U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

Geochemical results, sample localities, and descriptions of some rocks from the Proterozoic Kilbuck terrane, Goodnews quadrangle, southwestern Alaska

by

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Open-File Report 90-681

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1990

As part of the Alaska Minerals Resource Assessment Program Bethel Project, samples for geochemical analysis were collected from the Goodnews C-6 15' quadrangle, in the vicinity of Thumb Mountain. These samples are from presumed Proterozoic rocks of the Kilbuck terrane (Box and others, in press). The ages of some of the quartz veins is poorly constrained; some or all may be considerably younger than Proterozoic in age. The geochemical results and sample localities are reported in table 1, and sample descriptions are reported in table 2.

Analytical techniques

Rock samples were analysed by a semiquantitative, visual direct-current arc emission spectrographic (AES) technique adapted from Grimes and Marranzino (1968). The 35 elements Ag, As, Au, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, Ga, Ge, La, Mg, Mn, Mo, Na, Nb, Ni, P, Pb, Sb, Sc, Sn, Sr, Ti, Th, V, W, Y, Zn, and Zr were determined in samples analyzed by this method. Results in table 1 are in parts per million, except for Ca, Fe, Mg, Na, P, and Ti, which are in percent.

Mercury was determined in the rock samples by a continuous-flow, cold-vapor atomic absorbtion (AA) technique similar to that described by Kennedy and Crock (1987). The samples were digested with nitric acid and sodium dichromate in a closed Teflon vessel. Elemental mercury vapor was produced with a hydroxlyamine hydrochloride/sodium chloride and stannous chloride in a continuous flow system that feeds directly into an atomic absorbtion spectrophotometer (Wilson and others, 1987). Concentrations were calculated based on calibration curves generated by analysis of high-purity standard solutions. Results in Table 1 are in parts per million.

Gold was determined by a flame atomic (AA) absorbtion technique (Hubert and Chao, 1985). Gold was separated and concentrated by extraction into methyl isobutyl ketone. Detection limit for the technique is 0.05 ppm.

Silver, As, Au, Bi, Cd, Cu, Mo, Pb, Sb, and Zn were analysed by inductively coupled plasma-atomic emission spectroscopy (ICP) using the method of Motooka (1988). Samples were digested using hydrochloric acid-hydrogen peroxide digestion followed by extraction and aspiration dirtectly into the plasma with diisobutyl ketone. Detection limits and results are shown in table 1.

Discussion

The analytical results from the amphibolite facies metamorphic rocks are low in all elements indicative of mineralization. However, one quartz vein (88AMM13B) contains detectable gold. No other elements in the sample are anomalous.

The gold reported in the quartz vein sample suggests a local source for at least some of the gold in small placer prospects in Snow Gulch and Tyone Creek (Cobb and Condon, 1972; Hoare and Cobb, 1977), which are underlain by Precambrian rocks similar to those near Thumb Mountain (Hoare and Coonrad, 1978).

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Table 1. Analytical results and sample localities table. All results in parts per million except as indicated. ND, not detected. L preceeding value indicates element was detected but not quantifiable. See text for analytical technique.

