UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analyses and descriptions of geochemical samples from the Southern Nantahala Roadless Area and vicinity in Rabun County, Georgia, and Clay and Macon Counties, North Carolina.

by

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OPEN-FILE REPORT 89-104

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1989

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Studies related to wilderness

The Wilderness Act (Public law 88-577, September 3, 1964) and related acts require 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 be submitted to the President and the Congress. This report presents the results of a geochemical survey of the Southern Nantahala Roadless Area (B8025) and the eastern third of the Southern Nantahala Wilderness in the Nantahala National Forest, Clay and Macon Counties, North Carolina, and in the Chattahoochee National Forest, Rabun County, Georgia. The Southern Nantahala Wilderness was established as a wilderness by Public Laws 98-324, June 19, 1984, and 98-514, October 19, 1984. The Southern Nantahala Roadless Area in the Chattahoochee National Forest, Rabun County, Georgia, was classified as non-wilderness during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979. A multiple use classification for the roadless area was confirmed by the Georgia Wilderness Act of 1984 (Public Law 98-514).

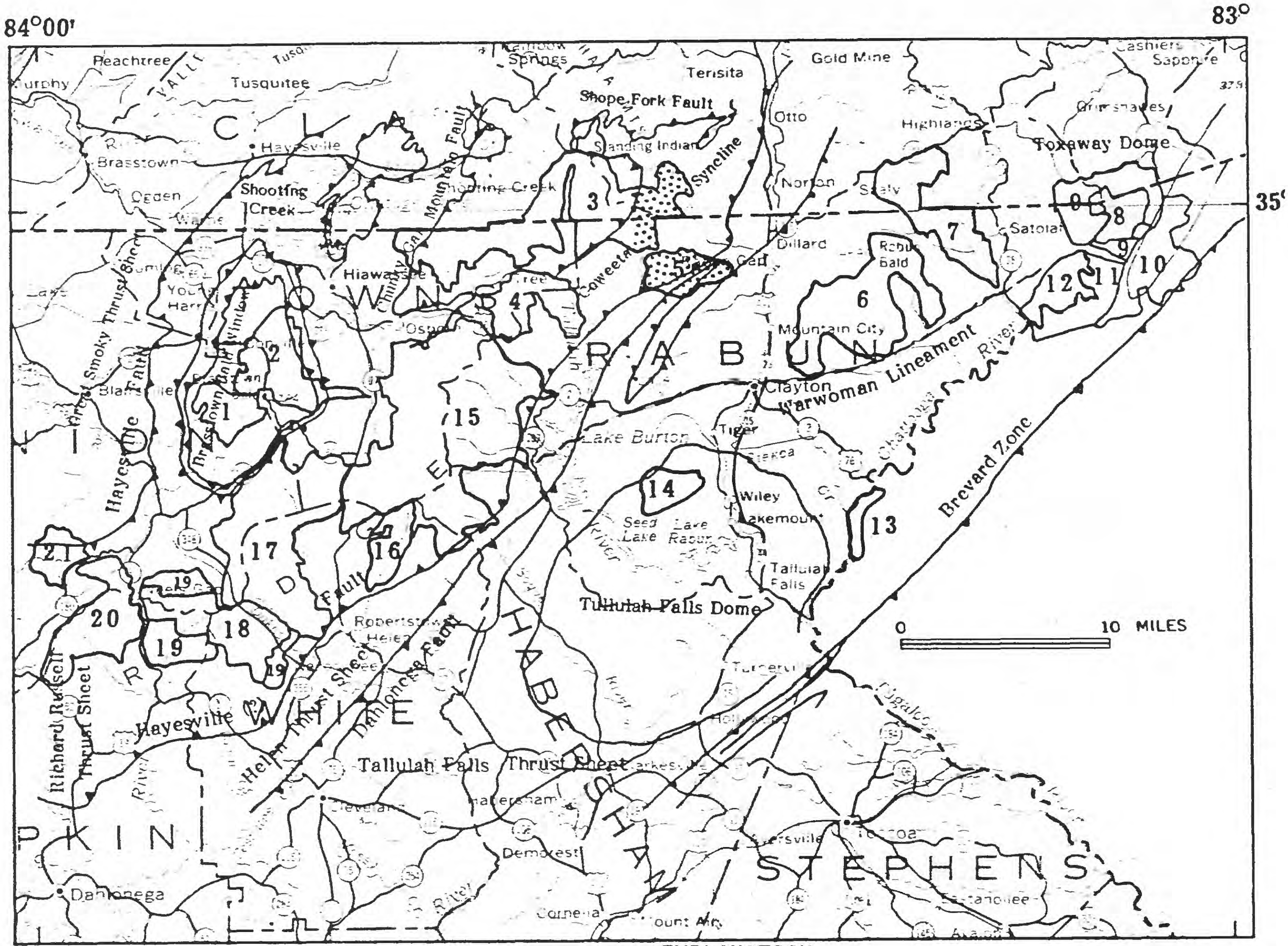
Abstract

Semiquantitative spectrographic analyses for 31 elements and atomic-absorption analyses for zinc are reported for rock, soil, stream-sediment, and panned-concentrate samples collected in the Southern Nantahala Roadless Area, Georgia, and the eastern part of Southern Nantahala Wilderness, Georgia-North Carolina. Latitude and longitude for all sample localities are given in degrees, minutes and seconds. Brief field descriptions of the rock samples are included in this report.

Introduction

Samples from the Southern Nantahala Roadless Area (no. 5, Figure 1) in Rabun County, Georgia, were collected by L. J. Cox and Debby Kay in April, 1985. Samples from the eastern part of the Southern Nantahala Wilderness (no. 3, Figure 1) in Rabun County, Georgia, and Clay and Macon Counties, North Carolina, were collected by L. J. Cox in November, 1985. The sample sites lie between longitude 83°30'00" to longitude 83°22'30", and between 35°02'00" latitude to the north and 34°55'50" latitude to the south in an area covering about 16 mi^2. The location of each sample site is given in degrees, minutes, and seconds of latitude and longitude beside each sample number in Tables 1 - 4. Sample locality maps and discussion of the results are given in Peper and others (in press).

The roadless area is less than 2 miles west of U.S. 23 (also U.S. 441) and is accessed by secondary roads heading west out of Dillard, Georgia. The roadless area boundary is closely paralleled by gravel roads, and to a lesser extent by a paved road, on all but the northeastern edge of the area. The proximity of the wilderness area (directly north) to the roadless area enables it to be accessed from the south by the roads described. The northern portion of the wilderness area is accessed by following over 8 miles of paved and gravel roads west of Otto, North Carolina, off U.S. 23. The Appalachian Trail and other developed trails follow the major ridges within the wilderness area.



EXPLANATION

3. Southern Nantahala Wilderness   8. Ellicott Rock Wilderness

Roadless Areas

1. Wolf Pen 8-149
2. Brasstown 8-146
4. Buzzard Knob 8-223
5. Southern Nantahala B8-025
6. Rabun Bald 8-147
7. Overflow 8-026
9. Ellicott Rock Extension A8-031
10. Persimmon Mountain L8-116
11. Ellicott Rock Expansion 8-112
12. Rand Mountain 8-148
13. Long Creek 8-113
14. Worley Ridge 8-224
15. Tray Mountain 8-030
16. Anna Ruby 8-225
17. Chattahoochee river 8-029
18. Raven Cliff A8-028
19. Raven Cliff B8-028
20. Blood Mountain 8-027
21. Board Camp 8-145

Figure 1.-- Index map showing locations of wilderness and roadless areas and major structural features in northeastern Georgia and adjacent North and South Carolina. The Southern Nantahala Roadless area and eastern third of the Wilderness area are stippled. Number after roadless area name is Forest Service identification number.

The highest altitude is 5007 ft on Ridgepole Mountain in the wilderness area; the lowest is about 2100 ft on a tributary to Persimmon Creek at the western edge of the roadless area. Sharp to rounded ridge crests cap steep valley slopes in generally rugged, heavily forested, topography.

