STATE OF ALASKA

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GEOCHEMICAL REPORT NO. 19

Preliminary Geochemistry and Geology Little Falls Creek Area Talkeetna Mountains Quadrangle, Alaska

By

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March 1969

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PRELIMINARY GEOCHEMISTRY AND GEOLOGY OF THE LITTLE FALLS CREEK AREA TALKEETNA MOUNTAINS QUADRANGLE, ALASKA

By

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ABSTRACT

A northeast-trending group of metasedimentary and metavolcanic rocks cut in places by post-Cretaceous igneous rocks in the Talkeetna Mountains C-3, C-4, B-3, and B-4 quadrangles are associated with stream sediment copper anomalies and rock sample gold anomalies. These anomalies are mostly from three stream drainages which cut through a steeply dipping bed of pyritic phyllite. The phyllite is up to 1000 feet thick and is exposed in a number of places for at least six miles as a limonite-stained linear belt. The following evidence discounts earlier suggestions that the pyritic phyllite is the source of copper in the stream sediments:

1) Samples that contain anomalous copper were collected on both sides of the phyllite.

2) Samples of phyllite collected throughout the area contain only small amounts of copper, but stream sediment samples from streams that cut the phyllite are anomalously high in copper. Thus the phyllite is not the source of the copper in the stream sediments.

3) Most of the leaching and oxidation products are limited to surface capping; the type of limonite in the capping indicates it is derived from pyrite alone.

Float containing copper-rich vein materials occurs in the area. Vein mineralization is probably the source of the anomalous copper in the sediments. No copper-bearing veins were found in place, but most of the area is covered by talus. All of the rock types sampled along Ocher Creek contain anomalous amounts of gold. None of the gold anomalies noted reach commercial quantities.

INTRODUCTION AND ACKNOWLEDGEMENT

Except for reconnaissance work along Iron Creek in 1917 by Capps (1919, p 197-205), very little geologic or geochemical work had been done in the Talkeetna Mountains until A. W. Rose did an aerial reconnaissance in 1965 (Rose, 1965). In 1966, Rose (1967) studied an area around Little Falls Creek in the upper Talkeetna River Valley. He reported anomalous concentrations of copper particularly interesting in streams draining an area of pyritic phyllite. In 1968, a Division of Mines and Geology field party returned to the area for eight days, from June 28 to July 7, to collect more geologic and geochemical data. This project is intended as the beginning of a long range study of all areas of possible commercial mineralization in the Talkeetna Mountains.

This report relies heavily on the work by Rose (1967), especially with regard to lithologic descriptions and geologic ages. The writer was assisted by Gardner Gillespie, who collected the stream sediment samples and was a great help in his geologic observations and suggestions. Access to the area was by light plane. Don Sheldon of Talkeetna Air Service transported the parties to and from the map area.

GENERAL GEOLOGY

GEOLOGIC SETTING

A northeast-trending belt of metasedimentary and metavolcanic rocks at least four miles wide, bounded on the northwest and southeast by granitic intrusive rocks, make up the general geologic setting of the area. Metamorphic rocks generally follow the regional northeast trend, but some units are not continuous across the entire area (fig 1). Capps (1919, p 197-205) describes metamorphic rocks on Iron Creek 20 miles to the southwest that are host rocks for copper deposits. The metamorphic rocks discussed in the Little Falls Creek area might belong to the same stratigraphic unit. They are possibly Lower Jurassic in age (Capps, 1940, p 74) and the granitic batholith is possibly Middle to Upper Jurassic in age (Capps, 1940, p 78). Small mafic intrusives in the area are possibly Tertiary in age (Capps, 1940, p 86).

The metasediments include phyllite, argillite, siltstone and subordinate limestone. The metavolcanic rocks are mainly greenstone and schistose greenstone. In some places the stratigraphic units are cut by dikes and irregular bodies of andesite, diabase, and related rocks. Dips in most places are steep, but the geologic structure is incompletely known because the top and bottom beds in the stratigraphic unit are uncertain. Only one fault is mapped (fig 1). Although others are indicated, the data are insufficient to map them or to determine their effects.

PETROLOGY

Metamorphic Rocks

Silicic schist and gneiss (Ss) -- Silicic schist, biotite schist, and schistose greenstone crop out adjacent to the intrusive rocks in the southeast section of the map area (fig 1). These rocks are mainly metamorphosed, locally porphyritic, volcanic units about 1500 feet thick.

Greenstone (Gs) -- Greenstone crops out in several places in the map area and is the thickest metamorphic rock exposed. Along Little Falls Creek the thickness is over 11,000 feet if the greenstone extends under the glacial alluvium in the valley. The fine grained rock ranges from poorly foliated material, parts of which display vesicul and amygdaloidal textures, to well foliated amphibolite. Some of the greenstone conta plagioclase porphyroblasts. In places the unit includes thin layers of chert or quart ite.

