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GEOCHEMICAL REPORT NO. 13

GEOCHEMICAL INVESTIGATIONS OF SELECTED AREAS IN THE YUKON-TANANA REGION, ALASKA 1965 AND 1966

By

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Fairbanks, Alaska

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IN THE YUKON-TANANA REGION, ALASKA, 1965 AND 1966

By

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INTRODUCTION AND SUMMARY

This report presents information and data obtained by geochemical investigations of stream sediments of the upper Tolovana River basin in the Tolovana Mining District, the Pedro Dome-Coffee Dome area in the Fairbanks Mining District, the Mastodon Dome-Porcupine Dome area in the Circle Mining District, and the Columbia Creek-O'Brien Creek area in the Fortymile Mining District during the summer field seasons of 1965 and 1966. Some data were taken from earlier Division of Mines and Minerals geochemical reports as follows: Report No. 9, A Geochemical Investigation Along the Taylor Highway by R. H. Saunders; Report No. 5, A Geochemical Investigation between Chatanika and Circle Hot Springs by W. M. Burand; and Report No. 11, A Geochemical Investigation of Stream Sediments in the Elliott Highway Area by W. M. Burand.

Four hundred seventy-five stream sediment samples were tested in the field for cold extractable heavy metals following the procedure given in the University of Alaska Mining Extension Bulletin No.2, Elementary Geochemical Prospecting Methods by Leo Mark Anthony. One minor departure from this procedure was made: a petroleum spirits paint thinner was used in place of white gasoline (Blazo) as a solvent. A minus 80 mesh portion of each sample was sent to Rocky Mountain Geochemical Laboratories at Salt Lake City for analyses of total copper, zinc, lead and molybdenum. Sixty-eight of the samples were also analyzed for nickel. Copper, zinc, and nickel were determined by atomic absorption methods; the lead and molybdenum were determined by colorimetric methods.

Results of the field tests and geochemical analyses are recorded in tables I through IV. Threshold values for anomalous quantities of metal contained in the stream sediments were determined from frequency distribution graphs (figures 4, 9, 13, and 17), which were plotted for each of the metals reported in the sediments of each of the areas investigated. The sample sites are shown on maps (figures 1-3, 5-8, 10-12, and 14-16) as numbered circles. Where samples are anomalous they are indicated by filled-in circles accompanied by the chemical symbol of each of the anomalous metals.

Geochemical tests and analyses were made on 77 sediment samples collected from the upper Tolovana River drainage basin. Although a number of these required four or more milliliters of dye solution in the field tests, few of these high tests were supported by the lab analyses of total metals. Sample 12 was the only sample determined to have an anomalous amount of metal. These results indicate that the known mineralized zones to the west do not extend eastward into the report area.

One hundred sixty-eight samples were collected from the Pedro Dome-Coffee Dome area. Sixteen of these were determined from the graphs to contain anomalous amounts of one or more metals. These anomalies indicate that four general areas are worthy of further study or prospecting. However, an attempt to extend the limits of a known mineralized zone was not successful.

Eighteen of the 145 stream sediment samples collected from the Mastodon Dome-Porcupine Dome area were determined to contain anomalous amounts of metal. The anomalous and near-anomalous sample locations outline three general areas of mineralization worthy of further study or prospecting. These zones occur in areas near the placer gold deposits, which suggests that other metals may be present which come from the same source as the placer gold.

Sixteen of the 84 stream sediment samples collected from Columbia Creek-O'Brien Creek area were determined to contain anomalous amounts of metals including nickel. Four areas worthy of further study or prospecting are indicated by the results. However, the nickel anomalies may only indicate areas in which basic or ultra-basic rocks occur.

LOCATION AND ACCESSIBILITY OF THE YUKON-TANANA REGION

The Yukon-Tanana Region contains about thirty-eight thousand square miles and lies between 141° and 152° west longitude and 62° 40' and 66° 35' north latitude. It extends from the Canadian Border 320 miles westward between the Yukon and Tanana Rivers to the junction of the two streams at Tanana, Alaska. Many parts of this region are now accessible by road by way of the Alaska Highway and the interconnecting road networks of Alaska and Canada. The trails and mine access roads that branch off the Alaska Highway are generally not kept open during the winter months.

The upper Tolovana River basin is in the central part of the Livengood quadrangle and is partly accessible by the Elliott Highway, north of Fairbanks. The Pedro Dome-Coffee Dome area is in the northeastern part of the Fairbanks quadrangle and the southeastern part of the Livengood quadrangle. The Steese Highway, extending northeastwardly from Fairbanks winds across the westerly and northerly sides of the report area. The Mastodon Dome-Porcupine Dome area is in the Circle Quadrangle, and is also accessible by the Steese Highway which winds northeastwardly through the central part of the report area. The Columbia Creek-O'Brien Creek area is in the east central part of the Eagle quadrangle. The Taylor Highway branches northeast from the Alaska Highway at Tetlin Junction and winds northerly through the report area along the westerly side of the O'Brien Creek valley from the Fortymile River to the Junction of Liberty Fork, King Solomon, and O'Brien Creeks. The upper Columbia Creek drainage is accessible from the highway over game trails, which are easily traversed on foot.

GENERAL FEATURES OF THE YUKON-TANANA REGION

Although widely separated, the four areas covered by this report lie within the uplands area of the region that forms an integral part of the Great Central Plateau province of Alaska. The crests of the divides and ridges appear to be of uniform elevation in each of the report areas; however, the surface of the plateau ranges in altitude from 2,000 feet to over 4,000 feet above sea level. It slopes in all directions from its highest point near the headwaters of Charlie River, but the steepest slopes are to the west.

The apparent continuity of the plateau's surface is interrupted in places by individual ridges, knobs, and domes that rise to over 1,000 feet above it and by individual mountain masses that rise to over 3,000 feet above it. Tirbutaries of the Yukon and Tanana Rivers have incised the plateau to depths of about 3,000 feet. Long, flat-topped spurs radiate and extend from many of the ridges into the valleys

The country rock throughout the region is generally covered bv vegetation and soil which in places is perenially frozen to depths of a few to more than 100 feet. Outcrops are generally limited to the higher ridges and mountain areas and to the valleys where recent stream action has eroded the valley walls. Timberline is generally at an elevation of about 2,500 feet, but may vary from 2000 to 3000 feet because of local bedrock or permafrost conditions.

GEOLOGY OF THE YUKON-TANANA REGION

The geology and mineral deposits of the Yukon-Tanana Region are described in the following U. S. Geological Survey bulletins: Bulletin 251, The Gold Placers of the Fortymile, Birch Creek, and Fairbanks Regions, Alaska by L. M. Prindle; Bulletin 816, Geology of the Fortymile, Eagle, and Circle Districts by J. B. Mertie, Jr.; Bulletin 872, The Yukon-Tanana Region, Alaska by J. B. Mertie, Jr.; Bulletin 897-C, Gold Placers of the Fortymile, Eagle, and Circle Districts, Alaska by J. B. Mertie, Jr.; and Bulletin 849-B, Lode Deposits of the Fairbanks District by James M. Hill. A pertinent Division of Mines and Minerals report is No. 194-1, A Preliminary Map of the Bedrock Geology of the Fairbanks Mining District, Alaska by Robert B. Forbes and Jim Brown. The descriptions of the geology and mineral deposits contained in the present report were obtained chiefly from these listed reports and from some field observations.

The Birch Creek schist, composed of meta-sedimentary and undifferentiated meta-igneous rocks of pre-Cambrian age, comprises about one fifth of the Bedrock of the Yukon-Tanana Region and the major part of the bedrock in each of the three report areas east of the Tolovana River drainage basin. The country rock of this region was intruded during the Mesozoic era by great masses of granite, which are now exposed over large areas east of the Tolovana River and as small bodies with associated dikes in each of the three report areas. Mineralization, which is believed to have accompanied these intrusives, is believed to have provided the source of the placer gold deposits and other mineral deposits found in this part of the region. During Tertiary time, the country was again intruded by granites which were accompanied by mineralization that is believed to have been the source of the placer gold deposits found in the Livengood area, and in Eureka, Rampart, and Hot Springs mining districts in the western part of the region. Although these Tertiary granites have not been mapped in the eastern part of this region, the cinnabar found in some of the placer concentrates is believed to have been derived from mineralization which accompanied the Tertiary intrusives.

The Birch Creek schist is in contact with undifferentiated rocks of Devonian age a little south of the liberty Fork of O'Brien Creek in the Columbia Creek-O'Brien Creek area, and east of the Tolovana River drainage in the Fairbanks district. These undifferentiated Devonian rocks are in contact with basic and ultra-basic Devonian greenstones and Livengood chert of Mississippian age in the Tolovana River basin. Tertiary granitic rocks crop out through these undifferentiated Devonian rocks on Amy Dome a little west of the Tolovana River.

GEOCHEMICAL STUDIES OF DRAINAGE BASINS IN GENERAL

A prospector in the Yukon-Tanana Region is confronted by a rigorous climate and bedrock covered nearly everywhere by vegetation, soil, or frost-riven material. Permafrost exists in places from depths of a few feet to more than 100 feet. Rock outcrops are generally limited to places along the higher ridges, along streams where recent erosion has exposed it, and in mined-out placer gold areas. Geochemistry provides a means by which the prospector may overcome to some degree the problems imposed by this country.

Geochemistry is a tool which will generally lead a prospector to locations in an area which are the more favorable for the occurrence of mineral deposits. However, he must be aware that a simple study of the geochemical data alone does not produce sufficient evidence upon which to predict that a certain size and grade of metal deposit does or does not exist. When interpreting the geochemical data he must consider the effects which the topography, geological features, and other environmental factors may have on the data obtained.

Carbonaceous matter and ferruginous scums may cause the precipitation of metal ions from ground and surface waters (Hawkes and Webb, 1962). Marshlands, swamps, or muskeg areas generally provide favorable environments for the precipitation and concentration of metal ions in the soils and sediments from the waters that flow into these areas. Changes in type of bedrock may also result in a significant increase or decrease of metal content in soils and sediments of streams draining these places. These are but a few of the many factors that must be considered when interpreting the results of this type of investigation; however, it is beyond the scope of this report to discuss these more fully.

The presence or absence of a strong anomaly by itself is not sufficient evidence that a mineral deposit does or does not exist. Strong anomalies may indicate: (1) a small high-grade deposit of metallic minerals, (2) a large low-grade deposit, (3) small deposits of weakly mineralized but highly fractured or weathered rock that is unusually accessible to the leaching action of ground or surface waters, or (4) the precipitation and concentration of metal ions by organic matter or ferruginous scums. On the other hand, the absence of an anomaly does not necessarily mean that an economic metal does not exist; such absence may mean that (1) a low rate of chemical attack on the bedrock or mineral deposit is taking place, (2) dilution or precipitation of metal ions is taking place somewhere above the sample site, (3) the metallic deposit occurs either too deep or below an impervious layer that prevents the transportation of the metal ions by ground waters to the surface.

To delimit or mark out an anomaly in a drainage basin, the prospector should take samples that are relatively closely spaced and work upstream through the anomalous area to a point of cut-off. It may also occasionally be useful to run field tests on the flowing water upstream from the point of cut-off; for in some places the P_h of the water or other factors may prevent the precipitation of metal ions onto the sediments nearest the mineral deposit. At and above the point of cut-off, the banks on both sides of the stream should be examined for indications of mineralization or for possible signs of contamination. If neither of these is found, a systematic sampling of the soils should be made along the banks of the stream and along the base of hills, which may rise above the drainage basin in the vicinity of the cut-off point.

Follow-up work on the anomalous areas covered by this report should include both field tests and laboratory analysis of all stream sediment samples. Soil samples, where taken, should also be checked by laboratory methods to determine the ratio of cold water extractable to total extractable metals. This ratio may help lead to the source of the anomaly. With certain exceptions a ratio of high cold water extractable to total extractable metals suggests a hydromorphic pattern, whereas a low ratio suggests a residual pattern or source (Hawkes and Webb, 1962).

The use of geophysical methods in several of these areas may be helpful in determining the possible source of the anomalies reported.

THE UPPER-TOLOVANA RIVER BASIN

Location and accessibility

The upper-Tolovana River basin, approximately 50 airline miles northwest of Fairbanks, is accessible from Fairbanks by way of the Steese and Elliott Highways. From the junction of the Steese and Elliott Highways at Fox, the Elliott Highway winds 71 miles northwestwardly to Livengood crossing the Tolovana River at 59 mile. The report area, approximately eighty square miles, extends 20 miles northeast from the Tolovana River bridge to the head of the river. Access to most of the area is difficult; there are no roads or trails except a discontinuous series of game trails and one old tractor trail which provides access from the highway to the head of Duncan Creek. It is also possible (but difficult) to use a small river boat to ascend the river to a point about one mile above the mouth of Duncan Creek, an airline distance of six and one quarter miles.

General features

The report area is in a country of moderate topographic relief; elevations range from 600 feet above sea level in the valley to over 3,100 feet along the crest of the highest ridge. Timberline is generally at 2,500 feet altitude, but local conditions may cause it to be higher or lower.

The country rock is nearly everywhere mantled by soil and vegetation except in places where exposed by stream action and along the higher ridges. The vegetation is chiefly moss, grass, and sedge tussocks, with stands of large white spruce or aspen growing in favored places along the banks of the streams and in favored areas on the hills and ridges. Willow and alder grow along hillside drainages and streams and in thickets along the banks of the river and its tributaries. Poor stands of black spruce and other woody brush grow in places on poorly drained slopes and muskeg areas.

Geology and mineral deposits

The country rock in the sourthern part of the report area is composed principally of undifferentiated noncalcareous rocks of Devonian age (Mertie, Jr., 1937). These include sandstone, quartzite, shale, slate, argillite, and a few thin beds of finely crystalline limestone ranging from light to dark gray in color. In places serpentine and greenstone bodies are found in the limestone. North of Duncan Creek, between the two large easterly tributaries of the Tolovana, this group is in contact with both the Livengood chert of Mississippian age and basic and ultra-basic greenstone of Devonian age.

Monzonite and quartz monzonite intruded these undifferentiated rocks during Tertiary time with accompanying mineralization which is believed to have provided the source of the placer gold found in the Livengood Creek area. These granitic rocks are exposed along a mineralized zone that is exposed on Amy Dome a few miles west of the report area.

A band of Livengood chert about sixty-five miles long by about eight miles wide extends N60°E east from north of the Sawtooth Mountains across the report area to Beaver Creek (Mertie, Jr., 1937). This band is composed of laminated chert and brecciated chert recemented with chalcedonic quartz that ranges from light gray to black in color.

In places these are colored red by the oxidation of included iron minerals. To the north the chert is in contact with noncalcereous rocks and limestones of Mississippian age; to the southwest of the Tolovana River the chert is in contact with the undifferentiated noncalcareous rocks, and east of the river it is in contact with the Devonian greenstone, which in turn is in contact to the south with the noncalcareous rocks of Devonian age.

Geochemical investigation

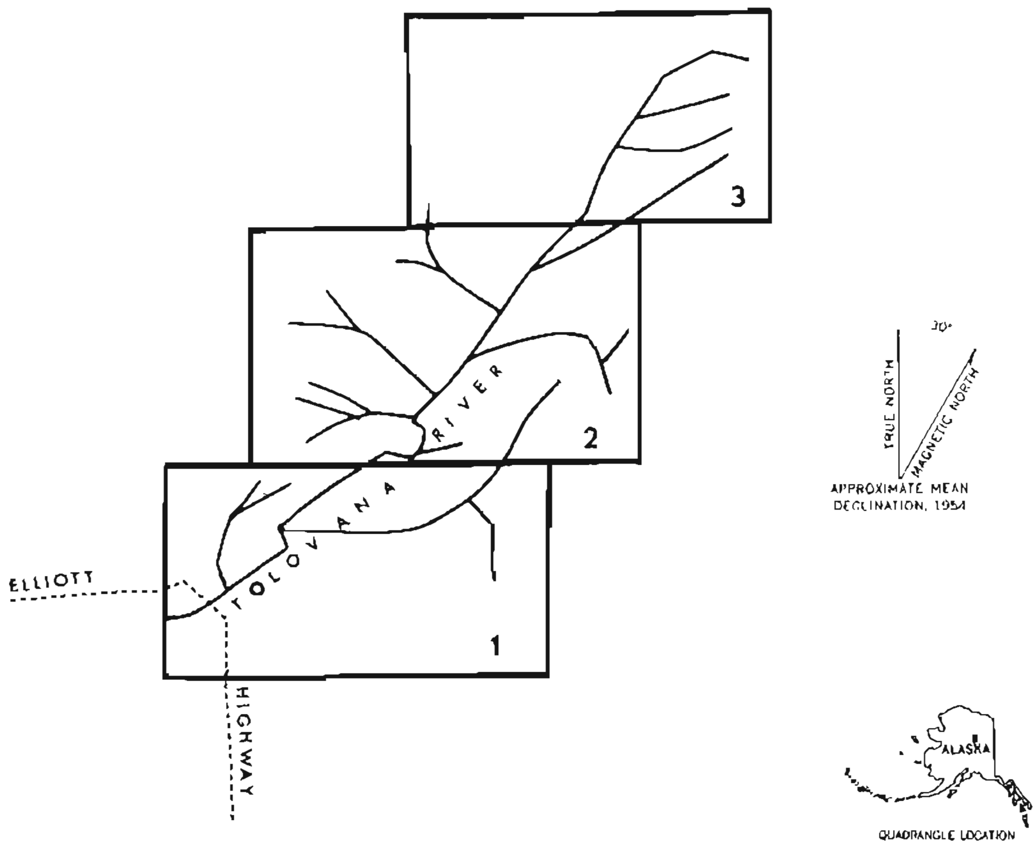
This investigation was made to attempt to find possible eastward extensions of the mineralized zones which provided the source of the Livengood placer gold deposits and which crop out on Amy Dome west of the report area in the upper Tolovana River drainage basin. The results failed to provide evidence that any of the mineralized zones extend into the area or that any exist in the area.

