Bureau of Mines
Report of Investigations 4890

INVESTIGATION OF THE MILLETT COPPER DEPOSIT ILIAMNA LAKE, SOUTHWESTERN ALASKA

BY F. A. RUTLEDGE AND J. J. MULLIGAN

United States Department of the Interior——July 1952

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UNITED STATES DEPARTMENT OF THE INTERIOR
Oscar L. Chapman, Secretary
BUREAU OF MINES
J. J. Forbes, Director

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by

F. A. Rutledge[1/] and J. J. Mulligan[1/]

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INTRODUCTION AND SUMMARY

The Millett copper deposit is on the north shore of Iliamna lake in southwestern Alaska. Copper mineralization occurs in a zone of altered limestone adjacent to and intruded by a diorite porphyry with some diabase facies.

During 1949 and 1950, the Bureau of Mines investigated this prospect as a part of the U. S. Department of the Interior program in Alaska for the development of critical and strategic minerals. Field work was begun August 8, 1949; it was recessed November 28, 1949, because of inclement weather. The work was resumed May 28, 1950, and completed July 3, 1950.

The program of investigation by the Bureau of Mines included topographic surveying, machine and hand trenching, diamond drilling, and sampling the zones of mineralization. This report outlines the general geology of the area, gives a description of the deposit, and contains the factual data resulting from work by the Bureau of Mines.

ACKNOWLEDGMENTS

The investigation of the Millett copper deposit was under the direction of G. D. Jermain, chief, Mining Division, Region I, Federal Bureau of Mines.

Analyses of samples were made by H. E. Peterson, chemist, Metallurgical Division, Region IV, Federal Bureau of Mines, Salt Lake City, Utah. Petrographic identification of rock specimens were made by LaMar G. Evans of the same station.

Diamond-drill cores were logged by W. S. Twenhofel, geologist, Federal Geological Survey, Juneau, Alaska.

The cooperation of St. Eugene Mining Corp., Ltd., N.P.L., Vancouver, British Columbia, Canada, holders of the property by option, is gratefully acknowledged.

A report on the property by J. C. Roehm of the Territorial Department of Mines was of utmost assistance in planning the development program of the Bureau of Mines.

Acknowledgment also is made to Lauritz Olsen, Iliamna, Alaska, for allowing the Bureau of Mines to use his cabin at Millett Point during the project.

LOCATION AND ACCESSIBILITY

The Millett copper deposit is in the Iliamna Lake region, southwestern Alaska, about 180 miles southwest of Anchorage, Alaska (fig. 1). The prospect is on the north shore of Iliamna Lake at Millett Point about 1-1/2 miles west of a small arm of Chekok Bay called Goose Bay; it is 12 miles east of Severseen's road hours (fig. 2).

Access to the area is slow and difficult, except by air. The Civil Aeronautics Administration maintains an airport at Iliamna, which is about 4 miles by road west of Severseen's road house. The Alaska, Northern Consolidated, and Pacific Northern airlines maintain regular schedules between Anchorage and Iliamna airport. The passenger rate from Anchorage to Iliamna in November 1951 was $29.50 plus tax per passenger and 6 cents per pound on cargo shipments between 100 and 500 pounds. On shipments of more than 500 pounds, the cargo rate was 5 cents per pound.

From Severseen's road house, small fishing boats may be chartered, except during the fishing season, to take men and equipment to Millett Point. The usual form of transportation, however, is small, pontoon-equipped planes. Rates range from $30 to $60 an hour, depending on the size and capacity of the plane under charter.

Two other means of access to the area are available. One is by small boat up the Kvichak River and Iliamna Lake from Bristol Bay; the other is by truck across the portage from Iliamna Bay on Cook Inlet to Pile Bay on Iliamna Lake, thence by small boat to Millett Point. The tractor-dozer used on the project was brought into the area over the latter route.

PHYSICAL FEATURES AND CLIMATE

Iliamna Lake, whose surface is 50 feet above sea level, is the largest fresh-water lake in Alaska; it is more than 80 miles long and over 22 miles wide at its widest point. Iliamna Lake is drained by the Kvichak River, which flows into Bristol Bay.

The topography of the project area is typical of most of the Iliamna Basin. The hills are well-rounded as a result of recent sheet glaciation. Only a small amount of glacial till is present.

Terraced parallel beaches are present at Millett Point. In trench 18, over 14 feet of clean sand lying on boulders and gravel was exposed.