Phyllite (Ph) -- Phyllite forms a belt as much as 1000 feet thick and at least six mile long. In places pyrite constitutes as much as 10% of the rock volume. Pyrite is most abundant along foliation planes. Surface oxidation of the pyrite has given the rock a distinct brown to reddish-brown limonite capping, particularly obvious from the air. No other sulfide minerals were observed in the rock.

Jointing is most prominent in the metamorphic siltstone, argillites, and graywackes. The following photograph (fig 2) was taken on Ocher Creek at an elevation of about 3390 feet.

Figure 2 - Jointing Along Ocher Creek

Camera was pointing roughly N 29° W. Note cap and pick in lower left hand corner. The major jointing is as described above.

Minor folds are present in several places in the metamorphosed argillite, siltstone, and graywacke unit. An interesting relationship of barren quartz veinlets found in the greenstone unit along Ocher Creek is shown in Figure 3.

Metaargillite, metasiltstone, and metagraywacke (Ag) -- Slightly metamorphosed dark gray argillite and light gray siltstone and graywacke form a belt 1500 feet to 5000 feet thick. Much of the argillite exhibits slaty cleavage. These beds are cut by thin barren quartz veins in several places.

Crystalline limestone (Ls) -- Slabby, recrystallized limestone as much as 600 feet thick crops out within the main belt of argillite and related rocks. The limestone is cherty and contains beds of phyllite. The metamorphic grade of the limestone appears to be highest adjacent to intrusive gabbro (Gb). The limestone, where observed, does not show signs of mineralization.

Volcanic and Related Rocks

Andesite (A) -- Highly fractured andesite crops out in the northern part of the map area (fig 1) east of Nan Creek. In some places andesite is interlayered with argillite but the relationship is uncertain.

Basalt (B) -- Basalt crops out north of the andesite along the east side of Nan Creek. The basalt consists mainly of fine-grained actinolite, some plagioclase and accessory magnetite.

Diabase -- Fine-grained, dark gray diabase dikes and sills, too thin to show on the map, cut the phyllite on Ocher Creek and the greenstone near the greenstone-phyllite contact on Cy Creek. The rock contains abundant plagioclase; moderate amounts of chlorite, epidote, and biotite; minor quartz; and accessory magnetite that is in places altered to hematite.

Gabbro (G) -- Forms medium grained sills in some of the metasediments and shows as irregular masses in the basalt.

Granitic Rocks

Quartz diorite (Qd) -- Well foliated quartz diorite and granodiorite form the southeast margin of the mapped area and similar rocks crop out on the northwest corner of the area mapped. These rocks consist mainly of andesine, quartz, hornblende, biotite with subordinate orthoclase, muscovite, and accessory magnetite and sphene.

STRUCTURAL GEOLOGY

The one fault that is shown on the map (fig 1) trends N 25° West and dips from 50° to 60° SW. It cuts the argillite, greenstone, and phyllite on the northwest side of Little Falls Creek and probably extends past Little Falls Creek to the southeast. Slickensides in the fault plane at Ocher Creek plunge S 55 W at about 50° to 60° indicating movement that offset the argillite, greenstone, and phyllite.

The basalt, andesite, and gabbro units in the NE section of the mapped area appear to be cut off by a fault somewhere near Nan Creek to and roughly parallel to it.

Jointing throughout the map area seems random from the limited data collected. Joints of one system found along all three streams draining the phyllite area strike from N 15° W to N 30° W, and dip steeply to the NE. The complementary joints strike from N 12° W to N 25° W and dip from 50° SW to 37° SW.

