Geochemical and Geological Reconnaissance in the Seventymile River Area, Alaska

GEOLOGICAL SURVEY BULLETIN 1315

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By SANDRA H. B. CLARK *and* HELEN L. FOSTER

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CONTENTS

ILLUSTRATIONS

TABLE

GEOCHEMICAL AND GEOLOGICAL RECONNAISSANCE IN THE SEVENTYMILE RIVER AREA, ALASKA

By SANDRA H. B. CLARK and HELEN L. FOSTER

ABSTRACT

Geochemical data were secured from 322 stream-sediment samples, 207 rock samples, and 76 soil samples collected in the Seventymile River area. Geochemical anomalies occur in the Flume Creek–Alder Creek, Crooked Creek, American Creek, and Eagle Bluff areas. Gold in the Flume Creek–Alder Creek area south of the Seventymile River is believed to be associated with ultramafic bodies in a fault zone. Placer gold and other metals in anomalous amounts in stream sediments north of the Seventymile River in the Crooked Creek area may be related to dikes and faults that cut Tertiary and Tertiary(?) sedimentary rocks. Geochemical sampling in the American Creek and Eagle Bluff areas did not define any new mineral deposits, but several anomalies of unknown origin, particularly in the Eagle D–2 and D–3 quadrangles, are worthy of further investigation.

INTRODUCTION

A geochemical and geological reconnaissance of part of the Seventymile River area (fig. 1), Eagle quadrangle, Alaska, was conducted during the summer of 1968 as a part of the U.S. Geological Survey's Heavy Metals Program. The principal investigation was in the Eagle D–2 and D–3 quadrangles, but some sampling was done in the American Creek and Eagle Bluff areas and at a locality north of Fisher Creek, in the Charley River A–4 quadrangle.

Gold was first discovered on tributaries of the Seventymile River near the end of the 19th century, and placer mining soon became an important activity. Gold has come primarily from Flume, Alder, Barney, Crooked, and American Creeks; but it has been mined on most of the tributaries entering the Seventymile River from the south between Last Chance and Flume Creeks and on tributaries entering from the north between Barney and Fox Creeks, as well as on the Seventymile River itself (Barney Hansen, oral commun.,

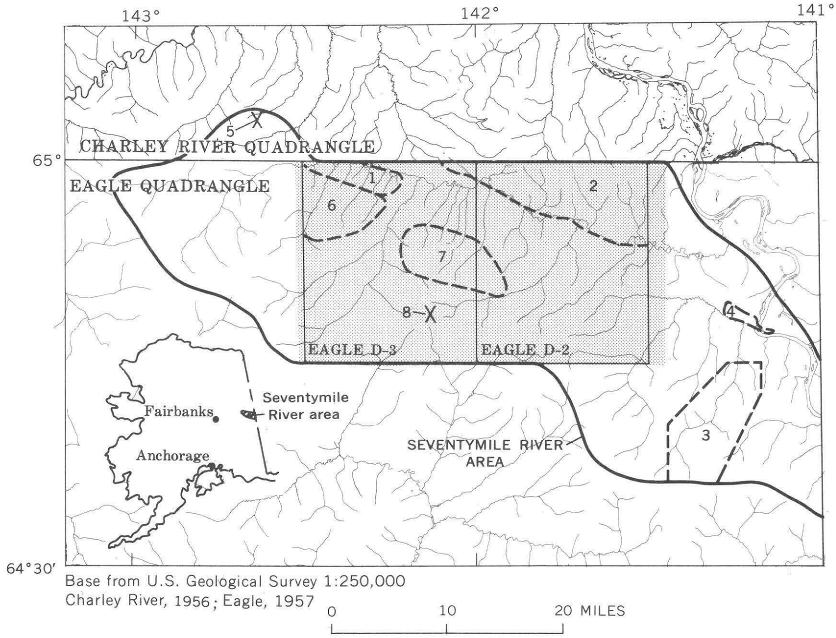


FIGURE 1.—Index map showing location of the Seventymile River area and of mineralized areas and localities discussed in text. The Seventymile River area is outlined; the area shown in figures 6 to 9 is stippled. Mineralized areas and localities discussed in text are: 1, Flume Creek–Alder Creek area; 2, Crooked Creek area; 3, American Creek area; 4, Eagle Bluff area; 5, locality north of Fisher Creek; 6, drainage area of upper Flume Creek, Alder Creek, and Deep Creek; 7, headwaters of Suter, Deer, and Sonickson Creeks, and 8, North Peak locality.

1968). Interest in the mining areas led to geologic exploration; the primary investigations were conducted by Prindle (1906) and Mertie (1930, 1937, 1938) from 1903 to 1936. Part of the area is now covered by more recent geological maps by Brabb and Churkin (1964, 1965), Foster and Keith (1968), and Clark and Foster (1969a).

The authors were assisted in the field by Ronald Warbelow, Sharleen McDonald, and Kathryn Nichols. Charles C. Hawley and Allen L. Clark contributed to the geological mapping and sampling. Mr. and Mrs. Barney Hansen, longtime residents and miners in the Seventymile River area, provided valuable information, particularly about the placer operations on Crooked Creek. Mr. and Mrs. Anton Merly, J. R. Layman, and other residents of Eagle also assisted the field party in many ways.

