UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Diskette version of analytical results, and sample locality map for rock samples from the Iditarod quadrangle, Alaska

By

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STUDIES RELATED TO AMRAP

The U.S. Geological Survey is required by the Alaskan National Interests Lands Conservation Act (Public Law 96-487, 1980) to survey certain Federal lands to determine their mineral values, if any. Results from the Alaskan Mineral Resource Assessment Program (AMRAP) are made available to the public and submitted to the President and the Congress.

INTRODUCTION

During the summers of 1983-1986, the U.S. Geological Survey conducted a reconnaissance geochemical survey, in conjunction with geologic mapping, of the Iditarod quadrangle, Alaska. This report contains chemical analyses and geographic locations of the 1601 rock samples that were collected. The chemical data is presented on three 5 1/4-inch diskettes in standard ASCII format and the sample locations are shown on Plate 1. This report is also available in paper copy (McGimsey and others, 1988).

The Iditarod quadrangle encompasses about 6700 sq. miles (17,300 sq. km) in west-central Alaska, spanning the Kuskokwim Mountain Range between the Yukon and Kuskokwim Rivers (fig. 1). The eastern edge of the quadrangle lies 19 miles (31 km) west of McGrath, the nearest community having commercial air service. Access to points within the Iditarod quadrangle is practically limited to air travel.

The topography ranges from marshy lowlands of the Innoko National Wildlife Refuge in the northwest corner, to the rugged, glaciated Beaver Mountains in the northeast part of the quadrangle. The low point is about 100 ft (30 m) elevation and the high point is 4055 ft (1235 m) in the Beaver Mountains; topographic relief averages about 1200 ft (365 m) over most of the quadrangle. The valleys and mountain slopes are heavily vegetated and timberline occurs at an elevation of about 1000 ft (300 m). The approximate height of the Kuskokwim Mountains averages 1600-1800 ft (490-550 m) and consequently, the tops of most ridges and mountains are bare or tundra covered. Rock samples were collected mainly from ridge tops, but also from outcrops along rivers and streams.

The Iditarod quadrangle is underlain predominantly by a Cretaceous turbidite sequence of interbedded sandstone, siltstone, and shale known as the Kuskokwim Group (Miller and Bundtzen, 1988; Bundtzen and Laird 1983; Cady and others, 1955). The sequence has been broadly folded and cut by numerous high angle faults. Cretaceous monzonite plutons are scattered throughout the central part of the quadrangle; coeval volcanic rocks occur locally near some of the intrusions. Late Cretaceous and early Tertiary volcanic rocks of the Yetna field cover much of the western part of the quadrangle (Miller and Bundtzen, 1987). Poorly exposed pre-Cretaceous rocks are found in a narrow northeast-southwest-trending belt in the western half of the quadrangle. These include 1) Paleozoic and Precambrian metaigneous and metasedimentary rocks, 2) Paleozoic to Jurassic chert and volcanic rocks, and 3) probable Jurassic age ultramafic rocks (Miller and Bundtzen, 1987; Angeloni and Miller, 1985; Miller and Angeloni, 1985).

METHODS

Sample Collection

Rock samples were collected from as many locations as access and time permitted in order to form a basis for both geologic and geochemical surveys. Of these, 1601 samples were submitted for semiquantitative and associated chemical analyses. Sample locations are shown on Plate 1. Samples were collected along foot traverses (usually on ridge tops) and during helicopter spot hops to mountaintops, river outcrops, and other isolated rock exposures. Unmineralized samples were collected to established background values for each rock type. The paucity of samples in some areas, such as the northwest corner of Plate 1, results from a lack of outcrops. Areas containing clusters of sample localities are typically either mineralized or well-exposed.

The samples are coded for latitude, longitude, the 1:63,360-scale quadrangle from which each sample was collected, and rock type. The codes for rock type are listed in Table 1.

