UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rock samples from the North Stansbury Mountains Wilderness Study Area, Tooele County, Utah

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STUDIES RELATED TO WILDERNESS

Bureau of Land Management Wilderness Study Areas

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and the U.S. Bureau of Mines to survey certain areas on Federal lands to determine their mineral resource potential. Results must be made available to the public and submitted to the President and the Congress. This report presents the results of a geochemical survey of the North Stansbury Mountains Wilderness Study Area (UT-020-089), Tooele County, Utah.

INTRODUCTION

During the 1986 summer and fall field seasons, the U.S. Geological Survey conducted a reconnaissance geochemical survey of the North Stansbury Mountains Wilderness Study Area (UT-020-089). The area comprises 10,000 acres (15.6 mi^2; 40.3 km^2) in northeast Tooele County approximately 45 miles west of Salt Lake City, and 20 miles west of the Oquirrh Mountains (fig. 1). Access to the area is provided by Interstate 80 north of the area, and the Skull Valley Road bordering the area on the west. Numerous unimproved roads and jeep trails provide access to more remote regions of the North Stansbury Mountains.

The mountains are bordered both east and west by wide flat valleys into which short streams drain in both directions from the central ridge. Elevations range from about 4,200 feet in the bordering valleys up to a maximum of 8,885 feet within the study area.

Stream-sediment samples, nonmagnetic heavy-mineral concentrates derived from the stream-sediment samples, and rock samples were collected as part of the mineral resource potential survey of the Wilderness Study Area (WSA). The analytical results are presented in this report.

GENERAL GEOLOGY

The Stansbury Mountains lie within the eastern Great Basin of north-central Utah, an area which is also part of the Basin and Range structural province. The following generalized geologic history of the area is taken from Tooker (1983). Lower Paleozoic (Cambrian through Devonian) carbonate and clastic sediments were deposited as part of a westward thickening miogeocline. This deposition was interrupted in the Devonian by uplift on the east-west trending Cortez-Uinta axis. Unconformable clastic sediments deposited during this uplift grade upwards into an overlying sequence (Mississippian through Permian) of mostly shallow-water sediments. During the Mesozoic, eastward-directed thrusting resulting from the Sevier Orogeny developed a series of imbricated thrust sheets. Mesozoic sediments are preserved in only a few of these thrust sheets. Tertiary igneous activity is represented by several intrusions of intermediate composition which occur in the central portion of the range (Davis, 1959).

METHODS OF STUDY

Sample Media

Twenty-eight unconsolidated stream sediment samples, 18 nonmagnetic heavy-mineral concentrates derived from the sediments, and 43 rock samples were collected for this study (plate 1). Stream sediments are useful sample

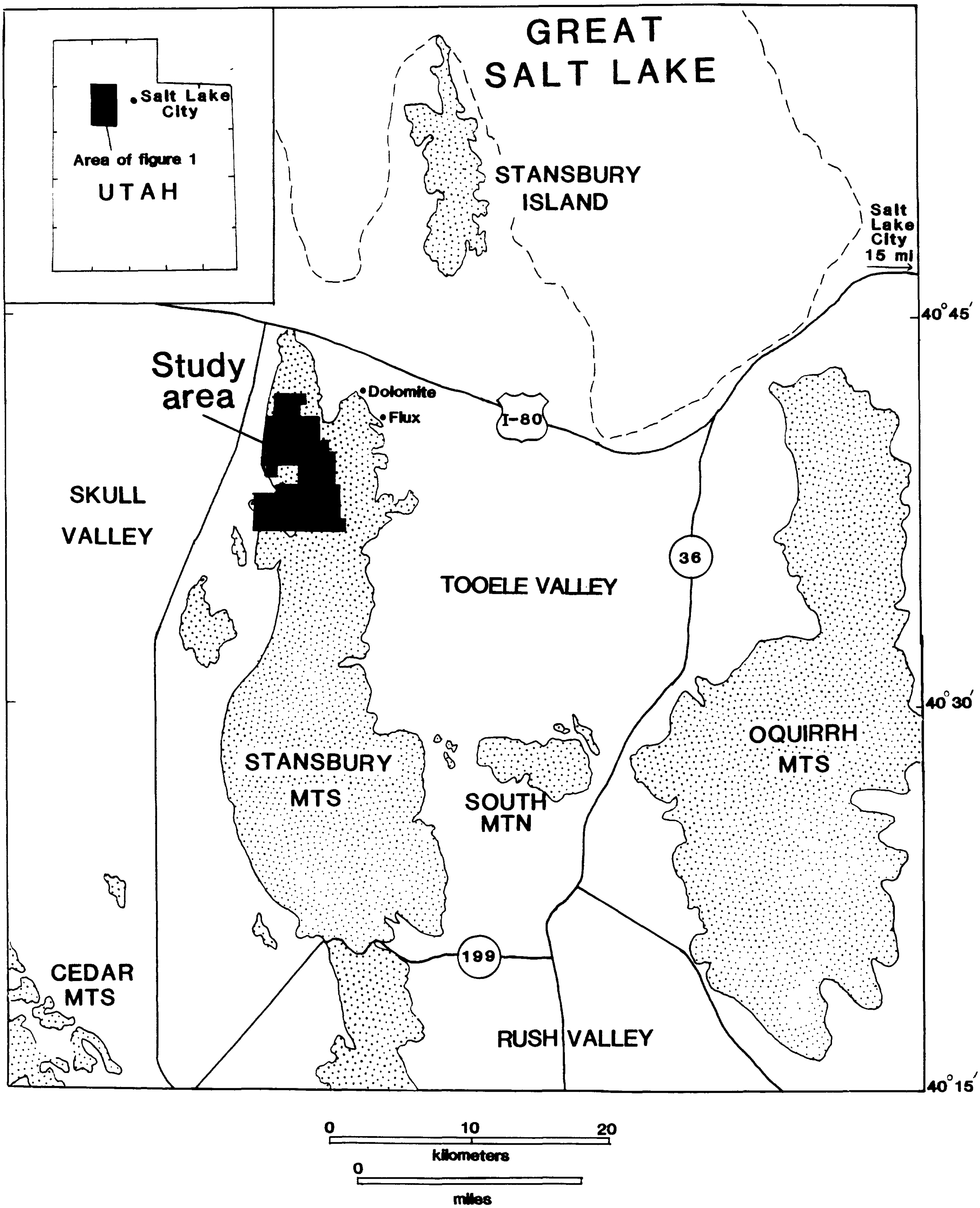

Figure 1. Location map of the North Stansbury Mountains Wilderness Study Area, Utah.

media because they represent the chemistry of the rock material eroded from the drainage basin upstream from the sample site. Minus-80-mesh stream sediments contain relatively fine material, whereas plus-80-mesh minus-30-mesh stream sediments contain coarse material. The minus-30-mesh sediments are useful in arid environments because they do not contain the very fine material deposited by wind which may possibly contaminate the sample. The nonmagnetic fraction of heavy-mineral concentrates are particularly useful in locating mineralized areas because primary and secondary ore-related minerals are commonly contained in this fraction. This selective concentration of heavy minerals permits determination of some elements that are not easily detected in stream sediment samples.