About one-quarter of a mile northwest of the white bluff (figure 2) in the Tolovana River near the mouth of the small stream where sample 39 was taken, a number of warm springs were observed issuing from the river bars. An odorless gas was also observed to bubble out of the river in this same area. The presence of these warm springs may indicate that Tertiary granitic rocks occur at some indeterminant depth in this area since these granitic rocks occur near hot springs found in the western part of the Yukon-Tanana Region.

A small riverboat was used during part of this investigation to test the practicability of using such craft for other investigations on small interior Alaskan rivers. It proved to be unsatisfactory.

Results of this investigation

Only one of the 77 stream sediment samples collected from the upper Tolovana River drainage basin contained an anomalous amount of metal. Sample 12 taken from a small northwesterly tributary of McCord Creek contained an anomalous amount of copper - 40 parts per million. Sample 13, taken from a smaller tributary draining the same hillside contained 25 parts per million of copper. The field test on the anomalous sample used 6 milliliters of dye solution,but other samples that were not anomalous by laboratory analyses required larger amounts of dye. Therefore, follow-up work should include both field testing and laboratory analyses of stream sediments. Soil samples should be taken from the hillside between the three tributaries where samples 11, 12, and 13 were taken.



Index diagram of the Upper Tolovana River basin maps
(Figures 1, 2 and 3)

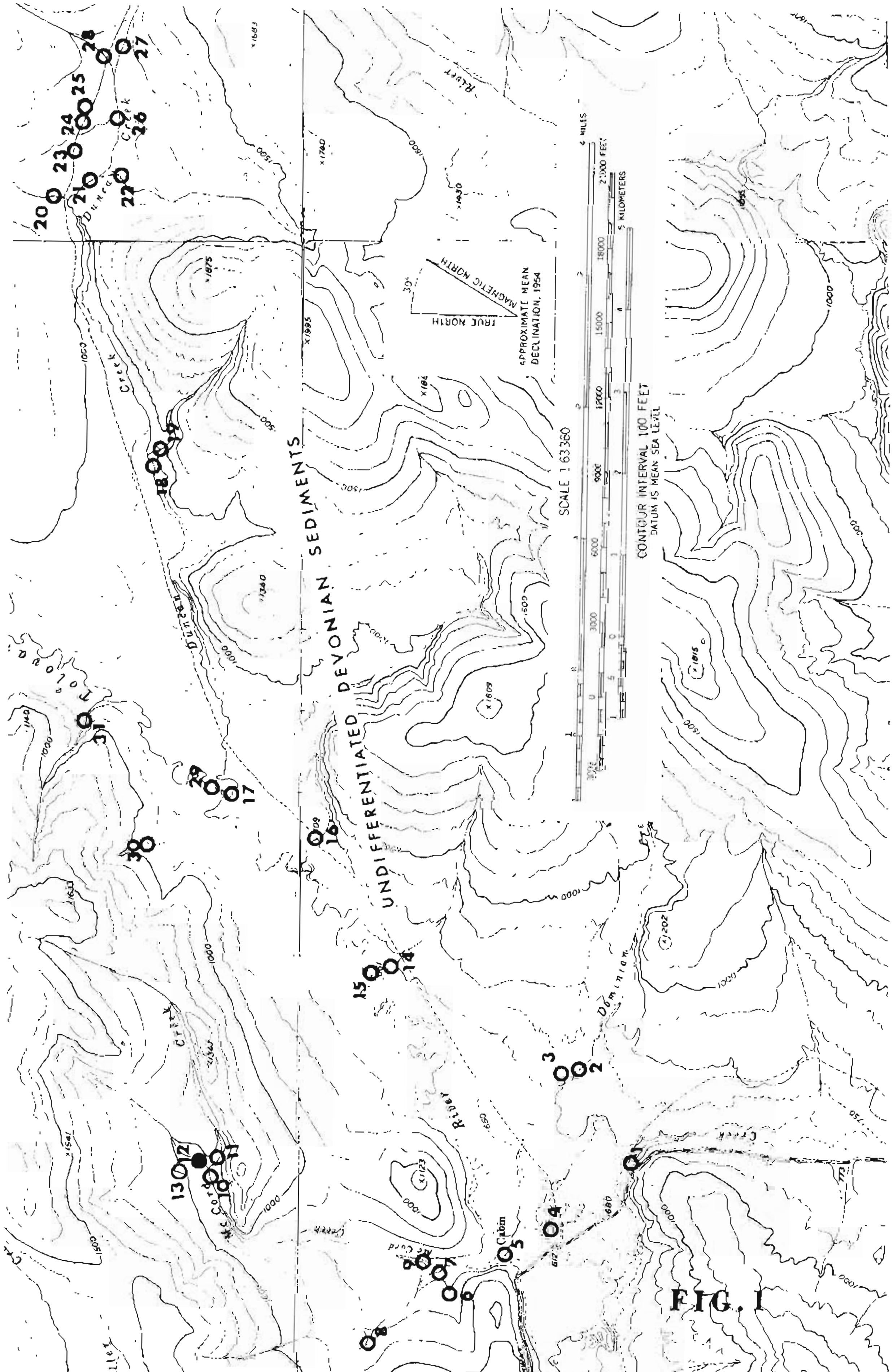

UNDIFFERENTIATED DEVONIAN SEDIMENTS
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1954
SCALE 1:63360
CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL
5 KILOMETERS
Duncan Creek
Dominion
River
Cabin

FIG. I

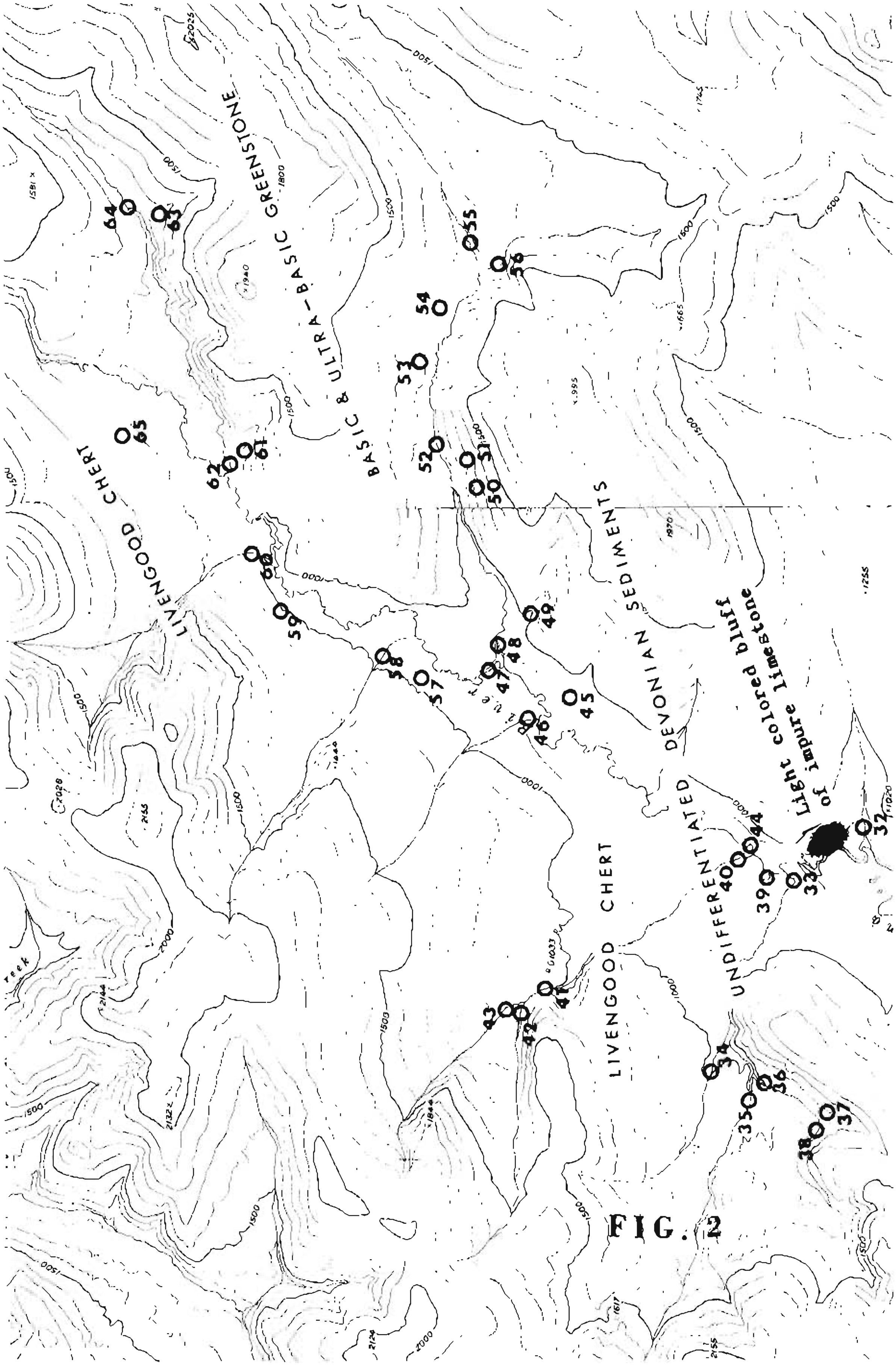
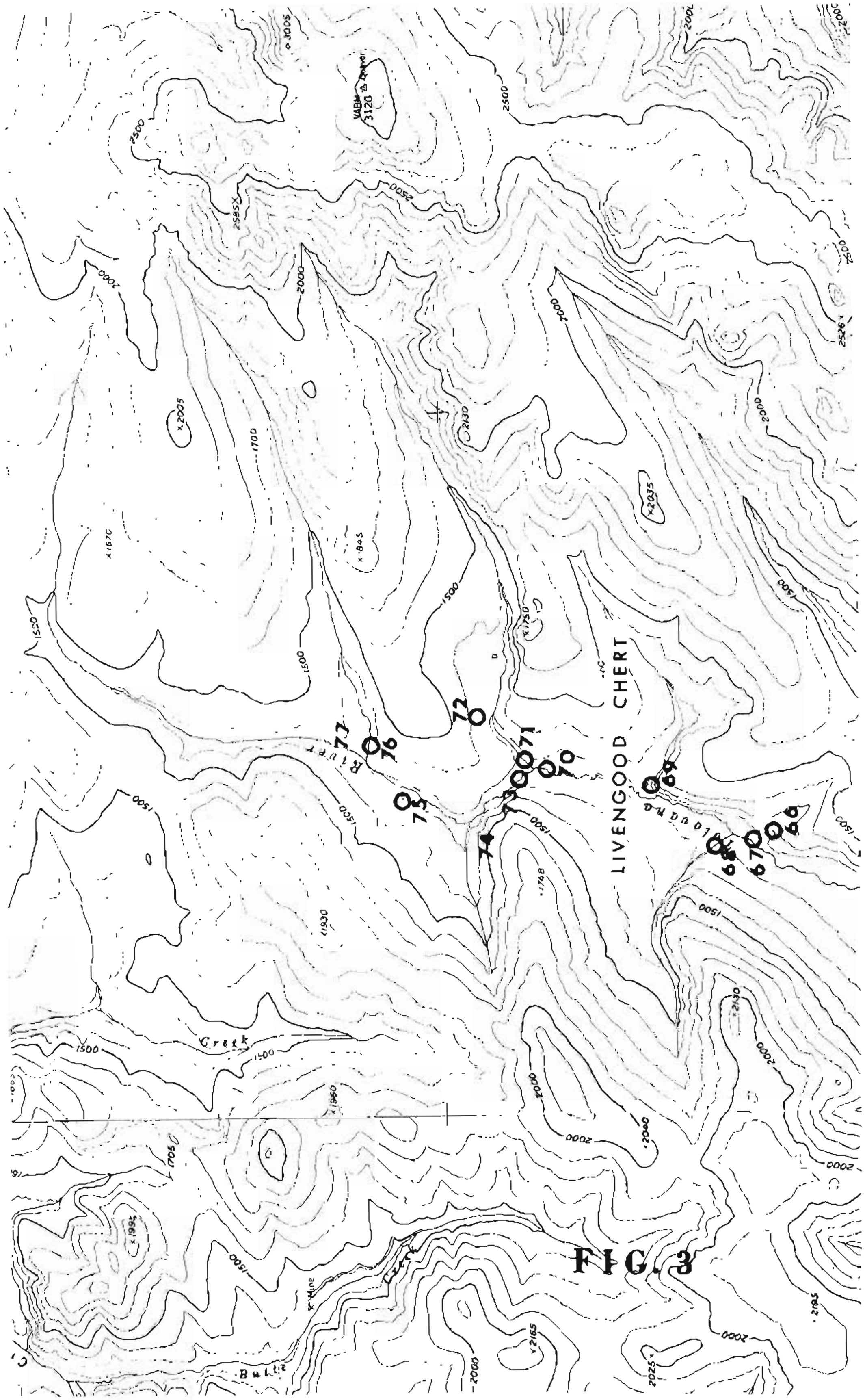

LIVENGOOD CHERT
BASIC & ULTRA-BASIC GREENSTONE
DEVONIAN SEDIMENTS
UNDIFFERENTIATED
Light colored bluff
of impure limestone

FIG. 2


LIVENGOOD CHERT
Creek
FIG. 3

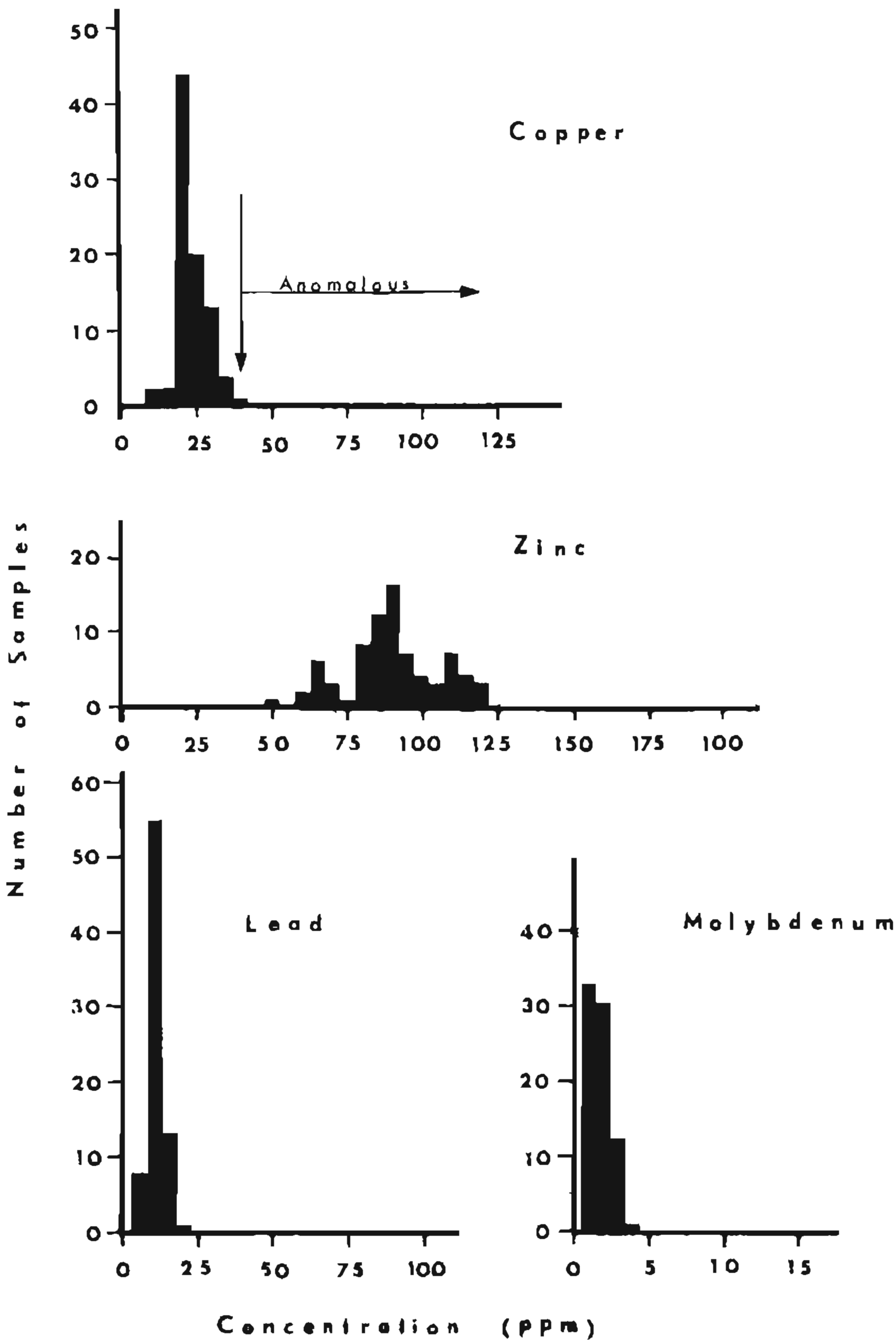


Figure 4 Frequency distribution graphs for copper, zinc lead and molybdenum: Upper Tolovana River area

TABLE I

Geochemical Sample Analyses

Upper Tolovona River Basin

Map No.	Field No.	Field Test Milliliters	Copper	Zinc	Lead	Molybdenum
			PARTS PER MILLION			
Figure 1						
1	6 H 76	3	20	85	10	1
2	6 H 74	4	20	75	10	1
3	6 H 75	2	20	95	15	2
4	5 K 156	4	20	95	10	3
5	5K 185	2	10	85	15	2
6	6 H 73	5	15	85	15	3
7	6 H 70 A	1	20	95	10	1
8	6 H 72	2	10	85	10	3
9	6 H 71	1	20	90	15	2
10	6 P 113	8	20	65	10	3
11	6 P 112	3	20	70	10	2
12	6 P 115	6	40	65	5	1
13	6 P 116	2	25	65	10	3
14	6 P 71	1	30	100	15	1
15	6 P 72	1	25	105	10	3
16	6 P 98	2	20	80	10	2
17	6 P 73	1	20	90	15	1
18	6 P 77	1	30	115	10	2
19	6 P 76	1	25	90	10	1
20	6 P 87	4	20	90	10	1
21	6 P 78	1	25	110	10	1
22	6 P 79	1	20	80	10	2
23	6 P 86	1	30	115	10	1
24	6 P 85	1	30	85	10	1
25	6 P 84	3	35	90	10	2
26	6 P 81	1	25	110	10	2
27	6 P 83	1	30	115	15	2
28	6 P 82	1	30	110	10	1
29	6 P 74	1	35	120	10	1
30	6 P 111	1	20	60	10	3
31	6 P 75	1	20	85	10	2
Figure 2						
32	6 H 42	7	35	110	10	3
33	6 P 97	2	20	90	5	2
34	6 P 93	1	25	95	10	2
35	6 P 90	6	20	80	10	3

The anomalous values are underlined.