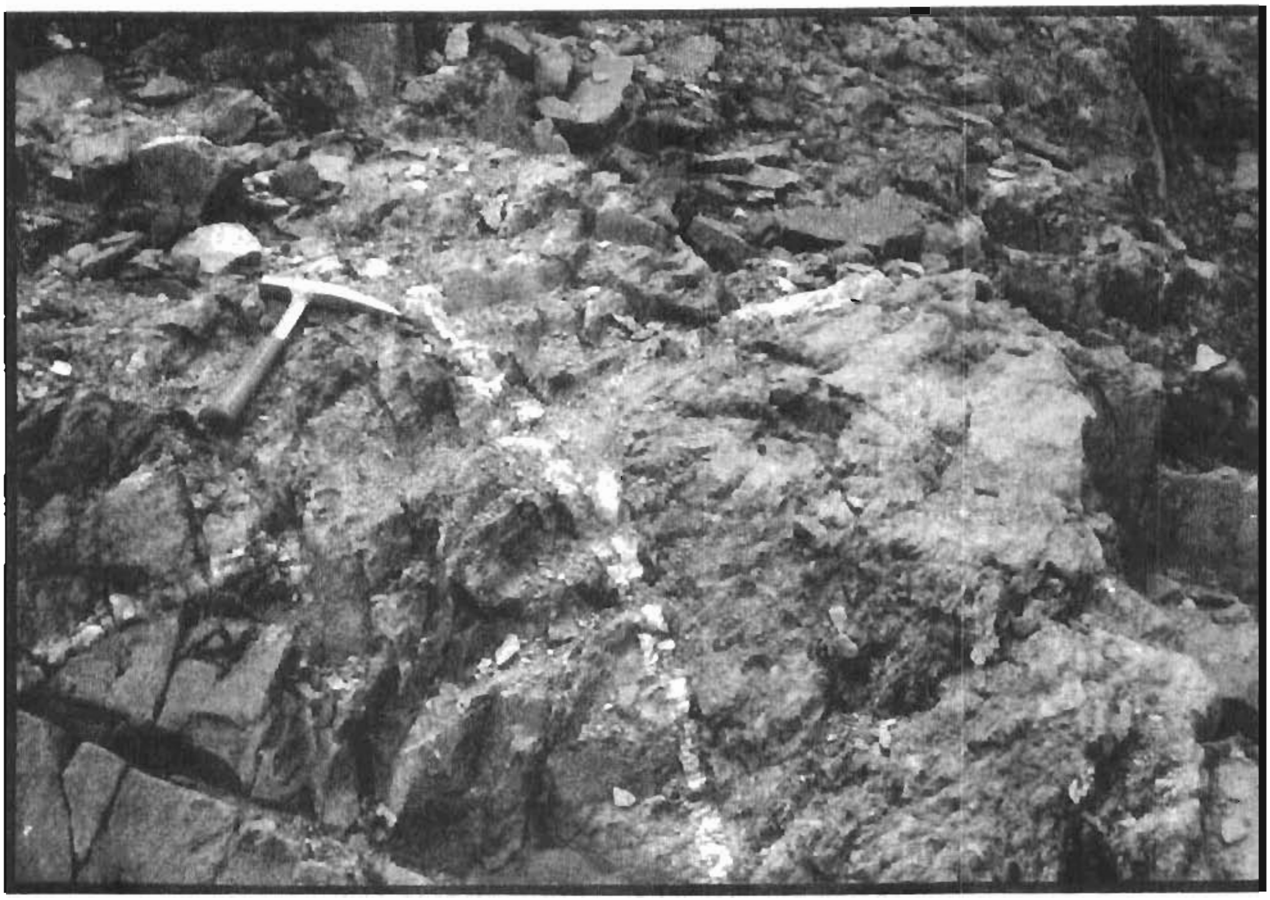

Figure 3 - Barren Quartz Veins

The veinlet going from lower left to upper right roughly parallels the greenstone bedding which at this point strikes N 70° E and dips 68° SE, toward the pick. The veinlet from upper left to lower center strikes N 20° W and dips 63° NE.

Similar barren quartz veinlets that cross at about right angles have been observed by the author in barren sections of the Morenci open pit copper mine in Arizona and the Berkeley Pit in Butte, Montana and have been reported in mineralized districts in New Mexico, Idaho, and South America. No information of the relationship of these veinlets with ore mineralization has been published as far as the author can determine. Furthermore, such veinlets were observed in a number of areas where no mineralization has been found.

GEOCHEMICAL INVESTIGATIONS

STREAM SEDIMENT GEOCHEMISTRY

The locations of all samples are shown on the map (fig 1). A total of 59 stream sediment samples have been collected in the Little Falls Creek area. Thirty-nine samples were collected by Rose (1967) in the general area (table 1). Twenty samples were collected for the author along the three major streams cutting the limonitic stained phyllite bed. These were analyzed by semiquantitative emission spectrographic methods (table 2).

Only two samples collected outside of the phyllite drainages showed anomalous metal concentrations. These stream sediment samples were collected by Rose (1967, p 5) and explained as follows:

> "Sample 14 is weakly anomalous in copper and has a relatively high nickel content. The sample was taken just below a zone of highly stained greenstone schist within the silicic schist unit. The weak anomaly combined with the relatively small size of the stained zone does not encourage further work.
>
> "A weak zinc anomaly in Sample 2 is outside the mapped area and cannot be evaluated."

