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Digital Release of Stream-Sediment, Heavy-Mineral-Concentrate,
and Other Geochemical Data Collected in the
McCarthy 1° x 3° Quadrangle, Alaska

By

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INTRODUCTION

The historic geochemical data presented here were compiled from the Rock Analysis Storage System (RASS) of the U.S. Geological Survey National Geochemical Database (NGDB). The RASS database consists of multi-element chemical and spectrographic analyses for approximately 700,000 geochemical samples collected from the mid-1960's to the late 1980's.

Reconnaissance geochemical sampling and analysis was conducted in the McCarthy quadrangle in the 1970's as part of the Alaska Mineral Resource Assessment Program (AMRAP). Although collected primarily for mineral resource studies, these geochemical data may be useful for environmental or other mineral resource studies in the region. The purpose of this report is to release these data in a more modern, easy-to-use format. While compiling the data for this report, sample coding and geochemical data were inspected and gross errors were corrected. The analytical data in this report includes data released previously in hard-copy format (O'Leary and others, 1976), as well as previously unpublished data residing in the NGDB. In addition, this report includes the analytical results for a large part of the stream sediments sampled in the northeastern part of the quadrangle by the Alaskan Division of Mines and Geology (Knaebel, 1970).

The McCarthy quadrangle is bounded by latitude 61° N to 62° N and by longitude 141° W to 144° W. The analytical results for 1,886 stream-sediment, 634 heavy-mineral-concentrate, and 257 organic samples are given in this report. The data files included on this diskette are separated by sample media type. All data files are in dBase III .dbf format. The first three letters of the filename refer to the quadrangle. Letters following the underscore refer to sample media: CONC, heavy-mineral concentrates; SED, stream sediments; and ORG, organic samples.

METHODS OF STUDY

Sample Media

The chemical composition of stream-sediment samples reflects the overall chemistry of rocks contained within the drainage basins. Such information is useful in identifying those basins which contain concentrations of elements that may be related to mineral deposits. Glacial moraine samples were collected from active lateral and medial moraines selected as being representative of distinct nunataks at higher elevations.

Heavy-mineral concentrates from stream sediment are selectively enriched in certain minerals, including many that may be ore-related. This concentration process permits detection of some elements that are not easily or reliably detected in bulk stream sediment.

Organic sample media generally refer to vegetation samples collected from specimens growing in the flood plains of a stream or river. These samples were usually collected at or near a corresponding stream-sediment or heavy-mineral-concentrate sample locality. Vegetation samples collected in the McCarthy quadrangle include willow leaves. Moose pellets were also collected as an experimental organic sample medium in the quadrangle (O'Leary and others, 1976).

Sample Collection

Stream sediments were obtained from active stream channels. Most samples are composites of material collected within a 100-ft radius. Duplicate samples were collected at several localities to test the variance of analytical results and sampling error.

Heavy-mineral-concentrate samples were collected, by panning sediment, in conjunction with stream sediment sampling. However, a concentrate was not routinely obtained at all stream sediment sample sites. At localities where a panned concentrate was taken, an effort was made to collect the sample as close to bedrock as possible, or under boulders and in natural riffle areas where the heavy minerals are likely to be most abundant. The leaves and twigs of willow trees were collected at all sites where the species was actively growing. Whenever present, moose pellets were collected at sample sites. The pellets are thought to represent a digested conglomeration of all edible vegetation from the area and the trace element content may reflect local mineralization (O'Leary and others, 1976).

Sample Preparation

Stream-sediment samples were air-dried and sieved through an 80-mesh (0.17 mm) sieve. The minus-80-mesh fraction was saved for analysis.

Glacial moraine samples were crushed to less than 0.25 inches using a chipmunk crusher. The crushed material was split with a Jones splitter and ground to minus-150 mesh using a vertical pulverizer with ceramic plates.

Many of the stream-sediment and glacial moraine samples were prepared with an oxalic-acid leaching technique. The secondary iron and manganese oxides coating grains in stream-sediment and glacial moraine samples are scavenging agents that concentrate elements leached from bedrock and colluvium and migrating as free ions in solution. The oxide components are extracted from the minus-80-mesh fraction using a weak, hot oxalic-acid solution (Alminas and Mosier, 1976). The residue was then pulverized with a mortar and pestle to less than 80-mesh. This fraction was saved for analysis.