TABLE I (Continued)

Map No.	Field No.	Field Test Milliliters	Copper	Zinc	Lead	Molybdenum
36	6 P 92	2	20	90	5	2
37	6 P 88	2	30	115	10	2
38	6 P 89	4	20	90	10	1
39	6 H 43	1	20	95	10	2
40	6 H 70	1	25	95	15	2
41	6 P 96	1	20	85	10	1
42	6 P 95	8	20	95	10	2
43	6 P 94	1	25	80	10	1
44	6 H 69	1	30	100	15	3
45	6 H 44	4	30	85	10	2
46	6 H 46	5	25	65	15	2
47	6 H 56	1	25	90	15	1
48	6 H 55	1	20	90	10	1
49	6 H 47	3	35	105	20	1
50	6 H 48	1	25	95	5	1
51	6 H 49	1	20	85	5	1
52	6 H 50	1	25	100	10	1
53	6 H 51	1	25	90	5	1
54	6 H 54	1	25	120	10	2
55	6 H 52	1	30	110	10	1
56	6 H 53	1	30	110	10	1
57	6 H 58	2	15	65	5	1
58	6 H 59	4	25	80	10	1
59	6 H 60	4	30	90	10	1
60	6 H 61	1	20	70	10	2
61	6 H 67	2	20	110	10	1
62	6 H 68	1	25	100	10	1
63	6 H 65	1	20	120	10	1
64	6 H 64	1	30	105	10	1
65	6 H 62	1	20	50	10	1
Figure 3						
66	6 H 63	1	20	80	15	2
67	6 P 110	1	20	80	10	3
68	6 P 99	1	25	85	10	2
69	6 P 109	4	20	70	10	4
70	6 P 102	2	25	90	10	3
71	6 P 108	5	25	80	5	3
72	6 P 103	2	20	65	10	2
73	6 P 100	2	25	90	10	2
74	6 P 104	2	20	90	15	2
75	6 P 105	1	20	85	10	2
76	6 P 107	1	25	90	10	2
77	6 P 106	5	20	85	10	2

PEDRO DOME-COFFEE DOME AREA

Location and accessibility

The Pedro Dome-Coffee Dome area, in the northeastern part of the Fairbanks Quadrangle and the southeastern part of the Livengood quadrangle is about 240 square miles. It is accessible to Fairbanks by way of the Steese Highway, an improved gravel road that stretches northeast from Fairbanks 162 miles to Circle City on the Yukon River, (see diagram showing layout of figures 5-8). The highway crosses the Western and northern sides of the report area, and trails and mine access roads branch off the highway to provide easy access to nearly all parts of the area.

General features

The area is in a country of moderate topographic relief; altitudes range from around 600 feet above sea level in the valley to about 2,600 feet at the crests of the higher ridges and domes. The southerly walls of the Chatanika Valley rise in a series of gentle to steep slopes to the crests of well-rounded hills and ridges. Although many of the valley walls are steep, few are precipitous. The most prominent topographic feature is the ridge separating the drainage of the Chatanika River from the drainages of Fairbanks and Fish creeks. This divide, extending across the central part of the report area, is irregular in both altitude and directional trend.

The country rock in this area is generally covered by a heavy growth of vegetation or soil, which in places is permanently frozen from a few feet to over 100 feet deep. In poorly drained areas and where permafrost is near the surface, the vegetation is comprised chiefly of moss, grass, sedge tussocks, and small woody brush typical of muskeg areas; whereas, on the better drained slopes, ridges, and valleys where conditions are more favorable the vegetation also includes large stands of white spruce, white birch, and aspen, or a mixture of these. Willow and alder generally grow abundantly along the hillside drainages and along the banks of the streams. Stands of stunted black spruce however, are generally confined to the more poorly drained areas or muskeg. Timberline is at about 2,500 feet.

Geology and mineral deposits

The oldest rock unit present is the Birch Creek schist, a series of metasedimentary rocks and undifferentiated metaigneous rocks. Early workers assigned these to the Precambrian age, but this is now questioned. Pelly gneiss, which crops out in places in this area, is believed to be of about the same age. All of these ancient rocks have been intruded in places by granitic rocks of Mesozoic age. Maps accompanying the U.S. Geological reports and Division of Mines and Minerals report 194 - 1 show the locations of the major exposures of these rocks. These also show a small body of basalt, probably of Tertiary age, on lower Alder Creek. Basalt fragments were found by Saunders during this investigation on a hillside downstream from sample 224 on Kokomo Creek (figure 7), which indicates that the body of Basalt probably extends east of Alder Creek to the hill above Kokomo Creek. A small body of Tertiary sandstone and conglomerate has been mapped at Fourth of July Hill in the eastern part of the report area.

Calcareous and limestone members of the Birch Creek schist series crop out as a group of crystalline lenses at the head of Pilot Creek and extend southwestward into the valleys of Dome and Vault creeks. The Birch Creek schist is folded in a series of recumbent folds overturned to the north with the axes trending in an easterly direction across the report area.

An important mineralized zone extends along the axis of an anticline that trends northwest of Pedro Dome across the headwaters of Cleary Creek (figures 5, 6, and 7) into the northerly side of upper Fairbanks Creek valley to Crane Creek where it bends to the north toward the head of Walnut Creek on the southwest flank of Coffee Dome (Forbes and Brown, 1961). Although this zone appears to continue on to the top, or possibly to the north of Coffee Dome, it has never been traced beyond the head of Walnut Creek.

Fracturing along the crest and limbs of this anticline appear to have provided control for the deposition of minerals in the zone. Streams that drain this zone have contained rich placer gold deposits. Cleary creek, which cuts this zone, has been one of the most productive placer gold streams in the Fairbanks Mining District Three of the most productive lode-gold mines in this district are the Cleary Hill Mine, the McCarty Mine, and the Hi-Yu Mine (figures 5 and 6). Some lode gold has recently been mined from a gold-quartz vein exposed west of the head of Wolf Creek. A lead-silver vein is presently being developed by BECS Corporation on the Keystone Mines property; the ore is jamesonite with galena that contains large amounts of silver. Silver-lead ore has also been produced from galena-bearing veins on Cleary Creek near the head of Bedrock Creek. Minerals associated with this area's ores are: arsenopyrite, pyrite, jamesonite, galena, stibnite, and sphalerite. Chalcopyrite and covellite, though rare, have been identified with these minerals.

In the past, exploration work was done on a lead-silver prospect at the head of Walnut Creek and in a lode-gold prospect in the Kokomo Creek drainage a few hundred feet west of the point where sample 239 (figure 7), was taken. Hill describes this prospect to be comprised of four or five gold-quartz veins spaced at approximately 100 foot intervals and varying from one to two feet in width. A sample across a 20-inch vein assayed $7.38 per ton when gold was $20.60. Some placer gold was produced from the Kokomo Creek valley west of sample 39 and is indicated by tailing piles. There have been no productive lode mines east of the Hi-Yu Mine and no lode prospects east of Coffee Dome in the report area.

Geochemical investigation

The mineralized zone that extends down the upper Fairbanks Creek valley to the head of Walnut Creek may weaken or die out east of the Hi-Yu Mine. It is possible, however, that this zone does continue and that prospecting has thus far failed to reveal the extension. Part of this investigation was an attempt to trace this mineralized zone by geochemistry.

Because the anticline providing structural control of the mineral deposits in this zone bends to the north, it appeared likely that the mineralized zone would do likewise and that part of the zone would lie within the headwaters area of Kokomo Creek. The mined-out placer gold deposit on Kokomo Creek and the lode-gold prospect near its head provides further evidence that the mineralized zone could extend into the Kokomo Valley. Although the results of this investigation failed to prove this hypothesis, they do show several interesting anomalies believed to be worthy of further study.

Results of this investigation

Field test and geochemical analyses were made on 168 samples of stream sediments collected from this area, and the results of these analyses were plotted on frequency distribution graphs (figure 9), to determine the threshold values of the anomalous samples. The threshold values, reported in parts per million, are 50 for copper, 140 for zinc, 40 for lead, and 6 for molybdenum.

Sample 85, Figure 5, was taken from a northerly tributary of Pedro Creek about one mile south of the mineralized veins mapped in 1961 by Forbes and Brown. This sample contained anomalous amounts of zinc and lead.

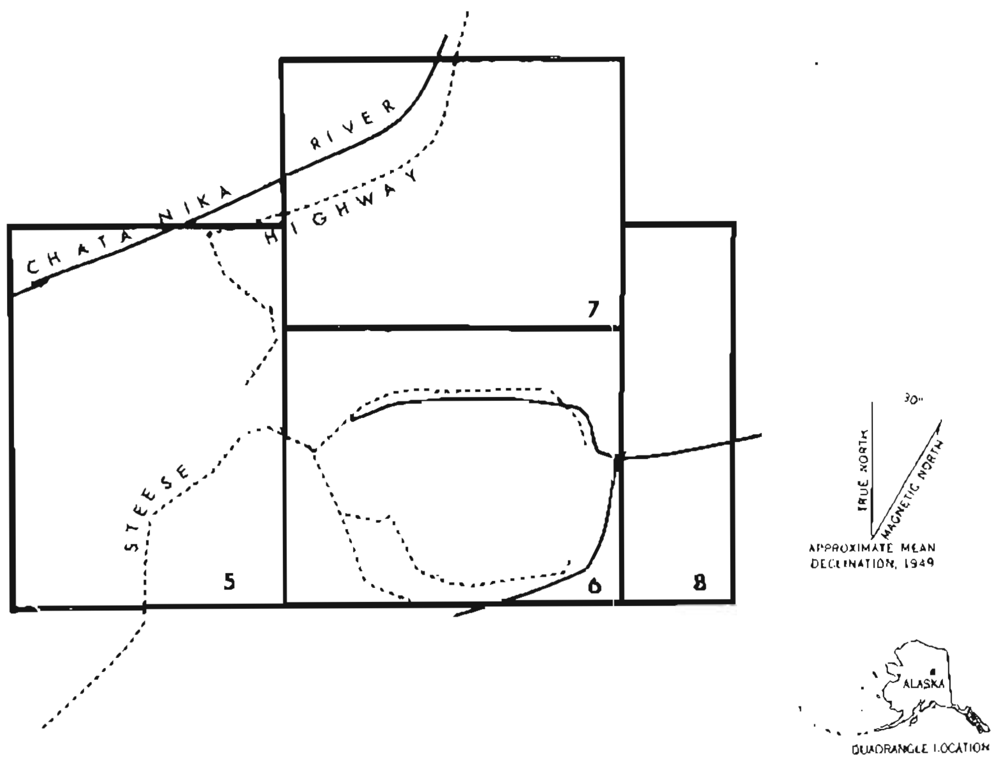
Sample 88, figure 5, was taken from Last Chance Creek on the northerly side of Pedro Dome and contained an anomalous amount of copper and 30 parts per million of lead. Both anomalies disappeared downstream, and at sample 89 had decreased to 30 ppm of copper and to 25 ppm of lead.

Scheelite veins, cropping out on Gilmore Dome about a mile south of samples 93, 94, 95, and 96, have been mined during times of favorable tungsten prices. These samples were collected from streams draining a granite area, and were found to be anomalous in molybdenum content but low in the other metals.

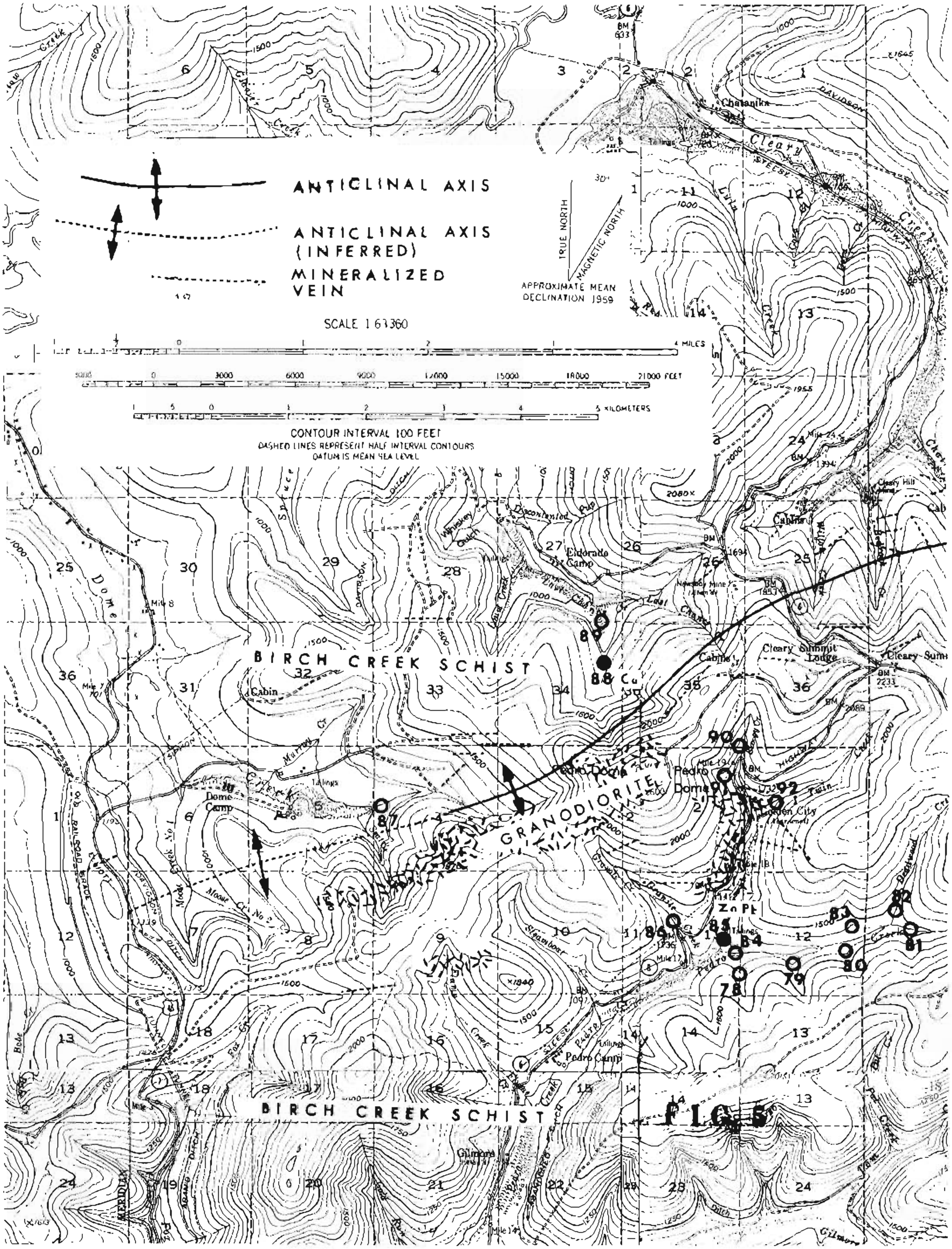
Samples 147, 153, 157, 158, 159, and 160 (figure 6) contained anomalous amounts of lead and samples 152 and 158 contained anomalous amounts of zinc. Samples 147 and 159 were taken from a stream draining an old mine workings and are believed to have been contaminated by increased leaching of minerals exposed to weathering by the Hi-Yu mining operations. This condition may exist in all places where sulfide minerals are exposed to air by mine workings, which greatly accelerates the leaching of sulfide minerals by perculation of water through these exposed minerals. It has been estimated that the metal content of such water may be increased by as much as 10 to 100 times greater than would be the case had the deposit not been opened by mining (Hawkes and Webb, 1962). Contaminated water may contaminate the underlying sediments but generally not to the same extent or magnitude.