Analytical Methods

All samples were analyzed for 31 elements using the six-step semiquantitative spectrographic method. Additional methods were used to verify analyses of some of these elements and to obtain data on two additional elements. Analytical methods and the lower limit of determination for the elements are listed in Table 2.

Analyses by the semiquantitative spectrographic method described by Grimes and Marranzino (1968) are reported in six steps (1.0, 1.5, 2.0, 3.0, 5.0, 7.0) per order of magnitude and the value of each step represents the approximate midpoint of a class interval. For example, values between 61 and 84 would be reported as 70, values between 86 and 124 would be reported as 100, and values between 260 and 390 would be reported as 300. Analytical precision is approximately one interval at the 83% confidence level and two intervals at the 96% level (Motooka and Grimes, 1976); therefore, a reported value of 70 could be as high as 150 or as low as 30 at the 96% confidence level.

Atomic-absorption spectrophotometry (AA) was used to determine antimony, arsenic, bismuth, cadmium, manganese, silver, tin, and zinc using modified methods described by O'Leary and Viets (1986). Gold was determined by AA using the method of Thompson and others (1968); tin was determined by AA after the method of Welsch and Chao (1976).

Fluorine was determined by the specific ion method (Hopkins, 1977), mercury by a modified technique of the instrumental method described by McNeary and others (1972) and Vaughn and McCarthy (1964), and tungsten by a colorimetric method described by Welsch (1983).

Analyses by AA, specific ion, instrumental, and colorimetric methods are quantitative and not on a stepped scale. The values reflect the higher precision and lower determination limits of these methods.

All values are in parts per million except for those of iron, magnesium, calcium, and titanium, which are in percent. Elements analyzed and their lower limit of determination are listed in Table 2.

Analysts were B. F. Arbogast, R. T. Fairfield, J. D. Hoffman, L. S. Landon, R. M. O'Leary, M. A. Pokorny, K. A. Romine, J. T. Ryder, S. J. Sutley, and C. D. Taylor.

Treatment of the data

Upon completion of spectrographic analyses, the 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. The RASS data was subsequently converted into a binary form (STATPAC) for computerized statistical analysis and production of data in tabular format (Grundy and Miesch, 1987a, 1987b, 1987c). The data were organized and edited using STATPAC programs on an IBM-compatible personal computer. Every effort was made to insure that the data are correctly reported. All data, including labels and locations, were checked against the original laboratory reports and field notes in order to find and eliminate keypunch and labelling errors. The sample locations were plotted by computer using the latitude and longitude information. Anomalously located samples were rechecked to minimize location errors.

The data were then converted into ASCII format using a STATPAC program that predetermines individual column width and spacing based on the largest value and number of decimal places in each column for all 1601 samples; consequently, at first glance some of the columns may appear to be unevenly spaced. The data were edited using the word processing program Microsoft Word version 4.0.

EXPLANATION OF SAMPLE LOCATION MAP AND DISKETTE FILE

The 1601 rock samples listed in file IDCHEM.DAT are sorted according to latitude, longitude, and quadrangle, and are consecutively numbered to correspond with numbered localities on Plate 1; there is no sample 620. There are twenty-four 1:63,360-scale quadrangles on Plate 1 situated in four tiers (A-D) of six quadrangles each. The sample numbers on Plate 1 are arranged from top to bottom and left to right, the same as reading a book, for each quadrangle beginning with D-6. The entire D tier is read before the C tier and so on. For example, sample 1245 is located in the upper left corner of the A-6 quadrangle and numerically succeeding samples are located either to the right, at the same latitude, or below at a lower latitude.

In file IDCHEM.DAT, samples are labelled according to the year collected and with a letter code to identify the collector as follows: Linda M. Angeloni (AI), Dave Blair (DB), Kate Bull (KB), Thomas K. Bundtzen (BT), Bruce M. Gamble (GE), Wendy Gerstel (WG), Greg M. Laird (GL), Mark S. Lockwood (MSL), Robert G. McGimsey (MC), and Marti L. Miller (AM). Several rock samples were collected by members of the stream-sediment survey party and these are labelled with an "I" for Iditarod quadrangle followed by a field number and the letter "R", which indicates the sample is a rock.

