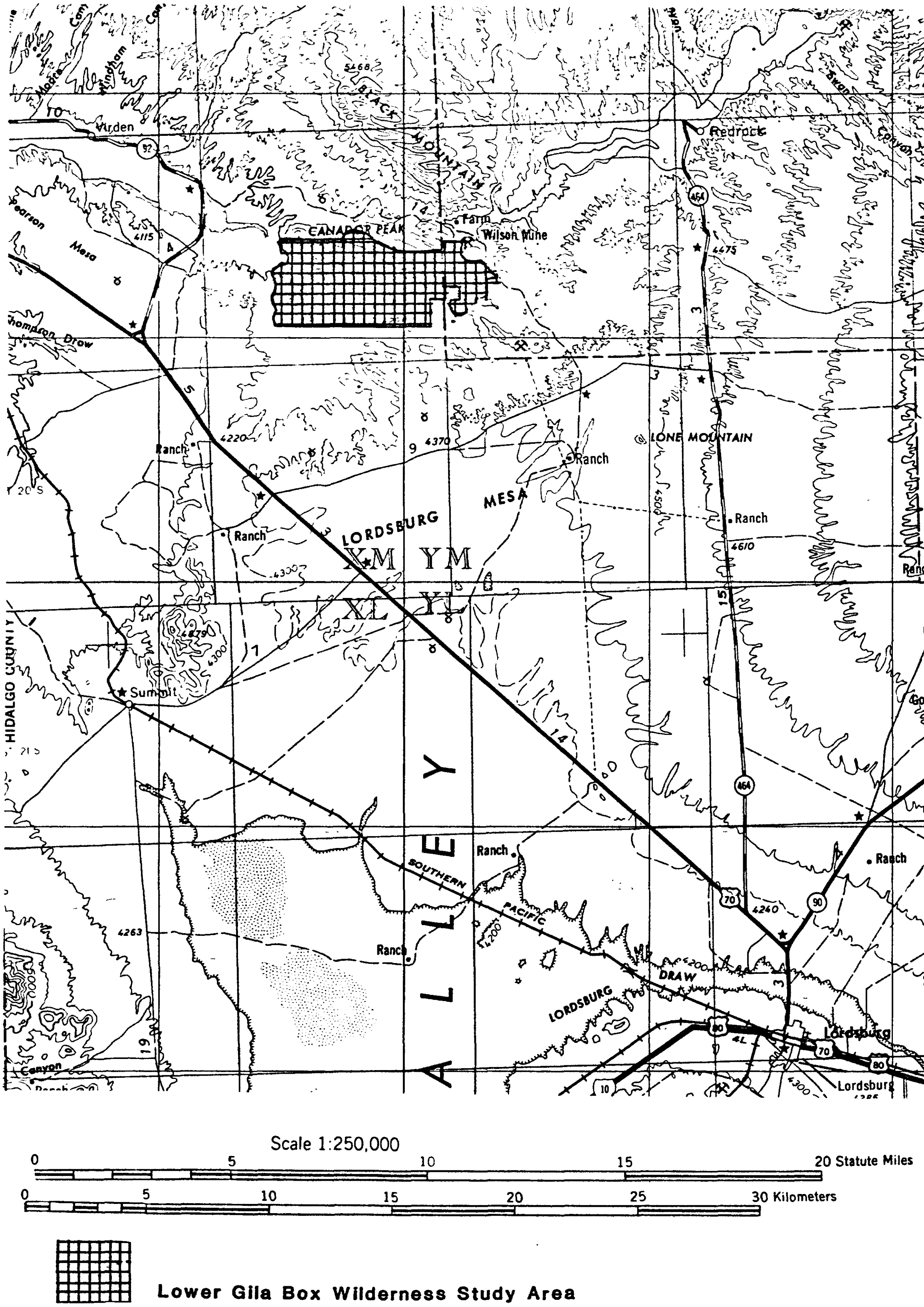

Figure 1. Location map of the Lower Gila Box Wilderness Study Area (NM-030-023), Grant and Hidalgo Counties, New Mexico

