UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Geochemical evaluation of the mineral resources of the Browns Canyon area, Chaffee County, Colorado

By

A.M. Leibold[1], D.E. Detra [1], and J.M. Motooka[1]

Open-File Report 87-0508

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STUDIES RELATED TO WILDERNESS
Bureau of Land Management Wilderness Study Area

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 of certain areas to determine the mineral values, if any, that may be present. 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 Browns Canyon Wilderness Study Area (CO-050-002), Chaffee County, Colorado.

INTRODUCTION

This investigation was designed to complement the evaluation of the mineral resource potential of the Browns Canyon study area in Chaffee County, Colorado (Leibold and others, 1976), and to illustrate the effectiveness of exploration geochemical methods in mineral resource evaluation. The study area includes a Bureau of Land Management (BLM) Wilderness Study Area and two known mineralized areas adjacent to the wilderness study area, the Browns Canyon fluorspar district and the Railroad Gulch-Stafford Gulch precious- and base-metal area.

A regional geochemical survey using heavy-mineral concentrates and the minus-80-mesh fraction of stream sediments was conducted in the Browns Canyon area. More detailed surveys were conducted over the Browns Canyon fluorspar district and the Railroad Gulch-Stafford Gulch area to characterize the geochemical responses of these deposits. Identification of a district geochemical signature related to known areas of mineralization is beneficial in the recognition of similar undiscovered areas of mineralization within the surrounding region, and in future reconnaissance-scale exploration programs in similar geologic terranes. This report summarizes the procedures, results, and conclusions of the geochemical survey.

Location and physiography

The Browns Canyon study area, located about 6 miles south of Buena Vista and 7 miles northwest of Salida, covers approximately 32 square miles along the Arkansas River in Chaffee County, Colorado (fig. 1). The entire area is included in the Nathrop 7.5-minute topographic quadrangle. About 13 square miles (6,614 acres) are contained within the Browns Canyon Wilderness Study Area. The Browns Canyon fluorspar district includes approximately 3.5 square miles in the southwest corner of the study area, and the Railroad Gulch-Stafford Gulch area includes about 5 square miles in the southeast corner of the study area (pl. 1).

Rugged, mountainous terrain characterizes the study area, with elevations ranging from approximately 7,400 feet along the Arkansas River to 9,082 feet in the eastern portion. Many intermittent streams drain the study area and flow into the Arkansas River. The climate is arid, and the sparse vegetation includes sage brush, cacti, juniper, oak, and pinon. The area is accessible by foot from dirt roads, and by boat along the Arkansas River.

GEOLOGY

The geology and known mineral deposits of the study area were mapped and described by Van Alstine (1969). Most recently, Scott and others (1975) mapped the study area at 1:62,500. The following geologic description is summarized from these works, and supplemented by observations of A.M. Leibold.

Browns Canyon lies on the western flank of the Mosquito Range, adjacent to the Arkansas Valley (fig. 1). Regional Basin-and-Range-style block faulting along a general north trend during the Miocene and Pliocene periods probably formed the Arkansas Valley structural depression. This graben is considered a northern extension of the Rio Grande rift and is now filled with thick sediments (Van Alstine, 1969; Epis and others, 1980). Proterozoic metamorphic and igneous rocks, Tertiary volcanic and sedimentary rocks, and Quaternary alluvium are exposed in the study area (p. 2 and fig. 2)

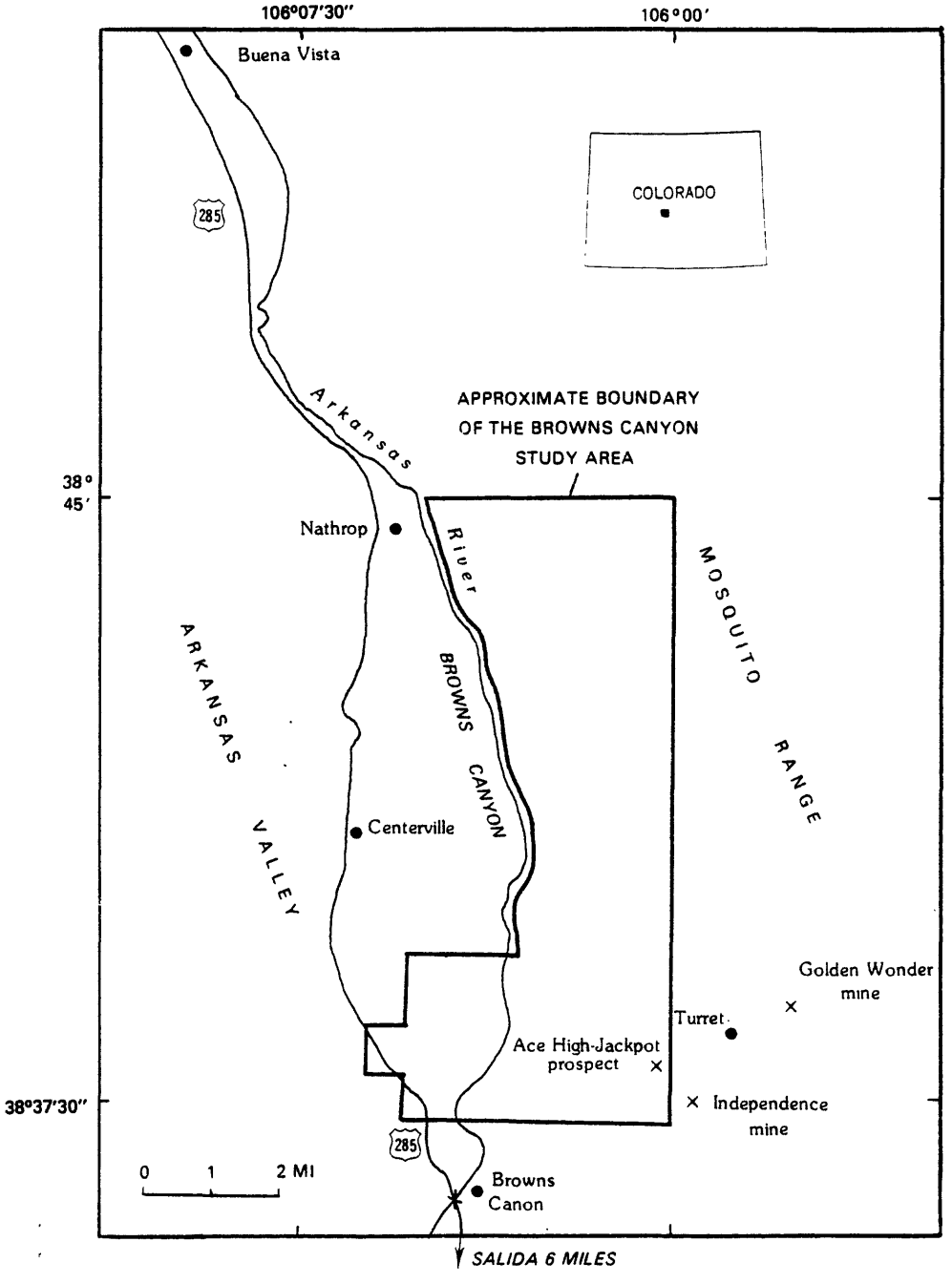

Figure 1. Index map of the Browns Canyon study area, Chaffee County, Colorado.

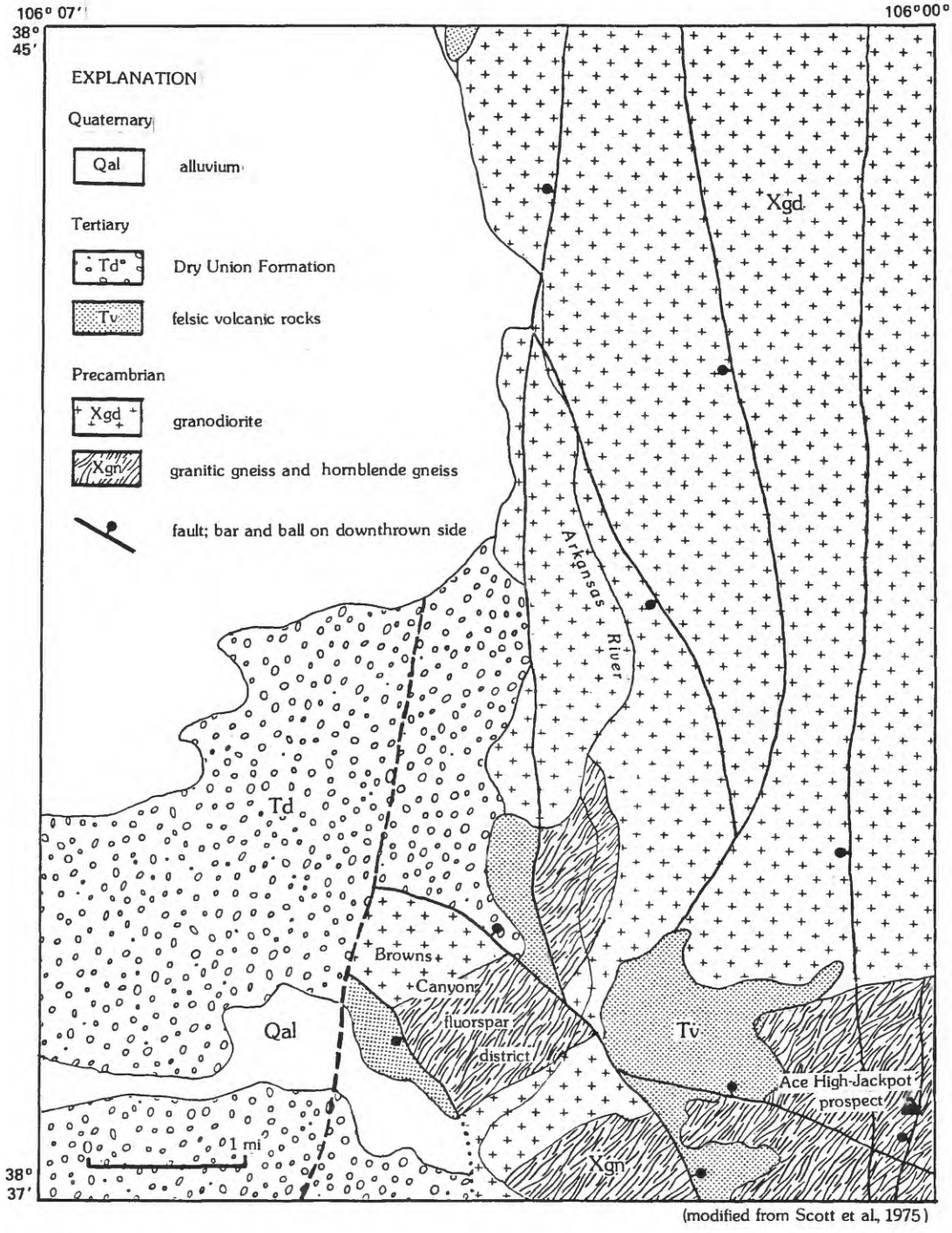

Figure 2. Generalized geologic map of the Browns Canyon area. See Plate 1 for study area boundaries.

Van Alstine, 1969; Scott and others, 1975). North- and northwest-trending normal faults are the dominant local geologic structures. Van Alstine (1969) suggested that some of these faults were active in the Proterozoic, as well as in Early and Late Tertiary time.

Description of rock units

Early Proterozoic metamorphic rocks exposed in the study area include hornblende gneiss (unit Xh, pl. 2) and banded quartz-feldspar-biotite gneiss (unit Xgn); they are locally intercalated and are interpreted as sedimentary in origin. The hornblende gneiss is a dark-green to black, fine- to medium-grained, foliated rock. The banded gneiss is a fine- to medium-grained, foliated rock with light- to dark-colored bands. (Van Alstine, 1969; Scott and others, 1975)

Early Proterozoic igneous rocks include a granodiorite batholith (unit Xgd, pl. 2), dated at approximately 1,700 m.y. by the rubidium-strontium method (Hutchinson and Hedge, 1967). The granodiorite is mottled gray and white, coarse grained, and foliated near the margins of the batholith. It contains large and small xenoliths of metasedimentary rocks, and large pendants of hornblende gneiss and banded gneiss, all foliated parallel to the foliation of the granodiorite. Early Proterozoic dikes and sills of granite aplite, granite pegmatite, dacite porphyry, and lamprophyre cut the granodiorite and the metamorphic rocks. (Van Alstine, 1969; Scott and others, 1975).

Tertiary volcanic and sedimentary rocks overlie the Proterozoic units. The volcanic rocks consist of a rhyodacitic sequence of Oligocene age and a rhyolitic sequence of Miocene age. The Oligocene sequence is composed of medium-gray, flow-banded, porphyritic rhyodacite (unit Tr, pl. 2), greenish-gray, argillaceous rhyodacite tuff (unit Ta), and gray, crystal-rich, welded rhyolite ash-flow tuff (unit Tw). A rhyolitic sequence of Miocene age, the Nathrop Volcanics (unit Tn), is exposed in the northwestern corner of the study area. In ascending order, this sequence consists of: (1) a white-to-pink pumiceous laharic flow, (2) a medium-gray to black perlitic obsidian, and (3) a gray or light-brown flow-banded rhyolite with lithophysae containing spessartine garnets and topaz. A small remnant of the Nathrop Volcanics is also exposed in the north-central part of the study area (sec. 29, T. 15 S., R. 77 W., pl. 2). (Van Alstine, 1969; Scott and others, 1975).

Sedimentary rocks in the study area include the Browns Canyon Formation (unit Tb, pl. 2) of Miocene and Oligocene age, and the Dry Union Formation (unit Td) of Pliocene and Miocene age. The Browns Canyon Formation is a gray to yellowish-brown, well-layered tuffaceous siltstone. The Dry Union Formation consists of poorly consolidated layers of gray mud, silt, sand, and gravel. Volcanic lithologies predominate in the gravels, but Precambrian rock fragments are also present (Van Alstine, 1969; Scott and others, 1975).

Quaternary alluvium (unit Qal, pl. 2) is present along the Arkansas River banks and in the Arkansas Valley.

Economic geology

The study area lies near the southeastern margin of the Colorado Mineral Belt (Tweto and Sims, 1963), and contains two mineralized areas, the Browns Canyon fluorspar district and the Railroad Gulch-Stafford Gulch precious- and

base-metals area. In addition, several prospects and quarries for industrial minerals are in the study area.

Browns Canyon fluorspar district

The Browns Canyon fluorspar district is localized in a northwest-trending horst. Normal faults on the northeast and southwest sides of the horst juxtapose Precambrian rocks against Oligocene volcanic and Pliocene/Miocene sedimentary rocks. Major fluorspar deposits are localized in the faults bounding the southwest side of the horst and in smaller southwest- and northwest-trending faults and joints which transect the horst (pl. 2).

Fluorite and microcrystalline-to-chalcedonic quartz are the principal vein minerals. Minor quantities of calcite, barite, pyrite, marcasite, manganese, and iron oxides, and clay minerals are locally present. Most of the fluorite is purple, green, yellow, or white, microgranular to fine grained, and botryoidal. In places, nearly concentric bands of fluorite enclose brecciated fragments of country rock, fluorite, or chalcedony (Van Alstine, 1969; Brady, 1975).

The Browns Canyon fluorspar deposits may be epithermal, formed during Oligocene time in hot springs at temperatures in the 120°-170°C range. Supporting evidence includes the proximity of thermal springs, data from fluid inclusion studies, and observed textural and mineralogical associations, as outlined by Van Alstine (1969).

Railroad Gulch-Stafford Gulch area

The Railroad Gulch-Stafford Gulch area is the western part of the Turret precious- and base-metals district (pl. 1). This district includes many mines and prospects in sections 28, 29, 31, and 32 (T. 51 N., R. 9 E., pl. 1). Most notable are the Gold Bug and Golden Wonder mines, characterized by gold-bearing quartz veins along faults in both Precambrian igneous and metamorphic rocks and in Tertiary volcanic rocks, and the Independence and Turret mines, which are considered as copper-zinc skarns (fig. 2) (Heinrich, 1981; Lindgren, 1908). This investigation covered only the Railroad Gulch-Stafford Gulch area, which includes several prospects for gold or tungsten and the Ace High-Jackpot prospect. The gold or tungsten prospects consist of several short adits (sec. 30, T. 51 N., R. 9 E., pl. 2) in north-dipping quartz-feldspar-biotite gneiss or hornblende gneiss. Specimens from the dumps include gneiss cut by pegmatite or aplite dikes, some of which are brecciated, veined by quartz and calcite, and stained by limonite. Gold and scheelite were not observed in any samples from dumps collected by Van Alstine (1969) or A.M. Leibold.

The Ace High-Jackpot copper-zinc prospect (sec. 32, T. 51 N., R. 9 E., pl. 2) lies in and adjacent to a lenticular body of Early Proterozoic hornblende gneiss bounded by two north-trending faults. These faults localize a chalcopyrite-quartz vein and a pegmatite dike. The prospect consists of two inaccessible shafts of unknown extent and several pits. Rock samples from the dumps and pits include metasomatized hornblende gneiss composed of a coarse-grained, skarn-like assemblage of hydrous magnesium, calcium, iron, and aluminum silicates including actinolite, anthophyllite, chlorite, cordierite, cummingtonite, epidote, sillimanite, talc, and tremolite. Small grains and veinlets of magnetic, now altered to hematite and limonite, and chalcopyrite, mostly altered to malachite, are intergrown with the silicates.

Coarse-grained, subhedral to euhedral gahnite crystals occur in quartz veinlets and in rocks composed predominantly of talc and tremolite. Outcrop specimens found adjacent to the prospect include feldspathic gneiss, anthophyllite schist, granitoid pegmatite, hornblende amphibolite, and garnet-biotite gneiss. Granodiorite is exposed about 1.5 miles to the north (pl. 2) and 1 mile to the east (Van Alstine, 1969; Boardman, 1976; Sheridan and Raymond, 1977).

Heinrich (1981) includes the Ace High-Jackpot prospect and the Independence and Turret mines in his description of copper-zinc-bearing skarns of south-central Colorado. In this category, he also includes the Sedalia Mine, once the largest copper mine in Colorado. The Sedalia Mine is located about 7 miles south of the study area. Heinrich (1981) describes these mines and prospects as epigenetic, disseminated replacement deposits found in terranes intruded by 1,400 or 1,700 m.y. granitoid plutons. He suggests that the host rock type, normally amphibolite, hornblende gneiss, or biotite gneiss, was a major factor in localizing zones of mineralization. Faults through or near the deposits are common. Chalcopyrite is ubiquitous; sphalerite and gahnite are common; galena, pyrite, and molybdenite are minor or absent.

Sheridan and Raymond (1977; 1978) described the deposits at the Sedalia Mine and several other mines in the Salida area as metamorphosed exhalative deposits. They suggest that the presence of metasedimentary and metavolcanic host rocks, the preponderance of concordant textural and structural features, the unusual gangue mineralogy, and the clustering of similar deposits in the Salida region support an exhalative origin for these deposits.

Industrial-mineral quarries and prospects

Perlite, quartzite, vermiculite, and pegmatite quarries and prospects are present in the study area. The Nathrop volcanics at Ruby Mountain (sec. 13, T. 15 S., R. 77 W., pl. 2) and southeast of Ruby Mountain (sec. 29, T. 15 S., R. 77 W., pl. 2) contain perlite, a glassy volcanic rock with resource potential primarily as lightweight aggregate and insulation. Two deposits of quartzite, quarried for use as aggregate and decorative material, are exposed in the study area (secs. 18 and 19, T. 51 N., R. 9 E., and sec. 8, T. 51 N., R. 9 E., pl. 2). The quartzite is associated with pendants of banded gneiss in granodiorite. Van Alstine (1969) described a vermiculite prospect located in a small outcrop of hornblende gneiss in sec. 29, T. 15 S., R. 77 W. (pl. 2). In the northern portion of the study area, several simple pegmatite dikes and sills in granodiorite have been prospected for bulk or industrial quartz and feldspar, and for mineral specimens.

GEOCHEMICAL SURVEY

The goal of the geochemical survey was to define element concentrations, element associations, and spatial distributions that reflect geologic processes or features, such as underlying lithology or geochemical dispersion processes, as well as areas of mineralization. For this geochemical survey, stream-sediment samples were used because they represent the best composite of materials from the drainage basin upstream. Two fractions of stream sediments, the minus-80-mesh fraction and a heavy-mineral concentrate, were collected from 123 sites in the study area and chemically analyzed. A split of each heavy-mineral concentrate sample was retained for mineralogical

study. The sample density in the wilderness study area averaged 3 samples per square mile. Well-developed drainages in the Browns Canyon fluorspar district and the Railroad Gulch-Stafford Gulch area were sampled approximately every 1/4 mile.

Sample collection

At each site, bulk-sediment samples and heavy-mineral concentrates were collected from four or more points within the stream channel. Duplicate samples were collected at 20 sites to measure within-site variation. Bulk samples were composed of approximately 1.6 kilograms of stream sediment collected from point bars or sections of lower gradient. To obtain the heavy-mineral concentrates, about 7 kilograms of sediment were collected from riffle gravels and passed through a 10-mesh stainless steel screen at each site. Using a steel gold pan, the sediment was panned until approximately 50% quartz and feldspar remained in the concentrate. Water for panning was rarely available at the sample site; most samples were panned in the Arkansas River. All samples were stored in brown paper envelopes and allowed to air dry.

Field observations, including underlying lithology, lithology of float, and a brief description of the stream channel, were made and noted at each site. In addition, the presence of factors which might produce false anomalies, such as nearby prospects, scrap metal, and iron and manganese oxide coatings, were noted.

Laboratory procedures

The bulk stream-sediment samples were passed through 80-mesh stainless steel sieves to obtain the fine fraction for chemical analysis. A 0.5 gram sample was digested in an aqua regia ($1HNO_3$:3HCl) solution, dried by heating, then cooled. The residue was then re-dissolved in 20 milliliters of 20% HCl and warmed on a hot plate. This solution was filtered into a test tube and analyzed by inductively coupled plasma atomic emission spectroscopy (ICP-AES) (Church, 1981) for the elements listed in the Appendix, table A1. Jerry M. Motooka performed the ICP analyses at the USGS Analytical Laboratories. The data were recorded on the USGS Data General computer system, and are listed in Appendix A, table A2.

The heavy-mineral concentrates were sieved to minus-30-mesh and processed through bromoform (specific gravity 2.85-2.89) and a modified Frantz Isodynamic Separator to obtain three fractions: (1) magnetic at .25 A (amperes), (2) magnetic at 1.2 A, and (3) nonmagnetic at 1.2 A. The nonmagnetic fraction is typically dominated by the accessory rock-forming minerals sphene, zircon, and apatite, but also contains most primary and secondary ore minerals and heavy gangue minerals. This fraction was split, then ground in a mortar and pestle and analyzed semiquantitatively by the six-step optical emission spectrographic method (Grimes and Marranzino, 1968) for the 31 elements listed in Appendix A, table A1. Dave E. Detra performed the spectrographic analysis at the USGS Branch of Exploration Geochemistry. The data are listed in Appendix A, table A4.

Mineralogical studies of the heavy-mineral concentrates were conducted using a binocular microscope, X-ray diffraction, and a scanning electron microscope. These studies enhanced data interpretation by identifying mineral phases in which certain elements reside, defining the source of anomalies and

distinguishing false anomalies. In addition, many lithologies or types of mineralization contain specific mineralogies distinguishable in heavy-mineral concentrates.

A data control program for this investigation included the analysis of blank samples, reference-material samples, sample splits (analytical duplicates), and field (within-site) duplicates. Results were assessed using data listings, scattergrams, and one-way analysis of variance. Appendix B contains the data and results of the program.

Data processing

The geochemical survey for this investigation provided two large, multivariate data sets for interpretation. To facilitate data interpretation, the Statistical Package (STATPAC) computer programs of VanTrump and Miesch (1976) were used.

Sample locations and bedrock geology are shown on plate 2. Summary statistics for the minus-80-mesh stream-sediment and heavy-mineral concentrate data sets are presented in Appendix A, tables A3 and A5 respectively. Using this information, the data sets were "cleaned" to facilitate data processing and interpretation. Qualified values are concentrations not detected (N), concentrations detected but less than the lower detection limit (L), and values greater than the upper limit (G). For the minus-80-mesh stream-sediment data, at least 90% of the values for Ag, As, B, Bi, Cd, Sb, Sn, and W were below or near the detection limit. These elements were eliminated from the data set and evaluated individually. To accommodate some STATPAC programs, remaining qualified values were replaced by a value 0.7 times the lower (or upper) detection limit. These replacements have minimal effect on data interpretation, because the detection of regional variation is maintained.

For the heavy-mineral concentrate data, at least 90% of the values for Ti, Ag, As, Au, Bi, Cd, Sb, Sc, and Zr were below or near the detection limit or greater than the upper limit. These elements were eliminated from the data set and evaluated individually. In addition, Be and Ni were eliminated because the values showed little regional variation. Remaining qualified values were replaced as follows: N replaced with a value three steps below the lower detecton limit, L replaced with a value two steps below the limit, G replaced with a value 2 steps above the upper limit. Because the emission spectrographic data is reported on a geometric scale, logarithmic (base 10) transformations are necessary to approximate more normal distributions, which are required by many statistical methods (Howarth and Martin, 1979). All heavy-mineral concentrate data were log transformed for evaluation in this investigation.

Raw data lists, basic statistics (mean, standard deviation, range), histograms, single-element plots, correlation matrices, R-mode factor analysis, and factor plots were used to classify the geochemical information and to examine the areal distribution of samples having anomalous element concentrations. For this investigation, values for each element or element association (factor) were classified using several categories including "background," "high background," "possible anomaly," "anomaly," and "high anomaly."

To examine the areal distribution of the data, single-element plots were constructed with symbols that identify the class category at each sample site. By constructing drainage basin maps (fig. 3) and relating these plots

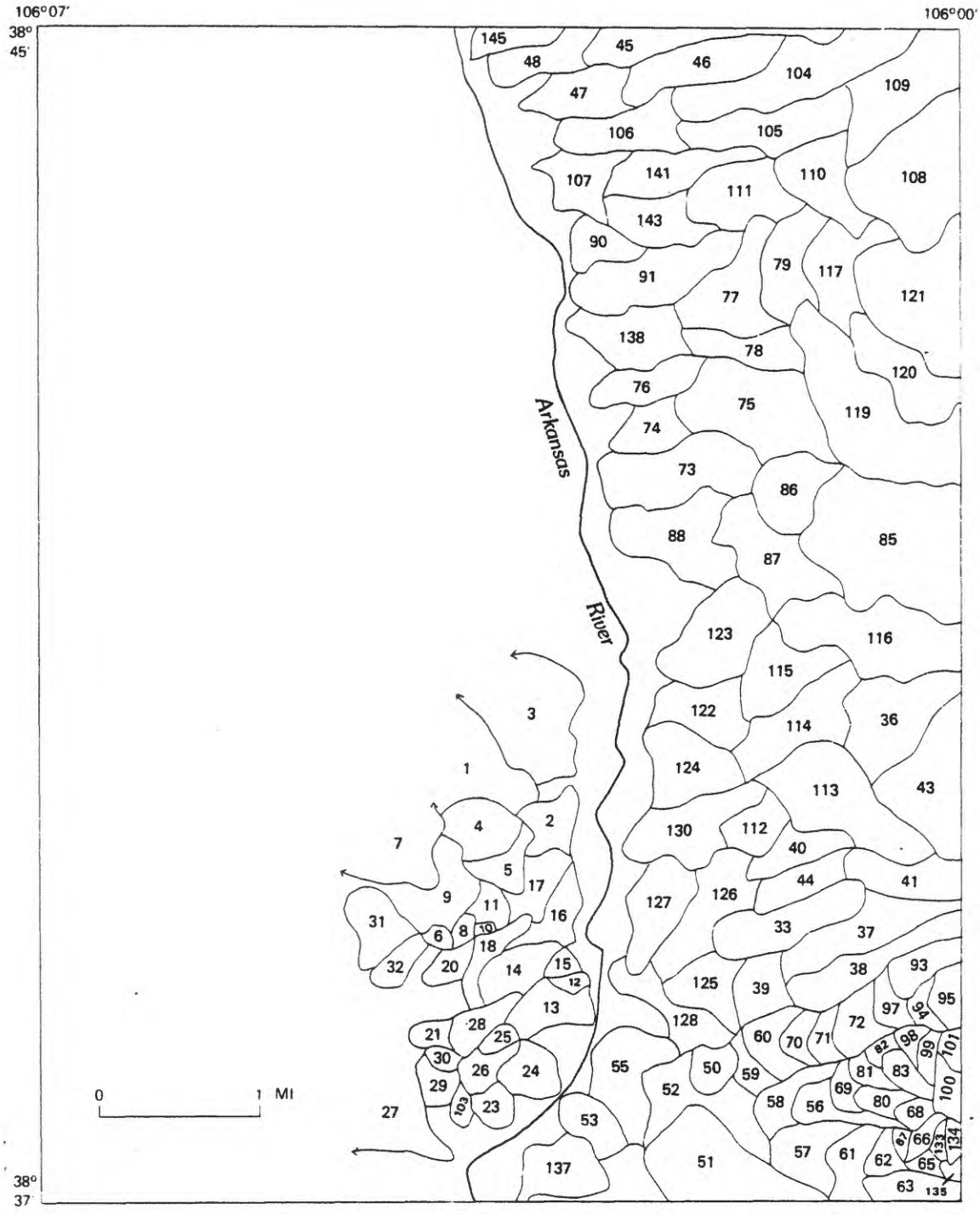

Figure 3. Index map showing numbering scheme for drainage basins.

to geologic maps, the anomalies may be attributed to known or suspected geologic processes or features (e.g. lithology, mineralization, alteration). This procedure was also used to suggest element associations.

The degree of association, or linear covariance, of pairs of elements may be mathematically evaluated by constructing correlation matrices (Appendix C). Linear correlation is valuable in that variables that correlate can essentially be treated as one variable. More importantly, the correlation may be indicative of a common geologic process.

Element associations may be evaluated further using multivariate statistical techniques. R-mode factor analysis, employing the Varimax criterion (Kaiser, 1958), greatly facilitated data interpretation in this investigation by simplifying data sets containing many variables and enabling the examination of their areal distribution. The goal is to group elements into factors that best characterize the data and that reflect underlying geologic or geochemical processes. Using the correlation matrix, this procedure mathematically evaluates the correlation of all the elements simultaneously, so that a large data set containing many variables can be reduced to a data set containing fewer variables, or factors, that are assemblages of the original elements. The extent to which an element contributes to a factor is quantified by the loading. R-mode factor analysis then quantifies the extent to which a particular association is represented in a given sample; this is the factor score. By plotting factor scores on the sample base map, the areal distribution of these geochemical assemblages may be related to some geologic process. Typical factors represent background lithology, alteration, or mineralization.

It is important to note that a number of factor models, or solutions, are created in R-mode factor analysis. Selection of the most appropriate model is guided by a variety of mathematical, geological, geochemical, and judgmental criteria. In general, the simplest model with factors which are geologically and geochemically meaningful is selected. Some more rigorous criteria, using statistical parameters, are described by Joreskog and others (1976) and Howarth and Martin (1979). The most important criterion, however, is that the element associations in the factor model can be used for meaningful geologic and geochemical interpretation of the data. For a complete exposition of factor analysis, see Davis (1973) and Joreskog and others (1976).

For each data set (heavy-mineral concentrates and minus-80-mesh stream sediments) factor models ranging from 3 to 8 factors were calculated (Appendix C). Elements with loadings over 0.4 or below -0.4 were used to describe each factor. Five-factor models were selected for interpretation of each the minus-80-mesh stream-sediment data and the heavy-mineral concentrate data.

To assess the areal distribution of the factors and confirm their geologic significance, factor score maps were constructed. The factor scores were standardized (mean set equal to 0, standard deviation set equal to 1), then classified using histograms and statistical parameters. The factor scores were then plotted on the sample location map and related to geologic features. Drainage basin maps were used to facilitate interpretation (fig. 3). Areas anomalous for five factors from the heavy-mineral concentrate data are shown in figures 4, 5, 6, 9, and 10. Areas anomalous for the five factors from the minus-80-mesh data are shown in figures 11, 12, 14, 15, and 16. The respective histograms and plotting intervals are included on each map. Selected single-element plots were examined to augment information obtained from factor analysis and to support the application of factor analysis.

RESULTS AND INTERPRETATION

The data interpretation may be summarized using the element associations obtained from R-mode factor analysis; however, it should be noted that a variety of procedures using basic statistics, single-element plots, and geologic common sense were also conducted to understand the data and support the use of factor analysis. The factor interpretations are as follows:

Heavy-mineral concentrate data

Factor 1: Co-V-Fe-Cr-Mo is a ferride suite which is almost ubiquitous in regional geochemical surveys, and normally reflects bedrock having a relatively high mafic mineral content (Theobald, 1981). In this study, most samples containing a high concentration of these elements are located in the northern portion of the study area, underlain by granodiorite (fig. 4). Field and laboratory observations of these samples indicate relatively coarse-grained sediments containing abundant magnetite, pyroxene, amphibole, and biotite. Similarly, mineralogic examination of the nonmagnetic fraction of the heavy-mineral concentrates indicated a relatively high content of coarse-grained sphene, amphibole, and biotite. The elements constituting this factor are frequently major constituents or trace substitutions in these minerals (Deer and others, 1966). Factor 1 is attributed to a slightly more mafic portion of the underlying granodiorite pluton.

Factor 2: High concentrations of Ba-La-Sr-Th-(-Y) are clustered just north and south of the Browns Canyon fluorspar district (fig. 5) in drainage basins underlain predominately by Tertiary volcanic rocks and the Tertiary Dry Union Formation. Mineralogic examination of these concentrates reveals a high barite content (hosting Ba and Sr) and high monazite content (hosting La and Th). Although unconfirmed, the barite may be from volcanic or hydrothermal sources. Felsic igneous rocks frequently contain monazite as an accessory mineral (Deer and others, 1966).

Factor 3: The Cu-Pb-W-Mo-Sn factor reflects mineralization in the Railroad Gulch-Stafford Gulch area (fig. 6). Relatively high concentrations of pyrite, gahnite, and scheelite were identified in many of these samples. Several samples in this area contained anomalous zinc concentrations (fig. 7). High tin values (500-1,500 ppm) in samples 56, 81, 98, and 99 (pl. 2) coincide with the identification of cassiterite in these samples. Silver was detected in sample 100, and both silver and gold were detected in sample 98, which was collected downstream from several gold and base-metal mines (i.e. the Turret, Golden Wonder, and Golden Bug mines) in the Turret district (fig. 8). Gold and molybdenite flakes were microscopically identified in sample 98. Samples 81 and 100 contained secondary copper minerals, and chalcopyrite was identified in sample 81. Mineralization in this area is reflected in both the geochemical and mineralogical data of the heavy-mineral concentrates.

Factor 4: The Mn-Y-Sn-(-W) factor is not spatially clustered (fig. 9); however, it is frequently found in samples collected downstream from dikes of lamprophyre and granitic aplite, or pendants of quartz-feldspar-biotite gneiss or hornblende gneiss. Mineralogically, most of these samples have a relatively high amphibole, biotite, and sphene content. Tin may substitute in any of these minerals and Y may substitute in sphene (Deer and others, 1966; Wedepohl, 1969). The provenance of the Mn anomalies is unknown. The significance of this element association, Mn-Y-Sn-(-W), is unclear.

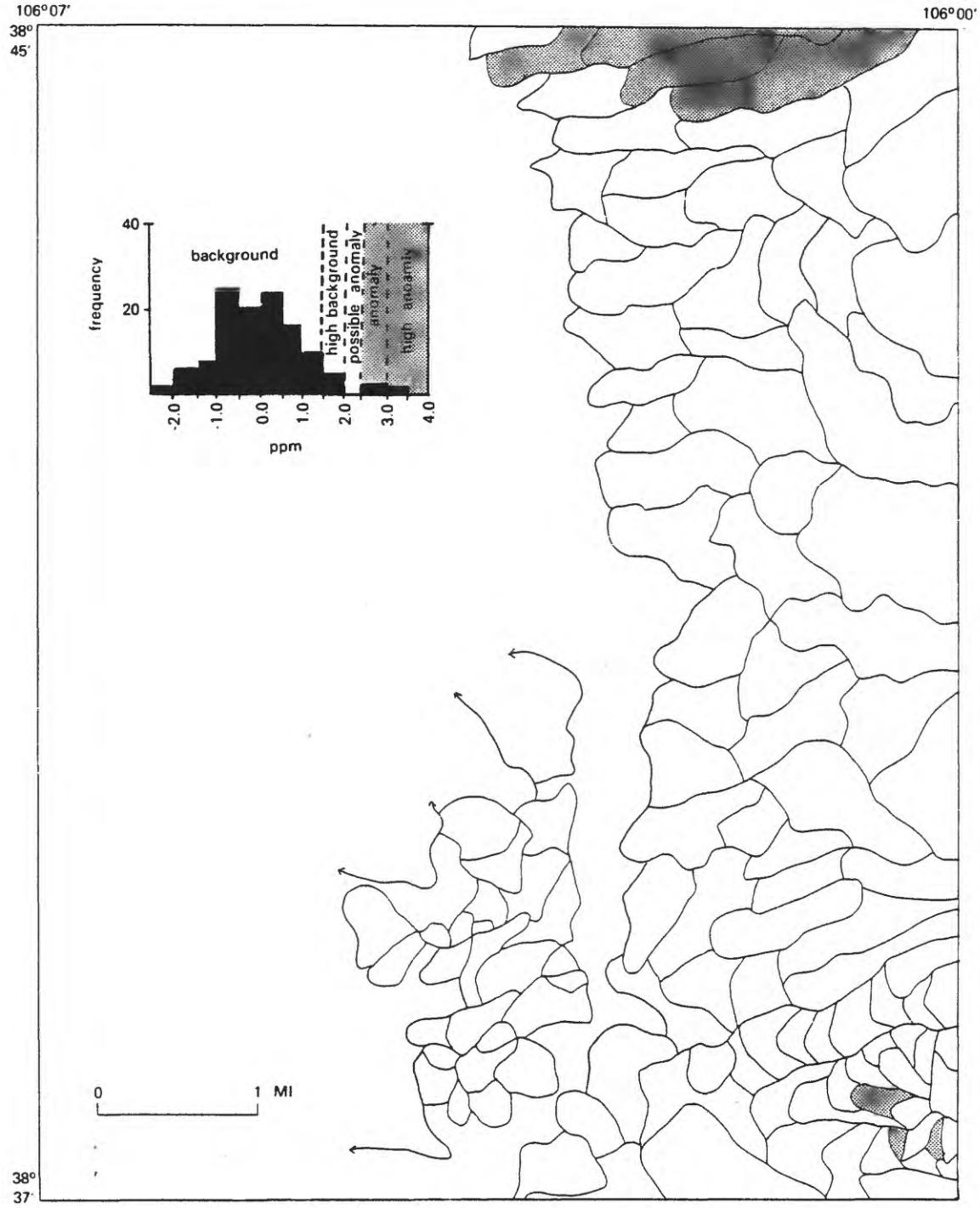

Figure 4. Drainage basins with anomalous values for factor 1, heavy-mineral concentrate data.