Rock-unit codes used in file IDCHEM.DAT are explained in Table 1 and "Quad" codes correspond to the 1:63,360-scale quadrangles as indicated on Plate 1. A "less than symbol" (<) preceding values in file IDCHEM.DAT indicates that the element was detected, but was below the acceptable lower limit; Table 2 lists the lower limit of determination for each element.

Table 3 lists univariate statistics for the analytical data in file IDCHEM.DAT. "Minimum" values correspond with the lower limits of determination given in Table 2. The "maximum" column indicates the highest detected concentration of an element in this data set. The "valid" column lists the number of samples in which the elemental abundance was greater than the lower limit of determination. AA methods and analyses for some elements were not applied to every sample. Hence, column "B" indicates the number of samples for which a particular element was not analyzed; in file IDCHEM.DAT, a double hyphen (--) signifies that an element was not analyzed. Column "L" indicates the number of samples in which an element was detected, but at a level below the acceptable lower limit of determination; samples that fall into this category appear in file IDCHEM.DAT with the lower limit of determination value preceded by a less than symbol (<). Column "N" lists the number of samples for which an element was analyzed but not detected. The "G" column lists the number of samples in which an elemental abundance is greater than the analytical upper limit of determination; these values are preceded by a greater than symbol (>) in file IDCHEM.DAT.

Note: Suggested margin settings for the file are as follows:
Text--top 1", bottom 1", page dimension 8.5 x 11"
Data--top .75", bottom .85", page dimension 15 x 11"

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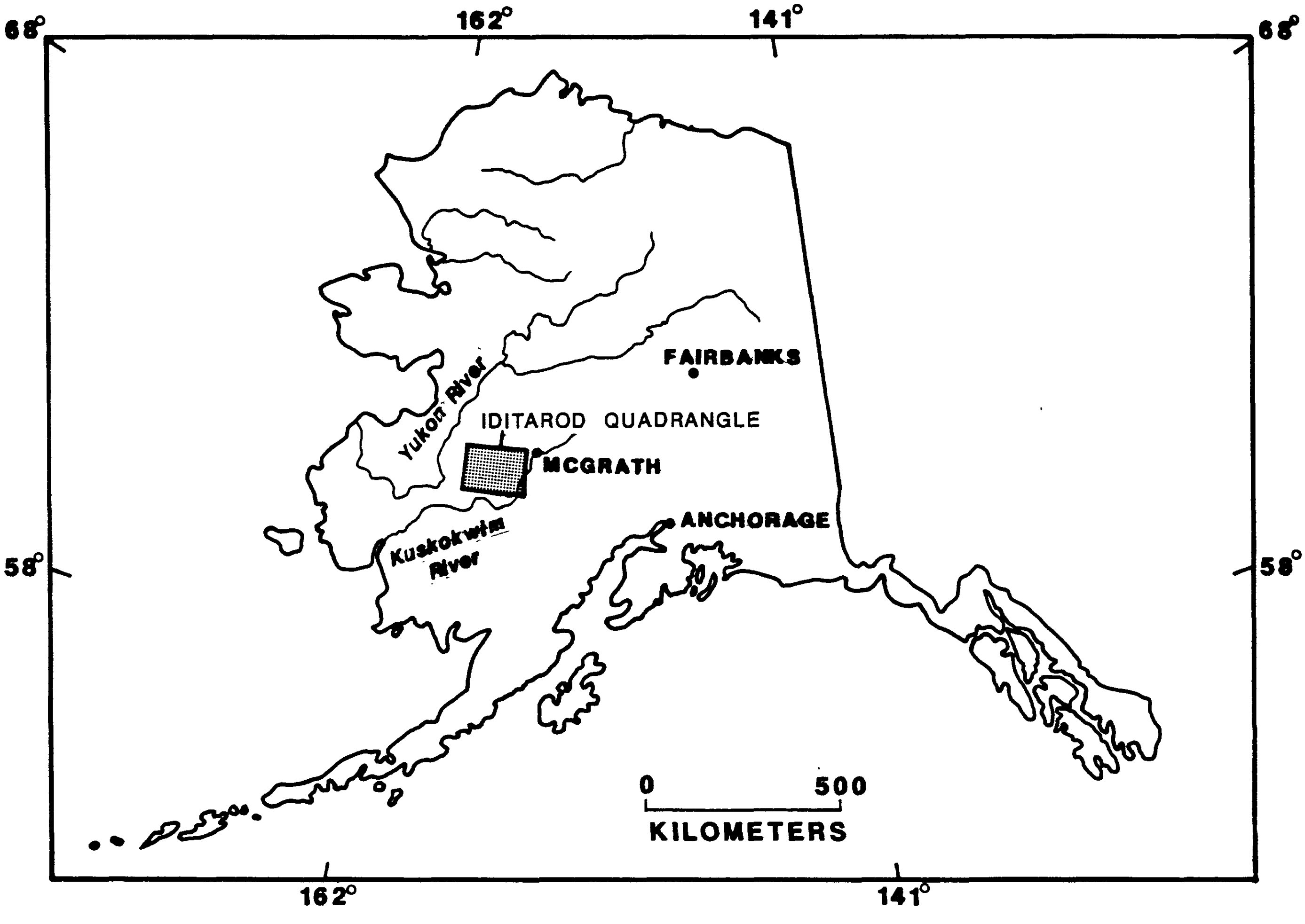