Rose (1967) established that samples from streams draining the phyllite contain anomalous amounts of copper. The author's samples were analyzed by spectrographic methods, and as expected they contained higher than normal concentrations of copper because they were collected in an anomalous area. All of the samples from streams draining the phyllite are moderately to strongly anomalous in copper. This conclusion is based on a comparison to spectrographic analyses of stream sediment samples from a nearby area that contains only background copper values. In each of the three streams the highest copper anomalies recorded are immediately downstream from the greenstone-phyllite contact and in the very next sample upstream in the phyllite. However, no copper occurrences, either in veins or as disseminated copper mineralization in the rocks, were seen near the greenstone-phyllite contact. The samples highest in copper, up to 700 ppm, are from Cy Creek. The lowest copper samples, averaging 170 ppm, are from Nan Creek. Stream sediment samples high in barium, chromium, and nickel are found along Nan Creek. However, none of these elements in the concentrations recorded are unusual for the rock types in the area (Hawkes and Webb appendix, 1962).

The lower detection limit for gold by the emission spectrographic analytical method is 10 ppm which is unsatisfactory for trace element studies.

Table 1
Geochemical Data on Stream Sediments (Rose 1967)

Location Fig 1	Sample No.	Concentration (ppm)				
		Copper	Zinc	Lead	Molybdenum	Nickel
1	6N-323	90	85	10	2	30
2	6N-324	100	240	10	1	10
3	6N-325	85	65	5	2	35
4	6N-320	95	70	5	2	45
5	6N-319	50	80	5	2	10
6	6N-318	50	85	5	2	5
7	6N-317	65	105	5	4	15
8	6N-322	80	95	10	2	50
9	6N-321	90	85	10	1	35
10	6E-748	140	100	10	1	85
11	6E-749	190	115	10	4	85
12	6N-307	105	105	5	2	50
13	6E-756	90	80	-5	3	20
14	6E-751	190	70	5	1	180
15	6N-312	45	65	5	2	-5
16	6N-313	45	75	5	3	10
17	6N-316	35	70	5	1	40
18	6N-315	25	55	5	1	25
19	6N-314	30	50	5	2	30
20	6N-308	40	35	5	2	-5
21	6N-309	135	105	5	2	50
22	6N-310	120	130	5	3	30
23	6N-306	460	185	10	3	45
24	6N-311	90	100	5	4	30
25	6N-326	115	80	10	1	35
26	6E-729	420	170	10	2	25
27	6N-303	170	130	15	3	35
28	6N-304	140	95	10	2	80
29	6N-305	65	95	15	2	25
30	6E-762	60	85	20	1	20
31	6E-759	60	105	5	3	25
32	6E-758	40	80	5	2	40
33	6E-710	40	75	5	1	25
34	6N-300	35	80	5	1	15
35	6N-327	35	70	10	5	10
36	6N-302	65	75	5	2	10
37	6N-301	30	85	10	3	20
38	6N-329	105	90	10	3	
39	6N-328	55	70	5	4	10

Analyses done by Rocky Mountain Geochemical Laboratories, Salt Lake City, Utah. Copper, zinc, and nickel were analyzed by quantitative atomic absorption and Pb, Mo, were analyzed colorimetrically.

Table 2
Stream Sediment Samples 1968*

Parts Per Million

.ocation Fig 1	Field Sample Nos.	Cu	Zn	Pb	Mo	Ni	Co	Cr	B	Ba	Be	Ca	Fe	La	Mg	Mn	Sc	Sr	Ti	V	Y	Zr
1	G- 1	150	L	L	N	30	15	100	15	1000	N	2	7	L	3	700	20	200	.2	150	15	30
2	G- 2	200	L	L	L	50	50	150	20	300	L	1.5	7	20	2	700	30	300	.2	150	20	50
3	G- 3	300	200	10	L	50	70	100	20	300	L	1.5	7	20	2	700	30	150	.2	150	20	50
4	G- 4	300	L	L	L	50	50	150	15	300	N	1.5	10	L	3	1000	30	100	.3	150	10	20
5	G- 5	150	L	L	N	50	30	70	30	700	N	2	10	L	3	1000	30	150	.5	200	15	70
6	G- 6	300	L	L	L	30	50	100	10	200	N	1.5	7	L	3	1000	30	L	.3	150	20	30
7	G- 7	500	L	10	5	30	70	150	15	300	L	1.5	10	L	3	1500	30	100	.3	200	30	30
8	G- 8	300	200	L	L	30	50	100	15	300	N	2	10	L	3	700	30	100	.3	200	20	30
9	G- 9	500	300	10	5	50	70	150	15	300	L	1.5	10	L	3	2000	30	L	.3	200	30	30
10	G-10	300	L	L	L	30	50	150	10	200	N	3	10	L	3	1500	30	150	.3	300	20	30
11	G-11	300	L	L	5	30	50	150	15	300	L	2	10	L	3	1000	30	300	.3	200	30	30
13	G-13	150	L	L	L	70	30	200	30	700	N	2	10	L	2	700	20	300	.5	150	30	50
14	G-14	150	L	10	5	100	30	300	30	700	L	3	15	20	3	1000	30	300	.7	300	30	100
15	G-15	200	L	10	L	150	70	300	20	700	N	3	15	L	3	1500	30	150	.7	300	30	70
16	G-16	200	L	10	L	150	30	300	30	700	N	2	10	L	3	1500	30	100	.7	300	15	150
17	G-17	150	L	L	L	150	30	300	30	700	N	2	15	L	3	2000	30	100	.7	200	30	150
18	G-18	700	L	L	L	70	150	100	10	200	N	1.5	10	N	3	3000	20	L	.3	150	30	30
19	G-19	300	L	10	L	50	50	150	15	300	N	2	15	N	3	1500	30	L	.3	300	30	30
20	G-20	700	L	L	L	70	70	150	30	300	N	1.5	15	N	3	2000	30	L	.3	300	15	30
21	G-21	500	L	10	5	70	100	70	20	700	N	1.5	20	N	3	2000	50	L	.5	300	30	30