The heavy-mineral concentrates were sieved to minus-40 mesh. The sample was further separated with bromoform into two fractions: a light-mineral fraction (specific gravity 2.86 or less) and a heavy-mineral fraction (specific gravity greater than 2.86). Magnetite and other strongly magnetic minerals first were removed from the heavy-mineral fraction by use of a hand magnet and a Frantz isodynamic magnetic separator set at 0.2 ampere and saved for analysis. The remaining fraction was again sent through the Frantz separator at a setting of 0.6 amperes and this fraction was retained for analysis. The non-magnetic fraction obtained at this higher setting was retained for analysis.

The willow leaves and moose pellets were air dried in cloth bags. The samples were then pulverized in a blender and ashed in a muffle furnace at a peak temperature of 500° C. The ash was saved for analysis.

Sample Analysis

Stream-sediment and glacial moraine samples were analyzed using a semiquantitative, direct-current arc emission spectrographic method (Grimes and Marranzino, 1968). Spectrographic results were determined by visually comparing spectra derived from the sample against spectra obtained from laboratory reference standards. Standard concentrations are geometrically spaced over any given order of magnitude of concentration such that values reported for each sample are reported in the geometric sequence 10, 15, 20, 30, 50, 70, 100 etc. The precision of the Grimes and Marranzino (1968) method is plus or minus one reporting interval at 83 percent, or two intervals at 96 percent confidence (Motooka and Grimes, 1976). The elements analyzed and their nominal limits of determination are listed in table 1.

Selected samples were analyzed for gold, copper, lead, zinc, and tellurium, by atomic-absorption methods (Ward and others, 1969). Arsenic was determined by a colorimetric method developed by Ward and others (1963). Mercury was determined by a mercury-vapor detector developed by Vaughn and McCarthy (1964). Selenium was determined by atomic absorption (fluorometric method). Thallium and indium were determined by atomic absorption (Hubert and Lakin, 1973). The lower limits of determination for these elements in parts per million (ppm) are: gold, 0.05; copper, 5; lead, 5; zinc, 5; tellurium, 0.5; arsenic, 10; mercury, 0.02; selenium, 0.4; thallium, 0.2; and indium, 0.2.

Heavy-mineral concentrates and the oxide residues of stream sediments were analyzed by the Grimes and Marranzino (1968) emission spectrographic procedure as described above, with the following modification: to eliminate the spectral interferences caused by high concentrations of iron, 5 mg of prepared sample was used instead of 10 mg, thus raising the lower limit of determination by two steps (Table 1). Selected heavy-mineral concentrates were analyzed for silver, bismuth, cadmium, copper, cobalt, nickel, lead, and zinc by atomic absorption (modification of Nakagawa, 1975). Gold, indium, and thallium contents were determined by atomic absorption (modification of Hubert and Lakin, 1973). The lower limits of determination for these elements in parts per million are: silver, 0.2; bismuth, 5; cadmium, 0.2; copper, 1; cobalt, 1; nickel, 1; lead, 5; zinc, 1; gold, 0.2; indium, 0.2; thallium, 0.2. Selected magnetic concentrates were measured to determine equivalent uranium. The radiation of each magnetic concentrate was reported as percent equivalent uranium and the lower limit of determination is 0.003 percent (Pan and others, 1980).

The ashed willow leaves and moose pellets were analyzed by a semiquantitative, direct-current emission spectrographic method developed by Mosier (1972) for the analysis of plant ash.

DESCRIPTION OF DATA

Sample description, geologic, and analytical data are presented in each of the sample media files. Sample site locations are given as latitude and longitude both in decimal degree and degree-minute-second formats in the tables. The following list summarizes table structure and sample description column headings. For table structures, "A8" refers to an alphanumeric format eight characters wide, while "N" indicates a numeric column format. Sample description code explanations are listed in Appendix A.

