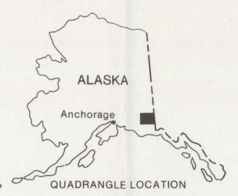
Base from U.S. Geological Survey, 1965
Geology generalized by MacKevett, 1976

SCALE 1:250 000

CONTOUR INTERVAL 200 FEET
DATUM IS MEAN SEA LEVEL
1960 MAGNETIC DECLINATION AT SOUTH EDGE OF SHEET VARIES FROM 28°30' TO 29° EAST



QUADRANGLE LOCATION

Background information for this folio is published as U.S. Geological Survey Circular 739, available free of charge from the U.S. Geological Survey, Reston, Va. 22092.

DISCUSSION

A geochemical survey was conducted in the McCarthy quadrangle Alaska, to identify areas containing anomalous concentrations of various metallic and nonmetallic elements. This study incorporates the results of analyses for gold from 478 rock samples collected in the quadrangle and analyzed by the U.S. Geological Survey between 1961 and 1976 using atomic absorption spectrophotometry. The samples include both unaltered and hydrothermally altered rocks. The hydrothermally altered rock consists of ore grade material, gossans, fault gouge, vein materials, silica-rich boxworks, veins adjacent to faults, and fracture surfaces showing evidence of mineralization. Therefore, the analytical data set may be considered representative of most rock types known to occur in the study area.

The accompanying map shows the distribution and relative abundance of gold in rocks collected. Geochemical analyses have been grouped and are represented by symbols on a base map, which includes topography and generalized geology. The range of analytical values and the symbol that represents it are shown on the histogram. Graphical representation of analytical values on the map permits easy observation of any large variation resulting from separate or duplicate samples collected at the same or nearby localities. All samples were crushed and ground to pass through a 180 micron opening sieve before being analyzed.

The chemical analyses of unaltered and unmineralized bedrock samples are considered to represent background concentrations for the various rock units in the McCarthy quadrangle. These analyses were merged with those from samples representative of hydrothermally altered, mineralized, and (or) biased rock types such as ore grade material. Thus the geochemical distribution of gold analyses may help to locate potential occurrences of concealed mineral deposits, particularly large buried deposits such as porphyry copper or molybdenum.

The arithmetic and geometric mean values of gold in rocks from the McCarthy quadrangle are 1.5 and 0.18 ppm, respectively. Based on an evaluation of the statistical data given in the accompanying histogram, gold values ranging from N(0.02) to 0.03 ppm are classified as background values. Those values between 0.05 and 0.5 ppm are classified as threshold to weakly anomalous, and values greater than 0.5 ppm gold are considered to be significantly anomalous.

Most of the gold detected in rocks collected in the McCarthy quadrangle is vein associated. Although many of the veins occur in the Middle and (or) Upper Triassic Nikolai Greenstone, the amygdaloidal basalt flows of this formation do not seem to be directly related to the gold mineralization. This lack of association in evidenced by the absence of statistically significant positive correlation coefficients occurring between gold, and component elements characteristic of the Nikolai Greenstone such as Fe, Mg, Ca, Ti, Mn, Ba, Co, Cr, Cu, Ni, Sr and V. Partly because of limited data and diverse rock types, only two elements, antimony and copper, determined by atomic absorption, show significant positive correlation with gold. The lack of significant correlation between gold determined the atomic absorption, and copper determined by spectrographic analysis, is not unexpected. by spectrographic analysis, is not unexpected. Spectrographic determinations for copper were routinely made on all samples irrespective of whether they were mineralized or not. Many of these samples contain no gold but do contain measurable copper, thereby resulting in a negative correlation between the two elements. Selective atomic absorption analyses however, were made for gold and copper on mineralized samples that included vein material, resulting in significant positive correlation.

Because erratic, biased, and in many cases widely separated sample localities were used in this project, undue emphasis may be placed on anomalous gold values occurring in only one or two samples in a given area. In all cases, geochemical interpretation has been made utilizing associated elements in combination with geological, structural, and geophysical data. More detailed geological, analytical, and statistical data for geochemical studies of specific areas in the McCarthy quadrangle can be found in reports by MacKevett and Smith (1968), Winkler and MacKevett (1970), Knaebel (1970), and Winkler, MacKevett, and Smith (1971).