Bismuth, cadmium, tungsten, tin, niobium, gold, silver, and arsenic were analyzed for but not detected. To determine limits of detection refer to Table 3.

Cu - Copper Mo - Molybdenum Cr - Chromium Be - Beryllium La - Lanthanum Sc - Scandium Ti - Titanium Y - Yttrium
Zn - Zinc Ni - Nickel B - Boron Ca - Calcium Mg - Magnesium Sr - Strontium V - Vanadium Zr - Zircon
Pb - Lead Co - Cobalt Ba - Barium Fe - Iron Mn - Manganese

N = Not detected
L = Present, but below determination limit (see Table 3)

* Semiquantitative Spectrographic Analyses by U. S. Geologic Survey Laboratory, Anchorage

Table 3
Semiquantitative Emission Spectrographic Analyses
Intervals of Estimate and Detection Limit

Parts Per Million

Cu	Zn	Pb	Mo	Ni	Co	Cr	B	Ba	Be
20,000	10,000	20,000	2,000	5,000	2,000	5,000	2,000	5,000	1,000
10,000	5,000	10,000	1,000	2,000	1,000	2,000	1,000	2,000	500
5,000	2,000	5,000	500	1,000	500	1,000	500	1,000	200
2,000	1,000	2,000	200	500	200	500	200	500	100
1,000	500	1,000	100	100	100	200	100	200	50
500	200	500	50	50	50	100	50	100	20
200	L	200	20	20	20	50	20	50	10
100		100	10	10	10	20	10	20	5
50		50	5	5	5	10	L	L	2
20		20	L	L	L	5			1
10		10				L			L
5		L							
2									
L									

Parts Per Million

Ca	Fe	La	Mg	Mn	Sc	Sr	Ti	V	Y	Zr
20	20	1,000	10	5,000	100	5,000	1	10,000	200	1,000
10	10	500	5	2,000	50	2,000	0.5	5,000	100	500
5	5	200	2	1,000	20	1,000	0.2	1,000	50	200
2	2	100	1	500	10	500	0.1	500	20	100
1	1	50	0.5	200	5	200	0.05	200	10	50
0.5	0.5	20	0.2	100	L	100	0.02	100	5	20
0.2	0.2	L	0.1	50		50	0.01	50	L	10
0.1	0.1		0.05	20		L	0.005	20		L
0.05	0.05		0.02	L			0.002	10		
L	L		L				0.001	L		
							L			

' = Present, but below determination limit

ROCK SAMPLE GEOCHEMISTRY

Samples of rock types in particular areas were collected by taking a number of chip samples or grab samples across the areas outlined in Figure 4. Results of the atomic absorption quantitative analyses of these samples are tabulated on Table 4. With the exception of two highly mineralized float samples tested (3, 7A), copper content of the rocks seems too low to have caused the stream sediment anomalies. Few rock exposures in place are available for sampling since most of the area is covered by talus. Consequently many samples were collected on talus slopes which covered the lithologic contacts.

There are no angular edges or corners on the quartz vein float (sample 3) found on Nan Creek. This indicates that the material had traveled some distance. The greenstone inclusions in the quartz showed that it came from the metamorphic zone. The mineralized fault gouge material found on Cy Creek (sample 7A) being very soft, could not have been transported far. These two samples indicate that the mineralized area extends beyond the phyllite bed in both directions.

All of the rock types sampled showed anomalous gold concentrations in one location or another. Gold concentrations of over 0.10 ppm are considered anomalous for even the highest normal gold-containing rocks, the ultramafics (Hawkes and Webb, appendix, 1962). With insufficient data to calculate gold anomalies for the various rock types in the area, only concentrations of gold over 0.10 ppm are considered anomalous. Using this criteria, there are nine anomalous samples which average 0.36 ppm. Six of the anomalous samples were collected in the Ocher Creek drainage, and their analyses averaged 0.45 ppm gold.