Geologic Setting

The study area lies within the Blue Ridge province of the southern Appalachian Mountains and is underlain mostly by stratified crystalline rocks of Late Proterozoic (?) to Ordovician (?) age (Nelson and others, 1987). The dominant structural features in the study area are three westwardly transported, allocthonous, litho-tectonic thrust sheets called (from east to west) the Tallulah Falls, Helen, and Richard Russell thrust sheets (Nelson and others, 1987) - the composite of which makes up the previously recognized Hayesville thrust sheet (Hatcher, 1978; Williams, 1978; Nelson and Zietz, 1983).

The rocks of the Tallulah Falls thrust sheet are represented in the study area by white, gneissic, medium- and coarse-grained locally pegmatitic granites and feldspathic orthogneiss. The Tallulah Falls thrust sheet is separated from the underlying Helen thrust sheet by the Dahlonega thrust fault (Figure 1). The Helen Group consists of steeply dipping, tightly folded, bedded metasedimentary rocks, mainly graywacke and sandstone inter-bedded with or intruded by amphibolites. Discontinuous granitic pegmatite veins and pods occur locally. Scarce garnets distinguish these rocks from those in the overlying Richard Russell thrust sheet.

Half of the Southern Nantahala Roadless Area and all of the wilderness area represented in this report are underlain by the units making up the easternmost portion of the Richard Russell thrust sheet. Hatcher (1979) subdivided these rocks into the Persimmon Creek, Coleman River, and Ridgepole Mountain formations. The Persimmon Creek Formation consists mostly of biotite gneiss, orthogneiss, and garnetiferous biotite schist with local amphibolite and hornblende gneiss. The Coleman River Formation consists mostly of gray pinstriped schist. The Ridgepole Mountain Formation is predominantly micaceous quartzite and pelitic schist.

Rock Nomenclature

The nomenclature used in the field descriptions of the metamorphic rocks in the following table is adopted from Winkler (1974, p. 312-316). The rock names generally list the constituent minerals, beginning with the mineral in the smallest amount, followed by a rock category such as schist or gneiss which designates the fabric of the rock. An exception to the abundance rule is made for rocks which contain more quartz relative to the sum of phyllosilicates (biotite, muscovite, chlorite, tremolite, etc.). These are designated as quartz-mica schist or gneiss. The use of a mineral as an adjective (such as "garnet-bearing") implies that "garnet", though less than 5% of the rock, is a significant constituent.

Gneiss is used for rocks with better coherence and coarser fissility than schists. Where orthogneiss is used, formation from a magmatic rock is implied. The prefix meta- used before sediment or sandstone designates a presumed protolith and does not imply that original fabric is recognized.

Field descriptions of rock samples in Table 1.

All samples unless otherwise described were collected from outcrop and are representative of the texture and mineralogy described as nearly as possible. Samples of non-banded rocks generally consist of one to three fresh chips whereas samples of banded rocks consist of 1 to 2 chips of each band. Composite chip samples were collected within a 1 foot radius.

Field number	Rock description
GA05023R	White, fine-grained, gneissic granite adjacent to narrow diabase dike.
GA05026R	Fine-grained, muscovite-biotite-quartz-feldspar orthogneiss layer within layered metasediments.
GA05032R	Fine-grained biotite-feldspar-quartz schist.
GA05040R	Moderately foliated, medium- to coarse-grained muscovite-biotite-quartz-feldspar gneiss.
GA05050R	Light gray, coarse-grained staurolite-garnet-biotite-muscovite schist.
GA05057R	Composite of float of strongly foliated, coarse-grained magnetite-feldspar-quartz gneiss. Weathered rocks have limonite in honeycombed quartz rind.
GA05058R	Light gray, fine-grained feldspar-quartz-muscovite-biotite schist with minor magnetite and pale pink garnet.
GA05065R	Coarse-grained, poorly foliated, quartz-biotite-feldspar orthogneiss with minor epidote.
GA05069R	Medium- to coarse-grained, black and white, strongly foliated amphibolite.
GA05077R	Dark gray, medium-grained biotite schist with minor pink garnet.
GA05163R	Light yellowish gray, very coarse-grained, porphyritic, gneissic, two mica granite.
GA05263R	Replicate of GA05163R.
GA05600R	Light gray pinstriped garnet-bearing mica schist interlayered with coarse-grained quartz-mica schist with red garnet megacrysts.
GA05601R	Gray pinstriped, fine- to medium-grained magnetite- and red garnet-bearing mica schist (or muscovite-quartz-biotite schist) interlayered in muscovite-feldspar-quartz gneiss.
GA05604R	Light gray feldspathic biotite-quartz schist with minor reddish brown garnet or staurolite interlayered with biotite schist.
NH05613R	Much deformed kyanite-bearing staurolite-garnet-biotite gneiss interlayered with finely laminated, staurolite-garnet-bearing biotite-feldspar-quartz gneiss.
NH05615R	Light gray, medium-coarse-grained poorly foliated, epidote-bearing feldspar-quartz-biotite orthogneiss. Minor garnet.
NH05617R	Light gray, banded and moderately foliated, feldspar-bearing, garnet-bearing quartz-mica schist.

Field descriptions of rock samples (continued)

Field number	
GA05623R	Composite chips of banded gneiss. Bands 5 to 25 cm thick are quartz-mica schist, coarse-grained garnet-biotite schist, and massive to poorly foliated feldspar-quartz-biotite gneiss. All layers are garnetiferous.
NH05627R	Light green-gray, medium- to coarse-grained, magnetite- and feldspar-bearing muscovite-biotite-epidote-quartz-mica schist with minor poikiolitic megacrysts of garnet.
NA05629R	Medium- to coarse-grained, poorly foliated feldspar-biotite-quartz gneiss.
NH05634R	Fine-grained, greenish-gray micaceous quartzite with minor garnet.
NH05635R	Greenish-gray, coarse-grained, garnet-mica schist. Reddish-brown garnets are typically 0.5 cm in diameter.
NH05636R	Coarse kyanite- and garnet-rich layers in fine-grained, garnet-bearing quartz-mica schist.
NH05637R	Gray, medium- to coarse-grained quartz-plagioclase-biotite gneiss with minor garnet.
NH05646R	Greenish-gray, medium- to coarse-grained, feldspar-bearing garnet-quartz-mica schist.
NH05648R	Gray, medium- to coarse-grained, garnet-quartz-mica schist.
GA05652R	Fine-grained, pinstriped, magnetite-bearing feldspar-quartz-biotite schist; probably metasandstone.
GA05655R	Greenish-gray, coarse-grained, strongly foliated, schist with thin beds (3-6 cm) of garnet-staurolite-kyanite-mica schist alternating with 5 cm thick beds of medium-grained quartz-biotite schist.
NA05657R	Greenish-gray garnet-staurolite mica schist. Garnets form knots 1-2 cm across.
NH05658R	Garnet-staurolite-kyanite mica schist. Some beds are feldspathic.
NA05659R	Gray, fine-grained, pinstriped feldspar-quartz-biotite schist with pegmatitic muscovite-quartz-feldspar lenses, mostly parallel to foliation.
GA05662R	Greenish-gray garnet-staurolite mica schist.
GA05668R	Coarse-grained staurolite-garnet-biotite-muscovite schist interbedded with coarser garnet-quartz-rich layers.
GA05669R	Medium- to coarse-grained, bedded, biotite-plagioclase-amphibolite.
GA05670R	Staurolite-mica schist and micaceous quartzite.
NH05676R	Black and white, coarse-grained, epidote-bearing biotite gneiss with minor garnet metacrysts.
NH05678R	Fine-grained gray-black diabase dike.
NH05679R	Coarse-grained, garnet-bearing quartz-plagioclase-biotite gneiss (metadiorite).
NH05681R	Amphibolite.

Field descriptions of rock samples (continued)

Field number	Rock description
NH05685R	Gray, pinstriped, medium-grained muscovite-biotite-quartz schist with garnet megacrysts.
NH05687R	Medium- to coarse-grained feldspar-quartz-biotite schist with minor pale pink poikiolitic garnet interlayered with coarse garnet- and pyrite-bearing quartz-biotite-feldspar gneiss.
NH05691R	Coarse-grained, garnet-bearing biotite gneiss.

Methods of Study

Rock samples (Table 1)

Forty-three rock samples were collected from outcrop. Representative rocks were collected. The rock samples were crushed to approximately 6 mm and pulverized to minus 140-mesh (0.15 mm) in a vertical grinder having ceramic plates.