Analyses of unaltered or unmineralized rock samples provide necessary information on geochemical background values and rock samples from prospects and mines provide information on the suites of elements that are associated with mineralization or alteration.

Sample Collection

Sediment samples were collected from first-order and second-order drainages (dry washes) at an approximate density of one site per square mile. Approximately 10 lbs of sediment were collected from each site; the sample was composited from several localities within an area that may extend as much as 20 feet from the site plotted on the map. Each bulk sample was screened with a 10-mesh (2.0-mm) screen to remove the coarse material. Approximately 1 lb of sieved material was saved for preparation and analysis. The remaining material was concentrated by panning in available streams nearby the study area.

Unaltered, altered, and mineralized rock samples (a total of 43) were collected from outcrops or exposures in the vicinity of the plotted site location.

Sample Preparation

After air-drying, the sediment samples were first sieved using a stainless steel 80-mesh (0.177-mm opening) screen. The minus-80-mesh fraction (that portion of sediment passing through the screen) of all but 10 samples was saved for analysis. The plus-80-mesh fraction was then sieved using a 30-mesh (0.59 mm) screen. The minus-30-mesh fraction was also analyzed.

The concentrate sample was air-dried, and the highly magnetic material (i.e., magnetite, ilmenite) was removed with an electromagnet. Any lightweight material remaining after panning was then separated by bromoform (specific gravity 2.8). The resulting heavy-mineral fraction was separated into three fractions using a large electromagnet (in this case a modified Frantz Isodynamic Separator). The most magnetic fraction, primarily magnetite, was not analyzed. The second fraction, largely ferromagnesian silicates and iron oxides, was saved for archival storage. The nonmagnetic fraction (at 0.6 ampere), may include zircon, sphene, and ore-related sulfides and oxides. Given sufficient material, the nonmagnetic fraction was split using a Jones splitter. One split was hand-ground for spectrographic analysis; the other split was saved for mineralogical analysis.

All rock samples were crushed and then pulverized to a fine powder (minus-100-mesh) with ceramic plates.

Sample Analysis

Spectrographic method

The stream-sediment, nonmagnetic heavy-mineral-concentrate, and rock samples were analyzed for 31 elements using a semiquantitative, direct-current arc emission spectrographic method (Grimes and Marranzino, 1968). The elements analyzed and their lower limits of determination are listed in table 1. Spectrographic results were obtained by visual comparison of spectra derived from the sample against spectra obtained from standards. Standard concentrations are geometrically spaced over any given order of magnitude of concentration as follows: 100, 70, 50, 30, 20, 15, 10, and so forth. The precision of the analytical method is +/- one reporting interval at the 83 percent confidence level and +/- two intervals at the 96 percent confidence level (Motooka and Grimes, 1976). Values determined for major elements (Fe, Mg, Ca, Ti) are given in weight percent; all others are in parts per million (micrograms/gram or ppm).

Chemical methods

Minus-30-mesh and minus-80-mesh stream-sediment samples and rock samples were also analyzed by an inductively coupled plasma-atomic emission spectroscopy (ICP-AES) method. Elements determined by this method were Zn, Cd, As, Bi, and Sb; gold was determined by atomic absorption spectroscopy (table 2).

ROCK ANALYSIS STORAGE SYSTEM

Upon completion of all analytical work, the analytical results were entered into a computer-based file called Rock Analysis Storage System (RASS). This data base contains both descriptive geological information and analytical data. Any or all of this information may be retrieved and converted to a binary form (STATPAC) for computerized statistical analysis or publication (VanTrump and Miesch, 1976).

DESCRIPTION OF DATA TABLES

Tables 3-6 list the analyses for nonmagnetic heavy-mineral concentrates, plus-80-mesh, minus-30-mesh sediments, minus-80-mesh sediments, and rocks, respectively. Rock descriptions are given in table 7. For tables 3-6, the data are arranged so that column 1 contains the USGS-assigned sample numbers, which correspond to the numbers shown on the site location map (plate 1). Columns in which the element headings show the letter "s" below the element symbol are emission spectrographic analyses; "icp" indicates inductively coupled plasma-atomic emission spectroscopic analyses; "aa" indicates atomic absorption analyses. Qualified values are those not detected, less than the lower limit of determination, or greater than the upper limit of determination. Therefore, a letter "N" in the tables indicates that a given element was looked for but not detected at the lower limit of determination shown for that element in table 1. If an element was observed but was below the lowest reporting value, a "less than" symbol (<) was entered in the tables in front of the lower limit of determination. If an element was observed but was above the highest reporting value, a "greater than" symbol (>) was entered in the tables in front of the upper limit of determination.

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TABLE 1.--Limits of determination for the spectrographic analysis of rocks and stream sediments, based on a 10-mg sample

[The spectrographic limits of determination for heavy-mineral-concentrate samples are based on a 5-mg sample, and are therefore two reporting intervals higher than the limits given for rocks and stream sediments]

Elements	Lower determination limit	Upper determination limit
	Percent	
Iron (Fe)	0.05	20
Magnesium (Mg)	.02	10
Calcium (Ca)	.05	20
Titanium (Ti)	.002	1
	Parts per million	
Manganese (Mn)	10	5,000
Silver (Ag)	0.5	5,000
Arsenic (As)	200	10,000
Gold (Au)	10	500
Boron (B)	10	2,000
Barium (Ba)	20	5,000
Beryllium (Be)	1	1,000
Bismuth (Bi)	10	1,000
Cadmium (Cd)	20	500
Cobalt (Co)	5	2,000
Chromium (Cr)	10	5,000
Copper (Cu)	5	20,000
Lanthanum (La)	20	1,000
Molybdenum (Mo)	5	2,000
Niobium (Nb)	20	2,000
Nickel (Ni)	5	5,000
Lead (Pb)	10	20,000
Antimony (Sb)	100	10,000
Scandium (Sc)	5	100
Tin (Sn)	10	1,000
Strontium (Sr)	100	5,000
Vanadium (V)	10	10,000
Tungsten (W)	50	10,000
Yttrium (Y)	10	2,000
Zinc (Zn)	200	10,000
Zirconium (Zr)	10	1,000
Thorium (Th)	100	2,000