In addition to being a commodity of considerable economic value, gold is an important pathfinder element that can be used in the search for porphyry-type copper deposits. Gold often forms halos around zoned porphyry copper deposits. The distributions of gold, molybdenum, silver, and arsenic in rocks, together with the distributions of copper, gold, lead, arsenic and mercury in stream sediments and glacial debris, may reveal zoning patterns that are related to undiscovered mineral deposits. Preliminary study of the geographic distribution of gold anomalies suggests that most of the gold is related either to areas of potential porphyry deposits or to the Jurassic(?) and Cretaceous Valdez Group.

Relatively few rocks were collected and analyzed for gold in the area of the McCarthy quadrangle south of the Chitina River. The only sample containing anomalous concentrations of gold is from the Golconda Creek area (T. 10 S., R. 11 E.) in the vicinity of the Yellowband and other gold mines. From a geochemical standpoint, the gold potential of this region is suggested by the association of anomalous concentrations of gold, silver, arsenic, lead, and mercury in samples of stream sediments and rock collected in the area.

Several significant gold anomalies were detected in rocks collected from Porphyry Mountain (T. 5 S., R. 14 E.). These anomalies are probably related to disseminated veins in the Nikolai Greenstone, that are associated with Tertiary felsic hypabyssal rocks of mainly porphyritic dacite composition. Anomalous concentrations of molybdenum, arsenic, and silver were also detected in rocks from the Porphyry Mountain locality. The samples with silver anomalies seem to be zoned peripherally to those containing gold and molybdenum anomalies. Stream sediments collected in the general vicinity contain anomalous concentrations of copper, arsenic, and mercury. In addition, an aeromagnetic survey suggests the presence of positive magnetic anomalies (Case and MacKevett, 1976). While the area is not presently known to contain economic mineralization, the potential for porphyry copper and molybdenum deposits should be considered.

Only one gold anomaly was detected in rocks collected adjacent to the Totschunda fault system (T. 3 S., R. 21 E.) and none to the northeast in the White River area. However, very few samples from this general area have been analyzed and no conclusions can be drawn from the available data. More detailed sampling is required in view of the high gold in the Ptarmigan Creek area (T. 2 N., R. 24 E.).

Several gold anomalies were detected in rock samples from the general area of Hawkins and Barnard glaciers, south of the University Peak (T. 6 S., R. 20 E.). Although some of these gold anomalies are related to dike occurrences, most are probably related to a monzonitic-granitic complex of Pennsylvanian age that intrudes rocks of the Devonian(?) Kaskawulsh Group and the metamorphosed Pennsylvanian and Permian Skolai Group. Outcrops covering several square kilometers show evidence of strong hydrothermal alteration and positive aeromagnetic anomalies occur locally (Case and MacKevett, 1976). Anomalous amounts of copper, silver, arsenic, mercury, and lead were detected in samples of stream sediments and rock collected in the same area. The intrusive complex also contains several molybdenum anomalies and two small tin anomalies. The presence of anomalies of all these elements suggests that this area might contain undiscovered porphyry-type copper and molybdenum deposits related to the intrusive complex.

Several weak gold anomalies were detected in rocks from an area intruded by Tertiary granodiorite and tonalite in the vicinity of The TWA Harpies (T. 6 S., R. 19 E.) and zones of intense hydrothermal alteration are visible in the outcrop. The intrusive may be inferred to extend northwest under the central part of the University Range, which is supported by the aeromagnetic data (Case and MacKevett, 1976). Anomalous concentrations of copper, arsenic, mercury, silver, and molybdenum are also present in samples of rocks and stream sediments collected in the same general area. Although this area may contain porphyry-type copper or molybdenum deposits, the possibility of contamination from the Nikolai Greenstone cannot be discounted.

Highly anomalous gold values were detected in rocks from the Dan Creek, Nikolai Butte, Williams Peak, Pyramid Peak, Andrus Peak, and Mount Holmes area (T. 6 S., R. 16 E.), and in the upper reaches of Canyon Creek, all located in the south-central part of the quadrangle. Even though this general area has been extensively placer mined, the anomalies are still considered to be extremely significant. An intrusion of Tertiary granodiorite and tonalite, which forms small outcropping plutons, is inferred to underlie much of the area. These intrusives are probably related to the Tertiary intrusive complex exposed in the University Range (T. 5 S., R. 18 E.) to the northeast. Anomalous concentrations of copper, silver, arsenic, mercury, antimony, lead, and molybdenum detected in samples of rock and stream sediment suggest that relatively intense mineralization probably occurs in this area. Strong positive magnetic anomalies are present (Case and MacKevett, 1976) and hydrothermally altered rocks are visible in outcrops. The area is known to contain veins of gold-arsenic-antimony, and gold-copper-molybdenum. These element associations suggest a strong possibility for concealed porphyry-type copper, molybdenum, or other types of deposits.