Soil samples (Table 2)

Eighty-seven residual soil samples were collected. The soil horizon sampled was from the first visible color change typically found between 2-20 cm beneath the generally grayish-black organic debris at the surface.

Stream-sediment (Table 3) and panned concentrates (Table 4)

Forty-seven stream-sediment and 40 panned-concentrate samples consisting of active alluvium were collected from major streams between 0.2 to 1.5 miles in length and underlain by drainage basins roughly 1 square mile in area. Mostly clay-to silt-sized sediment was collected near the center of each drainage for the representative stream-sediment sample. A small shovel was used to fill a 16-inch steel pan with mid-stream sediment which was then panned to achieve a heavy mineral concentration at the sample site. This process was generally repeated twice at each site. All samples were air-dried then processed in preparation for chemical analyses in the laboratories of the U.S.G.S. Branch of Exploration Geochemistry in Denver, Colorado. The stream sediment samples were sieved to minus 80 mesh (0.177 mm), pulverized to minus 140 mesh (0.105), and analyzed. The panned concentrate samples were also sieved. Density separation of the light fraction of minerals from the samples was accomplished with bromoform (specific gravity of 2.86). The remaining heavy fraction was passed twice through a large electromagnet to electromagnetically remove the most magnetic material, primarily magnetite, in the first pass and a slightly magnetic fraction of minerals, largely ferromagnesian silicates and iron oxides, in the second pass. The remaining heavy fraction (the least magnetic material including the ore minerals, zircon, sphene, etc.) was split, pulverized, and analyzed. These magnetic separates are the same separates that would be produced by using a Frantz Isodynamic Separator set at a slope of 15^{0}

and a tilt of 10^0 with a current of 0.1 ampere to remove the magnetite and ilmenite, and a current of 1.0 ampere to split the remainder of the sample into paramagnetic and nonmagnetic fractions.

Sample Analysis

All samples were analyzed semiquantitatively for 31 elements by means of a six-step, D.C.-(direct current) arc, optical-emission spectrographic method (Grimes and Marranzino, 1968) in U.S.G.S. laboratories, Denver, Colorado. The semiquantitative spectrographic values are reported as 0.15, 0.2, 0.3, 0.5, 0.7, 1.0 or powers of 10 of these numbers, which are the rounded values for the approximate geometric midpoints (0.16, 0.22, 0.34, 0.46, 0.73, 1.0 or powers of 10 of these numbers) of the intervals for the six steps per order of magnitude dilution of a standard by one order of magnitude. The expected precision is within one adjoining reporting interval on each side of the reported value 83 percent of the time and within two adjoining intervals 96 percent of the time (Motooka and Grimes, 1976). Analytical data for all samples from the study area are reported in Tables 1 - 4.

In addition, each sample was analyzed by means of a quantitative atomic absorption technique for zinc (Ward and others, 1969). Gold analyses by atomic absorption were made for the panned-concentrate samples only. The results of the atomic absorption analyses are listed in the last column of each table of data except for the panned-concentrate samples in Table 4 for which neither zinc nor gold was detected at the limit of determination for the sample weight remaining after the magnetic and density separation processes. For 27 of the panned-concentrate samples, analysis for gold was not attempted due to the low sample weight.

Explanation of Tables 1-4.

The spectrographic analyses of iron, magnesium, calcium, and titanium concentrations are reported in weight percent; all other elements are given in parts per million (ppm). Symbols and abbreviations used in the tables are: S, spectrographic; %, weight percent; AA, atomic absorption; -, not detected; <, amount detected is below the lowest limit of determination (which is the number preceding the <); and >, amount detected is greater than the upper limit of determination.

Of the 31 elements looked for spectrographically, those not detected in the samples have been omitted from each table. The elements (with the detection limits in ppm following each element in parenthesis) omitted from all tables (1-4) are: As (200), Au (10), Bi (10), Cd (20), Mo (5), Sb (100), W (50), and Th (100). Additional exclusions from Table 2 include: Nb (20), Sn (10), and Zn (200). Additional exclusions from Tables 3 and 4 include: Ag (0.5) and Zn (200).

References cited

Grimes, D. J., and Marranzino, A. P., 1968, Direct-current arc and alternating-current spark emission spectrographic field methods for the semiquantitative analysis of geologic materials: U.S. Geological Survey Circular 591, 6 p.

Hatcher, R. D., Jr., 1978, Tectonics of the western Piedmont and Blue Ridge, southern Appalachians: Review and speculations: American Journal of Science, v. 278, p. 276-304.

Hatcher, R. D., Jr., 1979, The Coweeta Group and Coweeta Syncline: Major features of the North Carolina-Georgia Blue Ridge: Southeastern Geology, v. 4, no. 1, p. 17-29.

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

Nelson, A. E., and Zietz, Isidore, 1983, The Clingman lineament, other aeromagnetic features, and major lithotectonic units in part of the southern Appalachian Mountains: Southeastern Geology, v. 24, no. 3, 147-157.

Nelson, A. E., Horton, J. W., Jr., and Clarke, J.W., 1987, Generalized tectonic map of the Greenville 1^{o} x 2^{o} quadrangle, Georgia, South Carolina, and North Carolina: U.S. Geological Survey Miscellaneous Field Studies Map MF-1898, scale 1:250,000.

Peper, J. D., Lesure, F. G., Cox, L. J., D'Agostino, J. P., (in press) Geology, geochemistry, and mineral resource assessment of the Southern Nantahala Wilderness and adjacent roadless areas, Rabun and Towns Counties, Georgia, and Clay and Macon Counties, North Carolina: U.S. Geological Survey Bulletin 1883.

Ward, F. N., Nakagawa, H. M., van Sickle, G. H., and Harms, T. F. 1969, Atomic-absorption methods of analysis useful in geochemical exploration: U.S. Geological Survey Bulletin 1289, 45 p.

Williams, Harold, 1978, Tectonic lithofacies map of the Appalachian Orogen: Memorial University of Newfoundland, scale 1:1,000,000.

Winkler, H. G. F., 1974, Petrogenesis of metamorphic rocks: 3rd edition, p. 312-316.

Table 1. Results of analyses of rock samples by semiquantitative emission spectrography (analysts: B.M. Adrian, R. Sanchez, and G.W. Day) and atomic-absorption (analysts: R.J. Fairfield and L.S. Laudon).