Samples 149 and 163 (figure 6) contained anomalous amounts of copper. Since copper minerals are rare in the known vein or lode deposits of the Fairbanks District it seems unlikely that either of these samples could be related to the mineralized zone unless the copper content of the veins increase at depths below those penetrated by the mining operations.

Sample 227 (figure 7) contained an anomalous amount of zinc; however, sample 228 was taken from a different branch of the same stream and contained only 90 ppm of zinc. The stream divides above the sample sites and reconverges below them; it is therefore doubtful that this anomaly, though strong for this area, is indicative of a mineral deposit of significant size.



Index diagram of the Pedro Dome-Coffee Dome maps
(Figures 5, 6, 7 and 8)


ANTICLINAL AXIS
ANTICLINAL AXIS (INFERRED)
MINERALIZED VEIN
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION 1959
SCALE 1:63360
CONTOUR INTERVAL 100 FEET
DASHED LINES REPRESENT HALF INTERVAL CONTOURS
DATUM IS MEAN SEA LEVEL
BIRCH CREEK SCHIST
GRANODIORITE
BIRCH CREEK SCHIST
Chatanika
Cleary Summit Lodge
Pedro Dome
Golden City
Pedro Camp
Gilmore
Eldorado Camp
Dome Camp
FIG. 5

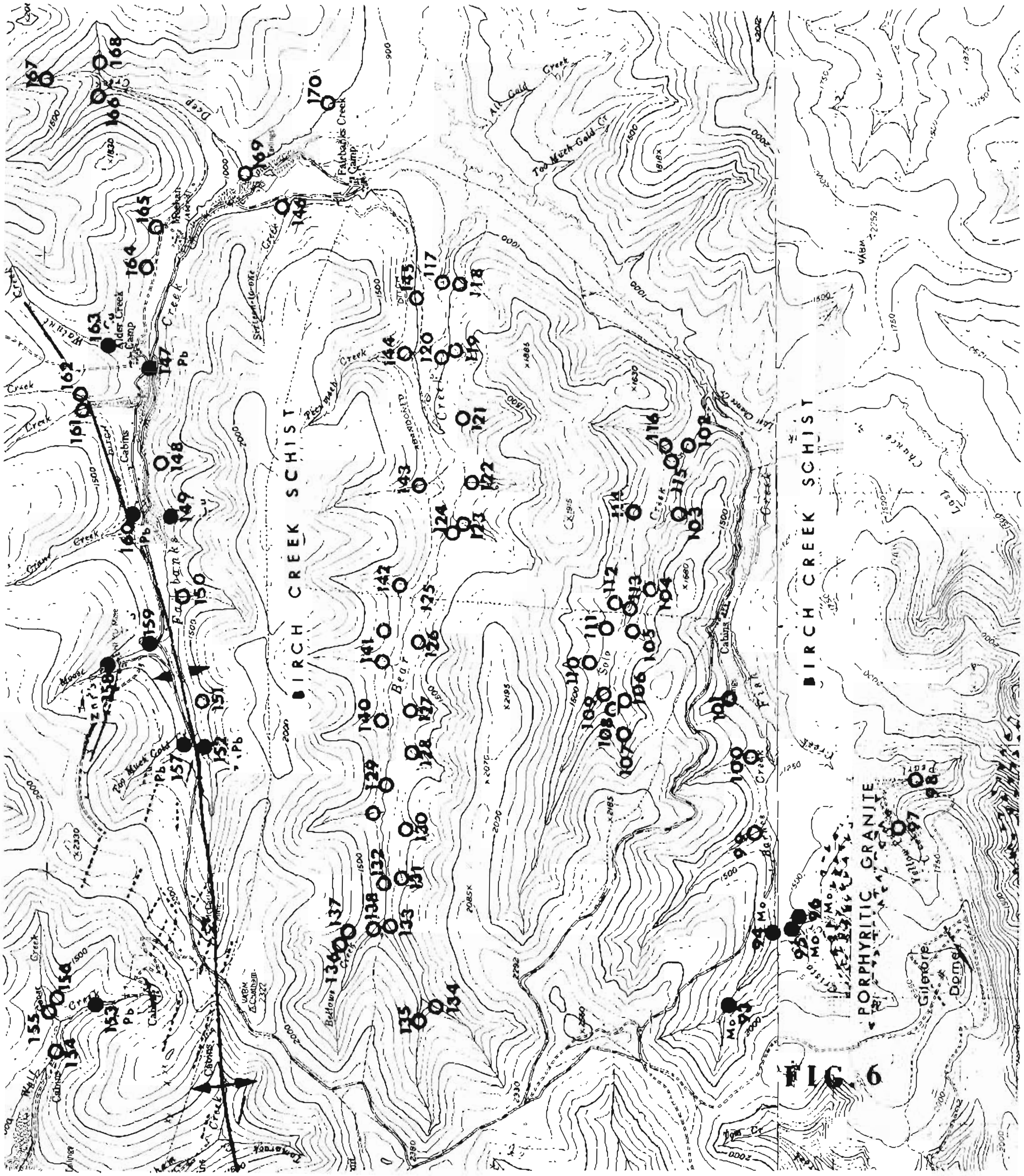

BIRCH CREEK SCHIST
BIRCH CREEK SCHIST
PORPHYRITIC GRANITE

FIG. 6

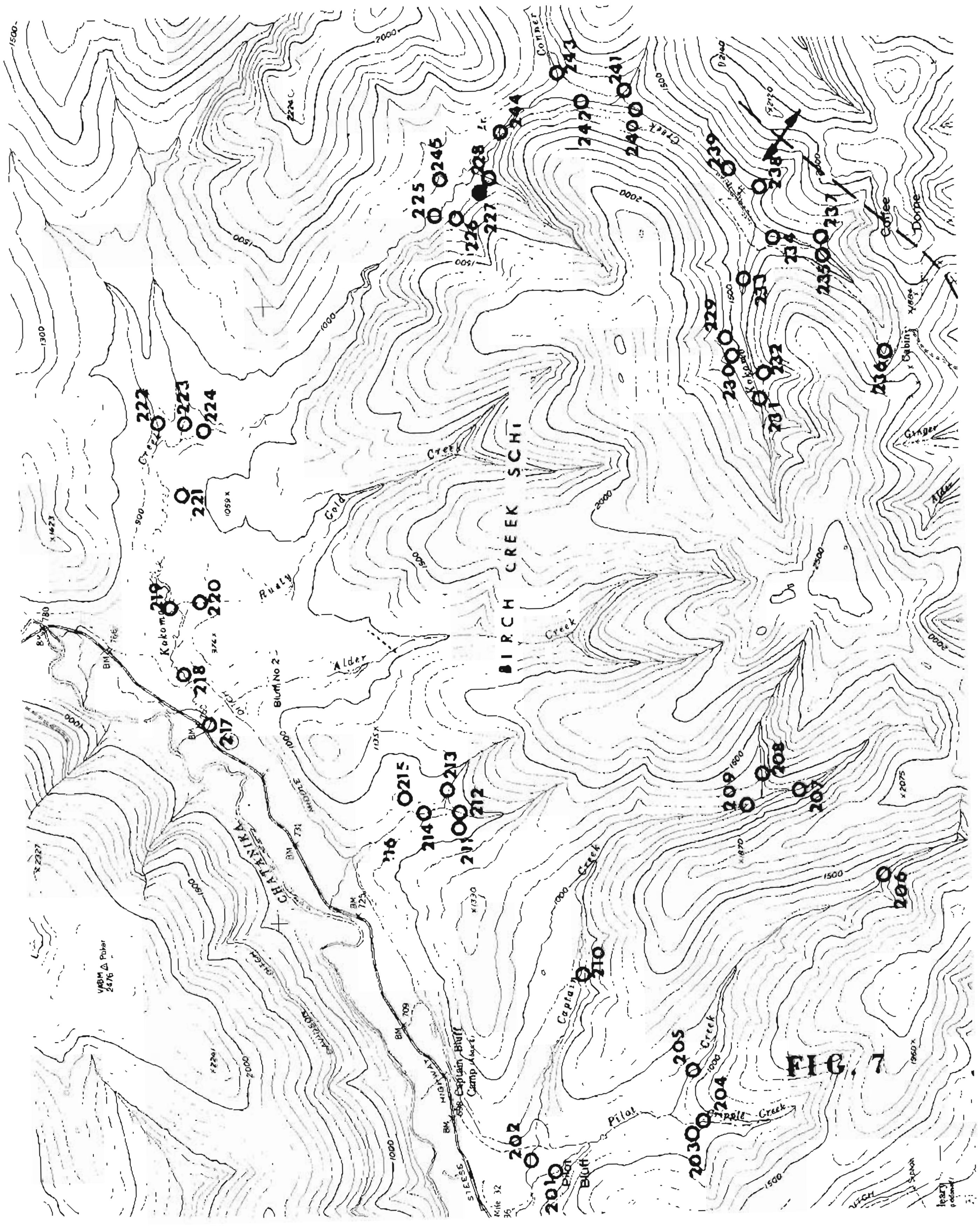

BIRCH CREEK SCHI
CHATANIKA
Captain Bluff
Camp
Pilot
Bluff
Cripple Creek
Captain
Creek
Alder
Rusty
Gold
Kokomo
Coffee
Dome
Ginger
STEESE HIGHWAY
Mile 32
VABM Poker 2476
201
202
203
204
205
206
207
208
209
210
212
213
214
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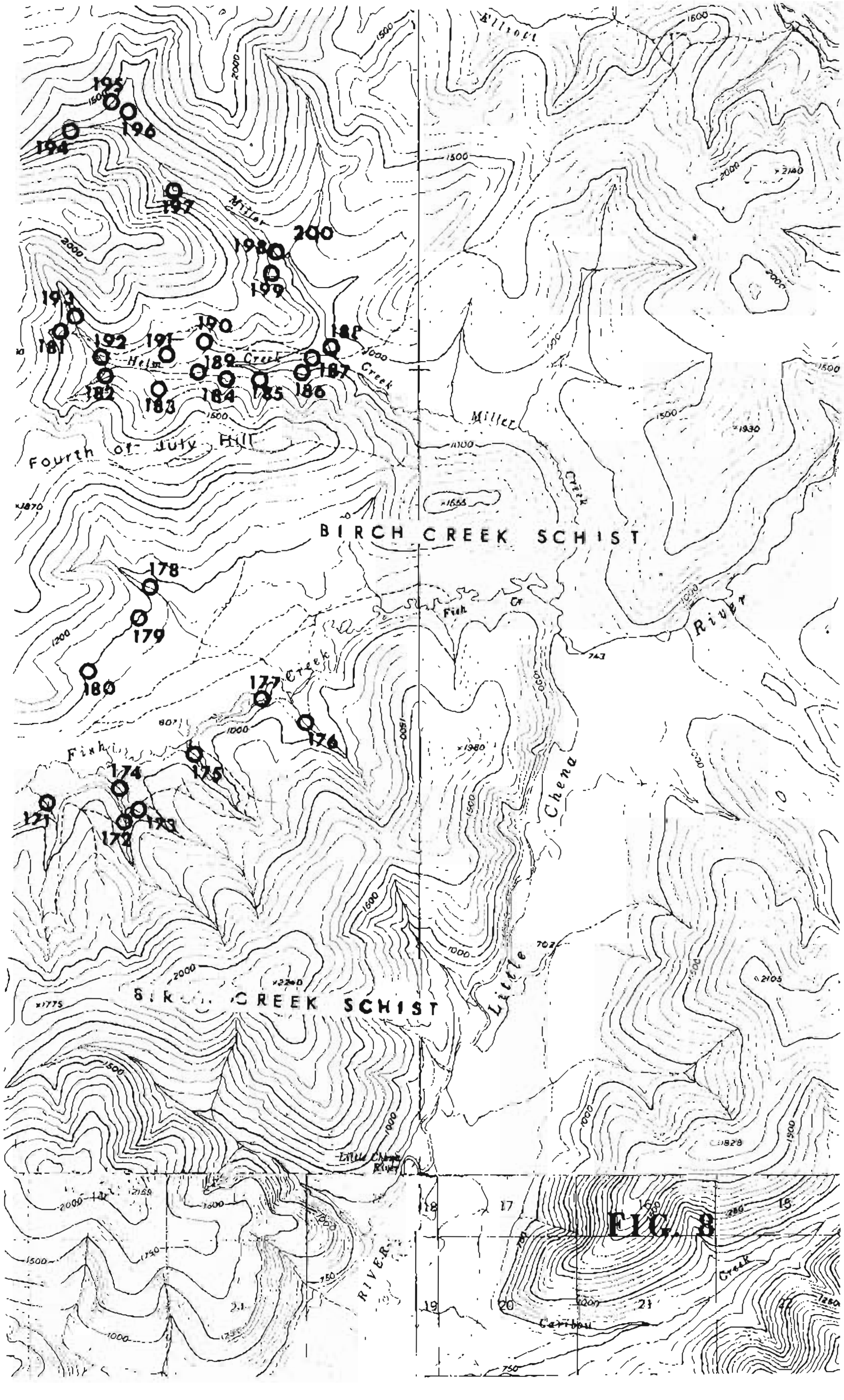
FIG. 7


BIRCH CREEK SCHIST
Fourth of July Hill
Miller Creek
Helm Creek
Fish Creek
Little Chena
River
FIG. 8

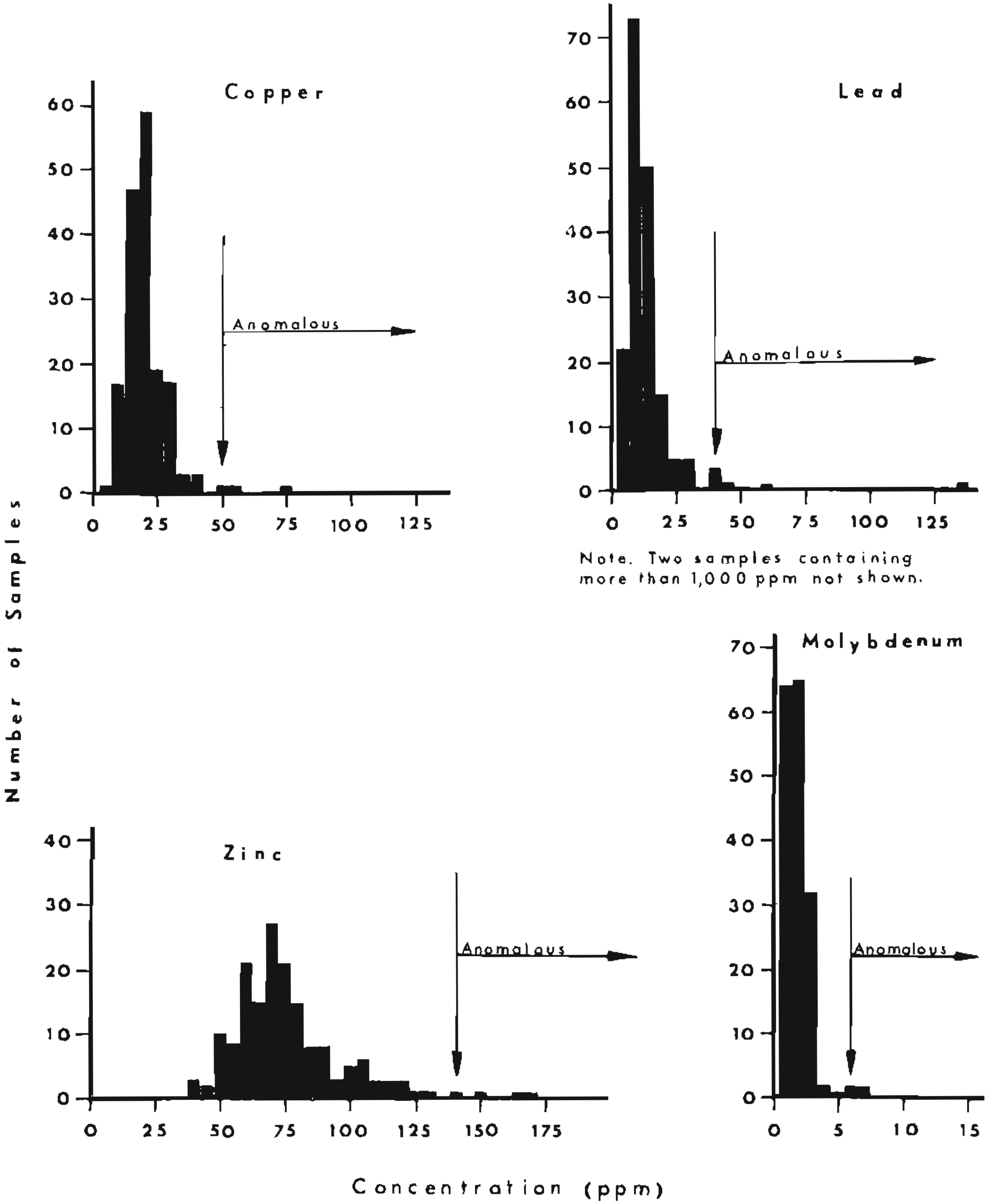


Figure 9 Frequency distribution graphs for copper, lead, zinc and molybdenum: Pedro Dome-Coffee Dome area

