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GEOLOGIC REPORT NO. 11

Geology of the Omilak-Otter Creek Area, Bendeleben Quadrangle, Seward Peninsula, Alaska

By

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ILLUSTRATIONS

GEOLOGY OF THE OMILAK-OTTER CREEK AREA,

BENDELEBEN QUADRANGLE, SEWARD PENINSULA, ALASKA

By

G. Herreid

SUMMARY

The map area extends across the northern part of the Darby Mountains on the Seward Peninsula from the west edge of the Darby batholith west to the Fish River Flats. The area is underlain by marble and schist which have been folded into north-northwesterly plunging folds that are overturned to the northeast. Granitic rocks intrude the schist in the eastern half of the map area. In the western part of the map area, lead-silver deposits present in marble are not associated with igneous rocks. Indications of tin mineralization are present in metamorphic rocks near the granite in the eastern part of the area. The field work was done from July 8 to July 31, 1964 by the author and Field Assistant Michael Mitchell.

METAMORPHISM

Metamorphism apparently accompanied folding. The rocks of the Caribou Creek syncline are of lower metamorphic grade than those in the adjacent Omilak and Jones Pup anticlines. The metamorphic grade is higher in the Omilak anticline along the eastern front of the Darby Range than in the Jones Pup anticline, even though the latter has been intruded by stocks of granitic rock and is nearer the granite batholith on the east side of the map area.

The regional metamorphism thus appears to be closely related to structure, but not to igneous intrusive rocks.

Contact metamorphism north of Jones Pup at map location M-2 is due to the proximity of the granite of the Darby batholith on Big Creek. In contrast to this, the contact metamorphism around the Omilak shaft is not associated with exposed igneous rock. It could be related to a buried intrusive or to the post-kinematic channeling of hydrothermal solutions by the moderate-sized plunging anticline in this locality. The association of higher grade regional metamorphism in the Omilak and Jones Pup anticlines may be due to a regional channeling of heat and fluids expelled during metamorphism.

The greenstone mapped by Smith and Eakin (1911, Figure 6) is metamorphic amphibolite located along the marble-schist contact in the core of the marble anticlinal body in which the Omilak shaft is located.

STRUCTURE

The map has been divided into three parts. For each of these areas the attitudes of crenulations, fold axes, foliation, and bedding planes have been plotted on lower hemisphere, equal area stereographic nets (see the geologic map). The mean fold axis in each of these areas falls within 13° of a 22° plunge trending N30W. This parallelism of fold axes indicates that the entire map area is a single structural domain in which cylindroidal folding is approximated. The folding includes not only the long recognized Omilak anticline, but also the Caribou Creek syncline and the less evident Jones Pup anticline.

The structural profile accompanying the map was constructed using the mean fold plunges in the different areas to project the geology onto a vertical section along line A-B-C on the geologic map. The structures can also be seen approximately in profile by viewing the map parallel to the plunge of the fold axes.

The interbanding of marble with schist and metagraywacke and of the schist with marble is an indication of a conformable contact between these units. Deformation by plastic flow appears to have greatly thickened and thinned the units and complicated the original structure. The marble of the Omilak fold appears to have migrated into a thick anticlinal crest leaving little or nothing at the limbs south of the map area. The pinching out of the schist along the northeast flank of the Omilak anticline (southeast of sample site 26) appears also to be due to tectonic thinning.

Crestal thickening has taken place on a smaller scale in the fold at the Omilak mine. A few hundred feet south of the crest the marble is 500 feet wide, but the limbs pinch out completely further south.

GEOCHEMISTRY

Sampling was done mainly of stream sediments (see Table 1). Wherever possible, these samples were taken of fine-grained nonorganic silt and mud below water level. In many places such samples were not obtainable, and samples with appreciable organic content were taken at or above water level. All samples were analyzed for copper, lead, and zinc content by the Division of Mines and Minerals or the Rocky Mountain Geochemical Laboratory, using extraction by bisulfate fusion or hot acid.

Strong lead-zinc stream sediment anomalies were found for about 1½ miles below the Omilak mine on Omilak Creek. The lack of anomalies, except for sample 50, on the North Fork of Omilak Creek indicates a probable lack of deposits as rich as the Omilak mine in that drainage. If a significant lead deposit were responsible for the isolated 350 ppm sample at #50, sample #49 would be expected to be high also.