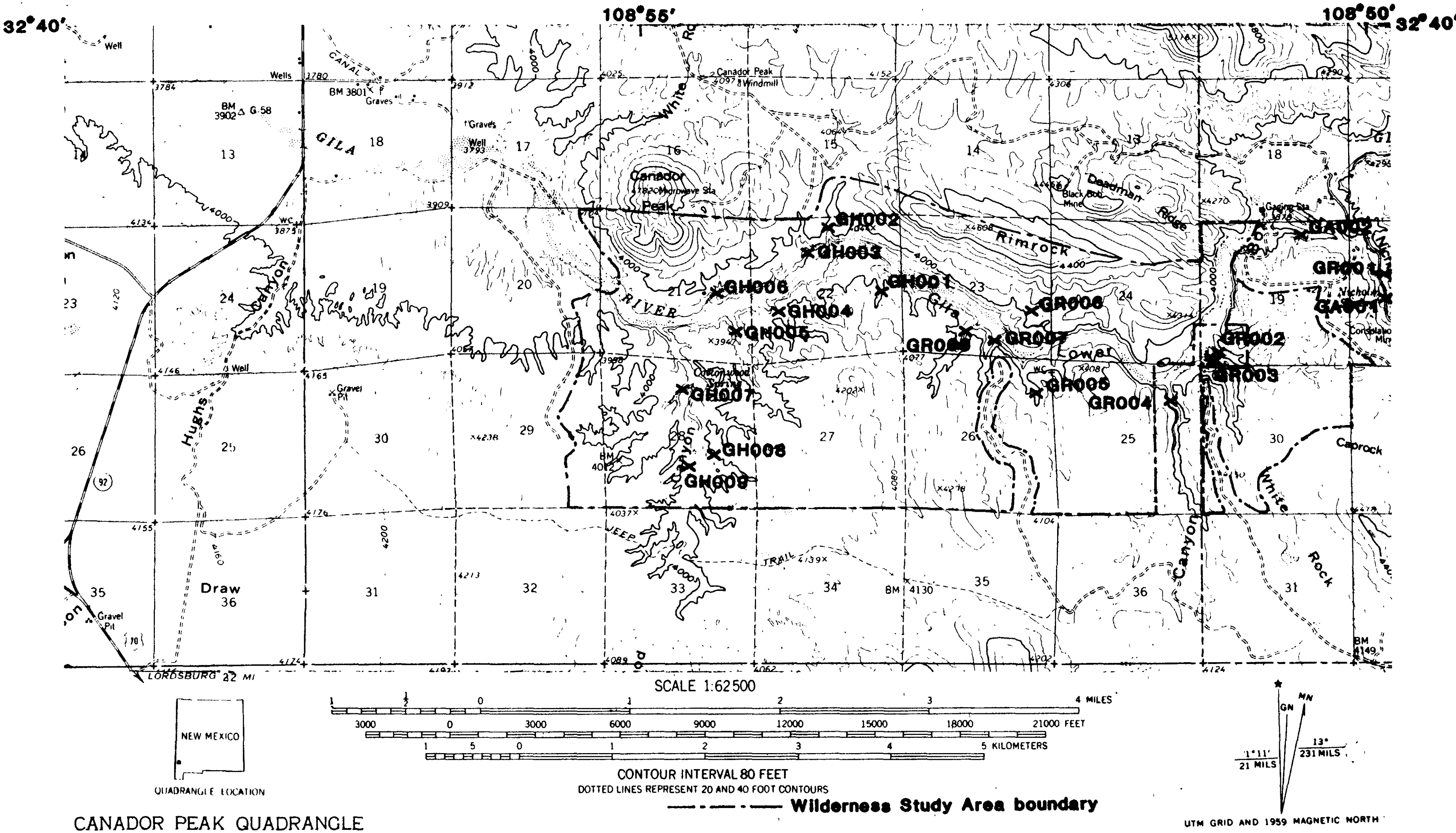

Figure 2. Localities of heavy-mineral-concentrate samples, Lower Gila Box Wilderness Study Area (NM-030-023), Grant and Hidalgo Counties, New Mexico.

Heavy-mineral-concentrate samples

Heavy-mineral-concentrate samples were collected from the active alluvium collected primarily from first-order (unbranched) and second-order (below the junction of first-order) streams as shown on U.S. Geological Survey topographic maps (scale = 1:62,500). Each bulk sample was screened with a 2.0-mm (10-mesh) screen to remove the coarse material. The less than 2.0-mm fraction was panned until most of the quartz, feldspar, organic material, and clay-sized material were removed.

Sample Preparation

After air drying, bromoform (specific gravity 2.8) was used to remove the remaining quartz and feldspar from the heavy-mineral-concentrate samples that had been panned in the field. The resultant heavy-mineral sample was separated into three fractions using a large electromagnet (in this case a modified Frantz Isodynamic Separator). The most magnetic material, primarily magnetite, was not analyzed. The second fraction, largely ferromagnesian silicates and iron oxides, was saved for archival storage. The third fraction (the least magnetic material which may include the nonmagnetic ore minerals, zircon, sphene, etc.) was split using a Jones splitter. One split was hand ground for spectrographic analysis; the other split was saved for mineralogical analysis. These magnetic separates are the same separates that would be produced by using a Frantz Isodynamic Separator set at a slope of 15° and a tilt of 10° with a current of 0.1 ampere to remove the magnetite and ilmenite, and a current of 1.0 ampere to split the remainder of the sample into paramagnetic and nonmagnetic fractions.