Figure 1. Map showing location of the Iditarod quadrangle, Alaska.

Table 1. Coding used for rock samples collected in Iditarod quadrangle, Alaska. Gh indicates rock samples collected at the Golden Horn lode gold mine near Flat, Alaska.

Rock Type (Unit):

Cretaceous: Kuskokwim Group, overlying volcanic rock, and intrusive rocks

Kvm	mafic volcanic.
Kvi	intermediate volcanic
Ki	intermediate igneous
Kac	volcaniclastic
Ks	sandstone
Ksh	shale
Khf	hornfels
Kdm	mafic dike
Kd	dike
Km	monzonite
Gh	Golden Horn Mine

Late Cretaceous-early Tertiary Yetna volcanic field

Vym	mafic
Vyi	intermediate
Vyf	felsic
Vyx	other

Paleozoic to Jurassic chert and associated rocks (part of Innoko terrane)

Tmc	chert
Tms	sandstone
Tmv	volcanic

other

KTf	rhyolite
Oss	other sandstone
Mto	Idono sequence amphibolite grade rocks
Mtd	greenschist facies metamorphic rocks of Ruby terrane
F	felsic
I	intermediate
M	mafic
Um	ultramafic
Mt	metamorphic
Qv	quartz vein
V	vein
Bx	breccia
X	other
Un	unknown

Table 2. Lower limit of determination for respective elements. All analyses are by six-step semiquantitative spectrography unless otherwise noted; AA indicates atomic-absorption spectrophotometry; Si indicates specific ion method; I indicates instrument method; Cm indicates colorimetric technique. Data are reported in weight percent for Fe, Mg, Ca, and Ti; all other data are in parts per million.