Sample Number	Latitude	Longitude	S-Fe %	S-Mg %	S-Ca %	S-Ti %	S-Mn ppm	S-Ag ppm	S-B ppm	S-Ba ppm	S-Be ppm	S-Co ppm	S-Cr ppm	S-Cu ppm
GA05023R	345724	832505	0.5	0.05	0.5	0.01	500	0.5	<10	500	2	<5	<10	5
GA05026R	345736	832548	1	0.5	0.5	0.2	300	<0.5	<10	300	1	5	20	5
GA05032R	345656	832628	2	1	0.7	0.5	300	<0.5	<10	300	1	5	30	5
GA05040R	345638	832733	2	1	0.7	0.5	500	<0.5	<10	500	1	10	30	5
GA05050R	345734	832643	2	1	0.2	0.5	700	<0.5	<10	300	2	15	100	15
GA05057R	375744	832803	1	<0.02	<0.05	0.02	20	<0.5	<10	20	<1	<5	20	<5
GA05058R	345742	832810	1	0.5	1	0.2	300	<0.5	<10	150	1	5	<10	<5
GA05065R	345706	832845	2	2	1	0.2	300	<0.5	<10	200	1	10	30	<5
GA05069R	345658	832813	5	3	3	0.5	1500	<0.5	10	<20	<1	30	200	50
GA05077R	345810	832910	5	2	1	0.7	1500	<0.5	10	300	1	30	100	20
GA05163R	345648	832558	0.5	0.2	1	0.07	200	<0.5	<10	50	2	<5	<10	<5
GA05263R	345648	832558	0.5	0.1	<0.05	0.07	3000	<0.5	<10	500	1	70	<10	<5
GA05600R	345822	832945	2	1	1	1	500	<0.5	10	500	1	20	50	20
GA05601R	345822	832945	1.5	0.7	1.5	0.2	500	<0.5	10	300	1.5	7	50	10
GA05604R	345836	832933	3	1	1	0.5	500	<0.5	10	300	1	20	50	100
NH05613R	350025	832800	5	1	0.5	0.7	1500	<0.5	<10	700	<1	20	100	7
NH05615R	350035	832815	1.5	1	1	0.2	500	<0.5	<10	300	1.5	10	20	7
NH05617R	350047	832834	1.5	0.3	0.5	0.3	300	<0.5	<10	300	<1	7	50	5
GA05623R	345948	832715	1.5	0.7	1.5	0.3	500	<0.5	10	300	1.5	10	50	5
NH05627R	350006	832806	1.5	0.3	0.2	0.5	300	<0.5	10	500	<1	7	50	<5
NA05629R	345959	832827	5	1.5	1	1	500	<0.5	<10	700	1	30	150	100
NH05634R	350113	832840	2	0.5	3	0.5	2000	<0.5	<10	<20	1.5	7	50	<5
NH05635R	350113	832840	7	1.5	0.05	1	1000	<0.5	<10	700	<1	20	150	100
NH05636R	350113	832837	5	1	0.2	0.7	1000	0.5	<10	700	<1	10	100	30
NH05637R	350116	832832	2	1	1	0.5	700	<0.5	<10	500	1	10	10	10
NH05646R	350025	832957	2	0.7	1	0.5	500	0.7	<10	300	1.5	10	10	20
NH05648R	350004	832959	2	2	2	0.5	700	<0.5	<10	500	1.5	10	30	20
GA05652R	345857	832857	2	0.7	1	0.5	200	0.7	<10	300	1.5	7	20	5
GA05655R	345933	832900	5	1	0.07	0.7	2000	<0.5	10	300	<1	15	70	7
NA05657R	345938	832902	2	1	0.15	0.5	300	<0.5	10	500	1	10	50	10
NA05658R	345947	832907	2	0.15	2	0.3	1000	<0.5	<10	<20	<1	5	20	<5
NA05659R	345953	832911	2	0.5	0.2	0.5	500	<0.5	10	500	<1	7	20	5
GA05662R	345936	832920	3	1	<0.05	0.5	500	<0.5	15	700	<1	30	100	7
GA05668R	345848	832937	2	0.5	0.05	0.2	500	<0.5	10	300	<1	7	50	10
GA05669R	345852	832939	7	3	3	1	1000	<0.5	15	<20	<1	50	70	50
GA05670R	345852	832939	1.5	0.5	0.5	0.1	500	<0.5	15	700	1	10	<10	50
NH05676R	350036	832700	2	0.7	0.7	0.5	300	<0.5	<10	500	1	10	50	7
NH05678R	350053	832707	5	3	3	1	1500	<0.5	20	<20	1	30	100	50
NH05679R	350053	832707	2	1.5	1.5	0.3	500	<0.5	<10	500	1.5	10	30	<5
NH05681R	350113	832719	2	2	2	0.2	1000	<0.5	<10	200	1.5	15	50	15
NH05685R	350034	832718	2	1	0.5	0.7	500	<0.5	<10	500	<1	20	50	<5
NH05687R	350036	832713	2	1	1	0.3	500	<0.5	10	300	1.5	10	20	<5
NH05691R	350150	832753	1	0.3	1	0.1	200	<0.5	<10	200	1.5	5	<10	<5

Table 1 continued.

Sample Number	S-La ppm	S-Nb ppm	S-Ni ppm	S-Pb ppm	S-Sc ppm	S-Sn ppm	S-Sr ppm	S-V ppm	S-Y ppm	S-Zn ppm	S-Zr ppm	AA-Zn ppm
GA05023R	<20	<20	5	50	<5	<10	100	<10	50	<200	50	5
GA05026R	<20	<20	5	15	5	<10	150	50	10	<200	150	20
GA05032R	20	<20	10	15	10	<10	200	30	30	<200	200	35
GA05040R	<20	30	10	20	10	<10	200	50	20	<200	300	130
GA05050R	30	<20	15	15	10	<10	150	50	30	<200	100	5
GA05057R	<20	<20	<5	<10	<5	<10	<100	30	<10	<200	100	<5
GA05058R	<20	<20	5	15	7	<10	200	30	30	<200	100	40
GA05065R	<20	<20	15	15	7	<10	200	50	20	<200	50	50
GA05069R	<20	<20	30	<10	30	<10	100	200	20	<200	50	20
GA05077R	<20	<20	30	15	20	<10	200	100	20	<200	150	50
GA05163R	<20	<20	<5	15	5	<10	200	20	<10	<200	70	25
GA05263R	<20	<20	10	30	5	<10	100	20	<10	<200	70	25
GA05600R	50	<20	20	20	15	<10	300	100	30	<200	500	65
GA05601R	<20	<20	10	15	10	<10	200	30	15	<200	200	50
GA05604R	50	<20	30	15	15	<10	150	70	20	<200	150	30
NH05613R	70	<20	50	20	30	<10	100	100	70	<200	500	10
NH05615R	<20	<20	15	10	10	<10	300	50	<10	<200	200	40
NH05617R	<20	<20	15	<10	7	<10	150	30	10	<200	300	35
GA05623R	<20	<20	15	10	10	<10	300	50	30	<200	150	45
NH05627R	50	<20	10	15	10	<10	100	50	20	<200	700	35
NA05629R	50	<20	50	15	20	<10	200	150	20	<200	200	110
NH05634R	50	<20	15	10	15	<10	150	50	70	<200	500	20
NH05635R	300	<20	20	<10	30	<10	<100	200	70	<200	150	10
NH05636R	70	20	15	15	20	<10	100	150	50	<200	500	25
NH05637R	50	<20	10	15	10	<10	300	50	15	<200	100	55
NH05646R	50	<20	20	20	10	<10	300	50	20	<200	100	40
NH05648R	<20	<20	20	15	10	<10	500	70	10	<200	70	75
GA05652R	<20	<20	15	20	7	<10	200	50	10	<200	100	50
GA05655R	<20	<20	30	15	20	10	<100	50	50	<200	300	15
NA05657R	50	<20	30	15	10	<10	100	50	10	<200	300	25
NA05658R	<20	<20	5	<10	5	<10	100	30	30	<200	300	5
NA05659R	<20	<20	15	10	5	<10	100	30	10	<200	300	40
GA05662R	100	<20	70	30	20	<10	<100	100	50	200	70	10
GA05668R	50	<20	10	<10	10	<10	<100	50	20	<200	300	5
GA05669R	<20	<20	150	20	30	<10	500	200	20	<200	50	10
GA05670R	<20	<20	15	20	5	<10	150	30	15	<200	100	25
NH05676R	<20	<20	15	10	10	<10	200	50	20	<200	200	45
NH05678R	<20	<20	100	15	20	<10	200	200	20	<200	70	25
NH05679R	<20	<20	15	20	10	<10	200	50	20	<200	150	70
NH05681R	<20	<20	20	10	20	<10	300	100	20	<200	70	40
NH05685R	50	<20	30	15	15	<10	200	100	20	<200	200	85
NH05687R	50	<20	15	15	10	<10	200	50	20	<200	150	55
NH05691R	<20	<20	10	<10	5	<10	200	30	10	<200	100	30

Table 2. Results of analyses of soil samples by semiquantitative emission spectrography (analysts: G.W. Day, B.M. Adrian, and R. Sanchez) and atomic-absorption (analysts: R.J. Fairfield and L.S. Laudon).