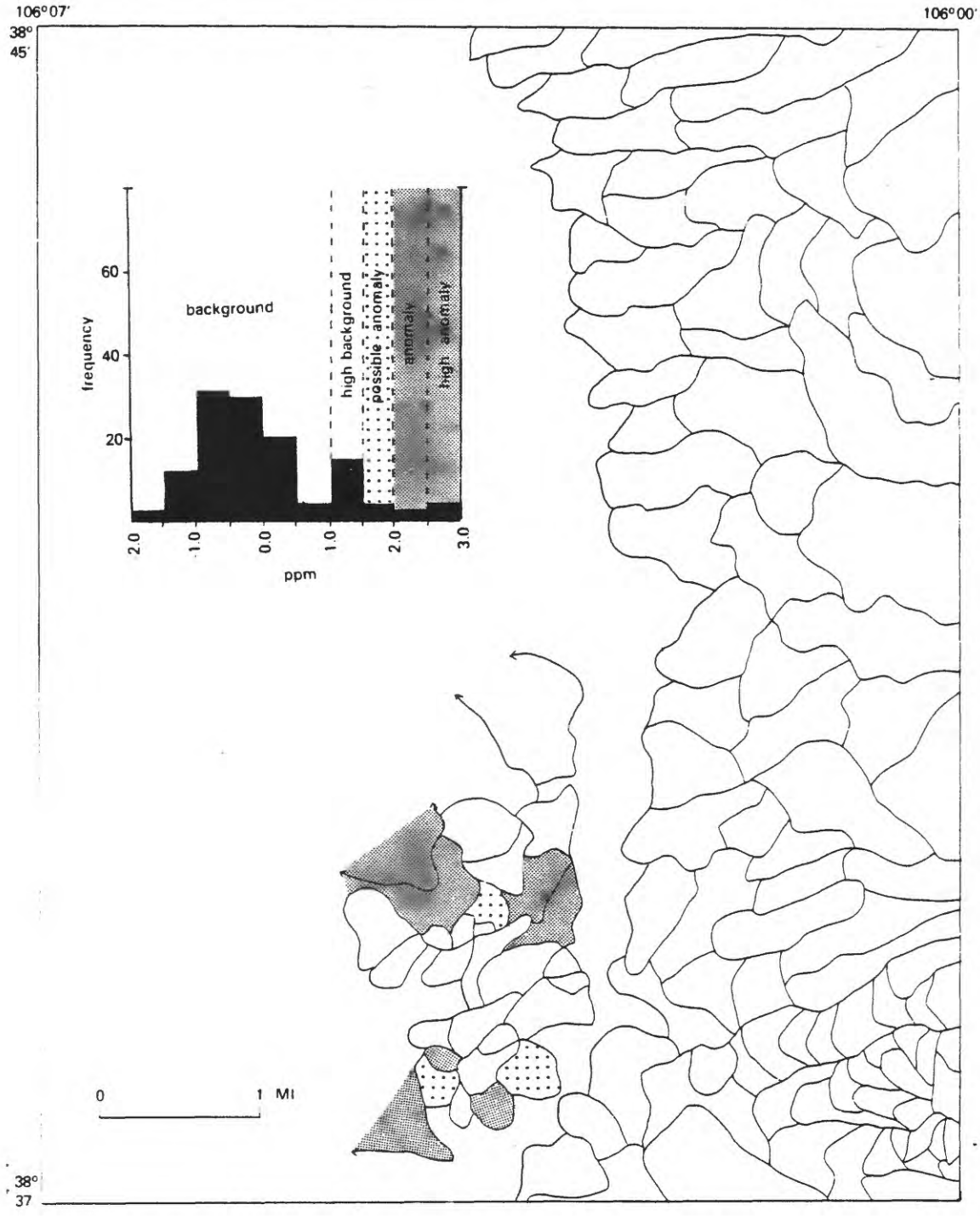

Figure 5. Drainage basins with anomalous values for factor 2, heavy-mineral concentrate data.

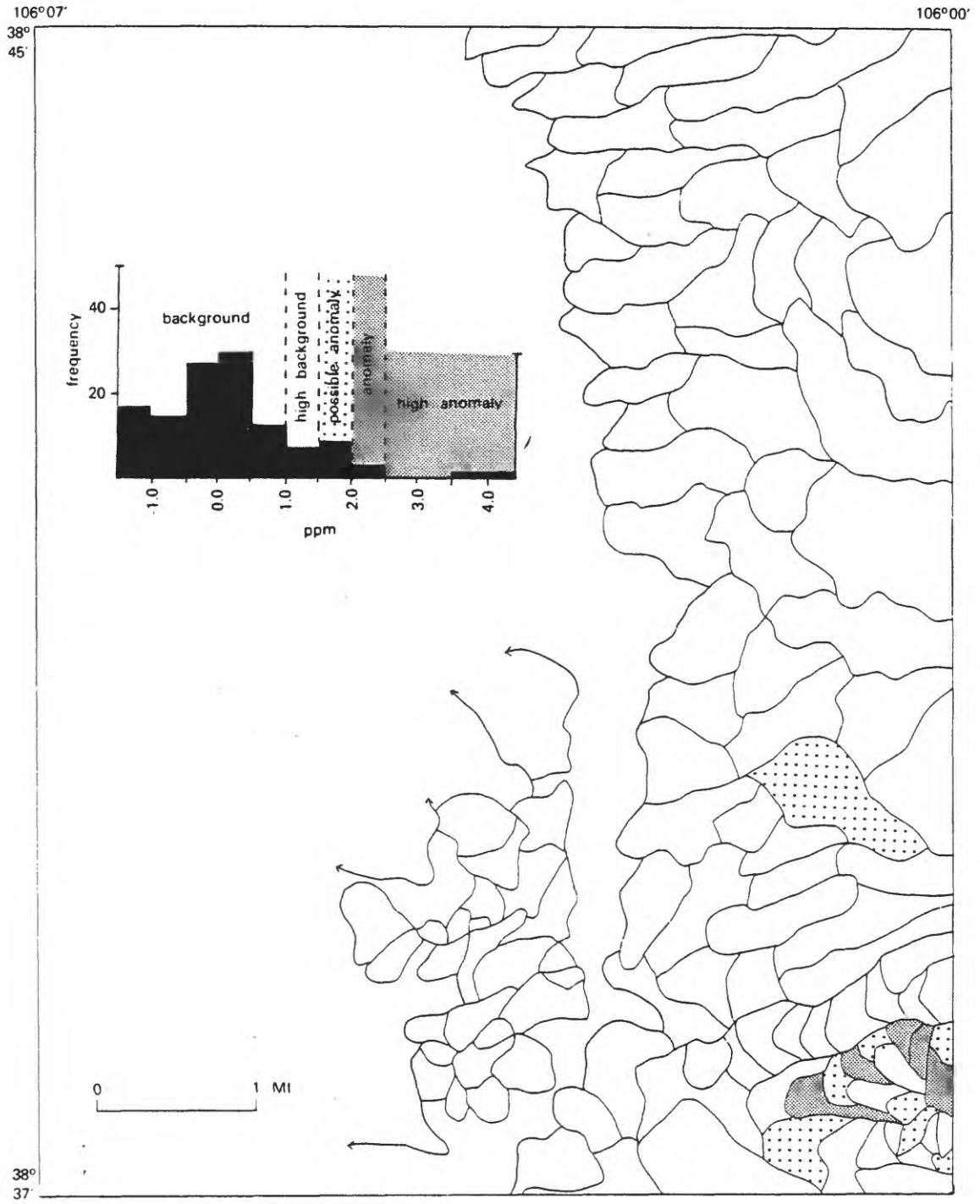

Figure 6. Drainage basins with anomalous values for factor 3, heavy-mineral concentrate data.

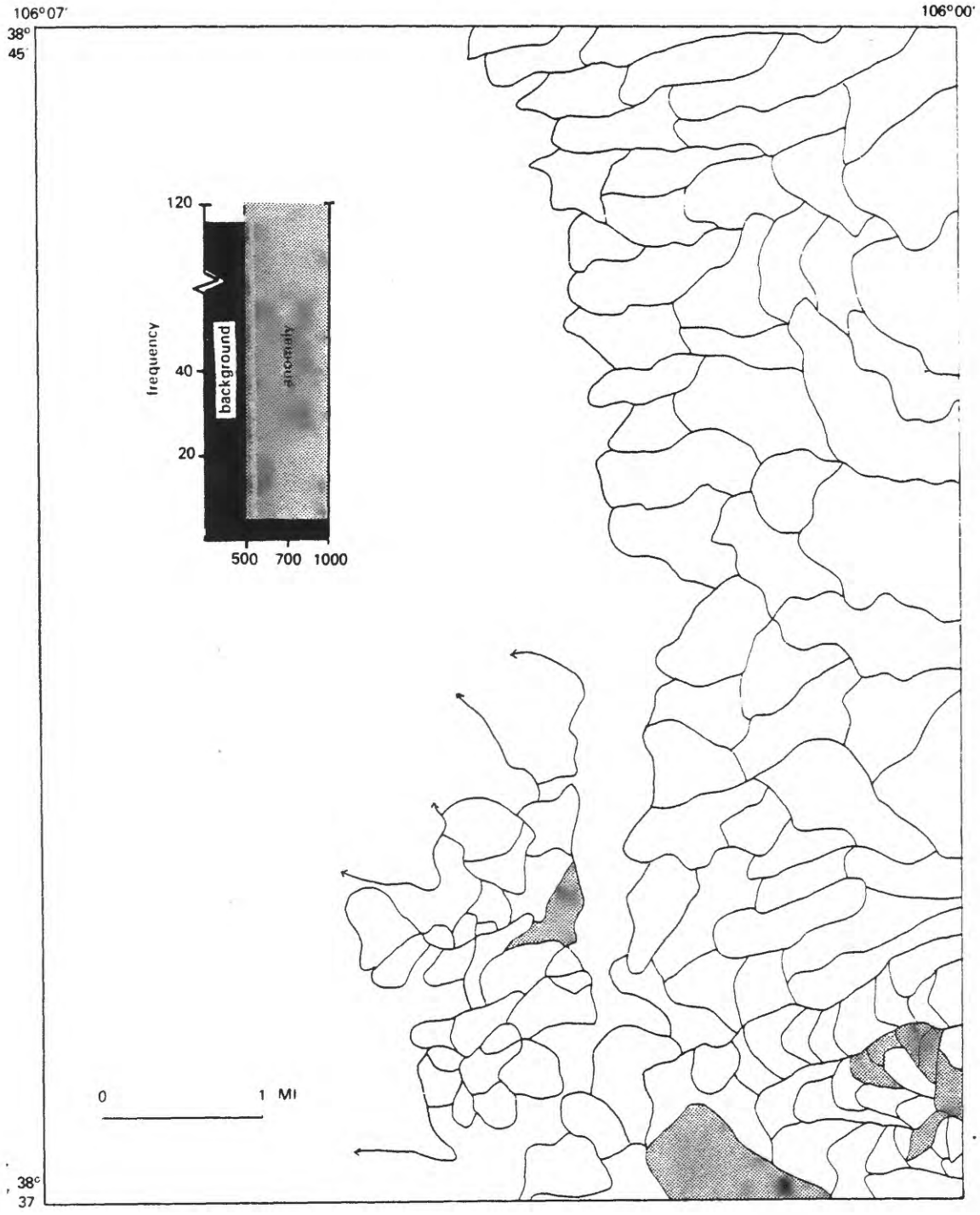

Figure 7. Drainage basins with anomalous concentrations of Zn in heavy-mineral concentrates.

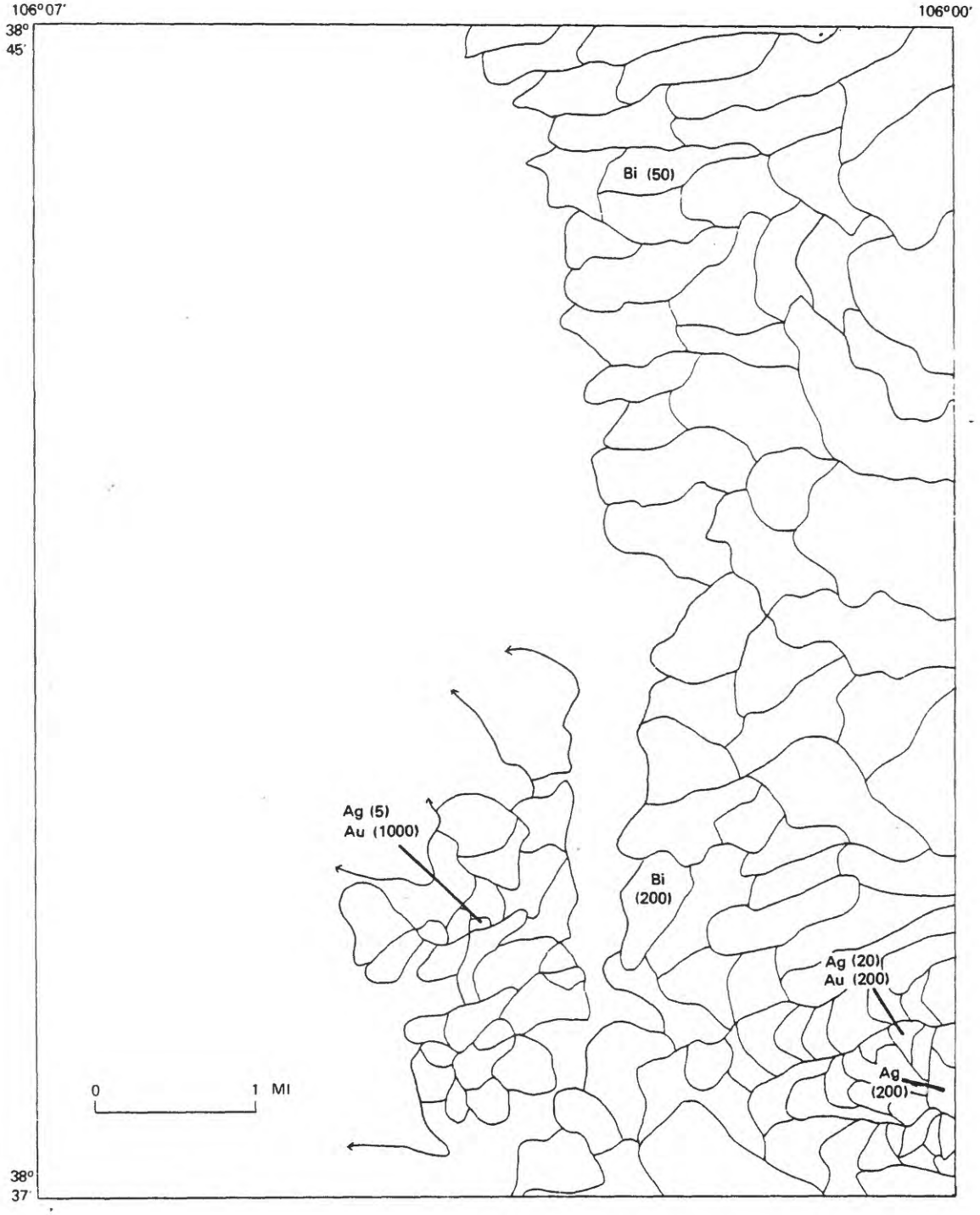

Figure 8. Anomalous concentrations of Ag, Au, and Bi in heavy-mineral concentrates.

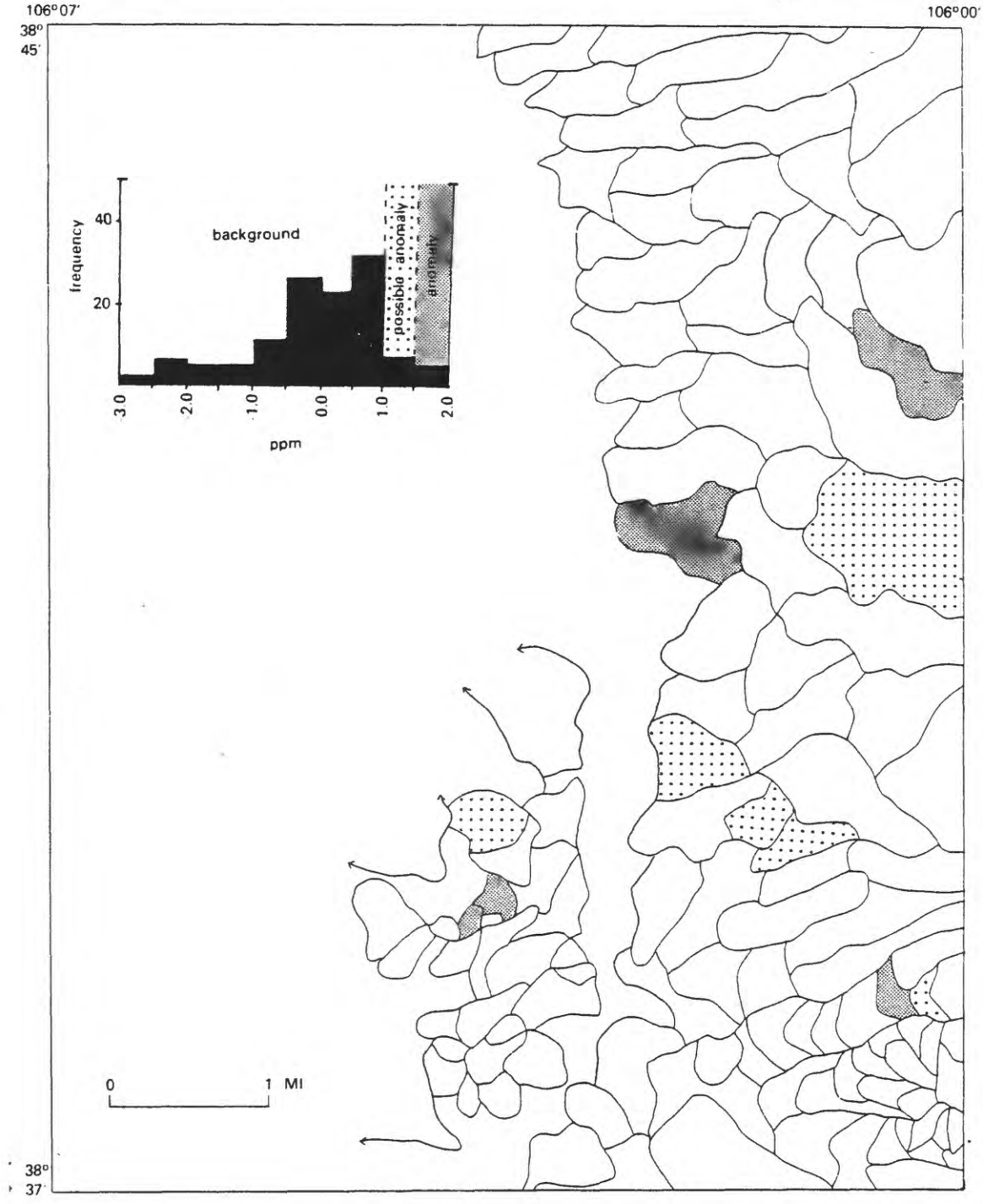

Figure 9. Drainage basins with anomalous values for factor 4, heavy-mineral concentrate data.

Factor 5: The Mg-Ca-Cr association is attributed to both lithology and mineralization. Anomalous samples cluster below the Ace High-Jackpot prospect in the Railroad Gulch-Stafford Gulch area (fig. 10), and are usually underlain by faulted Precambrian rocks (granodiorite, quartz-feldspar-biotite gneiss, or hornblende gneiss). These samples contain relatively high concentrations of one or several of the following minerals: apatite, amphibole, gahnite, or scheelite. Calcium is a major constituent of apatite and scheelite. Apatite is an accessory mineral in many igneous and metamorphic rocks (Deer and others, 1966). The scheelite may be related to local mineralization or may be an accessory mineral in the local gneisses (Tweto, 1960). Abundant amphibole and gahnite are found at the Ace High-Jackpot prospect. X-ray diffraction and scanning-electron microscope studies indicate that calcium and magnesium are major constituents of the amphiboles from this area. Magnesium and chromium may substitute into gahnite. Both magnesium-amphibole and gahnite are characteristic of the deposit model which Sheridan and Raymond (1978) proposed for the Ace High-Jackpot prospect.

Minus-80-mesh stream-sediment data

Factor 1: V-Cr-Fe-P-Nb-Co-Ni is similar in composition, significance, and distribution to the ferride suite observed in factor 1 of the heavy-mineral concentrate data (fig. 11). However, mafic minerals, such as magnetite and ilmenite, which were eliminated from the nonmagnetic fraction of the heavy-mineral concentrates, were still present in the stream-sediment samples, and probably contribute substantially to the observed factor 1 distribution.

Factor 2: Sr-Ca-Mn-Ba anomalies cluster in two areas (fig. 12): (1) north of the Browns Canyon Fluorspar district, in drainage basins underlain by the Dry Union Formation, and (2) in the southern portion of the fluorspar district. Single-element plots of barium and strontium support the factor anomalies in the northern cluster, and suggest a high concentration of barite, as seen in factor 2 of the heavy-mineral concentrate data (fig. 5). The anomalies in the southern portion of the fluorspar district are supported by the calcium single-element plot (fig. 13). These anomalies may be attributed to the fluorspar mineralization, and are supported by the identification of fluorite in the corresponding heavy-mineral concentrate samples.

Factor 3: Cs-La-Y is an incompatible lithophile element association characteristic of granitic bodies. Most samples having anomalous factor 3 scores are underlain by granodiorite (fig. 14).

Factor 4: Mg-Al-Ti-Ni anomalies do not cluster in a particular area, but do coincide with lamprophyre dikes and fault zones in the granodiorite (fig. 15). This asssociation may reflect relatively high contents of biotite (containing Mg and Al), rutile (containing Ti), and amphibole (containing Mg and Al) in the bedrock.

Factor 5: Pb-Be-Zn-Ba-Cu is interpreted to reflect both lithology and mineralization. Anomalous scores for this factor cluster north of the Browns Canyon fluorspar district, primarily in drainage basins underlain by Tertiary volcanic rocks and the Dry Union Formation (fig. 16). Coincident single-element anomaloies for Pb, Be, and Ba suggest a lithologic control; that is substitution of these elements in feldspars from the bedrock. Beryllium anomalies may also reflect the presence of beryl.

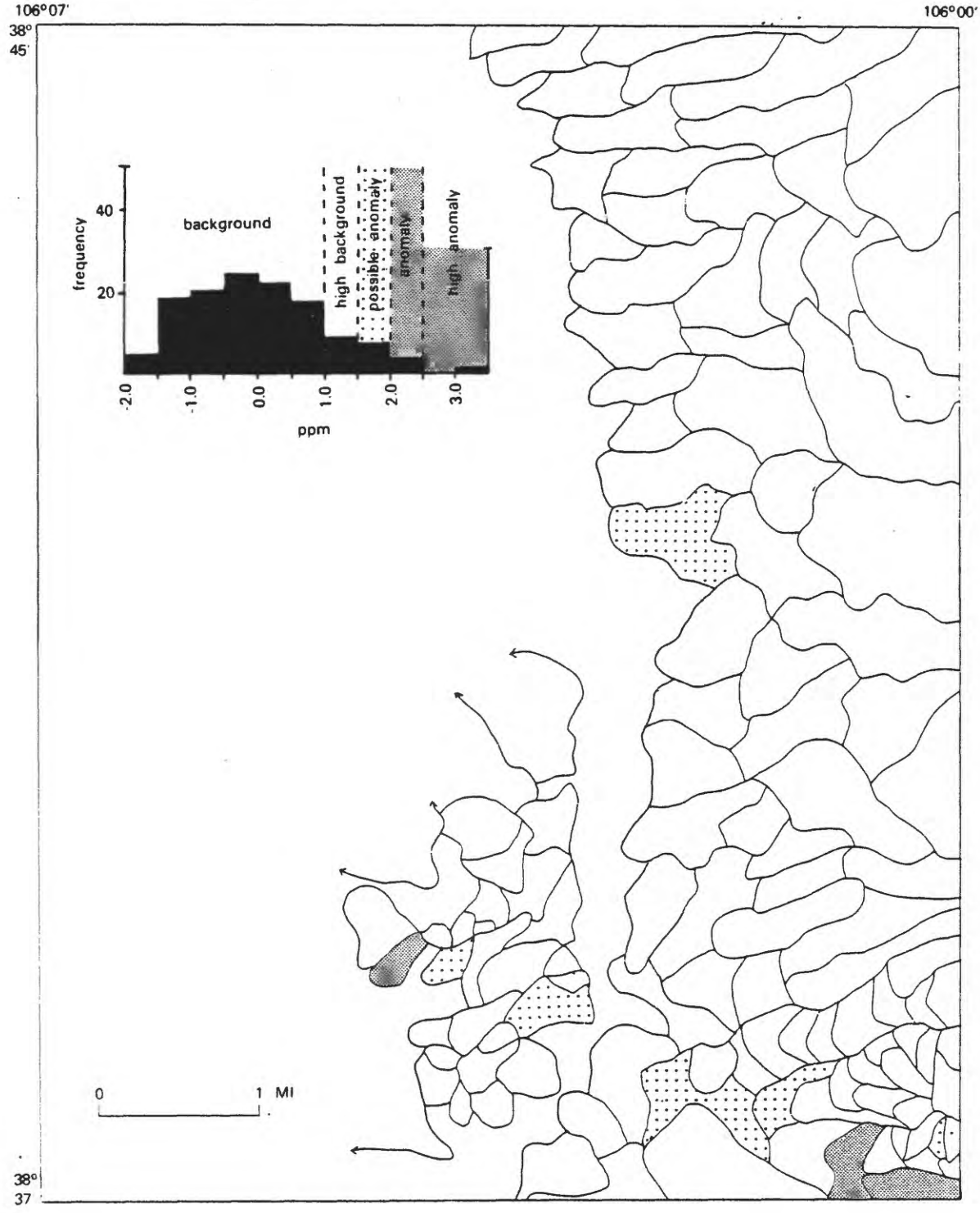

Figure 10. Drainage basins with anomalous values for factor 5, heavy-mineral concentrate data.

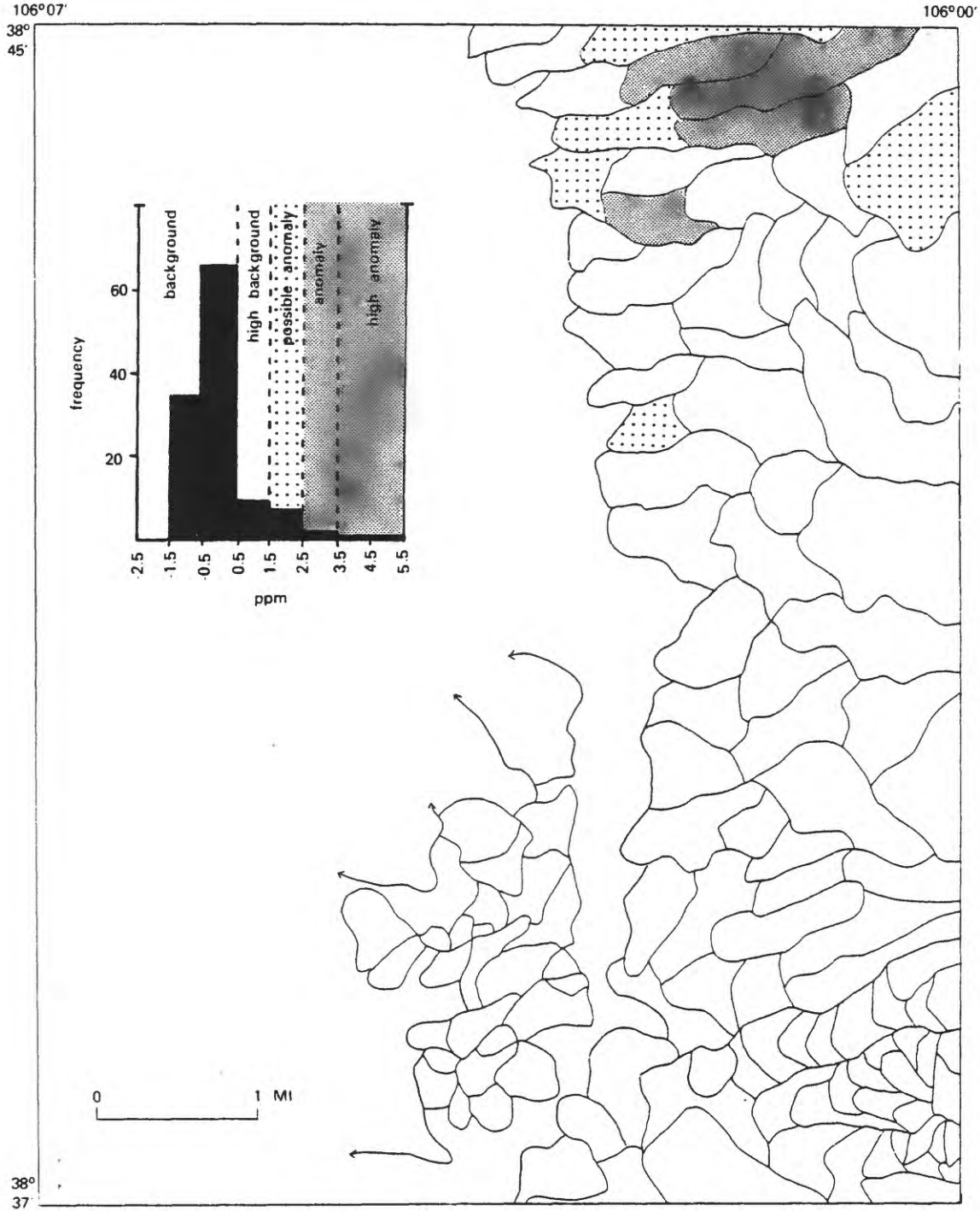

Figure 11. Drainage basins with anomalous values for factor 1, minus-80-mesh stream-sediment data.

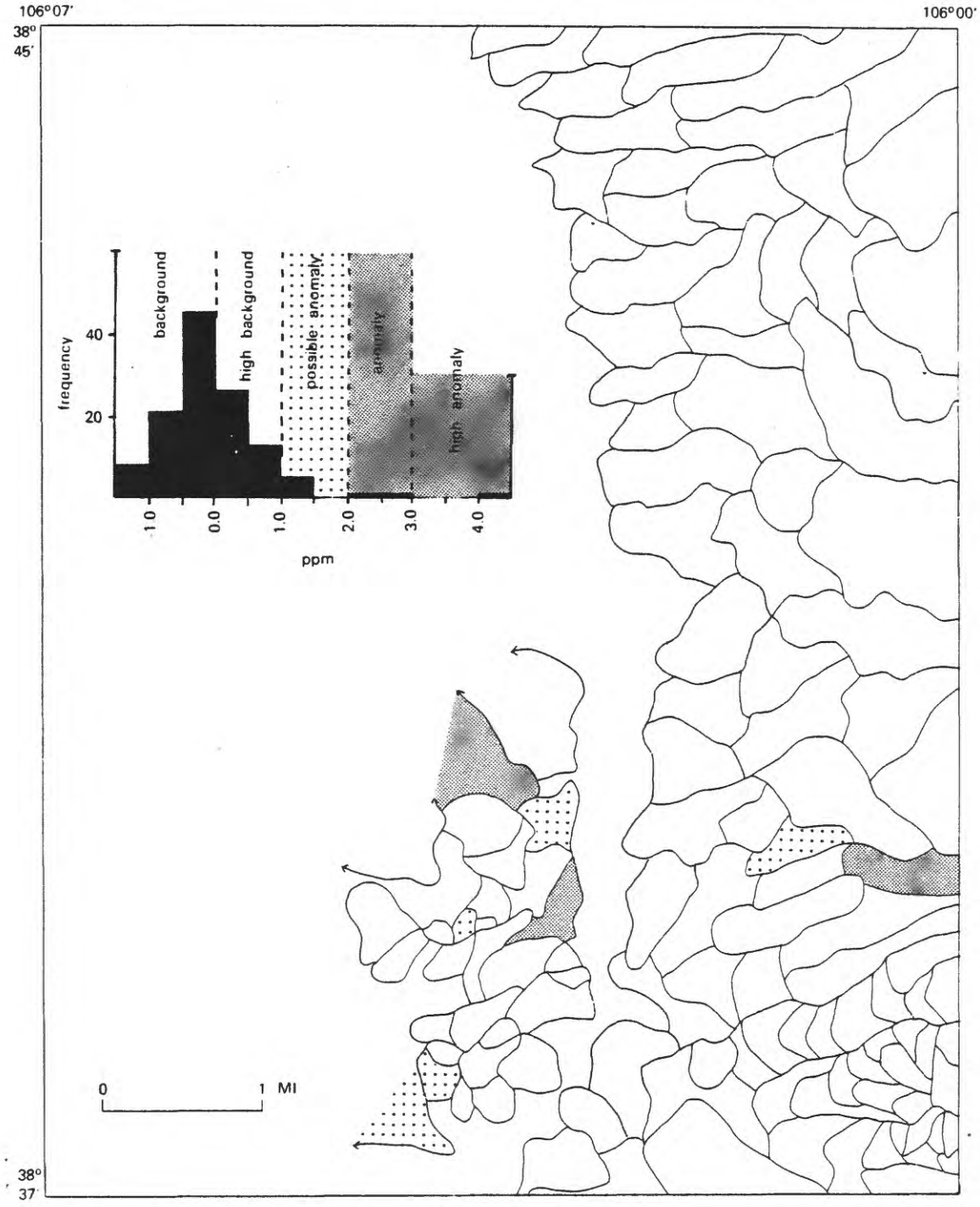

Figure 12. Drainage basins with anomalous values for factor 2, minus-80-mesh stream-sediment data.

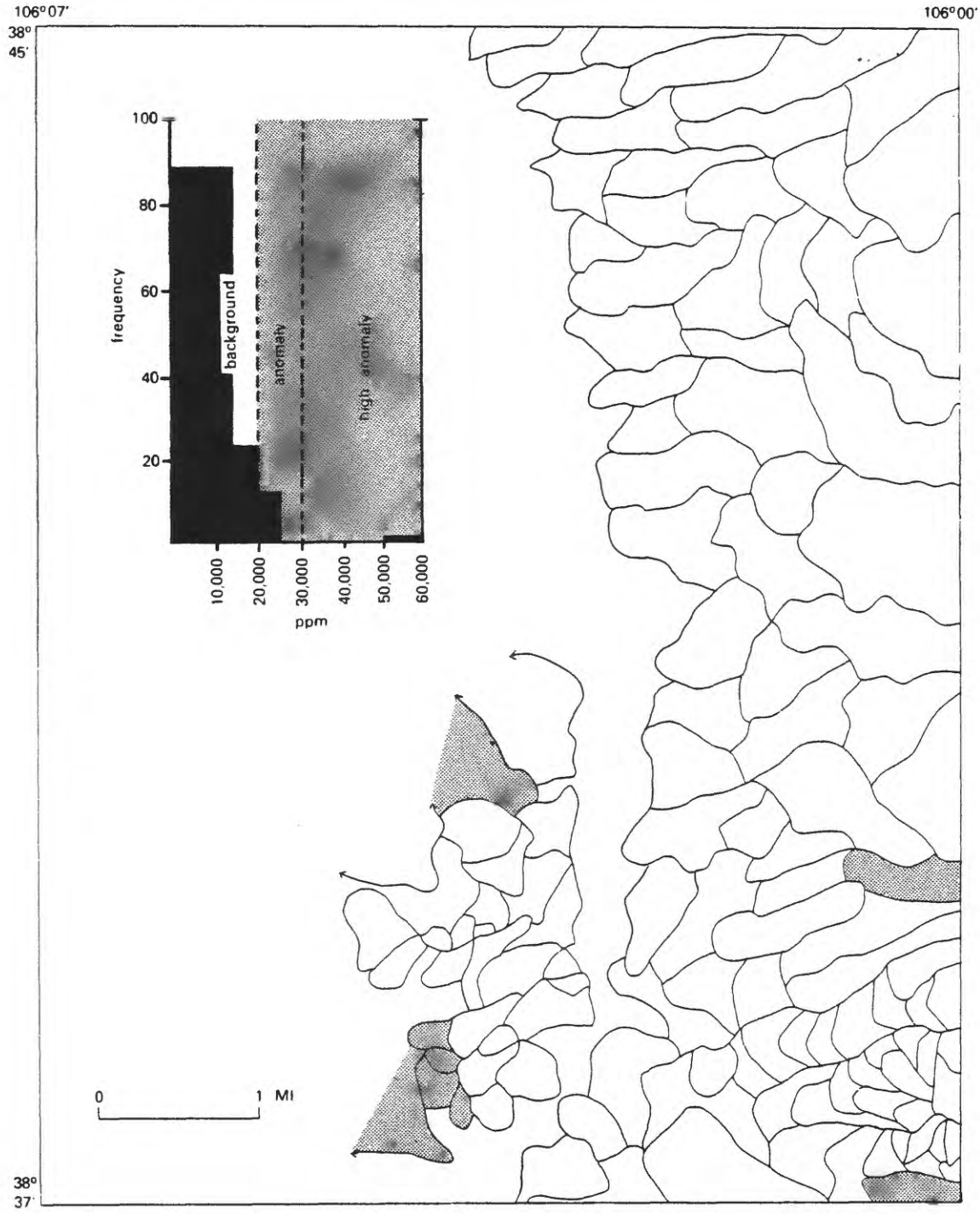

Figure 13. Drainage basins with anomalous concentrations of Ca in minus-80-mesh stream sediments.

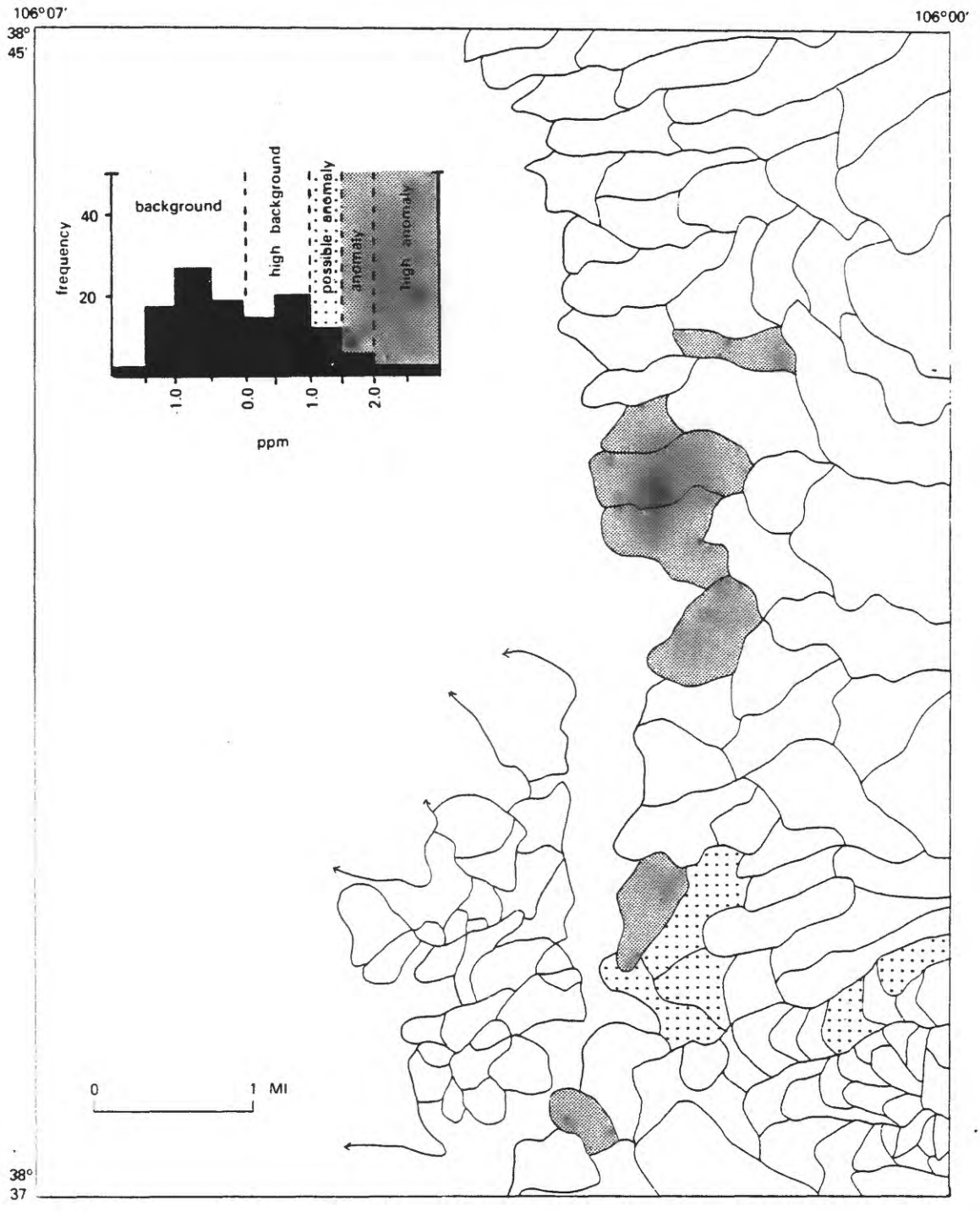

Figure 14. Drainage basins with anomalous values for factor 3, minus-80-mesh stream-sediment data.