TABLE 2.--Chemical methods used

[ICP = inductively coupled plasma spectroscopy; AA = atomic absorption spectroscopy]

Element determined	Method	Determination limit (micrograms/ gram or ppm)	Reference
Arsenic (As)	ICP	5*	Crock and others, 1987.
Antimony (Sb)	ICP	2*	"
Zinc (Zn)	ICP	2*	"
Bismuth (Bi)	ICP	2*	"
Cadmium (Cd)	ICP	0.1*	"
Gold (Au)	AA	0.1†	"

*Based on a 0.15-gm sample.

†Based on a 10-gm sample.

TABLE 3. ANALYTICAL RESULTS OF NONMAGNETIC HEAVY-MINERAL-CONCENTRATE SAMPLES

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

Sample	Latitude	Longitude	Fe-pct. s	Mg-pct. s	Ca-pct. s	Ti-pct. s	Mn-ppm s	Ag-ppm s	As-ppm s	Au-ppm s	B-ppm s	Ba-ppm s	Be-ppm s
JGNS002C	40 36 55	112 39 45	1.0	5.0	7.00	>2.00	150	N	N	N	50	500	50
JGNS003C	40 38 0	112 38 38	.5	2.0	3.00	>2.00	50	7	<500	20	30	300	5
JGNS004C	40 38 15	112 38 50	1.5	7.0	7.00	1.50	300	N	N	N	50	100	<2
JGNS005C	40 40 53	112 39 20	.7	7.0	10.00	1.00	200	N	N	N	50	<50	N
JGNS006C	40 38 27	112 35 28	1.5	5.0	7.00	>2.00	300	N	N	N	50	200	2
JGNS007C	40 40 6	112 34 0	.5	3.0	10.00	>2.00	100	N	N	N	50	150	<2
JGNS008C	40 40 13	112 36 15	.7	5.0	7.00	2.00	200	N	N	N	30	150	<2
KDNS003C	40 37 15	112 38 5	.7	.1	.15	>2.00	70	N	N	N	200	500	15
KDNS004C	40 40 8	112 39 22	.7	7.0	7.00	1.50	150	N	N	N	30	<50	<2
KDNS005C	40 41 43	112 38 50	.2	7.0	10.00	2.00	200	N	N	N	20	<50	<2
KDNS006C	40 36 28	112 35 25	.3	1.0	10.00	>2.00	50	N	N	N	30	5,000	3
KDNS007C	40 38 5	112 34 45	.5	3.0	5.00	2.00	100	N	N	N	50	2,000	N
KDNS008C	40 42 30	112 37 0	1.0	10.0	10.00	1.50	150	N	N	N	30	500	N
KDNS009C	40 41 0	112 36 35	.2	1.0	30.00	.05	30	5	N	N	30	<50	N
KDNS010C	40 38 6	112 38 48	.1	.5	.70	1.50	<20	N	N	20	<20	<50	<2
KDNS011C	40 37 55	112 37 55	.2	1.5	7.00	>2.00	70	N	N	N	50	<50	<2
KDNS012C	40 38 3	112 39 35	.2	2.0	7.00	>2.00	70	N	N	N	<20	<50	<2
KDNS013C	40 38 0	112 39 20	.2	1.0	1.50	2.00	50	N	N	N	20	50	<2

TABLE 3. ANALYTICAL RESULTS OF NONMAGNETIC HEAVY-MINERAL-CONCENTRATE SAMPLES--Continued

Sample	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	La-ppm s	Mo-ppm s	Nb-ppm s	Ni-ppm s	Pb-ppm s	Sb-ppm s	Sc-ppm s	Sn-ppm s	Sr-ppm s
JGNS002C	N	N	N	50	N	300	N	70	15	100	N	30	N	200
JGNS003C	70	N	N	30	500	<50	N	50	15	>50,000	1,500	50	N	300
JGNS004C	N	N	<10	<20	15	<50	N	<50	15	1,000	N	20	30	200
JGNS005C	N	N	N	N	<10	<50	N	<50	10	700	N	<10	<20	200
JGNS006C	N	N	<10	50	<10	200	N	70	20	3,000	N	20	N	300
JGNS007C	N	N	N	70	<10	500	N	N	20	150	N	<10	N	1,000
JGNS008C	N	N	N	20	N	100	N	<50	15	500	N	<10	N	200
KDNS003C	N	N	N	200	<10	300	N	50	15	50	N	150	<20	300
KDNS004C	N	N	N	<20	300	100	N	50	10	3,000	N	N	N	200
KDNS005C	N	N	<10	<20	<10	<50	N	N	10	3,000	N	N	N	200
KDNS006C	N	N	N	70	<10	200	N	50	20	200	N	<10	N	1,000
KDNS007C	N	N	N	50	N	<50	N	50	20	500	N	N	N	500
KDNS008C	N	N	N	N	<10	100	N	<50	10	70	N	N	20	200
KDNS009C	N	N	N	30	15	500	N	N	30	20	N	N	N	2,000
KDNS010C	200	N	N	50	70	50	N	50	N	>50,000	3,000	N	N	N
KDNS011C	N	N	N	150	N	70	N	50	N	1,500	N	N	N	N
KDNS012C	N	N	N	150	N	50	N	<50	N	1,000	N	30	N	N
KDNS013C	N	N	N	100	N	50	N	<50	N	1,000	N	N	<20	N

TABLE 3. ANALYTICAL RESULTS OF NONMAGNETIC HEAVY-MINERAL-CONCENTRATE SAMPLES--Continued

Sample	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s
J6NS002C	70	N	2,000	N	>2,000	<200
J6NS003C	70	N	700	N	>2,000	N
J6NS004C	70	N	300	N	>2,000	N
J6NS005C	50	N	200	N	>2,000	N
J6NS006C	100	N	300	700	>2,000	N
J6NS007C	150	N	500	N	>2,000	N
J6NS008C	70	N	200	N	>2,000	N
KDNS003C	70	N	2,000	N	>2,000	N
KDNS004C	50	N	200	N	>2,000	N
KDNS005C	70	N	200	N	>2,000	N
KDNS006C	100	N	700	N	>2,000	N
KDNS007C	50	N	100	N	>2,000	N
KDNS008C	50	N	100	N	>2,000	N
KDNS009C	70	N	500	N	2,000	N
KDNS010C	20	N	300	N	>2,000	N
KDNS011C	50	N	500	N	>2,000	N
KDNS012C	70	N	700	N	>2,000	N
KDNS013C	50	N	500	N	>2,000	N