Strong lead anomalies are present at #19, about 4 miles down Dry Creek from the Foster lead-silver prospect, and in all other stream sediment samples taken from Dry Creek above #19. These samples are not anomalous in zinc, although zinc soil anomalies are present adjacent to the ore showings in the area.

Sample 43 was taken on a narrow discontinuous gossan band in the float and is unlikely to be of any economic significance.

The stream sediment anomalies found in this investigation are below known deposits and would be expected to be stronger than anomalies associated with deposits that have not been opened up by trenching or shaft sinking. However, the strength of the anomalies suggests that stream sediment sampling would be effective in this area for 1-2 miles below any sizeable undiscovered or hidden deposits.

Several moderate tin anomalies were detected, mainly in the eastern portion of the map area. On Caribou Creek, samples 65 (10 ppm tin) and 70 (less than 6 ppm tin) were taken from eastern tributaries, while sample 68 (62 ppm tin) was taken from Caribou Creek itself. These anomalies indicate tin mineralization in the area, possibly associated with the intrusive at sample site 69. The eastern drainage of Caribou Creek was not traversed in detail. Other small intrusives could be present.

On Otter Creek, sample 74 (22 ppm tin) may be associated with the deposit which is the source of the placer tin at the Foster tin prospect.

Sample 81 (less than 6 ppm tin) may indicate anomalous concentrations of tin in the stream sediments along Big Creek. More sampling should be done in the area.

Sample 56 (56 ppm tin) was taken on the North Fork of Omilak Creek just below the Omilak mine. The lack of tin anomalies in other samples taken along this part of the creek suggests that no significant tin deposit is present in the area.

There is a complete lack of correlation of the contents of tin vs copper, lead, and zinc in the geochemical samples taken in the map area. None of the anomalous tin samples are anomalous in the other heavy metals.

This separation of the two types of mineralization is apparently genetic. With the exception of sample 56, tin anomalies are restricted to areas peripheral to granitic intrusives, whereas the copper, lead, and zinc anomalies occur in the Omilak anticlinal belt with no associated intrusives.

ORE DEPOSITS

The Omilak shaft lies near the crest of a subsidiary anticline on the western flank of the Omilak anticline. The outcrop of marble in the anticline is about 500 feet X 1500 feet and is shown on the geologic map. The anticline plunges 32 degrees in a N73W direction and is overturned to the northeast. The ore is probably related in origin to the contact metamorphism (hornblende hornfels facies) of the surrounding marble and schist. No sulfides are exposed in the vicinity of the shaft, which was full of ice when visited. Two stopes have been holed through to the surface. They are on one marble horizon and appear to have extended downward parallel to the plunge of the anticline. The marble around the ore zone is coarser-grained, with a more blocky fracture, than elsewhere in the area. Lead-zinc soil anomalies are present along the ore horizon southwest of the shaft (sample #37B-1, -2, and -3). The #37A line of soil samples across the anticline indicates that lead anomalies are present at a distance of a few hundred feet "below" the crest of the anticline. An inclined prospect shaft, now caved, lies roughly 350 feet south-southeast of the Omilak shaft. Adjacent to it is a dump of approximately 200 tons containing low grade stibnite ore, which has scattered 1-2 mm veinlets of stibnite and limonitized pyrite(?) cubes in yellowish stained granular (½ mm diameter) dolomite(?).

A few hundred feet southeast, an adit, now caved, was driven into the hill N25°W to strike the ore at depth. However, it apparently was driven from the wrong side of the mountain as the ore most probably plunges away from it. This work was done about 1924 by the Granby-Alaska Company.

Between 1880 and 1890 an estimated 300-400 tons of hand picked ore was shipped from the Omilak mine. Forty-one tons of galena shipped in 1889 ran 74.7% lead and 142.2 ounces per ton of silver (Smith and Eakin, 1911). Apparently no ore has been shipped since 1890. However, old newspapers and patent dates on machinery indicate that considerable work was done on the property as late as 1906-1907.

