STATE OF ALASKA

William A. Egan - Governor

DEPARTMENT OF NATURAL RESOURCES

Phil R. Holdsworth - Commissioner

DIVISION OF MINES AND MINERALS

James A. Williams - Director

GEOCHEMICAL REPORT NO. 3

A Geochemical Investigation in the Richardson Area, Big Delta Quadrangle, Alaska

By

R.H. Saunders

Juneau, Alaska
April 1965

CONTENTS

Tables and Figures

Map and Plates

A GEOCHEMICAL INVESTIGATION IN THE RICHARDSON AREA, BIG DELTA QUADRANGLE, ALASKA

By: R.H. Saunders

INTRODUCTION

A geochemical investigation of the Richardson area was made during August 10 through 20, 1964, by Willow M. Burand and Robert H. Saunders. Samples of sediment were collected from sand, silt, and gravel in stream beds. The samples were tested in the field for cold-extractable heavy metal and were analyzed in the laboratory for trace amounts of copper, lead, zinc, and molybdenum. Specimens of the types of rock present were collected, and distribution of the different types in outcrops and float was noted. Gravel in bars in some of the streams was panned, and heavy minerals in the panned concentrate were identified.

LOCATION AND ACCESSIBILITY

The Richardson area is in Interior Alaska on the north side of the Tanana River valley. It is in the southcentral part of the Big Delta (B-5) quadrangle. The area comprises the watersheds of four southerly-flowing streams. Two of these, Tenderfoot and Banner Creeks, flow directly into Tanana River. The other two, Rosa and Keystone Creeks, flow into Shaw Creek, which empties into Tanana River near the southeast corner of the area. The country to the north and west of the Richardson area is drained by streams that are tributary to Salcha River, which empties into Tanana River 30 miles to the west.

The Tanana River along the south boundary of the Richardson area is at about 850 feet altitude. Ridges and hilltops in the northern part of the area rise to nearly 3000 feet; timberline is at about 2800 feet. Most of the area is heavily timbered, and rock outcrops are sparse.

The Richardson Highway crosses the southern part of the area. The distance by road to Fairbanks is 70 miles and to Valdez 290 miles. A trail from the highway goes up the valley of Banner Creek to the mouth of Hinkley Gulch and to Democrat Creek. This trail is passable for four-wheel-drive vehicles during dry weather; it is seldom, if ever, passable for ordinary automobiles. Another trail from the highway climbs the ridge west of upper Tenderfoot Creek and goes to the head of Hinkley Gulch. Numerous other trails have been made throughout the area by tracked vehicles.

The Richardson area has been included in a land selection made by the State under the provisions of the Alaska Statehood Bill. Approval of the selection has not been given by the Federal Government at the time of this writing. Mineral entry on State lands may be made under provisions of the State Mining Rights Regulations, copies of which may be obtained from offices of the State Division of Lands or the State Division of Mines and Minerals.

HISTORY

Gold was discovered on Tenderfoot Creek in 1905 and on Banner Creek soon after. On Banner Creek the gold was recovered in open-pit mines, but on Tenderfoot Creek greater depth to bedrock (180 feet on the lower part of the creek) precluded open-pit mining. There, shafts were sunk to bedrock, and the gold was recovered in underground mines called drift mines. Most of the drift mines operated the year around; gold-bearing gravel was piled in "winter dumps" after the fall freeze-up to be sluiced during the spring break-up. One hundred and twenty men were employed on Tenderfoot Creek during 1908.

Mining began to decline in the area in 1909, and it appeared that the productive creeks were nearly worked out, but the discovery of gold in bench ground on Tenderfoot Creek in 1910 led to renewed activity. Seven mines were in operation on Tenderfoot Creek in 1916. Mining ceased during the last part of the first World War, and, although some of the mines reopened after the war, mining activity never reached its prewar proportions. A lode-gold deposit on Democrat Creek was explored in 1921; no production from the lode was reported, although a mill was built on the property. By the end of 1930, the Richardson area had produced $1,329,900 in gold (at $20.67 per ounce), mostly from Tenderfoot Creek. A few mines in the area operated intermittently until the second World War; since that war there has been little mining activity. A small-scale operation was begun on Hinkley Gulch in 1950, but it continued for only one season. Currently there are no producing mines, but a little prospecting is done in the area each year.