TABLE 4. ANALYTICAL RESULTS OF MINUS-30-MESH STREAM SEDIMENT SAMPLES

[NA, not analyzed; N, not detected; <, detected but below the limit of determination shown; >, determined to be greater than the value shown; s, emission spectroscopy; aa, atomic absorption; icp, inductively coupled plasma]

Sample	Latitude	Longitude	Fe-pct. s	Mg-pct. s	Ca-pct. s	Ti-pct. s	Mn-ppm s	Ag-ppm s	As-ppm s	Au-ppm s	B-ppm s	Ba-ppm s	Be-ppm s
13S	40 41 31	112 37 57	1.0	7.00	15.00	.07	300	1.0	N	N	30	100	1.0
21S	40 40 03	112 37 57	1.0	2.00	15.00	.10	300	N	N	N	30	100	1.5
108S	40 39 14	112 36 05	1.0	.70	1.50	.15	500	N	N	N	50	300	3.0
128S	40 38 56	112 39 02	1.5	1.50	15.00	.20	700	N	N	N	50	300	2.0
131S	40 39 12	112 39 18	1.5	3.00	10.00	.15	700	N	N	N	30	300	1.5
133S	40 38 13	112 38 09	2.0	3.00	7.00	.20	700	N	N	N	50	300	1.0
134S	40 38 01	112 38 04	2.0	3.00	3.00	.20	700	N	N	N	50	500	1.5
137S	40 37 35	112 38 35	2.0	2.00	5.00	.20	500	N	N	N	50	300	2.0
143S	40 37 57	112 37 14	2.0	.70	1.50	.30	1000	N	N	N	70	500	2.0
144S	40 37 53	112 37 18	3.0	1.00	1.50	.30	700	N	N	N	70	700	3.0
JGNS002S	40 36 55	112 39 45	1.5	2.00	5.00	.20	300	N	N	N	30	300	2.0
JGNS003S	40 38 0	112 38 38	1.5	1.50	10.00	.15	300	N	N	N	50	200	1.5
JGNS004S	40 38 15	112 38 50	1.5	5.00	15.00	.15	300	N	N	N	30	150	1.0
JGNS005S	40 40 53	112 39 20	.7	5.00	20.00	.07	200	N	N	N	15	100	<1.0
JGNS006S	40 38 27	112 35 28	2.0	1.50	3.00	.20	500	N	N	N	70	300	3.0
JGNS007S	40 40 6	112 34 0	1.5	1.50	7.00	.15	300	<.5	N	N	50	200	1.0
JGNS009S	40 40 13	112 36 15	2.0	2.00	7.00	.20	500	N	N	N	50	300	1.5
KDNS003S	40 37 15	112 38 5	1.0	.20	.15	.20	150	N	N	N	50	150	1.5
KDNS004S	40 40 8	112 39 22	.7	7.00	20.00	.07	200	N	N	N	10	50	<1.0
KDNS005S	40 41 43	112 38 50	1.5	5.00	20.00	.07	300	N	N	N	30	100	<1.0
KDNS006S	40 36 28	112 35 25	2.0	.70	1.50	.20	700	.7	N	N	70	300	2.0
KDNS007S	40 38 5	112 34 45	3.0	1.00	1.50	.50	700	N	N	N	50	700	3.0
KDNS008S	40 42 30	112 37 0	1.0	7.00	15.00	.07	200	N	N	N	10	70	<1.0
KDNS009S	40 41 0	112 36 35	1.5	1.50	10.00	.15	500	2.0	N	N	50	150	1.5
KDNS010S	40 38 6	112 38 48	1.5	1.00	10.00	.10	300	N	N	N	30	150	1.5
KDNS011S	40 37 55	112 37 55	1.5	1.00	7.00	.20	300	N	N	N	50	200	1.5
KDNS012S	40 38 3	112 39 35	.2	3.00	15.00	.03	150	N	N	N	<10	20	N
KDNS013S	40 38 0	112 39 20	1.5	1.00	7.00	.20	500	N	N	N	20	700	1.5

TABLE 4. ANALYTICAL RESULTS OF MINUS-30-MESH STREAM SEDIMENT SAMPLES--Continued

Sample	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	La-ppm s	Mo-ppm s	Nb-ppm s	Ni-ppm s	Pb-ppm s	Sb-ppm s	Sc-ppm s	Sn-ppm s	Sr-ppm s
13S	N	N	<5	30	10	20	N	N	10	30	N	<5	N	<100
21S	N	N	5	50	20	20	N	N	15	30	N	<5	N	<100
108S	N	N	15	50	20	20	N	N	20	30	N	5	N	<100
128S	N	N	10	50	30	20	N	20	20	30	N	5	N	300
131S	N	N	7	70	20	20	N	N	20	30	N	5	N	300
133S	N	N	10	70	20	20	N	N	15	30	N	7	N	200
134S	N	N	10	70	30	20	N	N	20	30	N	7	N	200
137S	N	N	10	70	30	20	N	N	20	50	N	7	N	300
143S	N	N	10	70	30	20	N	N	30	30	N	7	N	200
144S	N	N	10	70	30	20	N	N	30	50	N	7	N	200
JGNS002S	N	N	10	70	20	20	N	N	20	30	N	7	N	150
JGNS003S	N	N	7	70	20	20	N	N	20	30	N	5	N	200
JGNS004S	N	N	7	50	15	20	N	N	15	30	N	<5	N	150
JGNS005S	N	N	N	20	5	20	N	N	<5	30	N	5	N	200
JGNS006S	N	N	15	70	30	20	N	N	30	70	N	7	N	100
JGNS007S	N	N	5	70	20	20	N	N	30	30	N	5	N	200
JGNS008S	N	N	10	70	20	20	N	N	20	30	N	5	N	200
KDNS003S	N	N	N	30	7	20	N	N	10	<10	N	5	N	N
KDNS004S	N	N	N	15	5	<20	N	N	<5	20	N	<5	N	<100
KDNS005S	N	N	5	30	10	<20	N	N	20	30	N	<5	N	200
KDNS006S	N	N	10	70	20	20	N	N	30	50	N	5	N	150
KDNS007S	N	N	15	100	30	30	N	N	70	50	N	7	N	500
KDNS008S	N	N	N	30	15	20	N	N	5	50	N	N	N	<100
KDNS009S	N	N	10	150	30	20	N	N	50	50	N	5	N	100
KDNS010S	N	N	7	30	15	20	N	N	15	100	N	5	N	150
KDNS011S	N	N	15	50	15	20	N	N	20	20	N	5	N	150
KDNS012S	N	N	N	10	5	<20	N	N	<5	<10	N	N	N	<100
KDNS013S	N	N	10	100	10	20	N	N	50	20	N	5	N	300