Sample Number	Latitude	Longitude	S-Fe %	S-Mg %	S-Ca %	S-Ti %	S-Mn ppm	S-Ag ppm	S-B ppm	S-Ba ppm	S-Be ppm	S-Co ppm	S-Cr ppm	S-Cu ppm
GA05016D	345802	832843	3	1	0.5	0.5	300	<0.5	<10	200	<1	10	50	10
GA05017D	345802	832839	3	1	0.5	0.7	300	<0.5	<10	300	<1	15	100	30
GA05018D	345750	832832	2	0.5	0.1	0.3	200	<0.5	<10	150	1	10	50	15
GA05024D	345714	832520	2	0.5	0.1	0.3	200	<0.5	<10	300	2	10	50	15
GA05025D	345716	832542	2	0.2	<0.05	0.2	200	<0.5	<10	100	<1	5	30	15
GA05026D	345726	832554	2	0.5	<0.05	0.2	200	<0.5	<10	100	<1	5	50	15
GA05027D	345722	832617	1	0.2	0.05	0.1	100	<0.5	<10	300	<1	<5	10	15
GA05029D	345710	832620	2	0.5	0.1	0.3	200	<0.5	<10	300	<1	5	70	15
GA05031D	345700	832612	1	0.05	<0.05	0.2	100	<0.5	<10	100	<1	<5	20	10
GA05033D	345655	832628	2	0.5	0.05	0.2	300	<0.5	<10	300	<1	5	50	20
GA05034D	345648	832632	1	0.2	0.05	0.2	100	<0.5	<10	100	<1	<5	50	15
GA05039D	345620	832716	1	0.5	<0.05	0.2	100	<0.5	100	100	1	10	50	20
GA05041D	345621	832732	1	1	0.1	0.2	200	<0.5	<10	150	1	10	50	15
GA05043D	345640	832755	2	0.2	<0.05	0.5	200	<0.5	100	300	1	10	100	30
GA05044D	345705	835754	2	0.2	<0.05	0.2	100	<0.5	<10	50	<1	5	50	50
GA05047D	345802	832642	2	0.5	<0.05	0.2	300	<0.5	<10	200	<1	10	50	20
GA05049D	345734	832643	2	0.5	0.2	0.5	100	<0.5	<10	300	1	5	50	20
GA05052D	345737	832633	2	1	0.1	0.5	200	<0.5	<10	300	1	15	70	30
GA05053D	345754	832626	2	0.5	0.2	0.3	200	<0.5	<10	200	1	15	50	20
GA05054D	345730	832745	2	0.2	<0.05	0.5	100	<0.5	10	200	<1	5	30	20
GA05055D	345741	832752	2	1	0.5	0.2	200	<0.5	<10	300	1	15	30	5
GA05060D	345737	832812	3	1	0.5	1	500	<0.5	<10	300	<1	20	100	15
GA05061D	345752	832807	2	0.5	0.1	0.5	200	<0.5	10	100	1	5	50	10
GA05063D	345710	832853	1	0.05	<0.05	0.2	50	<0.5	<10	30	<1	<5	20	15
GA05064D	345716	832900	2	0.1	<0.05	0.2	100	<0.5	10	30	<1	10	30	50
GA05067D	345726	832836	2	0.5	<0.05	0.2	70	<0.5	<10	100	1	5	30	20
GA05073D	345652	832602	2	0.1	<0.05	0.3	50	<0.5	<10	150	<1	<5	50	15
GA05081D	345718	832803	2	1	0.7	0.3	300	<0.5	<10	200	2	15	30	<5
GA05105D	345736	832602	1	0.5	<0.05	0.3	200	<0.5	<10	200	<1	5	50	15
GA05106D	345748	832550	1	0.5	<0.05	0.3	200	<0.5	<10	300	<1	15	50	15
GA05107D	345746	832535	2	0.2	<0.05	0.3	100	<0.5	<10	100	<1	5	50	15
GA05108D	345740	832535	2	0.5	<0.05	0.5	200	<0.5	10	200	<1	5	70	20
GA05127D	345715	835724	2	0.2	<0.05	0.3	100	<0.5	<10	150	1	5	50	20
GA05128D	345714	832655	2	0.2	<0.05	0.5	200	<0.5	<10	200	<1	10	50	30
GA05129D	345702	832724	2	0.5	<0.05	0.2	300	<0.5	<10	200	<1	10	50	20
GA05131D	345744	832649	3	1	0.1	0.3	200	<0.5	<10	300	1	15	50	30
GA05132D	345753	832703	3	0.5	<0.05	0.3	200	<0.5	<10	100	1	15	100	30
GA05133D	345817	832650	3	0.3	<0.05	0.5	100	<0.5	<10	200	<1	5	50	10
GA05134D	345814	832733	2	0.5	0.1	0.3	100	<0.5	10	150	<1	10	70	15
GA05135D	345807	832857	2	1	<0.05	0.5	200	<0.5	10	200	1	10	50	20

Table 2 continued.

Sample Number	S-La ppm	S-Ni ppm	S-Pb ppm	S-Sc ppm	S-Sr ppm	S-V ppm	S-Y ppm	S-Zr ppm	AA-Zn ppm
GA05016D	30	20	15	10	100	70	20	300	75
GA05017D	70	30	15	15	100	70	50	300	110
GA05018D	20	15	15	5	<100	50	20	200	100
GA05024D	50	15	30	5	100	30	50	300	40
GA05025D	<20	10	20	5	<100	50	20	150	40
GA05026D	30	15	15	7	<100	50	30	200	100
GA05027D	<20	10	50	7	100	20	20	200	25
GA05029D	20	15	20	7	100	50	30	300	75
GA05031D	<20	5	20	7	<100	50	10	150	30
GA05033D	20	10	50	7	<100	50	30	300	60
GA05034D	<20	5	15	7	<100	50	20	200	75
GA05039D	<20	15	15	7	<100	50	20	200	110
GA05041D	<20	10	15	7	<100	50	20	100	110
GA05043D	50	20	50	20	<100	50	50	500	40
GA05044D	<20	10	15	15	<100	50	20	150	95
GA05047D	20	15	15	7	<100	30	30	100	120
GA05049D	70	15	20	7	100	50	30	150	75
GA05052D	20	15	30	7	<100	50	30	150	95
GA05053D	20	15	20	7	<100	50	50	150	70
GA05054D	20	10	20	10	<100	70	20	150	65
GA05055D	20	15	20	10	100	50	30	100	65
GA05060D	50	20	20	20	150	70	50	500	80
GA05061D	20	15	15	7	<100	70	20	200	60
GA05063D	<20	10	10	7	<100	50	10	100	35
GA05064D	<20	20	10	15	<100	70	20	30	40
GA05067D	<20	20	10	10	<100	70	15	150	55
GA05073D	70	10	30	7	<100	50	30	300	30
GA05081D	20	15	15	15	200	70	30	200	65
GA05105D	<20	10	20	7	<100	50	15	500	100
GA05106D	20	15	20	7	<100	50	30	150	90
GA05107D	<20	10	20	7	<100	50	15	200	65
GA05108D	20	15	20	7	<100	70	20	200	70
GA05127D	<20	15	30	10	<100	50	20	500	50
GA05128D	<20	15	20	10	<100	50	20	150	85
GA05129D	20	15	15	10	<100	50	20	150	95
GA05131D	50	15	20	7	<100	50	50	200	110
GA05132D	<20	30	15	10	<100	70	30	100	120
GA05133D	<20	20	15	10	<100	50	20	100	90
GA05134D	20	15	20	10	<100	70	20	300	60
GA05135D	50	20	15	15	<100	70	20	150	100

Table 2. continued.