GEOLOGY

Most of the Richardson area is so heavily covered by soil and vegetation that detailed geological mapping is not possible. The geology of the area has been described in a general way in U.S. Geological Survey Bulletin 525, A GEOLOGICAL RECONNAISSANCE OF THE FAIRBANKS QUADRANGLE, ALASKA, by L.M. Prindle, 1913; and in U.S. Geological Survey Bulletin 872, THE YUKON-TANANA REGION, ALASKA, by J.B. Mertie, Jr., 1937.

Most of the rock specimens that were collected during this investigation came from outcrops; the exceptions were specimens of granite, which although found as float in two locations, were not found in place. The rock types were identified by Gordon Herreid and Arthur W. Rose, mining geologists for the Division of Mines and Minerals. Plate I is a map of the geology as indicated by the outcrops and float.

The area between Keystone and Rosa Creeks has been a catchment basin for sand and silt carried northward by wind from bars along Tanana River. The resulting sand dunes are not heavily covered with grasses, brush, and timber. Stream drainage is not well developed; low places between the dunes are swampy and are covered by vegetation consisting mostly of sedge tussocks and occasional small spruce trees. In places Keystone and Rosa Creeks are incised as much as 20 feet in sand and silt. Sediment larger than sand grains is rare in these two streams. Some land in the sand dune area has been homesteaded and cultivated.

Sand and silt also cover most of the Tenderfoot Creek drainage; the upper 35 to 80 feet of alluvium in the Tenderfoot Creek valley is reported to be silt and humus. Rock outcrops and coarse float are rare. Drift mine tailing piles provide specimens of the rock types that make up the coarse part of the alluvium.

In the Banner Creek drainage, rock outcrops are somewhat more numerous, but brush and timber cover most of the area as they do in the eastern part. The cover of wind-blown material is thinner and in places is absent; boulders and coarse gravel are abundant in the stream beds.

The quartz-biotite-feldspar gneiss (Plate II) is a part of the Birch Creek schist formation, which has been assigned to the pre-Cambrian age. The quartzite found west of Banner Creek probably is also a part of the Birch Creek schist formation. The biotite-muscovite granite, which was found as float in two places in the Rosa Creek drainage, is probably younger than the Birch Creek formation, although it could represent an unsheared part of the gneiss. The pyroxene hornfels probably was formed by contact metamorphism and may be near the contact of an intrusion. The rhyolite porphyry in the Banner Creek drainage is younger than the gneiss and may be of Tertiary age.

The creeks in the area on which placer gold has been mined are: Tenderfoot Creek, Democrat Creek, Hinkley Gulch, the lower part of Banner Creek, and the lower part of Buckeye Creek.

Placer mining on Banner Creek and its tributaries has been confined to the area in which the bedrock is rhyolite porphyry; in other places there are prospect holes and test pits but no mined cuts. The deposits on Democrat Creek and Hinkley Gulch were, at least in part, residual placers, the gold having been derived from the rhyolite. Lighter and less resistant minerals in the rhyolite have been removed by weathering and erosion; the gold has been left behind and has not been moved far laterally from its original location in the rock. All the gold may have been disseminated through the rhyolite, or some may have been in more localized types of deposits. A specimen of the rhyolite selected at random from Democrat Creek was assayed for gold and silver; it was found to contain a trace of gold and 0.24 ounces of silver per ton. No rhyolite was found on Tenderfoot Creek. The placers on that creek probably were formed by the erosion of gold-bearing veins or veinlets in the Birch Creek formation.

The fineness of the gold mined in the Richardson area has ranged from 639¼ to 785 - some of the lowest reported from the Yukon-Tanana Region. The unusually low fineness indicates that base-metal mineralization accompanied gold mineralization in the area. Gold-bearing galena float was found on Tenderfoot Creek in the course of drift mining. Galena, scheelite, tourmaline, and cassiterite (?) have been found in placer concentrate from Buckeye Creek 1/, and cassiterite has also been identified in concentrate from Hinkley Gulch.

GEOCHEMICAL INVESTIGATION

Sixty-six samples of stream sediments were taken during this investigation. They were tested in the field for cold-extractable heavy metals following the procedure given in University of Alaska Mining Extension Bulletin No. 2, ELEMENTARY GEOCHEMICAL PROSPECTING METHODS, by Leo Mark Anthony. Locations where the samples were taken are shown on Plate I and Plate III, and the results of the field tests are listed in Table I. The samples were analyzed in the laboratory for trace amounts of copper, lead, zinc, and molybdenum. Results of the analyses are shown in Table I and on Plate I.

A graphic comparison of laboratory tests and field tests is shown in Figure 2. In each sample in which the field test indicated a high metal content, this was later confirmed by the laboratory analysis; however, there were several samples which were found by laboratory analysis to contain anomalous amounts of metal that were not detected in the field test. This can be attributed, of course, to the fact that the field test detects only the metal that can be extracted in a cold water solution.