Very strong gold anomalies were detected in samples of rock collected from the general area of the Kuskulana River south of Skyscraper Peak (T. 3 S., R. 10 E.). The anomalies may be related to veins of sulfides in the Nikolai Greenstone. However, the close proximity of monzodiorite, granodiorite, and tonalite intrusives of the Jurassic Chitina Valley batholith suggest that the mineralized rocks may be related to the intrusives in the area (Moffit and Mertie, 1923). The gold anomalies are associated with copper, arsenic, silver, and molybdenum anomalies.

A few weak gold anomalies were detected in rocks collected south of Granite Peak (T. 2 S., R. 8 E.). Anomalous concentrations of molybdenum, gold, copper, silver, arsenic, and mercury were also detected in some samples of stream sediment and rock collected in the area. The Jurassic Chitina Valley batholith of monzodiorite, granodiorite, and tonalite underlies the Nikolai Greenstone. Positive aeromagnetic highs occur locally (Case and MacKevett, 1976) and strongly altered rocks are visible in the area. Some geochemical anomalies may be related to veins of sulfide in the Nikolai Greenstone, however many of the anomalous samples may be related to undiscovered porphyry-type copper and possibly molybdenum deposits.

Gold anomalies occurring in rock samples south of the Kuskulana River (T. 3 S., R. 9 E.) suggest the possibility of mineralization in a skarn environment. Anomalous concentrations of copper, silver, arsenic, and molybdenum were detected in samples of rock and stream sediment collected in this area.

A complete set of coordinates for sample sites, as well as statistical and analytical data, obtained 1974-1976 eer gold in rocks collected in the McCarthy quadrangle is available, together with details of sample collection, preparation, analysis, data storage and retrieval, in U.S. Geological Survey Open-File Report 76-824 (O'Leary and others, 1976) and on a computer tape (VanTrump and others, 1977).

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Table showing linear correlation coefficients between logarithmic values of the concentration of selected elements versus gold, McCarthy quadrangle, Alaska.
[Leaders (---) indicate insufficient data.]

Analytical method	Six-step semiquantitive spectrographic analyses																								Atomic absorption and colorimetric 1/					
Element	Fe	Mg	Ca	Ti	Mn	Ag	As	B	Ba	Be	Bi	Co	Cr	Cu	La	Mo	Nb	Ni	Pb	Sb	Sc	Sr	V	Y	Zn	Zr	Au	Cu	Pb	Zn	Hg	As
Correlation Coefficient(X100)	-7	-25	-11	-14	-16	-2	9	-9	-3	7	--	-32	3	-18	37	6	1	-18	20	52	-11	-20	-9	-12	-2	6		68	43	2	-15	-29
Number of pairs	105	110	103	109	111	51	30	80	92	16	--	81	89	96	14	44	31	97	43	14	77	76	110	78	12	96		16	16	16	15	14

1/ Au, Cu, Pb, and Zn by atomic absorption analysis
Hg by flameless atomic absorption analysis
As by colorimetric analysis