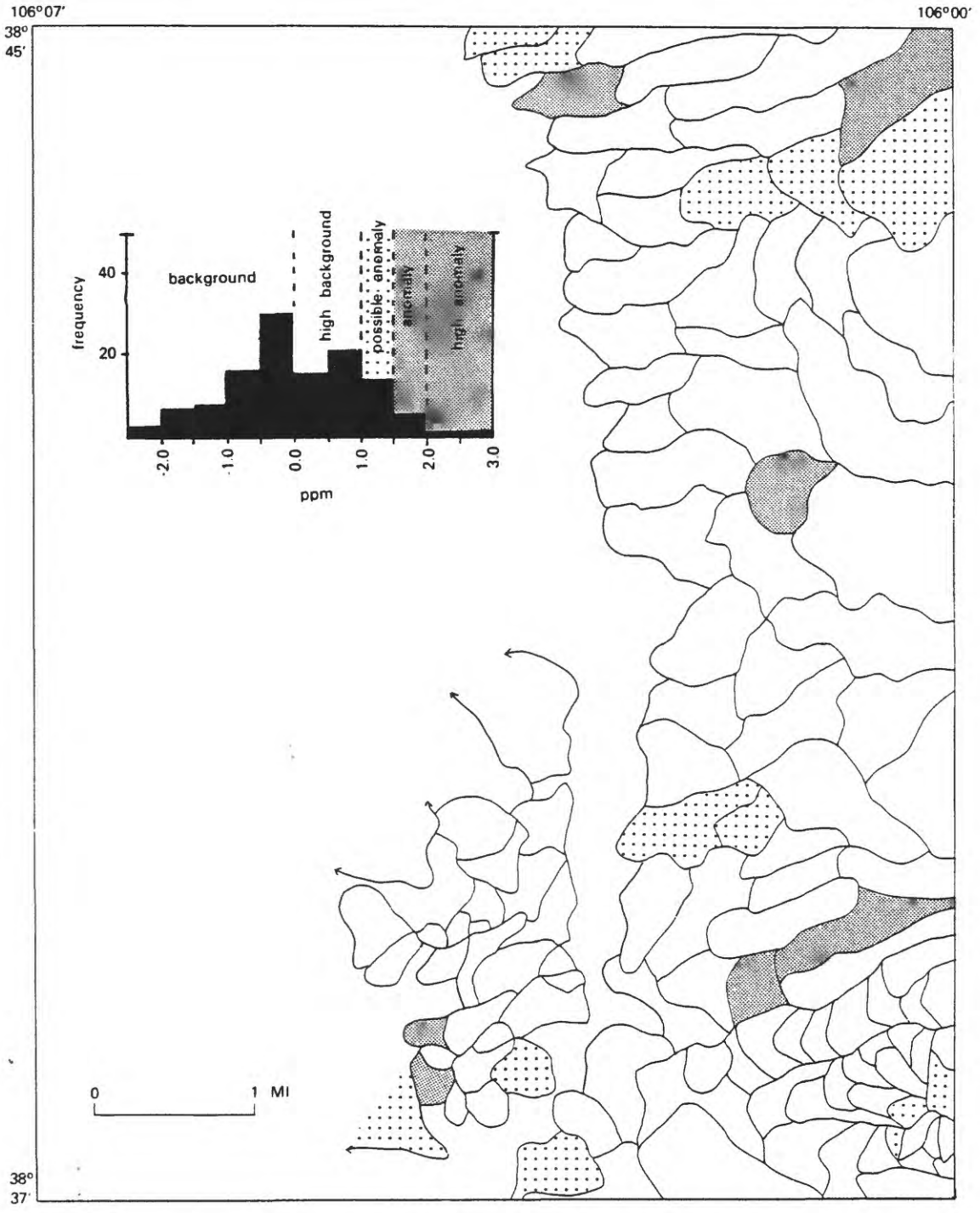

Figure 15. Drainage basins with anomalous values for factor 4, minus-80-mesh stream-sediment data.

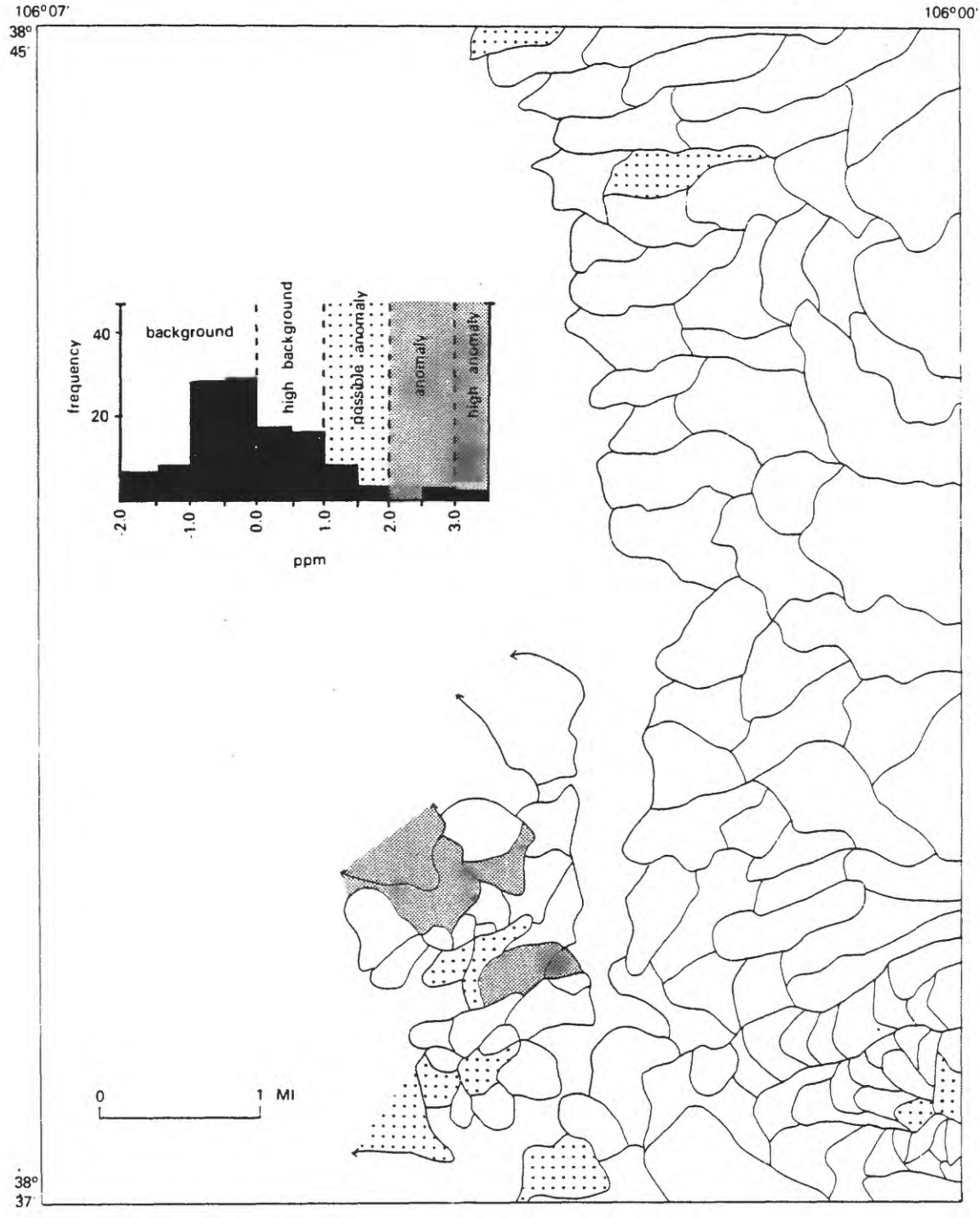

Figure 16. Drainage basins with anomalous values for factor 5, minus-80-mesh stream-sediment data.

The association of Pb, Zn, and Cu suggests mineralization. In the heavy-mineral concentrates, samples 5, 7, 9, 14, and 15 (pl. 2) from this area contain pyrite. In addition, gold flakes were identified in proximal samples (4, 7, 8, and 10), and gold was identified by spectrographic analysis of heavy-mineral concentrate sample 10. The source of the gold and the stream-sediment base-metal geochemical signature in this area is unknown; however, three follow-up heavy-mineral concentrate samples collected from the Dry Union Formation contained gold flakes and pyrite. Two of these samples also contained secondary copper minerals. The Dry Union Formation may be the source of the gold, and perhaps the base-metal anomalies as well.

The Miocene/Pliocene age Dry Union Formation is composed of poorly consolidated muds, silts, sands, and gravels, and occupies much of the Arkansas Valley to the west of the study area. The gravels are composed predominately of pebbles and cobbles of Tertiary volcanic lithologies; however, clasts of the following lithologies are also present: (1) Precambrian igneous and metamorphic rocks, (2) Paleozoic chert, quartzite, siltstone, and limestone, (3) the Tertiary Mount Princeton Quartz Monzonite, and (4) various quartz-feldspar-biotite porphyries, presumably Tertiary in age (Van Alstine, 1969; Scott and others, 1975). These alluvial-fan and river-terrace gravels form a pediment off the Sawatch Range, west of the study area. The Sawatch Range west of the Browns Canyon area hosts numerous precious- and base-metal deposits (Brewer,1931; Adams, 1953; Dings and Robinson 1957). Indications of mineralization in the Dry Union Formation may be a result of the redistribution of metals from some of these deposits.

Factor 5 (Pb-Be-Zn-Ba-Cu) anomalies in samples 68 and 100 (pl. 2) from the Railroad Gulch-Stafford Gulch area probably reflect dispersion of metals from mines in the Turret district. Sample 68 was taken below the Ace High-Jackpot copper-zinc prospect, and sample 100 was taken below the Independence copper-zinc mine.

SUMMARY

Geochemical responses of bedrock geology and mineralization were identified in the Browns Canyon study area using stream-sediment geochemistry. Mineralized targets defined by this geochemical survey include the Browns Canyon fluorspar district, the Railroad Gulch-Stafford Gulch area, and a previously unrecognized local target in the Dry Union Formation.

The geochemical response of the Browns Canyon fluorspar district was most pronounced in the calcium single-element map (fig. 17) and in the mineralogy of the heavy-mineral concentrates. While fluorite was noted in some samples taken in the granodioritic terrane, the fluorite from the fluorspar district was distinctive. It was generally coarse grained, subangular to subrounded and transluscent. White fluorite was most abundant, but pale-yellow and pale-purple grains were also present. Fluorite in samples from other areas was fine to medium grained, angular, tranparent, and medium to dark purple colored. This fluorite is probably an accessory rock-forming mineral.

The stream-sediment data included factor 2 (Sr-Ca-Mn-Ba) anomalies (fig. 12) and calcium single-element anomalies (fig. 13) in the southern portion of the Browns Canyon district as a reflection of the fluorspar mineralization.

The geochemical response of the mineralized area in Railroad Gulch-Stafford Gulch was most pronounced in the heavy-mineral concentrate data. The area was characterized by anomalous concentrations of factor 3 (Cu-Pb-W-Mo)

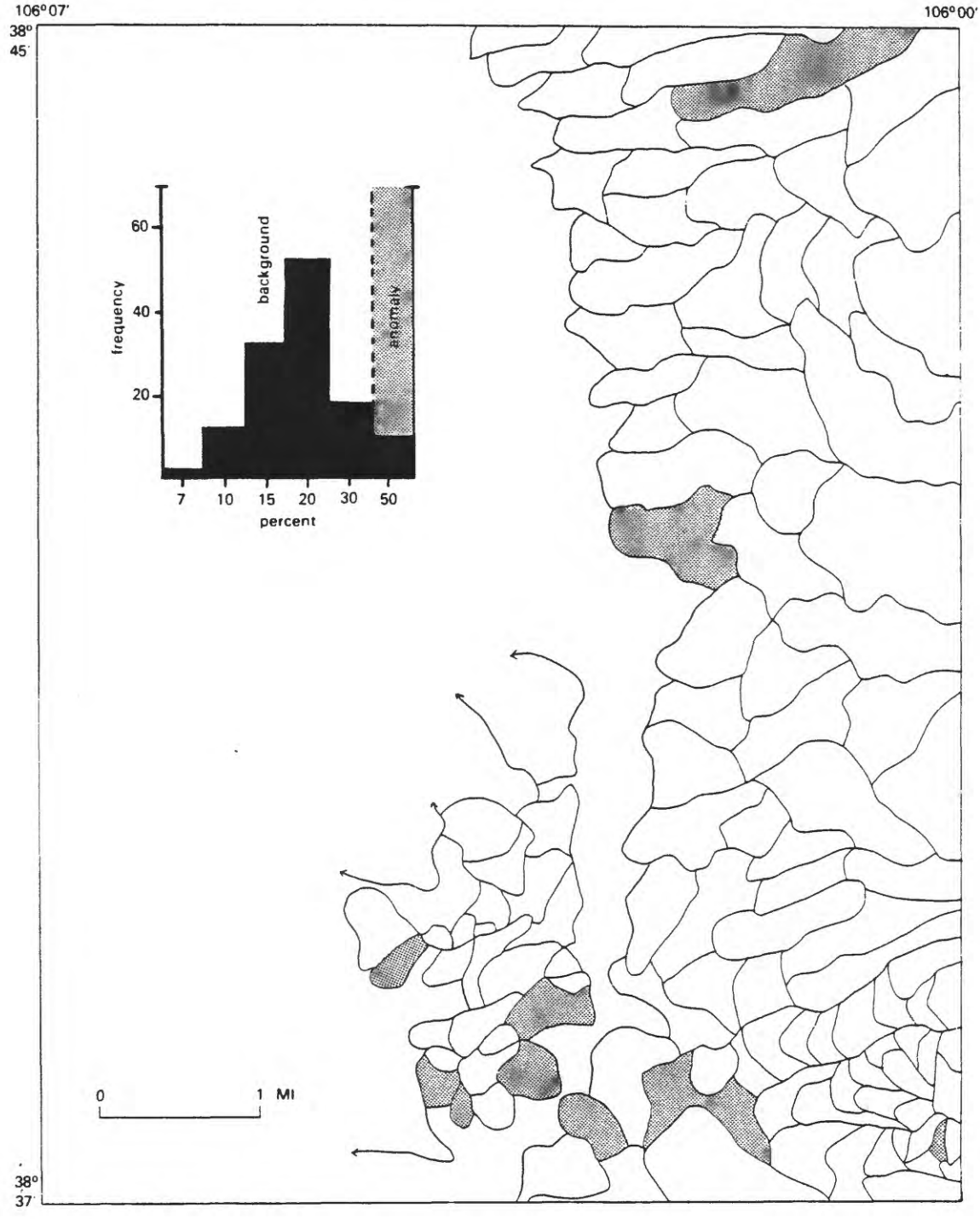

Figure 17. Drainage basins with anomalous concentrations of Ca in heavy-mineral concentrates.

(fig. 6) and factor 5 (Mg-Ca-Cr) (fig. 10), as well as single-element anomalies for gold and silver (fig. 8), and zinc (fig. 7). Factor 3 is a classic mineralization suite, and factor 5 was attributed mainly to favorable host lithology (i.e., Precambrian gneissic rocks containing an abundance of magnesium, calcium, iron, and aluminum silicates). Mineralogical examination of samples from this area revealed the presence of chalcopyrite, gahnite, gold, molybdenite, pyrite, scheelite, and secondary copper minerals, as well as several diagnostic gangue minerals (e.g., the magnesium-amphiboles anthophyllite and eckermanite, muscovite, and sillimanite). The geochemical response and assemblage of minerals noted in samples taken downstream from the Independence mine and the Ace High-Jackspot prospect are consistent with the corresponding copper-zinc deposit model described by Sheridan and Raymond (1977; 1978). Of particular significance is the identification of anthophyllite, chalcopyrite, gahnite, pyrite, and sillimanite, which are characteristic of this type of deposit.

Mineralization attributed to secondary dispersion of metals in the Dry Union Formation is reflected by scores for factor 5 (Pb-Be-Zn-Ba-Cu) of the minus-80-mesh stream-sediment data (fig. 16) and mineralogically substantiated by the presence of pyrite and gold flakes in the heavy-mineral concentrates. The mineralogical study of three follow-up heavy-mineral concentrate samples provided evidence to support the hypothesis that the Dry Union Formation in this area was the source of these anomalies.

Several geochemical anomalies within the wilderness study area boundaries were evaluated. With one exception, the anomalies were attributed to variations in lithology and did not indicate the presence of mineralized rocks. One sample from within the wilderness study area (113, pl. 2) contained an anomalous concentration of tungsten (1,000 ppm) in the heavy-mineral concentrate fraction, and scheelite was noted in this sample. This anomaly was attributed to accessory scheelite in the bedrock, as described by Tweto (1960), and is considered economically insignificant. Tungsten values for all other samples in this drainage were near or below the detection limit (100 ppm).

For this investigation, detailed-scale sampling (every 1/4 mile in well-developed drainages) was conducted over the Browns Canyon fluorspar district and Railroad Gulch-Stafford Gulch precious- and base-metal area to insure the geochemical definition and characterization of these areas, while the wilderness study area was covered by reconnaissance-scale sampling (approximately 3 samples per square mile). To test the effectiveness of detecting the known mineralized areas at this sample spacing, maps were constructed based on only those samples which would have been collected at the reconnaissance scale. This recompilation of the data indicates that anomalous geochemical responses would have been detected over these mineralized areas had they been sampled at the reconnaissance scale, and supports the effectiveness of the sample design used to evaluate the wilderness study area.

CONCLUSIONS

This study demonstrates the utility of stream-sediment geochemistry as an efficient and effective mineral exploration tool in a mineral resource assessment of the Browns Canyon study area. Known mineralized areas, the Browns Canyon fluorspar district and the Railroad Gulch-Stafford Gulch precious- and base-metal area, were characterized by coherent geochemical responses, and a previously unrecognized source of metal in the Dry Union

Formation was identified. This study provided no evidence of undiscovered mineral resources in the Browns Canyon Wilderness Study Area.

Techniques found to be effective in this geochemical program include: (1) multi-media sampling, (2) multi-element analyses, and (3) multivariate statistics. These techniques are particularly important when evaluating large areas with geologic terranes favorable for a variety of types of mineralization, such as the Browns Canyon study area.

The composite nature of stream-sediment samples enables efficient coverage of large areas, and the collection of multiple sediment fractions assists in the recognition of a variety of types of mineralization. In addition, multi-media sampling may help identify the source of a geochemical anomaly or false anomalies. Information from both the minus-80-mesh fraction and the nonmagnetic fraction of heavy-mineral concentrates was necessary to geochemically identify both known and previously known mineralized areas in the Browns Canyon study area.

While both sample media identified the Browns Canyon fluorspar district with calcium anomalies, mineralogical studies of the heavy-mineral concentrates provided information regarding the habit and relative abundance of the fluorite, in comparison with accessory fluorite in Precambrian igneous and metamorphic rocks of the area.

The parsimonious geochemical response of the Railroad Gulch-Stafford Gulch mineralization in the minus-80-mesh stream sediments, in contrast to the strong response seen in the data from the heavy-mineral concentrates from this area, strongly supports the effectiveness of multi-media geochemical surveys. Using only the minus-80-mesh stream-sediment information, this area would not have been identified as a likely target for further exploration. This is probably due to the mode of occurrence of the metallic constituents in these deposits. In general, the deposits in this area contain discrete blebs of gold, or metals contained in heavy minerals such as gahnite and chalcopyrite. This supports the utility of heavy-mineral concentrates for this and similar geochemical programs.

However, the minus-80-mesh stream-sediment samples provided a base-metal geochemical response just north of the fluorspar district which was not detected in the heavy-mineral concentrates. This response was from sample sites in arroyos predominantly draining Tertiary volcanic rocks and the Late Tertiary Dry Union Formation. Although little geochemical response was seen in the heavy-mineral concentrates, mineralogic studies of this fraction revealed gold flakes and pyrite in several samples from this area. High analytical detection limits and the "nugget effect" probably prohibited geochemical detection of gold in either sample fraction. Three follow-up heavy-mineral concentrate samples were taken from the Dry Union Formation in this area; each sample contained gold flakes and pyrite, and two of the samples contained secondary copper minerals. This mineralogical study provided evidence to support the hypothesis that the geochemical anomalies in the stream sediments and the mineralogical anomalies in the heavy-mineral concentrates could be attributed to the secondary dispersion of metals in the Dry Union Formation. Thus, the need for additional chemical analyses was eliminated.

Complementary use of both sample fractions was effective in locating and characterizing the geochemical response of the Browns Canyon fluorspar district, the Railroad Gulch-Stafford Gulch area, and the Dry Union Formation, as well as background variations due to lithology. Whereas the minus-80-mesh stream sediments are easy to collect and prepare for chemical analysis, the

heavy-mineral concentrates are highly effective in the enhancement of background/anomaly contrast and in identifying the geologic source of geochemical anomalies. These are achieved primarily through: (1) the removal of dilutent materials (especially quartz and feldspars), and (2) the ability to identify the mineral phases present. The concentration of accessory minerals and ore-related minerals may also raise the element concentrations above the analytical limits of detection.

Rapid multi-element chemical analyses of geochemical samples provides data for a large number of elements. Trace element anomalies and associations may assist in the identification of background lithology, mineralization, or alteration zones associated with mineralization. With the use of improved mineral deposit models and data interpretation techniques, more subtle coincidence of trace elements with geologic features has been used to detect concealed or low grade, disseminated mineral deposits.

Computer-aided data processing, machine plotting, and multivariate statistical techniques have greatly facilitated interpretation of these multi-element data sets. R-mode factor analysis was used to simplify the Browns Canyon data by identifying element associations which could then be plotted for evaluation with respect to underlying geology and known mineral deposits. Without the use of the computer, plotter, and R-mode factor analysis, data interpretation in the study area would have been slow and cumbersome, and subtle element associations probably would not have been identified. In addition, a large portion of the data from the multi-element analyses would have been neglected, as emphasis is normally placed on the "classical" suite of elements most directly associated with mineralization. The application of multivariate statistics to the data from the Browns Canyon study area assisted in full utilization of the data obtained in the geochemical program.

Transportation to the sample sites is normally the greatest expense of stream-sediment geochemical surveys, making multi-media sampling, multi-element chemical analyses, and multivariate statistics important tools in providing maximum exploitation of this initial expense. In the Browns Canyon area, all of the types of mineralization would not have been identified without the complementary use of the minus-80-mesh fraction and the heavy-mineral concentrates. The mineralized districts were targeted by anomalous concentrations of a limited number of elements, suggesting that extensive multi-element analyses, multivariate statistics, and machine plotting were unnecessary in this study. These geochemical techniques, however, were useful in identifying variations in lithology and in the identification of suitable host rocks, sparing the expense of detailed mapping over large "grassroots" areas. Efficient and effective identification of exploration targets is particularly important in the study of extensive or complex geologic terranes which are favorable for the presence of a variety of deposit types, as is often the case in regional mineral resource evaluation studies.

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APPENDIX A

Data Listings

Table A1.--Approximate lower limits of detection for inductively coupled plasma atomic emission spectroscopy (ICP-AES) analyses of minus-80-mesh stream sediments and semi-quantitative emission spectrographic (ES) analyses of heavy-mineral concentrates, in parts per million where not specified as percent. (-- indicates element not determined)

ELEMENT	ICP-AES	ES
Al	0.15	--
Fe	0.60	0.10%
Mg	0.60	0.05%
Ca	0.15	0.10%
Ti	0.20	0.005%
Mn	0.80	20
Ag	1.20	1
As	8.00	500
Au	--	20
B	0.40	20
Ba	0.02	50
Be	0.04	2
Bi	32.00	20
Cd	0.80	50
Ce	3.60	--
Co	8.00	10
Cr	4.00	20
Cu	0.60	10
La	4.00	50
Mo	1.60	10
Nb	4.00	50
Ni	4.00	10
P	16.00	--
Pb	8.00	20
Sb	10.00	200
Sn	8.00	20
Sr	0.16	200
V	0.60	20
W	12.00	100
Y	0.16	20
Zn	0.30	500
Zr	--	20
Th	--	200

Table A2.--Data from the inductively coupled plasma atomic emission spectroscopy analysis of minus-80-mesh stream-sediment samples. All values are reported in ppm. Samples having element contents not detectable or above upper detection limits were reported with the designations N and G, respectively. Samples having detectable element contents below stated detection limits were reported with the designation L. Relevant limits of detection are listed in table A1.

Table begins on next page.

Table A2.--Data fromICP-AES analysis of minus-80-mesh stream-sediment samples

Sample	AL	CA	FE	MG	AG	AS	B	BA	BE	BI
001	6100.00	57000.00	430 00.00	3300.00	1.20N	8.00N	0.40N	370.00	0.50	32.00N
002	5400.00	22000.00	400 00.00	2700.00	1.20N	8.00N	0.40N	150.00	0.57	32.00N
004	7400.00	18000.00	290 00.00	3900.00	1.20N	8.00N	0.40N	280.00	1.30	32.00N
005	4600.00	21000.00	96 00.00	2400.00	1.20N	8.00N	0.40N	260.00	0.92	32.00N
006	15000.00	23000.00	300 00.00	9500.00	1.20N	8.00N	0.40N	190.00	1.30	32.00N
007	7300.00	12000.00	330 00.00	3500.00	1.20N	8.00N	0.40N	330.00	1.60	32.00N
008	15000.00	16000.00	500 00.00	7000.00	1.20N	8.00N	0.40N	190.00	1.40	32.00N
009	9600.00	12000.00	270 00.00	4600.00	1.20N	8.00N	0.40N	310.00	1.70	32.00N
010	10000.00	18000.00	550 00.00	4300.00	1.20N	8.00N	0.40N	200.00	1.20	32.00N
011	7300.00	11000.00	280 00.00	3800.00	1.20N	8.00N	0.40N	290.00	1.60	32.00N
012	11000.00	11000.00	230 00.00	5700.00	1.20N	8.00N	0.40N	130.00	0.45	32.00N
013	11000.00	13000.00	250 00.00	5800.00	1.20N	8.00N	0.40N	140.00	0.53	32.00N
014	12000.00	12000.00	250 00.00	5100.00	1.20N	8.00N	0.40N	200.00	1.40	32.00N
015	12000.00	9400.00	230 00.00	5800.00	1.20N	8.00N	0.40N	120.00	0.68	32.00N
015	15000.00	7300.00	260 00.00	7100.00	1.20N	8.00N	0.40N	130.00	0.70	32.00N
016	11000.00	16000.00	240 00.00	5000.00	1.20N	8.00N	0.40N	340.00	1.70	32.00N
017	10000.00	14000.00	250 00.00	4900.00	1.20N	8.00N	0.40N	300.00	1.70	32.00N
018	20000.00	17000.00	270 00.00	5600.00	1.20N	8.00N	0.40N	350.00	1.60	32.00N
019	18000.00	16000.00	230 00.00	5100.00	1.20N	8.00N	0.40N	290.00	1.50	32.00N
020	16000.00	13000.00	360 00.00	6900.00	1.20N	8.00N	0.40N	140.00	1.10	32.00N
021	13000.00	10000.00	330 00.00	5700.00	1.20N	8.00N	0.40N	150.00	0.89	32.00N
022	17000.00	13000.00	310 00.00	8300.00	1.20N	8.00N	0.40N	210.00	1.10	32.00N
023	17000.00	11000.00	320 00.00	8900.00	1.20N	8.00N	0.40N	160.00	0.79	32.00N
024	21000.00	23000.00	800 00.00	11000.00	1.20N	8.00N	0.40N	120.00	0.75	32.00N
025	14000.00	7300.00	230 00.00	6100.00	1.20N	8.00N	0.40N	120.00	0.65	32.00N
026	15000.00	8900.00	260 00.00	7700.00	1.20N	8.00N	0.40N	130.00	0.70	32.00N
027	9700.00	11000.00	230 00.00	5200.00	1.20N	8.00N	0.40N	110.00	0.93	32.00N
028	13000.00	6700.00	280 00.00	6500.00	1.20N	8.00N	0.40N	170.00	0.71	32.00N
029	22000.00	24000.00	320 00.00	9300.00	1.20N	8.00N	0.40N	220.00	1.70	32.00N
030	13000.00	9600.00	280 00.00	4900.00	1.20N	8.00N	0.40N	170.00	1.00	32.00N
030	12000.00	8500.00	260 00.00	4700.00	1.20N	8.00N	0.40N	160.00	0.99	32.00N
031	9000.00	13000.00	420 00.00	4400.00	1.20N	8.00N	0.40N	160.00	1.00	32.00N
032	22000.00	23000.00	420 00.00	11000.00	1.20N	8.00N	0.40N	210.00	1.70	32.00N
033	15000.00	24000.00	530 00.00	7100.00	1.20N	8.00N	0.40N	120.00	0.51	32.00N
034	20000.00	20000.00	280 00.00	8300.00	1.20N	8.00N	0.40N	180.00	1.50	32.00N
035	11000.00	14000.00	460 00.00	4900.00	1.20N	8.00N	0.40N	390.00	1.90	32.00N
036	17000.00	9900.00	640 00.00	7700.00	1.20N	8.00N	0.40N	130.00	0.67	32.00N
037	15000.00	14000.00	540 00.00	6900.00	1.20N	8.00N	0.40N	110.00	0.53	32.00N
038	12000.00	10000.00	310 00.00	5700.00	1.20N	8.00N	0.40N	91.00	0.58	32.00N
039	16000.00	11000.00	370 00.00	7300.00	1.20N	8.00N	0.40N	120.00	0.62	32.00N
040	22000.00	12000.00	460 00.00	9300.00	1.20N	8.00N	0.40N	190.00	0.74	32.00N
041	17000.00	8900.00	370 00.00	7900.00	1.20N	8.00N	0.40N	160.00	0.67	32.00N
042	16000.00	9000.00	450 00.00	7400.00	1.20N	8.00N	0.40N	120.00	0.63	32.00N
043	20000.00	12000.00	380 00.00	10000.00	1.20N	8.00N	0.40N	160.00	0.74	32.00N
044	17000.00	9000.00	450 00.00	8000.00	1.20N	8.00N	0.40N	140.00	0.58	32.00N

Table A2.--Cont.

Sample	CE	CD	CO	CR	CU	LA	MN	MO	NB	NI
001	41.00	0.80N	9.20	32.00	7.70	22.00	7000.00	1.60N	9.10	6.60
002	78.00	0.80N	12.00	26.00	10.00	36.00	640.00	1.60N	7.40	7.90
004	68.00	2.40	13.00	39.00	17.00	33.00	840.00	1.70	11.00	11.00
005	88.00	1.50	8.00N	14.00	9.90	37.00	920.00	1.60N	4.00N	4.80
006	61.00	0.80N	17.00	36.00	26.00	35.00	900.00	1.60N	7.50	25.00
007	53.00	0.80N	13.00	23.00	33.00	30.00	1100.00	1.60N	5.60	10.00
008	140.00	0.80N	19.00	44.00	24.00	66.00	850.00	1.60N	12.00	13.00
009	55.00	0.80N	8.00N	25.00	35.00	31.00	1100.00	1.60N	4.00N	10.00
010	53.00	0.80N	8.00N	54.00	11.00	32.00	750.00	1.60N	13.00	10.00
011	52.00	0.80N	8.00N	22.00	36.00	30.00	1100.00	1.60N	4.00N	9.30
012	41.00	0.80N	8.00N	25.00	34.00	24.00	460.00	1.60N	7.50	8.90
013	55.00	0.80N	8.00N	25.00	29.00	32.00	500.00	1.60N	9.40	11.00
014	130.00	0.80N	8.00N	25.00	16.00	57.00	970.00	1.60N	6.00	12.00
015	66.00	0.80N	8.00N	29.00	23.00	39.00	640.00	1.60N	9.60	15.00
015	64.00	0.80N	8.00N	35.00	25.00	38.00	700.00	1.60N	12.00	17.00
016	65.00	0.95	16.00	23.00	35.00	35.00	1000.00	1.90	5.60	11.00
017	62.00	0.88	16.00	21.00	37.00	34.00	1100.00	2.20	5.30	11.00
018	120.00	0.80N	8.80	22.00	12.00	51.00	930.00	1.60N	8.90	6.80
019	120.00	0.80N	9.10	20.00	12.00	50.00	780.00	1.60N	8.50	6.70
020	180.00	0.80N	21.00	28.00	19.00	83.00	750.00	2.20	10.00	13.00
021	80.00	0.80N	20.00	28.00	32.00	42.00	450.00	2.50	11.00	15.00
022	71.00	0.96	17.00	30.00	41.00	38.00	650.00	1.60N	15.00	17.00
023	73.00	1.30	17.00	35.00	36.00	38.00	700.00	2.30	18.00	16.00
024	130.00	0.80N	21.00	88.00	29.00	66.00	720.00	1.60N	18.00	24.00
025	75.00	1.10	14.00	27.00	25.00	42.00	550.00	1.70	17.00	14.00
026	53.00	1.00	13.00	30.00	34.00	30.00	620.00	1.60N	17.00	14.00
027	41.00	0.80N	9.60	23.00	17.00	23.00	430.00	1.60N	7.70	9.70
028	62.00	0.80N	17.00	25.00	28.00	35.00	500.00	2.10	14.00	14.00
029	61.00	0.80N	15.00	24.00	28.00	35.00	620.00	1.60N	18.00	14.00
030	88.00	0.80N	10.00	17.00	22.00	50.00	390.00	1.60N	10.00	8.70
030	77.00	0.80N	12.00	17.00	21.00	44.00	370.00	1.60N	9.70	9.10
031	63.00	0.80N	10.00	23.00	12.00	34.00	510.00	1.60N	7.00	9.20
032	120.00	0.80N	21.00	53.00	29.00	61.00	920.00	1.60N	12.00	29.00
033	98.00	0.80N	15.00	49.00	17.00	49.00	470.00	1.60N	13.00	11.00
034	56.00	0.80N	16.00	26.00	25.00	30.00	520.00	2.00	16.00	13.00
035	75.00	0.80N	18.00	32.00	39.00	39.00	1200.00	2.00	8.00	13.00
036	71.00	0.80N	18.00	46.00	16.00	34.00	750.00	1.60N	14.00	13.00
037	120.00	0.80N	17.00	45.00	15.00	62.00	470.00	1.60N	13.00	13.00
038	100.00	0.80N	12.00	31.00	14.00	48.00	540.00	1.60N	9.70	11.00
039	130.00	0.80N	14.00	35.00	18.00	61.00	570.00	1.60N	13.00	12.00
040	81.00	0.80N	16.00	32.00	24.00	42.00	810.00	1.60N	13.00	14.00
041	71.00	0.80N	14.00	35.00	19.00	36.00	600.00	1.60N	11.00	15.00
042	61.00	0.80N	15.00	39.00	17.00	29.00	720.00	1.60N	11.00	12.00
043	68.00	0.80N	15.00	32.00	21.00	34.00	890.00	1.60N	12.00	13.00
044	74.00	0.80N	11.00	22.00	17.00	38.00	600.00	1.60N	9.30	9.90

Table A2.--Cont.

Sample	P	PB	SB	SN	SR	TI	V	W	Y	ZN
001	1300.00	24.00	10.00N	8.00N	220.00	360.00	74.00	12.00N	14.00	110.00
002	1600.00	22.00	10.00N	8.00N	69.00	370.00	78.00	12.00N	19.00	53.00
004	1000.00	44.00	10.00N	8.00N	140.00	130.00	110.00	38.00	14.00	59.00
005	1000.00	25.00	10.00N	8.00N	120.00	84.00	37.00	15.00	17.00	35.00
006	1500.00	48.00	10.00N	8.00N	48.00	230.00	37.00	12.00N	16.00	89.00
007	1200.00	100.00	10.00N	8.00N	64.00	64.00	49.00	12.00N	8.00	140.00
008	2300.00	48.00	10.00N	8.00N	49.00	420.00	86.00	12.00N	37.00	90.00
009	930.00	88.00	10.00N	8.00N	72.00	110.00	40.00	12.00N	7.50	150.00
010	1000.00	60.00	10.00N	8.00N	130.00	150.00	130.00	12.00N	5.20	70.00
011	1400.00	97.00	10.00N	8.00N	53.00	86.00	38.00	12.00N	8.70	140.00
012	1300.00	26.00	10.00N	8.00N	22.00	750.00	38.00	12.00N	15.00	73.00
013	1600.00	42.00	10.00N	8.00N	32.00	720.00	40.00	12.00N	17.00	80.00
014	1200.00	51.00	10.00N	8.00N	71.00	180.00	41.00	12.00N	23.00	80.00
015	840.00	47.00	10.00N	8.00N	41.00	870.00	32.00	12.00N	12.00	61.00
015	470.00	48.00	10.00N	8.00N	41.00	1400.00	35.00	12.00N	9.10	90.00
016	1100.00	92.00	10.00N	8.00N	100.00	110.00	32.00	12.00N	11.00	150.00
017	1000.00	93.00	10.00N	8.00N	76.00	130.00	31.00	12.00N	8.80	150.00
018	840.00	44.00	10.00N	8.00N	210.00	390.00	48.00	12.00N	19.00	72.00
019	860.00	42.00	10.00N	8.00N	170.00	340.00	42.00	12.00N	18.00	87.00
020	2200.00	43.00	10.00N	8.00N	23.00	970.00	44.00	12.00N	42.00	89.00
021	1000.00	58.00	10.00N	8.00N	35.00	480.00	50.00	12.00N	10.00	82.00
022	820.00	68.00	10.00N	8.00N	46.00	830.00	46.00	12.00N	9.20	110.00
023	1200.00	79.00	10.00N	8.00N	31.00	1300.00	48.00	12.00N	17.00	130.00
024	3900.00	63.00	10.00N	8.00N	27.00	1100.00	130.00	12.00N	46.00	110.00
025	750.00	69.00	10.00N	8.00N	24.00	1200.00	39.00	12.00N	9.10	93.00
026	690.00	58.00	10.00N	8.00N	23.00	1400.00	41.00	12.00N	8.60	100.00
027	890.00	32.00	10.00N	8.00N	50.00	330.00	40.00	12.00N	6.10	90.00
028	790.00	64.00	10.00N	8.00N	22.00	1000.00	38.00	12.00N	6.60	89.00
029	570.00	57.00	10.00N	8.00N	89.00	680.00	41.00	12.00N	8.00	100.00
030	670.00	48.00	10.00N	8.00N	29.00	520.00	29.00	12.00N	7.50	73.00
030	570.00	46.00	10.00N	8.00N	28.00	540.00	27.00	12.00N	6.30	71.00
031	830.00	33.00	10.00N	8.00N	65.00	150.00	60.00	12.00N	8.90	120.00
032	2200.00	32.00	10.00N	8.00N	50.00	810.00	64.00	12.00N	37.00	93.00
033	3400.00	34.00	10.00N	8.00N	42.00	1000.00	83.00	12.00N	55.00	71.00
034	520.00	51.00	10.00N	8.00N	73.00	680.00	39.00	12.00N	7.10	88.00
035	1400.00	110.00	10.00N	8.00N	76.00	170.00	68.00	12.00N	8.80	170.00
036	2000.00	40.00	10.00N	8.00N	24.00	1300.00	90.00	12.00N	37.00	92.00
037	3300.00	36.00	10.00N	8.00N	20.00	1100.00	80.00	12.00N	50.00	70.00
038	2300.00	33.00	10.00N	8.00N	20.00	730.00	47.00	12.00N	41.00	70.00
039	2300.00	40.00	10.00N	8.00N	20.00	1100.00	57.00	12.00N	43.00	80.00
040	1700.00	44.00	10.00N	8.00N	39.00	2000.00	64.00	12.00N	30.00	100.00
041	1300.00	34.00	10.00N	8.00N	25.00	1000.00	56.00	12.00N	21.00	82.00
042	1800.00	36.00	10.00N	8.00N	22.00	1200.00	71.00	12.00N	34.00	87.00
043	1300.00	42.00	10.00N	8.00N	30.00	1400.00	52.00	12.00N	26.00	100.00
044	1600.00	26.00	10.00N	8.00N	21.00	1400.00	55.00	12.00N	34.00	79.00

Table A2.--Cont.