PANNING TESTS

In most of the streams, panning failed to recover any heavy concentrates. In three places where heavy concentrates were recovered, the minerals in the concentrates were identified as shown in Table II. Panned samples were taken from the same locations as stream sediment samples with the same numbers.

PROSPECTING

Samples from five tributaries to the north fork of Banner Creek contained lead and copper or zinc, or both, in amounts higher than the background for the area. The anomaly indicated by those samples (126, 128, 130, 132, and 192) appears to warrant further investigation. The anomalous area probably could be delineated further by sampling the sediments in streams to the north and northwest of the north fork. Another anomaly is indicated by sample 95, which was taken from the dry bed of an intermittent tributary, and samples 93 and 92, which apparently show the downstream extension of the anomaly from the tributary.

1/ U.S. Geological Survey Circular 331, RECONNAISSANCE FOR RADIO-ACTIVE DEPOSITS IN EASTERN INTERIOR ALASKA, 1946, by Helmuth Wedow, Jr., P.L. Killeen and others, pg. 13.

TABLE I

Analyses of Stream Sediment Samples

Sample Number	Parts per Million Cu	Pb	Zn	Mo	Field Test Mls. Dye	Bedrock	Float
90	45	5	50	3	9	None	Silt
91	10	10	35	2	2	None	Sand and silt
92	15	15	40	2	1	None	Silt
93	15	20	110	2	1	None	Sand and silt
94	5	10	50	3	1	None	Silt
95	35	15	75	2	12	None	Silt
96	10	10	40	3	2	None	Sand and silt
97	15	10	50	3	2	None	Silt
99	15	10	40	3	1	None	Sand and silt
100	15	10	45	3	2	None	Sand and silt
101	10	5	40	3	1	None	Silt
102	15	10	40	3	1	None	Sand and silt
103	10	10	40	3	1	None	Sand and silt
104	20	10	60	2	2	None	Light-colored igneous; qtz. 1%
105	10	10	45	2	1	None	Light-colored igneous; qtz. 1%
106	15	10	60	2	2	None	Light-colored igneous
107	15	10	45	3	1	None	Light-colored igneous
108	10	10	45	3	1	None	Gneiss 50%, lt. igneous 45%, qtz. 5%
109	20	10	50	3	1	None	Gneiss 50%. lt. igneous 50%
111	20	10	55	3	6	None	Sand and silt
112	20	10	60	2	2	None	Silt

TABLE I (Continued)

113	20	15	70	3	2	None	Silt
115	25	10	70	3	1	None	Silt
116	15	5	200	2	2	None	Gneiss
117	20	5	50	2	2	None	Sand and silt
118	15	10	55	2	2	None	Sand and silt
119	10	5	50	3	2	None	Sand and silt
120	15	5	45	3	2	None	Sand and silt
121	15	5	55	2	2	None	Silt
122	20	5	60	3	1	None	Silt
123	15	15	105	4	9	None	Silt
124	20	10	75	3	3	None	Gneiss 49%, rhyolit 49%, qtz. 2%
126	30	15	95	2	2	None	Rhyolite 60%, gneis 39%, qtz. 1%
127	20	20	105	2	1	None	Sand and Silt
128	25	15	115	3	13	None	Gneiss
129	20	10	80	2	2	Gneiss	Gneiss 50%, lt.-colored igneous 50%
130	20	15	105	2	6	None	Gneiss 50%, lt.-colored igneous 50%
131	5	5	40	2	2	None	Sand and silt
132	30	15	85	3	5	None	Gneiss
133	20	10	80	2	7	None	Sand and silt
134	45	10	95	2	7	None	Silt
136	10	5	40	2	1	None	Gneiss
137	20	10	70	2	1	None	Silt

138	15	5	55	3	2	None	Gneiss
139	15	5	70	3	2	None	Silt
140	15	10	85	3	1	None	Silt
141	15	5	60	3	3	None	Rhyolite 50%, gneiss 50%
142	10	10	80	3	1	None	Rhyolite
143	15	5	50	2	2	None	Rhyolite 60 %, gneiss 20%, dark-colored igneo 20%
144	10	5	50	3	1	None	Rhyolite 80%, gneiss 19%, qtz. 1%
145	25	10	60	3	2	None	Gneiss
147	25	10	65	2	2	None	Silt
148	15	15	45	3	1	None	Silt
149	15	10	50	3	1	None	Sand and silt
150	20	10	50	2	1	None	Silt
190	20	10	40	2	2	Gneiss	Gneiss, qtz. - 1%
191	20	10	35	2	2	None	Sand
192	30	35	100	5	14	Rhyolite	Rhyolite, qtz. -1%
193	20	10	45	2	1	None	Silt