The shores of the eastern part of Iliamna Lake are covered with a forest of spruce, cottonwood, and birch, but only a small proportion of the spruce trees are of saw-log diameter. Millett Point is near the southern and western limits of the forested area. Large parts of the project area are covered only by grass or thickets of willows and alders. Much of the higher part of the project area is covered with mosses and lichens, which constitute the principal food of the reindeer.

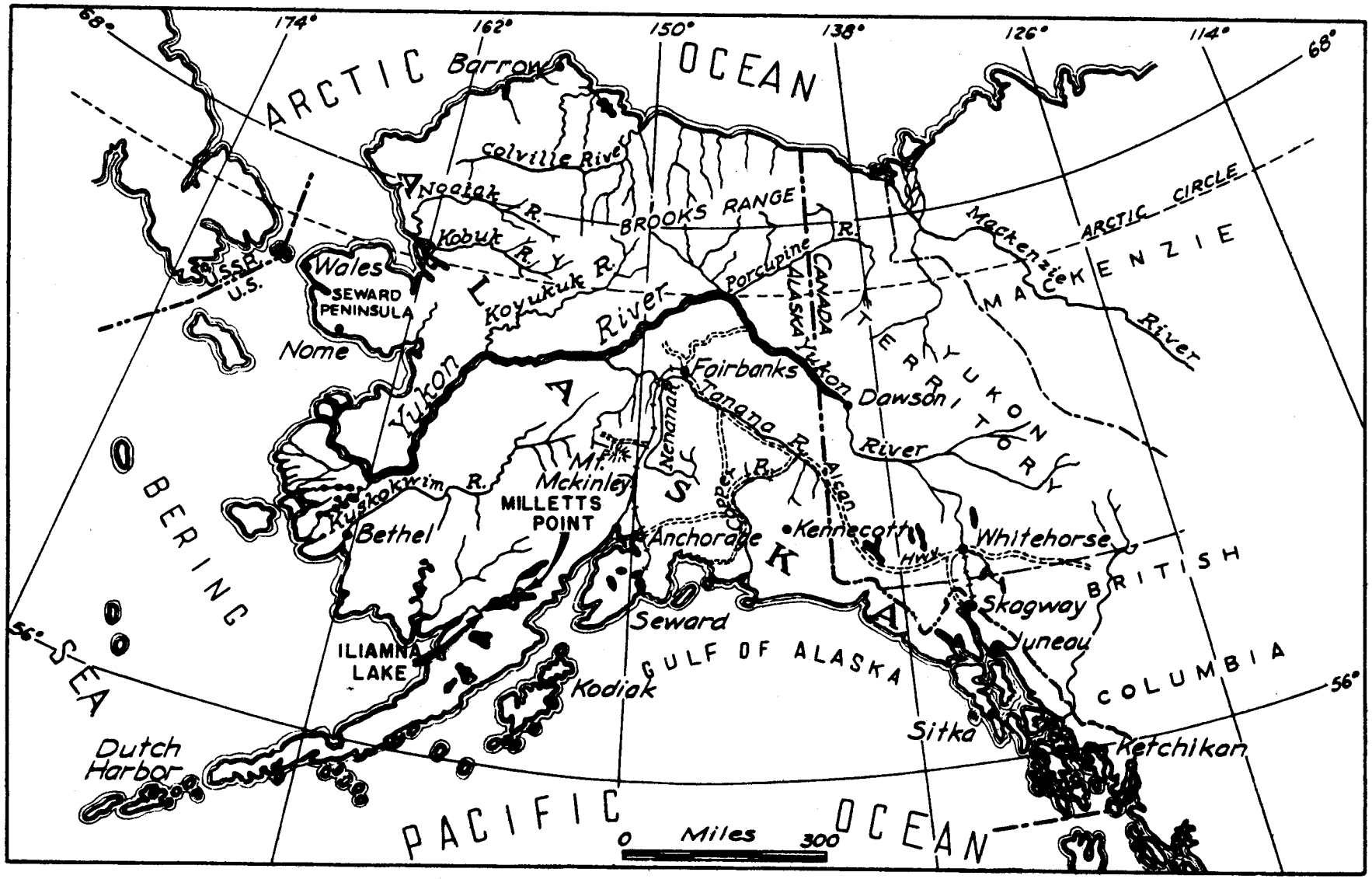

Figure 1. - Index map of Alaska.