DISTRIBUTION AND ABUNDANCE OF GOLD IN BEDROCK, MINERALIZED, VEIN, AND ALTERED ROCK SAMPLES, McCARTHY QUADRANGLE, ALASKA

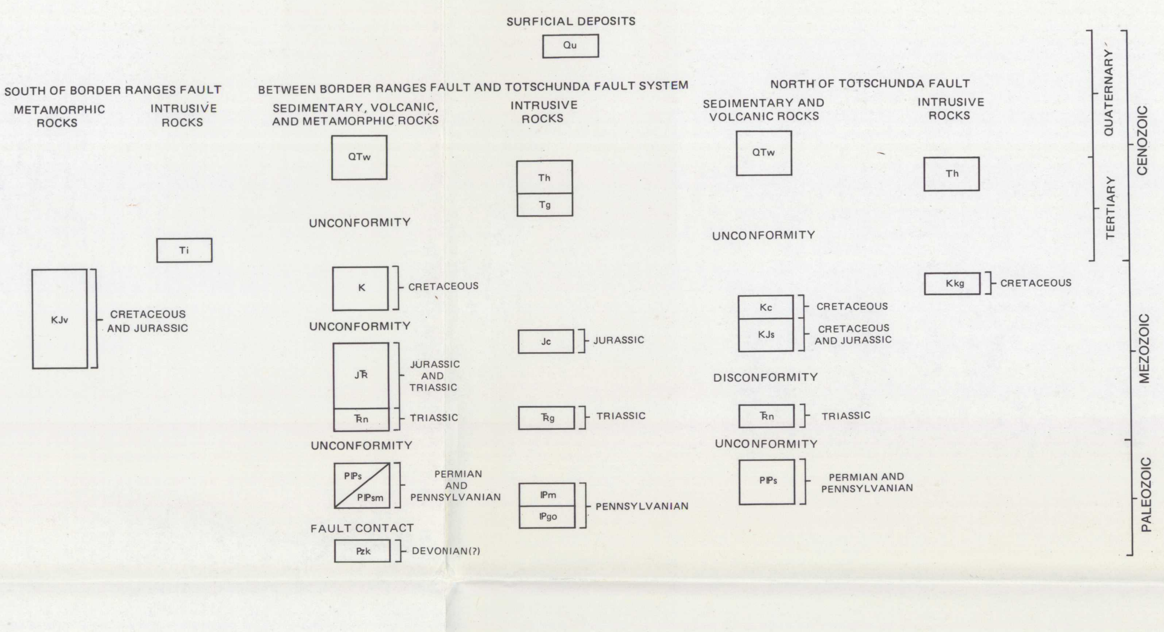
By

Keith Robinson, C. M. McDougal, S. K. McDanal, and Theodore Billings

1976

EXPLANATION FOR GENERALIZED GEOLOGIC MAP
(GEOLOGY GENERALIZED BY MacKEVETT, 1976)

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

Qu — UNCONSOLIDATED SEDIMENTARY DEPOSITS (Quaternary)

SOUTH OF BORDER RANGES FAULT

METAMORPHIC ROCKS

KJv — VALDEZ GROUP (Cretaceous and Jurassic?)

INTRUSIVE ROCKS

Ti — INTRUSIVE ROCKS (Eocene?) Typically, foliated granodiorite and tonalite

BETWEEN BORDER RANGES FAULT AND TOTSCHUNDA FAULT SYSTEM

SEDIMENTARY, VOLCANIC, AND METAMORPHIC ROCKS

QTw — WRANGELL LAVA (Quaternary and Tertiary) Chiefly subaerial andesitic lava flows and tephra; includes local subaerial sedimentary rocks of the Frederika Formation

K — MARINE SEDIMENTARY ROCKS (Upper and Lower Cretaceous) Includes MacColl Ridge, Chititu, Moonshine Creek, Schulze, and Kennicott Formations, and unnamed Lower Cretaceous rocks

JTR — MARINE SEDIMENTARY ROCKS (Jurassic and Triassic) Includes Root Glacier, Nizina Mountain, Lubbe Creek, and McCarthy Formations, Kotsina Conglomerate, and Nizina and Chitistone Limestones

TRn — NIKOLAI GREENSTONE (Upper and (or) Middle Triassic) Mainly subaerial tholeiitic basalt; includes subordinate Chitistone Limestone north of Totschunda fault system

PIPs — SKOLAI GROUP (Permian and Pennsylvanian) As mapped includes a few scattered remnants of Middle Triassic sedimentary rocks in northeastern part of quadrangle

PIPsm — METAMORPHOSED SKOLAI GROUP (Permian and Pennsylvanian) Includes a few small outcrops of serpentinized ultramafic rocks near Border Ranges fault

Pzk — KASKAWULSH GROUP OF KINDLE (1953) (Devonian?)

INTRUSIVE ROCKS

Th — FELSIC HYPABYSSAL ROCKS (Pliocene) Mainly porphyritic dacite

Tg — GRANODIORITE (Pliocene) Unfoliated granodiorite with local mafic border facies

Jc — CHITINA VALLEY BATHOLITH (Jurassic) Mainly foliated quartz monzodiorite, granodiorite, and tonalite

TRg — GABBRO

IPm — MONZONITIC-GRANITIC COMPLEX (Pennsylvanian) Mainly nonfoliated quartz monzonite and granite, local mafic border facies

IPgo — GABBRO AND ORTHOGNEISS (Pennsylvanian)