TABLE I (Continued)

194	15	10	35	3	2	None	Sand and silt
195	20	10	80	2	2	None	Silt
196	20	10	45	2	2	None	Sand and silt
197	20	10	70	3	2	None	Gneiss
199	20	5	50	3	2	None	Gneiss
200	35	10	80	2	5	None	Gneiss
201	20	5	50	2	1	None	Gneiss

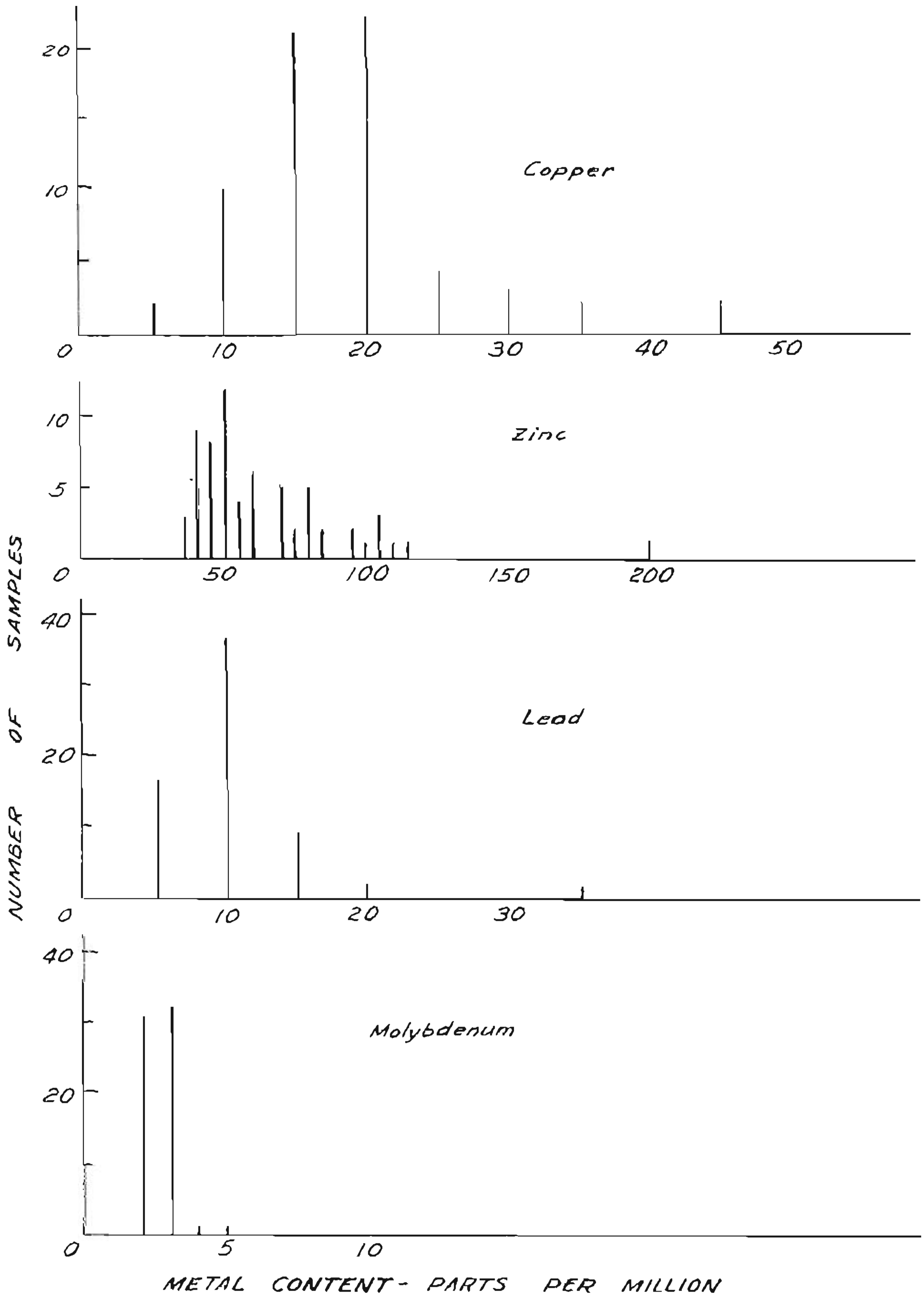
TABLE II

Minerals in Panned Concentrates

Sample 108 - Magnetite, hematite, ilmenite, zircon, tourmaline