TABLE 4. ANALYTICAL RESULTS OF MINUS-30-MESH STREAM SEDIMENT SAMPLES--Continued

Sample	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s	Au-ppm aa	As-ppm icp	Bi-ppm icp	Cd-ppm icp	Sb-ppm icp	Zn-ppm icp
13S	30	N	15	N	30	N	NA	NA	NA	NA	NA	NA
21S	30	N	15	N	30	N	NA	NA	NA	NA	NA	NA
109S	50	N	20	N	150	N	NA	NA	NA	NA	NA	NA
128S	30	N	20	N	70	N	NA	NA	NA	NA	NA	NA
131S	30	N	15	N	50	N	NA	NA	NA	NA	NA	NA
133S	50	N	20	N	150	N	NA	NA	NA	NA	NA	NA
134S	50	N	20	N	150	N	N	10	N	.9	N	60
137S	70	N	20	N	150	N	N	N	N	.9	N	55
143S	70	N	30	N	100	N	N	10	N	.6	N	70
144S	70	N	30	N	150	N	N	10	N	.8	N	80
J6NS002S	50	N	20	N	150	N	N	9	N	.9	4	35
J6NS003S	50	N	15	N	100	N	N	10	N	.8	3	45
J6NS004S	30	N	15	N	30	N	N	15	N	.7	9	31
J6NS005S	20	N	10	N	30	N	N	13	N	.6	10	9
J6NS006S	70	N	20	N	100	N	N	27	N	1.6	3	100
J6NS007S	50	N	15	N	150	N	N	17	N	.9	4	37
J6NS008S	70	N	15	N	150	N	N	12	N	1.1	4	51
KDNS003S	30	N	15	N	200	N	N	6	N	.2	N	10
KDNS004S	15	N	10	N	30	N	N	11	N	.3	12	6
KDNS005S	20	N	15	N	30	N	N	6	N	.7	9	15
KDNS006S	70	N	20	N	100	N	N	22	N	1.1	N	66
KDNS007S	100	N	20	N	200	N	N	23	N	1.5	N	100
KDNS008S	30	N	<10	N	30	N	N	12	N	.7	12	12
KDNS009S	100	N	30	N	50	N	N	17	N	2.2	4	76
KDNS010S	30	N	15	N	50	N	N	13	N	.6	4	23
KDNS011S	50	N	30	N	100	N	N	13	N	.7	N	27
KDNS012S	15	N	10	N	20	N	N	N	N	.2	8	6
KDNS013S	50	N	15	N	100	N	N	7	N	.6	2	21

TABLE 5. ANALYTICAL RESULTS OF MINUS-80-MESH STREAM SEDIMENT SAMPLES

[N, not detected; <, detected but below the limit of determination shown; >, determined to be greater than the value shown; s, emission spectroscopy; aa, atomic absorption; icp, inductively coupled plasma]

Sample	Latitude	Longitude	Fe-pct. s	Mg-pct. s	Ca-pct. s	Ti-pct. s	Mn-ppm s	Ag-ppm s	As-ppm s	Au-ppm s	B-ppm s	Ba-ppm s	Be-ppm s
JGNS002S	40 36 55	112 39 45	1.5	1.5	3.0	.15	300	N	N	N	15	300	<1.0
JGNS003S	40 38 0	112 38 38	1.0	1.5	7.0	.10	200	N	N	N	15	300	<1.0
JGNS004S	40 38 15	112 38 50	.7	2.0	7.0	.05	150	N	N	N	10	200	<1.0
JGNS005S	40 40 53	112 39 20	.7	3.0	7.0	.05	150	N	N	N	<10	200	<1.0
JGNS006S	40 38 27	112 35 28	1.5	2.0	3.0	.15	300	N	N	N	15	300	<1.0
JGNS007S	40 40 6	112 34 0	.7	1.5	5.0	.10	150	N	N	N	20	200	<1.0
JGNS008S	40 40 13	112 36 15	1.5	1.5	5.0	.15	300	N	N	N	15	200	<1.0
KDNS003S	40 37 15	112 38 5	1.0	.3	1.0	.10	300	N	N	N	20	300	<1.0
KDNS004S	40 40 8	112 39 22	.7	3.0	7.0	.05	150	N	N	N	<10	200	<1.0
KDNS005S	40 41 43	112 38 50	.7	3.0	7.0	.03	150	N	N	N	<10	200	<1.0
KDNS006S	40 36 28	112 35 25	1.5	.7	1.5	.15	300	N	N	N	20	300	<1.0
KDNS007S	40 38 5	112 34 45	2.0	1.0	1.5	.20	300	N	N	N	15	700	1.0
KDNS008S	40 42 30	112 37 0	.7	2.0	7.0	.03	150	N	N	N	<10	200	<1.0
KDNS009S	40 41 0	112 36 35	1.0	1.5	7.0	.07	200	.7	N	N	10	300	<1.0
KDNS010S	40 38 6	112 38 48	1.5	1.5	5.0	.20	300	N	N	N	30	200	1.5
KDNS011S	40 37 55	112 37 55	1.5	1.5	5.0	.20	300	N	N	N	30	200	1.5
KDNS012S	40 38 3	112 39 35	.7	3.0	7.0	.10	200	N	N	N	<10	150	<1.0
KDNS013S	40 38 0	112 39 20	1.5	1.0	3.0	.30	300	N	N	N	20	500	1.5