TABLE II

Geochemical Sample Analyses

Pedro Dome-Coffee Dome Area

Map	Field No.	ml of dye	Copper	Zinc	Lead	Molybdenum
Figure 5						
78	6 P 64	1	30	90	10	2
79	6 P 65	1	30	110	10	3
80	6 P 66	1	25	85	10	1
81	6 P 67	1	15	65	5	2
82	6 P 68	2	20	90	10	2
83	6 P 69	1	30	105	10	3
84	6 P 63	1	10	60	5	2
85	6 P 62	1	15	140	40	3
86	6 P 61	1	15	90	15	3
87	5 K 115	1	15	85	30	3
88	6 P 125	3	50	115	30	2
89	6 P 126	4	30	105	25	3
90	6 P 59	1	30	130	25	1
91	6 P 60	1	30	120	25	1
92	6 P 124	1	20	100	25	2
Figure 6						
93	6 P 28	2	15	60	10	7
94	6 P 31	1	10	80	10	6
95	6 P 29	1	10	75	10	6
96	6 P 30	1	15	85	15	7
97	6 P 26	1	30	90	15	2
98	6 P 27	1	15	80	30	1
99	6 P 32	2	15	55	5	2
100	6 P 41	1	15	70	10	1
101	6 P 40	1	25	65	10	2
102	6 P 58	1	15	55	10	2
103	6 P 54	1	20	75	20	1
104	6 P 52	1	40	110	20	1
105	6 P 50	1	15	60	10	1
106	6 P 45	1	20	80	15	2
107	6 P 44	1	30	70	15	4
108	6 P 43	1	15	60	10	3
109	6 P 46	1	15	70	10	1
110	6 P 47	1	15	55	10	1
111	6 P 48	18	20	65	15	2
112	6 P 49	2	15	65	20	2

Anomalous amount of metal are underlined

TABLE II (Continued)

Map	Field No.	ml of dye	Copper	Zinc	Lead	Molybdenum
113	6 P 51	1	15	60	10	2
114	6 P 53	1	25	100	20	2
115	6 P 55	2	30	85	20	1
116	6 P 57	1	20	75	10	1
117	6 P 9	1	15	65	5	1
118	6 P 8	1	20	75	10	2
119	6 P 7	1	30	95	20	3
120	6 P 6	1	20	80	10	2
121	6 P 5	1	20	75	10	1
122	6 P 4	1	25	120	10	1
123	6 P 3	1	20	70	10	3
124	6 P 2	1	15	60	10	2
125	6 H 1	1	20	70	5	1
126	6 H 2	1	10	55	10	1
127	6 H 3	1	5	55	5	1
128	6 H 4	1	15	80	10	3
129	6 H 5	1	10	70	10	1
130	6 H 9	1	10	65	10	1
131	6 H 8	3	20	105	15	1
132	6 H 7	1	15	65	10	2
133	6 P 37	1	15	85	20	2
134	6 P 39	1	20	90	10	1
135	6 P 38	1	15	80	15	2
136	6 P 36	1	25	65	15	2
137	6 P 35	1	35	110	30	1
138	6 P 34	1	25	75	15	1
139	6 H 6	1	20	70	10	1
140	6 H 10	1	20	70	10	1
141	6 H 11	1	20	70	10	1
142	6 P 1	1	20	75	10	1
143	6 P 12	1	20	75	10	1
144	6 P 11	1	15	70	5	1
145	6 P 10	1	20	70	5	1
146	6 P 13	1	15	65	10	1
*147	5 H 345	4	25	75	+1,000	1
148	5 H 342	1	25	75	15	2
149	5 H 341	1	55	80	10	3
150	5 H 338	2	35	105	20	2
151	5 H 336	2	30	100	20	2
152	5 H 335	1	30	150	135	2

* 147 0.29% Lead
0.40 ppm Silver

TABLE II (Continued)

Map	Field No.	ml of dye	Copper	Zinc	Lead	Molybdenum
153	5 K 326	7	20	115	40	3
154	5 K 329	5	25	125	30	2
155	5 K 329	6	20	65	10	2
156	5 K 327	10	15	70	10	1
157	5 H 334	1	20	120	45	2
158	5 H 346	2	20	165	40	2
*159	5 H 337	5	30	50	+1,000	2
160	5 H 340	1	20	115	60	3
161	5 H 343	1	30	105	15	2
162	5 H 344	1	20	75	15	2
163	6 H 41	1	75	100	20	2
164	6 H 40	1	25	90	25	1
165	6 H 39	2	30	75	10	2
166	6 H 29	1	20	70	10	1
167	6 H 13	2	20	75	10	1
168	6 H 28	1	20	80	20	1
169	6 H 30	1	30	75	10	1
170	6 P 14	2	15	65	15	1
Figure 8						
171	6 P 25	1	15	60	10	1
172	6 P 24	1	20	100	15	1
173	6 P 22	1	20	65	10	1
174	6 P 23	1	15	65	10	1
175	6 P 21	1	20	75	10	1
176	6 P 19	1	20	70	10	2
177	6 P 18	1	15	70	20	1
178	6 P 17	1	15	70	15	2
179	6 P 16	1	20	70	15	1
180	6 P 15	20	15	70	10	1
181	6 H 27	1	30	8[illegible]	15	1
182	6 H 24	1	20	60	10	2
183	6 H 22	1	15	70	10	1
184	6 H 18	1	25	75	15	1
185	6 H 17	1	35	80	15	1
186	6 H 16	1	25	85	15	2
187	6 H 15	1	25	75	10	2

*159 0.28% Lead
54 ppm Silver

TABLE II (Continued)

Map	Field No.	ml of dye	Copper	Zinc	Lead	Molybdenum
188	6 H 14	1	20	65	5	3
189	6 H 19	1	25	85	15	3
190	6 H 20	18	15	60	10	1
191	6 H 21	18	20	80	15	1
192	6 H 25	1	20	70	15	2
193	6 H 26	1	20	70	15	3
194	6 H 38	1	20	95	15	2
195	6 H 37	1	20	70	15	1
196	6 H 36	1	20	80	15	1
197	6 H 35	1	20	75	20	2
198	6 H 32	1	15	60	5	2
199	6 H 31	1	15	60	10	2
200	6 H 34	1	25	75	15	1
Figure 7						
201	6 P 122	3	20	70	10	2
202	6 P 121	3	20	55	5	1
203	6 P 117	3	20	60	10	2
204	6 P 118	1	20	70	10	3
205	6 P 119	3	20	75	10	3
206	5 H 330	8	25	90	15	3
207	5 H 331	1	15	60	10	2
208	5 H 332	1	15	50	10	2
209	5 H 333	1	20	60	15	3
210	6 P 120	2	15	70	5	1
211	5 K 330	8	15	50	5	2
212	5 K 331	17	20	50	5	2
213	5 K 332	18	20	55	5	3
214	5 K 333	20	20	55	5	1
215	5 K 334	17	20	60	5	1
216	5 K 335	19	25	60	10	1
217	64-11 2	1	15	40	10	1
218	5 H 1	1	10	45	10	2
219	5 H 2	1	20	60	15	3
220	5 H 7	1	20	70	10	3
221	5 H 6	4	15	50	15	3
222	5 H 3	2	15	50	10	2
223	5 H 4	1	15	50	10	3
224	5 H 5	2	10	40	5	2
225	5 H 12	1	20	85	15	3

TABLE II (Continued)

Map	Field No.		ml of dye	Copper	Zinc	Lead	Molybdenum
226	5 H	11	1	15	60	10	3
227	5 H	10	20	20	170	10	2
228	5 H	8	3	25	90	15	3
229	5 H	28	1	25	80	10	4
230	5 H	27	1	10	60	20	2
231	5 H	26	1	10	50	10	2
232	5 H	25	20	40	95	15	3
233	5 H	30	1	10	60	10	3
234	5 H	22	2	20	75	15	2
235	5 H	24	1	20	70	10	2
236	5 H	31	1	40	105	20	5
237	5 H	23	1	15	65	15	3
238	5 H	21	1	20	80	15	2
239	5 H	20	1	10	60	10	2
240	5 H	19	1	10	55	10	2
241	5 H	17	1	15	80	15	2
242	5 H	16	1	10	45	10	1
243	5 H	15	1	10	50	10	2
244	5 H	14	1	15	50	10	2
245	5 H	13	1	10	40	10	3

MASTODON DOME-PORCUPINE DOME AREA

Location and accessibility

The Mastodon Dome-Porcupine Dome area is approximately 65 airline miles northeast of Fairbanks. The Steese Highway, a gravel road extending from Fairbanks to Circle City, passes northeastward through the report area, crossing Eagle Summit about midway between Mastodon and Porcupine Domes. From Miller House, mine access roads radiate to all the mining camps in the report area.

General features

The report area is in a country of relatively high topographic relief; elevations range from about 1,200 feet above sea level in the valleys to 4,915 feet at the top of Porcupine Dome. Timberline is at about 2,500 feet. Most of the report area as seen from the Steese Highway appears to be barren or mantled by grasses and woody brush. Outcrops of rock in this area are scarce; frost riven material, soil, and vegetation mantle most of the country rock. The most prevalant types of vegetation growing in this area are grasses, mosses, sedge tussocks, and woody types of shrub. Timber growing in this area is generally confined to the lower favored slopes and valleys and includes fair stands of white birch, aspen and white spruce.

Rock outcroppings are generally limited to the high ridges and steep headland valleys where recent erosion has exposed the bedrock. Placer gold mining operations have also exposed the bedrock in some of the areas mined.

Geology and mineral deposits

The country rock in the area is mostly the Birch Creek series of metasedimentary and undifferentiated meta-igneous rocks of Precambrian age. These rocks include quartzite schist, quartz-mica schist, quartizite, and feldspathic schist. Interbedded in the upper or younger members of the Birch Creek series are carbonaceous and calcereous schist and thin beds of impure limestone. These schists are intruded in many places by granitic rocks of Cretaceous and Jurassic ages.

In the valleys of Mastodon and Mammoth Creeks the strike of the cleavage of the quartzite schist and quartz-mica schist is approximately N60°W (Mertie, Jr. 1938). Granitic rocks crop out along the easterly side of Mammoth Creek opposite the mouth of Miller Creek, and a number of smaller exposures and dikes of these granites crop out in various places throughout the area.

U. S. Geological Survey workers and others who have studied the placer gold deposits in the Mastodon Creek Valley believe that the gold was derived from veins or a mineralized zone that occurs along the northerly flank of Mastodon Dome. The zone probably extends through to the southeasterly side of the dome where it provided the source of the placer gold deposited in the South Fork of Harrison Creek.

The Independence Creek Valley bedrock north of Harrison Fork is composed mostly of quartzite schist and quartz-mica schist. The cleavage of these schists strikes from north to thirty degrees west, and dips about twenty degrees West.

In the Miller Creek valley west of Independence Creek these schists contain many quartz veins. Further west, between the heads of Miller and Eagle creeks, granite crops out in places along the divide but has not been observed to occur in the bedrock of either creek.

The bedrock in Porcupine Creek, a tributary of Crooked Creek is composed principally of metasedimentary and undifferentiated meta-igneous schists of the Birch Creek series. At the head of Dome Creek on the northwest flank of Porcupine Dome, a gold-silver lode containing some cassiterite has been exposed by prospectors. It is believed to be part of a mineralized zone that produced the placer gold and cassiterite found on Yankee and Porcupine creeks.

Geochemical investigation

U.S.G.S. geologists who studied the concentrates obtained by the early placer miners seldom mentioned the presence of sulfide minerals. Cassiterite in small amounts, is generally the only metallic mineral reported by them. This lack of sulfides is unique for placer deposits of the Yukon-Tanana region, where sulfide minerals generally occur abundantly in the placer concentrates. The present investigation was conducted to determine, if possible, whether sulfide deposits exist in the area. Results, though not conclusive, do indicate that sulfide minerals were deposited with the gold but have not yet been exposed by erosion.

Results of geochemical studies

Field tests and geochemical analyses were made on 145 stream sediment samples collected from the Mastodon Dome-Porcupine Dome area. Eighteen of these contained anomalous quantities of the metals sought. Threshold values for anomalies in the area are 80 parts per million of copper, 155 ppm of zinc, 50 ppm of lead, and 6 ppm of molybdenum.

Results of this study indicate three general areas worthy of further study and prospecting. The largest of these areas appears to extend from a little west of Mastodon Dome through the dome and along the ridge extending south and east above the North Fork of Harrison Creek (figure 11). The second largest area appears to be north of Mastodon Dome on the ridge separating the drainage of Mastodon Creek from the drainages of Mastodon and Miller forks. The third area appears to extend along the northerly side of Porcupine Dome from near the head of Yankee Creek westward toward Pennell Mountain (figure 10). The results also indicate that copper, zinc, and lead minerals may have been deposited with the gold in the mineralized zones that were the source of the placer deposits. If this is so, it is possible that sulfide mineral deposits may occur at depth.

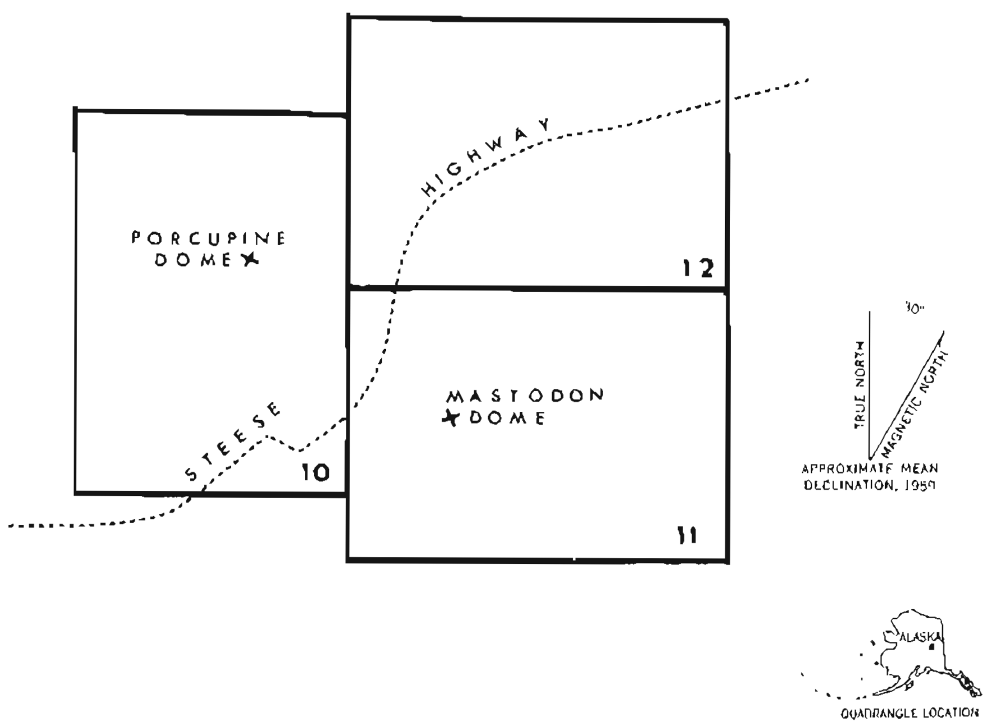
Samples 260 and 261, (figure 10), taken from the headwaters of Yankee Creek, contained anomalous amounts of lead, 25 to 50 ppm of copper, and 105 to 150 ppm of zinc. Metal content of sediments from streams draining the northerly side of Porcupine Dome between samples 259 and 271 ranges from 30 to 50 ppm of copper, and 20 to 50 ppm of lead. Sample 270, taken from a headwater tributary of Loper Creek, contained an anomalous amount of zinc and 40 ppm of both copper and lead. Sample 271, about one half mile northeast of sample 270, contained 50 ppm of copper, 145 ppm of zinc, and 30 ppm of lead.

Sample 296 (figure 11) taken from a headwater tributary of Gold Dust Creek, contained an anomalous amount of zinc. Metal content of stream sediments from this area range from 30 to 50 ppm of copper, 80 to 160 ppm of zinc, and 20 to 40 ppm of lead, which may represent a westward extension of the mineralized zone on Mastodon Dome.

Metal content in sediments of streams that drain the northwesterly side of the ridge extending north from Mastodon Dome to Eagle Summit ranges from 40 to 50 ppm copper, 100 to 155 ppm zinc, and 20 to 40 ppm lead. Metal content in sediments of streams draining the easterly side of this ridge ranges from 45 to 85 ppm copper, 100 to 140 ppm zinc, and 15 to 40 ppm of lead. Samples 309, 310, and 311 had anomalous amounts of copper. These results indicate a mineralize zone extending northward from Mastodon Dome toward Eagle summit.

Sample 308, taken from a small tributary of Miller Fork, contained an anomalous amount of molybdenum; however, it was the only sample in this area to contain a significant amount of molybdenum and is therefore believed to be of little importance.

Samples 344, 345, 346, and 347, taken from the head of the North Fork of Harrison Creek on the southeasterly side of Mastodon Dome, contained anomalous amounts of lead, and sample 347 also contained an anomalous amount of zinc. Metal content of these samples and of other samples taken from streams draining the northerly side of the ridge, which extends southeastwardly from Mastodon Dome between the North Fork of Harrison Creek and Harrison Creek, ranges from 40 to 110 ppm copper, 80 to 145 ppm zinc, and 10 to 25 ppm lead. Samples 343, and 344 on the southwest side of this ridge contained 50 to 80 ppm copper, 110 to 125 ppm zinc, and 15 to 25 ppm lead. These results appear to indicate that the mineralized zone, which produced the placer gold found on the North Fork of Harrison Creek extends from Mastodon Dome southeastward to the mouth of the North Fork of Harrison Creek. The increased proportion of these metals in this area may indicate that sulfide minerals exist at depth in this mineralized zone.