TABLE 4
Geochemical Data on Rock Samples
Parts Per Million

Locations Fig 4	Field Sample Nos.	Rock Type	Gold	Silver	Copper	Lead	Zinc	Area
1	7-1-2-4	Phyllite, leached	0.02	1	20	4	20	Nan Creek
2	7-1-5	Argillite	0.02	1	50	20	60	" "
3	1-3	Quartz vn. w/pyrite & chalcopyrite. Greenstone inclusions	0.22	3.0	750	22	93	" "
4	4-16	Phyllite	0.02	1	68	12	44	Cy Creek
5	4-14	Pyritic phyllite	0.16	1.0	78	17	67	" "
6	4-9-12-13-15	Greenstone	0.02	1	56	15	49	" "
7	4-8-18	Iron stained phyllite	0.16	1	64	20	63	" "
7A	4G-9	Float - Fault gouge	0.02	1	1,600	-	-	" "
8	4-11	Greenstone	0.02	1	27	8	39	" "
9	4-19	Quartz vein-barren	0.02	1	19	4	ND	" "
10	6-7-8	Phyllite	0.02	1	27	12	93	Ocher Creek
11	H-I-11-13-14	Phyllite	0.14	1	27	10	35	" "
12	M-9-10	Quartz vein	0.44	1	77	20	5	" "
13	J-K-L-12	Greenstone (interbedded with the phyllite	1.26	9.5	84	45	104	" "
14	9-5-6-7	Quartz veins along stream	0.22	1	96	10	19	" "
15	14-D-5B	Phyllite	0.22	1	29	12	46	" "
16	9-13-8	Siltstone (argillite)	0.44	1	76	20	51	" "

Atomic Absorption Quantitative Analysis by Division of Mines and Geology Laboratory