Sample	AL	CA	FE	MG	AG	AS	B	BA	BE	BI
045	10000.00	17000.00	1300 00.00	5300.00	1.20N	8.00N	0.40N	130.00	0.52	32.00N
045	13000.00	15000.00	720 00.00	7600.00	1.20N	8.00N	0.40N	160.00	0.54	32.00N
046	8800.00	21000.00	1400 00.00	5000.00	1.20N	8.00N	0.40N	120.00	0.44	32.00N
047	18000.00	17000.00	430 00.00	11000.00	1.20N	8.00N	0.40N	270.00	0.65	32.00N
048	17000.00	21000.00	550 00.00	11000.00	1.20N	8.00N	0.40N	210.00	0.66	32.00N
049	16000.00	20000.00	580 00.00	10000.00	1.20N	8.00N	0.40N	210.00	0.69	32.00N
050	7000.00	12000.00	250 00.00	6900.00	1.20N	8.00N	0.40N	83.00	0.32	32.00N
051	6100.00	3000.00	200 00.00	3000.00	1.20N	8.00N	0.40N	100.00	0.53	32.00N
052	6700.00	13000.00	210 00.00	7300.00	1.20N	8.00N	0.40N	84.00	0.35	32.00N
053	16000.00	12000.00	410 00.00	7500.00	1.20N	8.00N	0.40N	110.00	0.71	32.00N
055	5800.00	11000.00	310 00.00	5800.00	1.20N	8.00N	0.40N	68.00	0.32	32.00N
056	10000.00	2600.00	200 00.00	5800.00	1.20N	8.00N	0.40N	95.00	0.41	32.00N
057	5500.00	11000.00	230 00.00	6300.00	1.20N	8.00N	0.40N	66.00	0.27	32.00N
058	7700.00	12000.00	220 00.00	7500.00	1.20N	8.00N	0.40N	83.00	0.33	32.00N
059	11000.00	6400.00	300 00.00	5100.00	1.20N	8.00N	0.40N	100.00	0.57	32.00N
060	8200.00	3700.00	200 00.00	2700.00	1.20N	8.00N	0.40N	110.00	0.64	32.00N
060	8900.00	3700.00	210 00.00	2900.00	1.20N	8.00N	0.40N	110.00	0.62	32.00N
061	8300.00	13000.00	230 00.00	8000.00	1.20N	8.00N	0.40N	83.00	0.33	32.00N
062	12000.00	5900.00	300 00.00	6100.00	1.20N	8.00N	0.40N	110.00	0.71	32.00N
063	8800.00	21000.00	350 00.00	8900.00	1.20N	8.00N	0.40N	100.00	0.40	32.00N
064	12000.00	5900.00	410 00.00	6700.00	1.20N	8.00N	0.40N	110.00	0.63	32.00N
065	13000.00	5800.00	310 00.00	6900.00	1.20N	8.00N	0.40N	99.00	0.48	32.00N
066	13000.00	5900.00	380 00.00	6500.00	1.20N	8.00N	0.40N	100.00	0.56	32.00N
067	17000.00	9500.00	300 00.00	9900.00	1.20N	8.00N	0.40N	100.00	1.00	32.00N
068	17000.00	7200.00	310 00.00	8700.00	1.20N	8.00N	0.40N	220.00	1.00	32.00N
069	10000.00	19000.00	190 00.00	7200.00	1.20N	8.00N	0.40N	120.00	0.46	32.00N
070	12000.00	9300.00	370 00.00	6400.00	1.20N	8.00N	0.40N	110.00	0.69	32.00N
071	12000.00	9700.00	310 00.00	5900.00	1.20N	8.00N	0.40N	100.00	0.51	32.00N
072	11000.00	14000.00	390 00.00	5600.00	1.20N	8.00N	0.40N	110.00	0.61	32.00N
073	15000.00	11000.00	400 00.00	6600.00	1.20N	8.00N	0.40N	80.00	0.67	32.00N
074	17000.00	15000.00	1400 00.00	6300.00	1.20N	8.00N	0.40N	110.00	0.79	32.00N
075	16000.00	8600.00	370 00.00	6700.00	1.20N	8.00N	0.40N	110.00	0.62	32.00N
075	15000.00	7400.00	350 00.00	6600.00	1.20N	8.00N	0.40N	110.00	0.58	32.00N
076	11000.00	9600.00	620 00.00	5100.00	1.20N	8.00N	0.40N	73.00	0.55	32.00N
077	15000.00	15000.00	420 00.00	8700.00	1.20N	8.00N	0.40N	100.00	0.73	32.00N
078	14000.00	11000.00	420 00.00	6200.00	1.20N	8.00N	0.40N	82.00	0.61	32.00N
079	12000.00	15000.00	350 00.00	8400.00	1.20N	8.00N	0.40N	75.00	0.59	32.00N
080	17000.00	4900.00	310 00.00	7400.00	1.20N	8.00N	0.40N	170.00	0.98	32.00N
081	9200.00	3800.00	230 00.00	4500.00	1.20N	8.00N	0.40N	77.00	0.39	32.00N
082	10000.00	6600.00	410 00.00	5000.00	1.20N	8.00N	0.40N	110.00	0.52	32.00N
083	12000.00	7800.00	260 00.00	5600.00	1.20N	8.00N	0.40N	130.00	0.66	32.00N
084	12000.00	6700.00	310 00.00	5700.00	1.20N	8.00N	0.40N	100.00	0.47	32.00N
085	15000.00	9700.00	400 00.00	6800.00	1.20N	8.00N	0.40N	120.00	0.74	32.00N
086	20000.00	9300.00	540 00.00	9100.00	1.20N	8.00N	0.40N	160.00	0.87	32.00N
087	17000.00	11000.00	440 00.00	7300.00	1.20N	8.00N	0.40N	140.00	0.80	32.00N

TableA2.--Cont.

Sample	CE	CD	CO	CR	CU	LA	MN	MO	NB	NI
045	54.00	0.80N	14.00	88.00	5.90	28.00	440.00	1.60N	17.00	16.00
045	51.00	0.80N	16.00	45.00	11.00	26.00	490.00	1.60N	12.00	15.00
046	46.00	0.80N	18.00	98.00	5.10	24.00	360.00	1.60N	19.00	17.00
047	48.00	0.80N	17.00	36.00	21.00	24.00	620.00	1.60N	12.00	17.00
048	54.00	0.80N	17.00	43.00	19.00	27.00	590.00	1.60N	12.00	17.00
049	57.00	0.80N	17.00	47.00	19.00	27.00	630.00	1.60N	12.00	17.00
050	35.00	0.80N	8.40	23.00	14.00	18.00	340.00	1.60N	7.10	8.20
051	67.00	0.80N	9.80	15.00	11.00	25.00	460.00	1.60	6.50	6.10
052	46.00	0.80N	11.00	21.00	14.00	22.00	340.00	1.60N	7.10	8.10
053	140.00	0.80N	18.00	27.00	21.00	69.00	540.00	1.60	11.00	11.00
055	45.00	0.80N	10.00	29.00	12.00	22.00	300.00	1.60N	8.00	7.50
056	36.00	0.80N	9.10	19.00	18.00	19.00	370.00	1.60N	6.70	7.60
057	32.00	0.80N	9.80	26.00	13.00	17.00	280.00	1.60N	7.20	7.60
058	33.00	0.80N	8.00N	26.00	19.00	18.00	320.00	1.60N	6.80	8.70
059	82.00	0.80N	8.00N	24.00	14.00	39.00	500.00	1.60N	7.70	15.00
060	100.00	0.80N	8.00N	16.00	9.40	46.00	600.00	1.60N	5.40	28.00
060	100.00	0.80N	8.00N	14.00	7.10	45.00	590.00	1.60N	5.40	4.40
061	52.00	0.80N	8.00N	25.00	13.00	18.00	370.00	1.60N	7.10	7.70
062	36.00	0.80N	8.00N	30.00	31.00	19.00	470.00	1.60N	9.70	21.00
063	42.00	0.80N	9.00	40.00	17.00	23.00	590.00	1.60N	10.00	10.00
064	38.00	0.80N	8.40	35.00	25.00	20.00	470.00	1.60N	11.00	13.00
065	40.00	0.80N	8.00N	30.00	25.00	20.00	400.00	1.60N	10.00	13.00
066	37.00	0.80N	11.00	49.00	70.00	19.00	420.00	1.60N	11.00	17.00
067	47.00	0.80N	13.00	78.00	40.00	23.00	620.00	1.60N	10.00	28.00
068	47.00	0.80N	15.00	36.00	36.00	25.00	940.00	1.60N	17.00	21.00
069	35.00	0.80N	8.10	19.00	19.00	19.00	360.00	1.60N	11.00	23.00
070	94.00	0.80N	14.00	28.00	18.00	44.00	580.00	1.60N	11.00	12.00
071	76.00	0.80N	9.40	23.00	14.00	37.00	510.00	1.60N	8.90	9.30
072	99.00	0.80N	11.00	34.00	18.00	46.00	540.00	1.60N	10.00	11.00
073	140.00	0.80N	16.00	23.00	16.00	67.00	670.00	1.60N	10.00	9.30
074	170.00	0.80N	19.00	70.00	9.90	80.00	770.00	1.60N	21.00	13.00
075	110.00	0.80N	13.00	30.00	13.00	52.00	640.00	1.60N	11.00	12.00
075	100.00	0.80N	15.00	26.00	12.00	49.00	620.00	1.60N	11.00	11.00
076	110.00	0.80N	14.00	44.00	14.00	48.00	490.00	1.60	13.00	22.00
077	96.00	0.80N	16.00	27.00	14.00	45.00	630.00	1.60N	12.00	12.00
078	130.00	0.80N	15.00	28.00	14.00	56.00	550.00	1.60N	11.00	11.00
079	85.00	0.80N	9.90	27.00	8.30	40.00	510.00	1.60N	9.80	10.00
080	46.00	0.80N	8.00N	33.00	28.00	24.00	660.00	1.60N	15.00	14.00
081	49.00	0.80N	8.00N	22.00	16.00	26.00	330.00	1.60N	7.50	7.40
082	65.00	1.70	11.00	65.00	40.00	32.00	540.00	2.00	15.00	11.00
083	40.00	0.80N	8.90	26.00	23.00	20.00	460.00	1.60N	8.70	13.00
084	85.00	0.80N	11.00	21.00	15.00	39.00	470.00	1.60N	9.50	15.00
085	96.00	0.80N	11.00	23.00	13.00	45.00	670.00	1.60N	11.00	10.00
086	100.00	0.80N	15.00	26.00	20.00	53.00	820.00	1.60N	15.00	17.00
087	100.00	0.80N	12.00	23.00	19.00	50.00	710.00	1.60N	12.00	12.00

Table A2.--Cont.

Sample	P	PB	SB	SN	SR	TI	V	W	Y	ZN
045	3200.00	22.00	10.00N	8.00N	30.00	630.00	190.00	12.00N	4.00	59.00
045	2700.00	25.00	10.00N	8.00N	32.00	800.00	110.00	12.00N	10.00	70.00
046	4700.00	19.00	10.00N	8.00N	30.00	650.00	230.00	12.00N	0.16N	52.00
047	2900.00	44.00	10.00N	8.00N	44.00	1100.00	77.00	12.00N	9.00	96.00
048	2300.00	38.00	10.00N	8.00N	55.00	1000.00	84.00	12.00N	10.00	88.00
049	2400.00	41.00	10.00N	8.00N	54.00	910.00	87.00	12.00N	11.00	90.00
050	560.00	14.00	10.00N	8.00N	19.00	500.00	45.00	12.00N	7.40	38.00
051	360.00	25.00	10.00N	8.00N	14.00	280.00	31.00	12.00N	9.30	47.00
052	840.00	14.00	10.00N	8.00N	19.00	430.00	35.00	12.00N	11.00	39.00
053	1900.00	53.00	10.00N	8.00N	21.00	920.00	48.00	12.00N	32.00	110.00
055	830.00	12.00	10.00N	8.00N	15.00	460.00	60.00	12.00N	9.70	34.00
056	320.00	15.00	10.00N	8.00N	10.00	790.00	25.00	12.00N	7.80	63.00
057	550.00	11.00	10.00N	8.00N	15.00	380.00	48.00	12.00N	7.00	30.00
058	510.00	11.00	10.00N	8.00N	18.00	570.00	38.00	12.00N	7.10	39.00
059	1100.00	25.00	10.00N	8.00N	14.00	850.00	40.00	12.00N	25.00	66.00
060	540.00	30.00	10.00N	8.00N	14.00	370.00	28.00	12.00N	19.00	60.00
060	530.00	30.00	10.00N	8.00N	14.00	440.00	27.00	12.00N	19.00	53.00
061	510.00	9.90	10.00N	8.00N	20.00	610.00	42.00	12.00N	7.30	39.00
062	710.00	27.00	10.00N	8.00N	16.00	680.00	50.00	12.00N	9.90	64.00
063	710.00	13.00	10.00N	8.00N	31.00	620.00	77.00	12.00N	9.10	44.00
064	660.00	26.00	10.00N	8.00N	18.00	840.00	69.00	12.00N	7.90	63.00
065	660.00	23.00	10.00N	8.00N	17.00	840.00	57.00	12.00N	7.90	59.00
066	710.00	30.00	10.00N	8.00N	15.00	810.00	71.00	12.00N	7.50	70.00
067	480.00	42.00	10.00N	8.00N	20.00	720.00	42.00	12.00N	15.00	79.00
068	490.00	71.00	10.00N	8.00N	22.00	1000.00	42.00	12.00N	15.00	120.00
069	410.00	31.00	10.00N	8.00N	65.00	680.00	26.00	12.00N	8.90	81.00
070	1500.00	35.00	10.00N	8.00N	21.00	720.00	48.00	12.00N	32.00	77.00
071	1500.00	27.00	10.00N	8.00N	19.00	930.00	40.00	12.00N	29.00	69.00
072	3200.00	32.00	10.00N	8.00N	18.00	730.00	59.00	12.00N	57.00	70.00
073	2200.00	44.00	10.00N	8.00N	18.00	1400.00	52.00	12.00N	62.00	82.00
074	2900.00	51.00	10.00N	8.00N	23.00	1500.00	200.00	12.00N	69.00	82.00
075	1400.00	43.00	10.00N	8.00N	19.00	1800.00	62.00	12.00N	48.00	76.00
075	1100.00	41.00	10.00N	8.00N	17.00	1700.00	54.00	12.00N	42.00	75.00
076	1800.00	37.00	10.00N	8.00N	15.00	1200.00	110.00	12.00N	45.00	96.00
077	1500.00	35.00	10.00N	8.00N	25.00	1500.00	63.00	12.00N	44.00	80.00
078	1800.00	34.00	10.00N	8.00N	14.00	1600.00	66.00	12.00N	57.00	64.00
079	1200.00	21.00	10.00N	8.00N	21.00	1300.00	63.00	12.00N	33.00	63.00
080	390.00	44.00	10.00N	8.00N	19.00	1100.00	42.00	12.00N	13.00	92.00
081	680.00	13.00	10.00N	8.00N	10.00	800.00	42.00	12.00N	11.00	51.00
082	800.00	27.00	10.00N	8.00N	20.00	900.00	130.00	49.00	14.00	72.00
083	540.00	27.00	10.00N	8.00N	26.00	520.00	42.00	12.00N	9.00	61.00
084	1400.00	31.00	10.00N	8.00N	16.00	1100.00	46.00	12.00N	30.00	70.00
085	1200.00	42.00	10.00N	8.00N	27.00	1200.00	57.00	12.00N	37.00	88.00
086	1200.00	65.00	10.00N	8.00N	36.00	2100.00	74.00	12.00N	44.00	110.00
087	1200.00	55.00	10.00N	8.00N	37.00	1200.00	61.00	12.00N	41.00	98.00

TableA2.--Cont.

Sample	AL	CA	FE	MG	AG	AS	B	BA	BE	BI
088	15000.00	10000.00	53000.00	5500.00	1.20N	8.00N	0.40N	90.00	0.61	32.00N
089	15000.00	9500.00	47000.00	6000.00	1.20N	8.00N	0.40N	94.00	0.63	32.00N
090	12000.00	5700.00	36000.00	5000.00	1.20N	8.00N	0.40N	83.00	0.47	32.00N
090	12000.00	6900.00	45000.00	5000.00	1.20N	8.00N	0.40N	88.00	0.50	32.00N
091	15000.00	6700.00	46000.00	7300.00	1.20N	8.00N	0.40N	110.00	0.65	32.00N
092	4300.00	13000.00	410000.00	1600.00	1.20N	8.00N	0.40N	48.00	0.43	32.00N
093	13000.00	10000.00	30000.00	5100.00	1.20N	8.00N	0.40N	110.00	0.46	32.00N
094	13000.00	11000.00	66000.00	4800.00	1.20N	8.00N	0.40N	110.00	0.52	32.00N
095	12000.00	8800.00	31000.00	4300.00	1.20N	8.00N	0.40N	94.00	0.45	32.00N
096	14000.00	12000.00	32000.00	5300.00	1.20N	8.00N	0.40N	110.00	0.49	32.00N
097	17000.00	9100.00	40000.00	6800.00	1.20N	8.00N	0.40N	150.00	0.64	32.00N
098	11000.00	4800.00	31000.00	5800.00	1.20N	8.00N	0.40N	100.00	0.47	32.00N
099	9500.00	4400.00	29000.00	5200.00	1.20N	8.00N	0.40N	92.00	0.43	32.00N
100	14000.00	3400.00	30000.00	8500.00	1.20N	8.00N	0.40N	130.00	0.58	32.00N
101	8900.00	8000.00	23000.00	4500.00	1.20N	8.00N	0.40N	91.00	0.42	32.00N
102	15000.00	3500.00	29000.00	9600.00	1.20N	8.00N	0.40N	140.00	0.61	32.00N
103	19000.00	21000.00	57000.00	8400.00	1.20N	8.00N	0.40N	200.00	0.92	32.00N
104	8700.00	18000.00	160000.00	5200.00	1.20N	8.00N	0.40N	120.00	0.53	32.00N
105	6200.00	13000.00	250000.00	3300.00	1.20N	8.00N	0.40N	85.00	0.48	32.00N
105	6200.00	14000.00	220000.00	3300.00	1.20N	8.00N	0.40N	86.00	0.45	32.00N
106	13000.00	16000.00	92000.00	7500.00	1.20N	8.00N	0.40N	170.00	0.56	32.00N
107	11000.00	16000.00	110000.00	7200.00	1.20N	8.00N	0.40N	140.00	0.52	32.00N
108	15000.00	14000.00	83000.00	11000.00	1.20N	8.00N	0.40N	180.00	0.74	32.00N
109	19000.00	14000.00	51000.00	14000.00	1.20N	8.00N	0.40N	280.00	0.72	32.00N
110	15000.00	15000.00	71000.00	10000.00	1.20N	8.00N	0.40N	190.00	0.66	32.00N
111	15000.00	17000.00	45000.00	11000.00	1.20N	8.00N	0.40N	180.00	0.59	32.00N
112	18000.00	6600.00	32000.00	8100.00	1.20N	8.00N	0.40N	150.00	0.99	32.00N
113	14000.00	9100.00	33000.00	7400.00	1.20N	8.00N	0.40N	120.00	0.56	32.00N
114	16000.00	8900.00	31000.00	8400.00	1.20N	8.00N	0.40N	140.00	0.67	32.00N
115	13000.00	9100.00	31000.00	5900.00	1.20N	8.00N	0.40N	100.00	0.54	32.00N
116	11000.00	6700.00	76000.00	4800.00	1.20N	8.00N	0.40N	97.00	0.59	32.00N
117	10000.00	14000.00	67000.00	7400.00	1.20N	8.00N	0.40N	74.00	0.59	32.00N
118	11000.00	15000.00	100000.00	7000.00	1.20N	8.00N	0.40N	80.00	0.65	32.00N
119	12000.00	7200.00	44000.00	6100.00	1.20N	8.00N	0.40N	88.00	0.61	32.00N
120	18000.00	8700.00	33000.00	8000.00	1.20N	8.00N	0.40N	130.00	0.90	32.00N
120	18000.00	8400.00	40000.00	8100.00	1.20N	8.00N	0.40N	130.00	0.90	32.00N
121	16000.00	17000.00	40000.00	9500.00	1.20N	8.00N	0.40N	140.00	0.76	32.00N
122	12000.00	18000.00	33000.00	6500.00	1.20N	8.00N	0.40N	95.00	0.55	32.00N
123	13000.00	12000.00	40000.00	5900.00	1.20N	8.00N	0.40N	87.00	0.86	32.00N
124	17000.00	7500.00	44000.00	7300.00	1.20N	8.00N	0.40N	120.00	0.88	32.00N
125	5000.00	4200.00	14000.00	2200.00	1.20N	8.00N	0.40N	110.00	0.67	32.00N
126	8800.00	9300.00	28000.00	4400.00	1.20N	10.00	0.40N	79.00	0.82	32.00N
127	12000.00	13000.00	55000.00	6100.00	1.20N	8.00N	0.40N	89.00	0.55	32.00N
128	11000.00	8700.00	23000.00	5800.00	1.20N	8.00N	0.40N	100.00	0.61	32.00N
129	12000.00	7700.00	27000.00	6600.00	1.20N	8.00N	0.40N	120.00	0.64	32.00N

Table A2.--Cont.

Sample	CE	CD	CO	CR	CU	LA	MN	MO	NB	NI
088	130.00	0.80N	15.00	26.00	14.00	61.00	620.00	1.60N	11.00	8.80
089	130.00	0.80N	16.00	19.00	15.00	62.00	660.00	1.60N	10.00	9.30
090	76.00	0.80N	15.00	20.00	10.00	38.00	430.00	1.70	10.00	8.70
090	84.00	0.80N	11.00	27.00	9.70	42.00	450.00	1.60N	11.00	8.70
091	89.00	0.80N	15.00	25.00	15.00	44.00	660.00	1.60N	11.00	10.00
092	33.00	0.80N	10.00	210.00	0.60N	25.00	290.00	1.60N	37.00	24.00
093	100.00	0.80N	13.00	20.00	15.00	49.00	510.00	1.60N	9.30	8.10
094	99.00	0.80N	15.00	39.00	14.00	49.00	510.00	1.60N	14.00	11.00
095	94.00	0.80N	14.00	22.00	16.00	48.00	420.00	1.70	9.80	9.70
096	110.00	0.80N	15.00	21.00	15.00	55.00	520.00	1.60N	10.00	8.80
097	100.00	0.80N	12.00	29.00	20.00	52.00	640.00	1.60N	12.00	14.00
098	57.00	0.80N	8.00N	26.00	48.00	30.00	450.00	1.60N	11.00	8.50
099	52.00	0.80N	8.20	25.00	48.00	27.00	400.00	1.60N	11.00	7.80
100	57.00	0.80N	9.20	25.00	95.00	29.00	660.00	1.60N	14.00	9.40
101	50.00	0.80N	8.70	24.00	13.00	27.00	370.00	1.60N	9.10	8.20
102	57.00	0.80N	8.40	25.00	120.00	27.00	660.00	1.60N	16.00	9.30
103	80.00	0.80N	19.00	54.00	31.00	43.00	480.00	1.60N	17.00	16.00
104	51.00	0.80N	20.00	160.00	6.30	27.00	360.00	1.60N	23.00	20.00
105	28.00	0.60N	20.00	230.00	0.60N	19.00	300.00	1.60N	31.00	23.00
105	29.00	0.80N	18.00	200.00	0.60N	18.00	290.00	1.60N	27.00	21.00
106	49.00	0.80N	17.00	99.00	11.00	26.00	440.00	1.60N	17.00	18.00
107	53.00	0.80N	17.00	110.00	8.40	28.00	440.00	1.60N	18.00	17.00
108	70.00	0.80N	22.00	87.00	15.00	33.00	580.00	1.60N	16.00	20.00
109	51.00	0.80N	22.00	53.00	22.00	26.00	710.00	1.60N	14.00	22.00
110	60.00	0.80N	19.00	72.00	15.00	30.00	560.00	1.60N	15.00	19.00
111	54.00	0.80N	16.00	49.00	16.00	27.00	530.00	1.60N	11.00	17.00
112	99.00	0.82	17.00	35.00	19.00	47.00	810.00	1.60N	13.00	18.00
113	62.00	0.80N	16.00	29.00	16.00	31.00	610.00	1.60N	10.00	12.00
114	75.00	0.80N	14.00	28.00	19.00	38.00	710.00	1.60N	10.00	13.00
115	120.00	0.80N	13.00	24.00	14.00	55.00	590.00	1.60N	9.60	9.20
116	66.00	0.80N	14.00	51.00	8.30	34.00	520.00	1.60N	14.00	11.00
117	95.00	0.80N	15.00	49.00	9.90	46.00	510.00	1.60N	13.00	12.00
118	93.00	0.80N	15.00	67.00	7.70	45.00	550.00	1.60N	17.00	12.00
119	94.00	0.80N	14.00	34.00	12.00	44.00	560.00	1.60N	10.00	11.00
120	94.00	0.80N	12.00	31.00	18.00	45.00	750.00	1.60N	11.00	13.00
120	98.00	0.80N	15.00	28.00	18.00	45.00	760.00	1.60N	11.00	13.00
121	83.00	0.80N	18.00	33.00	16.00	41.00	720.00	1.80	12.00	14.00
122	87.00	0.80N	15.00	27.00	13.00	43.00	520.00	1.60N	10.00	12.00
123	150.00	0.80N	15.00	24.00	18.00	70.00	700.00	1.90	9.80	8.70
124	100.00	0.80N	15.00	29.00	18.00	49.00	780.00	1.60N	12.00	10.00
125	130.00	0.80N	12.00	11.00	6.80	46.00	560.00	2.60	5.20	4.50
126	93.00	0.80N	16.00	25.00	13.00	46.00	480.00	4.20	7.60	7.40
127	120.00	0.80N	22.00	42.00	13.00	54.00	440.00	2.20	12.00	10.00
128	110.00	0.80N	19.00	23.00	16.00	53.00	500.00	2.50	9.60	9.80
129	100.00	0.80N	18.00	26.00	16.00	50.00	560.00	2.40	9.80	10.00

Table A2.--Cont.

Sample	P	PB	SB	SN	SR	TI	V	W	Y	ZN
088	1900.00	36.00	10.00N	8.00N	20.00	1400.00	73.00	12.00N	52.00	82.00
089	1700.00	37.00	10.00N	8.00N	20.00	1400.00	62.00	12.00N	49.00	87.00
090	930.00	33.00	10.00N	8.00N	12.00	1300.00	54.00	12.00N	26.00	63.00
090	1200.00	29.00	10.00N	8.00N	13.00	1300.00	69.00	12.00N	30.00	65.00
091	1100.00	35.00	10.00N	8.00N	17.00	1600.00	63.00	12.00N	35.00	89.00
092	2700.00	14.00	10.00N	8.00N	20.00	480.00	520.00	12.00N	0.16N	29.00
093	1900.00	34.00	10.00N	8.00N	20.00	1100.00	40.00	12.00N	42.00	68.00
094	2400.00	31.00	10.00N	8.00N	20.00	1000.00	97.00	12.00N	39.00	62.00
095	1800.00	28.00	10.00N	8.00N	17.00	930.00	44.00	12.00N	31.00	57.00
096	2200.00	35.00	10.00N	8.00N	22.00	1100.00	43.00	12.00N	47.00	71.00
097	1500.00	40.00	10.00N	8.00N	24.00	1200.00	55.00	12.00N	33.00	87.00
098	770.00	27.00	10.00N	8.00N	16.00	630.00	49.00	12.00N	13.00	91.00
099	810.00	22.00	10.00N	8.00N	13.00	590.00	47.00	12.00N	13.00	81.00
100	420.00	29.00	10.00N	8.00N	16.00	730.00	43.00	12.00N	9.80	150.00
101	970.00	21.00	10.00N	8.00N	22.00	520.00	45.00	12.00N	15.00	52.00
102	370.00	33.00	10.00N	8.00N	17.00	800.00	40.00	12.00N	9.50	170.00
103	2200.00	44.00	10.00N	8.00N	38.00	1200.00	110.00	12.00N	26.00	85.00
104	4100.00	27.00	10.00N	8.00N	27.00	670.00	260.00	12.00N	0.16N	160.00
105	3100.00	13.00	10.00N	8.00N	19.00	540.00	400.00	12.00N	0.16N	42.00
105	3500.00	14.00	10.00N	8.00N	21.00	490.00	350.00	12.00N	0.16N	43.00
106	3500.00	26.00	10.00N	8.00N	31.00	1000.00	170.00	12.00N	5.40	73.00
107	3600.00	20.00	10.00N	8.00N	29.00	910.00	200.00	12.00N	5.60	67.00
108	3100.00	25.00	10.00N	8.00N	28.00	1000.00	140.00	12.00N	16.00	89.00
109	2600.00	41.00	10.00N	8.00N	33.00	1500.00	88.00	12.00N	14.00	110.00
110	3200.00	24.00	10.00N	8.00N	29.00	1200.00	130.00	12.00N	15.00	87.00
111	3100.00	24.00	10.00N	8.00N	34.00	1200.00	86.00	12.00N	16.00	89.00
112	980.00	57.00	10.00N	8.00N	25.00	1500.00	46.00	12.00N	43.00	110.00
113	1400.00	38.00	10.00N	8.00N	23.00	1100.00	51.00	13.00	30.00	84.00
114	1100.00	39.00	10.00N	8.00N	27.00	1300.00	47.00	12.00	32.00	98.00
115	1800.00	40.00	10.00N	8.00N	21.00	1400.00	52.00	13.00	47.00	82.00
116	990.00	33.00	10.00N	8.00N	21.00	930.00	120.00	12.00N	23.00	68.00
117	1300.00	22.00	10.00N	8.00N	19.00	1000.00	110.00	12.00N	31.00	67.00
118	1600.00	23.00	10.00N	8.00N	22.00	1100.00	170.00	12.00N	35.00	70.00
119	1400.00	32.00	10.00N	8.00N	16.00	870.00	68.00	12.00N	36.00	75.00
120	1300.00	44.00	10.00N	8.00N	27.00	1100.00	57.00	12.00N	40.00	100.00
120	1200.00	46.00	10.00N	8.00N	26.00	1100.00	57.00	12.00N	39.00	100.00
121	1100.00	36.00	10.00N	8.00N	38.00	1500.00	62.00	12.00N	31.00	94.00
122	1800.00	32.00	10.00N	8.00N	33.00	1100.00	53.00	12.00N	40.00	75.00
123	2000.00	50.00	10.00N	8.00N	28.00	830.00	49.00	12.00N	62.00	110.00
124	1600.00	56.00	10.00N	8.00N	22.00	1400.00	55.00	12.00N	47.00	100.00
125	840.00	30.00	10.00N	8.00N	14.00	200.00	21.00	12.00N	23.00	44.00
126	1800.00	30.00	10.00N	8.00N	21.00	480.00	37.00	12.00N	34.00	57.00
127	3100.00	34.00	10.00N	8.00N	14.00	870.00	77.00	12.00N	54.00	73.00
128	1800.00	34.00	10.00N	8.00N	17.00	740.00	41.00	12.00N	36.00	76.00
129	1300.00	35.00	10.00N	8.00N	17.00	930.00	38.00	12.00N	29.00	84.00

TableA2.--Cont.

Sample	AL	CA	FE	MG	AG	AS	B	BA	BE	BI
130	18000.00	10000.00	45000.00	8200.00	1.20N	8.00N	0.40N	150.00	0.83	32.00N
131	13000.00	13000.00	33000.00	6200.00	1.20N	8.00N	0.40N	91.00	0.89	32.00N
132	17000.00	11000.00	39000.00	7400.00	1.20N	8.00N	0.40N	140.00	0.80	32.00N
133	11000.00	4700.00	32000.00	6500.00	1.20N	8.00N	0.40N	120.00	0.33	32.00N
134	14000.00	3000.00	25000.00	8000.00	1.20N	8.00N	0.40N	120.00	0.54	32.00N
135	12000.00	3700.00	22000.00	7000.00	1.20N	8.00N	0.40N	110.00	0.45	32.00N
135	12000.00	3700.00	23000.00	7300.00	1.20N	8.00N	0.40N	120.00	0.46	32.00N
136	11000.00	5400.00	30000.00	7000.00	1.20N	8.00N	0.40N	130.00	0.33	32.00N
137	16000.00	8100.00	30000.00	9700.00	1.20N	8.00N	0.40N	170.00	0.69	32.00N
139	15000.00	10000.00	39000.00	8300.00	1.20N	8.00N	0.40N	100.00	0.85	32.00N
140	18000.00	8400.00	31000.00	10000.00	1.20N	8.00N	0.40N	180.00	0.74	32.00N
141	17000.00	19000.00	60000.00	11000.00	1.20N	8.00N	0.40N	270.00	0.69	32.00N
142	15000.00	17000.00	72000.00	8900.00	1.20N	8.00N	0.40N	210.00	0.69	32.00N
143	12000.00	17000.00	77000.00	7800.00	1.20N	8.00N	0.40N	150.00	0.58	32.00N
144	18000.00	21000.00	72000.00	12000.00	1.20N	8.00N	0.40N	290.00	0.72	32.00N
145	19000.00	15000.00	28000.00	11000.00	1.20N	8.00N	0.40N	220.00	1.20	32.00N
B	38.00	35.00	62.00	18.00	1.20N	8.00N	6.50	0.57	0.04N	32.00N
B	37.00	51.00	88.00	23.00	1.20N	8.00N	5.20	0.73	0.04N	32.00N
B	31.00	23.00	79.00	13.00	1.20N	8.00N	6.10	0.45	0.04N	32.00N
B	76.00	42.00	130.00	25.00	1.20N	8.00N	11.00	0.91	0.04N	32.00N
B	30.00	33.00	160.00	25.00	1.20N	8.00N	11.00	0.95	0.04N	32.00N
B	58.00	37.00	140.00	19.00	1.20N	8.00N	11.00	0.69	0.04N	32.00N
B	40.00	31.00	99.00	20.00	1.20N	8.00N	6.40	0.46	0.04N	32.00N
B	42.00	17.00	48.00	11.00N	1.20N	8.00N	6.50	0.53	0.04N	32.00N
B	55.00	34.00	130.00	19.00	1.20N	8.00N	7.60	0.78	0.04N	32.00N
GXR6	63000.00	1400.00	45000.00	3200.00	1.20N	120.00	0.40N	860.00	0.81	32.00N
GXR6	82000.00	1800.00	51000.00	3900.00	1.20N	18.00	0.40N	940.00	0.88	32.00N
GXR6	68000.00	1500.00	55000.00	3500.00	1.20N	71.00	0.40N	910.00	0.84	32.00N
GXR6	80000.00	1700.00	61000.00	3900.00	1.20N	37.00	0.40N	920.00	0.89	32.00N
GXR6	69000.00	1500.00	57000.00	3300.00	1.20N	8.90	0.40N	840.00	0.77	32.00N
GXR6	70000.00	1600.00	58000.00	3500.00	1.20N	48.00	0.40N	940.00	0.83	32.00N
GXR6	71000.00	1500.00	56000.00	3700.00	1.20N	8.00N	0.40N	850.00	0.83	32.00N
GXR6	76000.00	1600.00	55000.00	3900.00	1.20N	8.00N	0.40N	940.00	0.86	32.00N
GXR6	64000.00	1400.00	53000.00	3300.00	1.20N	83.00	0.40N	870.00	0.81	32.00N

TableA2.--Cont.

Sample	CE	CO	CO	CR	CU	LA	MN	MO	NB	NI
130	94.00	0.80N	16.00	42.00	24.00	46.00	800.00	1.60N	14.00	13.00
131	150.00	0.95	17.00	30.00	20.00	72.00	720.00	2.00	9.80	10.00
132	99.00	0.83	16.00	41.00	24.00	49.00	720.00	2.40	13.00	13.00
133	32.00	0.80N	12.00	31.00	32.00	18.00	350.00	1.60N	9.60	9.50
134	56.00	0.80N	8.00N	26.00	23.00	27.00	520.00	1.60N	14.00	6.50
135	40.00	0.80N	9.60	27.00	25.00	21.00	410.00	1.60	11.00	9.10
135	41.00	0.80N	9.70	27.00	25.00	21.00	420.00	1.60N	12.00	9.10
136	35.00	0.80N	13.00	36.00	34.00	20.00	350.00	1.60N	9.70	9.20
137	77.00	0.95	19.00	50.00	37.00	40.00	580.00	2.00	14.00	18.00
139	120.00	0.80N	18.00	46.00	19.00	58.00	680.00	1.70	11.00	12.00
140	81.00	0.80	18.00	47.00	39.00	43.00	600.00	1.60N	14.00	18.00
141	52.00	1.20	24.00	110.00	24.00	27.00	570.00	2.00	17.00	21.00
142	65.00	1.40	23.00	130.00	19.00	32.00	540.00	1.80	19.00	22.00
143	69.00	0.80N	26.00	110.00	16.00	33.00	460.00	2.00	18.00	20.00
144	50.00	0.80N	22.00	110.00	24.00	26.00	610.00	1.60N	18.00	22.00
145	82.00	1.00	18.00	43.00	26.00	37.00	690.00	1.60	15.00	16.00
B	3.60N	0.80N	8.00N	4.00N	0.60N	4.00N	1.20	1.60N	4.00N	4.00N
B	3.60N	0.80N	8.00N	4.00N	1.10	4.00N	1.40	1.60N	4.00N	4.00N
B	3.60N	0.80N	8.00N	4.00N	0.70	4.00N	0.80N	1.60N	4.00N	4.00N
B	3.60N	0.80N	8.00N	4.00N	0.79	4.00N	2.10	1.60N	4.00N	4.00N
B	3.60N	0.80N	8.00N	4.00N	0.74	4.00N	2.10	1.60N	4.00N	4.00N
B	3.60N	0.80N	8.00N	4.00N	0.82	4.00N	1.40	1.60N	4.00N	4.00N
B	3.60N	0.80N	8.00N	4.00N	0.97	4.00N	0.94	1.60N	4.00N	4.00N
B	3.60N	0.80N	8.00N	4.00N	0.92	4.00N	0.80N	1.60N	4.00N	4.00N
B	3.60N	0.80N	8.00N	4.00N	3.20	4.00N	1.10	1.60N	4.00N	4.00N
GXR6	20.00	0.80N	17.00	110.00	66.00	8.30	960.00	2.20	20.00	23.00
GXR6	20.00	0.80N	15.00	120.00	73.00	8.70	1200.00	1.70	19.00	25.00
GXR6	20.00	0.80N	15.00	100.00	66.00	8.50	1000.00	1.60N	19.00	24.00
GXR6	21.00	0.80N	16.00	100.00	70.00	8.10	1200.00	1.70	20.00	25.00
GXR6	18.00	0.80N	14.00	73.00	60.00	8.10	1000.00	1.60N	16.00	20.00
GXR6	19.00	0.80N	13.00	90.00	64.00	8.90	1000.00	1.60N	17.00	23.00
GXR6	19.00	0.80N	11.00	83.00	57.00	8.80	1000.00	1.60N	16.00	22.00
GXR6	20.00	0.80N	11.00	91.00	61.00	9.10	1100.00	1.60N	16.00	23.00
GXR6	19.00	0.80N	13.00	88.00	63.00	7.90	1000.00	1.60N	18.00	22.00

Table A2.--Cont.

Sample	P	PB	SE	SN	SR	TI	V	W	Y	ZN
130	1900.00	65.00	10.00N	8.00N	28.00	1500.00	72.00	12.00N	43.00	160.00
131	2300.00	52.00	10.00N	8.00N	31.00	820.00	47.00	14.00	68.00	120.00
132	2200.00	65.00	10.00N	8.00N	29.00	1200.00	65.00	12.00N	47.00	160.00
133	1000.00	30.00	10.00N	8.00N	11.00	1000.00	62.00	12.00N	4.00	54.00
134	540.00	38.00	10.00N	8.00N	11.00	1100.00	36.00	12.00N	14.00	86.00
135	620.00	34.00	10.00N	8.00N	14.00	700.00	38.00	12.00N	9.10	72.00
135	580.00	33.00	10.00N	8.00N	14.00	720.00	37.00	12.00N	8.40	74.00
136	1200.00	28.00	10.00N	8.00N	12.00	1100.00	63.00	12.00N	5.00	54.00
137	1200.00	48.00	10.00N	8.00N	23.00	1500.00	59.00	15.00	19.00	95.00
139	1800.00	39.00	10.00N	8.00N	20.00	1100.00	70.00	16.00	54.00	90.00
140	1200.00	46.00	10.00N	8.00N	24.00	1600.00	57.00	13.00	19.00	99.00
141	4900.00	41.00	10.00N	8.00N	49.00	1300.00	150.00	31.00	9.40	100.00
142	4300.00	41.00	10.00N	8.00N	37.00	1100.00	180.00	37.00	14.00	92.00
143	4400.00	28.00	10.00N	8.00N	26.00	890.00	170.00	29.00	17.00	100.00
144	5100.00	42.00	10.00N	8.00N	53.00	1400.00	170.00	23.00	8.60	110.00
145	3000.00	45.00	10.00N	8.00N	50.00	1000.00	62.00	16.00	20.00	110.00
B	16.00N	8.00N	10.00N	8.00N	0.16N	1.60	0.60N	12.00N	0.16N	4.20
B	16.00N	8.00N	10.00N	8.00N	0.16N	25.00	0.60N	12.00N	0.16N	3.00
B	16.00N	8.00N	10.00N	8.00N	0.16N	0.89	0.60N	12.00N	0.16N	1.30
B	16.00N	8.00N	10.00N	8.00N	0.16N	2.70	0.60N	12.00N	0.16N	1.70
B	16.00N	8.00N	10.00N	8.00N	0.16N	3.50	0.60N	12.00N	0.16N	1.90
B	16.00N	8.00N	10.00N	8.00N	0.16N	3.10	0.60N	12.00N	0.16N	1.10
B	16.00N	8.00N	10.00N	8.00N	0.16N	2.20	0.60N	12.00N	0.16N	1.20
B	16.00N	8.00N	10.00N	8.00N	0.16N	1.30	0.60N	12.00N	0.16N	0.88
B	16.00N	8.00N	10.00N	8.00N	0.16N	1.80	0.60N	12.00N	0.16N	2.40
GXR6	180.00	140.00	35.00	8.00N	27.00	560.00	120.00	16.00	0.16N	110.00
GXR6	180.00	130.00	10.00N	8.00N	30.00	800.00	140.00	12.00N	0.16N	130.00
GXR6	130.00	130.00	22.00	8.00N	29.00	630.00	130.00	12.00N	0.16N	120.00
GXR6	200.00	140.00	10.00N	8.00N	28.00	850.00	140.00	12.00N	0.16N	130.00
GXR6	120.00	120.00	11.00	8.00N	27.00	540.00	95.00	12.00N	0.16N	110.00
GXR6	120.00	130.00	15.00	8.00N	29.00	670.00	110.00	12.00N	0.16N	120.00
GXR6	120.00	130.00	20.00	8.00N	28.00	630.00	85.00	12.00N	0.16N	120.00
GXR6	130.00	140.00	18.00	8.00N	29.00	680.00	92.00	12.00N	0.16N	120.00
GXR6	140.00	130.00	23.00	8.00N	27.00	600.00	130.00	12.00N	0.16N	110.00

Table A3.--Summary statistics for minus-80-mesh stream-sediment data. "Valid" = number of uncensored values; "N" = not detectable.