Fe	0.05 %	F-Si	100
Mg	0.02 %	Hg-I	0.02
Ca	0.05 %	La	20
Ti	0.002 %	Mo	5
Mn	10	Nb	20
Mn-AA	1	Ni	5
Ag	0.5	Pb	10
As	200	Sb	100
As-AA	10	Sb-AA	2
Au	10	Sc	5
Au-AA	0.05	Sn	10
B	10	Sn-AA	1
Ba	20	Sr	100
Be	1	Th	100
Bi	10	V	10
Bi-AA	1	W	20
Cd	20	W-Cm	1
Cd-AA	0.1	Y	10
Co	5	Zn	200
Cr	10	Zn-AA	5
Cu	5	Zr	10

Table 3. Univariate statistics for analytical data in Table 4. Minimum and maximum detected values are in parts per million except for Fe, Mg, Ca, and Ti which are in percent. The valid column lists the number of samples having elemental concentrations above the lower limit of determination. Column B gives the number of samples for which an element was not analyzed. Column L lists the number of samples in which a particular element was detected below the lower limit of determination. Column N reports the number of samples in which a particular element was not detected. Column G lists the number of samples in which an elemental abundance is greater than the upper limit of detection.

Element	Minimum	Maximum	Valid	B	L	N	G
Fe%	0.05	>20	1594	0	1	0	6
Mg%	0.02	>10	1560	0	34	0	7
Ca%	0.05	20	1213	0	372	16	0
Ti%	0.002	>1	1590	0	7	0	4
Mn	10	>5,000	1576	0	4	0	21
Mn-AA	1	10,000	1	1600	0	0	0
Ag	0.5	>2,000	193	0	109	1299	0
Ag-AA	0.05	38	61	1536	1	3	0
As	200	>10,000	88	0	20	1479	14
As-AA	10	2,500	638	79	92	756	36
Au	10	100	14	0	1	1586	0
Au-AA	0.05	180	89	924	39	549	0
B	10	>2,000	1450	0	68	13	70
Ba	20	>5,000	1561	0	25	12	3
Be	1	20	1014	0	454	133	0
Bi	10	700	42	0	19	1540	0
Bi-AA	1	570	112	74	14	1401	0
Cd	20	>500	12	0	5	1583	1
Cd-AA	0.1	>200	741	75	87	695	3
Co	5	700	1267	0	142	192	0
Cr	10	>5,000	1274	0	196	127	4
Cu	5	>20,000	1378	0	202	15	6
F-Si	100	1,300	84	1508	8	1	0
Hg-I	0.02	>14	481	1008	24	55	33
La	20	1,000	474	0	196	931	0
Mo	5	100	162	0	174	1265	0
Nb	20	150	101	0	265	1235	0
Ni	5	3,000	1448	0	105	48	0
Pb	10	>20,000	1055	0	361	182	3
Sb	100	>10,000	79	0	17	1479	26
Sb-AA	2	>100,000	497	85	21	967	31
Sc	5	100	1319	0	142	140	0
Sn	10	>1,000	196	0	50	1352	3
Sn-AA	1	1,200	33	1568	0	0	0
Sr	100	3,000	803	0	165	633	0
Th	1	200	1	1071	6	523	0
V	10	1,000	1478	0	119	4	0
W	50	>10,000	13	0	10	1576	2
W-Cm	1	46	61	1536	3	1	0
Y	10	200	1327	0	126	148	0
Zn	200	7,000	180	0	632	789	0
Zn-AA	5	>2,000	1468	75	13	40	5
Zr	10	>1,000	1532	0	30	29	10

Table 4. Explanation of Diskette File IDCHEM.DAT: Analyses of rock samples from the Iditarod quadrangle, Alaska. All analyses are by six-step semi-quantitative emission spectrography unless otherwise noted: AA indicates atomic-absorption spectrophotometry; Si indicates specific ion method; I indicates instrument method; Cm indicates colorimetric technique. Data are reported in weight percent for Fe, Mg, Ca, and Ti; all other data are in parts per million. "Sample" refers to the sample location on Plate 1; "Quad" indicates the 1:63,360-scale quadrangle where the sample is located. "Unit" symbols reflect rock type (see Table 1 for description). The letter N indicates that the element was not detected. A double dash (--) indicates that the element was not analyzed.