Sample	Detection limit	88AMM06A	88AMM06C	88AMM08	88AMM10A	88AMM10B
Lab number		D-342285	D-342286	D-342287	D-342288	D-342289
Latitude, W		59 38 49	59 38 49	59 38 59	59 36 48	59 36 48
Longitude, I		161 14 28	161 14 28	161 12 26	161 12 48	161 12 48
Ca % (AES)	0.05	7	2	L0.05	1	0.5
Fe % (AES)	0.02	7	0.15	0.07	5	1
Mg % (AES	0.02	3	0.05	L0.02	2	0.5
Na % (AES)	0.2	1.5	3	L0.2	3	3
P % (AES)	0.2	ND	ND	ND	L0.2	L0.2
Ti % (AES)	0.002	0.7	L0.002	0.003	0.3	0.07
Au (AA)	0.05	ND	ND	ND	ND	ND
Hg (AA)	0.02	0.02	0.04	ND	ND	ND
Ag (ICP)	0.045	0.046	ND	ND	ND	ND
As (ICP)	0.6	ND	ND	ND	ND	ND
Au (ICP)	0.15	ND	ND	ND	ND	ND
Bi (ICP)	0.6	ND	ND	ND	ND	ND
Cd (ICP)	0.03	0.05	ND	ND	ND	ND
Cu (ICP)	0.03	180.00	1.70	0.39	20.00	0.99
Mo (ICP)	0.09	ND	ND	0.17	0.11	ND
Pb (ICP)	0.60	2.10	3.10	0.77	1.70	1.70
Sb (ICP)	0.6	ND	ND	ND	ND	ND
Zn (ICP)	0.03	15	0.42	0.32	33	3.2
Ag (AES)	0.5	ND	ND	ND	ND	ND
As (AES)	200	ND	ND	ND	ND	ND
Au (AES)	10	ND	ND	ND	ND	ND
B (AES)	10	ND	20	15	L10	30
Ba (AES)	10	70	300	30	300	300
Be (AES)	1	ND	ND	ND	1.5	1.5
Bi (AES)	10	ND	ND	ND	ND	ND
Cd (AES)	20	ND	ND	ND	ND	ND
Co (AES)	10	50	ND	ND	20	L10
Cr (AES)	10	70	L10	L10	L10	L10
Cu (AES)	5	150	L5	L5	20	L5
Ga (AES)	5	15	15	ND	15	10
Ge (AES)	10	ND	ND	ND	ND	ND
La (AES)	50	ND	ND	ND	L50	ND
Mn (AES)	10	1500	30	30	1000	50
Mo (AES)	5	L20	ND	ND	ND	ND
Nb (AES)	20	ND	L20	L20	L20	L20
Ni (AES)	5	30	L5	L5	7	L5
Pb (AES)	10	L10	10	ND	10	10
Sb (AES)	100	ND	ND	ND	ND	ND
Sc (AES)	5	15	ND	ND	15	L5
Sn (AES)	10	ND	ND	ND	ND	ND
Sr (AES)	100	200	1500	L100	700	700
Th (AES)	100	ND	ND	ND	ND	ND
V (AES)	10	200	L10	ND	150	30
W (AES)	20	ND	ND	ND	ND	ND
Y (AES)	10	30	ND	L10	20	L10
Zn (AES)	200	ND	ND	ND	ND	ND
Zr (AES)	10	70	15	15	150	100