GEOLOGIC SETTING

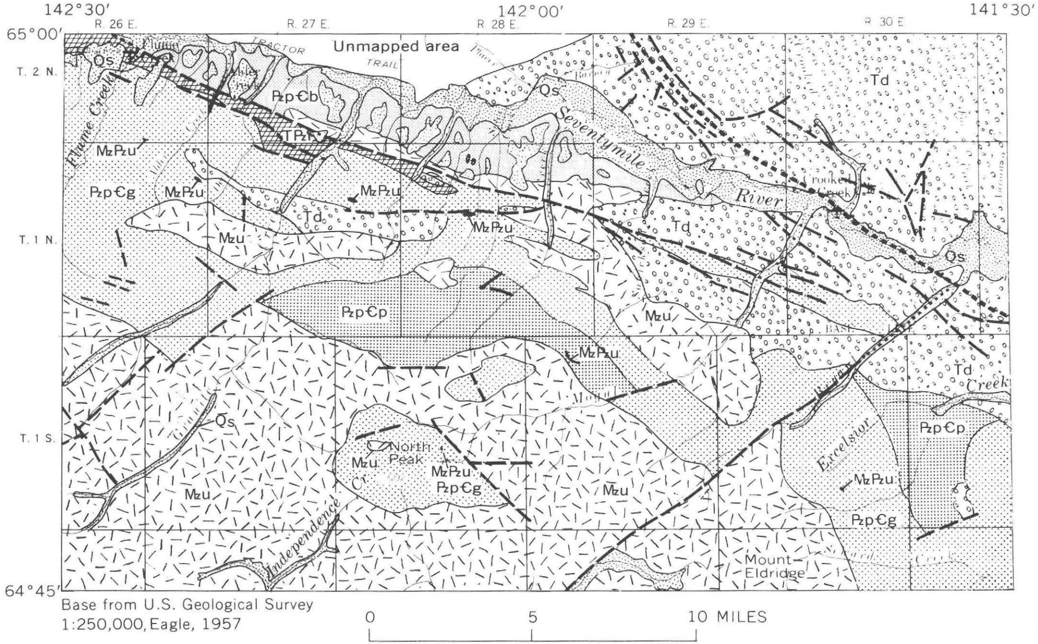
The geology of the Seventymile River area is complex, partly because the Tintina Trench (Roddick, 1967), a major fault zone, cuts through the northeastern part of the area. The Tintina fault zone trends about N. 55° W. and, in this part of Alaska, separates unmetamorphosed Paleozoic and Mesozoic rocks (Brabb and Churkin, 1964) on the northeast from Precambrian and (or) Paleozoic metamorphic rocks on the southwest. In the Eagle D–2 quadrangle (fig. 2), the Tintina fault zone is buried beneath Quaternary deposits and Tertiary and Tertiary(?) sedimentary rocks, although there are some small faults in the sedimentary rocks above, which may or may not be related to it. Prominent northwest-trending faults occur on the southwest side of the Tintina fault zone. Serpentinized ultramafic rocks, altered basalt and diorite, and, locally, orange-stained silica-carbonate rock crop out for at least 13 miles along the southwest side of the most continuous of these faults. The metamorphic rocks southwest of the Tintina fault zone are intruded by granitic rocks of Mesozoic(?) age. Locally, Tertiary and Tertiary(?) detrital rocks of subaerial origin unconformably overlie the metamorphic and igneous rocks.

Metamorphic rocks of Precambrian and (or) Paleozoic age south of the Tintina fault zone are divided into three map units (fig. 2). These units are (1) a biotite gneiss and schist unit of amphibolite facies rocks exposed along the southwest side of the Seventymile River; (2) a quartz-graphite schist unit with subordinate greenschist, phyllite, marble, and quartzite; and (3) a phyllite unit with subordinate argillite, quartzite, metaconglomerate, and metagraywacke. The latter two units are primarily greenschist facies rocks.

The granitic rocks are primarily granodiorite but range in composition from granite to diorite. The large intrusions are probably of Mesozoic age, but some small unmapped hypabyssal intrusions must be of Tertiary and Tertiary(?) age because they cut sedimentary rocks.

A few dikes and small masses of serpentinized ultramafic rocks of uncertain age, outside of the zone previously described, cut the metamorphic rocks.

The sedimentary rocks consist of conglomerate, sandstone, siltstone, shale, and local seams of coal. Plant fossils indicate that at least part of this sedimentary sequence is Tertiary (Mertie, 1938, p. 237–241).



142°30′
142°00′
141°30′
65°00′
64°45′
R. 26 E.
R. 27 E.
R. 28 E.
R. 29 E.
R. 30 E.
T. 2 N.
T. 1 N.
T. 1 S.
Unmapped area
TRACTOR TRAIL
Qs
PzpЄb
TPz
MzPzu
PzpЄg
Mzu
Td
PzpЄp
Seventymile River
Flume Creek
North Peak
Independence Cr.
Excelsior
Mount Eldridge
Creek
Base from U.S. Geological Survey 1:250,000, Eagle, 1957
0
5
10 MILES

EXPLANATION

UNCONSOLIDATED DEPOSITS

Qs

Surficial deposits

Flood-plain alluvium and terrace deposits

QUATERNARY

SEDIMENTARY ROCKS

Td

Detrital rocks

Conglomerate, sandstone, siltstone, and shale; include coal locally

TERTIARY AND TERTIARY(?)

IGNEOUS ROCKS

TPzi

Mafic and ultramafic intrusive rocks with associated silicic and intermediate rocks in a fault zone

PALEOZOIC(?) TO TERTIARY(?)

Mzu

Undifferentiated granitic rocks

Chiefly granodiorite and quartz monzonite. Could include rocks younger than Mesozoic age

MESOZOIC

MzPzu

Ultramafic rocks

PALEOZOIC AND (OR) MESOZOIC

METAMORPHIC ROCKS

Pzp€p

Phyllite unit

Mainly phyllite, argillite, and quartzite

Pzp€g

Quartz-graphite schist unit

Mainly quartz-graphite schist, quartzite, quartz phyllite, quartz-muscovite schist, and quartz-muscovite-chlorite schist. Greenstone, greenschist, or marble predominant locally

Pzp€b

Biotite gneiss and schist unit

Mainly quartz-biotite gneiss and schist, quartzite, and amphibolite

PRECAMBRIAN AND (OR) PALEOZOIC

Approximate contact

Probable fault

Dotted where concealed

Tintina fault zone

Inferred and approximately located; concealed beneath detrital rocks and unconsolidated deposits

FIGURE 2.—Generalized geologic map of the Eagle D-2 and D-3 quadrangles.