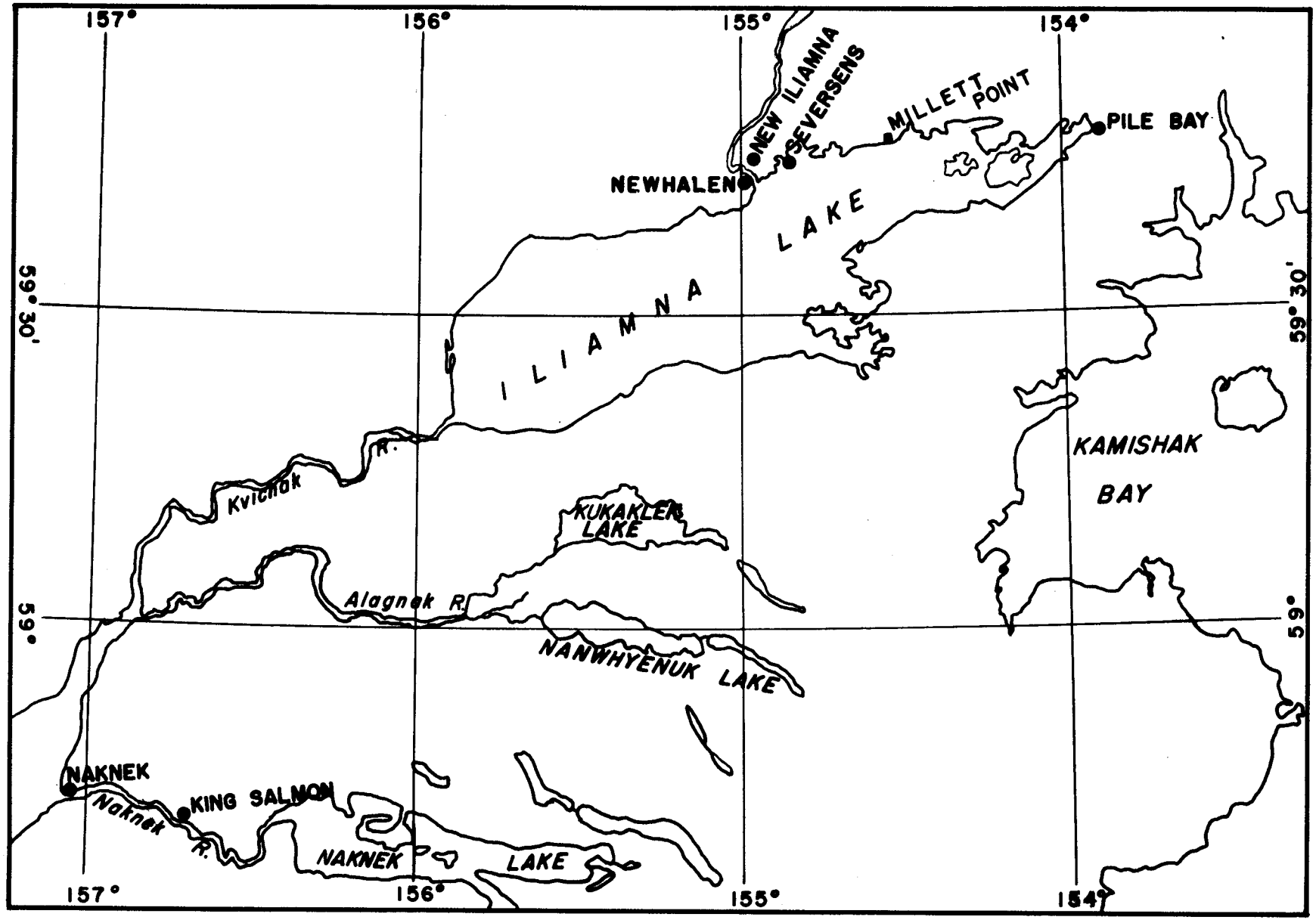

Figure 2. - Location map of Millett Point.