The Foster lead prospect on Dry Creek has been diamond drilled and mapped geologically by the U.S. Bureau of Mines.

"The Foster prospect comprises a zonally arranged lead-silver-bearing gossan deposit extending about 700 feet along a line of fracturing. The fracture system is on or near the axis of an anticline, generally strikes

N 20° to 40°W and has a nearly vertical dip. The gossan material is principally limonite and goethite with some cerussite and less anglesite. The only recognizable primary mineral occurs as nodules of galena which are most abundant on the outcrop in the Foster pit, but are also scattered in the overburden for a few hundred feet to the north and south.

"The outcrop, exposed in the Foster pit, is about 12 ft. wide and 90 ft. long with poorly defined, irregular borders except where it is terminated abruptly to the northwest by hard, moderately bleached meta-limestone. The southeast end is buried under a deep cover of overburden. Near the surface the outcrop resembles massive galena owing to residual concentration of galena nodules. The nodules range in size from less than an inch to about 2 feet in diameter and occur encased in oxidation products and imbedded in a matrix of ice, clay, and earthy oxides. The pit was excavated to a depth of about 20 feet without encountering much change except that the galena nodules were less abundant in the bottom than nearer the surface. The depth and degree of residual concentration are uncertain. No nodules large enough to core were encountered in the drill holes, but a few recognizable fragments of galena were recovered in the sludge samples. Silver runs 0.2-0.4 ounces per ton per each 1 percent lead.

"The effects of intense weathering made it impossible to determine definitely the nature of the primary deposits.........

" Weathering and leaching effects similar in nature and intensity to those on the surface, extend to depths in excess of 400 feet -- the practical depth-limit of the drilling equipment." (Mulligan, 1962).

A line of geochemical soil samples taken across the strike of the ore zone, 230 feet south of the pit (#9 on geologic map), indicates a bedrock dispersion halo of lead-zinc that extends 200 feet uphill from the deposit (samples 9, 9-1, 9-2). High values extending downhill from the deposit (9-4, 9-5, 9-6) may be due to secondary surficial movement of material from the vein. Sample 7 was taken 500 feet south of the pit and uphill from the projection of the vein. The high values of lead and zinc likewise indicate the presence of a primary dispersion halo.

At the Foster tin prospect on Otter Creek a number of bulldozer cuts in the creek alluvium yielded placer tin. Few bedrock exposures are present and none with mineralized rock were seen.

The caved shaft of an old gold prospect is present next to the remains of 2 log cabins 3000 feet south of the Foster tin prospect. The shaft was an estimated 20 feet deep in quartz-mica schist which contains much less than 1% sulfides along tiny crosscutting quartz veins. Grab samples were taken of quartz-bearing and quartz-poor schist from the dump.

	Gold Oz/T	Silver Oz/T	Value $/T
Quartz-bearing	0.03	Tr	$1.05
Quartz-poor	0.01	0.27	0.71

CONCLUSIONS AND SUGGESTIONS FOR PROSPECTING

The lead-silver deposits are located in marble on the Omilak anticline. The rocks of the Omilak anticline have been metamorphosed to a higher grade than those in the adjacent Caribou Creek anticline. The association of ore with anticlinal structure and higher grade metamorphism is repeated on a smaller scale at the Omilak mine, where contact metamorphism is present around the deposit. This regional and local association of high temperature, as evidenced by higher grade metamorphism, and ore in anticlinal areas, is probably genetic and should be investigated further over a wider area.

Areas underlain by marble in the anticlinal belt along the western part of the Darby range have a better-than-average potential for lead-silver deposits. Such areas are readily identifiable from the air or on air photos. Stream sediment geochemical surveys at one-mile intervals on the drainages should give indications of deposits of significant size and grade.

The tin placer prospect on Otter Creek and the localized tin stream sediment anomalies on Otter Creek, Caribou Creek and a western tributary to Big Creek indicate that tin deposits are present in this part of the area near granite intrusives. The west edge of the Darby batholith extends for many miles in a southerly direction from its location on Big Creek in the map area, and it is reasonable to suppose that undiscovered tin mineralization may occur in the metamorphic rocks along this contact. Stream sediment goechemical sampling for tin would be the most effective means of prospecting this belt.