Sample Number	Latitude	Longitude	S-Fe %	S-Mg %	S-Ca %	S-Ti %	S-Mn ppm	S-Ag ppm	S-B ppm	S-Ba ppm	S-Be ppm	S-Co ppm	S-Cr ppm	S-Cu ppm
GA05140D	345744	832850	1	0.2	<0.05	0.2	100	<0.5	<10	100	1	5	30	50
GA05147D	345650	832902	1	0.5	0.1	0.2	100	<0.5	<10	100	1	20	50	20
GA05148D	345642	832847	1	0.05	<0.05	0.5	50	<0.5	10	100	<1	<5	50	15
GA05150D	345722	832800	1	0.2	0.1	0.2	100	<0.5	<10	100	1	<5	20	5
GA05151D	345700	832847	2	1	1	0.3	300	<0.5	<10	200	1	15	50	<5
GA05152D	345700	832836	2	0.2	<0.05	0.2	100	<0.5	10	100	1	5	30	5
GA05159D	345650	832825	2	0.2	<0.05	0.5	200	<0.5	10	200	<1	7	50	30
GA05162D	345656	832547	0.5	0.1	0.1	0.1	100	<0.5	<10	100	2	<5	<10	<5
GA05602D	345826	832943	1.5	0.07	<0.05	0.5	50	<0.5	10	200	1	7	20	30
GA05603D	345836	832933	2	0.5	0.15	1	300	<0.5	<10	300	1	10	50	10
NH05614D	350029	832805	2	0.3	0.5	0.7	200	<0.5	<10	200	1.5	7	20	7
NH05616D	350036	832820	1.5	0.5	<0.05	0.2	150	<0.5	<10	<20.000	1	15	100	30
NH05618D	350051	832845	1	0.1	<0.05	0.3	1000	<0.5	15	300	<1	5	50	15
NH05620D	350012	832853	1.5	0.07	<0.05	0.5	200	<0.5	15	300	1	5	50	10
NA05624D	345950	832715	3	0.5	0.2	1	500	<0.5	<10	300	1.5	10	70	15
NA05625D	350000	832800	2	0.3	0.1	1	500	<0.5	<10	300	1.5	7	70	10
NH05626D	350006	832806	1.5	0.1	0.15	0.7	200	<0.5	10	300	<1	5	50	5
NA05628D	345959	832827	1	0.2	0.15	0.3	300	<0.5	10	100	1	7	70	15
NA05630D	345946	832818	3	0.7	0.5	1	700	<0.5	<10	300	1.5	10	70	20
NH05631D	350150	832837	2	0.2	<0.05	1	500	<0.5	15	200	<1	7	100	30
NH05632D	350135	832746	1.5	0.05	<0.05	0.3	300	<0.5	10	100	<1	5	50	15
NH05633D	350126	832859	1.5	0.05	<0.05	0.3	300	<0.5	<10	150	<1	5	30	15
NH05634D	350113	832840	2	0.3	<0.05	0.5	700	<0.5	10	150	1	7	70	20
NH05638D	350126	832827	1	0.1	0.2	0.2	200	<0.5	<10	<20.000	1	<5	10	7
NH05639D	350051	832942	1.5	0.2	<0.05	0.3	500	0.7	10	300	1	7	30	30
NH05644D	350035	832959	1.5	0.2	0.2	0.5	700	<0.5	20	150	<1	7	30	15
NH05645D	350025	832957	1.5	0.3	0.05	0.3	1000	<0.5	<10	150	1	7	20	20
NH05647D	350004	832959	1.5	0.5	0.15	0.3	1000	<0.5	15	<20.000	1	7	30	15
GA05649D	345827	832851	2	0.7	0.5	0.7	500	<0.5	<10	200	2	10	50	20
GA05650D	345842	832854	2	0.1	0.05	0.7	200	<0.5	20	300	1.5	5	70	30
GA05653D	345858	832859	1.5	0.15	<0.05	0.3	300	<0.5	<10	300	1	10	50	20
GA05654D	345912	832858	1	0.05	<0.05	0.5	50	<0.5	10	300	1	<5	50	10
NA05656D	345938	832902	1.5	0.15	<0.05	0.7	100	<0.5	10	500	1	7	70	15
NA05660D	345954	832912	1	0.05	0.05	0.3	200	<0.5	10	200	<1	<5	30	10
GA05661D	345936	832920	1.5	0.07	0.07	0.7	300	<0.5	20	300	<1	5	50	10
GA05667D	345848	832937	1.5	0.1	<0.05	0.5	50	<0.5	<10	300	1	5	70	70
GA05675D	345850	832916	1.5	0.2	<0.05	0.7	300	<0.5	20	300	1	7	50	20
NH05675D	345850	832801	1	0.2	0.05	0.2	200	<0.5	<10	200	1	5	10	5
NH05677D	350036	832700	2	0.7	0.2	0.7	500	<0.5	<10	200	1.5	10	50	7
NH05680D	350106	832712	1.5	0.5	0.15	0.7	100	<0.5	15	300	1.5	7	50	10
NH05682D	350102	832725	1	0.2	0.2	0.5	1000	<0.5	15	200	1.5	5	30	7
NH05683D	350151	832726	3	0.2	<0.05	1	200	<0.5	10	300	<1	10	70	30
NH05684D	350040	832712	2	0.15	<0.05	1	200	<0.5	<10	300	1	7	50	10
NH05686D	350032	832717	2	0.7	<0.05	0.3	200	<0.5	<10	70	1.5	7	100	20
NH05689D	350117	832728	0.7	0.07	0.3	0.07	100	<0.5	<10	70	1.5	<5	<10	<5
NH05690D	350134	832728	1.5	0.07	<0.05	0.7	150	<0.5	15	300	<1	<5	50	15
NH05692D	350154	832734	1.5	1	0.5	0.2	1500	<0.5	20	100	1.5	7	200	15

Table 2 continued.

Sample Number	S-La ppm	S-Ni ppm	S-Pb ppm	S-Sc ppm	S-Sr ppm	S-V ppm	S-Y ppm	S-Zr ppm	AA-Zn ppm
GA05140D	50	10	15	7	<100	50	15	200	70
GA05147D	20	30	10	15	<100	50	20	100	100
GA05148D	<20	20	15	7	<100	50	15	1000	25
GA05150D	<20	5	10	5	<100	30	15	100	60
GA05151D	30	20	15	15	200	70	30	200	55
GA05152D	<20	20	20	10	<100	70	10	150	50
GA05159D	20	15	20	10	<100	100	15	200	55
GA05162D	50	<5	15	5	100	20	10	50	50
GA05602D	50	15	50	5	<100	50	15	100	55
GA05603D	50	20	20	10	<100	150	30	300	100
NH05614D	<20	10	20	10	<100	100	20	200	70
NH05616D	<20	20	20	10	<100	70	20	300	80
NH05618D	<20	10	30	7	<100	50	10	150	50
NH05620D	<20	5	50	7	<100	70	10	200	45
NA05624D	50	15	15	15	100	150	30	200	100
NA05625D	50	10	20	10	<100	70	30	300	85
NH05626D	<20	<5	20	10	100	70	10	300	30
NA05628D	50	10	20	10	<100	50	20	70	75
NA05630D	50	15	30	20	100	100	30	500	80
NH05631D	50	15	30	10	<100	100	20	500	110
NH05632D	<20	10	30	5	<100	70	10	100	50
NH05633D	50	10	30	7	<100	50	15	500	55
NH05634D	<20	15	20	10	<100	70	20	200	80
NH05638D	<20	7	20	5	<100	50	10	70	55
NH05639D	70	10	30	10	<100	70	20	150	90
NH05644D	<20	5	10	10	<100	100	20	200	80
NH05645D	70	10	20	7	<100	70	30	100	85
NH05647D	<20	15	15	5	<100	50	15	100	65
GA05649D	50	20	30	15	150	100	30	70	95
GA05650D	50	15	30	10	<100	150	20	200	60
GA05653D	<20	20	30	10	<100	70	20	100	75
GA05654D	<20	10	30	7	<100	50	10	150	45
NA05656D	<20	20	30	7	<100	70	15	300	55
NA05660D	<20	5	30	5	<100	50	10	200	35
GA05661D	<20	15	30	7	<100	50	15	100	55
GA05667D	<20	15	15	10	<100	50	10	200	15
GA05675D	50	15	20	10	<100	50	30	200	60
NH05675D	50	10	15	7	<100	50	15	200	70
NH05677D	<20	20	20	10	<100	70	30	1000	90
NH05680D	<20	15	15	10	100	70	15	200	30
NH05682D	50	5	20	10	100	50	30	200	45
NH05683D	<20	20	20	15	<100	100	15	500	40
NH05684D	50	20	15	10	<100	70	20	300	70
NH05686D	50	20	15	15	<100	70	30	200	70
NH05689D	<20	5	15	5	100	30	10	100	35
NH05690D	<20	5	15	10	<100	70	15	100	40
NH05692D	<20	30	15	7	<100	70	15	70	75

Table 3. Results of analyses of stream sediment samples by semiquantitative emission spectrography (analysts: G.W. Day and B.M. Adrian) and atomic-absorption (analysts: E.P. Welsch, R.J. Fairfield, and L.S. Laudon).