GEOCHEMICAL DATA

Three hundred and twenty-two stream-sediment samples, 207 rock samples, and 76 soil samples from the Seventymile River area were analyzed by semiquantitative spectrographic methods. Gold was determined by the atomic absorption method. The results, along with a statistical summary which includes histograms, are available in an open-file report (Clark and Foster, 1969b). The selection of anomalous levels is based largely on inspection of the histograms and is subjective and interpretive. The following concentrations are considered anomalous in this report:

Element	Lower limit of anomalous concentrations, in parts per million	
	Stream-sediment and soil samples	Rock samples
Gold	0.04	0.06
Silver	.5	.7
Molybdenum	5.0	20
Copper	150	300
Lead	100	300
Zinc	200	300
Nickel	[1] 150	5,000
Chromium	500	5,000
Barium	5,000	5,000
Tin	[2] Detected	50

[1] In the American Creek area, 200 ppm nickel is the lower limit.
[2] Less than 10 ppm.

MINERALIZED AREAS

Several areas in the Seventymile River area contain placer gold deposits and (or) bedrock prospects and were sampled in more detail than the rest of the area. The principal areas are the Flume Creek–Alder Creek, Crooked Creek, Eagle Bluff, and American Creek areas. The results of the sampling are discussed below.

FLUME CREEK–ALDER CREEK AREA

The Flume Creek–Alder Creek area (area 1, fig. 1) includes a northwest-trending fault zone (fig. 2) along which altered ultramafic masses and other igneous rocks, including diorite and basalt, occur. Alteration includes serpentinization, sericitization, silicification, and the formation of silica-carbonate rock. Mineralization is associated with this fault zone and particularly with the ultramafic masses along it.

Stream-sediment samples from the fault zone and downstream from it contain anomalous amounts of chromium, nickel, and copper. Placer gold has been reported from these streams, but gold was not detected in the samples.

A limonite-stained silica-carbonate (magnesite) zone up to 40 feet wide associated with serpentinite and altered diorite(?) occurs a few hundred yards upstream from the mouth of Flume Creek. Locally, rocks in the zone have a green garnierite(?) stain. The silica-carbonate rocks are cut by numerous small quartz and carbonate veinlets. Euhedral crystals in vugs suggest open-space filling.

Partial analyses of samples from the silica-carbonate zone are given in table 1 (samples 1 to 5); these analyses show anomalous amounts of arsenic and minor amounts of gold. Sample localities are shown in figure 3.

A few hundred feet upstream from the mineralized silica-carbonate zone, a short adit has been driven into limonite-stained altered diorite on the east side of the creek. The diorite is probably only a small intrusive body, because serpentinite crops out on either side. An irregular quartz vein with a width of about 1 to 3 feet occurs near the portal, and other quartz veins from a fraction of an inch to about 7 inches wide cut the diorite. The diorite is silicified adjacent to the larger veins; strongly silicified and

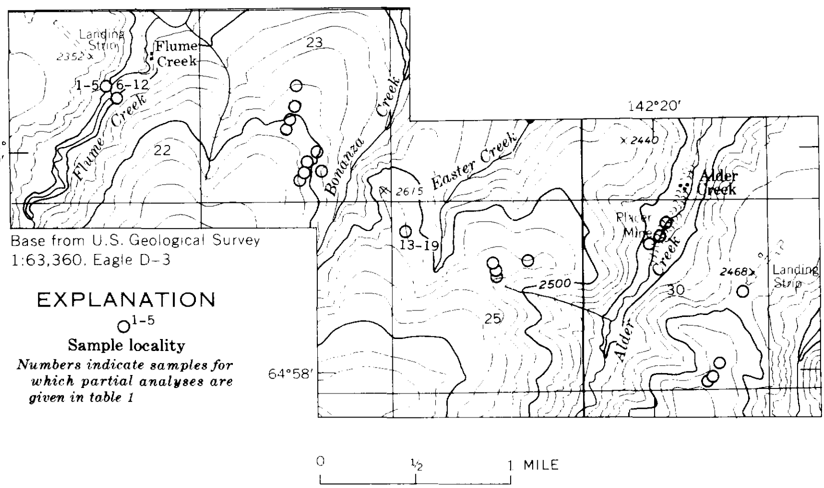


FIGURE 3.—Rock and soil sample localities in the Flume Creek–Alder Creek area.

TABLE 1.—*Partial analyses of selected samples from the Seventymile River area*

[Analyses, except gold, are semiquantitative spectrographic by K. J. Curry. Analyses for gold are atomic absorption by A. L. Meier, W. R. Vaughn, and R. L. Miller. Results are in parts per million. Limit of determination given in parentheses in boxhead below element symbol. N, not detected; L, detected but below limit of determination]

Sample No.	Description	Au (0.02)	Ag (0.5)	Mo (5.0)	Cu (5.0)	Pb (10.0)	Zn (200.0)	As (200.0)	Ni (5.0)	Cr (5.0)
	Flume Creek silica-carbonate zone									
1	Garnierite (?)-stained silica-carbonate rock	0.2	L	N	50	10	L	700	1,500	1,500
2	Limonite-stained silica-carbonate rock	.9	L	N	15	L	L	7,000	50	50
3	Limonite, garnierite (?)-stained silica-carbonate rock	.4	0.5	N	15	10	N	1,500	1,000	1,500
4	Quartz vein	.4	L	N	100	10	N	700	150	50
5	Serpentinite from a few inches above silica-carbonate zone	N	L	N	30	L	N	N	>5,000	5,000
	Flume Creek adit									
6	Quartz vein about 3–7 inches wide	2.3	N	N	50	L	N	>10,000	50	100
7	Silicified diorite above quartz vein	.3	N	N	70	15	N	1,500	150	700
8	Quartz vein about 2–5 inches wide	.7	N	N	50	10	N	N	50	150
9	Silicified zone below quartz vein	N	N	N	100	L	N	N	300	2,000
10	Quartz vein from outcrop above adit	6.0	N	N	15	L	N	>10,000	10	L
11	Quartz vein material from dump	6.0	L	N	20	L	L	>10,000	10	7
12	Altered diorite host rock from outcrop near adit	N	N	N	70	10	N	N	70	70