TABLE 5. ANALYTICAL RESULTS OF MINUS-80-MESH STREAM SEDIMENT SAMPLES--Continued

Sample	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	La-ppm s	Mo-ppm s	Nb-ppm s	Ni-ppm s	Pb-ppm s	Sb-ppm s	Sc-ppm s	Sn-ppm s	Sr-ppm
JGNS002S	N	N	<5	30	10	<30	N	N	5	15	N	7	N	150
JGNS003S	N	N	<5	30	10	<30	N	N	5	15	N	7	N	150
JGNS004S	N	N	<5	20	7	<30	N	N	<5	15	N	5	N	<100
JGNS005S	N	N	<5	15	7	<30	N	N	<5	15	N	5	N	100
JGNS006S	N	N	<5	30	15	30	N	N	10	30	N	7	N	150
JGNS007S	N	N	<5	30	10	<30	N	N	7	15	N	5	N	150
JGNS008S	N	N	<5	30	7	<30	N	N	5	15	N	5	N	150
KDNS003S	N	N	5	30	10	70	N	N	5	15	N	5	N	100
KDNS004S	N	N	<5	15	7	<30	N	N	<5	10	N	<5	N	<100
KDNS005S	N	N	<5	30	7	<30	N	N	<5	10	N	<5	N	150
KDNS006S	N	N	5	30	10	<30	N	N	15	20	N	7	N	150
KDNS007S	N	N	7	70	15	30	N	N	20	20	N	10	N	300
KDNS008S	N	N	<5	15	7	<30	N	N	<5	15	N	<5	N	<100
KDNS009S	N	N	<5	50	15	30	N	N	15	15	N	5	N	100
KDNS010S	N	N	10	50	15	20	N	N	15	50	N	5	N	200
KDNS011S	N	N	10	50	20	20	N	N	20	20	N	5	N	150
KDNS012S	N	N	<5	50	5	<20	N	N	15	10	N	<5	N	150
KDNS013S	N	N	10	70	10	20	N	N	30	20	N	5	N	300

TABLE 5. ANALYTICAL RESULTS OF MINUS-80-MESH STREAM SEDIMENT SAMPLES--Continued

Sample	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s	Au-ppm aa	As-ppm icp	Bi-ppm icp	Cd-ppm icp	Sb-ppm icp	Zn-ppm icp
JGNS002S	30	<50	10	<200	70	<200	N	9	N	.8	18	38
JGNS003S	30	<50	<10	<200	70	<200	N	10	N	.8	23	44
JGNS004S	30	<50	<10	<200	70	<200	N	8	N	.7	27	57
JGNS005S	30	<50	<10	<200	70	<200	N	6	N	.5	17	14
JGNS006S	30	<50	15	<200	70	<200	N	17	N	1.1	25	70
JGNS007S	30	<50	10	<200	70	<200	N	8	N	.8	13	37
JGNS008S	30	<50	<10	<200	70	<200	N	5	N	.7	8	41
KDNS003S	30	<50	20	<200	150	<200	N	13	N	.5	15	33
KDNS004S	20	<50	<10	<200	70	<200	N	9	N	.5	20	19
KDNS005S	30	<50	<10	<200	70	<200	N	6	N	.6	14	21
KDNS006S	30	<50	15	<200	100	<200	N	15	N	.9	11	57
KDNS007S	70	<50	10	<200	150	<200	N	17	N	1.1	16	79
KDNS008S	30	<50	<10	<200	30	<200	N	7	N	.6	17	21
KDNS009S	50	<50	20	<200	150	<200	N	10	N	1.5	9	62
KDNS010S	50	N	20	N	150	N	.1	8	N	.4	4	26
KDNS011S	50	N	20	N	200	N	N	11	N	.6	3	27
KDNS012S	30	N	10	N	100	N	N	<5	N	.3	7	9
KDNS013S	70	N	20	N	150	N	<.1	<5	N	.5	N	23

TABLE 6. ANALYTICAL RESULTS OF ROCK SAMPLES

[N, not detected; <, detected but below the limit of determination shown; >, determined to be greater than the value shown; s, emission spectroscopy; aa, atomic absorption; icp, inductively coupled plasma]