UNIVARIATE STATISTICS

VAR	COLUMN	MINIMUM	MAXIMUM	MEAN	DEVIATION	VALID	B	L	N	G	OTHER
1	AL	4.600E+03	2.200E+04	1.298E+04	4.0336E+03	121	0	0	0	0	0
2	CA	2.600E+03	5.700E+04	1.209E+04	6.5710E+03	121	0	0	0	0	0
3	FE	9.600E+03	2.200E+05	4.340E+04	2.9552E+04	121	0	0	0	0	0
4	MG	2.200E+03	1.400E+04	6.777E+03	2.1534E+03	121	0	0	0	0	0
5	AG	1.200E+00	1.200E+00	1.200E+00	1.0000E+35	0	0	0	121	0	0
6	AS	8.000E+00	1.000E+01	8.017E+00	1.8182E-01	1	0	0	120	0	0
7	B	4.000E-01	4.000E-01	4.000E-01	1.0000E+35	0	0	0	121	0	0
8	BA	6.600E+01	3.700E+02	1.437E+02	6.5588E+01	121	0	0	0	0	0
9	BE	2.700E-01	1.700E+00	7.318E-01	3.3345E-01	121	0	0	0	0	0
10	BI	3.200E+01	3.200E+01	3.200E+01	1.0000E+35	0	0	0	121	0	0
11	CE	2.900E+01	1.800E+02	7.676E+01	3.2113E+01	121	0	0	0	0	0
12	CD	8.000E-01	2.400E+00	8.430E-01	1.8860E-01	12	0	0	109	0	0
13	CO	8.000E+00	2.600E+01	1.363E+01	4.2701E+00	103	0	0	18	0	0
14	CR	1.100E+01	2.000E+02	3.853E+01	2.7725E+01	121	0	0	0	0	0
15	CU	6.000E-01	9.500E+01	2.052E+01	1.2255E+01	120	0	0	1	0	0
16	LA	1.700E+01	8.300E+01	3.801E+01	1.4192E+01	121	0	0	0	0	0
17	MN	2.800E+02	7.000E+03	6.460E+02	6.1159E+02	121	0	0	0	0	0
18	MO	1.600E+00	4.200E+00	1.693E+00	3.0364E-01	25	0	0	96	0	0
19	NB	4.000E+00	2.700E+01	1.141E+01	3.9574E+00	118	0	0	3	0	0
20	NI	4.500E+00	2.900E+01	1.289E+01	4.9796E+00	121	0	0	0	0	0
21	P	3.200E+02	4.900E+03	1.583E+03	1.0143E+03	121	0	0	0	0	0
22	PB	9.900E+00	1.000E+02	3.849E+01	1.7942E+01	121	0	0	0	0	0
23	SB	1.000E+01	1.000E+01	1.000E+01	1.0000E+35	0	0	0	121	0	0
24	SN	8.000E+00	8.000E+00	8.000E+00	1.0000E+35	0	0	0	121	0	0
25	SR	1.000E+01	2.200E+02	3.443E+01	3.2838E+01	121	0	0	0	0	0
26	TI	6.400E+01	2.100E+03	8.842E+02	4.3658E+02	121	0	0	0	0	0
27	V	2.100E+01	3.500E+02	7.011E+01	5.0092E+01	121	0	0	0	0	0
28	W	1.200E+01	4.900E+01	1.292E+01	4.6808E+00	10	0	0	111	0	0
29	Y	1.600E-01	6.900E+01	2.342E+01	1.6321E+01	118	0	0	3	0	0
30	ZN	3.000E+01	1.600E+02	8.279E+01	2.6966E+01	121	0	0	0	0	0

Table A4.--Data from the emission spectrographic analysis of heavy-mineral concentrates. All values are reported in ppm, except those for Fe, Mg, Ca, and Ti, which are in percent. Element concentrations are reported on a six-step nominal scale in the series 2, 2.5, 3, 4, 6, 7, 10, etc. Samples having element contents not detectable or above upper detection limits were reported with the designations N and G, respectively. Samples having detectable element contents below stated detection limits were reported with the designation L. Relevant limits of detection are listed in table A1.

Table begins on next page.

Table A4.--Data from ES analysis of heavy-mineral concentrates.

Sample	S-B	S-BA	S-BE	S-BI	S-CD	S-CO	S-CR	S-CU	S-LA	S-MO
001	30.00	5000.00	2.00L	20.00N	50.00N	20.00	50.00	10.00N	2000.00G	15.00
002	20.00	10000.00G	2.00L	20.00N	50.00N	10.00	30.00	10.00N	500.00	10.00N
003	20.00	3000.00	2.00	20.00N	50.00N	10.00	50.00	10.00	1000.00	15.00
004	50.00	5000.00	2.00N	20.00N	50.00N	15.00	70.00	10.00L	2000.00G	30.00
005	150.00	10000.00G	2.00L	20.00N	50.00N	15.00	70.00	10.00	2000.00G	30.00
006	30.00	5000.00	2.00L	20.00N	50.00N	10.00	100.00	10.00L	700.00	10.00
007	20.00	10000.00G	2.00	20.00N	50.00N	15.00	70.00	20.00	2000.00G	10.00N
008	70.00	5000.00	2.00	20.00N	50.00N	20.00	100.00	15.00	2000.00G	10.00
009	50.00	10000.00G	2.00	20.00N	50.00N	15.00	70.00	30.00	2000.00G	10.00N
010	50.00	7000.00	2.00L	20.00N	50.00N	15.00	70.00	10.00L	2000.00G	10.00N
011	50.00	10000.00G	2.00	20.00N	50.00N	20.00	70.00	30.00	2000.00G	15.00
012	20.00	1000.00	2.00	20.00N	50.00N	10.00	70.00	15.00	1000.00	10.00
013	20.00	10000.00	2.00L	20.00N	50.00N	10.00	100.00	10.00L	700.00	10.00N
014	30.00	2000.00	2.00	20.00N	50.00N	10.00	50.00	10.00N	1000.00	10.00N
015	50.00	700.00	2.00L	20.00N	50.00N	10.00	150.00	10.00L	700.00	10.00N
016	50.00	10000.00G	2.00L	20.00N	50.00N	10.00	70.00	50.00	1500.00	10.00
017	20.00	10000.00G	2.00	20.00N	50.00N	10.00N	100.00	10.00	2000.00G	10.00N
018	20.00	10000.00	2.00	20.00N	50.00N	10.00	50.00	10.00	2000.00	10.00N
019	30.00	10000.00	2.00	20.00N	50.00N	15.00	50.00	10.00N	2000.00G	10.00N
020	20.00	10000.00G	2.00	20.00N	50.00N	15.00	30.00	10.00L	500.00	10.00N
021	20.00	10000.00G	2.00L	20.00N	50.00N	20.00	70.00	20.00	2000.00G	10.00
022	20.00	10000.00G	2.00L	20.00N	50.00N	15.00	70.00	20.00	2000.00	15.00
023	30.00	5000.00	2.00	20.00N	50.00N	10.00	50.00	10.00	1000.00	10.00N
024	20.00	500.00	2.00L	20.00N	50.00N	10.00	70.00	10.00	700.00	10.00N
025	20.00	10000.00	2.00L	20.00N	50.00N	10.00	100.00	10.00L	2000.00	10.00N
026	30.00	5000.00	2.00	20.00N	50.00N	10.00	70.00	15.00	1500.00	10.00N
027	50.00	5000.00	2.00	20.00N	50.00N	15.00	70.00	10.00	2000.00G	10.00N
028	20.00	10000.00G	2.00L	20.00N	50.00N	15.00	150.00	30.00	2000.00	10.00N
029	20.00L	10000.00G	2.00L	20.00N	50.00N	10.00	70.00	10.00	2000.00	10.00N
030	20.00L	10000.00G	2.00L	20.00N	50.00N	10.00	70.00	15.00	2000.00	10.00N
031	50.00	7000.00	2.00L	20.00N	50.00N	10.00	50.00	10.00L	2000.00G	10.00N
032	20.00L	10000.00	2.00L	20.00N	50.00N	10.00	100.00	10.00L	1000.00	10.00L
033	20.00	500.00	2.00L	20.00N	50.00N	10.00	70.00	10.00L	200.00	10.00N
034	20.00L	10000.00G	2.00	20.00N	50.00N	10.00	30.00	50.00	1000.00	10.00N
035	50.00	10000.00G	2.00	20.00N	50.00N	15.00	100.00	70.00	2000.00G	10.00N
036	30.00	700.00	2.00	20.00N	50.00N	15.00	100.00	10.00L	300.00	10.00N
037	70.00	500.00	2.00	20.00N	50.00N	15.00	100.00	10.00	500.00	10.00N
038	20.00	300.00	2.00	20.00N	50.00N	10.00	70.00	10.00N	500.00	10.00N
039	30.00	300.00	2.00L	20.00N	50.00N	10.00	100.00	10.00L	300.00	10.00N
040	30.00	200.00	2.00L	20.00N	50.00N	10.00	100.00	15.00	200.00	10.00
041	50.00	2000.00	2.00	20.00N	50.00N	10.00	100.00	10.00	300.00	10.00N
042	20.00	500.00	2.00L	200.00	50.00N	10.00	70.00	10.00L	500.00	10.00N
043	100.00	200.00	2.00L	20.00N	50.00N	10.00	70.00	10.00L	500.00	10.00N
044	20.00	200.00	2.00L	20.00N	50.00N	10.00	50.00	10.00	500.00	10.00N
045	30.00	300.00	2.00L	20.00N	50.00N	30.00	100.00	15.00	1000.00	20.00

Table A4.--Cont.

Sample	S-NB	S-NI	S-PB	S-SB	S-SC	S-SN	S-SR	S-V	S-W	S-Y
001	200.00	10.00	200.00	200.00N	0.00B	150.00	200.00N	300.00	100.00N	3000.00
002	50.00	10.00	150.00	200.00N	0.00B	70.00	1000.00	150.00	100.00N	1500.00
003	100.00	10.00	500.00	200.00N	0.00B	150.00	200.00N	200.00	100.00N	2000.00
004	200.00	15.00	300.00	200.00N	0.00B	200.00	200.00	300.00	100.00N	2000.00
005	150.00	10.00	200.00	200.00N	0.00B	200.00	500.00	500.00	100.00N	2000.00
006	150.00	10.00	150.00	200.00N	0.00B	100.00	200.00N	500.00	100.00N	2000.00
007	50.00	10.00	300.00	200.00N	0.00B	50.00	1000.00	200.00	100.00N	1500.00
008	100.00	10.00	300.00	200.00N	0.00B	150.00	200.00N	200.00	100.00N	3000.00
009	150.00	10.00	500.00	200.00N	0.00B	100.00	2000.00	200.00	100.00N	1500.00
010	100.00	10.00N	200.00	200.00N	0.00B	150.00	200.00N	300.00	100.00N	2000.00
011	200.00	15.00	700.00	200.00N	0.00B	150.00	1500.00	300.00	100.00N	1500.00
012	100.00	10.00	200.00	200.00N	0.00B	70.00	200.00N	300.00	1000.00	1000.00
013	50.00L	10.00N	150.00	200.00N	0.00B	100.00	200.00N	500.00	100.00L	3000.00
014	100.00	10.00N	200.00	200.00N	0.00B	100.00	200.00N	300.00	100.00N	2000.00
015	150.00	10.00	500.00	200.00N	0.00B	150.00	200.00N	200.00	100.00N	1500.00
016	150.00	15.00	500.00	200.00N	0.00B	150.00	1000.00	200.00	100.00N	2000.00
017	50.00L	10.00N	300.00	200.00N	0.00B	100.00	1500.00	100.00	100.00N	1000.00
018	50.00L	10.00	300.00	200.00N	0.00B	150.00	300.00	200.00	100.00N	3000.00
019	100.00	15.00	300.00	200.00N	0.00B	150.00	200.00	150.00	100.00N	3000.00
020	50.00N	15.00	300.00	200.00N	0.00B	100.00	200.00	150.00	100.00N	3000.00
021	200.00	15.00	500.00	200.00N	0.00B	70.00	700.00	300.00	100.00	1500.00
022	150.00	10.00	300.00	200.00N	0.00B	70.00	1500.00	300.00	100.00	1000.00
023	50.00	15.00	150.00	200.00N	0.00B	50.00	200.00	200.00	100.00N	1500.00
024	50.00	15.00	200.00	200.00N	0.00B	70.00	200.00N	200.00	100.00N	2000.00
025	100.00	10.00N	200.00	200.00N	0.00B	100.00	200.00	300.00	100.00N	1500.00
026	100.00	10.00N	200.00	200.00N	0.00B	50.00	700.00	200.00	100.00N	1000.00
027	300.00	10.00N	150.00	200.00N	0.00B	150.00	700.00	300.00	100.00L	2000.00
028	150.00	10.00	300.00	200.00N	0.00B	100.00	500.00	300.00	100.00N	1500.00
029	70.00	10.00	150.00	200.00N	0.00B	100.00	700.00	200.00	100.00N	1000.00
030	200.00	10.00N	200.00	200.00N	0.00B	100.00	1000.00	200.00	100.00N	1000.00
031	70.00	10.00	150.00	200.00N	0.00B	50.00	200.00N	200.00	100.00N	2000.00
032	100.00	15.00	200.00	200.00N	0.00B	100.00	200.00N	200.00	100.00N	5000.00
033	200.00	10.00N	100.00	200.00N	0.00B	200.00	200.00N	200.00	100.00L	3000.00
034	70.00	10.00N	100.00	200.00N	0.00B	20.00N	700.00	150.00	100.00	700.00
035	50.00L	10.00	500.00	200.00N	0.00B	100.00	1000.00	200.00	100.00N	1500.00
036	200.00	10.00	150.00	200.00N	0.00B	200.00	200.00N	200.00	100.00	3000.00
037	500.00	10.00	150.00	200.00N	0.00B	100.00	200.00N	200.00	100.00L	2000.00
038	50.00	15.00	100.00	200.00N	0.00B	50.00	200.00N	150.00	100.00N	3000.00
039	200.00	10.00	200.00	200.00N	0.00B	70.00	200.00N	150.00	100.00N	2000.00
040	500.00	10.00N	200.00	200.00N	0.00B	200.00	200.00N	200.00	100.00L	3000.00
041	150.00	10.00N	150.00	200.00N	0.00B	100.00	200.00	200.00	150.00	2000.00
042	200.00	15.00	150.00	200.00N	0.00B	150.00	200.00	300.00	100.00	2000.00
043	100.00	10.00	200.00	200.00N	0.00B	200.00	200.00N	300.00	100.00N	3000.00
044	150.00	10.00N	200.00	200.00N	0.00B	100.00	200.00N	200.00	150.00	3000.00
045	200.00	10.00	150.00	200.00N	0.00B	150.00	200.00	500.00	100.00N	1500.00

Table A4.--Cont.

Sample	S-ZN	S-ZR	S-TH
001	500.00N	2000.00G	1000.00
002	500.00N	2000.00G	200.00
003	500.00N	2000.00G	200.00
004	500.00N	2000.00G	700.00
005	500.00N	2000.00G	300.00
006	500.00N	2000.00G	200.00N
007	500.00L	2000.00G	700.00
008	500.00N	2000.00G	200.00
009	500.00N	2000.00G	700.00
010	500.00N	2000.00G	500.00
011	500.00N	2000.00G	500.00
012	500.00L	2000.00G	200.00
013	500.00N	2000.00G	200.00L
014	500.00N	2000.00G	200.00L
015	500.00N	2000.00G	200.00L
016	500.00	2000.00G	500.00
017	500.00N	2000.00G	200.00
018	500.00N	2000.00G	200.00
019	500.00N	2000.00G	200.00
020	500.00N	2000.00G	200.00N
021	500.00N	2000.00G	500.00
022	500.00N	2000.00G	500.00
023	500.00N	2000.00G	200.00
024	500.00N	2000.00G	200.00L
025	500.00N	2000.00G	700.00
026	500.00N	2000.00G	200.00
027	500.00N	2000.00G	2000.00
028	500.00N	2000.00G	300.00
029	500.00N	2000.00G	200.00L
030	500.00N	2000.00G	200.00
031	500.00N	2000.00G	700.00
032	500.00N	2000.00G	200.00L
033	500.00N	2000.00G	200.00N
034	500.00N	2000.00G	200.00L
035	500.00N	2000.00G	300.00
036	500.00N	2000.00G	200.00L
037	500.00N	2000.00G	200.00
038	500.00N	2000.00G	200.00L
039	500.00N	2000.00G	200.00
040	500.00N	2000.00G	200.00
041	500.00N	2000.00G	200.00
042	500.00N	2000.00G	300.00
043	500.00N	2000.00G	200.00
044	500.00N	2000.00G	200.00
045	500.00N	2000.00G	200.00

TableA4.--Cont.

Sample	LATITUDE	LONGITUD	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-AS	S-AU
046	38 44 32N	106 02 48W	3.00	0.50	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
047	38 44 27N	106 03 40W	1.00	0.20	10.00	2.00G	1000.00	1.00N	500.00N	20.00N
048	38 44 36N	106 03 53W	5.00	0.50	15.00	2.00G	2000.00	1.00N	500.00N	20.00N
049	38 44 43N	106 03 53W	2.00	0.20	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
050	38 38 11N	106 02 05W	1.50	5.00	15.00	2.00G	1000.00	1.00N	500.00N	20.00N
051	38 38 07N	106 02 08W	1.50	0.50	15.00	2.00G	2000.00	1.00N	500.00N	20.00N
052	38 38 20N	106 02 33W	2.00	0.50	30.00	2.00G	2000.00	1.00N	500.00N	20.00N
053	38 38 09N	106 03 13W	1.00	0.30	50.00	2.00G	1000.00	1.00N	500.00N	20.00N
055	38 38 26N	106 02 57W	1.50	2.00	10.00	2.00G	1000.00	1.00N	500.00N	20.00N
056	38 38 02N	106 01 19W	1.50	0.50	15.00	2.00G	2000.00	1.00N	500.00N	20.00N
057	38 37 58N	106 01 21W	1.00	3.00	15.00	2.00G	1000.00	1.00N	500.00N	20.00N
058	38 38 10N	106 01 36W	1.50	5.00	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
059	38 38 14N	106 01 38W	0.50	0.10	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
060	38 38 28N	106 01 39W	1.00	0.10	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
061	38 37 52N	106 01 03W	1.50	5.00	20.00	2.00G	1000.00	1.00N	500.00N	20.00N
062	38 37 43N	106 00 44W	1.00	0.30	15.00	2.00G	1000.00	1.00N	500.00N	20.00N
063	38 37 40N	106 00 47W	1.50	5.00	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
064	38 37 43N	106 00 40W	1.00	0.50	15.00	2.00G	700.00	1.00N	500.00N	20.00N
065	38 37 46N	106 00 27W	2.00	1.00	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
066	38 37 48N	106 00 24W	1.00	0.30	10.00	2.00G	1000.00	1.00N	500.00N	20.00N
067	38 37 49N	106 00 26W	10.00	5.00	15.00	2.00G	2000.00	1.00N	500.00N	20.00N
068	38 38 04N	106 00 31W	1.50	0.30	15.00	2.00G	1000.00	1.00N	500.00N	20.00N
069	38 38 07N	106 00 59W	1.00	0.20	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
070	38 38 30N	106 01 24W	0.70	0.15	15.00	2.00G	1000.00	1.00N	500.00N	20.00N
071	38 38 32N	106 01 11W	1.00	0.30	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
072	38 38 34N	106 00 59W	1.00	0.20	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
073	38 42 11N	106 02 55W	1.50	0.20	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
074	38 42 20N	106 02 53W	2.00	0.20	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
075	38 42 34N	106 02 21W	2.00	0.30	30.00	2.00G	2000.00	1.00N	500.00N	20.00N
076	38 42 34N	106 03 03W	1.50	0.15	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
077	38 43 05N	106 02 16W	1.50	0.20	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
078	38 43 02N	106 02 16W	1.00	0.20	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
079	38 43 12N	106 01 38W	1.50	0.50	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
080	38 38 12N	106 00 50W	1.50	0.30	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
081	38 38 19N	106 00 52W	2.00	0.50	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
082	38 38 23N	106 00 40W	1.00	0.15	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
083	38 38 26N	106 00 35W	1.00	0.15	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
084	38 38 36N	106 00 56W	1.00	0.10	15.00	2.00G	1000.00	1.00N	500.00N	20.00N
085	38 41 45N	106 01 21W	2.00	0.30	15.00	2.00G	2000.00	1.00N	500.00N	20.00N
086	38 41 47N	106 01 24W	1.50	0.20	10.00	2.00G	1500.00	1.00N	500.00N	20.00N
087	38 41 44N	106 02 04W	1.00	0.20	10.00	2.00G	2000.00	1.00N	500.00N	20.00N
088	38 41 41N	106 02 46W	2.00	0.50	50.00	2.00G	2000.00	1.00N	500.00N	20.00N
089	38 41 40N	106 02 46W	1.50	0.20	15.00	2.00G	2000.00	1.00N	500.00N	20.00N
090	38 43 23N	106 03 12W	1.50	0.20	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
091	38 43 17N	106 03 13W	2.00	0.20	20.00	2.00G	1500.00	1.00N	500.00N	20.00N

Table A4.--Cont.

Sample	S-B	S-BA	S-BE	S-BI	S-CD	S-CO	S-CR	S-CU	S-LA	S-MO
046	20.00	150.00	2.00N	20.00N	50.00N	15.00	100.00	10.00L	700.00	10.00
047	20.00L	100.00	2.00N	20.00N	50.00N	10.00	50.00	10.00N	500.00	10.00N
048	30.00	300.00	2.00L	20.00N	50.00N	50.00	70.00	10.00L	1000.00	10.00L
049	20.00	200.00	2.00L	20.00N	50.00N	20.00	100.00	10.00N	1000.00	15.00
050	70.00	10000.00	2.00	20.00N	50.00N	15.00	100.00	10.00	700.00	30.00
051	30.00	700.00	2.00L	20.00N	50.00N	15.00	100.00	10.00L	1000.00	10.00
052	50.00	10000.00G	2.00	20.00N	50.00N	10.00	100.00	10.00	1000.00	10.00N
053	20.00L	2000.00	2.00L	20.00N	50.00N	10.00	50.00	10.00	200.00	10.00N
055	100.00	10000.00G	2.00L	20.00N	50.00N	15.00	100.00	20.00	1000.00	10.00N
056	50.00	5000.00	2.00	20.00N	50.00N	15.00	70.00	150.00	700.00	70.00
057	100.00	10000.00G	2.00	20.00N	50.00N	15.00	100.00	50.00	500.00	15.00
058	200.00	10000.00G	2.00	20.00N	50.00N	10.00	100.00	20.00	700.00	10.00N
059	20.00	700.00	2.00	20.00N	50.00N	10.00	50.00	10.00L	500.00	10.00N
060	20.00	2000.00	2.00	20.00N	50.00N	10.00	50.00	100.00	500.00	10.00N
061	50.00	10000.00G	2.00L	20.00N	50.00N	10.00	150.00	10.00	1000.00	10.00N
062	50.00	700.00	2.00	20.00N	50.00N	15.00	70.00	20.00	700.00	20.00
063	70.00	10000.00	2.00	20.00N	50.00N	15.00	150.00	30.00	1000.00	10.00N
064	30.00	1500.00	2.00	20.00N	50.00N	10.00	50.00	20.00	300.00	30.00
065	50.00	700.00	2.00L	20.00N	50.00N	15.00	150.00	70.00	700.00	20.00
066	30.00	500.00	2.00L	20.00N	50.00N	10.00	100.00	20.00	500.00	10.00N
067	50.00	700.00	5.00	20.00L	50.00N	20.00	1000.00	70.00	1000.00	70.00
068	30.00	1500.00	2.00	20.00N	50.00N	10.00	100.00	10.00L	500.00	150.00
069	50.00	500.00	2.00	20.00N	50.00N	10.00N	50.00	50.00	500.00	10.00N
070	20.00	1000.00	2.00	20.00N	50.00N	10.00	30.00	10.00	200.00	10.00N
071	20.00	500.00	2.00L	20.00N	50.00N	10.00	50.00	20.00	300.00	10.00N
072	20.00	1000.00	2.00L	20.00N	50.00N	10.00	50.00	15.00	300.00	10.00N
073	20.00L	150.00	2.00L	20.00N	50.00N	10.00	70.00	10.00	500.00	20.00
074	20.00	200.00	2.00N	20.00N	50.00N	10.00	100.00	20.00	300.00	20.00
075	30.00	200.00	2.00L	20.00N	50.00N	10.00	100.00	20.00	300.00	50.00
076	20.00L	150.00	2.00L	20.00N	50.00N	15.00	50.00	10.00L	300.00	10.00N
077	30.00	2000.00	2.00L	20.00N	50.00N	10.00	30.00	10.00N	300.00	10.00N
078	20.00L	100.00	2.00L	20.00N	50.00N	10.00	50.00	10.00N	200.00	30.00
079	50.00	1000.00	2.00L	20.00N	50.00N	10.00	70.00	10.00N	500.00	10.00
080	20.00	1500.00	2.00	20.00N	50.00N	10.00	150.00	10.00L	2000.00	100.00
081	70.00	500.00	3.00	20.00N	50.00N	10.00	70.00	300.00	1000.00	20.00
082	30.00	500.00	3.00	20.00N	50.00N	10.00	50.00	300.00	1000.00	10.00N
083	30.00	500.00	2.00	20.00N	50.00N	10.00	70.00	10.00	2000.00	50.00
084	20.00L	200.00	2.00	20.00N	50.00N	10.00N	30.00	10.00N	500.00	10.00N
085	20.00	200.00	2.00L	20.00N	50.00N	10.00	70.00	30.00	300.00	10.00N
086	20.00	300.00	2.00L	20.00N	50.00N	10.00	70.00	10.00N	150.00	10.00N
087	20.00	150.00	2.00L	20.00N	50.00N	10.00	70.00	10.00N	150.00	10.00L
088	20.00L	200.00	2.00	20.00N	50.00N	10.00	150.00	10.00	500.00	10.00N
089	20.00	200.00	2.00L	20.00N	50.00N	10.00	100.00	10.00N	200.00	10.00
090	20.00	200.00	2.00L	20.00N	50.00N	10.00	70.00	10.00L	300.00	20.00
091	20.00	150.00	2.00L	20.00N	50.00N	10.00	70.00	10.00L	300.00	20.00

Table A4.--Cont.

Sample	S-NB	S-NI	S-PB	S-SB	S-SC	S-SN	S-SR	S-V	S-W	S-Y
046	70.00	10.00	200.00	200.00N	0.00B	150.00	200.00N	500.00	100.00N	1500.00
047	50.00	10.00N	100.00	200.00N	0.00B	70.00	200.00N	300.00	100.00N	1000.00
048	50.00	10.00	100.00	200.00N	0.00B	100.00	200.00N	500.00	100.00N	1500.00
049	200.00	10.00	1000.00	200.00N	0.00B	100.00	200.00N	500.00	100.00L	2000.00
050	150.00	10.00	200.00	200.00N	0.00B	70.00	500.00	200.00	1500.00	700.00
051	200.00	10.00	300.00	200.00N	0.00B	100.00	200.00N	300.00	100.00N	1000.00
052	50.00L	10.00	200.00	200.00N	0.00B	70.00	200.00	300.00	100.00N	3000.00
053	100.00	10.00N	200.00	200.00N	0.00B	100.00	200.00N	150.00	100.00N	2000.00
055	100.00	10.00N	200.00	200.00N	0.00B	200.00	500.00	200.00	150.00	1500.00
056	200.00	10.00N	3000.00	200.00N	0.00B	1500.00	200.00N	300.00	2000.00	1500.00
057	100.00	10.00N	700.00	200.00N	0.00B	30.00	700.00	500.00	1000.00	1000.00
058	200.00	10.00N	50.00	200.00N	0.00B	70.00	300.00	300.00	150.00	1000.00
059	150.00	10.00N	150.00	200.00N	0.00B	100.00	200.00N	200.00	100.00N	2000.00
060	150.00	10.00N	100.00	200.00N	0.00B	150.00	200.00N	200.00	100.00N	1500.00
061	150.00	10.00N	200.00	200.00N	0.00B	100.00	200.00	200.00	500.00	700.00
062	200.00	10.00N	150.00	200.00N	0.00B	70.00	200.00	300.00	700.00	1000.00
063	200.00	10.00	500.00	200.00N	0.00B	100.00	300.00	300.00	150.00	1000.00
064	100.00	10.00N	200.00	200.00N	0.00B	30.00	200.00	300.00	1000.00	700.00
065	150.00	10.00	500.00	200.00N	0.00B	70.00	200.00	500.00	1500.00	1000.00
066	100.00	10.00N	50.00	200.00N	0.00B	50.00	200.00N	500.00	100.00	1000.00
067	150.00	70.00	200.00	200.00N	0.00B	70.00	300.00	300.00	2000.00	700.00
068	100.00	10.00N	700.00	200.00N	0.00B	100.00	200.00N	500.00	3000.00	1500.00
069	200.00	10.00N	500.00	200.00N	0.00B	200.00	200.00N	300.00	150.00	2000.00
070	100.00	10.00N	500.00	200.00N	0.00B	150.00	200.00N	200.00	300.00	2000.00
071	150.00	10.00N	500.00	200.00N	0.00B	150.00	200.00N	200.00	100.00N	2000.00
072	100.00	10.00N	3000.00	200.00N	0.00B	150.00	200.00N	200.00	100.00L	2000.00
073	150.00	10.00N	500.00	200.00N	0.00B	200.00	200.00N	300.00	100.00N	3000.00
074	200.00	10.00N	500.00	200.00N	0.00B	200.00	200.00N	500.00	100.00N	3000.00
075	200.00	10.00N	300.00	200.00N	0.00B	300.00	200.00N	500.00	100.00L	3000.00
076	100.00	10.00	200.00	200.00N	0.00B	150.00	200.00N	300.00	100.00	2000.00
077	70.00	10.00	200.00	200.00N	0.00B	150.00	200.00N	500.00	100.00N	3000.00
078	300.00	10.00N	150.00	200.00N	0.00B	200.00	200.00N	500.00	100.00L	3000.00
079	70.00	10.00N	300.00	200.00N	0.00B	200.00	200.00N	300.00	100.00L	2000.00
080	300.00	10.00N	300.00	200.00N	0.00B	100.00	200.00N	500.00	2000.00	2000.00
081	200.00	10.00N	300.00	200.00N	0.00B	500.00	200.00N	300.00	200.00	2000.00
082	100.00	10.00N	700.00	200.00N	0.00B	300.00	200.00N	300.00	100.00N	2000.00
083	100.00	10.00N	200.00	200.00N	0.00B	70.00	200.00	300.00	300.00	2000.00
084	70.00	10.00N	150.00	200.00N	0.00B	50.00	200.00N	150.00	100.00N	2000.00
085	100.00	10.00N	300.00	200.00N	0.00B	300.00	200.00N	500.00	100.00N	5000.00
086	200.00	10.00N	300.00	200.00N	0.00B	200.00	200.00N	300.00	100.00N	3000.00
087	300.00	10.00N	200.00	200.00N	0.00B	200.00	200.00N	300.00	200.00	3000.00
088	50.00	10.00N	500.00	200.00N	0.00B	300.00	200.00N	500.00	100.00N	5000.00
089	300.00	10.00N	200.00	200.00N	0.00B	200.00	200.00N	300.00	100.00N	5000.00
090	300.00	10.00N	300.00	200.00N	0.00B	200.00	200.00N	200.00	100.00	5000.00
091	200.00	10.00N	300.00	200.00N	0.00B	200.00	200.00N	300.00	100.00N	5000.00G

TableA4.--Cont.

Sample	S-ZN	S-ZR	S-TH
046	500.00N	2000.00G	200.00L
047	500.00N	2000.00G	200.00N
048	500.00N	2000.00G	200.00L
049	500.00N	2000.00G	200.00L
050	500.00N	2000.00G	200.00
051	700.00	2000.00G	300.00
052	500.00N	2000.00G	200.00
053	500.00N	2000.00G	200.00N
055	500.00N	2000.00G	200.00
056	500.00N	2000.00G	200.00
057	500.00N	2000.00G	200.00
058	500.00L	2000.00G	200.00
059	500.00N	2000.00G	200.00
060	500.00N	2000.00G	200.00
061	500.00N	2000.00G	300.00
062	500.00L	2000.00G	300.00
063	500.00N	2000.00G	300.00
064	500.00N	2000.00G	200.00
065	500.00N	2000.00G	300.00
066	700.00	2000.00G	200.00L
067	500.00N	2000.00G	200.00
068	500.00N	2000.00G	300.00
069	500.00N	2000.00G	200.00
070	500.00N	2000.00G	200.00L
071	500.00N	2000.00G	200.00L
072	500.00N	2000.00G	200.00L
073	500.00N	2000.00G	200.00
074	500.00N	2000.00G	200.00N
075	500.00N	2000.00G	200.00N
076	500.00N	2000.00G	200.00L
077	500.00N	2000.00G	200.00L
078	500.00N	2000.00G	200.00
079	500.00N	2000.00G	200.00
080	500.00N	2000.00G	700.00
081	500.00	2000.00G	300.00
082	1000.00	2000.00G	200.00
083	500.00N	2000.00G	700.00
084	500.00N	2000.00G	200.00
085	500.00N	2000.00G	200.00L
086	500.00N	2000.00G	200.00L
087	500.00N	2000.00G	200.00L
088	500.00N	2000.00G	200.00
089	500.00N	2000.00G	200.00L
090	500.00N	2000.00G	200.00L
091	500.00N	2000.00G	200.00L

TableA4.--Cont.

Sample	LATITUDE	LONGITUD	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-AS	S-AU
092	38 44 27N	106 03 40W	2.00	0.30	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
093	38 38 51N	106 00 26W	1.00	0.20	30.00	2.00G	1500.00	1.00N	500.00N	20.00N
094	38 38 47N	106 00 25W	1.00	0.15	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
095	38 38 43N	106 00 14W	1.50	0.50	30.00	2.00G	1500.00	1.00N	500.00N	20.00N
096	38 38 51N	106 00 26W	1.00	0.15	30.00	2.00G	1500.00	1.00N	500.00N	20.00N
097	38 38 42N	106 00 38W	1.50	0.15	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
098	38 38 34N	106 00 32W	2.00	0.50	20.00	2.00G	2000.00	20.00	500.00N	200.00
099	38 38 33N	106 00 19W	1.00	0.30	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
100	38 38 26N	106 00 10W	2.00	0.50	15.00	2.00G	1500.00	200.00	500.00N	20.00N
101	38 38 29N	106 00 07W	1.00	0.15	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
102	38 38 26N	106 00 10W	2.00	0.30	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
103	38 37 59N	106 04 01W	1.00	0.30	50.00	2.00G	1000.00	1.00N	500.00N	20.00N
104	38 44 24N	106 02 20W	2.00	0.50	50.00	2.00G	2000.00	1.00N	500.00N	20.00N
105	38 44 21N	106 02 19W	1.50	0.20	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
106	38 44 13N	106 03 22W	2.00	0.50	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
107	38 44 04N	106 03 34W	0.70	0.10	10.00	2.00G	1000.00	1.00N	500.00N	20.00N
108	38 44 01N	106 00 59W	1.50	0.20	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
109	38 44 05N	106 00 59W	2.00	0.20	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
110	38 44 01N	106 01 34W	2.00	0.30	30.00	2.00G	1500.00	1.00N	500.00N	20.00N
111	38 43 46N	106 02 16W	1.50	0.20	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
112	38 39 54N	106 01 56W	1.50	0.20	30.00	2.00G	2000.00	1.00N	500.00N	20.00N
113	38 40 26N	106 01 20W	1.00	1.50	15.00	2.00G	2000.00	1.00N	500.00N	20.00N
114	38 40 34N	106 01 44W	1.00	1.00	30.00	2.00G	2000.00	1.00N	500.00N	20.00N
115	38 40 37N	106 01 45W	1.50	0.20	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
116	38 41 07N	106 01 27W	1.00	0.20	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
117	38 43 16N	106 01 14W	1.50	1.00	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
118	38 43 16N	106 01 14W	1.00	0.70	10.00	2.00G	1500.00	1.00N	500.00N	20.00N
119	38 43 14N	106 01 17W	1.00	0.20	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
120	38 43 06N	106 00 54W	2.00	0.30	30.00	2.00G	3000.00	1.00N	500.00N	20.00N
121	38 43 10N	106 00 52W	1.50	2.00	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
122	38 40 46N	106 02 28W	1.00	1.00	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
123	38 40 58N	106 02 29W	1.50	0.20	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
124	38 40 36N	106 02 23W	2.00	0.30	30.00	2.00G	2000.00	1.00N	500.00N	20.00N
125	38 38 56N	106 02 22W	1.00	0.20	50.00	2.00G	1500.00	1.00N	500.00N	20.00N
126	38 38 57N	106 02 25W	1.00	0.20	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
127	38 38 58N	106 02 39W	0.70	0.15	15.00	2.00	1000.00	1.00N	500.00N	20.00N
128	38 38 59N	106 02 49W	1.50	0.30	30.00	2.00G	1500.00	1.00N	500.00N	20.00N
129	38 38 59N	106 02 49W	1.00	0.20	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
130	38 39 49N	106 02 42W	1.00	0.15	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
131	38 40 58N	106 02 29W	1.50	0.20	30.00	2.00G	2000.00	1.00N	500.00N	20.00N
132	38 39 49N	106 02 44W	1.00	0.30	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
133	38 37 47N	106 00 05W	3.00	1.50	30.00	2.00G	2000.00	1.00N	500.00N	20.00N
134	38 37 47N	106 00 02W	1.50	0.30	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
135	38 37 43N	106 00 08W	2.00	1.50	15.00	2.00G	2000.00	1.00N	500.00N	20.00N
136	38 37 47N	106 00 05W	1.50	0.30	20.00	2.00G	1000.00	1.00N	500.00N	20.00N

TableA4.--Cont.