Table Structure	Column Identifier	Description
A6	Jobnum	assigned laboratory job number
A7	Labnum	assigned sample laboratory number
A8	Fieldnum	sample field identification number
A8	Date_sub	date sample submitted to laboratory
A20	Submitter	submitter name
A20	Subm2	secondary submitter name
A9	Lat_dms	latitude in degree-minute-second
A11	Lon_dms	longitude in degree-minute-second
N	D_lat	latitude in decimal degrees
N	D_lon	longitude in decimal degrees
A2	LL_precis	latitude/longitude precision
A1	St	type of sample media
A1	Mc	method sample collected
A1	Sc	sample source
A1	Rt	rock type
A1	Ss	structural setting
A1	M	matrix

A1	Os	oxidation state
A1	A	alteration
A1	Om	ore minerals
A1	Mdf	mineral deposit form
A1	Ga	geologic age
A2	Ms	mesh/sieve code
A2	Sd	additional sample description information
A2	Sd3	additional sample description information
A2	Sd4	additional sample description information
A2	Sd5	additional sample description information
A2	Sp1	sample lab preparation information
A2	Sp2	sample lab preparation information
A2	Sp3	sample lab preparation information
A2	Ft	field treatment
A2	Cm	lab/submitter comments

Chemical data follows the above sample description information in the data files. The chemical data are accurate to two significant digits. Trailing zeros are nonsignificant. Columns in which the element headings contain the prefix "S" represent emission-spectrographic data; the prefix "Aa" indicates atomic absorption analyses; "Cm" indicates colorimetric method; the suffix "p" indicates a partial digestion; "t" indicates a total digestion. The results for all elements are reported in parts per million (ppm) except for iron, magnesium, calcium, titanium, and sodium, which are given in percent (pct).

Definitions of the qualifier codes used in the tables are as follows: B, sample not analyzed for this element; N, not detected at the specified level of detection; L, detected, but below the specified limit of determination; G, greater than the specified upper limit of determination; and H, values not determined due to interference.

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Table 1.--Limits of determination for Emission Spectrographic Analysis
Numbers in () were limits before 1988

Elements	Sediments		Concentrates	
	Lower limit	Upper limit	Lower limit	Upper limit
Percent				
Iron (Fe)	.05	20	.1	50
Magnesium (Mg)	.02	10	.05	20
Calcium (Ca)	.05	20	.1	50
Sodium (Na)	.2	5	.5	10
Titanium (Ti)	.002	1	.005	2
Parts per million				
Silver (Ag)	.5	5,000	1.0	10,000
Arsenic (As)	200	10,000	500	20,000
Gold (Au)	10	500	20	1,000
Boron (B)	10	2,000	20	5,000
Barium (Ba)	20	5,000	50	10,000
Beryllium (Be)	1	1,000	2	2,000
Bismuth (Bi)	10	1,000	20	2,000
Cadmium (Cd)	20	500	50	1,000
Cobalt (Co)	(5) 10	2,000	(10) 20	5,000
Chromium (Cr)	(5) 10	5,000	(10) 20	10,000
Copper (Cu)	5	20,000	10	50,000
Lanthanum (La)	(20) 50	1,000	(50) 100	2,000
Manganese (Mn)	10	5,000	20	10,000
Molybdenum (Mo)	5	2,000	10	5,000
Niobium (Nb)	(10) 20	2,000	(20) 50	5,000
Nickel (Ni)	5	5,000	10	10,000
Lead (Pb)	10	20,000	20	50,000
Antimony (Sb)	100	10,000	200	20,000
Scandium (Sc)	5	100	10	200
Tin (Sn)	10	1,000	20	2,000
Strontium (Sr)	100	5,000	200	10,000
Thorium (Th)	100	2,000	200	5,000
Vanadium (V)	10	10,000	20	20,000
Tungsten (W)	(50) 20	10,000	(100) 50	20,000
Yttrium (Y)	10	2,000	20	5,000
Zinc (Zn)	200	10,000	500	20,000
Zirconium (Zr)	10	1,000	20	2,000