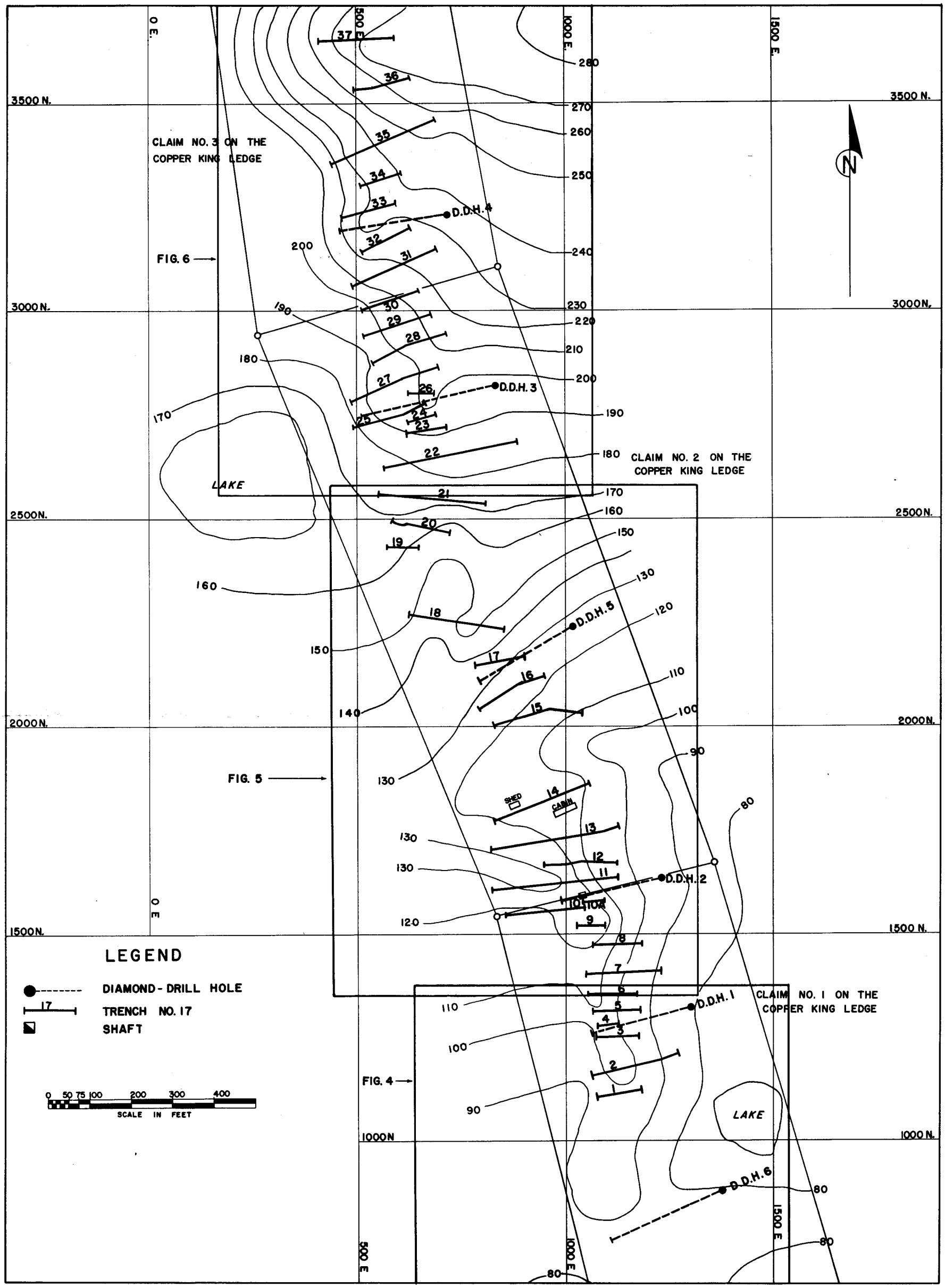

Figure 3. - Topographic and claim map, Millett copper deposit.

The climate in the region is typical of the coastal climate of Alaska; therefore it is not extreme. Weather records have been kept at Iliamna for 7 years (1939-46). The following data have been taken from a report of the Weather Bureau.2/ The mean annual temperature at Iliamna is 31.8° F.; freezing weather can be expected from the last part of September to the beginning of June. The lake usually is frozen over completely by the end of November, though in some years it remains comparatively free from ice throughout the winter. Highest and lowest temperatures recorded at Iliamna are 71° F. and -31° F., respectively. The average annual precipitation, including 127.6 inches of snowfall, is 37.29 inches.