Sample	S-B	S-BA	S-BE	S-BI	S-CD	S-CO	S-CR	S-CU	S-LA	S-MO
092	20.00	150.00	2.00N	20.00N	50.00N	15.00	100.00	10.00N	1000.00	20.00
093	20.00	200.00	2.00L	20.00N	50.00N	10.00	70.00	10.00	500.00	10.00N
094	20.00L	150.00	2.00L	20.00N	50.00N	10.00	50.00	10.00N	500.00	10.00N
095	20.00	200.00	2.00L	20.00N	50.00N	10.00	100.00	10.00N	500.00	10.00N
096	20.00L	300.00	2.00L	20.00N	50.00N	10.00N	50.00	10.00N	300.00	10.00N
097	20.00	500.00	2.00L	20.00N	50.00N	10.00	50.00	10.00N	700.00	10.00N
098	50.00	1000.00	2.00	20.00N	50.00N	10.00	100.00	200.00	1500.00	200.00
099	30.00	500.00	2.00L	20.00N	50.00N	10.00	70.00	150.00	1000.00	10.00N
100	70.00	700.00	3.00	20.00N	50.00N	15.00	50.00	1000.00	700.00	500.00
101	300.00	300.00	2.00L	20.00N	50.00N	10.00	50.00	70.00	500.00	10.00
102	70.00	500.00	5.00	20.00N	50.00N	10.00	100.00	1000.00	2000.00	150.00
103	20.00	10000.00G	2.00	20.00N	50.00N	10.00	50.00	10.00	200.00	10.00N
104	20.00	200.00	2.00L	20.00N	50.00N	15.00	150.00	10.00L	1000.00	30.00
105	20.00	200.00	2.00L	20.00N	50.00N	15.00	100.00	10.00L	500.00	10.00N
106	20.00	700.00	2.00L	20.00N	50.00N	10.00	70.00	10.00L	700.00	15.00
107	20.00	200.00	2.00L	20.00N	50.00N	10.00	70.00	10.00N	500.00	10.00N
108	20.00	150.00	2.00L	20.00N	50.00N	15.00	100.00	10.00L	700.00	10.00N
109	20.00	150.00	2.00L	20.00N	50.00N	15.00	70.00	10.00L	500.00	10.00
110	20.00	200.00	2.00N	20.00N	50.00N	15.00	150.00	10.00L	1000.00	20.00
111	20.00	100.00	2.00N	20.00N	50.00N	15.00	100.00	10.00N	1000.00	20.00
112	30.00	100.00	2.00L	20.00N	50.00N	10.00	100.00	10.00L	300.00	10.00N
113	70.00	700.00	2.00L	20.00N	50.00N	15.00	70.00	10.00	200.00	15.00
114	50.00	150.00	2.00N	20.00N	50.00N	10.00	70.00	10.00	200.00	10.00N
115	30.00	300.00	2.00L	20.00N	50.00N	15.00	50.00	10.00L	200.00	10.00N
116	50.00	700.00	2.00L	20.00N	50.00N	10.00	50.00	10.00L	200.00	10.00N
117	50.00	2000.00	2.00L	20.00N	50.00N	10.00	50.00	10.00L	500.00	10.00N
118	50.00	2000.00	2.00L	20.00N	50.00N	10.00	50.00	10.00L	200.00	10.00N
119	20.00	150.00	2.00L	20.00N	50.00N	10.00	70.00	10.00L	200.00	10.00N
120	30.00	100.00	2.00L	20.00N	50.00N	15.00	100.00	10.00L	500.00	15.00
121	70.00	2000.00	2.00L	20.00N	50.00N	10.00	100.00	10.00L	300.00	15.00
122	30.00	150.00	2.00L	20.00N	50.00N	10.00	50.00	10.00L	200.00	10.00N
123	20.00	100.00	2.00L	20.00N	50.00N	15.00	50.00	10.00L	500.00	10.00N
124	20.00	100.00	2.00L	20.00N	50.00N	15.00	50.00	10.00L	200.00	15.00
125	30.00	500.00	2.00N	20.00N	50.00N	10.00	70.00	10.00L	500.00	10.00N
126	30.00	500.00	2.00L	20.00N	50.00N	10.00	50.00	10.00L	300.00	10.00N
127	20.00	5000.00	2.00L	200.00	50.00N	10.00	30.00	15.00	200.00	10.00N
128	30.00	2000.00	2.00L	20.00N	50.00N	15.00	50.00	10.00L	500.00	10.00N
129	30.00	1000.00	2.00N	20.00N	50.00N	10.00	50.00	10.00	500.00	10.00N
130	20.00L	100.00	2.00N	20.00N	50.00N	10.00	30.00	10.00L	200.00	10.00N
131	30.00	100.00	2.00L	20.00N	50.00N	15.00	50.00	10.00L	500.00	15.00
132	20.00	200.00	2.00L	20.00N	50.00N	15.00	70.00	10.00L	300.00	10.00N
133	50.00	700.00	2.00L	20.00N	50.00N	20.00	150.00	50.00	1000.00	30.00
134	20.00	300.00	2.00	20.00N	50.00N	10.00	50.00	15.00	1000.00	10.00L
135	200.00	500.00	2.00L	20.00N	50.00N	15.00	100.00	30.00	1000.00	10.00
136	20.00	500.00	2.00L	20.00N	50.00N	10.00	70.00	30.00	500.00	20.00

Table A4.--Cont.

Sample	S-NB	S-NI	S-PB	S-SB	S-SC	S-SN	S-SR	S-V	S-W	S-Y
092	200.00	10.00N	100.00	200.00N	0.00B	150.00	200.00N	500.00	100.00N	1500.00
093	100.00	10.00N	300.00	200.00N	0.00B	100.00	200.00N	200.00	100.00N	5000.00
094	150.00	10.00N	100.00	200.00N	0.00B	150.00	200.00N	200.00	100.00N	3000.00
095	100.00	10.00	300.00	200.00N	0.00B	100.00	200.00N	200.00	100.00N	3000.00
096	150.00	10.00N	150.00	200.00N	0.00B	50.00	200.00N	200.00	100.00N	3000.00
097	70.00	10.00N	200.00	200.00N	0.00B	70.00	200.00N	200.00	100.00N	5000.00
098	150.00	10.00	1000.00	200.00N	0.00B	500.00	200.00N	300.00	100.00N	5000.00
099	200.00	10.00N	700.00	200.00N	0.00B	500.00	200.00N	300.00	700.00	5000.00
100	200.00	10.00N	5000.00	200.00N	0.00B	100.00	200.00	500.00	300.00	2000.00
101	100.00	10.00N	500.00	200.00N	0.00B	200.00	200.00N	200.00	100.00N	2000.00
102	150.00	10.00N	10000.00	200.00N	0.00B	100.00	200.00	1500.00	100.00	3000.00
103	50.00	10.00N	200.00	200.00N	0.00B	20.00N	500.00	200.00	100.00L	1500.00
104	300.00	10.00N	200.00	200.00N	0.00B	200.00	200.00N	700.00	100.00N	3000.00
105	150.00	10.00N	100.00	200.00N	0.00B	100.00	200.00	500.00	100.00N	2000.00
106	100.00	10.00N	100.00	200.00N	0.00B	150.00	200.00	700.00	100.00N	1500.00
107	50.00	10.00N	50.00	200.00N	0.00B	70.00	200.00	300.00	100.00N	700.00
108	100.00	10.00	100.00	200.00N	0.00B	150.00	200.00	500.00	100.00N	1500.00
109	100.00	10.00	100.00	200.00N	0.00B	100.00	200.00	300.00	100.00N	1500.00
110	200.00	10.00N	100.00	200.00N	0.00B	200.00	200.00N	300.00	100.00N	3000.00
111	100.00	10.00N	100.00	200.00N	0.00B	150.00	200.00N	300.00	100.00N	2000.00
112	200.00	10.00N	200.00	200.00N	0.00B	200.00	200.00N	200.00	100.00	5000.00
113	300.00	15.00	200.00	200.00N	0.00B	150.00	200.00N	200.00	1000.00	5000.00
114	200.00	10.00N	300.00	200.00N	0.00B	300.00	200.00N	200.00	100.00L	3000.00
115	200.00	10.00	200.00	200.00N	0.00B	150.00	200.00N	200.00	150.00	5000.00
116	200.00	15.00	200.00	200.00N	0.00B	200.00	200.00N	200.00	700.00	3000.00
117	200.00	10.00	200.00	200.00N	0.00B	200.00	200.00N	200.00	100.00N	3000.00
118	200.00	10.00	150.00	200.00N	0.00B	100.00	200.00N	200.00	100.00	3000.00
119	200.00	10.00	200.00	200.00N	0.00B	200.00	200.00N	200.00	100.00N	5000.00
120	300.00	10.00N	300.00	200.00N	0.00B	200.00	200.00N	300.00	100.00N	5000.00
121	500.00	10.00N	300.00	200.00N	0.00B	200.00	200.00N	300.00	300.00	5000.00
122	200.00	10.00N	200.00	200.00N	0.00B	200.00	200.00N	200.00	100.00N	3000.00
123	200.00	10.00	150.00	200.00N	0.00B	150.00	200.00N	200.00	100.00N	2000.00
124	500.00	10.00	200.00	200.00N	0.00B	300.00	200.00N	300.00	100.00	5000.00
125	200.00	10.00	150.00	200.00N	0.00B	150.00	200.00N	150.00	100.00N	3000.00
126	200.00	10.00N	150.00	200.00N	0.00B	150.00	200.00N	200.00	100.00N	3000.00
127	100.00	10.00N	200.00	200.00N	0.00B	100.00	200.00N	100.00	100.00N	1000.00
128	200.00	10.00	1500.00	200.00N	0.00B	100.00	200.00N	200.00	100.00N	3000.00
129	200.00	10.00N	150.00	200.00N	0.00B	100.00	200.00N	200.00	100.00N	2000.00
130	200.00	10.00N	70.00	200.00N	0.00B	100.00	200.00N	300.00	100.00N	2000.00
131	200.00	10.00N	200.00	200.00N	0.00B	200.00	200.00N	300.00	100.00N	3000.00
132	200.00	10.00	150.00	200.00N	0.00B	200.00	200.00N	200.00	150.00	5000.00
133	200.00	10.00	200.00	200.00N	0.00B	150.00	200.00	500.00	100.00L	2000.00
134	70.00	10.00N	200.00	200.00N	0.00B	100.00	200.00N	200.00	200.00	1500.00
135	200.00	10.00	150.00	200.00N	0.00B	150.00	200.00N	300.00	500.00	1500.00
136	200.00	10.00N	200.00	200.00N	0.00B	150.00	200.00N	500.00	100.00N	1000.00

Table A4.--Cont.

Sample	S-ZN	S-ZR	S-TH
092	500.00N	2000.00G	200.00L
093	500.00N	2000.00G	200.00L
094	500.00N	2000.00G	200.00L
095	500.00N	2000.00G	200.00L
096	500.00N	2000.00G	200.00N
097	500.00N	2000.00G	200.00L
098	500.00	2000.00G	300.00
099	700.00	2000.00G	300.00
100	1000.00	2000.00G	700.00
101	500.00N	2000.00G	200.00L
102	2000.00	2000.00G	300.00
103	500.00N	2000.00G	200.00N
104	500.00N	2000.00G	200.00
105	500.00N	2000.00G	200.00L
106	500.00N	2000.00G	200.00
107	500.00N	2000.00G	200.00
108	500.00N	2000.00G	300.00
109	500.00N	2000.00G	200.00
110	500.00N	2000.00G	200.00
111	500.00N	2000.00G	200.00
112	500.00N	2000.00G	200.00
113	500.00N	2000.00G	300.00
114	500.00N	2000.00G	200.00
115	500.00N	2000.00G	300.00
116	500.00N	2000.00G	200.00
117	500.00N	2000.00G	300.00
118	500.00N	2000.00G	300.00
119	500.00N	2000.00G	200.00
120	500.00N	2000.00G	200.00
121	500.00N	2000.00G	200.00
122	500.00N	2000.00G	200.00
123	500.00N	2000.00G	200.00
124	500.00N	2000.00G	200.00
125	500.00N	2000.00G	200.00
126	500.00N	2000.00G	200.00L
127	500.00N	2000.00G	200.00N
128	500.00N	2000.00G	200.00
129	500.00N	2000.00G	200.00
130	500.00N	2000.00G	200.00L
131	500.00N	2000.00G	200.00L
132	500.00N	2000.00G	200.00N
133	500.00N	2000.00G	200.00
134	500.00N	2000.00G	200.00L
135	500.00N	2000.00G	300.00
136	500.00N	2000.00G	200.00L

Table A4.--Cont.

Sample	LATITUDE	LONGITUD	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-AS	S-AU
137	38 37 32N	106 03 30W	1.00	0.20	20.00	2.00G	1000.00	1.00N	500.00N	20.00N
138	38 43 02N	106 03 15W	1.00	0.70	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
139	38 43 17N	106 03 13W	2.00	0.30	30.00	2.00G	1500.00	1.00N	500.00N	20.00N
140	38 37 32N	106 03 30W	1.00	0.50	20.00	2.00G	1000.00	1.00N	500.00N	20.00N
141	38 43 55N	106 02 55W	2.00	0.50	30.00	2.00G	2000.00	1.00N	500.00N	20.00N
142	38 44 13N	106 03 22W	1.50	0.50	30.00	2.00G	2000.00	1.00N	500.00N	20.00N
143	38 43 52N	106 02 55W	1.50	0.50	30.00	2.00G	2000.00	1.00N	500.00N	20.00N
144	38 43 55N	106 02 55W	1.00	0.20	20.00	2.00G	1000.00	1.00N	500.00N	20.00N
145	38 44 48N	106 03 59W	1.00	0.50	30.00	2.00G	2000.00	1.00N	500.00N	20.00N
151	38 37 15N	106 03 29W	3.00	0.15	10.00	2.00G	1500.00	5.00	500.00N	20.00N
152	38 40 04N	106 03 12W	0.70	0.20	10.00	2.00G	1000.00	1.00N	500.00N	20.00N
153	38 39 07N	106 03 21W	1.50	0.50	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
154	38 38 02N	106 03 40W	2.00	0.70	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
155	38 38 26N	106 03 53W	1.00	0.15	15.00	2.00G	1000.00	1.00N	500.00N	20.00N
156	38 38 54N	106 04 47W	1.00	0.30	30.00	2.00G	1500.00	1.00N	500.00N	20.00N
157	38 39 17N	106 01 59W	1.00	0.20	30.00	2.00G	2000.00	1.00N	500.00N	20.00N
158	38 38 11N	106 02 05W	1.00	3.00	10.00	2.00G	1000.00	1.00N	500.00N	20.00N
159	38 38 09N	106 03 13W	1.00	0.30	30.00	2.00G	1000.00	1.00N	500.00N	20.00N
160	38 37 58N	106 01 21W	0.50	2.00	10.00	2.00G	700.00	1.00N	500.00N	20.00N
161	38 42 11N	106 02 55W	2.00	0.30	15.00	2.00G	2000.00	1.00N	500.00N	20.00N
162	38 42 34N	106 03 03W	0.50	0.15	10.00	2.00G	1000.00	1.00N	500.00N	20.00N
163	38 38 36N	106 00 56W	2.00	0.30	30.00	2.00G	1500.00	1.00N	500.00N	20.00N
164	38 41 45N	106 01 21W	1.00	0.20	15.00	2.00G	2000.00	1.00N	500.00N	20.00N
165	38 38 33N	106 00 19W	1.50	0.30	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
166	38 44 13N	106 03 22W	1.00	0.20	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
167	38 38 34N	106 00 32W	1.00	0.20	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
168	38 44 01N	106 00 50W	0.70	0.20	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
169	38 38 19N	106 00 52W	2.00	0.30	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
170	38 38 59N	106 02 49W	1.00	0.30	30.00	2.00G	1500.00	1.00N	500.00N	20.00N
171	38 38 58N	106 04 50W	1.50	0.20	15.00	2.00G	1000.00	1.00N	500.00N	20.00N

Table A4.--Cont.

Sample	S-B	S-BA	S-BE	S-BI	S-CD	S-CO	S-CR	S-CU	S-LA	S-MO
137	20.00	700.00	2.00L	20.00N	50.00N	10.00	50.00	10.00N	1000.00	10.00N
138	20.00	200.00	2.00	20.00N	50.00N	15.00	70.00	10.00	500.00	30.00
139	20.00	700.00	2.00N	20.00L	50.00N	15.00	70.00	10.00L	700.00	10.00N
140	30.00	2000.00	2.00	20.00N	50.00N	15.00	70.00	10.00L	700.00	10.00N
141	30.00	500.00	2.00N	50.00	50.00N	20.00	100.00	10.00L	1000.00	20.00
142	20.00	700.00	2.00N	20.00N	50.00N	20.00	150.00	10.00L	1000.00	20.00
143	30.00	500.00	2.00N	20.00N	50.00N	15.00	100.00	10.00L	1000.00	10.00
144	20.00L	200.00	2.00N	20.00N	50.00N	10.00	100.00	10.00N	700.00	20.00
145	20.00	100.00	2.00N	20.00N	50.00N	10.00	100.00	10.00	1000.00	20.00
151	20.00	2000.00	2.00L	20.00N	50.00N	20.00	50.00	70.00	2000.00G	10.00N
152	20.00	10000.00G	2.00L	20.00N	50.00N	10.00	20.00	10.00	500.00	10.00N
153	30.00	2000.00	2.00	20.00N	50.00N	10.00	70.00	10.00L	1500.00	10.00N
154	30.00	3000.00	2.00	20.00N	50.00N	10.00	50.00	20.00	700.00	10.00N
155	20.00	5000.00	2.00L	20.00N	50.00N	10.00	50.00	10.00L	2000.00	10.00N
156	20.00	10000.00G	2.00L	20.00N	50.00N	15.00	100.00	10.00L	1000.00	10.00N
157	20.00L	500.00	2.00N	20.00N	50.00N	10.00	50.00	10.00	200.00	10.00N
158	70.00	10000.00	2.00L	20.00N	50.00N	15.00	100.00	15.00	500.00	10.00
159	20.00	2000.00	2.00L	20.00N	50.00N	10.00	50.00	10.00	200.00	10.00N
160	50.00	10000.00G	2.00	20.00N	50.00N	10.00	70.00	10.00N	300.00	10.00N
161	20.00	300.00	2.00L	20.00N	50.00N	10.00	50.00	20.00	500.00	10.00N
162	20.00	150.00	2.00L	20.00N	50.00N	10.00	30.00	10.00	200.00	10.00N
163	20.00L	300.00	2.00N	20.00N	50.00N	10.00	50.00	20.00	1000.00	10.00N
164	20.00	150.00	2.00L	20.00N	50.00N	10.00	50.00	10.00N	500.00	10.00N
165	30.00	500.00	2.00L	20.00N	50.00N	10.00	70.00	200.00	2000.00	10.00N
166	20.00L	500.00	2.00N	20.00N	50.00N	10.00	70.00	10.00N	1000.00	10.00N
167	50.00	1000.00	2.00L	20.00N	50.00N	10.00	50.00	200.00	2000.00	10.00L
168	20.00	150.00	2.00N	20.00N	50.00N	10.00	100.00	10.00N	700.00	10.00
169	50.00	700.00	2.00	20.00N	50.00N	10.00	70.00	200.00	1000.00	15.00
170	20.00	2000.00	2.00N	20.00N	50.00N	10.00	70.00	10.00N	500.00	10.00N
171	50.00	10000.00	2.00L	20.00N	50.00N	15.00	50.00	15.00	2000.00	10.00N

Table A4.--Cont.

Sample	S-NB	S-NI	S-PB	S-SB	S-SC	S-SN	S-SR	S-V	S-W	S-Y
137	50.00	10.00N	150.00	200.00N	0.00B	30.00	200.00N	100.00	500.00	1500.00
138	200.00	10.00N	300.00	200.00N	0.00B	200.00	200.00N	200.00	100.00N	5000.00
139	300.00	10.00	300.00	200.00N	0.00B	200.00	200.00N	200.00	100.00N	5000.00G
140	100.00	10.00N	150.00	200.00N	0.00B	50.00	200.00N	150.00	1000.00	1500.00
141	100.00	10.00N	200.00	200.00N	0.00B	150.00	200.00N	500.00	100.00N	2000.00
142	150.00	10.00N	200.00	200.00N	0.00B	200.00	200.00N	500.00	100.00N	2000.00
143	50.00	10.00N	200.00	200.00N	0.00B	200.00	200.00N	500.00	100.00N	3000.00
144	200.00	10.00N	100.00	200.00N	0.00B	100.00	200.00N	500.00	100.00L	2000.00
145	200.00	10.00N	150.00	200.00N	0.00B	300.00	200.00N	500.00	100.00N	2000.00
151	70.00	15.00	700.00	200.00N	0.00B	100.00	200.00N	200.00	100.00	5000.00
152	100.00	15.00	200.00	200.00N	0.00B	100.00	1000.00	200.00	100.00N	1500.00
153	100.00	10.00N	300.00	200.00N	0.00B	150.00	200.00N	500.00	100.00N	2000.00
154	50.00	10.00	150.00	200.00N	0.00B	70.00	200.00	300.00	100.00N	1000.00
155	100.00	10.00N	200.00	200.00N	0.00B	100.00	200.00N	300.00	100.00N	1500.00
156	70.00	15.00	300.00	200.00N	0.00B	70.00	200.00N	200.00	100.00N	3000.00
157	200.00	10.00N	100.00	200.00N	0.00B	150.00	200.00N	200.00	100.00L	3000.00
158	150.00	10.00N	200.00	200.00N	0.00B	50.00	200.00	200.00	1500.00	700.00
159	100.00	10.00N	300.00	200.00N	0.00B	100.00	200.00N	150.00	100.00N	2000.00
160	100.00	10.00N	200.00	200.00N	0.00B	20.00N	300.00	200.00	1500.00	300.00
161	200.00	10.00N	500.00	200.00N	0.00B	200.00	200.00N	300.00	100.00N	5000.00
162	150.00	10.00	100.00	200.00N	0.00B	100.00	200.00N	200.00	100.00L	2000.00
163	150.00	10.00N	500.00	200.00N	0.00B	150.00	200.00N	150.00	100.00L	2000.00
164	200.00	10.00N	100.00	200.00N	0.00B	200.00	200.00N	300.00	100.00N	3000.00
165	150.00	10.00N	1000.00	200.00N	0.00B	500.00	200.00N	300.00	200.00	3000.00
166	50.00L	10.00N	70.00	200.00N	0.00B	70.00	200.00N	500.00	100.00N	1000.00
167	50.00	10.00N	1000.00	200.00N	0.00B	500.00	200.00N	300.00	100.00N	5000.00
168	100.00	10.00N	100.00	200.00N	0.00B	100.00	200.00N	500.00	100.00N	1500.00
169	200.00	10.00N	300.00	200.00N	0.00B	500.00	200.00N	300.00	200.00	3000.00
170	100.00	10.00N	500.00	200.00N	0.00B	70.00	200.00N	200.00	100.00N	5000.00
171	70.00	15.00	200.00	200.00N	0.00B	70.00	200.00	200.00	100.00N	3000.00

Table A4.--Cont.

Sample	S-ZN	S-ZR	S-TH
137	500.00N	2000.00G	200.00
138	500.00N	2000.00G	200.00L
139	500.00N	2000.00G	200.00L
140	500.00N	2000.00G	200.00
141	500.00N	2000.00G	200.00
142	500.00N	2000.00G	200.00L
143	500.00N	2000.00G	200.00L
144	500.00N	2000.00G	200.00L
145	500.00N	2000.00G	200.00
151	1000.00	2000.00G	1000.00
152	500.00N	2000.00G	300.00
153	500.00N	2000.00G	200.00
154	500.00N	2000.00G	200.00L
155	500.00N	2000.00G	700.00
156	500.00N	2000.00G	200.00L
157	500.00N	2000.00G	200.00
158	500.00N	2000.00G	200.00
159	500.00N	2000.00G	200.00
160	500.00N	2000.00G	200.00N
161	500.00N	2000.00G	200.00L
162	500.00N	2000.00G	200.00L
163	500.00N	2000.00G	200.00
164	500.00N	2000.00G	200.00L
165	500.00	2000.00G	300.00
166	500.00N	2000.00G	200.00L
167	700.00	2000.00G	200.00
168	500.00N	2000.00G	200.00
169	500.00L	2000.00G	300.00
170	500.00N	2000.00G	200.00
171	500.00N	2000.00G	500.00

Table A5.--Summary statistics for heavy-mineral concentrate data. "Valid" = number of uncensored values; "L" = detectable but below stated detection limits; "N" = not detected; "G" = above stated detection limits.

UNIVARIATE STATISTICS

VAR	COLUMN	MINIMUM	MAXIMUM	MEAN	DEVIATION	VALID	B	L	N	G	OTHER
1	S*FE%	5.000E*01	1.000E+01	1.608E+00	1.0534E+00	123	0	0	0	0	0
2	S*MG%	1.000E*01	5.000E+00	6.146E*01	9.9626E*01	123	0	0	0	0	0
3	S*CA%	7.000E+00	5.000E+01	2.064E+01	9.2383E+00	123	0	0	0	0	0
4	S*TI%	2.000E+00	2.000E+00	2.000E+00	1.0000E+35	2	0	0	0	121	0
5	S*MN	7.000E+02	5.000E+03	1.697E+03	5.3084E+02	123	0	0	0	0	0
6	S*AG	1.000E+00	2.000E+02	2.805E+00	1.8011E+01	3	0	0	120	0	0
7	S*AS	5.000E+02	5.000E+02	5.000E+02	1.0000E+35	0	0	0	123	0	0
8	S*AU	2.000E+01	1.000E+03	2.943E+01	8.9711E+01	2	0	0	121	0	0
9	S*B	2.000E+01	3.000E+02	3.902E+01	3.8120E+01	112	0	11	0	0	0
10	S*BA	1.000E+02	1.000E+04	2.854E+03	3.8236E+03	105	0	0	0	18	0
11	S*BE	2.000E+00	5.000E+00	2.049E+00	3.0978E*01	40	0	71	12	0	0
12	S*BI	2.000E+01	2.000E+02	2.171E+01	1.6432E+01	2	0	1	120	0	0
13	S*CD	5.000E+01	5.000E+01	5.000E+01	1.0000E+35	0	0	0	123	0	0
14	S*CO	1.000E+01	5.000E+01	1.252E+01	4.8067E+00	121	0	0	2	0	0
15	S*CR	3.000E+01	1.000E+03	8.545E+01	8.8403E+01	123	0	0	0	0	0
16	S*CU	1.000E+01	1.000E+03	3.215E+01	9.8848E+01	63	0	44	16	0	0
17	S*LA	1.500E+02	2.000E+03	8.179E+02	5.9075E+02	111	0	0	0	12	0
18	S*MO	1.000E+01	5.000E+02	2.150E+01	4.9774E+01	49	0	4	70	0	0
19	S*NB	5.000E+01	5.000E+02	1.568E+02	9.2730E+01	118	0	4	1	0	0
20	S*NI	1.000E+01	7.000E+01	1.098E+01	5.5684E+00	53	0	0	70	0	0
21	S*PB	5.000E+01	5.000E+03	3.514E+02	5.8123E+02	123	0	0	0	0	0
22	S*SB	2.000E+02	2.000E+02	2.000E+02	1.0000E+35	0	0	0	123	0	0
23	S*SN	2.000E+01	1.500E+03	1.592E+02	1.4839E+02	122	0	0	1	0	0
24	S*SR	2.000E+02	2.000E+03	2.976E+02	2.8269E+02	39	0	0	84	0	0
25	S*V	1.000E+02	7.000E+02	2.943E+02	1.2839E+02	123	0	0	0	0	0
26	S*W	1.000E+02	3.000E+03	2.508E+02	4.4868E+02	36	0	12	75	0	0
27	S*Y	7.000E+02	5.000E+03	2.417E+03	1.2450E+03	122	0	0	0	1	0
28	S*ZN	5.000E+02	1.000E+03	5.130E+02	7.0081E+01	8	0	4	111	0	0
29	S*ZR	2.000E+03	2.000E+03	2.000E+03	1.0000E+35	0	0	0	0	123	0
30	S*TH	2.000E+02	2.000E+03	2.764E+02	2.1580E+02	82	0	32	9	0	0

APPENDIX B

Data Reliability Program

APPENDIX B
Data Reliability Program

A control program was designed to assess data reliability. By determining data precision, data interpretation may proceed with an established confidence, and a knowledge of possible errors may be incorporated.

The data control program for this investigation involved the analysis of:

(1) blank samples to detect analytical contamination
(2) reference-material samples to measure analytical precision
(3) sample splits, or analytical duplicates, to measure analytical precision
(4) field (within-site) duplicates, to measure within-site precision

For the minus-80-mesh stream-sediment samples, analyzed by ICP-AES, acceptable precision limits were ±15% at the 90% confidence level. Acceptable precision limits were ±50% at the 95% confidence level (Rose and others, 1979). The expected precision limits for the heavy-mineral concentrate data, analyzed by semiquantitative emission spectrography and reported on a "step" scale (intervals of .10, .15, .20, .30, .50, .70, 1.0...), were ±2 steps at the 96% confidence level and ±1 step at the 83% confidence level (Motooka and Grimes, 1976). These acceptability criteria are reasonable because the data generally showed large regional variation so that high (anomalous) element concentration could be readily distinguished from background concentrations. The goal of distinguishing element concentrations related to mineral deposits from background concentrations was preserved.

Data for elements not detected, rarely detected, or greater than the upper limit of detection were not included in the precision control program. For the stream sediments, these include Ag, As, B, Bi, Cd, Sb, Sn, V, and W. For the heavy-mineral concentrates, elements eliminated from this program include Ti, Ag, As, Au, Bi, Cd, Sb, Sc, and Zr. At least 90% of the values for these elements were censored.

Blanks

Nine blank samples were submitted for analysis by ICP-AES. Only boron was detected in these samples. This contamination may be due to an instrumentation problem on the ICP-AES machine, or may be due to the use of boron-silicate glass test tubes as sample containers. Regardless, boron was not detected in any of the minus-80-mesh stream-sediment samples, so the contamination is insignificant.

Reference-material samples

Eight GXR-6 reference-material samples, routinely used by the USGS, were submitted for emission spectrographic analysis and nine GXR-6 samples were submitted for ICP-AES analysis.

Precision was acceptable for the emission spectrographic method. In the ICP-AES data P, Ti, and V were acceptable only at the 66% confidence level, and arsenic data were inconsistent. Because arsenic was not detected in any of the minus-80-mesh stream-sediment samples, the poor arsenic precision is insignificant in this investigation.

Analytical duplicates and field duplicates

Analytical and within-site precision were assessed using data from duplicate samples. Data listings, X-Y plots, and one-way analysis of variance (ANOV) were utilized. Nine minus-80-mesh stream-sediment samples (every 15th sample) and 20 heavy-mineral concentrates (randomly chosen) were split in the laboratory and analyzed to assess analytical precision. Twenty field duplicates were analyzed by each method to measure within-site reproducibility.

Minus-80-mesh stream sediments

The stream-sediment sample splits showed good analytical precision for all elements except Fe, Mg, Cr, Ni, and Ti. One of the split samples, sample 45 showed poor precision for several elements including Fe, Mg, Cr, and Ti. A greater than average amount (based on visual estimation in the field and laboratory) of magnetite was noted in this sample. It contained high concentrations of Fe, Cr, and Ni, and average concentrations of Mg and Ti. With the elimination of this atypical sample, the ICP analytical precision is considered adequate; regardless, the data for these elements was considered suspect in subsequent data interpretation. It should be noted that Fe, Mg, Cr, Ni, and Ti were among the elements having poor within-site precision. For these elements, the dubious analytical precision may have contributed to the poor within-site precision. Other elements having less than desirable precision, both analytical and within-site, include Co, P, and Y.

Heavy-mineral concentrates

Examination of data listings and X-Y plots for the heavy-mineral concentrate sample splits showed that analytical precision was good for all elements except Pb. ANOV, using log (base 10) transformed data, was applied to help determine the source of the data variation. Davis (1973) describes the ANOV technique in detail. In this case, ANOV was used to distinguish regional variation from analytical variation for the elements having unacceptable precision. Large regional variation may contribute to, and reduce the significance of, apparently poor analytical precision. ANOV for this data indicate that the precision for Pb is acceptable due to high regional variation (table B2).

Examination of data listings and X-Y plots showed that within-site precision was unacceptable for Fe, Mg, Ba, La, Nb, Pb, and Sn. ANOV results indicate that precision for Ba and La is acceptable due to high regional variation of these elements. Significant within-site variance and an F-ratio near or below the critical value is shown in the data for Fe, Mg, Nb, Pb, and Sn. These elements were considered suspect in subsequent data interpretation. It should be noted that a portion of the variance can be attributed to difficulty in sample preparation, particularly in the case of Fe, Pb, and Sn. These elements can reside in minerals which are subject to the "nugget" effect when the sample is split and ground.

Table B1.--Analysis of variance results, heavy mineral concentrates.

	Element	VCP-1	VCP-2	F-ratio	n
within-site duplicates	Fe	41.91	58.09	2.44	40
	Mg	13.21	86.79	1.30	40
	Ba	90.22	9.78	19.44	40
	La	72.40	27.60	6.25	40
	Nb	6.58	93.42	1.14	40
	Pb	47.95	52.05	2.84	40
	Sn	37.10	62.90	2.18	40
analytical duplicates	Pb	71.02	28.98	5.90	40

VCP-1: Regional variation component, expressed as percent of total variance
VCP-2: Within-site variation component, expressed as a percent of total variance
n: number of samples
Critical value of F = 2.12 at the 95% confidence level

Table B2.--Data from the emission spectrographic analysis of field duplicate samples, heavy-mineral concentrates. All values are reported in parts per million, except those for Fe, Mg, Ca, and Ti, which are in percent. Element concentrations are reported on a six-step nominal scale in the series 1, 1.5, 2, 3, 5, 7, 10, etc. Samples having element contents not detectable or above upper detection limits were reported with the designations N and G, respectively. Samples having detectable element contents below stated detection limits were reported with the designation L. Relevant limits of detection are listed in table A1.

Table begins on next page.

Table B2.--Data from the ES analysis of field duplicate samples, heavy-mineral concentrates.

Sample	LATITUDE	LONGITUD	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-AS	S-AU
018	38 39 17N	106 03 33W	1.00	0.20	30.00	2.00G	1500.00	1.00N	500.00N	20.00N
019	38 39 17N	106 03 33W	1.00	0.50	30.00	2.00G	2000.00	1.00N	500.00N	20.00N
021	38 38 35N	106 04 12W	1.50	0.30	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
022	38 38 35N	106 04 12W	1.50	0.30	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
029	38 38 02N	106 04 17W	2.00	0.70	50.00	2.00G	1000.00	1.00N	500.00N	20.00N
034	38 38 02N	106 04 17W	1.00	0.30	50.00	2.00	500.00	1.00N	500.00N	20.00N
036	38 40 14N	106 00 45W	1.50	0.50	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
042	38 40 14N	106 00 45W	2.00	0.30	15.00	2.00G	2000.00	1.00N	500.00N	20.00N
048	38 44 36N	106 03 53W	5.00	0.50	15.00	2.00G	2000.00	1.00N	500.00N	20.00N
049	38 44 36N	106 03 53W	2.00	0.20	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
072	38 38 34N	106 00 59W	1.00	0.20	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
084	38 38 34N	106 00 59W	1.00	0.10	15.00	2.00G	1000.00	1.00N	500.00N	20.00N
088	38 41 38N	106 02 24W	2.00	0.50	50.00	2.00G	2000.00	1.00N	500.00N	20.00N
089	38 41 38N	106 02 24W	1.50	0.20	15.00	2.00G	2000.00	1.00N	500.00N	20.00N
093	38 38 49N	106 00 26W	1.00	0.20	30.00	2.00G	1500.00	1.00N	500.00N	20.00N
096	38 38 49N	106 00 26W	1.00	0.15	30.00	2.00G	1500.00	1.00N	500.00N	20.00N
100	38 38 24N	106 00 10W	2.00	0.50	15.00	2.00G	1500.00	200.00	500.00N	20.00N
102	38 38 24N	106 00 10W	2.00	0.30	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
117	38 43 16N	106 01 12W	1.50	1.00	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
118	38 43 16N	106 01 12W	1.00	0.70	10.00	2.00G	1500.00	1.00N	500.00N	20.00N
128	38 38 56N	106 02 49W	1.50	0.30	30.00	2.00G	1500.00	1.00N	500.00N	20.00N
129	38 38 56N	106 02 49W	1.00	0.20	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
130	38 39 47N	106 02 42W	1.00	0.15	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
132	38 39 47N	106 02 42W	1.00	0.30	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
133	38 37 44N	106 00 05W	3.00	1.50	30.00	2.00G	2000.00	1.00N	500.00N	20.00N
136	38 37 44N	106 00 05W	1.50	0.30	20.00	2.00G	1000.00	1.00N	500.00N	20.00N
137	38 37 30N	106 03 30W	1.00	0.20	20.00	2.00G	1000.00	1.00N	500.00N	20.00N
140	38 37 30N	106 03 30W	1.00	0.50	20.00	2.00G	1000.00	1.00N	500.00N	20.00N
011	38 39 22N	106 03 39W	5.00	0.20	7.00	2.00G	5000.00	1.00N	500.00N	20.00N
035	38 39 22N	106 03 39W	2.00	0.50	10.00	2.00G	2000.00	1.00N	500.00N	20.00N
047	38 44 27N	106 03 40W	1.00	0.20	10.00	2.00G	1000.00	1.00N	500.00N	20.00N
092	38 44 27N	106 03 40W	2.00	0.30	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
091	38 43 16N	106 03 00W	2.00	0.20	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
139	38 43 16N	106 03 00W	2.00	0.30	30.00	2.00G	1500.00	1.00N	500.00N	20.00N
123	38 40 58N	106 02 29W	1.50	0.20	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
131	38 40 58N	106 02 29W	1.50	0.20	30.00	2.00G	2000.00	1.00N	500.00N	20.00N
062	38 37 41N	106 00 36W	1.00	0.30	15.00	2.00G	1000.00	1.00N	500.00N	20.00N
064	38 37 41N	106 00 36W	1.00	0.50	15.00	2.00G	700.00	1.00N	500.00N	20.00N
141	38 43 52N	106 02 55W	2.00	0.50	30.00	2.00G	2000.00	1.00N	500.00N	20.00N
144	38 43 52N	106 02 55W	1.00	0.20	20.00	2.00G	1000.00	1.00N	500.00N	20.00N

Table B2.--Cont.

Sample	S-B	S-BA	S-BE	S-BI	S-CD	S-CO	S-CR	S-CU	S-LA	S-MO
018	20.00	10000.00	2.00	20.00N	50.00N	10.00	50.00	10.00	2000.00	10.00N
019	30.00	10000.00	2.00	20.00N	50.00N	15.00	50.00	10.00N	2000.00G	10.00N
021	20.00	10000.00G	2.00L	20.00N	50.00N	20.00	70.00	20.00	2000.00G	10.00
022	20.00	10000.00G	2.00L	20.00N	50.00N	15.00	70.00	20.00	2000.00	15.00
029	20.00L	10000.00G	2.00L	20.00N	50.00N	10.00	70.00	10.00	2000.00	10.00N
034	20.00L	10000.00G	2.00	20.00N	50.00N	10.00	30.00	50.00	1000.00	10.00N
036	30.00	700.00	2.00	20.00N	50.00N	15.00	100.00	10.00L	300.00	10.00N
042	20.00	500.00	2.00L	200.00	50.00N	10.00	70.00	10.00L	500.00	10.00N
048	30.00	300.00	2.00L	20.00N	50.00N	50.00	70.00	10.00L	1000.00	10.00L
049	20.00	200.00	2.00L	20.00N	50.00N	20.00	100.00	10.00N	1000.00	15.00
072	20.00	1000.00	2.00L	20.00N	50.00N	10.00	50.00	15.00	300.00	10.00N
084	20.00L	200.00	2.00	20.00N	50.00N	10.00N	30.00	10.00N	500.00	10.00N
088	20.00L	200.00	2.00	20.00N	50.00N	10.00	150.00	10.00	500.00	10.00N
089	20.00	200.00	2.00L	20.00N	50.00N	10.00	100.00	10.00N	200.00	10.00
093	20.00	200.00	2.00L	20.00N	50.00N	10.00	70.00	10.00	500.00	10.00N
096	20.00L	300.00	2.00L	20.00N	50.00N	10.00N	50.00	10.00N	300.00	10.00N
100	70.00	700.00	3.00	20.00N	50.00N	15.00	50.00	1000.00	700.00	500.00
102	70.00	500.00	5.00	20.00N	50.00N	10.00	100.00	1000.00	2000.00	150.00
117	50.00	2000.00	2.00L	20.00N	50.00N	10.00	50.00	10.00L	500.00	10.00N
118	50.00	2000.00	2.00L	20.00N	50.00N	10.00	50.00	10.00L	200.00	10.00N
128	30.00	2000.00	2.00L	20.00N	50.00N	15.00	50.00	10.00L	500.00	10.00N
129	30.00	1000.00	2.00N	20.00N	50.00N	10.00	50.00	10.00	500.00	10.00N
130	20.00L	100.00	2.00N	20.00N	50.00N	10.00	30.00	10.00L	200.00	10.00N
132	20.00	200.00	2.00L	20.00N	50.00N	15.00	70.00	10.00L	300.00	10.00N
133	50.00	700.00	2.00L	20.00N	50.00N	20.00	150.00	50.00	1000.00	30.00
136	20.00	500.00	2.00L	20.00N	50.00N	10.00	70.00	30.00	500.00	20.00
137	20.00	700.00	2.00L	20.00N	50.00N	10.00	50.00	10.00N	1000.00	10.00N
140	30.00	2000.00	2.00	20.00N	50.00N	15.00	70.00	10.00L	700.00	10.00N
011	50.00	10000.00G	2.00	20.00N	50.00N	20.00	70.00	30.00	2000.00G	15.00
035	50.00	10000.00G	2.00	20.00N	50.00N	15.00	100.00	70.00	2000.00G	10.00N
047	20.00L	100.00	2.00N	20.00N	50.00N	10.00	50.00	10.00N	500.00	10.00N
091	20.00	150.00	2.00L	20.00N	50.00N	10.00	70.00	10.00L	300.00	20.00
092	20.00	150.00	2.00N	20.00N	50.00N	15.00	100.00	10.00N	1000.00	20.00
123	20.00	100.00	2.00L	20.00N	50.00N	15.00	50.00	10.00L	500.00	10.00N
139	20.00	700.00	2.00N	20.00L	50.00N	15.00	70.00	10.00L	700.00	10.00N
131	30.00	100.00	2.00L	20.00N	50.00N	15.00	50.00	10.00L	500.00	15.00
062	50.00	700.00	2.00	20.00N	50.00N	15.00	70.00	20.00	700.00	20.00
064	30.00	1500.00	2.00	20.00N	50.00N	10.00	50.00	20.00	300.00	30.00
141	30.00	500.00	2.00N	50.00	50.00N	20.00	100.00	10.00L	1000.00	20.00
144	20.00L	200.00	2.00N	20.00N	50.00N	10.00	100.00	10.00N	700.00	20.00

TableB2.--Cont.