	Bonanza Creek prospect									
13	Channel sample, 7 feet, mixed weathered bedrock and colluvium	.1	N	N	30	L	L	L	1,500	1,500
14	Channel sample, 7 feet, soil and colluvium containing serpentinite and silica-carbonate rock	7.0	L	N	100	L	L	500	3,000	5,000
15	Channel sample, 6 feet, serpentinized fine-grained intrusive (diorite?)	.2	L	N	50	100	N	N	70	150
16	Channel sample, 7 feet, same rock type as sample 15	N	N	N	1.5	30	N	N	5	30
17	Channel sample, 6 feet, silica carbonate rock at contact between serpentinite and intrusive rock	.06	N	N	70	L	N	1,000	2,000	5,000
18	Channel sample, 5 feet, same rock type as sample 17	11.0	1.5	N	150	L	L	1,000	2,000	3,000
19	Silicified diorite(?) inclusion	.02	N	N	70	L	N	700	3,000	2,000
	Crooked Creek area									
----	Trachyte porphyry	N	L	5	100	300	L	N	L	10
----	Andesite	N	N	N	70	15	L	L	50	70

sericitized fragments of wallrock are included in the veins. Arsenopyrite occurs in some of the vein quartz, around the wallrock fragments included in the vein quartz, in euhedral crystals disseminated throughout the fragments, and in the silicified zone. Samples 6 to 12 (fig. 3) were taken near and in the adit; partial analyses of these samples are given in table 1. These analyses indicate that gold occurs in the quartz veins which cut the diorite and in the silicified zone above the veins.

Descriptions and partial analyses of rocks from outcrops and trenches on a small prospect between Bonanza Creek and Easter Creek are given in table 1 (samples 13 to 19). Mineralization occurs in a 60-foot-wide limonite-stained contact zone between serpentinite and a fine-grained mafic intrusive rock. Siliceous and calcareous veinlets cut both the serpentinite and the intrusive rock. The highest gold contents in the samples are 11 ppm (parts per million) in a channel sample of the silica-carbonate rock (sample 18) and 7 ppm in a channel sample across the contact zone (sample 14).

The analyses suggest that lode gold in the Flume and Bonanza Creek area occurs in small amounts in quartz veins and silica-carbonate rock associated with serpentinized ultramafic bodies. The ultramafic bodies along the fault zone are discontinuous, and reconnaissance sampling along the fault zone to the southeast does not indicate a continuation of mineralization. The possibility of extension to the northwest was not checked.

A belt of discontinuous ultramafic masses in association with gold here along the Seventymile River has some similarity to a discontinuous belt of alpine-type serpentinite bodies that locally contain anomalous amounts of nickel, chromium, copper, and gold in the central Alaska Range described by Hawley, Clark, Herdrick, and Clark (1969). Also, silica-carbonate rocks which were derived from serpentinite contain small lode gold deposits in the Livengood district (Foster, 1968).

CROOKED CREEK AREA

The Crooked Creek area (area 2, fig. 1), one of the principal placer mining districts along the Seventymile River, differs from the other mineralized areas discussed because the bedrock consists of Tertiary and Tertiary(?) sedimentary rocks that are largely conglomerate. Gold is found in streams from Barney Creek to Fox Creek on the north side of the Seventymile River, and gold from Crooked Creek assays the highest of any from the Seventymile

River area—the mean fineness of three samples is 902 parts per thousand (Mertie, 1938, p. 197). The source of the gold is unknown, but fine gold has been panned in very small amounts from the conglomerate (Mertie, 1942, p. 249). Silver nuggets, galena, and hematite have also been recovered from sluice boxes (Mertie, 1938, p. 197; Barney Hansen, oral commun., 1968). Arsenic was detected in all stream-sediment samples from Crooked Creek and in about 55 percent of all the samples from tributaries entering the Seventymile River from the north. Zinc (200 to 500 ppm) was found in several stream-sediment samples from Fox Creek and Broken Neck Creek but in only one sample from Crooked Creek (fig. 7). Anomalous amounts of copper (fig. 6), barium, and boron ($>$ 150 ppm) occur with the zinc on Fox Creek. An anomalous amount of lead occurs with the zinc on Broken Neck Creek (fig. 7). Slightly anomalous amounts of chromium and nickel were found, particularly in Fox Creek sediments (fig. 8).

Trachyte porphyry and other dikes (partial analyses in table 1) cut the sedimentary rocks on Crooked Creek. Also, the Tintina fault zone is inferred to lie beneath the Crooked Creek area. Thus, there are several possible sources of gold and other economic minerals. For example, all or part of the gold may be derived from the Tertiary and Tertiary(?) sedimentary rocks; mineralization may be associated with the igneous dikes which cut the sedimentary rocks; or mineralization may be associated with the underlying Tintina fault zone and (or) younger faults. One or more of these sources may be involved, as well as sources such as Pleistocene terrace gravel. The source of the slightly anomalous chromium and nickel is unexplained because no relation to ultramafic rocks, such as was found south of the Seventymile River, is known.

AMERICAN CREEK AREA

Stream-sediment, soil, and bedrock sampling was carried on in the American Creek area (area 3, fig. 1) because mineralization is indicated by the occurrence of placer gold.

The high background concentrations of nickel and chromium in stream-sediment, rock, and soil samples from the northern and eastern parts of the area (fig. 4) are probably due to the greenschist and scattered small ultramafic masses in the area. One sample of ultramafic rock (sample 1, fig. 4) contains more than 5,000 ppm of both chromium and nickel, and another (sample 2, fig. 4) contains more than 5,000 ppm of chromium and 5,000 ppm of nickel.