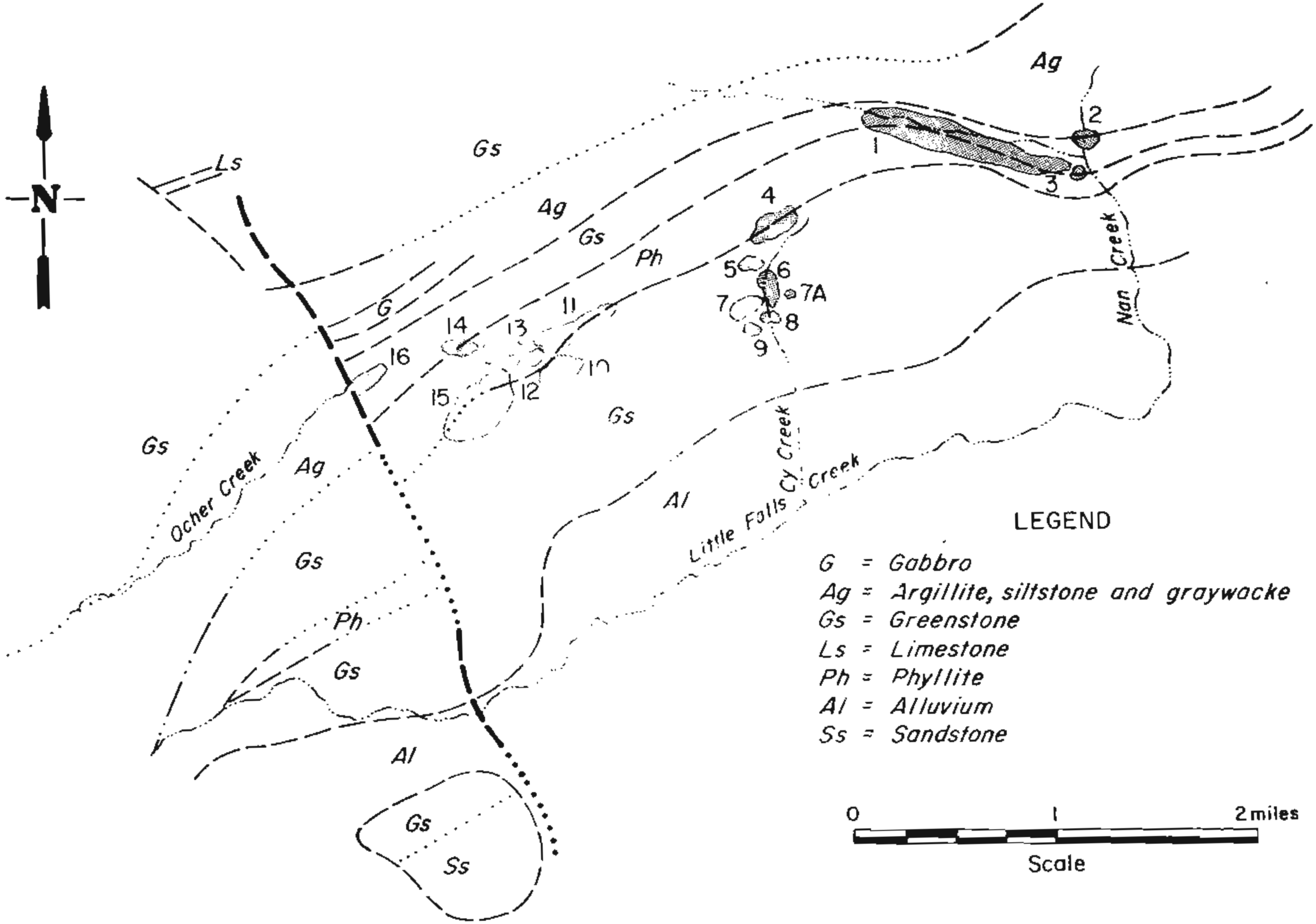

Figure 4

ROCK SAMPLE LOCATIONS

CAPPING INVESTIGATIONS

Parts of the pyritic phyllite show prominent limonite staining and are considered capping. Leaching of the pyrite is comparatively recent because this area was glaciated in late Pleistocene time. Earlier leaching and oxidation products would have been removed by the glaciers. In most places the phyllite is leached only on the surface and along cracks, with fresh surfaces showing no staining and unaltered pyrite. In a few places, where the pyrite parallels the bedding, leaching is more complete.

OCHER CREEK AREA

On the ridge near location 3 (fig 4), phyllite with two to three percent pyrite, is only slightly leached. Surface stain on the rocks examined in this area shows as smeary limonite crusts or very fine-grained botryoidal crusts. The same type of staining persists even in the more completely leached beds in this area, indicating pyrite only as the source for the limonite (Blanchard, 1968, p 115-121).

On the upper part of the southeast fork of Ocher Creek, much of the stained phyllite is similar to that described above. In addition, there are very fine-grained dark brown box works that show a cellular structure. In a very few places, a dark brown box works was observed in conjunction with the smeary limonite (fig 5).

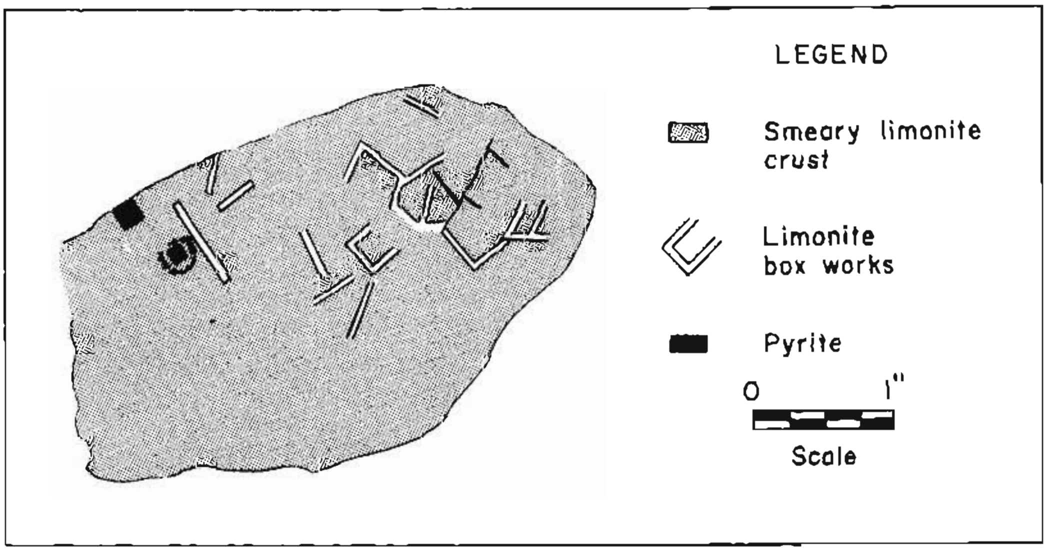

Figure 5

LIMONITE BOX WORKS

In this area several pieces of quartz vein float were observed, some of which showed minor green copper stains. Samples of this vein material were analyzed (fig 4, location 12) and showed an average of only 77 ppm copper which is only slightly above the rock sample average of 51 ppm.

Downstream from this area (southwest) in the greenstone, other quartz veins were observed in place, but here the quartz is completely barren of sulfide mineralization; it contains only minor accessory biotite and chlorite. The veins vary in thickness from 1/4 to 2 inches and are not continuous in length for more than a few tens of feet.

LITTLE FALLS CREEK, PHYLLITE EXPOSURE

In this location the phyllite narrows to about 250 feet, and the leaching and oxidation are limited to exposed surfaces and major cracks. The phyllite shows only minor pyrite, less than one percent. No copper stains or quartz veins were observed in this area. Limonite capping is of the smeary crust variety, probably derived from the pyrite (Blanchard, 1968, p 115-121).