Sample	S-NB	S-NI	S-PB	S-SB	S-SC	S-SN	S-SR	S-V	S-W	S-Y
018	50.00L	10.00	300.00	200.00N	0.00B	150.00	300.00	200.00	100.00N	3000.00
019	100.00	15.00	300.00	200.00N	0.00B	150.00	200.00	150.00	100.00N	3000.00
021	200.00	15.00	500.00	200.00N	0.00B	70.00	700.00	300.00	100.00	1500.00
022	150.00	10.00	300.00	200.00N	0.00B	70.00	1500.00	300.00	100.00	1000.00
029	70.00	10.00	150.00	200.00N	0.00B	100.00	700.00	200.00	100.00N	1000.00
034	70.00	10.00N	100.00	200.00N	0.00B	20.00N	700.00	150.00	100.00	700.00
036	200.00	10.00	150.00	200.00N	0.00B	200.00	200.00N	200.00	100.00	3000.00
042	200.00	15.00	150.00	200.00N	0.00B	150.00	200.00	300.00	100.00	2000.00
048	50.00	15.00	100.00	200.00N	0.00B	100.00	200.00N	500.00	100.00N	1500.00
049	200.00	10.00	1000.00	200.00N	0.00B	100.00	200.00N	500.00	100.00L	2000.00
072	100.00	10.00N	3000.00	200.00N	0.00B	150.00	200.00N	200.00	100.00L	2000.00
084	70.00	10.00N	150.00	200.00N	0.00B	50.00	200.00N	150.00	100.00N	2000.00
088	50.00	10.00N	500.00	200.00N	0.00B	300.00	200.00N	500.00	100.00N	5000.00
089	300.00	10.00N	200.00	200.00N	0.00B	200.00	200.00N	300.00	100.00N	5000.00
093	100.00	10.00N	300.00	200.00N	0.00B	100.00	200.00N	200.00	100.00N	5000.00
096	150.00	10.00N	150.00	200.00N	0.00B	50.00	200.00N	200.00	100.00N	3000.00
100	200.00	10.00N	5000.00	200.00N	0.00B	100.00	200.00	500.00	300.00	2000.00
102	150.00	10.00N	10000.00	200.00N	0.00B	100.00	200.00	1500.00	100.00	3000.00
117	200.00	10.00	200.00	200.00N	0.00B	200.00	200.00N	200.00	100.00N	3000.00
118	200.00	10.00	150.00	200.00N	0.00B	100.00	200.00N	200.00	100.00	3000.00
128	200.00	10.00	1500.00	200.00N	0.00B	100.00	200.00N	200.00	100.00N	3000.00
129	200.00	10.00N	150.00	200.00N	0.00B	100.00	200.00N	200.00	100.00N	2000.00
130	200.00	10.00N	70.00	200.00N	0.00B	100.00	200.00N	300.00	100.00N	2000.00
132	200.00	10.00	150.00	200.00N	0.00B	200.00	200.00N	200.00	150.00	5000.00
133	200.00	10.00	200.00	200.00N	0.00B	150.00	200.00	500.00	100.00L	2000.00
136	200.00	10.00N	200.00	200.00N	0.00B	150.00	200.00N	500.00	100.00N	1000.00
137	50.00	10.00N	150.00	200.00N	0.00B	30.00	200.00N	100.00	500.00	1500.00
140	100.00	10.00N	150.00	200.00N	0.00B	50.00	200.00N	150.00	1000.00	1500.00
011	200.00	15.00	700.00	200.00N	0.00B	150.00	1500.00	300.00	100.00N	1500.00
035	50.00L	10.00	500.00	200.00N	0.00B	100.00	1000.00	200.00	100.00N	1500.00
047	50.00	10.00N	100.00	200.00N	0.00B	70.00	200.00N	300.00	100.00N	1000.00
091	200.00	10.00N	300.00	200.00N	0.00B	200.00	200.00N	300.00	100.00N	5000.00G
092	200.00	10.00N	100.00	200.00N	0.00B	150.00	200.00N	500.00	100.00N	1500.00
123	200.00	10.00	150.00	200.00N	0.00B	150.00	200.00N	200.00	100.00N	2000.00
139	300.00	10.00	300.00	200.00N	0.00B	200.00	200.00N	200.00	100.00N	5000.00G
131	200.00	10.00N	200.00	200.00N	0.00B	200.00	200.00N	300.00	100.00N	3000.00
062	200.00	10.00N	150.00	200.00N	0.00B	70.00	200.00	300.00	700.00	1000.00
064	100.00	10.00N	200.00	200.00N	0.00B	30.00	200.00	300.00	1000.00	700.00
141	100.00	10.00N	200.00	200.00N	0.00B	150.00	200.00N	500.00	100.00N	2000.00
144	200.00	10.00N	100.00	200.00N	0.00B	100.00	200.00N	500.00	100.00L	2000.00

Table B2.--Cont.

Sample	S-ZN	S-ZR	S-TH
018	500.00N	2000.00G	200.00
019	500.00N	2000.00G	200.00
021	500.00N	2000.00G	500.00
022	500.00N	2000.00G	500.00
029	500.00N	2000.00G	200.00L
034	500.00N	2000.00G	200.00L
036	500.00N	2000.00G	200.00L
042	500.00N	2000.00G	300.00
048	500.00N	2000.00G	200.00L
049	500.00N	2000.00G	200.00L
072	500.00N	2000.00G	200.00L
064	500.00N	2000.00G	200.00
088	500.00N	2000.00G	200.00
089	500.00N	2000.00G	200.00L
093	500.00N	2000.00G	200.00L
096	500.00N	2000.00G	200.00N
100	1000.00	2000.00G	700.00
102	2000.00	2000.00G	300.00
117	500.00N	2000.00G	300.00
118	500.00N	2000.00G	300.00
128	500.00N	2000.00G	200.00
129	500.00N	2000.00G	200.00
130	500.00N	2000.00G	200.00L
132	500.00N	2000.00G	200.00N
133	500.00N	2000.00G	200.00
136	500.00N	2000.00G	200.00L
137	500.00N	2000.00G	200.00
140	500.00N	2000.00G	200.00
011	500.00N	2000.00G	500.00
035	500.00N	2000.00G	300.00
047	500.00N	2000.00G	200.00N
091	500.00N	2000.00G	200.00L
092	500.00N	2000.00G	200.00L
123	500.00N	2000.00G	200.00
139	500.00N	2000.00G	200.00L
131	500.00N	2000.00G	200.00L
062	500.00L	2000.00G	300.00
064	500.00N	2000.00G	200.00
141	500.00N	2000.00G	200.00
144	500.00N	2000.00G	200.00L

Table B3. Data from the emission spectrographic analysis of analytical duplicate samples, heavy-mineral concentrates. All values are reported in parts per million, except those for Fe, Mg, Ca, and Ti, which are in percent. Element concentrations are reported on a six-step nominal scale in the seriers 1, 1.5, 2, 3, 5, 7, 10, etc. Samples having element contents not detectable or above the detection limits were reported with the designations N and G, respectively. Samples having detectable element contents below stated detection limits were reported with the designation L. Relevant limits of detection are listed in table A1.

Table begins on next page.

Table B3.--Data from the ES analysis of analytical duplicate samples, heavy-mineral concentrates.

Sample	LATITUDE	LONGITUD	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-AS	S-AU
002	38 40 04N	106 03 12W	0.70	0.20	10.00	2.00G	1500.00	1.00N	500.00N	20.00N
152	38 40 04N	106 03 12W	0.70	0.20	10.00	2.00G	1000.00	1.00N	500.00N	20.00N
014	38 39 07N	106 03 21W	1.00	0.30	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
153	38 39 07N	106 03 21W	1.50	0.50	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
023	38 38 02N	106 03 40W	2.00	0.50	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
154	38 38 02N	106 03 40W	2.00	0.70	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
025	38 38 26N	106 03 53W	1.50	0.20	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
155	38 38 26N	106 03 53W	1.00	0.15	15.00	2.00G	1000.00	1.00N	500.00N	20.00N
031	38 38 58N	106 04 50W	1.50	0.20	10.00	2.00G	1000.00	1.00N	500.00N	20.00N
171	38 38 58N	106 04 50W	1.50	0.20	15.00	2.00G	1000.00	1.00N	500.00N	20.00N
032	38 38 54N	106 04 47W	1.50	0.30	30.00	2.00G	1000.00	1.00N	500.00N	20.00N
156	38 38 54N	106 04 47W	1.00	0.30	30.00	2.00G	1500.00	1.00N	500.00N	20.00N
033	38 39 17N	106 01 59W	1.50	0.50	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
157	38 39 17N	106 01 59W	1.00	0.20	30.00	2.00G	2000.00	1.00N	500.00N	20.00N
050	38 38 11N	106 02 05W	1.50	5.00	15.00	2.00G	1000.00	1.00N	500.00N	20.00N
158	38 38 11N	106 02 05W	1.00	3.00	10.00	2.00G	1000.00	1.00N	500.00N	20.00N
053	38 38 09N	106 03 13W	1.00	0.30	50.00	2.00G	1000.00	1.00N	500.00N	20.00N
159	38 38 09N	106 03 13W	1.00	0.30	30.00	2.00G	1000.00	1.00N	500.00N	20.00N
057	38 37 58N	106 01 21W	1.00	3.00	15.00	2.00G	1000.00	1.00N	500.00N	20.00N
160	38 37 58N	106 01 21W	0.50	2.00	10.00	2.00G	700.00	1.00N	500.00N	20.00N
073	38 42 11N	106 02 55W	1.50	0.20	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
161	38 42 11N	106 02 55W	2.00	0.30	15.00	2.00G	2000.00	1.00N	500.00N	20.00N
076	38 42 34N	106 03 03W	1.50	0.15	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
162	38 42 34N	106 03 03W	0.50	0.15	10.00	2.00G	1000.00	1.00N	500.00N	20.00N
081	38 38 19N	106 00 52W	2.00	0.50	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
169	38 38 19N	106 00 52W	2.00	0.30	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
084	38 38 36N	106 00 56W	1.00	0.10	15.00	2.00G	1000.00	1.00N	500.00N	20.00N
163	38 38 36N	106 00 56W	2.00	0.30	30.00	2.00G	1500.00	1.00N	500.00N	20.00N
085	38 41 45N	106 01 21W	2.00	0.30	15.00	2.00G	2000.00	1.00N	500.00N	20.00N
164	38 41 45N	106 01 21W	1.00	0.20	15.00	2.00G	2000.00	1.00N	500.00N	20.00N
098	38 38 34N	106 00 32W	2.00	0.50	20.00	2.00G	2000.00	20.00	500.00N	200.00
167	38 38 34N	106 00 32W	1.00	0.20	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
099	38 38 33N	106 00 19W	1.00	0.30	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
165	38 38 33N	106 00 19W	1.50	0.30	20.00	2.00G	2000.00	1.00N	500.00N	20.00N
106	38 44 13N	106 03 22W	2.00	0.50	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
166	38 44 13N	106 03 22W	1.00	0.20	15.00	2.00G	1500.00	1.00N	500.00N	20.00N
168	38 44 01N	106 00 50W	0.70	0.20	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
108	38 44 01N	106 00 50W	1.50	0.20	20.00	2.00G	1500.00	1.00N	500.00N	20.00N
170	38 38 59N	106 02 49W	1.00	0.30	30.00	2.00G	1500.00	1.00N	500.00N	20.00N
128	38 38 59N	106 02 49W	1.50	0.30	30.00	2.00G	1500.00	1.00N	500.00N	20.00N

Table B.3 -- Cont.

Sample	S-B	S-BA	S-BE	S-BI	S-CD	S-CO	S-CR	S-CU	S-LA	S-MO
002	20.00	10000.00G	2.00L	20.00N	50.00N	10.00	30.00	10.00N	500.00	10.00N
152	20.00	10000.00G	2.00L	20.00N	50.00N	10.00	20.00	10.00	500.00	10.00N
014	30.00	2000.00	2.00	20.00N	50.00N	10.00	50.00	10.00N	1000.00	10.00N
153	30.00	2000.00	2.00	20.00N	50.00N	10.00	70.00	10.00L	1500.00	10.00N
023	30.00	5000.00	2.00	20.00N	50.00N	10.00	50.00	10.00	1000.00	10.00N
154	30.00	3000.00	2.00	20.00N	50.00N	10.00	50.00	20.00	700.00	10.00N
025	20.00	10000.00	2.00L	20.00N	50.00N	10.00	100.00	10.00L	2000.00	10.00N
155	20.00	5000.00	2.00L	20.00N	50.00N	10.00	50.00	10.00L	2000.00	10.00N
031	50.00	7000.00	2.00L	20.00N	50.00N	10.00	50.00	10.00L	2000.00G	10.00N
171	50.00	10000.00	2.00L	20.00N	50.00N	15.00	50.00	15.00	2000.00	10.00N
032	20.00L	10000.00	2.00L	20.00N	50.00N	10.00	100.00	10.00L	1000.00	10.00L
156	20.00	10000.00G	2.00L	20.00N	50.00N	15.00	100.00	10.00L	1000.00	10.00N
033	20.00	500.00	2.00L	20.00N	50.00N	10.00	70.00	10.00L	200.00	10.00N
157	20.00L	500.00	2.00N	20.00N	50.00N	10.00	50.00	10.00	200.00	10.00N
050	70.00	10000.00	2.00	20.00N	50.00N	15.00	100.00	10.00	700.00	30.00
158	70.00	10000.00	2.00L	20.00N	50.00N	15.00	100.00	15.00	500.00	10.00
053	20.00L	2000.00	2.00L	20.00N	50.00N	10.00	50.00	10.00	200.00	10.00N
159	20.00	2000.00	2.00L	20.00N	50.00N	10.00	50.00	10.00	200.00	10.00N
057	100.00	10000.00G	2.00	20.00N	50.00N	15.00	100.00	50.00	500.00	15.00
160	50.00	10000.00G	2.00	20.00N	50.00N	10.00	70.00	10.00N	300.00	10.00N
073	20.00L	150.00	2.00L	20.00N	50.00N	10.00	70.00	10.00	500.00	20.00
161	20.00	300.00	2.00L	20.00N	50.00N	10.00	50.00	20.00	500.00	10.00N
076	20.00L	150.00	2.00L	20.00N	50.00N	15.00	50.00	10.00L	300.00	10.00N
162	20.00	150.00	2.00L	20.00N	50.00N	10.00	30.00	10.00	200.00	10.00N
081	70.00	500.00	3.00	20.00N	50.00N	10.00	70.00	300.00	1000.00	20.00
169	50.00	700.00	2.00	20.00N	50.00N	10.00	70.00	200.00	1000.00	15.00
084	20.00L	200.00	2.00	20.00N	50.00N	10.00N	30.00	10.00N	500.00	10.00N
163	20.00L	300.00	2.00N	20.00N	50.00N	10.00	50.00	20.00	1000.00	10.00N
085	20.00	200.00	2.00L	20.00N	50.00N	10.00	70.00	30.00	300.00	10.00N
164	20.00	150.00	2.00L	20.00N	50.00N	10.00	50.00	10.00N	500.00	10.00N
098	50.00	1000.00	2.00	20.00N	50.00N	10.00	100.00	200.00	1500.00	200.00
167	50.00	1000.00	2.00L	20.00N	50.00N	10.00	50.00	200.00	2000.00	10.00L
099	30.00	500.00	2.00L	20.00N	50.00N	10.00	70.00	150.00	1000.00	10.00N
165	30.00	500.00	2.00L	20.00N	50.00N	10.00	70.00	200.00	2000.00	10.00N
106	20.00	700.00	2.00L	20.00N	50.00N	10.00	70.00	10.00L	700.00	15.00
166	20.00L	500.00	2.00N	20.00N	50.00N	10.00	70.00	10.00N	1000.00	10.00N
168	20.00	150.00	2.00N	20.00N	50.00N	10.00	100.00	10.00N	700.00	10.00
108	20.00	150.00	2.00L	20.00N	50.00N	15.00	100.00	10.00L	700.00	10.00N
170	20.00	2000.00	2.00N	20.00N	50.00N	10.00	70.00	10.00N	500.00	10.00N
128	30.00	2000.00	2.00L	20.00N	50.00N	15.00	50.00	10.00L	500.00	10.00N

Table B.3 -- Cont.

Sample	S-NB	S-NI	S-PB	S-SB	S-SC	S-SN	S-SR	S-V	S-W	S-Y
002	50.00	10.00	150.00	200.00N	0.00B	70.00	1000.00	150.00	100.00N	1500.00
152	100.00	15.00	200.00	200.00N	0.00B	100.00	1000.00	200.00	100.00N	1500.00
014	100.00	10.00N	200.00	200.00N	0.00B	100.00	200.00N	300.00	100.00N	2000.00
153	100.00	10.00N	300.00	200.00N	0.00B	150.00	200.00N	500.00	100.00N	2000.00
023	50.00	15.00	150.00	200.00N	0.00B	50.00	200.00	200.00	100.00N	1500.00
154	50.00	10.00	150.00	200.00N	0.00B	70.00	200.00	300.00	100.00N	1000.00
025	100.00	10.00N	200.00	200.00N	0.00B	100.00	200.00	300.00	100.00N	1500.00
155	100.00	10.00N	200.00	200.00N	0.00B	100.00	200.00N	300.00	100.00N	1500.00
031	70.00	10.00	150.00	200.00N	0.00B	50.00	200.00N	200.00	100.00N	2000.00
171	70.00	15.00	200.00	200.00N	0.00B	70.00	200.00	200.00	100.00N	3000.00
032	100.00	15.00	200.00	200.00N	0.00B	100.00	200.00N	200.00	100.00N	5000.00
156	70.00	15.00	300.00	200.00N	0.00B	70.00	200.00N	200.00	100.00N	3000.00
033	200.00	10.00N	100.00	200.00N	0.00B	200.00	200.00N	200.00	100.00L	3000.00
157	200.00	10.00N	100.00	200.00N	0.00B	150.00	200.00N	200.00	100.00L	3000.00
050	150.00	10.00	200.00	200.00N	0.00B	70.00	500.00	200.00	1500.00	700.00
158	150.00	10.00N	200.00	200.00N	0.00B	50.00	200.00	200.00	1500.00	700.00
053	100.00	10.00N	200.00	200.00N	0.00B	100.00	200.00N	150.00	100.00N	2000.00
159	100.00	10.00N	300.00	200.00N	0.00B	100.00	200.00N	150.00	100.00N	2000.00
057	100.00	10.00N	700.00	200.00N	0.00B	30.00	700.00	500.00	1000.00	1000.00
160	100.00	10.00N	200.00	200.00N	0.00B	20.00N	300.00	200.00	1500.00	300.00
073	150.00	10.00N	500.00	200.00N	0.00B	200.00	200.00N	300.00	100.00N	3000.00
161	200.00	10.00N	500.00	200.00N	0.00B	200.00	200.00N	300.00	100.00N	5000.00
076	100.00	10.00	200.00	200.00N	0.00B	150.00	200.00N	300.00	100.00	2000.00
162	150.00	10.00	100.00	200.00N	0.00B	100.00	200.00N	200.00	100.00L	2000.00
081	200.00	10.00N	300.00	200.00N	0.00B	500.00	200.00N	300.00	200.00	2000.00
169	200.00	10.00N	300.00	200.00N	0.00B	500.00	200.00N	300.00	200.00	3000.00
084	70.00	10.00N	150.00	200.00N	0.00B	50.00	200.00N	150.00	100.00N	2000.00
163	150.00	10.00N	500.00	200.00N	0.00B	150.00	200.00N	150.00	100.00L	2000.00
085	100.00	10.00N	300.00	200.00N	0.00B	300.00	200.00N	500.00	100.00N	5000.00
164	200.00	10.00N	100.00	200.00N	0.00B	200.00	200.00N	300.00	100.00N	3000.00
098	150.00	10.00	1000.00	200.00N	0.00B	500.00	200.00N	300.00	100.00N	5000.00
167	50.00	10.00N	1000.00	200.00N	0.00B	500.00	200.00N	300.00	100.00N	5000.00
099	200.00	10.00N	700.00	200.00N	0.00B	500.00	200.00N	300.00	700.00	5000.00
165	150.00	10.00N	1000.00	200.00N	0.00B	500.00	200.00N	300.00	200.00	3000.00
106	100.00	10.00N	100.00	200.00N	0.00B	150.00	200.00	700.00	100.00N	1500.00
166	50.00L	10.00N	70.00	200.00N	0.00B	70.00	200.00N	500.00	100.00N	1000.00
168	100.00	10.00N	100.00	200.00N	0.00B	100.00	200.00N	500.00	100.00N	1500.00
108	100.00	10.00	100.00	200.00N	0.00B	150.00	200.00	500.00	100.00N	1500.00
170	100.00	10.00N	500.00	200.00N	0.00B	70.00	200.00N	200.00	100.00N	5000.00
128	200.00	10.00	1500.00	200.00N	0.00B	100.00	200.00N	200.00	100.00N	3000.00

Table B.3 -- Cont.

Sample	S-ZN	S-ZR	S-TH
002	500.00N	2000.00G	200.00
152	500.00N	2000.00G	300.00
014	500.00N	2000.00G	200.00L
153	500.00N	2000.00G	200.00
023	500.00N	2000.00G	200.00
154	500.00N	2000.00G	200.00L
025	500.00N	2000.00G	700.00
155	500.00N	2000.00G	700.00
031	500.00N	2000.00G	700.00
171	500.00N	2000.00G	500.00
032	500.00N	2000.00G	200.00L
156	500.00N	2000.00G	200.00L
033	500.00N	2000.00G	200.00N
157	500.00N	2000.00G	200.00
050	500.00N	2000.00G	200.00
158	500.00N	2000.00G	200.00
053	500.00N	2000.00G	200.00N
159	500.00N	2000.00G	200.00
057	500.00N	2000.00G	200.00
160	500.00N	2000.00G	200.00N
073	500.00N	2000.00G	200.00
161	500.00N	2000.00G	200.00L
076	500.00N	2000.00G	200.00L
162	500.00N	2000.00G	200.00L
081	500.00	2000.00G	300.00
169	500.00L	2000.00G	300.00
084	500.00N	2000.00G	200.00
163	500.00N	2000.00G	200.00
085	500.00N	2000.00G	200.00L
164	500.00N	2000.00G	200.00L
098	500.00	2000.00G	300.00
167	700.00	2000.00G	200.00
099	700.00	2000.00G	300.00
165	500.00	2000.00G	300.00
106	500.00N	2000.00G	200.00
166	500.00N	2000.00G	200.00L
168	500.00N	2000.00G	200.00
108	500.00N	2000.00G	300.00
170	500.00N	2000.00G	200.00
128	500.00N	2000.00G	200.00

Table B4.--Data from the inductively coupled plasma atomic emission spectroscopy analysis of field duplicates, minus-80-mesh stream-sediment samples. All values are reported in parts per million. Samples having element contents not detectable or above the upper detection limits were reported with the designations N and G, respectively. Samples having detectable element contents below stated detection limits were reported with the designation L. Relevant limits of detection are listed in table A1. Stream-sediment blanks (B), reference material (GXR-6), and analytical duplicates are included in the total data listing, Appendix A.

Table begins on next page.

Table B4.--Data from the ICP-AES analysis of field duplicates, minus-80-mesh stream-sediment samples.

Sample	AL	CA	FE	MG	AG	AS	B	BA	BE	BI
11	7300.00	11000.00	23000.00	3800.00	1.20N	8.00N	0.40N	290.00	1.60	32.00N
35	11000.00	14000.00	46000.00	4900.00	1.20N	8.00N	0.40N	390.00	1.90	32.00N
18	20000.00	17000.00	27000.00	5600.00	1.20N	8.00N	0.40N	350.00	1.60	32.00N
19	13000.00	16000.00	23000.00	5100.00	1.20N	8.00N	0.40N	290.00	1.50	32.00N
21	13000.00	10000.00	33000.00	5700.00	1.20N	8.00N	0.40N	150.00	0.89	32.00N
22	17000.00	13000.00	31000.00	8300.00	1.20N	8.00N	0.40N	210.00	1.10	32.00N
29	22000.00	24000.00	32000.00	9300.00	1.20N	8.00N	0.40N	220.00	1.70	32.00N
34	20000.00	20000.00	28000.00	8300.00	1.20N	8.00N	0.40N	180.00	1.50	32.00N
36	17000.00	9900.00	64000.00	7700.00	1.20N	8.00N	0.40N	130.00	0.67	32.00N
42	16000.00	9000.00	46000.00	7400.00	1.20N	8.00N	0.40N	120.00	0.63	32.00N
47	18000.00	17000.00	46000.00	11000.00	1.20N	8.00N	0.40N	270.00	0.65	32.00N
92	4300.00	13000.00	410000.00	1600.00	1.20N	8.00N	0.40N	48.00	0.43	32.00N
48	17000.00	21000.00	55000.00	11000.00	1.20N	8.00N	0.40N	210.00	0.66	32.00N
49	16000.00	20000.00	58000.00	10000.00	1.20N	8.00N	0.40N	210.00	0.69	32.00N
62	12000.00	5900.00	30000.00	6100.00	1.20N	8.00N	0.40N	110.00	0.71	32.00N
64	12000.00	5900.00	41000.00	6700.00	1.20N	8.00N	0.40N	110.00	0.63	32.00N
72	11000.00	14000.00	39000.00	5600.00	1.20N	8.00N	0.40N	110.00	0.61	32.00N
84	12000.00	6700.00	31000.00	5700.00	1.20N	8.00N	0.40N	100.00	0.47	32.00N
88	15000.00	10000.00	53000.00	5500.00	1.20N	8.00N	0.40N	90.00	0.61	32.00N
89	15000.00	9500.00	47000.00	6000.00	1.20N	8.00N	0.40N	94.00	0.63	32.00N
91	15000.00	6700.00	46000.00	7300.00	1.20N	8.00N	0.40N	110.00	0.65	32.00N
139	15000.00	10000.00	39000.00	8300.00	1.20N	8.00N	0.40N	100.00	0.85	32.00N
93	13000.00	10000.00	30000.00	5100.00	1.20N	8.00N	0.40N	110.00	0.46	32.00N
96	14000.00	12000.00	32000.00	5300.00	1.20N	8.00N	0.40N	110.00	0.49	32.00N
100	14000.00	3400.00	30000.00	8500.00	1.20N	8.00N	0.40N	130.00	0.58	32.00N
102	15000.00	3500.00	29000.00	9600.00	1.20N	8.00N	0.40N	140.00	0.61	32.00N
117	10000.00	14000.00	67000.00	7400.00	1.20N	8.00N	0.40N	74.00	0.59	32.00N
118	11000.00	15000.00	100000.00	7000.00	1.20N	8.00N	0.40N	80.00	0.65	32.00N
123	13000.00	12000.00	40000.00	5900.00	1.20N	8.00N	0.40N	87.00	0.86	32.00N
131	13000.00	13000.00	33000.00	6200.00	1.20N	8.00N	0.40N	91.00	0.89	32.00N
128	11000.00	8700.00	23000.00	5800.00	1.20N	8.00N	0.40N	100.00	0.61	32.00N
129	12000.00	7700.00	27000.00	6600.00	1.20N	8.00N	0.40N	120.00	0.64	32.00N
130	16000.00	10000.00	46000.00	8200.00	1.20N	8.00N	0.40N	150.00	0.83	32.00N
132	17000.00	11000.00	39000.00	7400.00	1.20N	8.00N	0.40N	140.00	0.80	32.00N
133	11000.00	4700.00	32000.00	6500.00	1.20N	8.00N	0.40N	120.00	0.33	32.00N
136	11000.00	5400.00	30000.00	7000.00	1.20N	8.00N	0.40N	130.00	0.33	32.00N
137	16000.00	8100.00	30000.00	9700.00	1.20N	8.00N	0.40N	170.00	0.69	32.00N
140	16000.00	8400.00	31000.00	10000.00	1.20N	8.00N	0.40N	180.00	0.74	32.00N
141	17000.00	19000.00	60000.00	11000.00	1.20N	8.00N	0.40N	270.00	0.69	32.00N
144	18000.00	21000.00	72000.00	12000.00	1.20N	8.00N	0.40N	290.00	0.72	32.00N

Table B4.--Cont.

Sample	CE	CO	CO	CR	CU	LA	MN	MO	NB	NI
11	52.00	0.80N	8.00N	22.00	36.00	30.00	1100.00	1.60N	4.00N	9.30
35	75.00	0.80N	18.00	32.00	39.00	39.00	1200.00	2.00	8.00	13.00
18	120.00	0.80N	8.80	22.00	12.00	51.00	930.00	1.60N	8.90	6.80
19	120.00	0.80N	9.10	20.00	12.00	50.00	780.00	1.60N	8.50	6.70
21	80.00	0.80N	20.00	28.00	32.00	42.00	450.00	2.50	11.00	15.00
22	71.00	0.98	17.00	30.00	41.00	38.00	650.00	1.60N	15.00	17.00
29	61.00	0.80N	15.00	24.00	28.00	35.00	620.00	1.60N	18.00	14.00
34	56.00	0.80N	16.00	26.00	25.00	30.00	520.00	2.00	16.00	13.00
36	71.00	0.80N	18.00	46.00	16.00	34.00	750.00	1.60N	14.00	13.00
42	61.00	0.80N	15.00	39.00	17.00	29.00	720.00	1.60N	11.00	12.00
47	48.00	0.80N	17.00	36.00	21.00	24.00	620.00	1.60N	12.00	17.00
92	33.00	0.80N	10.00	210.00	0.60N	25.00	290.00	1.60N	37.00	24.00
48	54.00	0.80N	17.00	43.00	19.00	27.00	590.00	1.60N	12.00	17.00
49	57.00	0.80N	17.00	47.00	19.00	27.00	630.00	1.60N	12.00	17.00
62	36.00	0.80N	8.00N	30.00	31.00	19.00	470.00	1.60N	9.70	21.00
64	38.00	0.80N	8.40	35.00	25.00	20.00	470.00	1.60N	11.00	13.00
72	99.00	0.80N	11.00	34.00	18.00	46.00	540.00	1.60N	10.00	11.00
84	85.00	0.80N	11.00	21.00	15.00	39.00	470.00	1.60N	9.50	15.00
88	130.00	0.80N	15.00	26.00	14.00	61.00	620.00	1.60N	11.00	8.80
89	130.00	0.80N	16.00	19.00	15.00	62.00	660.00	1.60N	10.00	9.30
91	99.00	0.80N	15.00	25.00	15.00	44.00	660.00	1.60N	11.00	10.00
139	120.00	0.80N	18.00	46.00	19.00	58.00	680.00	1.70	11.00	12.00
93	100.00	0.80N	13.00	20.00	15.00	49.00	510.00	1.60N	9.30	8.10
96	110.00	0.80N	15.00	21.00	15.00	55.00	520.00	1.60N	10.00	8.80
100	57.00	0.80N	9.20	25.00	95.00	29.00	660.00	1.60N	14.00	9.40
102	57.00	0.80N	8.40	25.00	120.00	27.00	660.00	1.60N	16.00	9.30
117	95.00	0.80N	15.00	49.00	9.90	46.00	510.00	1.60N	13.00	12.00
118	93.00	0.80N	15.00	67.00	7.70	45.00	550.00	1.60N	17.00	12.00
123	150.00	0.80N	15.00	24.00	18.00	70.00	700.00	1.90	9.80	8.70
131	150.00	0.95	17.00	30.00	20.00	72.00	720.00	2.00	9.80	10.00
128	110.00	0.80N	19.00	23.00	16.00	53.00	500.00	2.50	9.60	9.80
129	100.00	0.80N	18.00	26.00	16.00	50.00	560.00	2.40	9.80	10.00
130	94.00	0.80N	16.00	42.00	24.00	46.00	800.00	1.60N	14.00	13.00
132	99.00	0.83	16.00	41.00	24.00	49.00	720.00	2.40	13.00	13.00
133	32.00	0.80N	12.00	31.00	32.00	18.00	350.00	1.60N	9.60	9.50
136	35.00	0.80N	13.00	36.00	34.00	20.00	350.00	1.60N	9.70	9.20
137	77.00	0.95	19.00	50.00	37.00	40.00	580.00	2.00	14.00	18.00
140	81.00	0.80	18.00	47.00	39.00	43.00	600.00	1.60N	14.00	18.00
141	52.00	1.20	24.00	110.00	24.00	27.00	570.00	2.00	17.00	21.00
144	50.00	0.80N	22.00	110.00	24.00	26.00	610.00	1.60N	18.00	22.00

Table B4.--Cont.

Sample	P	Pb	Sb	Sn	Sr	Ti	V	W	Y	Zn
11	1400.00	97.00	10.00N	8.00N	53.00	86.00	38.00	12.00N	8.70	140.00
35	1400.00	110.00	10.00N	8.00N	76.00	170.00	68.00	12.00N	8.80	170.00
18	840.00	44.00	10.00N	8.00N	210.00	390.00	48.00	12.00N	19.00	72.00
19	850.00	42.00	10.00N	8.00N	170.00	340.00	42.00	12.00N	18.00	87.00
21	1000.00	58.00	10.00N	8.00N	35.00	480.00	50.00	12.00N	10.00	82.00
22	820.00	68.00	10.00N	8.00N	46.00	830.00	46.00	12.00N	9.20	110.00
29	570.00	57.00	10.00N	8.00N	39.00	680.00	41.00	12.00N	8.00	100.00
34	520.00	51.00	10.00N	8.00N	73.00	680.00	39.00	12.00N	7.10	88.00
36	2000.00	40.00	10.00N	8.00N	24.00	1300.00	90.00	12.00N	37.00	92.00
42	1800.00	36.00	10.00N	8.00N	22.00	1200.00	71.00	12.00N	34.00	87.00
47	2900.00	44.00	10.00N	8.00N	44.00	1100.00	77.00	12.00N	9.00	96.00
92	2700.00	14.00	10.00N	8.00N	20.00	480.00	520.00	12.00N	0.16N	29.00
48	2300.00	38.00	10.00N	8.00N	55.00	1000.00	84.00	12.00N	10.00	88.00
49	2400.00	41.00	10.00N	8.00N	54.00	910.00	87.00	12.00N	11.00	90.00
62	710.00	27.00	10.00N	8.00N	16.00	680.00	50.00	12.00N	9.90	64.00
64	660.00	26.00	10.00N	8.00N	18.00	840.00	69.00	12.00N	7.90	63.00
72	3200.00	32.00	10.00N	8.00N	18.00	730.00	59.00	12.00N	57.00	70.00
84	1400.00	31.00	10.00N	8.00N	16.00	1100.00	46.00	12.00N	30.00	70.00
88	1900.00	36.00	10.00N	8.00N	20.00	1400.00	75.00	12.00N	52.00	82.00
89	1700.00	37.00	10.00N	8.00N	20.00	1400.00	62.00	12.00N	49.00	87.00
91	1100.00	25.00	10.00N	8.00N	17.00	1600.00	63.00	12.00N	35.00	89.00
139	1800.00	39.00	10.00N	8.00N	20.00	1100.00	70.00	16.00	54.00	90.00
93	1900.00	34.00	10.00N	8.00N	20.00	1100.00	40.00	12.00N	42.00	68.00
96	2200.00	35.00	10.00N	8.00N	22.00	1100.00	43.00	12.00N	47.00	71.00
100	420.00	29.00	10.00N	8.00N	16.00	730.00	43.00	12.00N	9.80	150.00
102	370.00	33.00	10.00N	8.00N	17.00	800.00	40.00	12.00N	9.50	170.00
117	1300.00	22.00	10.00N	8.00N	19.00	1000.00	110.00	12.00N	31.00	67.00
118	1600.00	28.00	10.00N	8.00N	22.00	1100.00	170.00	12.00N	35.00	70.00
123	2000.00	50.00	10.00N	8.00N	28.00	830.00	49.00	12.00N	62.00	110.00
131	2300.00	52.00	10.00N	8.00N	31.00	820.00	47.00	14.00	68.00	120.00
128	1800.00	34.00	10.00N	8.00N	17.00	740.00	41.00	12.00N	36.00	76.00
129	1300.00	35.00	10.00N	8.00N	17.00	930.00	38.00	12.00N	29.00	84.00
130	1900.00	65.00	10.00N	8.00N	28.00	1500.00	72.00	12.00N	43.00	160.00
132	2200.00	65.00	10.00N	8.00N	29.00	1200.00	65.00	12.00N	47.00	160.00
133	1000.00	30.00	10.00N	8.00N	11.00	1000.00	62.00	12.00N	4.00	54.00
136	1200.00	28.00	10.00N	8.00N	12.00	1100.00	63.00	12.00N	5.00	54.00
137	1200.00	43.00	10.00N	8.00N	23.00	1500.00	59.00	15.00	19.00	95.00
140	1200.00	46.00	10.00N	8.00N	24.00	1600.00	67.00	13.00	19.00	99.00
141	4900.00	41.00	10.00N	8.00N	49.00	1300.00	150.00	31.00	9.40	100.00
144	5100.00	42.00	10.00N	8.00N	53.00	1400.00	170.00	23.00	8.60	110.00

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APPENDIX C

R-mode Factor Analysis

Table C1.--Correlation coefficients for log (base 10) transformed heavy-mineral concentrate data (n=123). The minimum significant correlation coefficient is .20 at the 95% confidence level.

	Fe	Mg	Ca	Mn	B	Ba	Co	Cr	Cu	La	Mo	Nb	Pb	Sn	Sr	V	W	Y	Th
Fe	1.00	.38	.03	.44	.21	.02	.55.	.53	.20	.33	.34	.07	.07	.11	.21	.36	.02	-.05	.17
Mg	.38	1.00	.11	.06	.49	.25	.22	.55	.20	.10	.20	.15	.04	-.03	.21	.15	.40	-.27	.06
Ca	.03	.11	1.00	.06	-.12	-.15	-.14	.20	-.13	-.13	.02	-.05	.00	.10	-.23	.05	-.17	.33	-.29
Mn	.44	.06	.06	1.00	.14	-.18	.24	.12	.08	.07	.22	.28	.17	.51	-.08	.21	-.18	.40	.14
B	.21	.49	-.12	.14	1.00	.32	.15	.23	.33	.20	.16	.18	.14	.07	.11	.02	.26	-.07	.24
Ba	.02	.25	-.15	-.18	.32	1.00	.03	.00	.16	.55	-.09	-.29	.17	-.34	.66	-.20	.08	-.40	.34
Co	.55	.22	-.14	.24	.15	.03	1.00	.25	.06	.27	.25	.13	-.01	.00	.13	.32	.05	-.12	.24
Cr	.53	.55	.20	.12	.23	.00	.25	1.00	.14	.26	.32	.18	-.03	.01	.11	.35	.27	-.18	.11
Cu	.20	.20	-.13	.08	.33	.16	.06	.14	1.00	.20	.37	.14	.54	.23	.19	.14	.30	-.18	.22
La	.33	.10	-.13	.07	.20	.55	.27	.26	.20	1.00	.17	-.24	.08	-.14	.51	.11	-.05	-.36	.62
Mo	.34	.20	.02	.22	.16	-.09	.25	.32	.37	.17	1.00	.30	.38	.24	-.04	.46	.41	-.02	.26
Nb	.07	.15	-.05	.28	.18	-.29	.13	.18	.14	-.24	.30	1.00	.11	.43	-.17	.12	.20	.24	.22
Pb	.07	.04	.00	.17	.14	.17	-.01	-.03	.54	.08	.38	.11	1.00	.30	.06	.02	.23	.14	.18
Sn	.11	-.03	.10	.51	.07	-.34	.00	.01	.23	-.14	.24	.43	.30	1.00	-.36	.21	-.05	.48	-.01
Sr	.21	.21	-.23	-.08	.11	.66	.13	.11	.19	.51	-.04	-.17	.06	-.36	1.00	-.10	.00	-.48	.38
V	.36	.15	.05	.21	.02	-.20	.32	.35	.14	.11	.46	.12	.02	.21	-.10	1.00	.10	-.02	.10
W	.02	.40	-.17	-.18	.26	.08	.05	.27	.30	-.05	.41	.20	.23	-.05	.00	.10	1.00	-.25	.19
Y	-.05	-.27	.33	.40	-.07	-.40	-.12	-.18	-.18	-.36	.02	.24	.14	.48	-.48	-.02	-.25	1.00	-.14
Th	.17	.06	-.29	.14	.24	.34	.24	.11	.22	.62	.26	.22	.18	-.01	.38	.10	.19	-.14	1.00

Table C2.--Correlation coefficients for minus-80-mesh stream-sediment data (n=121). The minimum significant correlation coefficient is .20 at the 95% confidence level.