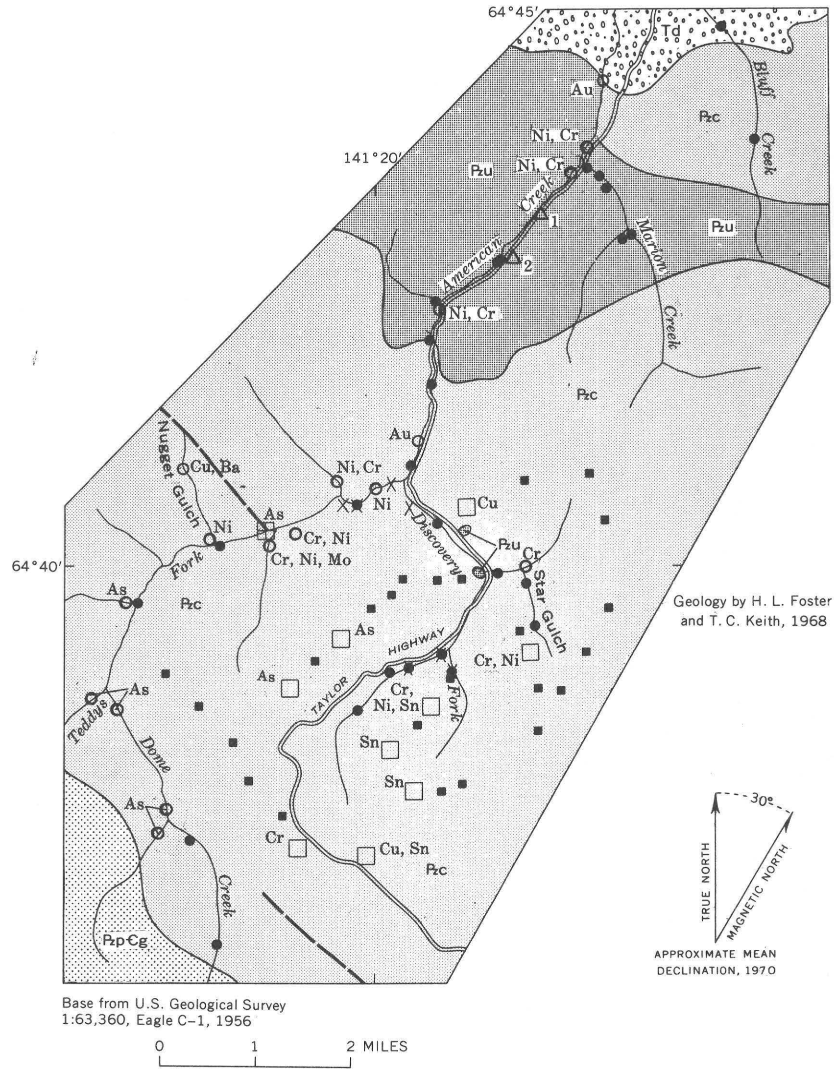


FIGURE 4.—Generalized geologic map showing sample localities in the American Creek area.

EXPLANATION

Detrital rocks
Conglomerate, sandstone, and shale

TERTIARY(?)

Pzu

Ultramafic rocks
Mostly serpentinized

PALEOZOIC(?)

Pzc

Chiefly greenschist, quartzite, and marble

PALEOZOIC

Pzp€g

Chiefly quartz-graphite schist

PRECAMBRIAN AND(OR) PALEOZOIC

Approximate contact

Probable fault

SAMPLE LOCALITIES

●
Stream-sediment sample; no anomalous amounts of selected elements

○
Stream-sediment sample, showing element(s) present in anomalous concentration

Au, gold (0.04–0.08 ppm);
As, arsenic (detected but less than 200 ppm);
Cu, copper (150 ppm);
Cr, chromium (500–1000 ppm);
Ni, nickel (200–1500 ppm);
Mo, molybdenum (5.0–7.0 ppm);
Sn, tin (detected to 15 ppm);
Ba, barium (5000 ppm)

■
Soil sample; no anomalous amounts of selected elements

□
Soil sample; one or more elements present in anomalous concentration. Symbols for elements given above

⊞
Series of five soil samples; four of the five contain detectable arsenic

Δ^1
Location of rock sample discussed in text

X
Location of panned concentrate sample; all samples contain gold

The arsenic, tin, and barium content of the samples shown in figure 4 cannot be directly related to normal bedrock content and may indicate mineralized localities. Four out of five soil samples taken across a probable fault (fig. 4) on Teddys Fork near Nugget Gulch contain detectable arsenic. Arsenic was also detected in other samples collected farther upstream on Teddys Fork, on Dome Creek, and in the ridge between Teddys Fork and Discovery Fork.

EAGLE BLUFF AREA

The Eagle Bluff area (area 4, fig. 1) was sampled because of its proximity to the Tintina fault zone and because mineralized rock has long been recognized there (Saunders, 1967). Eagle Bluff is dominantly greenstone on the south and east faces, and argillite crops out on the north (fig. 5). Several different rock types from Eagle Bluff were analyzed and found to contain locally high but sporadic concentrations of copper (7 to > 10,000 ppm), lead (<10 to 1,500 ppm), zinc (<200 to 1,500 ppm), cobalt (<5 to 2,000 ppm), silver (<5 to 1.5 ppm), and tin (<10 to 500 ppm). Silver is present in amounts of 0.7 to 3 ppm in two soil samples, and zinc is present in an amount of 700 ppm in one soil sample collected about 1.2 miles northwest of Eagle Bluff. Zinc (300 to 500 ppm), barium (>5,000 ppm), and (or) molybdenum (5 ppm) are present in anomalous amounts in four stream-sediment samples from Lost Creek (fig. 5). Anomalous values are very irregular in distribution, and not enough data are available to determine their significance.

ANOMALOUS SAMPLES FROM OTHER LOCALITIES

Malachite- and azurite(?)-stained chalcopyite-bearing quartz and carbonate vein material occurs in the Charley River A–4 quadrangle north of Fisher Creek (loc. 5, fig. 1). Small mineralized veins cut greenschist, greenstone, and thin carbonate layers. The vein material is estimated as less than 3 percent of the rock exposed. No other nearby localities were examined.