REFERENCES

Mulligan, J.H., 1962, Lead-silver deposits in the Omilak area, Seward Peninsula, Alaska: U.S. Bureau of Mines Report of Investigations 6018, p. 1-44.

Smith, P.S. and Eakin, H.M., 1911, A geologic reconnaissance in Southeastern Seward Peninsula and the Norton Bay-Nulato Region, Alaska: U.S. Geological Survey Bulletin 448, p. 1-146.

ANALYSES OF GEOCHEMICAL SAMPLES

Sample No.	Copper (ppm)	Lead (ppm)	Zinc (ppm)	Tin (ppm)	Soil	Dry Creek	Creek Sediment	Remarks
1	5	15	25			X		
							X	
2	10	5	40				X	North Fork - drains area north of #2
3	15	55	110		X			Brown marble soil
4	20	100	210		X			Limonite cubes in folded marble
5	10	15	25		X			Marble soil (light brown)
6	20	130	170			X		800' up Dry Creek from Foster lead pros. pit
7	50	750	1600			X		Creek about 500' SE of Foster prospect elevation 1500'.
8	35	600	500			X		Creek about 500' SE of Foster prospect elevation 1300'.
9	15	150	140		X			On strike with the Foster lead vein, 230' S of pit.
9-1	15	250	300		X			60' N50E of 9
9-2	25	110	150		X			170' N50E of 9
9-3	10	30	85		X			260' N50E of 9
9-4	20	600	3500		X			30' S50W of 9
9-5	20	100	1400		X			70' S50W of 9
9-6	15	550	450		X			90' S50W of 9
10	20	150	230				X	
11	15	1500	1400				X	Dry creek 500' downstream from Foster prospect
12	10	55	60			X		Float - 99% marble, 1% greenstone.
13	10	200	140			X		Float - marble
14	10	10	30			X		Float - marble
15	5	15	30			X		Float - marble
16	10	15	40			X		Float - 99% marble, 1% green stone
17	10	200	115			X		1 piece limonite float about every 10' in creek bed
18	5	60	60			X		Small northern trib. to Dry Creek
19	15	300	120				X	Stream float 80% schist, 20% marble

Sample No.	Copper (ppm)	Lead (ppm)	Zinc (ppm)	Tin (ppm)	Soil	Dry Creek	Creek Sediment	Remarks
20	25	15	60			X		Stream float 50% schist, 50% marble
21	15	10	50				X	Stream float 60% schist, 40% marble
22	40		30	-*		X		Stream float 80% schist, 20 % meta-graywacke and marble
23	50	75	80	-		X		Stream float 80% schist, 20% meta-graywacke
24	60	175	420	-			X	Stream float schist and metagray-wacke
25	30	30	40	-		X		Stream float 75% schist, 25% marble
26	30	110	105	-			X	
27	15	115	30	-		X		Stream float marble
28		150	30	-		X		Stream float 90% marble, 10% meta-graywacke
29	10	50	30	-		X		Stream float 95% marble, 5% meta-graywacke
30	15	65	30	-	X			Pit on south limit of Omilak Creek
31	10	10	30	-		X		Stream float 45% schist, 45% marble, 10% greenstone, etc.
32	15	45	45	-			X	Stream float 75% schist, 20% marble, 5% greenstone, etc.
33	15	45	40	-			X	Stream float 75% schist, 20% marble, 5% greenstone, etc.
34	10	15	30	-			X	Stream float 75% schist, 20% marble, 5% greenstone, etc.
35	15	25	70	-			X	
36	50	25	120	-	X			Moderately limonitized schist near pit
37-5	65	+1000	+1000		X			Limonite stained soil about 150' S of 37A, taken from edge of open cut 50' S of caved prospect shaft
37	65	15	140		X			Brown schist rubble
37A	15	55	70		X			In marble 10' from schist contact
37A-1	20	100	135		X			100' S60W from 37A diopside - tremolite present in marble