NORTH OF TOTSCHUNDA FAULT SYSTEM

SEDIMENTARY AND VOLCANIC ROCKS

QTw — WRANGELL LAVA See above

Kc — CHISANA FORMATION (Lower Cretaceous) Marine and subaerial volcaniclastic and volcanic rocks

KJs — NUTZOTIN MOUNTAINS SEQUENCE (Lower Cretaceous and Upper Jurassic)

TRn — NIKOLAI GREENSTONE See above

PIPs — SKOLAI GROUP See above

INTRUSIVE ROCKS

Th — FELSIC HYPABYSSAL ROCKS See above

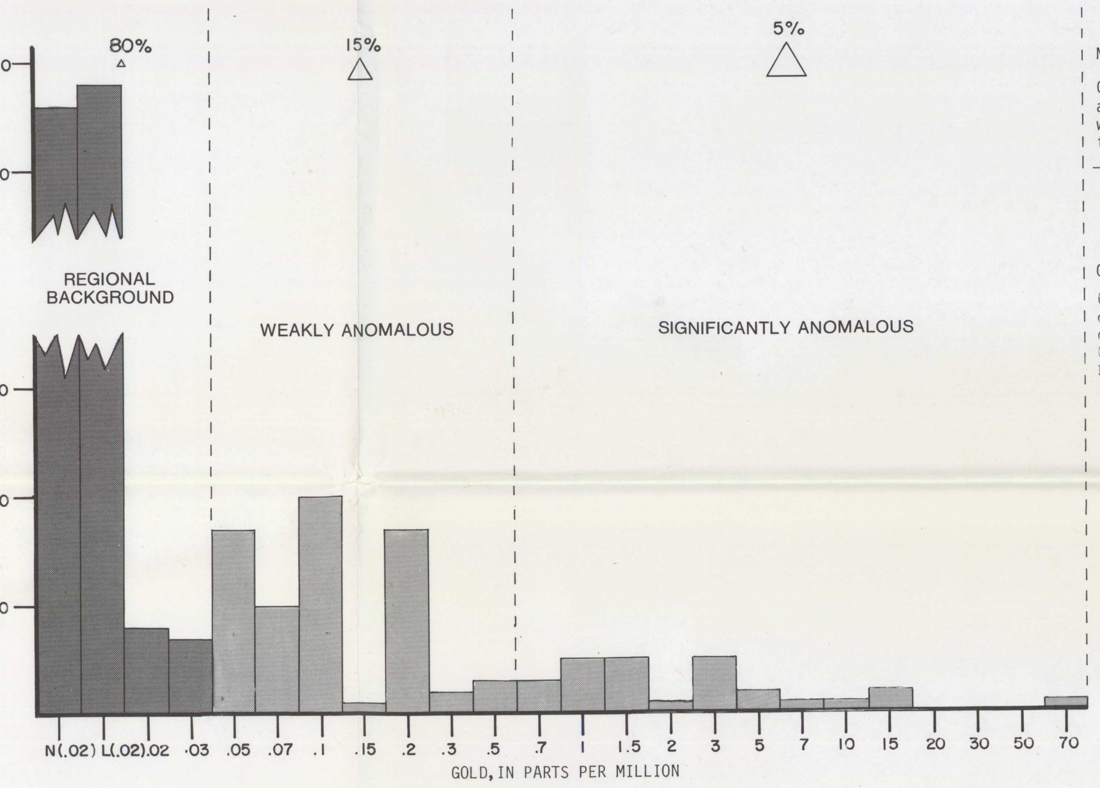
Kkg — KLEIN CREEK PLUTON (Cretaceous) Chiefly granodiorite

Contact; dotted where concealed

High-angle fault; dotted where concealed

Thrust fault; sawteeth on upper plate. Dotted where concealed

NOTE: Areas without letter symbols are glaciers and snowfields



MODE = L(.02) ppm
MEDIAN = L(.02) ppm
Calculation based on analysis of 478 samples with concentrations of Au in the range N(.02) through 66 ppm

ARITHMETIC MEAN = 1.5 ppm
STANDARD DEVIATION = 6.6
GEOMETRIC MEAN = 0.18 ppm
GEOMETRIC DEVIATION = 5.6
Calculation based on analysis of 111 samples with concentrations of Au in the range 0.02 through 66 ppm. Qualified N and L values not included. N, not detected; L, detected but below limit of determination (0.2).

Histogram showing frequency distribution, analytical range, and map symbols for gold in samples of bedrock, mineralized rock, veins and altered rock, McCarthy quadrangle, Alaska.

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1976

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