Sample Analysis

Spectrographic method

The heavy-mineral-concentrate samples were analyzed for 31 elements using a semiquantitative, direct-current arc emission spectrographic method (Grimes and Marranzino, 1968; Motooka and Grimes, 1976). The elements analyzed and their limits of determination are listed in table 1. Spectrographic results were obtained by visual comparison of spectra derived from the sample against spectra obtained from standards made from pure oxides and carbonates. Standard concentrations are geometrically spaced over any given order of magnitude of concentration as follows: 100, 50, 20, 10, and so forth. Samples whose concentrations are estimated to fall between those values are assigned values of 70, 30, 15, and so forth. The precision of the analytical method is approximately plus or minus one reporting interval at the 83 percent confidence level and plus or minus two reporting intervals at the 96 percent confidence level (Motooka and Grimes, 1976). Values determined for the major elements (iron, magnesium, calcium, and titanium) are given in weight percent; all others are given in parts per million (micrograms/gram). Analytical data for heavy-mineral-concentrate samples from the Lower Gila Box Wilderness Study Area are listed in table 2.

ROCK ANALYSIS STORAGE SYSTEM

Upon completion of all analytical work, the analytical results were entered into a computer-based file called Rock Analysis Storage System (RASS). This data base contains both descriptive geological information and analytical data. Any or all of this information may be retrieved and converted to a binary form (STATPAC) for computerized statistical analysis or publication (VanTrump and Miesch, 1977).

DESCRIPTION OF DATA TABLES

Table 2 lists the results of analyses for the heavy-mineral-concentrate samples. The data are arranged so that column 1 contains the USGS-assigned sample numbers. These numbers correspond to the numbers shown on the site location maps (fig. 1). Columns in which the element headings show the letter "s" below the element symbol are emission spectrographic analyses. A letter "N" in the tables indicates that a given element was looked for but not detected at the lower limit of determination shown for that element in table 1. If an element was observed but was below the lowest reporting value, a "less than" symbol (<) was entered in the tables in front of the lower limit of determination. If an element was observed but was above the highest reporting value, a "greater than" symbol (>) was entered in the tables in front of the upper limit of determination. Because of the formatting used in the computer program that produced table 2, some of the elements listed in these tables (Fe, Mg, Ca, Ti, Ag, and Be) carry one or more nonsignificant digits to the right of the significant digits. The analysts did not determine these elements to the accuracy suggested by the extra zeros.

The spectrographic determinations for Ag, As, Au, Cd, Co, Mo, Ni, Sb, W, and Zn in the heavy-mineral concentrate were all below the lower limits of determinations shown in table 1; consequently, the columns for these elements have been deleted from table 2.

REFERENCES CITED

Elston, Wolfgang E., 1960, Reconnaissance Geologic Map of Virden thirty minute quadrangle: New Mexico State Bureau of Mines and Mineral Resources, Geologic Map 15.

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Motooka, J. M., and Grimes, D. J., 1976, Analytical precision of one-sixth order semiquantitative spectrographic analyses: U.S. Geological Survey Circular 738, 25 p.

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TABLE 1.--Limits of determination for the spectrographic analysis of heavy-mineral concentrates based on a 5-mg sample

Elements	Lower determination limit	Upper determination limit
	Percent	
Iron (Fe)	0.1	50
Magnesium (Mg)	.05	20
Calcium (Ca)	.1	50
Titanium (Ti)	.005	2
	Parts per million	
Manganese (Mn)	20	10,000
Silver (Ag)	1	10,000
Arsenic (As)	500	20,000
Gold (Au)	20	1,000
Boron (B)	20	5,000
Barium (Ba)	50	10,000
Beryllium (Be)	2	2,000
Bismuth (Bi)	20	2,000
Cadmium (Cd)	50	1,000
Cobalt (Co)	10	5,000
Chromium (Cr)	20	10,000
Copper (Cu)	10	50,000
Lanthanum (La)	50	2,000
Molybdenum (Mo)	10	5,000
Niobium (Nb)	50	5,000
Nickel (Ni)	10	10,000
Lead (Pb)	20	50,000
Antimony (Sb)	200	20,000
Tin (Sn)	20	2,000
Strontium (Sr)	200	10,000
Vanadium (V)	20	20,000
Tungsten (W)	100	20,000
Yttrium (Y)	20	5,000
Zinc (Zn)	500	20,000
Zirconium (Zr)	20	2,000
Thorium (Th)	200	5,000

TABLE 2.--SPECTROGRAPHIC ANALYSIS OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE LOWER GILA BOX WILDERNESS STUDY AREA, GRANT COUNTY, NEW MEXICO

[N, not detected; <, detected but below the limit of determination shown; >, determined to be greater than the value shown.]