APPENDIX A
Explanation of sample description codes

Sample Type (St)	Structural setting (Ss)
A rock	A fracture/joint
B unconsolidated sediment	B shear or fault
C organic material	C other
D soil	
E water	Matrix (M)
F other	A silica
G gas	B fe/mn
	C carbonate
Method collected (Mc)	D clay
A single (grab)	E other
B composite	
C channel	Oxidation state (Os)
D other	A oxidized
	B partially oxidized
Sample source (Sc)	C unoxidized
A outcrop	
B mine	Alteration (A)
C dump or prospect pit	A propylitic
D float	B argillitic
E drill hole, well	C siliceous
F marine	D sericitic
G other	E feldspathic
H stream	F other
I spring	G zeolitic
J lake	H iron/manganese
K aquaduct, canal, irr. ditch	I supergene
L atmosphere	
	Ore minerals (Om)
Rock type (Rt)	A base metals
A unidentified rock	B precious metals
B sedimentary rock	C mixed base and precious metals
C metamorphic rock	D other
D igneous rock	E radioactive
E unconsolidated sediment	F rare earths
F conglomerate	
G sandstone	Mineral deposit form (Mdf)
H siltstone	A vein
I claystone	B replacement
J shale	C disseminated
K limestone or dolomite	D other
L carbonate	E magmatic segregation
M gneiss	F carbonatite
N schist	G greisen
O quartzite	H pegmatite
P marble	I contact metamorphic
Q skarn	J porphyry/stockwork
R phyllite or slate	K massive sulfide
S felsic igneous	L lithophile metals in volcanic rocks
T intermediate igneous	M stratiform
U mafic igneous	N sandstone uranium
V ultramafic igneous	O chemical sediments
W feldspathoidal	P hot springs
X chert or jasperoid	Q placer
Y other	R residual

Geologic age of sample (Ga)

A Precambrian undifferentiated
 B Early Precambrian
 C Middle Precambrian
 D Late Precambrian
 E Paleozoic undifferentiated
 F Cambrian
 G Ordovician
 H Silurian
 I Devonian
 J Mississippian
 K Pennsylvanian
 L Permian
 M Mesozoic undifferentiated
 N Triassic
 P Jurassic
 Q Cretaceous
 R Tertiary undifferentiated
 S Paleocene
 T Eocene
 U Oligocene
 V Miocene
 W Pliocene
 X Quaternary undifferentiated
 Y Pleistocene
 Z Holocene

Mesh/sieve fraction (Ms)

A unknown, assumed to be -80 mesh
 B identified as -80 mesh
 C identified as -100 mesh
 D identified as -120 mesh
 E identified as -150 mesh
 F identified as -200 mesh
 G identified as -60 mesh
 H identified as -40 mesh
 I identified as -35 mesh
 J identified as -30 mesh
 K identified as -24 mesh
 L identified as -20 mesh
 M identified as -30+80 mesh

Sample description (Sd)

AL alluvium
 AS ash
 CL clay
 CV colluvium
 C pan or artificial concentrate
 C1 concentrate, high magnetic fraction
 C2 concentrate, moderate magnetic fraction
 C3 concentrate, low or non-magnetic fraction
 GV gravel
 GT grit
 HS heavy sand
 LO loess
 MD mud
 OZ ooze
 SN sand
 SD stream sediment
 SI silt
 TI till

Sample description (Sd3)

AN animal parts
 CS combined split of heavy-mineral-concentrate
 DM detrital magnetites
 MS splits of magnetites
 NS non-magnetic split from heavy-mineral-concentrate
 OA oxalic acid leachate
 VG vegetation

Sample description (Sd4)

GD glacial debris
 MT moss-trap-sediment sample
 PT peat material
 SP spruce

Sample description (Sd5)

MI mill tailings
 WL willow leaves
 MT moose pellets

Sample preparation (Sp1)

AD ashed
BR bromoform
GR ground

Sample preparation (Sp2)

FR Frantz isodynamic separator
PV pulverized

Sample preparation (Sp3)

FS fire assay PTE
HG hand ground
HM separated by hand magnet
RT split into red tops

Field treatment (Ft)

A air-dried
B sieved
C panned concentrate
D washed
E other

Lab/submitter comments (Cm)

HG high organic content
RS rock/soil survey
VG visible gold

Lat/lon precision (LL_precis)

A apparently accurate to nearest
second
B apparently accurate to nearest
minute
C apparently accurate to nearest
degree

Information for monthly listing of USGS publications:

OF-95-623. Digital release of stream-sediment, heavy-mineral-concentrate, and other geochemical data collected in the McCarthy 1 x 3 degree quadrangle, Alaska, by S.L. George. 1995. One 3-1/2 inch diskette.

Requirements: IBM PC or compatible computer; 3-1/2 inch, 1.44 Mb floppy disk drive; PC or MS DOS; software capable of importing dBase III .DBF files.