Index diagram of the Mastodon Dome-Porcupine Dome area
(Figures 10,11 and 12)

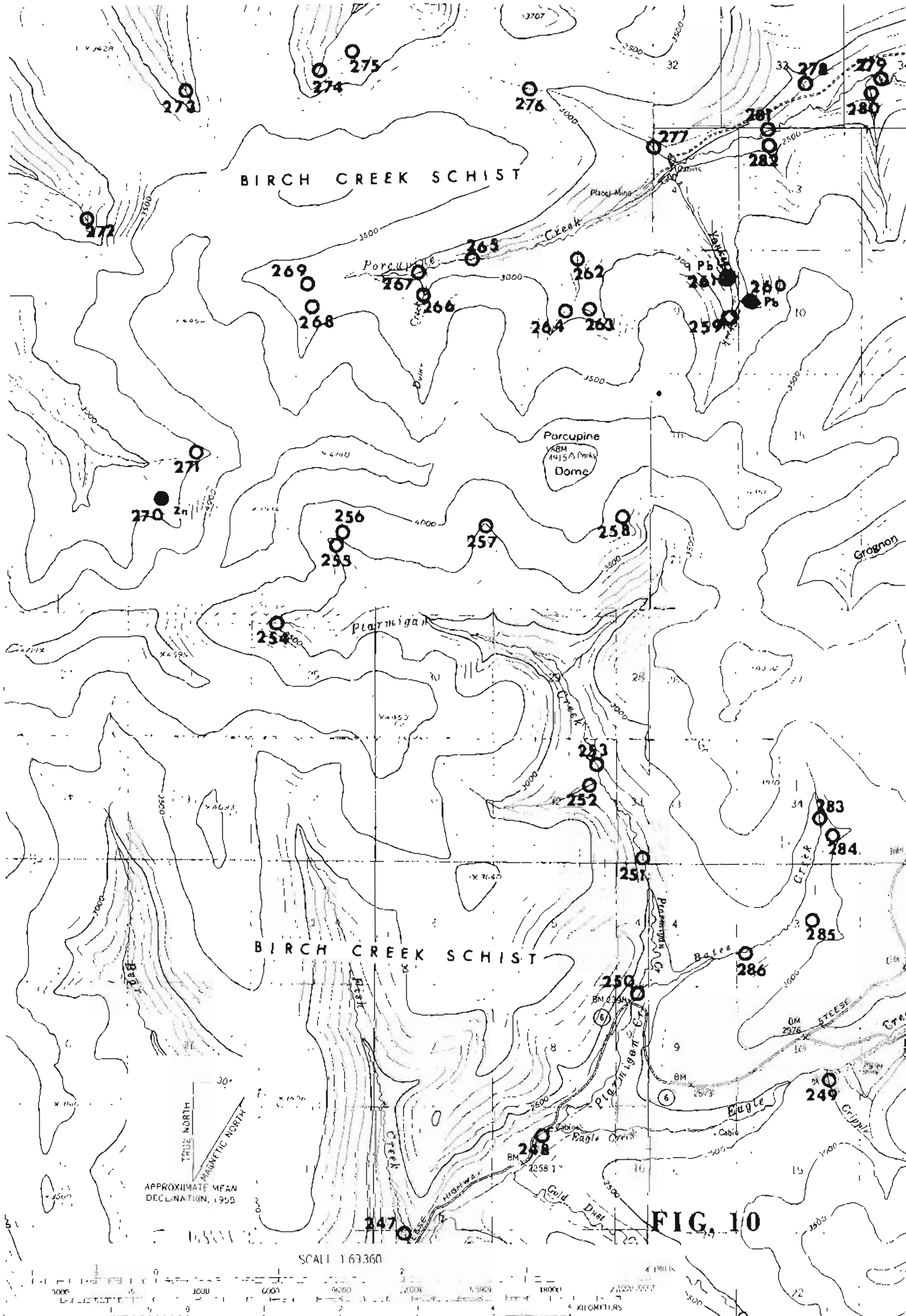

BIRCH CREEK SCHIST
BIRCH CREEK SCHIST
Porcupine
Dome
Porcupine Creek
Ptarmigan
Ptarmigan Creek
Grognon
Bates
Eagle Creek
Gold Dust
STEESE
HIGHWAY
Placer Mine
Cabins
Zn
Pb
247
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
TRUE NORTH
MAGNETIC NORTH
30°
APPROXIMATE MEAN DECLINATION, 1955
SCALE 1:63 360
CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL

FIG. 10

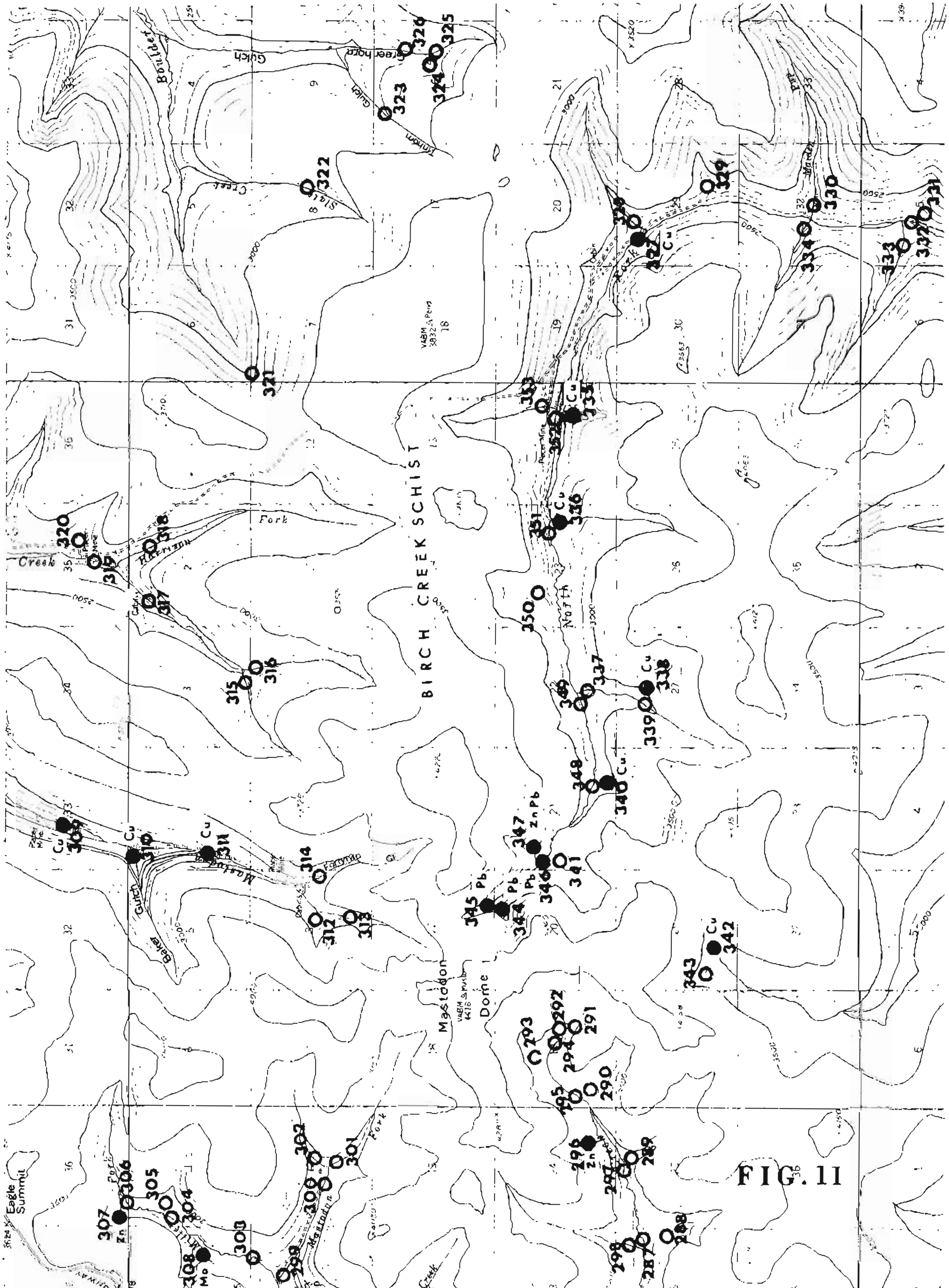

BIRCH CREEK SCHIST
Mastodon Dome
Eagle Summit
Boulder
Fork
Creek
North

FIG. 11

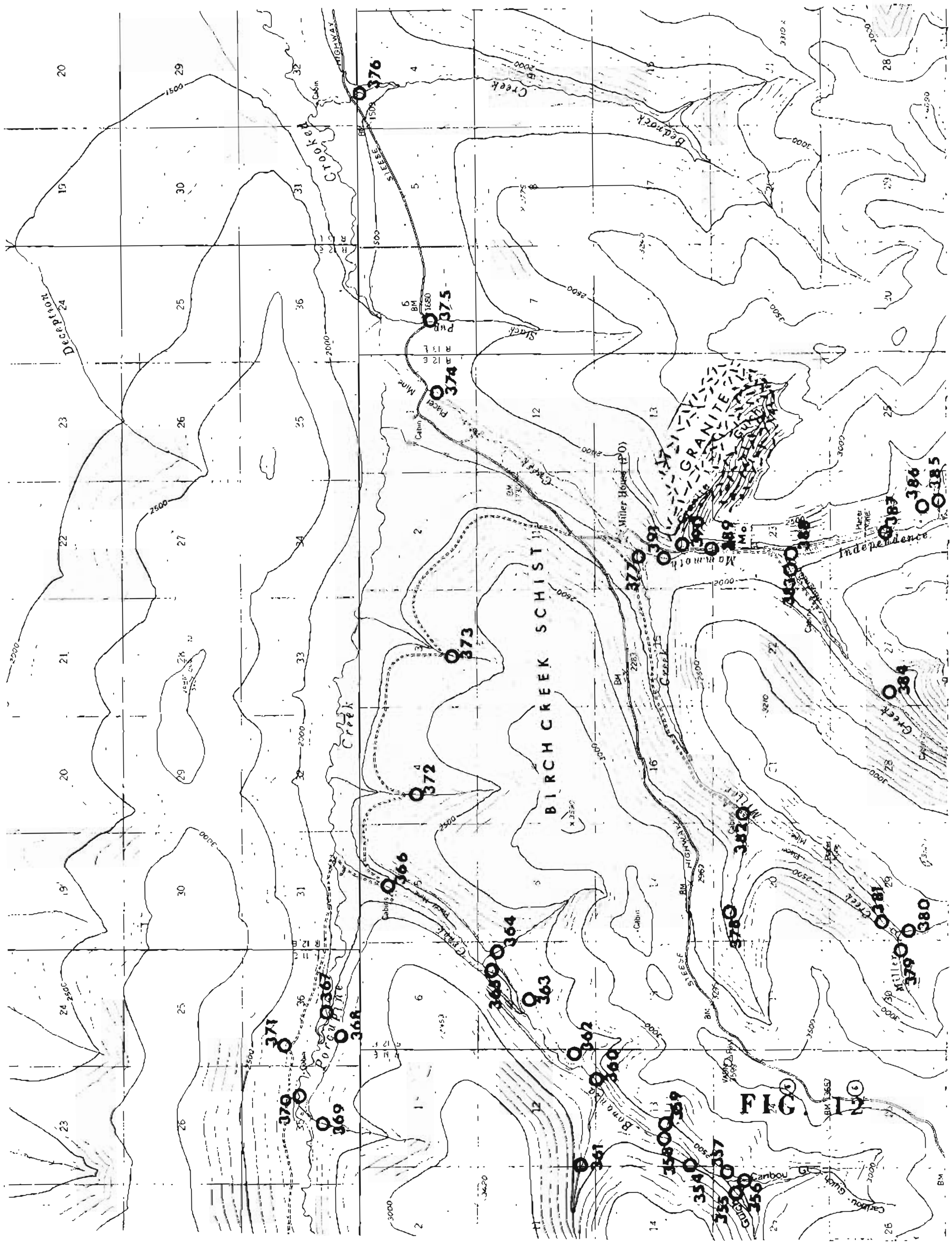

BIRCH CREEK SCHIST
GRANITE
Crooked Creek
Deception
Porcupine
Mammoth
Independence
Miller House (P.O.)
Bedrock Creek
STEESE HIGHWAY
Placer Mine
Miller
Caribou

FIG. 12

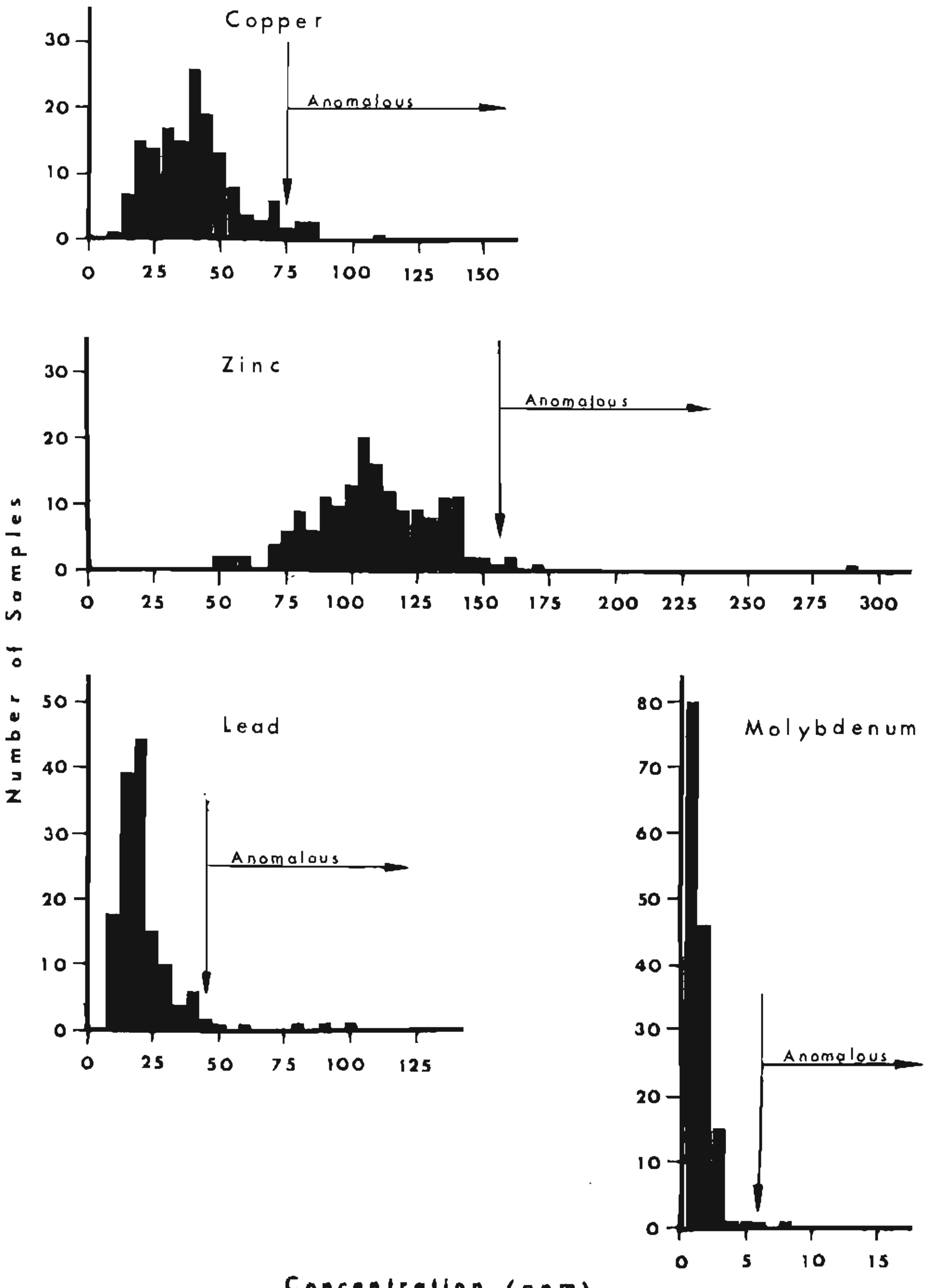


Figure 13 Frequency distribution graphs for copper, zinc, lead and molybdenum: Mastodon Dome-Porcupine Dome area

TABLE III

Geochemical Sample Analyses

MASTODON DOME--PORCUPINE DOME AREA

Map Figure 10	Field No.	Ml of Dye	Copper	Zinc	Lead	Molybdenum
247	1964 44	2	25	75	15	1
248	1964 45	2	30	60	10	2
249	6 P 198	1	35	95	15	2
250	1964 46	3	20	75	15	1
251	6 H 150	1	25	90	15	1
252	6 H 147	1	25	75	15	1
253	6 H 148	1	20	90	15	1
254	6 H 90	1	30	105	15	2
255	6 H 92	1	25	80	15	2
256	6 H 91	1	30	95	20	3
257	6 H 93	1	20	85	20	2
258	6 H 94	1	30	95	20	3
259	6 H 78	1	40	110	45	1
260	6 H 77	4	25	150	80	1
261	6 H 79	1	45	105	90	1
262	6 H 80	1	30	105	30	2
263	6 H 81	1	30	105	30	1
264	6 H 82	6	35	115	35	1
265	6 H 85	1	20	85	20	1
266	6 H 84	1	30	135	25	2
267	6 H 83	6	30	110	25	1
268	6 H 87	1	30	100	25	1
269	6 P 147	2	40	135	20	1
270	6 H 89	1	40	170	40	1
271	6 H 88	6	50	145	30	1
272	6 P 146	6	45	115	15	1
273	6 P 145	4	25	95	25	3
274	6 P 144	4	15	75	20	4
275	6 P 143	2	20	95	35	3
276	6 P 142	5	15	80	15	2
277	6 P 141	1	30	110	15	1
278	6 H 98	6	15	70	15	1
279	6 H 100	1	15	55	15	1
280	6 H 99	1	35	95	20	2
281	6 H 97	6	15	70	20	1
282	6 H 96	1	35	75	20	2
283	6 H 152	1	30	105	20	1
284	6 H 151	1	35	100	20	2
285	6 H 153	1	30	105	20	1
286	6 H 154	1	30	90	15	1

Anomalous amounts of metal are underlined.