Sample	Latitude	Longitude	Fe-pct. s	Mg-pct. s	Ca-pct. s	Ti-pct. s	Mn-ppm s	Ag-ppm s	As-ppm s	Au-ppm s	B-ppm s	Ba-ppm s	Be-ppm s
JGNS004R	40 38 0	112 38 38	20.00	.70	1.50	.010	100	N	<200	N	10	70	<1.0
JGNS005R	40 38 15	112 38 50	1.50	5.00	10.00	.050	200	N	N	N	10	<20	<1.0
JGNS006R	40 40 8	112 39 22	.30	5.00	15.00	.030	200	N	N	N	<10	<20	<1.0
JGNS007R	40 40 53	112 39 20	.07	1.50	3.00	<.002	20	N	N	N	10	N	N
JGNS008R	40 36 28	112 35 25	.30	1.50	10.00	.070	70	N	N	N	30	20	N
JGNS009R	40 37 58	112 34 38	1.00	.70	2.00	.015	100	2.0	N	N	15	N	N
JGNS010R	40 37 58	112 34 38	5.00	2.00	3.00	.700	500	N	N	N	N	2,000	1.0
JGNS011R	40 38 27	112 35 28	10.00	.20	10.00	.003	50	N	N	N	N	N	<1.0
JGNS012R	40 38 27	112 35 28	5.00	.10	.10	.015	500	<.5	N	N	10	<20	<1.0
JGNS013R	40 42 30	112 37 0	10.00	.15	.10	.030	200	N	200	N	10	20	N
JGNS014R	40 42 30	112 37 0	.20	7.00	15.00	.002	70	N	N	N	N	N	N
JGNS015R	40 40 25	112 36 0	.07	1.50	7.00	.007	70	30.0	N	N	10	N	N
JGNS016R	40 40 25	112 36 0	20.00	.15	.07	.005	150	N	300	N	10	<20	N
KDNS004R	40 36 55	112 39 45	5.00	3.00	15.00	.005	100	N	<200	N	<10	N	3.0
KDNS005R	40 36 55	112 39 45	.30	7.00	20.00	.020	70	N	N	N	N	N	N
KDNS006R	40 37 15	112 38 5	2.00	.50	.15	.300	100	N	N	N	70	500	2.0
KDNS007R	40 37 15	112 38 5	.05	.03	.05	.050	<10	N	N	N	<10	N	N
KDNS008R	40 41 43	112 38 50	2.00	3.00	10.00	.070	500	.5	N	N	20	70	<1.0
KDNS009R	40 41 43	112 38 50	.15	5.00	20.00	.020	70	N	N	N	N	N	N
KDNS010R	40 36 28	112 35 25	5.00	.20	20.00	.007	300	N	N	N	<10	<20	<1.0
KDNS011R	40 36 28	112 35 25	10.00	.03	.07	.015	100	N	N	N	15	<20	1.0
KDNS012R	40 37 58	112 34 38	.15	.70	2.00	.002	100	<.5	N	N	15	N	N
KDNS013R	40 37 58	112 34 38	<.05	1.00	15.00	N	100	N	N	N	N	N	N
KDNS014R	40 37 58	112 34 38	10.00	.05	.50	.003	200	.5	N	N	10	<20	<1.0
KDNS015R	40 37 58	112 34 38	.30	1.00	2.00	.030	70	N	N	N	20	150	N
KDNS016R	40 38 27	112 35 28	15.00	.03	<.05	.030	50	5.0	1,000	N	10	<20	N
KDNS017R	40 38 27	112 35 28	.50	2.00	7.00	.005	150	150.0	N	N	<10	N	N
KDNS018R	40 38 27	112 35 28	.20	.70	>20.00	.003	100	5.0	N	N	N	N	N
KDNS019R	40 40 6	112 34 0	.10	.20	2.00	.015	30	2.0	N	N	20	30	N
KDNS020R	40 40 6	112 34 0	N	5.00	20.00	.002	70	N	N	N	20	N	N
KDNS021R	40 42 30	112 37 0	3.00	1.50	.30	.500	50	N	N	N	150	700	1.5
KDNS022R	40 41 0	112 36 35	.10	1.00	>20.00	.015	50	N	N	N	N	N	N
KDNS023R	40 41 0	112 36 35	3.00	1.00	>20.00	.020	150	N	N	N	10	<20	<1.0
KDNS024R	40 41 7	112 36 17	1.00	.50	5.00	.015	500	.5	N	N	10	30	N
KDNS026R	40 38 6	112 38 48	2.00	.30	.05	.100	100	N	N	N	30	100	1.5
KDNS027R	40 37 54	112 38 9	<.05	<.02	<.05	<.002	20	N	N	N	N	<20	<1.0
KDNS028R	40 38 6	112 38 48	3.00	.70	10.00	.300	1,000	N	N	N	30	150	1.0
KDNS029R	40 38 6	112 38 48	.50	7.00	10.00	.030	150	N	N	N	N	N	N
KDNS030R	40 38 6	112 38 48	.10	7.00	10.00	.010	70	N	N	N	N	N	N
KDNS031R	40 38 6	112 38 48	.70	.07	.20	.070	200	N	N	N	20	20	<1.0
KDNS032R	40 38 6	112 38 48	5.00	.15	.50	.100	200	N	N	N	30	150	2.0
KDNS033R	40 37 50	112 39 26	.05	1.50	3.00	.007	20	N	N	N	<10	N	N
KDNS034R	40 37 50	112 39 20	N	7.00	10.00	.005	70	N	N	N	N	N	N

TABLE 6. ANALYTICAL RESULTS OF ROCK SAMPLES--Continued

Sample	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	La-ppm s	Mo-ppm s	Nb-ppm s	Ni-ppm s	Pb-ppm s	Sb-ppm s	Sc-ppm s	Sn-ppm s	Sr-ppm s
JGNS004R	N	N	N	N	150	N	N	N	50	150	N	<5	N	N
JGNS005R	N	N	N	<10	5	<20	N	N	<5	20	N	N	N	N
JGNS006R	N	N	N	<10	<5	<20	N	N	<5	<10	N	<5	N	N
JGNS007R	N	N	N	10	<5	<20	N	N	<5	N	N	N	N	N
JGNS008R	N	N	N	50	<5	<20	N	N	7	<10	N	N	N	N
JGNS009R	N	N	N	15	5	N	N	N	7	50	N	N	N	N
JGNS010R	N	N	50	200	30	70	N	N	100	50	N	20	N	1,000
JGNS011R	N	N	15	10	15	N	N	N	20	200	N	N	N	N
JGNS012R	N	N	10	15	20	N	N	N	30	500	N	N	N	N
JGNS013R	N	N	7	15	20	N	N	N	30	300	N	<5	N	N
JGNS014R	N	N	N	N	<5	N	N	N	N	<10	N	N	N	N
JGNS015R	<10	N	N	15	300	<20	N	N	<5	5,000	N	N	N	<100
JGNS016R	N	N	5	10	30	N	5	N	70	70	N	N	N	N
KDNS004R	N	N	<5	<10	10	N	N	N	20	150	N	N	N	N
KDNS005R	N	N	N	15	<5	<20	N	N	<5	<10	N	N	N	N
KDNS006R	N	N	10	50	5	20	N	N	15	10	N	7	N	N
KDNS007R	N	N	N	20	N	N	N	N	5	N	N	N	N	N
KDNS008R	N	N	5	20	5	<20	N	N	7	15	N	<5	N	N
KDNS009R	N	N	N	10	<5	N	N	N	N	N	N	N	N	200
KDNS010R	N	N	N	30	5	N	N	N	20	100	N	N	N	200
KDNS011R	N	N	15	10	7	N	N	N	30	<10	N	5	N	N
KDNS012R	N	N	N	10	<5	N	N	N	<5	N	N	N	N	N
KDNS013R	N	N	N	N	N	N	N	N	N	N	N	N	N	500
KDNS014R	N	N	N	10	20	N	N	N	15	500	N	N	N	N
KDNS015R	N	N	N	10	<5	N	N	N	<5	10	N	N	N	N
KDNS016R	N	N	N	10	500	N	5	N	<5	20,000	N	N	N	N
KDNS017R	N	100	N	20	30	<20	N	N	<5	>20,000	N	N	N	N
KDNS018R	N	20	N	30	<5	N	N	N	<5	700	N	N	N	200
KDNS019R	N	N	N	30	7	N	N	N	10	20	N	N	N	N
KDNS020R	N	N	N	15	<5	N	N	N	N	15	N	N	N	150
KDNS021R	N	N	15	100	20	30	N	N	50	20	N	10	N	N
KDNS022R	N	N	N	<10	N	N	N	N	N	<10	N	N	N	300
KDNS023R	N	N	N	10	20	<20	N	N	50	30	N	N	N	150
KDNS024R	N	N	N	10	<5	N	N	N	7	30	N	N	N	N
KDNS026R	N	N	10	30	10	20	N	N	20	<10	N	<5	N	N
KDNS027R	N	N	N	<10	N	<20	N	N	7	N	N	N	N	N
KDNS028R	N	N	10	50	20	20	N	N	20	<10	N	7	N	300
KDNS029R	N	N	N	15	<5	<20	N	N	<5	15	N	N	N	N
KDNS030R	N	N	N	<10	N	<20	N	N	N	N	N	N	N	N
KDNS031R	N	N	<5	15	10	20	N	N	5	N	N	N	N	N
KDNS032R	N	N	10	30	<5	20	N	N	15	<10	N	5	N	N
KDNS033R	N	N	N	15	<5	<20	N	N	5	N	N	N	N	N
KDNS034R	N	N	N	N	<5	<20	N	N	N	N	N	N	N	N