Other anomalous samples that are not related to known mineralized areas are from the Eagle D–2 and D–3 quadrangles. The localities of all stream-sediment samples from these quadrangles and the localities of samples having anomalous amounts of selected metals are given in figures 6 to 8. Localities of rock samples from the Eagle D–2 and D–3 quadrangles that have anomalous amounts of selected metals are shown in figure 9.

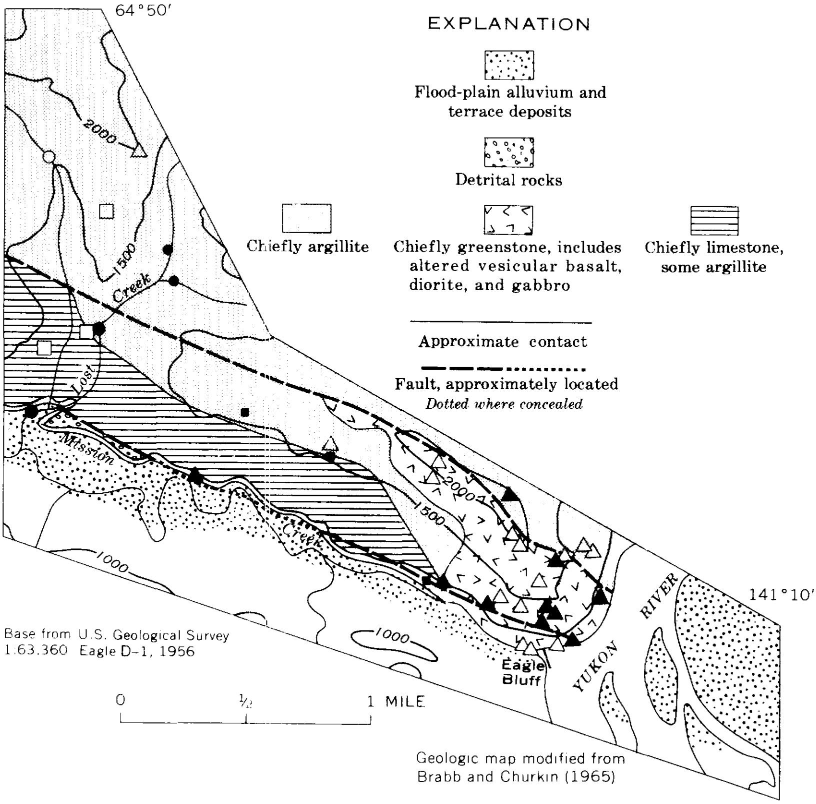


FIGURE 5.—Generalized geology and sample localities in the Eagle Bluff area. Triangles show rock sample localities; squares show soil sample localities; and circles show stream-sediment sample localities. Solid symbols indicate localities of samples that contain anomalous amounts of gold, silver, copper, lead, zinc, molybdenum, tin, or barium.

In the drainage area of Flume Creek, Alder Creek, and Deep Creek (area 6, fig. 1) upstream from the fault zone in the Flume Creek–Alder Creek area, anomalous amounts of several metals were found in some stream-sediment and rock samples (figs. 6 to 9). Stream-sediment samples from all three creeks contain anomalous amounts of chromium and nickel. Anomalous amounts of silver and molybdenum were found in two samples from Flume Creek; anomalous amounts of copper were found in two samples from Flume Creek and one from Alder Creek; and anomalous amounts of lead and zinc were found in one sample from Flume Creek.

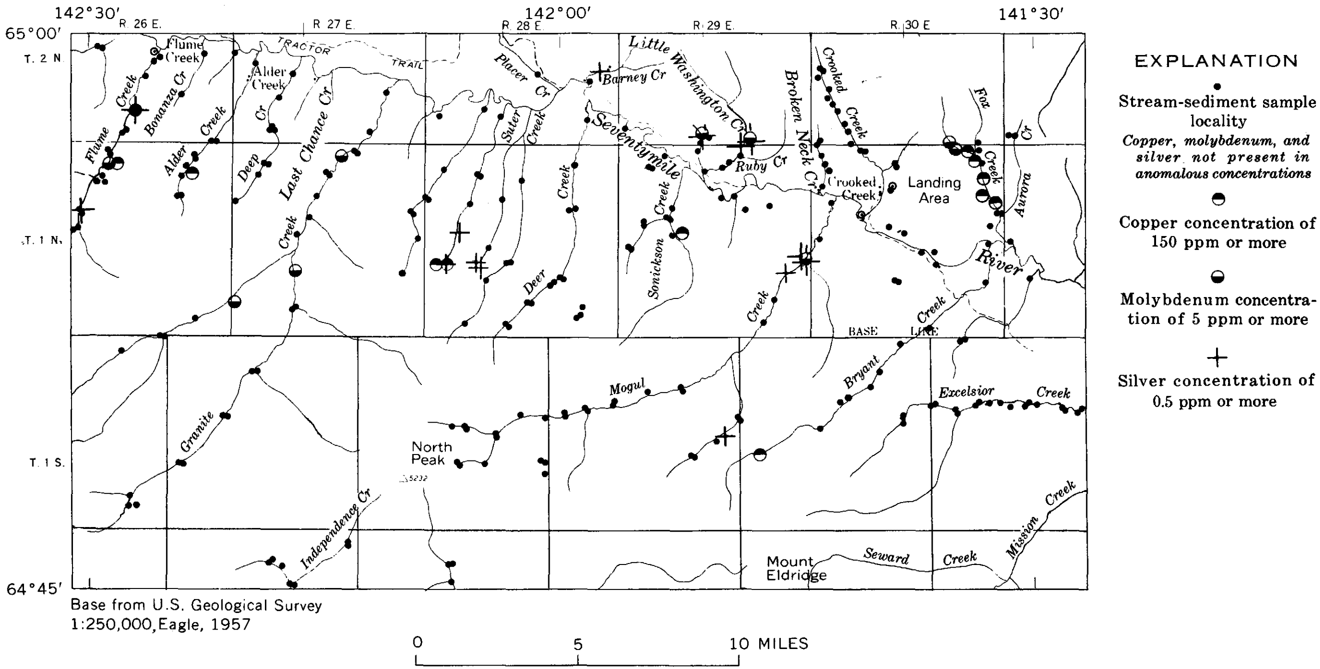


FIGURE 6.—Distribution of anomalous amounts of silver, molybdenum, and copper in stream-sediment samples from Eagle D–2 and D–3 quadrangles.