	Al	Ca	Fe	Mg	Ba	Be	Ce	Cd	Co	Cr	Cu	La	Mn	Mo	Nb	Ni	P	Pb	Sr	Ti	V	W	Y	Zn
Al	1.00	.01	.03	.74	.18	.28	.35	-.08	.46	.04	.22	.41	-.04	-.11	.42	.42	.21	.34	-.05	.69	-.04	-.07	.41	.43
Ca	.01	1.00	.26	.14	.48	.19	-.01	.06	.25	.27	-.24	.02	.64	-.10	.14	.16	.40	-.02	.67	-.17	.31	.05	-.02	.10
Fe	.03	.26	1.00	.04	-.08	-.15	.02	-.13	.46	.88	-.32	.04	-.05	-.14	.74	.36	.69	-.16	-.07	.14	.96	-.01	.01	.04
Mg	.74	.14	.04	1.00	.12	.08	-.04	-.06	.46	.18	.21	-.01	-.08	-.14	.39	.51	.26	.05	-.16	.57	.04	.00	.08	.28
Ba	.18	.48	-.08	.12	1.00	.71	-.12	.31	.10	.01	.19	-.10	.51	.02	-.09	.13	.08	.56	.76	-.26	-.01	.17	-.29	.52
Be	.28	.19	-.15	.03	.71	1.00	.21	.21	.10	-.11	.23	.25	.19	.11	-.15	.16	-.08	.73	.53	-.29	-.15	.03	-.02	.55
Ce	.35	-.01	.02	-.04	-.12	.21	1.00	-.05	.35	-.16	-.22	.98	.00	.20	.02	-.06	.25	.21	-.05	.30	-.07	-.05	.84	.10
Cd	-.08	.06	-.13	-.06	.31	.21	-.05	1.00	.06	.04	.15	-.06	.04	.32	.07	.00	-.05	.20	.30	-.08	.04	.73	-.15	.07
Co	.46	.25	.46	.46	.10	.10	.35	.06	1.00	.47	-.11	.37	-.03	.34	.56	.42	.66	.16	-.10	.41	.44	.14	.32	.29
Cr	.04	.27	.88	.18	.01	-.11	-.16	.04	.47	1.00	-.16	-.14	-.08	-.05	.74	.53	.70	-.17	-.05	.06	.93	.22	-.18	.06
Cu	.22	-.24	-.32	.21	.19	.23	-.22	.15	-.11	-.16	1.00	-.17	-.03	.05	-.02	.11	-.30	.34	-.07	-.04	-.30	.08	-.23	.44
La	.41	.02	.04	-.01	-.10	.25	.98	-.06	.37	-.14	-.17	1.00	.01	.18	.07	-.02	.26	.29	-.04	.33	-.06	-.07	.83	.17
Mn	-.04	.64	-.05	-.08	.51	.19	.00	.04	-.03	-.08	-.03	.01	1.00	-.04	-.10	-.08	-.04	.16	.63	-.11	-.05	-.01	.01	.27
Mo	-.11	-.10	-.14	-.14	.02	.11	.20	.32	.34	-.05	.05	.18	-.04	1.00	-.02	-.08	.04	.19	-.03	-.10	-.09	.28	.03	.07
Nb	.42	.14	.74	.39	-.09	-.15	.02	.07	.56	.74	-.02	.07	-.10	-.02	1.00	.48	.54	-.02	-.16	.47	.73	.13	.04	.18
Ni	.42	.16	.36	.51	.13	.16	-.06	.00	.42	.53	.11	-.02	-.08	-.08	.48	1.00	.36	.12	-.10	.21	.36	.06	-.08	.25
P	.21	.40	.69	.26	.08	-.08	.25	-.05	.66	.70	-.30	.26	-.04	.04	.54	.36	1.00	-.08	-.05	.22	.70	.14	.25	.12
Pb	.34	-.02	-.16	.05	.56	.73	.21	.20	.16	-.17	.34	.29	.16	.19	-.02	.12	-.08	1.00	.26	.02	-.21	-.04	.10	.74
Sr	-.05	.67	-.07	-.16	.76	.53	-.05	.30	-.10	-.05	-.07	-.04	.63	-.03	-.16	-.10	-0.05	.26	1.00	-.40	.01	.15	-.20	.19
Ti	.69	-.17	.14	.57	-.26	-.29	.30	-.08	.41	.06	-.04	.33	-.11	-.10	.47	.21	.22	.02	-.40	1.00	.09	-.02	.53	.15
V	-.04	.31	.96	.04	-.01	-.15	-.07	.04	.44	.93	-.30	-.06	-.05	-.09	.73	.36	.70	-.21	.01	.09	1.00	.20	-.09	-.02
W	-.07	.05	-.01	.00	.17	.03	-.05	.73	.14	.22	.08	-.07	-.01	.28	.13	.06	.14	-.04	.15	-.02	.20	1.00	-.09	.02
Y	.41	-.02	.01	.08	-.29	-.02	.84	-.15	.32	-.18	-.23	.83	.01	.03	.04	-.08	.25	.10	-.20	.53	-.09	-.09	1.00	.06
Zn	.43	.10	.04	.28	.52	.55	.10	.07	.29	.06	.44	.17	.27	.07	.18	.25	.12	.74	.19	.15	-.02	-.02	.06	1.00

Table C3.--Summary statistics for minus-80-mesh stream-sediment data used in R-mode factor analysis.

UNIVARIATE STATISTICS

VAR	COLUMN	MINIMUM	MAXIMUM	MEAN	DEVIATION	VALID	B	L	N	G	OTHER
1	AL	4.600E+03	2.200E+04	1.298E+04	4.0336E+03	121	0	0	0	0	0
2	CA	2.600E+03	5.700E+04	1.209E+04	6.5710E+03	121	0	0	0	0	0
3	FE	9.600E+03	2.200E+05	4.340E+04	2.9552E+04	121	0	0	0	0	0
4	MG	2.200E+03	1.400E+04	6.777E+03	2.1534E+03	121	0	0	0	0	0
5	BA	6.600E+01	3.700E+02	1.437E+02	6.5588E+01	121	0	0	0	0	0
6	BE	2.700E-01	1.700E+00	7.318E-01	3.3345E-01	121	0	0	0	0	0
7	CE	2.900E+01	1.800E+02	7.676E+01	3.2113E+01	121	0	0	0	0	0
8	CO	4.000E+00	2.600E+01	1.303E+01	5.1988E+00	121	0	0	0	0	0
9	CR	1.100E+01	2.000E+02	3.853E+01	2.7725E+01	121	0	0	0	0	0
10	CU	3.000E-01	9.500E+01	2.052E+01	1.2259E+01	121	0	0	0	0	0
11	LA	1.700E+01	8.300E+01	3.801E+01	1.4192E+01	121	0	0	0	0	0
12	MN	2.800E+02	7.000E+03	6.460E+02	6.1159E+02	121	0	0	0	0	0
13	MO	8.000E-01	4.200E+00	1.058E+00	5.6255E-01	121	0	0	0	0	0
14	NB	2.000E+00	2.700E+01	1.136E+01	4.0620E+00	121	0	0	0	0	0
15	NI	4.500E+00	2.900E+01	1.289E+01	4.9796E+00	121	0	0	0	0	0
16	P	3.200E+02	4.900E+03	1.583E+03	1.0143E+03	121	0	0	0	0	0
17	PB	9.900E+00	1.000E+02	3.849E+01	1.7942E+01	121	0	0	0	0	0
18	SR	1.000E+01	2.200E+02	3.443E+01	3.2838E+01	121	0	0	0	0	0
19	TI	6.400E+01	2.100E+03	8.842E+02	4.3658E+02	121	0	0	0	0	0
20	V	2.100E+01	3.500E+02	7.011E+01	5.0092E+01	121	0	0	0	0	0
21	Y	8.000E-02	6.900E+01	2.342E+01	1.6324E+01	121	0	0	0	0	0
22	ZN	3.000E+01	1.600E+02	8.279E+01	2.6966E+01	121	0	0	0	0	0

Table C4.--Communalities for factor analysis, minus-80-mesh stream-sediment data

	FAC 1	FAC 2	FAC 3	FAC 4	FAC 5	FAC 6	FAC 7	FAC 8	FAC 9	FAC 10
AL	0.29	0.52	0.66	0.80	0.89	0.89	0.90	0.92	0.93	0.95
CA	0.09	0.16	0.48	0.66	0.84	0.88	0.88	0.91	0.91	0.91
FE	0.60	0.72	0.82	0.85	0.88	0.94	0.95	0.96	0.96	0.96
MG	0.25	0.29	0.31	0.63	0.81	0.88	0.92	0.92	0.93	0.94
BA	0.00	0.52	0.87	0.87	0.87	0.87	0.88	0.91	0.92	0.92
BE	0.00	0.66	0.71	0.71	0.79	0.82	0.93	0.93	0.93	0.94
CE	0.09	0.22	0.64	0.92	0.93	0.94	0.94	0.96	0.96	0.97
CO	0.63	0.66	0.67	0.68	0.70	0.86	0.86	0.86	0.87	0.87
CR	0.59	0.70	0.90	0.90	0.94	0.94	0.94	0.95	0.95	0.95
CU	0.03	0.14	0.14	0.58	0.61	0.61	0.68	0.86	0.86	0.98
LA	0.11	0.28	0.68	0.92	0.93	0.94	0.94	0.96	0.97	0.97
MN	0.00	0.20	0.37	0.49	0.67	0.69	0.87	0.90	0.92	0.95
MO	0.00	0.02	0.04	0.06	0.41	0.93	0.94	0.94	0.97	0.97
NB	0.70	0.73	0.74	0.78	0.78	0.78	0.83	0.84	0.91	0.94
NI	0.36	0.36	0.39	0.55	0.55	0.55	0.69	0.79	0.87	0.98
P	0.66	0.67	0.69	0.75	0.75	0.76	0.77	0.77	0.93	0.93
PB	0.00	0.65	0.65	0.68	0.80	0.84	0.85	0.88	0.88	0.91
SR	0.02	0.30	0.67	0.81	0.86	0.86	0.86	0.88	0.90	0.94
TI	0.28	0.28	0.60	0.67	0.81	0.81	0.87	0.93	0.94	0.94
V	0.56	0.71	0.88	0.91	0.93	0.96	0.97	0.97	0.97	0.98
Y	0.10	0.15	0.69	0.87	0.89	0.90	0.91	0.92	0.92	0.92
ZN	0.07	0.58	0.59	0.68	0.71	0.73	0.84	0.84	0.88	0.92

	EIGENVALUES	CPM
1	5.4184	0.2463
2	4.1099	0.4331
3	3.6661	0.5997
4	2.5542	0.7158
5	1.5981	0.7885
6	1.0320	0.8354
7	0.8314	0.8732
8	0.5723	0.8992
9	0.4904	0.9215

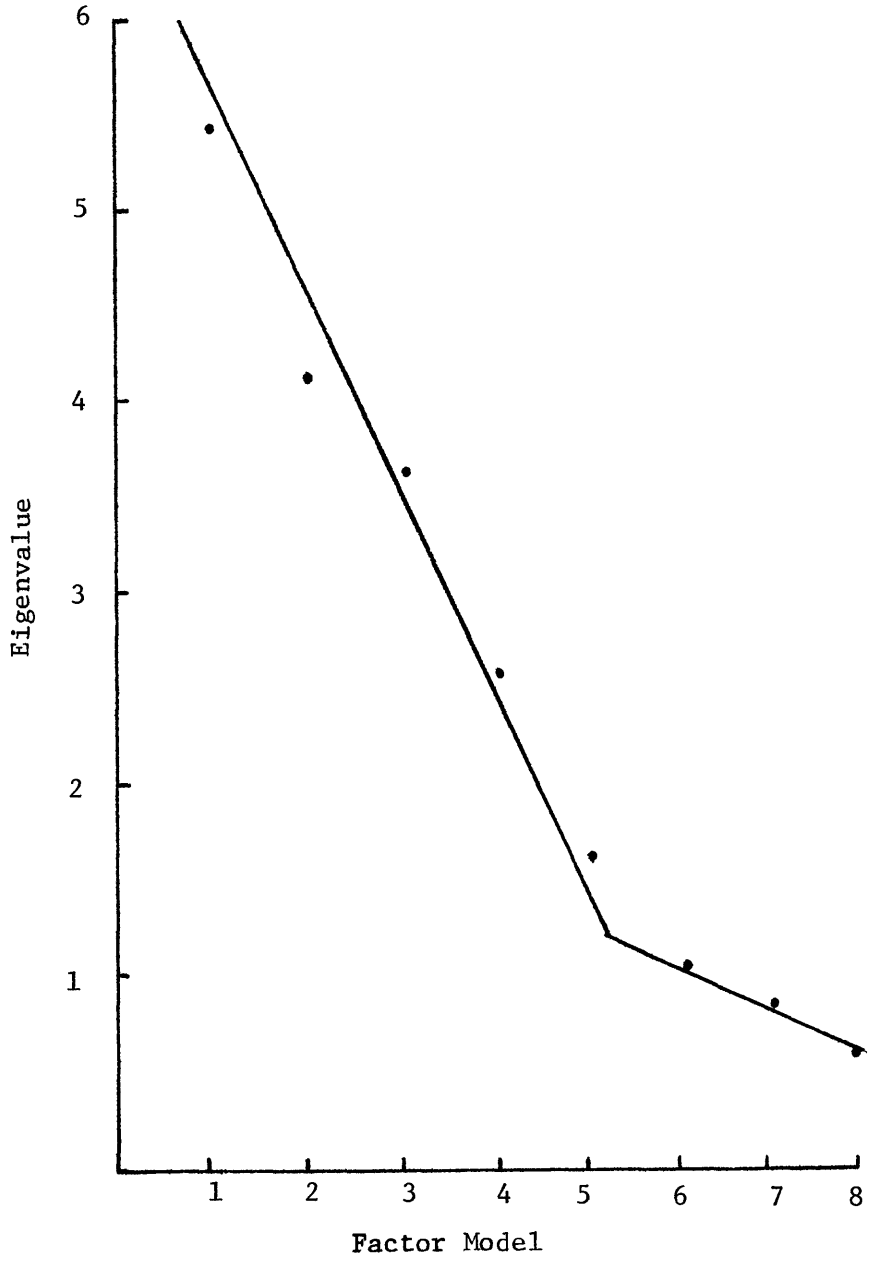

Figure C1.--Eigenvalues vs. factor models, minus-80-mesh stream-sediment data.

Table C5.--Factor loadings for 3-factor model, minus-80-mesh stream-sediment data

	VX 1	VX 2	VX 3
AL	0.2509	0.2251	0.7408
CA	0.4160	0.5177	-0.1871
FE	0.8909	-0.1400	-0.0873
MG	0.3684	0.1030	0.4009
BA	0.0745	0.9219	-0.1119
BE	-0.1036	0.8103	0.2047
CE	-0.0399	-0.0231	0.7961
CO	0.6461	0.0980	0.4973
CR	0.9268	-0.0596	-0.1897
CU	-0.2272	0.2958	0.0661
LA	-0.0108	0.0259	0.8246
MN	0.0040	0.5911	-0.1360
MO	-0.0872	0.0629	0.1743
NB	0.8319	-0.0999	0.1861
NI	0.5877	0.1584	0.1518
P	0.8030	-0.0248	0.2019
PB	-0.1260	0.6929	0.3938
SR	-0.0119	0.7716	-0.2797
TI	0.2704	-0.2783	0.6732
V	0.9110	-0.1127	-0.1927
Y	-0.0274	-0.1867	0.8105
ZN	0.1340	0.6659	0.3593

Table C6.--Factor loadings for 4-factor model, minus-80-mesh stream-sediment data

	VX 1	VX 2	VX 3	VX 4
AL	0.1208	-0.0237	0.3626	0.8111
CA	0.4417	0.6613	0.0299	-0.1564
FE	0.9208	-0.0367	-0.0193	-0.0555
MG	0.2316	-0.1440	-0.0234	0.7438
BA	-0.0100	0.8765	-0.1551	0.2749
BE	-0.1864	0.7250	0.1330	0.3624
CE	0.0157	0.0282	0.9575	0.0316
CO	0.6058	0.0444	0.3853	0.3987
CR	0.9186	-0.0107	-0.2241	0.0700
CU	-0.3687	0.0435	-0.3224	0.5783
LA	0.0297	0.0544	0.9488	0.1050
MN	0.0151	0.6860	0.0493	-0.1247
MO	-0.0742	0.0780	0.2286	-0.0081
NB	0.7794	-0.1676	-0.0087	0.3753
NI	0.4826	0.0065	-0.1504	0.5458
P	0.8223	0.0480	0.2585	0.0715
PB	-0.2365	0.5296	0.1996	0.5469
SR	-0.0055	0.8853	-0.0624	-0.1650
TI	0.2122	-0.4422	0.4048	0.5154
V	0.9410	0.0013	-0.1162	-0.0903
Y	0.0225	-0.1643	0.9127	0.0706
ZN	-0.0017	0.4710	0.0784	0.6696

Table C7.--Factor loadings for 5-factor model, minus-80-mesh stream-sediment data

	VX 1	VX 2	VX 3	VX 4	VX 5
AL	0.0743	-0.0084	0.3335	0.8157	0.3268
CA	0.3205	0.8563	0.0330	0.0351	-0.0330
FE	0.9279	0.0256	0.0056	-0.0192	-0.1256
MG	0.1526	-0.0033	-0.0449	0.8784	0.1140
BA	0.0046	0.6627	-0.1818	0.0185	0.6299
BE	-0.0924	0.3286	0.1021	-0.0826	0.8084
CE	0.0205	-0.0310	0.9553	-0.0177	0.1201
CO	0.6338	-0.0413	0.3835	0.2815	0.2640
CR	0.9444	0.0009	-0.2041	0.0442	-0.0226
CU	-0.2780	-0.2380	-0.3532	0.2649	0.5305
LA	0.0388	-0.0251	0.9437	0.0307	0.1793
MN	-0.0913	0.8095	0.0406	0.0030	0.0726
MO	0.0688	-0.2673	0.2271	-0.3823	0.3741
NB	0.7813	-0.1256	-0.0015	0.3889	0.0324
NI	0.4952	-0.0393	-0.1598	0.4650	0.2547
P	0.8094	0.1070	0.2742	0.1092	-0.0248
PB	-0.1159	0.0839	0.1641	0.0505	0.8685
SR	-0.0564	0.8574	-0.0730	-0.2073	0.2707
TI	0.1260	-0.2275	0.3966	0.7487	-0.1418
V	0.9491	0.0637	-0.0900	-0.0563	-0.1313
Y	-0.0341	-0.0539	0.9120	-0.2089	-0.1000
ZN	0.0764	0.1392	0.0445	0.2864	0.7755

Table C8.--Factor loadings for 6-factor model, minus-80-mesh stream-sediment data

	VX 1	VX 2	VX 3	VX 4	VX 5	VX 6
AL	0.0722	-0.0126	0.3213	0.8119	0.3358	-0.0994
CA	0.2941	0.8861	0.0053	0.0615	-0.0659	0.0150
FE	0.9555	-0.0098	0.0570	-0.0609	-0.0803	-0.1213
MG	0.1194	0.0410	-0.0994	0.9210	0.0567	0.0231
BA	0.0075	0.6624	-0.1908	0.0205	0.6268	0.0410
BE	-0.0696	0.3017	0.1223	-0.0982	0.8379	0.0386
CE	0.0022	-0.0156	0.9548	0.0224	0.1047	0.1191
CO	0.5539	0.0782	0.3042	0.4391	0.0984	0.4999
CR	0.9511	0.0010	-0.1831	0.0435	-0.0288	0.0209
CU	-0.2649	-0.2457	-0.3599	0.2585	0.5317	0.0313
LA	0.0253	-0.0164	0.9474	0.0632	0.1722	0.0960
MN	-0.1026	0.8158	0.0226	0.0027	0.0718	-0.0588
MO	-0.0553	-0.0735	0.0950	-0.1238	0.1004	0.9392
NB	0.7819	-0.1217	0.0071	0.3931	0.0239	-0.0089
NI	0.4945	-0.0319	-0.1656	0.4723	0.2398	0.0084
P	0.7798	0.1506	0.2592	0.1675	-0.0843	0.1704
PB	-0.0969	0.0642	0.1787	0.0470	0.8865	0.0812
SR	-0.0503	0.8444	-0.0704	-0.2260	0.2917	-0.0583
TI	0.1136	-0.2208	0.3811	0.7527	-0.1436	-0.1098
V	0.9666	0.0445	-0.0512	-0.0800	-0.1088	-0.0591
Y	-0.0452	-0.0546	0.9156	0.2201	-0.0892	-0.0337
ZN	0.0934	0.1214	0.0539	0.2773	0.7924	0.0203

Table C9.--Factor loadings for 7-factor model, minus-80-mesh stream-sediment data

	VX 1	VX 2	VX 3	VX 4	VX 5	VX 6	VX 7
AL	0.0559	-0.0168	0.3506	0.8114	0.3237	-0.1097	-0.0010
CA	0.2732	0.8737	0.0061	0.1102	-0.1517	0.0086	0.0899
FE	0.9632	0.0066	0.0475	-0.0601	-0.0701	-0.1139	-0.0437
MG	0.0897	0.0127	-0.0775	0.9481	0.0450	0.0038	-0.0176
BA	-0.0133	0.6780	-0.1601	0.0868	0.5098	0.0348	0.3512
BE	-0.1024	0.3044	0.1636	0.0121	0.6430	0.0179	0.6175
CE	-0.0009	-0.0221	0.9600	0.0240	0.0397	0.1138	0.0776
CO	0.5409	0.0743	0.3154	0.4620	0.0616	0.4933	0.0304
CR	0.9456	0.0065	-0.1860	0.0778	-0.0476	0.0196	0.0609
CU	-0.2395	-0.1931	-0.3381	0.1871	0.6429	0.0529	-0.1455
LA	0.0238	-0.0174	0.9557	0.0601	0.1131	0.0924	0.0723
MN	-0.0762	0.8603	0.0192	-0.0779	0.1487	-0.0287	-0.3075
MO	-0.0469	-0.0600	0.0957	-0.1300	0.1012	0.9464	0.0117
NB	0.7966	-0.0943	0.0076	0.3477	0.1071	0.0049	-0.2315
NI	0.4532	-0.0619	-0.1411	0.5728	0.1260	-0.0208	0.3354
P	0.7646	0.1386	0.2584	0.2105	-0.1453	0.1613	0.0808
PB	-0.0878	0.1156	0.2150	0.0378	0.8568	0.0921	0.1998
SR	-0.0675	0.8485	-0.0581	-0.1673	0.1757	-0.0626	0.2692
TI	0.1346	-0.2061	0.3809	0.6456	0.0046	-0.0945	-0.4873
V	0.9696	0.0557	-0.0613	-0.0647	-0.1122	-0.0546	-0.0065
Y	-0.0348	-0.0549	0.9127	0.1667	-0.0674	-0.0289	-0.1899
ZN	0.1183	0.1917	0.0852	0.2129	0.8533	0.0459	-0.0676

Table 10.--Factor loadings for 8-factor model, minus-80-mesh stream-sediment data

	VX 1	VX 2	VX 3	VX 4	VX 5	VX 6	VX 7	VX 8
AL	0.0626	0.2904	0.3200	0.8355	0.0930	-0.0963	-0.0515	0.0783
CA	0.2667	0.0667	0.0193	0.0268	-0.1703	-0.0137	0.8702	0.2154
FE	0.9642	-0.0555	0.0318	-0.0448	-0.0761	-0.1077	0.0039	-0.0448
MG	0.0876	0.0027	-0.0761	0.9057	0.0623	-0.0002	0.0356	0.2781
BA	-0.0126	0.7539	-0.2173	0.0769	-0.0328	0.0523	0.5259	0.0719
BE	-0.1070	0.9095	0.1234	-0.0461	0.0038	0.0257	0.1199	0.2400
CE	0.0010	0.1064	0.9632	0.0196	-0.0828	0.1051	-0.0371	0.0246
CO	0.5399	0.0893	0.3019	0.4471	-0.0428	0.4948	0.0642	0.1420
CR	0.9401	-0.0454	-0.1715	0.0270	0.0070	0.0116	0.0171	0.1707
CU	-0.2344	0.2142	-0.2176	0.1288	0.8141	0.0269	-0.1117	0.1422
LA	0.0270	0.1596	0.9599	0.0590	-0.0346	0.0850	-0.0360	0.0199
MN	-0.0657	0.0977	0.0476	-0.0514	0.1849	-0.0366	0.8998	-0.1865
MO	-0.0476	0.0670	0.0962	-0.1185	0.0451	0.9507	-0.0673	-0.0277
NB	0.8045	-0.0403	-0.0052	0.4003	0.1241	0.0192	-0.0687	-0.0991
NI	0.4378	0.1292	-0.0710	0.3951	0.1784	-0.0583	-0.0470	0.6223
P	0.7589	-0.0533	0.2623	0.1574	-0.1388	0.1498	0.1443	0.1982
PB	-0.0761	0.8498	0.1704	0.1014	0.2786	0.1218	-0.0236	-0.1375
SR	-0.0685	0.4965	-0.1124	-0.1766	-0.2232	-0.0530	0.7280	0.0032
TI	0.1520	-0.2009	0.3373	0.7864	0.0541	-0.0654	-0.1538	-0.3232
V	0.9682	-0.0681	-0.0768	-0.0644	-0.1088	-0.0504	0.0507	0.0009
Y	-0.0270	-0.1174	0.9198	0.2061	-0.0289	-0.0338	-0.0145	-0.1112
ZN	0.1333	0.6504	0.0959	0.2616	0.5309	0.0602	0.1429	-0.1225

Table C11.--Summary statistics for log (base 10) transformed heavy-mineral concentrate data used in R-mode factor analysis

UNIVARIATE STATISTICS

VAR	COLUMN	MINIMUM	MAXIMUM	MEAN	DEVIATION	VALID	B	L	N	G	OTHER
1	FE	-3.010E-01	1.000E+00	1.590E-01	1.8388E-01	123	0	0	0	0	0
2	MG	-1.000E+00	6.990E-01	-4.372E-01	3.7011E-01	123	0	0	0	0	0
3	CA	8.451E-01	1.699E+00	1.279E+00	1.7240E-01	123	0	0	0	0	0
4	MN	2.845E+00	3.699E+00	3.211E+00	1.2691E-01	123	0	0	0	0	0
5	B	1.146E+00	2.845E+00	1.496E+00	2.8976E-01	123	0	0	0	0	0
6	BA	2.000E+00	4.155E+00	2.987E+00	7.2752E-01	123	0	0	0	0	0
7	CO	6.990E-01	1.699E+00	1.073E+00	1.2760E-01	123	0	0	0	0	0
8	CR	1.477E+00	3.000E+00	1.870E+00	1.9610E-01	123	0	0	0	0	0
9	CU	6.990E-01	3.000E+00	1.085E+00	4.2461E-01	123	0	0	0	0	0
10	LA	2.176E+00	3.456E+00	2.815E+00	3.4781E-01	123	0	0	0	0	0
11	MO	6.990E-01	2.699E+00	9.602E-01	3.9017E-01	123	0	0	0	0	0
12	NB	1.398E+00	2.699E+00	2.119E+00	3.6582E-01	123	0	0	0	0	0
13	PB	1.699E+00	3.699E+00	2.375E+00	3.1847E-01	123	0	0	0	0	0
14	SN	1.000E+00	3.176E+00	2.114E+00	1.6769E-01	123	0	0	0	0	0
15	SR	2.000E+00	3.301E+00	2.185E+00	3.2423E-01	123	0	0	0	0	0
16	V	2.000E+00	2.845E+00	2.431E+00	1.7901E-01	123	0	0	0	0	0
17	W	1.699E+00	3.477E+00	1.959E+00	4.5189E-01	123	0	0	0	0	0
18	Y	2.845E+00	3.854E+00	3.329E+00	2.2474E-01	123	0	0	0	0	0
19	TH	2.000E+00	3.301E+00	2.324E+00	2.3093E-01	123	0	0	0	0	0

Table C12.--Communalities for factor analysis, heavy-mineral concentrate data

	FAC 1	FAC 2	FAC 3	FAC 4	FAC 5	FAC 6	FAC 7	FAC 8	FAC 9	FAC 10
FE	0.39	0.47	0.69	0.73	0.73	0.73	0.80	0.82	0.83	0.85
MG	0.35	0.35	0.40	0.65	0.77	0.82	0.83	0.83	0.83	0.83
CA	0.04	0.12	0.22	0.24	0.59	0.72	0.85	0.85	0.87	0.92
MN	0.05	0.40	0.41	0.66	0.70	0.73	0.75	0.75	0.75	0.84
B	0.29	0.29	0.32	0.35	0.47	0.66	0.67	0.91	0.91	0.92
BA	0.19	0.63	0.67	0.68	0.80	0.80	0.80	0.80	0.81	0.82
CO	0.26	0.27	0.43	0.48	0.56	0.58	0.65	0.66	0.83	0.92
CR	0.33	0.37	0.58	0.68	0.70	0.70	0.75	0.76	0.80	0.83
CU	0.29	0.31	0.57	0.58	0.58	0.65	0.74	0.74	0.81	0.83
LA	0.38	0.53	0.54	0.74	0.74	0.77	0.83	0.86	0.87	0.87
MO	0.31	0.51	0.53	0.54	0.61	0.72	0.75	0.75	0.77	0.78
NB	0.04	0.36	0.40	0.41	0.45	0.68	0.75	0.85	0.87	0.95
PB	0.11	0.16	0.57	0.58	0.63	0.76	0.78	0.81	0.86	0.86
SN	0.00	0.56	0.63	0.68	0.69	0.70	0.70	0.70	0.78	0.78
SR	0.24	0.61	0.61	0.67	0.68	0.68	0.68	0.80	0.82	0.83
V	0.13	0.30	0.40	0.40	0.52	0.64	0.64	0.76	0.80	0.84
W	0.18	0.18	0.28	0.69	0.74	0.74	0.76	0.76	0.81	0.88
Y	0.15	0.56	0.57	0.65	0.72	0.73	0.76	0.76	0.83	0.83
TH	0.34	0.36	0.42	0.57	0.63	0.66	0.88	0.88	0.88	0.88

	EIGENVALUES	CPM
1	4.0666	0.2140
2	3.2891	0.3871
3	1.8830	0.4862
4	1.7413	0.5779
5	1.3174	0.6472
6	1.1759	0.7091
7	0.8807	0.7555
8	0.6951	0.7921
9	0.6755	0.8276
10	0.5238	0.8552

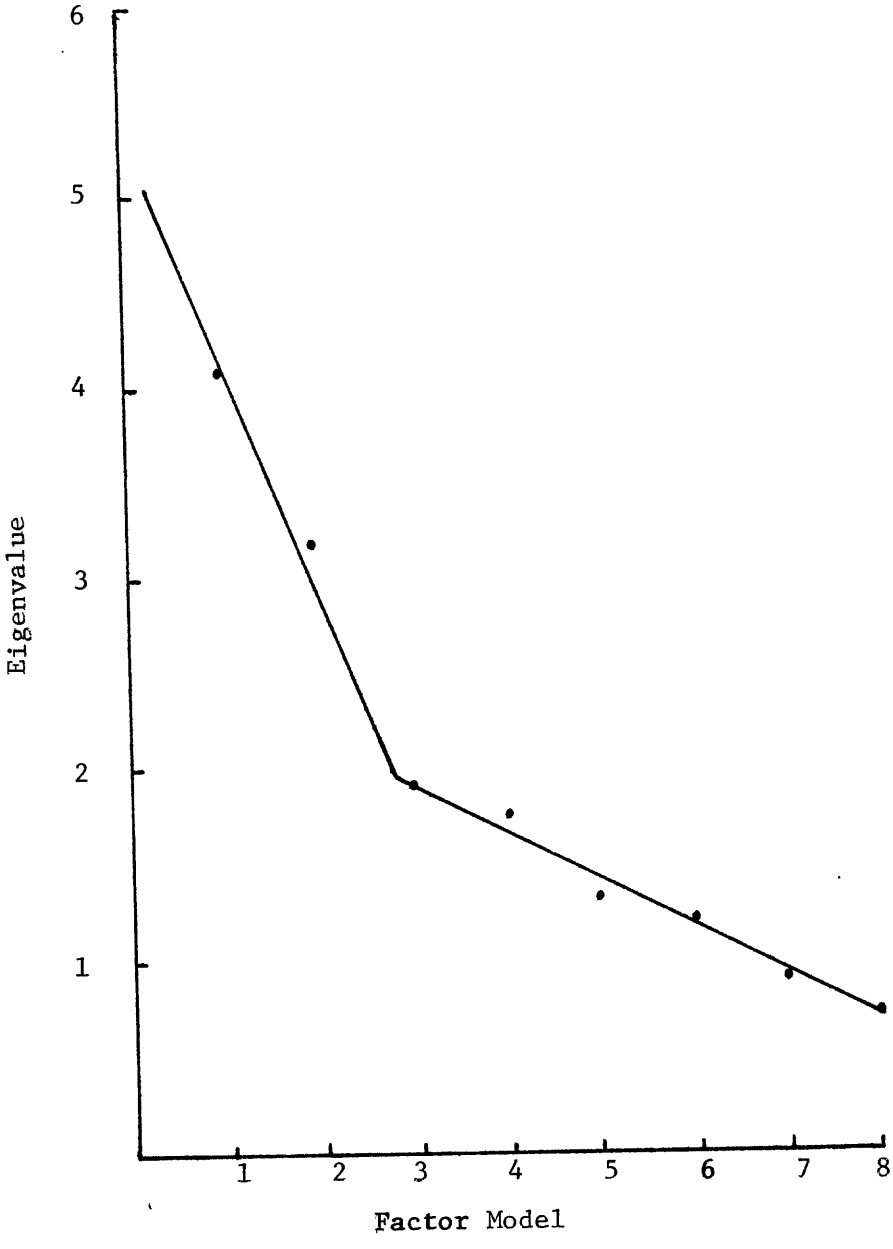

Figure C2.--Eigenvalues vs. factor models, heavy-mineral concentrate data.

Table C13.--Factor loadings for 3-factor model, heavy-mineral concentrate data

	VX 1	VX 2	VX 3
FE	0.8247	-0.0244	0.0905
MG	0.5559	-0.2111	0.2085
CA	0.1632	0.3259	-0.2924
MN	0.4121	0.4476	0.1958
B	0.2573	-0.1713	0.4752
BA	-0.0369	-0.7710	0.2630
CO	0.6484	-0.0916	0.0442
CR	0.7575	-0.0609	0.0524
CU	0.0747	-0.0644	0.7482
LA	0.3527	-0.5993	0.2302
MO	0.4345	0.2101	0.5455
NB	0.1771	0.4602	0.3964
PB	-0.1148	0.1281	0.7364
SN	0.0930	0.6932	0.3741
SR	0.1325	-0.7518	0.1774
V	0.5934	0.2171	0.0715
W	0.1034	-0.1066	0.5097
Y	-0.1179	0.7447	-0.0259
TH	0.1969	-0.3460	-.5123

Table C14.--Factor loadings for 4-factor model, heavy-mineral concentrate data

	VX 1	VX 2	VX 3	VX 4
FE	0.8352	0.1537	0.0676	-0.0011
MG	0.4460	0.0471	0.1112	0.6591
CA	0.1777	-0.4288	-0.1565	-0.0104
MN	0.5180	-0.0891	0.3415	-0.5155
B	0.1977	0.2322	0.3779	0.3403
BA	-0.0967	0.7944	-0.0333	0.2073
CO	0.6600	0.2005	0.0020	-0.0343
CR	0.6899	-0.0484	-0.0185	0.4523
CU	0.0359	0.2688	0.6731	0.2201
LA	0.3508	0.7825	-0.0050	-0.0735
MO	0.4160	-0.0355	0.5799	0.1805
NB	0.1918	-0.2992	0.5341	0.0097
PB	-0.1069	0.1684	0.7342	-0.0375
SN	0.1815	-0.3639	0.5992	-0.3936
SR	0.0872	0.7918	-0.1077	0.1391
V	0.5999	-0.1518	0.1392	0.0491
W	-0.0179	-0.0133	0.4341	0.7077
Y	-0.0010	-0.5174	0.2473	-0.5673
TH	0.2045	0.6293	0.3511	-0.0976

Table C15.--Factor loadings for 5-factor model, heavy-mineral concentrate data

	VX 1	VX 2	VX 3	VX 4	VX 5
FE	0.6925	0.2640	0.0122	0.2330	0.3590
MG	0.2310	0.1285	0.2498	-0.2367	0.7635
CA	-0.1494	-0.2387	-0.2148	-0.3512	0.5806
MN	0.3757	0.0263	0.1361	0.7302	0.0553
B	0.0411	0.2689	0.4624	-0.0102	0.4221
BA	-0.2369	0.8159	0.1260	-0.1813	0.1565
CO	0.7175	0.2092	-0.0404	0.0221	0.0032
CR	0.5393	0.0388	0.0740	-0.1196	0.6236
CU	0.0456	0.2067	0.7289	0.0022	0.0783
LA	0.2983	0.8062	0.0384	0.0238	-0.0273
MO	0.5281	-0.1042	0.5604	0.0009	0.0410
NB	0.2957	-0.3556	0.4597	0.1432	-0.0429
PB	-0.1397	0.1334	0.7198	0.2644	-0.0133
SN	0.1355	-0.3268	0.4097	0.6324	-0.0366
SR	0.0254	0.7959	0.0203	-0.2028	0.0434
V	0.6986	-0.1665	0.0759	0.0117	0.0408
W	0.1359	-0.1537	0.6000	-0.5589	0.1712
Y	-0.1217	-0.4210	0.0261	0.7249	-0.0413
TH	0.3268	0.5487	0.3647	0.0045	-0.2928

Table C16.--Factor loadings for 6-factor model, heavy-mineral concentrate data

	VX 1	VX 2	VX 3	VX 4	VX 5	VX 6
FE	0.7255	0.2586	-0.0158	0.2625	-0.0745	0.2574
MG	0.2723	0.0884	0.0599	-0.1450	-0.1567	0.8312
CA	0.0630	-0.1442	0.0042	0.1891	-0.8076	0.0670
MN	0.3037	0.0204	0.0331	0.7921	0.0529	0.0871
B	-0.0367	0.1982	0.1732	0.1423	0.1680	0.7383
BA	-0.2069	0.8011	0.1222	-0.1905	0.0221	0.2430
CO	0.6481	0.1705	-0.1509	0.1145	0.2856	0.1061
CR	0.6265	0.0291	0.0301	-0.0925	-0.2275	0.4998
CU	0.0826	0.1705	0.7580	0.0061	0.0853	0.1813
LA	0.3204	0.7978	0.1044	0.0049	0.1245	-0.0283
MO	0.5625	-0.1373	0.6056	0.0163	0.1153	0.0565
NB	0.1129	-0.4404	0.1368	0.3431	0.4573	0.3632
PB	-0.0802	0.1264	0.8320	0.2136	-0.0412	-0.0073
SN	0.0799	-0.3365	0.3461	0.6749	0.0392	0.0200
SR	0.0328	0.7761	0.0178	-0.1977	0.1328	0.1309
V	0.7551	-0.1655	0.1758	-0.0080	-0.0104	-0.1137
W	0.1184	-0.2302	0.4646	-0.4601	0.2477	0.4338
Y	-0.1525	-0.3876	0.0181	0.7128	-0.1716	-0.1292
TH	0.1941	0.4757	0.2224	0.1197	0.5703	0.0603