Sample No.	Copper (ppm)	Lead (ppm)	Zinc (ppm)	Tin (ppm)	Soil	Dry creek	Creek Sediment	Remarks
37A-2	20	200	145		X			200' S60W from 37A
37A-3	25	100	250		X			300' S60W from 37A
37A-4	25	35	105		X			400' S60W from 37A
37B	35	125	135		X			Barren schist about 350' SW of Omilak vert. shaft
37B-1	15	850	400		X			On approx. ore horizon about 150' SW of Omilak shaft. Large white diopside crystals in marble.
37B-2	15	600	250		X			100' SSW of 37B-1
37B-3	15	50	125		X			200' SSW of 37B-1
38	15	40	105	-			X	Stream float - limestone, schist, some vein quartz.
39	15	+1000	170	-			X	Stream float - limestone, schist, some vein quartz.
40	20	200	275	-			X	Stream float - limestone, schist, some vein quartz.
41	15	300	105	-			X	Stream float - limestone, schist, some vein quartz.
42	30	100	40	-			X	Stream float - mostly schist
43	70	1100	3000		X			Linear gossan zone
44	40	20	140			X		Stream float - 95% black slate.
45	40	120	220			X		Stream float - marble, greenstone, black slate, schist.
46	40	60	140			X		Stream float - greenstone, black slate.
47	55	20	130				X	Stream float - greenstone, marble schist, black slate.
48	40	60	110				X	Stream float - 80% schist, 20% greenstone, black slate, marble.
49	35	45	140				X	Stream float - 95% schist, 5% greenstone
50	55	350	400			X		Stream float - 95% schist, 5% green-stone.
51	60	25	150			X		Stream float - 95% schist, 5%' greenstone
52	30	15	125			X		Stream float - schist

Sample No.	Copper (ppm)	Lead (ppm)	Zinc (ppm)	Tin (ppm)	Soil	Dry Creek	Creek Sediment	Remarks
53	15	20	105				X	Stream float - schist
54	35	30	135				X	Stream float - schist
55	15	5	80	-			X	Stream float - mainly schist
56	15	0	35	56			X	Stream float - mainly schist
57	20	10	45	-			X	Stream float - mainly schist
58	15	10	40	-			X	Stream float - mainly schist
59	20	10	70	-			X	Stream float - 99% schist, 1% marble, eastern trib.
60	25	15	90	-		X		Stream float - 49% marble, 49% schist, 2% black slate
61	50	15	130	-		X		Stream float - 80% schist, 15% marble, 5% black slate, western trib.
62	35	20	105	-		X		Stream float - 80% schist, 20% marble
63	45	20	110	-		X		Stream float - 50% schist, 50% marble
64	20	10	90	-		X		Stream float - 75% schist, 15% marble, 10% black slate, western trib.
65	15	15	90	10			X	Stream float - 99% schist, eastern trib.
66	15	15	70				X	Stream float - 85% schist, 10% marble, 5% black slate.
67	15	15	75	-			X	Stream float - schist, marble, western trib.
68	20	10	70	62			X	Stream float - 90% schist, 5% marble, 5% black slate.
69	20	10	70	-			X	Stream float - 90% schist & granite, 5% marble, 5% black slate.
70	30	25	120	<6		X		Stream float - 99% schist, eastern trib.
71	15	10	85	-			X	Stream float - 90% schist and granite, 5% marble, 5% bl slate.
72	25	25	115	-		X		Stream float - 95% schist, 3% marble, 2% black slate. Western trib

Sample No.	Copper (ppm)	Lead (ppm)	Zinc (ppm)	Tin (ppm)	Soil	Dry Creek	Creek Sediment	Remarks
73	25	30	85	-		X		Stream float - 99% schist.
74	20	60	95	22		X		Stream float - 99% schist.
75	50	75	120	-		X		Stream float - schist & marble.
76	20	40	95				X	Stream float - schistose marble & limy schist scheelite(?) panned. 200' up stream from cabin
77	10	15	55	-			X	Stream float - 98% schist.
78	15	15	85	-		X		Stream float - marble bedrock.
79	15	25	55				X	Stream float - marble & granite.
80	30	10	90	-			X	Stream float - marble & schist.
81	30	10	85	<6			X	Stream float - marble, schist, and quartz.
82	40	15	95	-			X	Stream float - 95% schist, 5% marble and quartz.
83	25	10	80	-			X	Stream float - marble, schist and quartz.
84	20	5	60	-			X	Stream float - 98% schist, quartz.