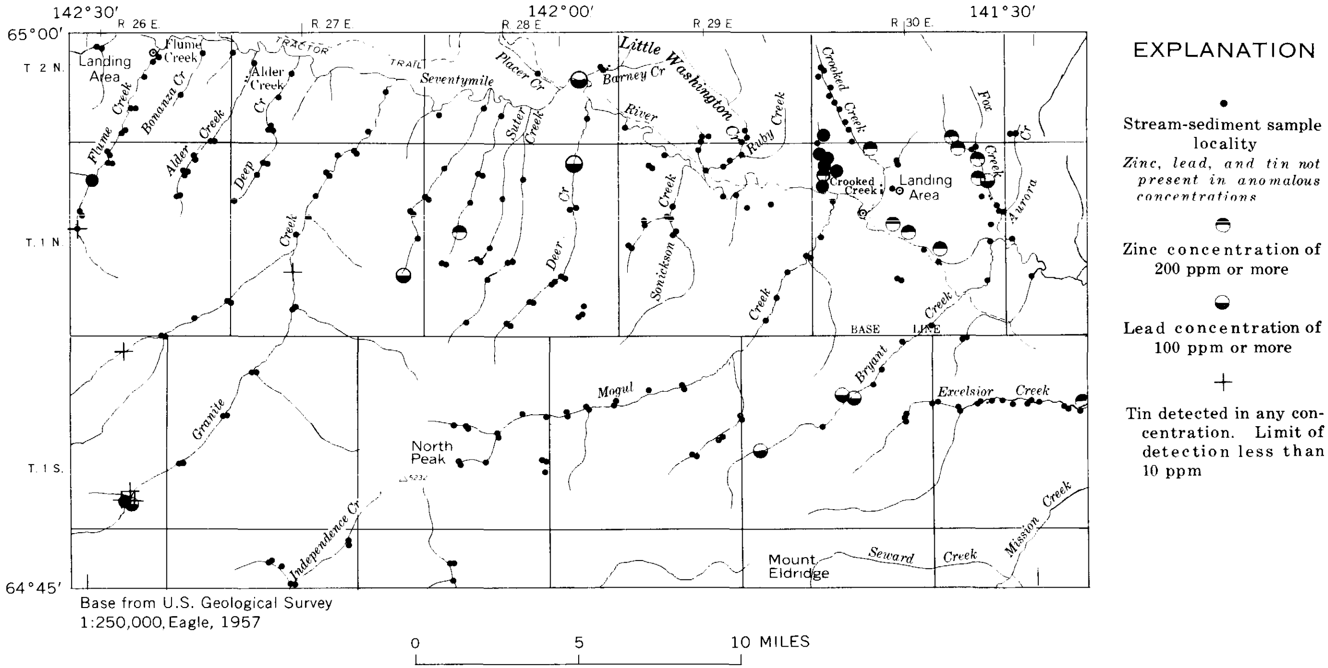


FIGURE 7.—Distribution of anomalous amounts of lead, zinc, and tin in stream-sediment samples from the Eagle D-2 and D-3 quadrangles.

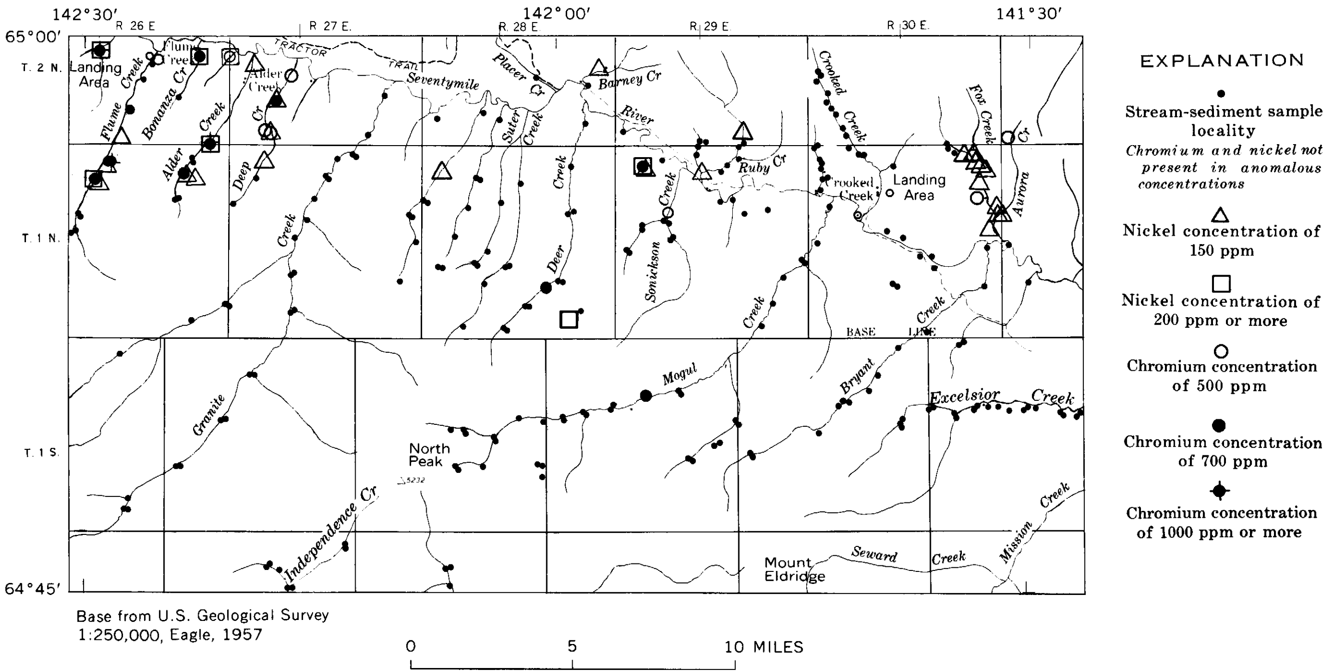


FIGURE 8.—Distribution of anomalous amounts of nickel and chromium in stream-sediment samples from the Eagle D-2 and D-3 quadrangles.