Sample Number	Latitude	Longitude	S-Fe %	S-Mg %	S-Ca %	S-Ti %	S-Mn ppm	S-B ppm	S-Ba ppm	S-Be ppm	S-Co ppm	S-Cr ppm	S-Cu ppm	S-La ppm
GA05001S	345818	832530	2	0.7	0.7	0.7	500	<10	200	<1	10	50	30	111
GA05003S	345812	832515	1	0.3	0.5	0.5	500	<10	500	1	5	10	5	<20
GA05005S	345822	832612	3	0.7	0.5	0.7	700	<10	200	<1	20	50	15	<20
GA05007S	345827	832623	10	0.3	0.5	>1.000	2000	20	200	<1	15	200	30	<20
GA05010S	345822	832707	2	0.7	2	0.5	500	<10	200	1	10	70	<5	<20
GA05011S	345817	832720	2	1	1	0.5	500	<10	300	1	15	70	15	20
GA05013S	345804	832823	7	0.7	1	1	1000	10	200	<1	15	100	20	20
GA05020S	345718	832528	2	0.7	0.2	0.7	500	20	500	1	15	30	20	20
GA05035S	345613	832711	2	0.3	0.5	1	1000	<10	200	<1	10	20	15	30
GA05037S	345612	832700	1	0.2	0.5	0.7	500	<10	300	1	5	20	10	70
GA05045S	345655	832726	3	0.7	0.5	1	1000	<10	300	1	15	100	30	<20
GA05070S	345640	832824	5	0.7	0.5	1	1000	10	200	<1	10	100	30	<20
GA05072S	345630	832825	1	0.2	0.1	0.5	200	<10	200	<1	<5	20	5	20
GA05080S	345742	832810	2	0.5	1	0.7	500	<10	100	<1	7	50	15	<20
GA05101S	345822	832615	2	0.7	0.5	0.7	700	<10	200	1	10	50	15	<20
GA05103S	345714	832525	1	0.5	0.1	0.3	300	<10	300	1	5	50	10	<20
GA05110S	345700	832532	1	0.3	0.5	0.2	300	<10	500	2	5	10	<5	20
GA05112S	345632	832610	2	0.7	0.2	0.7	300	<10	300	2	15	30	15	30
GA05114S	345630	832632	2	0.5	0.5	0.5	1000	10	300	2	15	30	15	20
GA05116S	345629	832637	2	1	1	0.7	1000	10	300	1	10	50	15	<20
GA05118S	345620	832717	2	0.1	<0.05	0.3	100	<10	200	<1	5	30	15	<20
GA05119S	345624	832717	1	0.2	0.7	0.2	300	<10	300	1	5	20	5	70
GA05121S	345646	832705	2	0.3	0.7	0.7	500	<10	300	1	10	50	15	<20
GA05123S	345709	832726	3	0.5	0.5	0.7	500	50	200	1	15	100	20	<20
GA05125S	345714	832728	3	0.5	0.5	1	500	<10	300	1	10	100	15	<20
GA05136S	345734	832800	3	1	0.2	1	300	<10	300	<1	15	100	20	<20
GA05138S	345736	832855	3	0.5	0.2	1	500	<10	150	<1	15	100	20	<20
GA05142S	345709	832804	3	1	0.5	0.7	500	<10	150	<1	15	150	30	<20
GA05143S	345700	832857	2	0.7	0.7	0.7	500	<10	150	<1	15	100	20	<20
GA05145S	345658	832857	2	0.7	1	0.2	300	<10	200	<1	10	70	5	<20
GA05149S	345225	832845	2	0.5	0.1	0.7	300	10	200	<1	15	100	20	<20
GA05153S	345713	832828	2	1	1	0.5	500	<10	150	<1	10	100	15	<20
GA05155S	345700	832823	2	0.7	1	0.7	300	<10	300	<1	10	100	15	<20
GA05160S	345634	832827	3	1	1	0.5	300	10	200	<1	10	100	20	<20
GA05605S	345802	832933	10	0.7	0.07	>1.000	1000	20	500	1	20	100	50	<20
NH05607S	350020	832744	5	1	1	1	1000	<10	500	1.5	15	70	15	50
NH05609S	350023	832738	5	0.7	1.5	>1.000	1000	<10	200	1	15	70	10	<20
NH05611S	350013	832720	2	0.5	1	>1.000	1000	<10	300	1	10	70	15	<20
NH05640S	350044	832936	2	0.2	0.3	>1.000	700	<10	500	<1	7	50	7	<20
NH05642S	350043	832941	3	0.7	0.3	>1.000	700	20	300	<1	10	70	7	<20
GA05663S	345918	832752	3	0.5	0.3	>1.000	700	10	300	1	10	70	7	<20
GA05665S	345922	832803	3	0.7	0.2	>1.000	700	10	300	1.5	10	70	10	<20
GA05671S	345856	832948	3	0.3	0.1	>1.000	500	15	500	1	15	70	30	50
GA05673S	345856	832953	3	0.7	0.2	>1.000	500	10	300	1	20	100	15	50
GA05693S	345825	832800	5	0.3	0.5	>1.000	700	10	300	1	7	70	7	<20
GA05695S	345822	832757	2	1	1	>1.000	500	<10	300	1.5	10	70	15	<20
GA05698S	345720	832928	7	0.5	0.2	>1.000	1000	10	300	1	10	70	15	<20

Table 3. continued.

Sample Number	S-Nb ppm	S-Ni ppm	S-Pb ppm	S-Sc ppm	S-Sn ppm	S-Sr ppm	S-V ppm	S-Y ppm	S-Zr ppm	AA-Zn ppm
GA05001S	111	20	15	10	<10	<100	50	20	1000	50
GA05003S	<20	5	15	5	<10	100	20	20	700	40
GA05005S	<20	10	15	10	<10	<100	50	50	700	45
GA05007S	<20	10	10	10	30	100	100	100	1000	90
GA05010S	<20	10	15	20	<10	200	70	50	700	45
GA05011S	<20	15	15	15	<10	150	70	30	700	80
GA05013S	20	15	15	15	<10	150	100	30	1000	45
GA05020S	20	15	15	5	<10	100	50	30	1000	50
GA05035S	20	5	15	5	<10	150	30	50	700	30
GA05037S	20	10	15	5	<10	200	30	200	500	35
GA05045S	<20	15	15	7	<10	100	50	15	500	60
GA05070S	20	10	15	7	<10	<100	100	20	700	40
GA05072S	<20	5	15	<5	<10	<100	30	15	300	20
GA05080S	<20	10	15	15	<10	100	50	20	700	35
GA05101S	<20	10	15	7	<10	200	50	15	700	50
GA05103S	<20	5	20	5	<10	100	15	20	500	65
GA05110S	<20	10	30	5	<10	200	50	10	200	50
GA05112S	<20	15	30	7	<10	100	50	20	300	80
GA05114S	<20	15	20	7	<10	100	50	100	300	70
GA05116S	<20	15	15	7	<10	150	50	20	300	40
GA05118S	<20	15	20	7	<10	100	30	15	100	40
GA05119S	<20	10	20	5	<10	200	30	20	100	25
GA05121S	<20	10	15	7	<10	200	50	15	300	50
GA05123S	20	15	15	10	<10	100	50	15	300	55
GA05125S	20	15	15	10	<10	100	50	20	500	60
GA05136S	<20	20	15	10	<10	100	50	20	200	100
GA05138S	<20	10	15	10	<10	100	50	20	500	80
GA05142S	<20	20	15	10	<10	100	70	20	500	75
GA05143S	<20	15	15	15	<10	100	70	30	500	70
GA05145S	<20	5	15	15	<10	150	70	30	700	60
GA05149S	<20	15	15	7	<10	<100	70	15	500	60
GA05153S	<20	10	15	20	<10	200	70	15	700	65
GA05155S	<20	10	15	15	<10	100	70	20	300	55
GA05160S	<20	10	15	15	<10	150	70	50	500	60
GA05605S	20	30	10	20	<10	100	200	150	500	60
NH05607S	<20	20	10	20	<10	300	100	30	300	50
NH05609S	<20	20	10	30	<10	300	100	50	1000	30
NH05611S	<20	20	10	20	<10	200	150	30	500	40
NH05640S	<20	15	10	10	<10	100	50	20	500	20
NH05642S	<20	20	15	15	<10	100	50	20	300	25
GA05663S	<20	20	10	20	<10	150	100	30	500	50
GA05665S	<20	20	15	20	<10	150	100	30	500	45
GA05671S	<20	30	15	20	<10	100	70	30	500	40
GA05673S	<20	30	15	20	<10	100	100	20	300	40
GA05693S	<20	15	10	30	<10	150	150	30	700	50
GA05695S	<20	20	15	20	<10	150	100	30	200	65
GA05698S	20	20	<10	30	<10	100	200	30	1000	50

Table 4. Results of analyses of panned concentrate samples by semiquantitative emission spectrography (analysts: G.W. Day and B.M. Adrian) and atomic-absorption (analysts: L.S. Laudon and R.J. Fairfield).