* - sought but not detected.

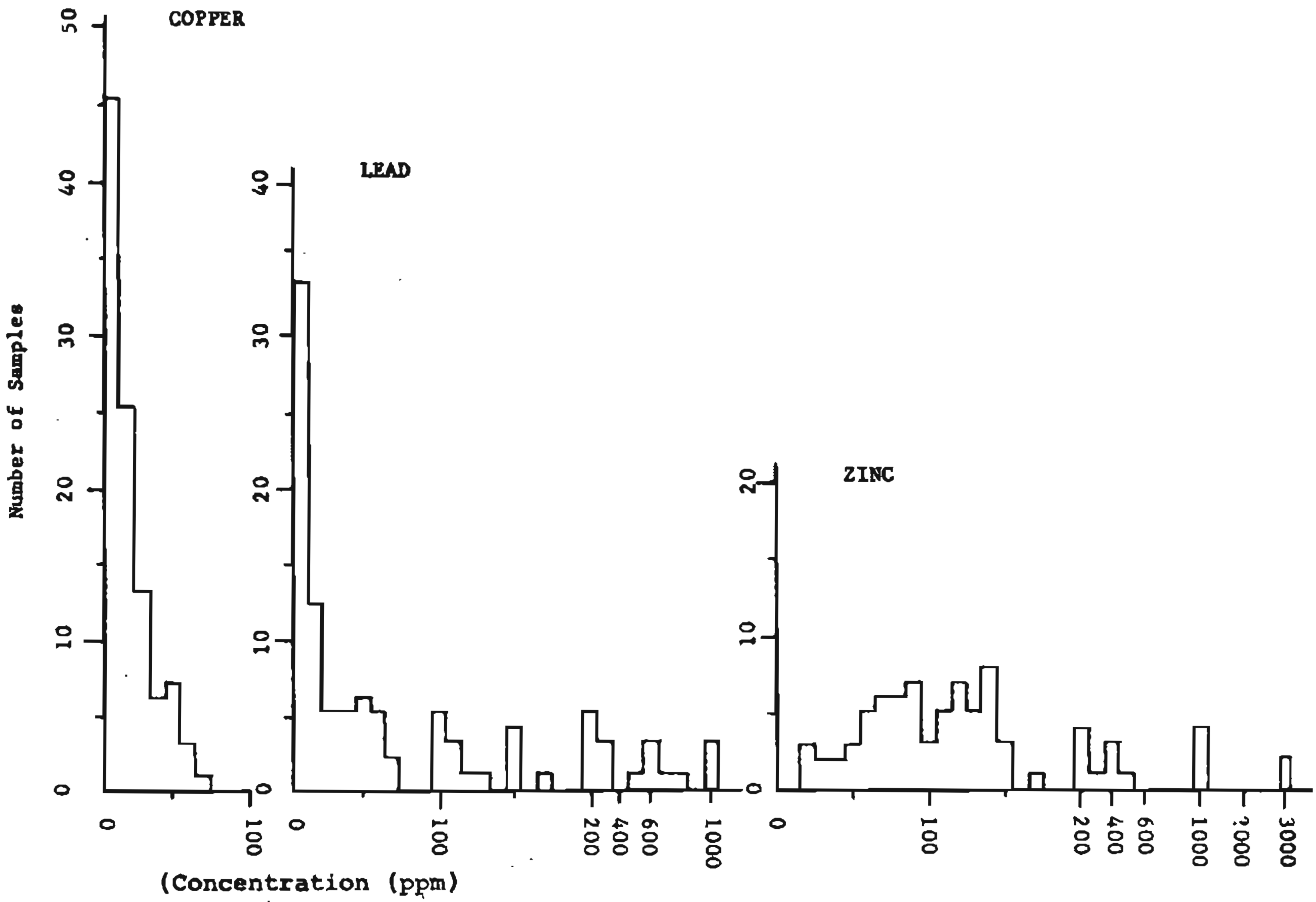

Figure 1. Graphical summary of geochemical data in the Omilak-Otter Creek area.