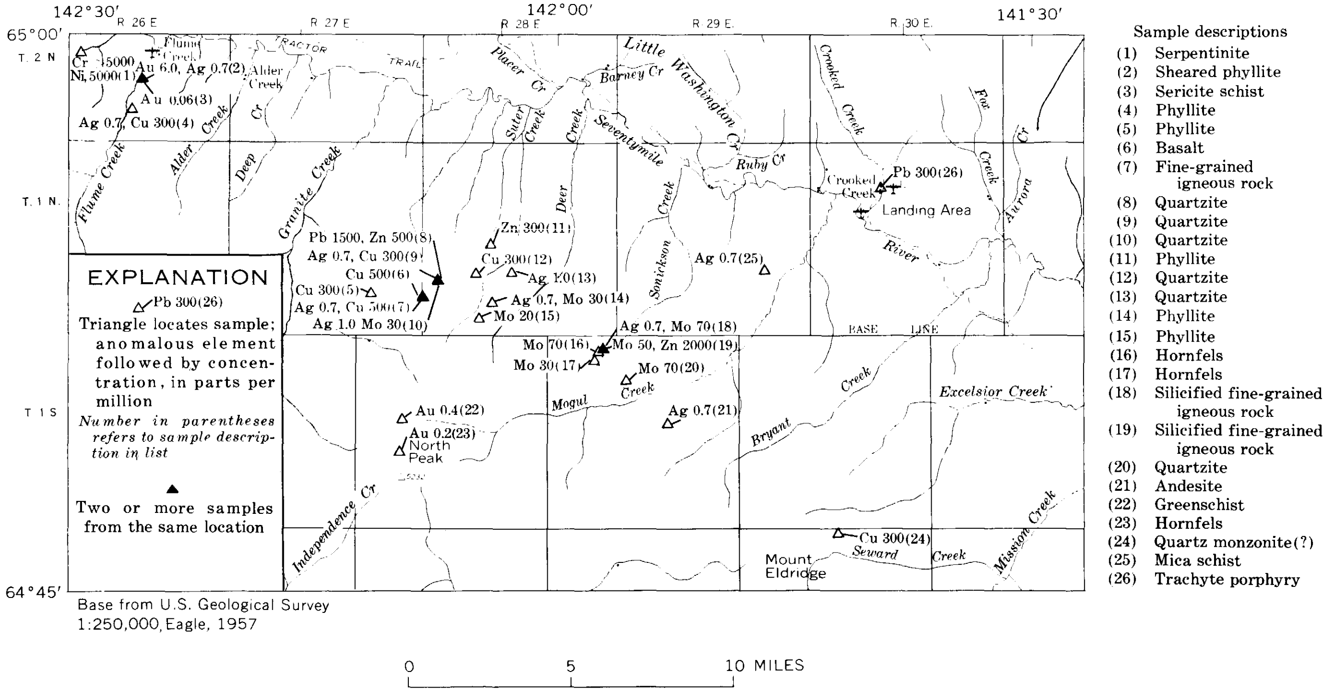


FIGURE 9.—Localities in the Eagle D-2 and D-3 quadrangles where rocks contain anomalous amounts of selected metals. Sample localities in the Flume Creek–Alder Creek area are omitted on this map and shown in figure 3.

Samples of sheared metamorphic rocks from a fault zone exposed near Flume Creek contain anomalous gold, silver, and copper (fig. 9). Greenstone and ultramafic rocks occur in the drainage basins and may be the source of the anomalous nickel, chromium, and copper in the stream-sediment samples.

Anomalous amounts of silver, molybdenum, copper, lead, and zinc were found in quartzite and phyllite near the headwaters of Suter, Deer, and Sonickson Creeks (area 7, fig. 1). Of 44 grab samples analyzed, 16 contain anomalous metals (fig. 9). Limonite-stained outcrops are common in the area, and specks of sulfide minerals are abundant in the stained rock. More than half of the stream-sediment samples from the headwaters of Suter Creek contain silver but in amounts less than 0.5 ppm. Four of the samples contain 0.5 ppm silver, and two contain 150 ppm copper (fig. 6).

Two rock samples collected near North Peak (loc. 8, fig. 1) contain gold (fig. 9).

A few rock samples from other undiscussed parts of the Eagle D–2 and D–3 quadrangles also contain anomalous amounts of metals. Likewise, single stream-sediment samples from several undiscussed places in these quadrangles (figs. 6, 7) contain anomalous amounts of one or more metals from an unknown source.

Most of the chromium and nickel anomalies (fig. 8) can be attributed to mapped mafic and ultramafic bodies. Some scattered chromium-nickel anomalies, especially in the Eagle D–2 and D–3 quadrangles, may indicate the presence of unmapped ultramafic rocks.

CONCLUSIONS

During geochemical reconnaissance in the Seventymile River area, no new mineral deposits were detected, although several anomalies were found in localities not previously known to be mineralized. These anomalies may be worthy of further investigation, particularly the chromium and nickel anomalies that may indicate unmapped ultramafic rock bodies.

Gold in the Flume Creek–Alder Creek area seems to be related to ultramafic rock in a fault zone, but studies of analyses of samples did not indicate an extension of mineralized rock to the southeast, and the possibility of extension to the northwest was not investigated. The significance of the zone is not fully understood and deserves further geologic study.

The origin of the placer gold and anomalous amounts of other metals in stream sediments on the north side of the Seventymile River seems to be different from the origin of the gold on the south side. The tributaries entering from the north drain an area of Tertiary and Tertiary(?) sedimentary rocks, which may be a source of the gold; however, all or part of the mineralization may be related to dikes and (or) faults which cut the sedimentary rocks.

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