Sample	Latitude	Longitude	Fe-pct. s	Mg-pct. s	Ca-pct. s	Ti-pct. s	Mn-ppm s	B-ppm s	Ba-ppm s	Be-ppm s	Bi-ppm s
GA001H	32 38 21	108 49 53	.7	.5	10	2.0	500	<20	>10,000	2	N
GA002H	32 38 44	108 50 27	1.0	.5	10	>2.0	500	<20	300	2	N
GH001H	32 38 25	108 53 20	1.0	.5	5	2.0	500	<20	500	2	N
GH002H	32 38 48	108 53 40	1.5	1.0	5	2.0	700	<20	5,000	N	N
GH003H	32 38 38	108 53 50	1.0	.2	5	>2.0	500	<20	700	<2	N
GH004H	32 38 16	108 54 1	.5	.1	2	.5	150	<20	700	2	N
GH005H	32 38 10	108 54 20	2.0	.7	10	2.0	700	<20	500	2	N
GH006H	32 38 24	108 54 28	1.0	1.0	20	2.0	700	<20	1,000	N	30
GH007H	32 37 50	108 54 42	.5	.2	5	1.5	200	<20	500	2	N
GH008H	32 37 25	108 54 30	.5	.2	2	.2	100	<20	700	2	N
GH009H	32 37 23	108 54 39	1.0	.2	5	2.0	700	<20	200	5	N
GR001H	32 38 30	108 49 53	.7	.2	10	2.0	500	<20	>10,000	2	N
GR002H	32 38 2	108 51 2	.7	.2	2	1.0	200	<20	500	2	N
GR003H	32 38 0	108 51 6	1.5	.5	10	>2.0	1,000	<20	100	2	N
GR004H	32 37 44	108 51 22	2.0	.5	10	>2.0	500	<20	100	2	N
GR005H	32 37 48	108 52 17	1.5	1.0	5	2.0	500	<20	700	2	N
GR006H	32 38 18	108 52 18	1.0	.2	5	>2.0	500	<20	1,000	<2	N
GR007H	32 38 7	108 52 35	.5	.2	5	1.5	200	<20	500	<2	N
GR008H	32 38 9	108 52 46	2.0	1.0	10	>2.0	500	<20	200	2	N

TABLE 2.--SPECTROGRAPHIC ANALYSIS OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE LOWER GILA BOX WILDERNESS STUDY AREA, GRANT COUNTY, NEW MEXICO--Continued

Sample	Cr-ppm s	Cu-ppm s	La-ppm s	Nb-ppm s	Pb-ppm s	Sc-ppm s	Sn-ppm s	Sr-ppm s	V-ppm s	Y-ppm s	Zr-ppm s	Th-ppm s
GA001H	70	50	500	70	50	50	70	2,000	50	1,000	>2,000	N
GA002H	100	20	500	70	70	70	200	200	100	1,500	>2,000	200
GH001H	50	10	200	50	30	30	70	200	100	700	>2,000	N
GH002H	500	30	500	150	50	30	>2,000	N	100	1,500	>2,000	300
GH003H	20	30	500	100	70	10	70	200	100	1,000	>2,000	N
GH004H	N	<10	100	N	20	10	N	200	50	500	>2,000	200
GH005H	150	30	1,000	50	50	70	150	N	100	2,000	>2,000	200
GH006H	100	30	1,000	50	20	50	70	500	100	1,000	>2,000	N
GH007H	N	<10	150	50	20	10	N	200	50	200	>2,000	N
GH008H	N	<10	50	N	20	10	N	200	20	150	>2,000	N
GH009H	70	20	1,000	50	30	70	100	200	100	1,500	>2,000	500
GR001H	100	10	500	50	50	70	500	2,000	50	1,500	>2,000	200
GR002H	20	<10	150	50	20	20	200	200	50	500	>2,000	N
GR003H	100	10	700	50	30	50	200	200	100	1,500	>2,000	N
GR004H	100	10	500	100	30	20	70	<200	100	1,500	>2,000	200
GR005H	100	20	500	70	30	70	70	200	100	2,000	>2,000	N
GR006H	N	10	500	100	30	10	150	200	50	1,000	>2,000	N
GR007H	N	<10	200	50	30	10	20	200	50	300	>2,000	N
GR008H	200	30	700	50	30	70	200	200	100	1,500	>2,000	N