Sample Number	Latitude	Longitude	S-Fe %	S-Mg %	S-Ca %	S-Ti %	S-Mn ppm	S-B ppm	S-Ba ppm	S-Be ppm	S-Co ppm	S-Cr ppm	S-Cu ppm	S-La ppm
GA05002C	345818	832530	0.5	0.05	0.2	>2.000	150	<20	50	<2	<10	100	70	100
GA05004C	345812	832515	0.2	0.05	<0.1	>2.000	150	<20	70	<2	<10	50	10	70
GA05006C	345822	832612	0.5	0.1	0.5	2	200	<20	70	<2	<10	70	100	500
GA05008C	345827	832623	0.15	<0.05	0.2	0.5	50	<20	<50	<2	<10	<20	<10	50
GA05012C	345817	832720	0.5	<0.05	0.5	1	300	<20	70	<2	<10	<20	<10	100
GA05014C	345804	832823	0.2	0.05	0.5	1.5	300	<20	70	<2	<10	<20	<10	50
GA05021C	345718	832528	0.5	0.1	0.1	2	500	<20	100	<2	<10	50	<10	700
GA05036C	345613	832711	1	0.05	0.1	>2.000	500	<20	50	<2	<10	100	20	150
GA05038C	345612	832700	0.5	<0.05	<0.1	>2.000	100	20	50	<2	<10	50	20	1000
GA05046C	345655	832726	0.2	<0.05	0.1	>2.000	100	<20	50	<2	<10	<20	10	50
GA05071C	345640	832824	1	1	0.2	2	200	<20	150	<2	<10	50	<10	<50
GA05083C	345720	832928	20	0.1	<0.1	>2.000	3000	<20	100	<2	30	500	<10	200
GA05085C	345700	832926	15	0.1	5	>2.000	3000	<20	70	<2	15	300	10	150
GA05102C	345822	832615	0.2	0.07	0.5	0.5	200	<20	70	<2	<10	20	<10	150
GA05104C	345714	832525	0.7	0.1	0.2	>2.000	150	<20	200	5	<10	70	10	150
GA05113C	345632	832610	0.7	0.2	0.1	>2.000	500	20	150	<2	<10	70	10	700
GA05115C	345630	832632	0.5	0.1	0.1	>2.000	100	<20	150	<2	<10	50	10	50
GA05117C	345629	832637	0.2	<0.05	0.1	>2.000	100	<20	50	<2	<10	50	10	50
GA05120C	345624	832717	1	0.2	0.2	>2.000	500	<20	200	<2	<10	100	10	700
GA05122C	345646	832705	0.2	<0.05	0.2	>2.000	150	<20	50	<2	<10	50	10	50
GA05124C	345709	832726	2	0.1	0.5	2	200	200	50	<2	<10	50	<10	100
GA05137C	345734	832800	0.1	<0.05	0.1	1.5	50	<20	<50	<2	<10	<20	<10	<50
GA05144C	345700	832857	0.1	<0.05	0.1	2	150	<20	<50	<2	<10	<20	<10	<50
GA05146C	345658	832857	0.5	<0.05	0.5	0.5	200	<20	50	<2	<10	20	<10	<50
GA05154C	345713	832828	0.2	<0.05	0.5	0.7	150	<20	<50	<2	<10	<20	<10	<50
GA05156C	345700	832823	2	1	0.5	1	200	<20	500	<2	<10	70	<10	<50
GA05161C	345634	832827	0.7	0.5	0.5	1	150	<20	50	<2	<10	<20	<10	50
GA05606C	345802	832933	1	0.1	0.2	0.7	100	50	300	<2	10	50	<10	<50
NH05608C	350020	832744	1	0.1	1	0.3	200	20	150	<2	10	50	<10	<50
NH05610C	350023	832738	0.5	<0.05	1	1	70	20	<50	<2	<10	100	<10	<50
NH05612C	350013	832720	0.7	0.1	0.7	0.5	100	20	<50	<2	10	30	<10	<50
GA05622C	345934	832748	0.7	0.5	1	2	150	20	<50	<2	10	150	<10	<50
NH05641C	350044	832936	0.7	0.05	<0.1	0.2	70	20	<50	<2	10	200	<10	<50
NH05643C	350043	832941	0.7	0.1	<0.1	0.1	70	20	100	<2	10	20	<10	<50
GA05664C	345918	832752	0.7	0.05	0.5	0.2	200	20	<50	<2	10	50	<10	150
GA05666C	345922	832803	0.7	0.05	0.2	0.2	50	20	<50	<2	<10	150	<10	<50
GA05672C	345856	832948	0.7	0.05	<0.1	0.5	50	20	<50	<2	10	200	<10	<50
GA05674C	345856	832953	0.5	0.05	0.3	0.1	70	20	<50	<2	10	50	<10	<50
GA05694C	345825	832800	0.5	<0.05	0.5	0.07	70	20	<50	<2	<10	<20	<10	150
GA05696C	345822	832757	0.5	<0.05	1	0.2	100	20	<50	<2	<10	<20	<10	<50

Table 4 continued.

Sample Number	S-Nb ppm	S-Ni ppm	S-Pb ppm	S-Sc ppm	S-Sn ppm	S-Sr ppm	S-V ppm	S-Y ppm	S-Zr ppm
GA05002C	100	<10	30	30	20	<200	150	500	>2000
GA05004C	200	<10	30	50	<20	<200	100	700	>2000
GA05006C	50	<10	30	30	20	<200	100	300	>2000
GA05008C	<50	<10	<20	<10	30	<200	20	100	>2000
GA05012C	<50	<10	20	100	<20	<200	70	700	>2000
GA05014C	<50	<10	<20	50	<20	<200	50	200	>2000
GA05021C	50	<10	30	50	<20	<200	50	500	>2000
GA05036C	150	<10	<20	50	<20	<200	150	300	>2000
GA05038C	150	<10	20	70	<20	<200	100	700	>2000
GA05046C	<50	<10	<20	20	<20	<200	70	200	>2000
GA05071C	50	<10	<20	20	<20	<200	100	200	>2000
GA05083C	50	50	<20	50	<20	<200	1000	50	500
GA05085C	50	15	<20	100	<20	700	700	200	1500
GA05102C	<50	<10	20	30	<20	200	50	200	>2000
GA05104C	100	<10	20	50	<20	<200	70	300	>2000
GA05113C	150	<10	30	70	<20	<200	100	700	>2000
GA05115C	100	<10	20	30	<20	<200	70	300	>2000
GA05117C	70	<10	20	50	<20	<200	100	300	>2000
GA05120C	70	<10	30	70	<20	300	150	1000	>2000
GA05122C	70	<10	20	50	<20	<200	70	500	>2000
GA05124C	<50	<10	<20	10	<20	<200	100	200	>2000
GA05137C	<50	<10	<20	10	<20	<200	30	200	>2000
GA05144C	<50	<10	<20	150	<20	<200	50	500	>2000
GA05146C	<50	<10	<20	150	<20	200	70	700	>2000
GA05154C	<50	<10	<20	30	<20	<200	20	150	>2000
GA05156C	<50	<10	20	50	<20	<200	100	200	>2000
GA05161C	<50	<10	<20	20	<20	200	50	100	>2000
GA05606C	<50	<10	<20	<10	<20	<200	50	20	2000
NH05608C	<50	<10	<20	<10	<20	200	50	20	2000
NH05610C	<50	<10	<20	<10	<20	200	50	100	>2000
NH05612C	<50	<10	<20	<10	<20	200	50	20	>2000
GA05622C	<50	20	<20	<10	<20	200	70	100	>2000
NH05641C	<50	<10	<20	<10	<20	<200	70	20	>2000
NH05643C	<50	<10	<20	<10	<20	<200	30	20	>2000
GA05664C	<50	<10	<20	<10	<20	200	50	50	>2000
GA05666C	<50	<10	<20	<10	<20	<200	50	20	>2000
GA05672C	<50	<10	<20	<10	<20	<200	70	<20	>2000
GA05674C	<50	<10	<20	<10	<20	200	30	<20	1500
GA05694C	<50	<10	<20	<10	<20	200	20	<20	2000
GA05696C	<50	<10	<20	<10	<20	300	20	50	>2000