Map	Field No.	Ml of Dye	Copper	Zinc	Lead	Molybdenum
Figure 11						
287	6 P 165	4	40	110	20	1
288	6 P 166	2	60	85	15	2
289	6 P 162	4	25	80	15	2
290	6 P 159	4	45	135	25	3
291	6 P 155	1	40	120	30	2
292	6 P 154	4	45	130	40	2
293	6 P 157	1	40	125	30	2
294	6 P 158	4	40	130	30	1
295	6 P 160	1	30	90	15	1
296	6 P 161	1	40	160	40	3
297	6 P 163	1	40	115	25	1
298	6 P 164	1	40	115	20	1
299	6 P 197	1	50	95	25	3
300	6 P 196	1	45	100	25	1
301	6 P 194	1	40	105	20	1
302	6 P 195	1	40	100	20	1
303	6 P 193	1	45	105	20	1
304	6 P 191	1	45	105	20	1
305	6 P 188	1	55	115	20	1
306	6 P 189	1	50	110	20	2
307	6 P 190	1	40	155	20	2
308	6 P 192	1	25	105	20	8
309	6 P 183	1	85	110	15	3
310	6 P 182	1	85	110	20	2
311	6 P 180	1	85	105	20	1
312	6 P 178	1	50	110	25	1
313	6 P 177	1	60	140	40	2
314	6 P 179	1	60	135	25	1
315	6 H 129	1	45	150	20	2
316	6 H 130	1	30	120	15	2
317	6 H 131	1	30	100	20	2
318	6 H 132	1	35	100	35	1
319	6 H 133	1	35	125	25	1
320	6 H 134	1	35	140	30	1
321	6 P 176	1	25	90	15	2
322	6 P 175	1	20	90	15	2
323	6 P 174	4	20	85	10	2
324	6 P 172	4	35	100	15	1
325	6 P 173	10	35	100	10	2
326	6 P 171	6	40	115	10	1
327	6 H 121	1	80	90	10	1
328	6 H 120	4	70	105	15	1
329	6 H 122	4	60	115	10	1
330	6 H 124	2	55	95	10	1
331	6 H 125	1	40	85	10	1

Map	Field No.	Ml of Dye	Copper	Zinc	Lead	Molybdenum
332	6 H 126	1	70	80	10	2
333	6 H 128	1	65	110	10	1
334	6 H 123	1	70	90	10	1
335	6 H 117	6	110	130	20	1
336	6 H 115	1	75	140	20	2
337	6 H 111	4	65	100	10	2
338	6 H 109	1	75	110	10	2
339	6 H 110	1	70	80	10	2
340	6 P 169	4	80	100	15	2
341	6 P 149	4	50	145	25	3
342	6 P 168	1	80	110	15	1
343	6 P 167	1	40	125	25	2
344	6 P 152	1	50	160	100	1
345	6 P 153	1	40	115	50	1
346	6 P 150	1	40	140	45	2
347	6 P 148	1	45	290	60	3
348	6 P 170	2	35	120	30	1
349	6 H 112	4	45	115	20	1
350	6 H 113	1	20	105	10	1
351	6 H 114	1	40	100	20	1
352	6 H 118	1	65	80	15	2
353	6 H 119	1	35	100	15	1
Figure 12						
354	6 P 131	1	25	95	25	2
355	6 P 134	1	40	110	15	2
356	6 P 133	1	45	115	20	1
357	6 P 132	7	25	110	15	3
358	6 P 130	6	25	110	15	2
359	6 P 129	1	20	105	20	3
360	6 P 136	1	40	135	40	2
361	6 P 135	1	30	120	30	2
362	6 P 128	6	40	140	20	3
363	6 P 137	6	20	125	20	1
364	6 P 138	1	35	140	40	3
365	6 P 127	1	40	110	20	5
366	6 P 140	1	25	105	25	1
367	6 H 105	1	20	55	15	1
368	6 H 104	1	25	80	10	2
369	6 H 101	1	20	70	15	1
370	6 H 103	2	20	70	15	1
371	6 H 102	1	15	50	10	1
372	6 H 107	6	25	80	15	1
373	6 H 108	1	15	50	10	1

Map	Field No.	Ml of Dye	Copper	Zinc	Lead	Molybdenum
374	50	7	45	90	20	1
375	51	9	20	75	20	1
376	52	4	10	60	20	1
377	6 H 145	3	40	105	25	1
378	6 H 140	1	55	115	20	2
379	6 H 141	1	45	105	20	1
380	6 H 142	1	50	105	20	1
381	6 H 143	1	50	105	15	1
382	6 H 144	1	55	90	20	2
383	6 P 185	1	70	80	15	2
384	6 P 184	1	40	90	15	2
385	6 H 137	1	35	115	30	1
386	6 H 136	2	55	100	20	1
387	6 H 139	1	40	105	25	1
388	6 H 186	1	45	110	20	3
389	6 H 187	1	70	90	15	6
390	6 H 135	1	20	135	35	1
391	6 H 146	1	55	85	15	1

THE COLUMBIA CREEK-O'BRIEN CREEK AREA

Location and accessibility

The Columbia Creek-O'Brien Creek area is in east central Alaska in the Fortymile mining district. It is accessible from Fairbanks and the Alaska road network by way of the Taylor Highway, which branches north from the Alaska Highway at Tetlin Junction. The highway runs from the Fortymile River to Liberty Fork along the westerly side of O'Brien Creek traversing the easterly side of the report area.

General features

The topography of the report area is one of moderate relief. Altitudes range from about 1400 feet at the junction of O'Brien Creek and the Fortymile River to around 4000 feet along the crests of the higher hills and ridges. The plateau has been deeply incised by O'Brien Creek and its tributaries, thereby producing many steep-walled valleys. In some places these rise sharply to the crests of well rounded ridges and hills; in other places they rise sharply to the floors of broad, poorly drained valleys.

Soil and vegetation generally mantle the country rock except in some places along the crests of the higher ridges and along steep-walled valleys. In poorly drained areas along the ridges, hillslopes, and broad upland valleys, the vegetation is chiefly moss, grass sedge tussocks, and woody shrubs with occasional stands of small black spruce. On favored slopes and ridges and in places along the banks of some of the streams, stands of white spruce grow abundantly. Timberline in the Fortymile district is about 2,500 feet in altitude.

All of the streams that drain the report area ultimately flow into the Fortymile River, which derives its name from the fact that its junction is forty miles downriver from the old Hudson Bay Trading Post at Fort Reliance, Yukon Territory, Canada. The two larger northerly tributaries of Columbia creek head in broad open, poorly-drained valleys of muskeg and small ponds. This kind of environment is ideal for the concentration and precipitation of metallic ions from ground and surface water by carbonaceous matter and ferrugenous scums.

Geology and mineralization

The country rock in the report area is composed primarily of the Birch Creek schist series of metasedimentary and associated meta-igneous rocks that include quartzite, quartzite-schist, quartz-mica schist, mica schist, feldspathic and chloritic schist, with minor beds of carbonaceous and calcareous schist, and thin-bedded limestone. These carbonaceous and calcereous schists and limestones are believed by Mertie to belong to the upper or younger Birch Creek series. Younger Paleozoic rocks composed principally of quartzite, quartz-mica schist, greenstone, and greenstone schist occur in places in the northern and western part of the area. Mertie reported the Birch Creek schist to be in contact with the undifferentiated Devonian rocks a little below the junction of Liberty Fork and O'Brien creeks.

Geochemical studies

During his geochemical investigation of streams along the Taylor Highway in 1965, Robert H. Saunders collected a weakly anomalous sediment sample near the mouth of Columbia Creek. The purpose of the present investigation was to determine the source of this weakly anomalous sample. Samples were also collected from O'Brien Creek at points where high water had prevented sampling during the 1965 investigation.

Sixteen of the 84 samples collected had anomalous amounts of metal. All samples were analyzed for trace amounts of copper, zinc, lead, and molybdenum, and 64 were also analyzed for nickel. The threshold values were determined to be 60 ppm for copper, 170 ppm for zinc, 40 ppm for lead, 6 ppm for molybdenum, and 115 ppm for nickel.

Results of geochemical studies

Sample 399, collected from a westerly tributary of O'Brien Creek about two miles north of Alder Creek (figure 14), contained an anomalous amount of copper. It may represent a small zone. Further work in this area should include upstream sampling of soils and sediments and a physical examination of the soil and rocks on either side of this stream above the sample site. Samples should also be taken from small streams and seepages that occur along the south side of King Creek above sample 400.

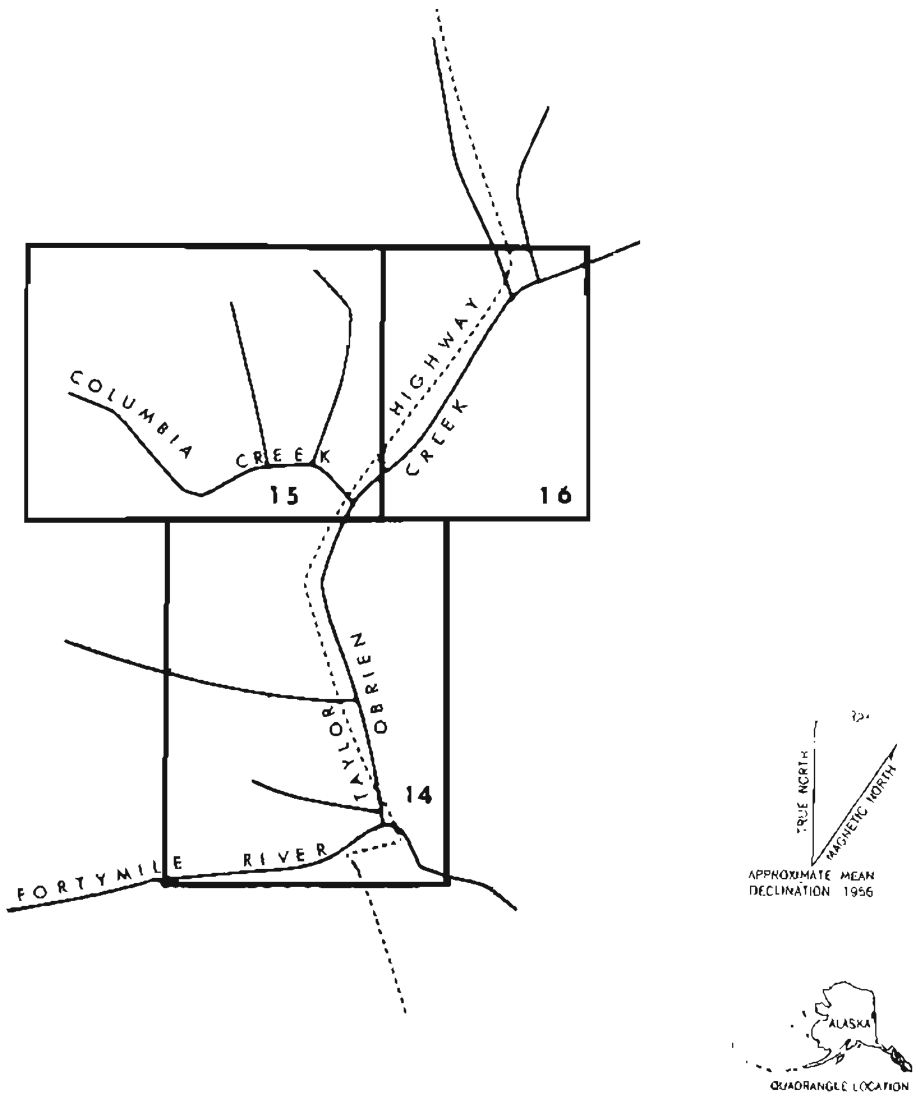
Four areas in the Columbia Creek drainage appear anomalous. Sample 411, (figure 15), taken above the mouth of the first large northerly tributary of Columbia Creek, was found to contain an anomalous amount of zinc and 20 ppm of lead. It has a higher content of heavy metals than does sample 413, which was taken from a point about 2 miles above sample 411. Sample 414, taken from a small easterly tributary of this stream, contained an anomalous amount of lead. This lead anomaly appears to come from a small local source for sample 418, which was taken from a stream draining part of the same hill and saddle, had a lower metal content.

Sample 425, taken from near the head of the first large northerly tributary, contained anomalous amounts of both zinc and lead, and 30 ppm of copper. This sample was taken from a sluggish part of the stream above a small pond where carbonaceous matter may have concentrated these metals.

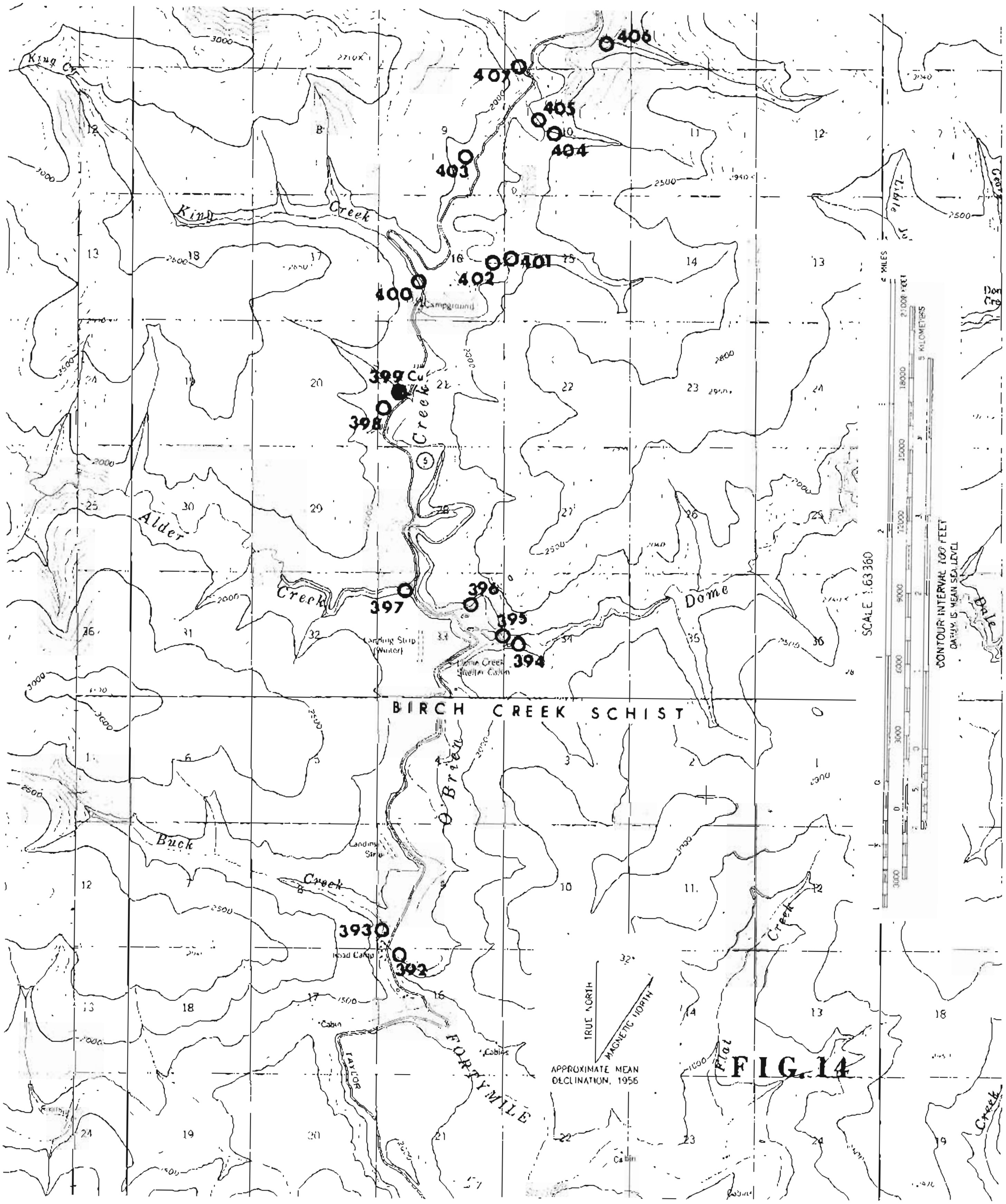
Sediment samples collected from small tributaries of Columbia Creek between the two larger northerly tributaries contained anomalous amounts of metal. Sample 427, contained anomalous amounts of nickel, 428 contained anomalous amounts of copper, zinc, molybdenum, and nickel. Sample 429, taken from the south side of Columbia Creek contained an anomalous amount of molybdenum. These results indicate a possible mineralized zone somewhere along the hillside between the two tributaries.