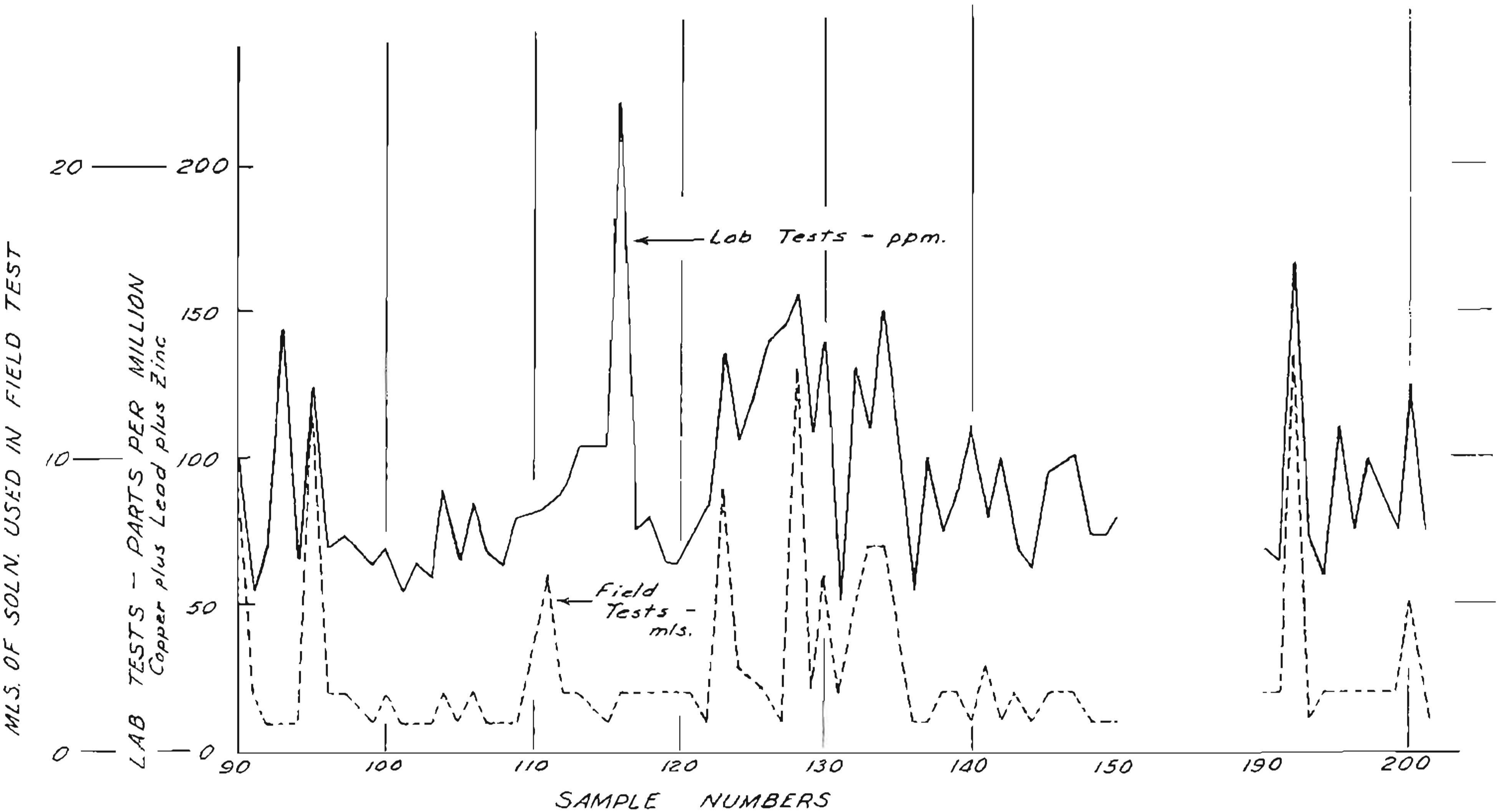
Sample 109 - Magnetite, ilmenite, zircon, scheelite (one piece).

Sample 142 - Magnetite, hematite, ilmenite, zircon, tourmaline, scheelite.



Copper
Zinc
Lead
Molybdenum
NUMBER OF SAMPLES
METAL CONTENT - PARTS PER MILLION

FIG. 1



COMPARISON OF LABORATORY ANALYSES
AND FIELD TESTS

FIG. 2

Vicinity Map