Sample	88AMM11B	88AMM13B	88AMM14	88AMM15B	88AMM17C	88AMM18
Lab number	D-342290	D-342291	D-342292	D-342293	D-342294	D-342295
Latitude, W	59 36 42	59 36 53	59 37 06	59 36 02	59 35 38	59 35 19
Longitude, !	161 13 46	161 14 47	161 13 24	161 13 23	161 13 39	161 13 33
Ca % (AES)	0.3	0.15	0.1	L0.05	3	L.05
Fe % (AES)	1.5	0.15	0.3	0.15	0.3	0.3
Mg % (AES	0.5	0.07	0.2	0.07	1.5	L0.2
Na % (AES)	1.5	1	2	0.3	L0.2	L0.2
P % (AES)	ND	ND	ND	ND	ND	ND
Ti % (AES)	0.1	0.015	0.02	0.01	0.01	ND
Au (AA)	ND	0.05	ND	ND	ND	ND
Hg (AA)	ND	ND	ND	ND	ND	0.02
Ag (ICP)	ND	ND	ND	ND	ND	ND
As (ICP)	ND	ND	ND	ND	ND	ND
Au (ICP)	ND	ND	ND	ND	ND	ND
Bi (ICP)	ND	ND	ND	ND	ND	ND
Cd (ICP)	ND	ND	ND	ND	ND	ND
Cu (ICP)	0.94	0.31	7.00	0.22	0.31	2.40
Mo (ICP)	0.16	0.12	0.14	0.15	0.14	0.11
Pb (ICP)	2.20	1.00	3.00	0.67	2.50	0.62
Sb (ICP)	ND	ND	ND	ND	ND	ND
Zn (ICP)	19	1.7	2.6	0.22	2.3	0.12
Ag (AES)	L0.5	ND	ND	ND	ND	ND
As (AES)	ND	ND	ND	ND	ND	ND
Au (AES)	ND	ND	ND	ND	ND	ND
B (AES)	15	15	15	15	15	15
Ba (AES)	3000	150	500	100	30	30
Be (AES)	ND	ND	ND	ND	ND	ND
Bi (AES)	ND	ND	ND	ND	ND	ND
Cd (AES)	ND	ND	ND	ND	ND	ND
Co (AES)	L10	ND	L10	ND	L10	ND
Cr (AES)	L10	L10	L10	L10	L10	L10
Cu (AES)	L5	L5	L5	L5	L5	5
Ga (AES)	10	L5	15	L5	L5	L5
Ge (AES)	ND	ND	ND	ND	ND	ND
La (AES)	L50	ND	ND	ND	ND	ND
Mn (AES)	300	30	100	50	70	500
Mo (AES)	ND	ND	ND	ND	ND	ND
Nb (AES)	L20	L20	L20	L20	L20	L20
Ni (AES)	L5	L5	L5	L5	L5	L5
Pb (AES)	20	ND	30	ND	ND	ND
Sb (AES)	ND	ND	ND	ND	ND	ND
Sc (AES)	L5	ND	ND	ND	ND	ND
Sn (AES)	ND	ND	ND	ND	ND	ND
Sr (AES)	300	100	300	L100	L100	L100
Th (AES)	ND	ND	ND	ND	ND	ND
V (AES)	30	L10	L10	L10	L10	L10
W (AES)	ND	ND	ND	ND	ND	ND
Y (AES)	ND	L20	ND	ND	ND	ND
Zn (AES)	ND	ND	ND	ND	ND	ND
Zr (AES)	ND	30	20	ND	ND	ND

Sample	88AM21
Lab number	D-342296
Latitude, W	59 38 42
Longitude, !	161 11 36
Ca % (AES)	0.7
Fe % (AES)	0.07
Mg % (AES	3
Na % (AES)	3
P % (AES)	ND
Ti % (AES)	ND
Au (AA)	ND
Hg (AA)	ND
Ag (ICP)	ND
As (ICP)	ND
Au (ICP)	ND
Bi (ICP)	ND
Cd (ICP)	ND
Cu (ICP)	0.32
Mo (ICP)	0.12
Pb (ICP)	9.40
Sb (ICP)	ND
Zn (ICP)	0.59
Ag (AES)	ND
As (AES)	ND
Au (AES)	ND
B (AES)	20
Ba (AES)	150
Be (AES)	3
Bi (AES)	ND
Cd (AES)	ND
Co (AES)	ND
Cr (AES)	L10
Cu (AES)	L5
Ga (AES)	15
Ge (AES)	ND
La (AES)	ND
Mn (AES)	70
Mo (AES)	ND
Nb (AES)	L20
Ni (AES)	L5
Pb (AES)	30
Sb (AES)	ND
Sc (AES)	ND
Sn (AES)	ND
Sr (AES)	700
Th (AES)	ND
V (AES)	L10
W (AES)	ND
Y (AES)	ND
Zn (AES)	ND
Zr (AES)	ND

Table 2 - sample descriptions

Sample	Description
88AMM06A	garnet-green hornblende-quartz-epidote amphibolite
88AMM06C	quartz vein in amphibolite
88AMM08	quartz vein (may be part of deformed pegmatite)
88AMM10A	leucocratic garnet-biotite orthogneiss
88AMM10B	quartz lens or vein in orthogneiss
88AMM11B	coarse quartz vein (pegmatite?)
88AMM13B	1 meter thick quartz vein cutting leucocratic orthogneiss
88AMM14	leucocratic muscovite-bearing gneiss
88AMM15B	quartz vein cutting granite gneiss
88AMM17C	garnet-muscovite schist
88AMM18	quartz vein in augen gneiss
88AMM21	quartz vein in granodiorite gneiss