NAN CREEK AREA

Capping, where first observed just upstream from the greenstone-phyllite contact, is limonite-stained on the surface and along cracks with fresh surfaces showing unaltered pyrite. On the west fork about 500 feet upstream from the major fork, pyrite in the phyllite is highly leached. The limonite observed here shows mostly as smeary crusts with minor botryoidal limonite. Farther up the west fork just below the contact with the greenstone, the limonite staining in phyllite, is limited to the surface and cracks. A few inch-thick beds are more completely altered. Capping is limited to the smeary crust and botryoidal types, indicating that pyrite alone was the source of iron (Blanchard, 1968, p 103, 118).

A piece of quartz float observed in this same area showed a limonite box works from 1/4 to 3/4 inch size in a rhombohedral pattern probably derived from siderite (Blanchar 1968, p 167, 168).

One large piece of quartz vein float along west fork of Nan Creek (fig 1, location 3) showed abundant pyrite, chalcopyrite, minor azurite, and limonite staining. The limonite staining is finely cellular, which is often typical of chalcopyrite (Blanchard, 1968, p 135).

On the east fork, limonite staining is absent except in a few narrow and only slightly stained areas. Because of this absence, stream sediment sampling was not continued up this fork.

CY CREEK AREA

All of the iron staining is either botryoidal or smeary crust, and no limonite box works were observed in the phyllite. Leaching seems to be somewhat more intense than in the other areas examined. The interbedded phyllite-greenstone section is more extensive in this drainage and in places the greenstone carries up to three percent pyrite.

None of the phyllite or greenstone rocks analyzed showed anomalous copper content. Quartz veins in the greenstone downstream from the greenstone-phyllite contact are up to 12 inches thick; all those observed are barren of sulfide mineralization.

CONCLUSIONS

Atomic absorption analyses of rock samples indicate that copper is not concentrated in either the greenstone or the phyllite (table 2) in sufficient quantity to account for the stream sediment anomalies (table 1). The copper concentrations in the stream sediment samples may be derived from epigenetic pyrite-chalcopyrite-quartz veins similar to the rocks seen as float in sample 3 (table 2) on Nan Creek. No veins of this nature were seen in place, but because so much of the area is covered by talus, odds are against veins being exposed. Highly mineralized fault gouge material, found as float along Cy Creek may also reflect the epigenetic source of copper mineralization Because the mineralization cuts through older metamorphic rocks or contains them as inclusions, an association between the mineralization and the post-Cretaceous igneous rocks is probable. Both stream sediment samples and rock samples indicate that copper mineralization extends northwest of the limonite stained phyllite. Sampling was not extended far enough to determine where the mineralized area ends.

Further geochemical and geologic work is needed in this entire region of the Talkeetna Mountains to:

1) Outline the extent of copper mineralization in the Little Falls Creek area and to determine targets for further exploration by prospectors.

2) Determine the extent and cause of the gold anomalies found in the geochemical rock samples in an effort to locate areas of possible economic concentrations of gold.

3) Evaluate possible extensions of mineralization along the metamorphic series of beds southwest of the Little Falls Creek area across the Talkeetna River toward Iron Creek.

SUGGESTIONS FOR PROSPECTORS

Stream sediment samples show that Cy Creek is the best area for more detailed copper exploration. In order to locate the expected hydrothermal sulfide veins buried in talus slopes, trenching or geophysical methods are required.

Rock sample geochemistry shows that Ocher Creek is a favorable area for further gold exploration. The gold is possibly associated with or included in the pyrite. Gold panning the stream sediments and assaying the heavy residuals could indicate economic gold possibilities in the area. Detailed rock sampling is necessary to determine if there are lode concentrations of possible economic interest.

REFERENCES CITED

Blanchard, Roland, 1968, Interpretation of leached outcrops: Nevada Bureau of Mines, Bulletin 66, University of Nevada, Reno, 196 p

Capps, S. R., 1940, Geology of the Alaska Railroad Region: U. S. Geological Survey, Bulletin 907, 201 p

Capps, S. R., 1919, Mineral resources of the western Talkeetna Mountains: U. S. Geological Survey, Bulletin 692-D, p 197-205

Hawkes, H. E.; Webb, J. S., 1962, Geochemistry in mineral exploration: New York, Harper & Row, 415 p

Rose, A. W., 1967, Geology of an area on the upper Talkeetna River, Talkeetna Mountains Quadrangle, Alaska: Alaska Division of Mines and Minerals, Geologic Report No. 32, 7 p

Rose, A. W., 1965, An aerial reconnaissance in the northern Talkeetna Mountains: Alaska Division of Mines and Minerals, Annual Report for 1965, p 57-59