Sediment samples collected from the second larger northerly tributary appear to result from a possible mineralized area occuring near the head of the stream or from a zone in the ridge between the heads of the two larger northerly tributaries. Samples 440 and 441 contained anomalous amounts of zinc and lead, and copper ranged from 30 to 40 parts per million. This anomaly appears to diminish downstream as represented by decreases in amounts of zinc from 290 to 155 parts per million, and lead from 140 to 40 parts per million between the head and the mouth of this stream.

Results of this investigation indicate that weak anomalies or above average metal content in sediments of large streams may be indicative of an anomalous area occuring somewhere upstream in the drainage. The anomalous nickel samples probably indicate only that basic or ultra basic types of rock are present and not a deposit of nickel.



Index diagram of the Columbia Creek-O"Brien Creek area
(Figures 14, 15 and 16)


King Cr.
King Creek
Alder Creek
Buck Creek
Dome
O'Brien Creek
FORTYMILE
Flat Creek
Campground
Landing Strip (Water)
Dome Creek Shelter Cabin
Road Camp
Cabin
TAYLOR
BIRCH CREEK SCHIST
406
407
405
404
403
401
402
400
399
398
397
396
395
394
393
392
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1956
SCALE 1:63 360
CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL
5 KILOMETERS
FIG. 14

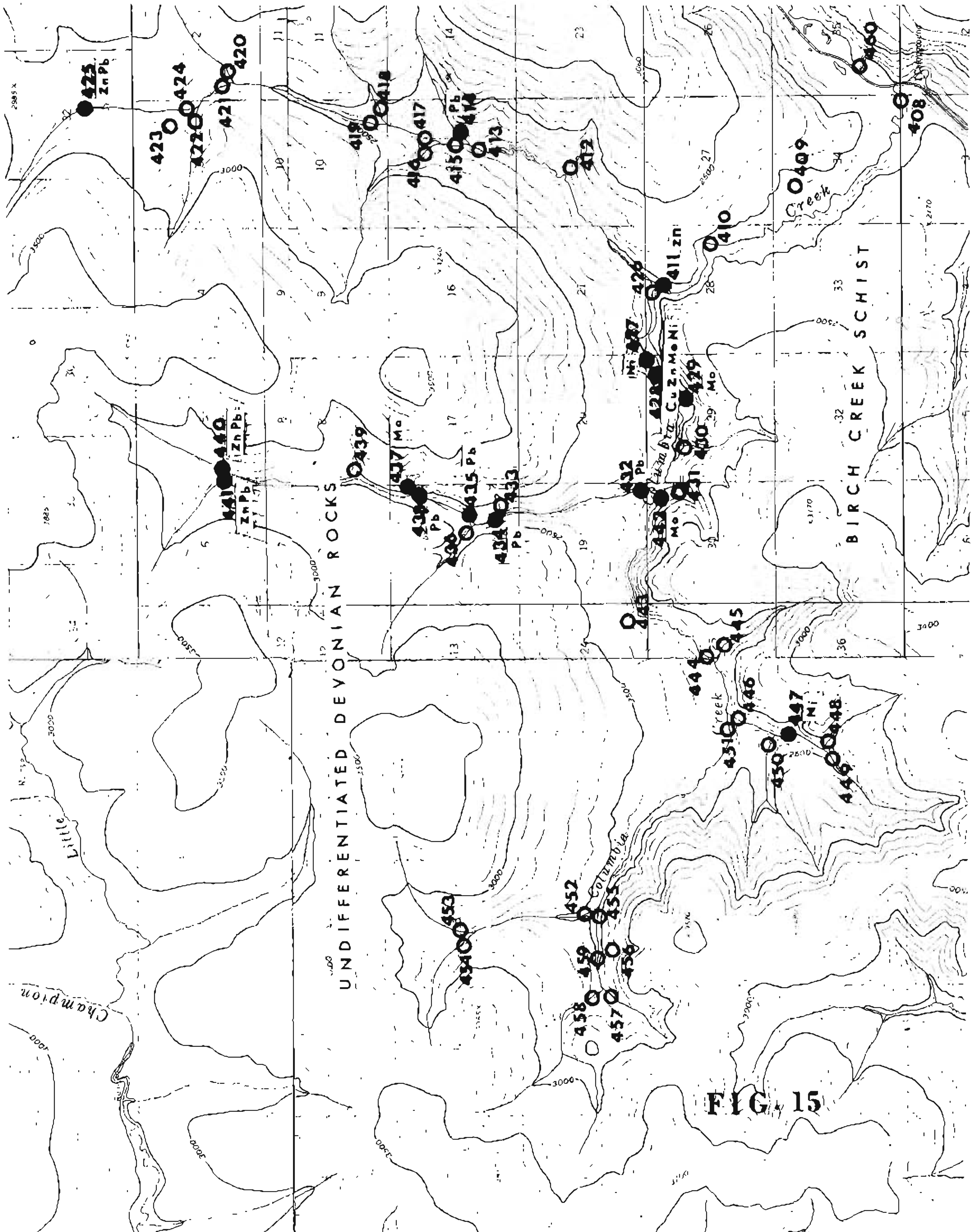

UNDIFFERENTIATED DEVONIAN ROCKS
BIRCH CREEK SCHIST
Champion
Little
Creek
Columbia
Creek

FIG. 15

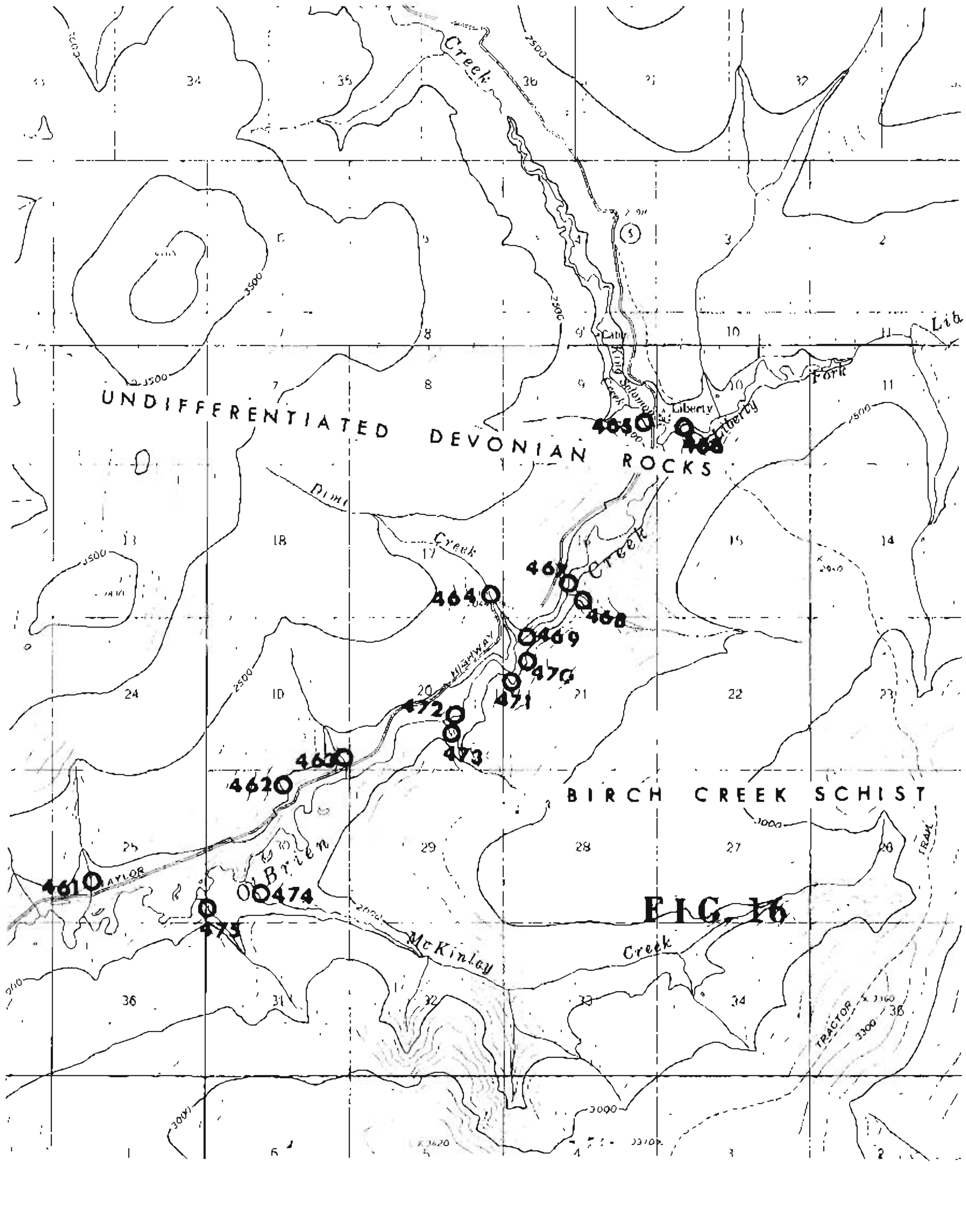

UNDIFFERENTIATED DEVONIAN ROCKS
BIRCH CREEK SCHIST
Liberty
McKinley
Creek
O'Brien
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475

FIG. 16

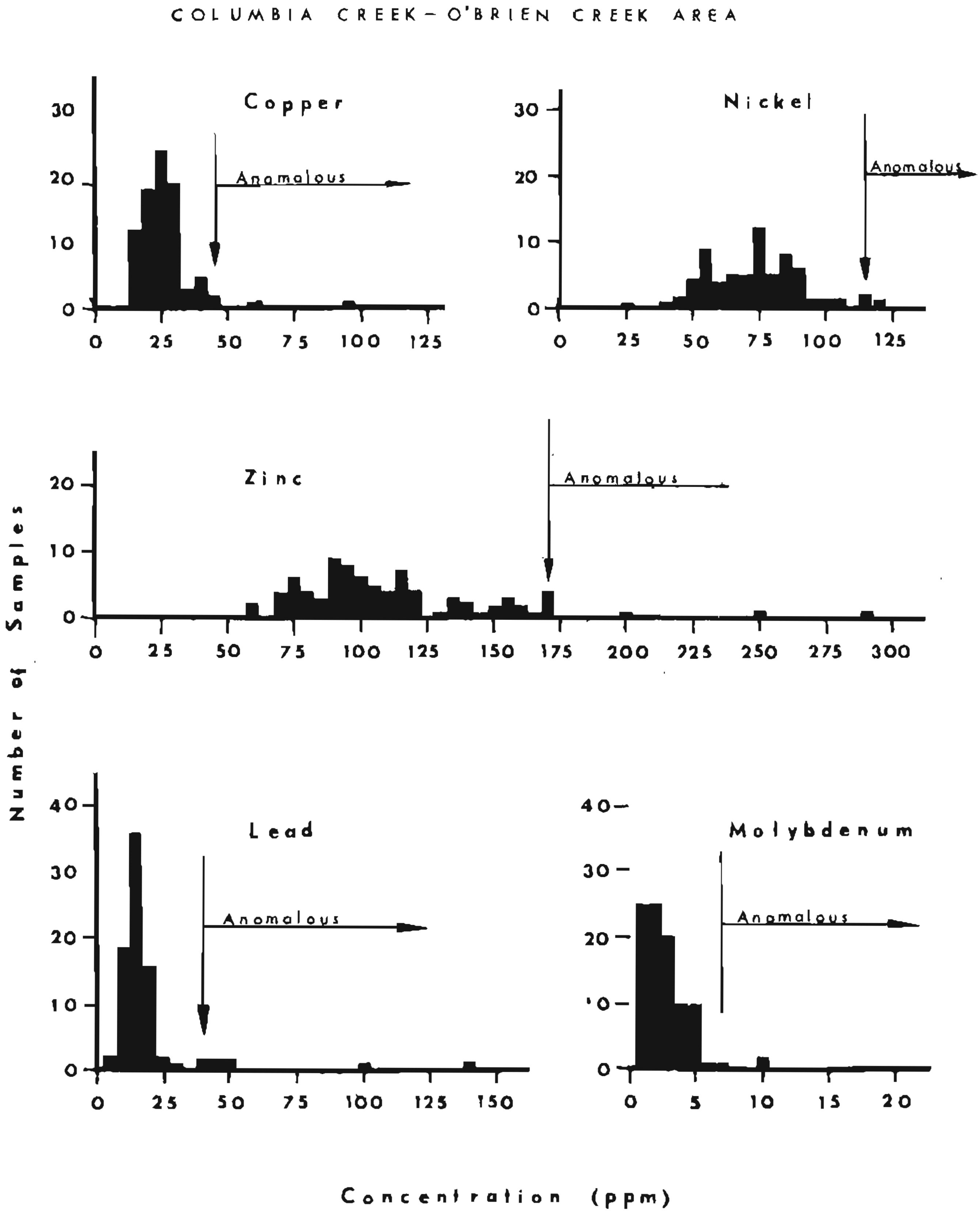


Figure 17 Frequency distribution chart for copper, zinc, lead and molybdenum: Columbia Creek-O'Brien Creek area

TABLE IV

Geochemical Sample Analyses

Columbia Creek-O'Brien Creek Area

Map	Field No.	ml of dye	Copper	Zinc	Lead	Molybdenum	Nickel
Figure 14							
392	5 H 212	5	30	75	15	2	
393	5 H 211	7	15	70	10	3	
394	6 H 191	1	25	70	5	1	50
395	6 H 192	1	25	95	15	3	75
396	5 H 213	1	25	105	10	4	
397	5 H 214	7	25	60	5	2	
398	5 H 215	6	35	70	10	3	
399	5 H 216	5	95	90	10	3	
400	5 H 217	1	30	105	10	2	
401	6 H 189	1	25	120	10	1	65
402	6 H 190	1	30	120	15	1	75
403	5 H 219	9	40	95	20	3	
404	6 H 186	1	20	80	15	1	55
405	6 H 187	1	25	120	15	1	75
406	6 H 185	1	30	90	10	1	45
407	5 H 220	7	20	80	15	3	
Figure 15							
408	5 H 221	1	35	135	20	4	
409	6 H 155	1	25	165	25	1	85
410	6 H 156	1	35	155	20	2	90
411	6 H 158	1	30	170	20	1	80
412	6 H 163	1	15	95	10	1	85
413	6 H 162	1	20	135	15	2	85
414	6 H 160	1	20	90	40	2	90
415	6 H 161	1	15	130	15	2	55
416	6 H 164	1	20	115	15	1	80
417	6 H 165	1	15	140	15	3	55
418	6 H 173	1	20	75	10	1	90
419	6 H 174	1	20	145	15	1	75
420	6 H 166	1	15	90	20	1	55
421	6 H 167	1	20	160	20	1	65
422	6 H 169	1	15	115	15	1	80
423	6 H 171	1	25	105	20	1	75
424	6 H 170	6	15	150	20	1	75
425	6 H 172	10	30	410	45	2	80
426	6 H 157	1	30	115	15	3	85
427	6 P 199	1	20	90	20	2	115

Anomalous amounts of metal are underlined

TABLE IV (Continued)

Map	Field No.	ml of dye	Copper	Zinc	Lead	Molybdenum	Nickel
428	6 P 200	1	60	200	20	10	120
429	6 P 201	1	25	105	15	7	70
430	6 P 202	1	25	100	10	2	90
431	6 P 203	1	30	110	15	4	70
432	6 P 205	1	20	155	40	3	70
433	6 P 206	1	30	90	15	1	105
434	6 P 207	1	20	155	45	2	65
435	6 P 208	1	25	170	50	3	60
436	6 P 209	1	20	95	15	1	55
437	6 P 210	1	40	170	15	10	85
438	6 P 211	1	25	170	50	1	75
439	6 P 213	1	30	150	15	1	75
440	6 P 215	1	40	290	140	5	65
441	6 P 214	1	30	250	100	3	55
442	6 P 204	1	30	105	10	6	80
443	6 P 216	1	15	100	25	2	55
444	6 P 218	1	25	100	15	5	25
445	6 P 217	2	20	100	15	3	55
446	6 P 219	10	25	95	15	3	75
447	6 P 222	7	25	100	15	4	115
448	6 P 223	3	25	85	15	5	55
449	6 P 224	1	25	100	15	5	95
450	6 P 221	1	15	80	10	5	50
451	6 P 220	2	20	95	15	3	60
452	6 P 228	1	25	90	20	3	65
453	6 P 227	1	25	85	10	2	45
454	6 P 226	1	20	85	20	3	60
455	6 P 229	1	25	95	15	3	90
456	6 P 230	1	25	95	15	3	85
457	6 P 232	1	45	140	20	2	90
458	6 P 233	1	15	70	10	2	75
459	6 P 231	1	25	90	15	4	100
460	5 H 222	5	30	115	20	2	
Figure 16							
461	6 H 175	1	30	160	20	2	85
462	5 H 224	1	40	115	15	2	
463	5 H 225	4	45	110	30	3	
464	5 H 226	4	25	90	10	2	
465	5 H 227	5	25	115	15	2	
466	5 H 228	5	20	80	10	2	
467	6 H 177	1	30	115	15	1	70

TABLE IV (Continued)

Map	Field No.	ml of dye	Copper	Zinc	Lead	Molybdenum	Nickel
468	6 H 176	1	30	135	15	3	75
469	6 H 178	1	30	120	15	2	75
470	6 H 179	1	15	75	10	2	50
471	6 H 180	1	15	60	10	1	40
472	6 H 182	1	20	110	15	1	85
473	6 H 181	4	20	75	10	2	70
474	6 H 184	1	30	110	20	1	60
475	6 H 183	4	30	75	15	2	50

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