TABLE 6. ANALYTICAL RESULTS OF ROCK SAMPLES--Continued

Sample	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s	Au-ppm aa	As-ppm icp	Bi-ppm icp	Cd-ppm icp	Sb-ppm icp	Zn-ppm icp
JGNS004R	700	N	N	500	<10	N	N	340	3	10.0	9	470
JGNS005R	15	N	<10	N	30	N	N	N	N	.5	12	N
JGNS006R	10	N	<10	N	20	N	N	27	N	.2	13	37
JGNS007R	10	N	N	N	N	N	N	N	N	N	4	N
JGNS008R	20	N	15	N	50	N	N	N	N	.7	5	14
JGNS009R	15	N	N	N	<10	N	N	N	N	.4	3	3
JGNS010R	150	N	30	N	300	N	N	N	N	1.1	N	50
JGNS011R	20	N	N	N	N	N	N	150	3	12.0	N	21
JGNS012R	100	N	20	1,500	15	N	N	120	N	4.2	N	1,300
JGNS013R	300	N	10	N	20	N	N	230	N	4.2	N	12
JGNS014R	10	N	N	N	N	N	N	N	N	.2	15	4
JGNS015R	70	N	N	300	10	N	N	88	4	4.5	10	260
JGNS016R	300	N	<10	1,500	N	N	N	360	N	5.6	4	1,300
KDNS004R	70	N	N	N	N	N	N	270	N	4.0	12	79
KDNS005R	<10	N	N	N	15	N	N	7	N	.3	15	N
KDNS006R	50	N	30	N	200	N	N	N	N	.5	N	33
KDNS007R	<10	N	N	N	100	N	N	N	N	N	N	3
KDNS008R	50	N	<10	N	50	N	N	23	N	.9	9	N
KDNS009R	<10	N	N	N	<10	N	N	N	N	.1	9	N
KDNS010R	70	N	15	N	N	N	N	41	N	3.1	N	77
KDNS011R	15	N	10	N	20	N	N	14	N	2.3	N	14
KDNS012R	<10	N	N	N	N	N	N	N	N	.1	N	13
KDNS013R	<10	N	N	N	N	N	N	N	N	.1	5	N
KDNS014R	200	N	<10	N	N	N	N	180	N	4.5	N	27
KDNS015R	10	N	N	N	30	N	N	N	N	.3	3	8
KDNS016R	30	N	N	>10,000	200	N	N	1,200	N	21.0	35	14,000
KDNS017R	<10	N	N	>10,000	20	N	N	25	N	50.0	30	16,000
KDNS018R	<10	N	N	1,000	N	N	N	8	N	19.0	3	1,300
KDNS019R	30	N	N	N	<10	N	N	N	N	.4	N	32
KDNS020R	10	N	N	N	N	N	N	N	N	.2	9	26
KDNS021R	70	N	15	N	100	N	N	N	2	.6	N	46
KDNS022R	<10	N	N	N	N	N	N	N	N	.1	5	16
KDNS023R	100	N	15	N	20	N	N	72	N	2.0	4	62
KDNS024R	15	N	N	N	15	N	N	N	N	.5	N	67
KDNS026R	20	N	10	N	100	N	N	N	N	N	N	9
KDNS027R	<10	N	N	N	N	N	N	N	N	N	N	N
KDNS028R	50	N	70	N	150	N	N	N	2	.6	N	45
KDNS029R	15	N	N	N	15	N	N	N	N	.1	13	N
KDNS030R	<10	N	N	N	<10	N	N	N	N	.1	14	N
KDNS031R	10	N	50	N	150	N	N	8	N	.2	N	8
KDNS032R	30	N	50	N	300	N	N	7	N	.7	N	14
KDNS033R	10	N	N	N	N	N	N	N	N	.1	4	16
KDNS034R	<10	N	N	N	N	N	N	N	N	N	14	N

Table 7.--Description of rock samples

JGNS004R - Limestone, silicified, red to gray.
005R - Shaly limestone, black to gray.
006R - Limestone with minor calcite veining.
007R - Jasperoid, black.
008R - Limestone, pink to gray.
009R - Limestone with quartz veining, minor iron-oxides.
010R - Volcanic rock, phenocrysts of biotite and hornblende.
011R - Altered limestone, red-orange, abundant iron-oxides.
012R - Highly altered limestone, iron-oxides and clays.
013R - Limestone, light gray, calcite veining.
014R - Limestone, calcite veining.
015R - Brecciated limestone, quartz, secondary Cu minerals.
016R - Silicified limestone, dark tan to brown.
KDNS004R - Limestone, calcite veining.
005R - Limestone, gray, unaltered.
006R - Sandstone-shale, micaceous.
007R - Tintic quartzite, pink.
008R - Sandy shale, red-orange.
009R - Limestone, gray, unaltered.
010R - Limestone, calcite veining, iron-oxides.
011R - Altered quartzite.
012R - Limestone, dark gray, minor calcite veining.
013R - Calcite vein.
014R - Brecciated limestone, iron-oxides.
015R - Sandstone.
016R - Altered limestone, silicified, iron-oxides.
017R - Quartz veining in limestone, minor galena.
018R - Limestone, gray, unaltered.
019R - Limestone, gray, unaltered.
020R - Limestone, gray-blue, unaltered.
021R - Silty shale, greenish.
022R - Limestone, gray, unaltered.
023R - Limestone, iron-oxides.
024R - Limestone, quartz veining, iron-oxides.
026R - Tintic quartzite, minor iron-oxides.
027R - Quartz veining, barren
028R - Shale, brown.
029R - Limestone, gray-blue, unaltered.
030R - Limestone, greenish, calcite veining.
031R - Quartz veining, iron-oxides.
032R - Tintic quartzite, iron-oxides.
033R - Limestone, silicified.
034R - Limestone, gray, unaltered.