HISTORY AND PRODUCTION

The first location of claims on the copper prospect at Millett Point was made by O. B. Millett in 1906. At the time of the first examination by the Federal Geological Survey in 1909,3/ the mineralized zone had been developed by seven trenches. Millett continued to explore and develop the deposit. By 1940, when Harry Townsend made an examination for the Anaconda Copper Co., there were 30 trenches and a 38-foot shaft.

J. C. Roehm, mining engineer, Territorial Department of Mines, Juneau, Alaska, examined the Millett prospect June 9-10, 1941. Roehm's sample location and his analyses of samples are shown on a topographic and geologic map of the mineralized area, which was included with his report to the Territorial Commissioner of Mines4/.

The Bureau of Mines made a preliminary examination of the area in September 1948; project work began August 8, 1949.

No production from this deposit has been recorded.

PROPERTY AND OWNERSHIP

The property is in the Iliamna mining district in southwestern Alaska. Figure 3 is a claim map showing the general location of the mineralized zones at Millett Point. The property consists of three claims, 1, 2, and 3, on the Copper King Ledge, which were patented September 26, 1928, by O. B. Millett, Juneau, Alaska, the owner. The claims were surveyed in June 1925, under United States Mineral Survey 1510, and the patent is 1019508. Two additional mineral claims and three mill sites were at one time held by location. In November 1951, the property was under option to the St. Eugene Mining Corp., Ltd., N.P.L., Vancouver, B. C., Canada.

2/ Jefferson, Glen, Climatological Data, Alaska Section: U. S. Department of Commerce, Weather Bureau, vol. 32, Anchorage, Alaska, 1946, No. 13, pp. 73-79.

3/ Martin, G. D., and Katz, F. J., A Geological Reconnaissance of the Iliamna Region, Alaska: Geol. Survey Bull. 485, 1912, pp. 122-123.

4/ Roehm, J. C., Summary Report of Mining Investigations and Itinerary, in the Iliamna and Iniskin Bay Districts, Iliamna Precinct Alaska: Territorial Dept. of Mines Rept. 1941.

GENERAL GEOLOGY

The copper mineralization at Millett Point is in a band of limestone about 3,000 feet wide, which extends northward from Iliamna Lake to the river that flows from Roadhouse Mountain into Goose Bay. Martin and Katz,[5] on the basis of specimens collected near Millett Point, have assigned this limestone to the Upper Triassic and have shown it in contact[6] with Lower Jurassic porphyries on both the east and west. On the south near the lake shore, the limestone beds are terminated by volcanic breccia; termination to the north is hidden by heavy overburden. Where cut in diamond-drill hole 6, the breccia consists of limestone and volcanic fragments ranging in size from a pin head to more than 1/2-inch across; some fragments are more than 2 inches across. The fragments are cemented in a fine- to medium-grained matrix of basalt that is slightly chloritic. Some zones in the breccia contain an appreciable amount of graphitic material.

The mineralized zone containing the copper is in the limestone near its western contact with the porphyry. This porphyry is a diorite with some diabase facies.

The copper mineralization is associated with numerous dikes in the limestone. These dikes are parallel to the adjacent igneous intrusive; they also are parallel to the bedding of the limestone.

The general strike of the limestone and of the mineralized zone within the limestone is N. 05° W.

DESCRIPTION OF DEPOSIT

The mineralized zone that was investigated begins near the breccia-limestone contact about 950 feet north of the shore of Lake Iliamna. From this point it extends northward across low hills for approximately 2,500 feet. The two principal copper deposits occur at the north and south ends of the zone separated by several hundred feet of slightly mineralized or barren limestone. Other smaller deposits are present adjacent to igneous dikes intrusive into the limestone.

The copper deposits are of the contact metamorphic type. The host rock is a fine-grained, massive, dark-gray to black limestone. Mineralization consists of calcite, quartz, amphibole, garnet, epidote, pyrite, chalcopyrite, and a little hematite.

The southernmost of the main deposits is on claims 1 and 2 of the Copper King Ledge (figs. 4 and 5). This deposit, 525 feet long, is on the east contact of an igneous dike, which parallels the diorite-limestone contact at a distance of approximately 200 feet. The dike swells and pinches throughout its length; its width ranges from 3 to 80 feet. The width of the mineralized zone ranges from 10 to 30 feet; its average width is 18.8 feet. Samples taken from 13 trenches and 3 diamond-drill holes delimit this deposit and indicate an average grade of 1.08 percent copper.

5/ Work cited in footnote 3, pp. 42-45.
6/ Work cited in footnote 3, plate II.

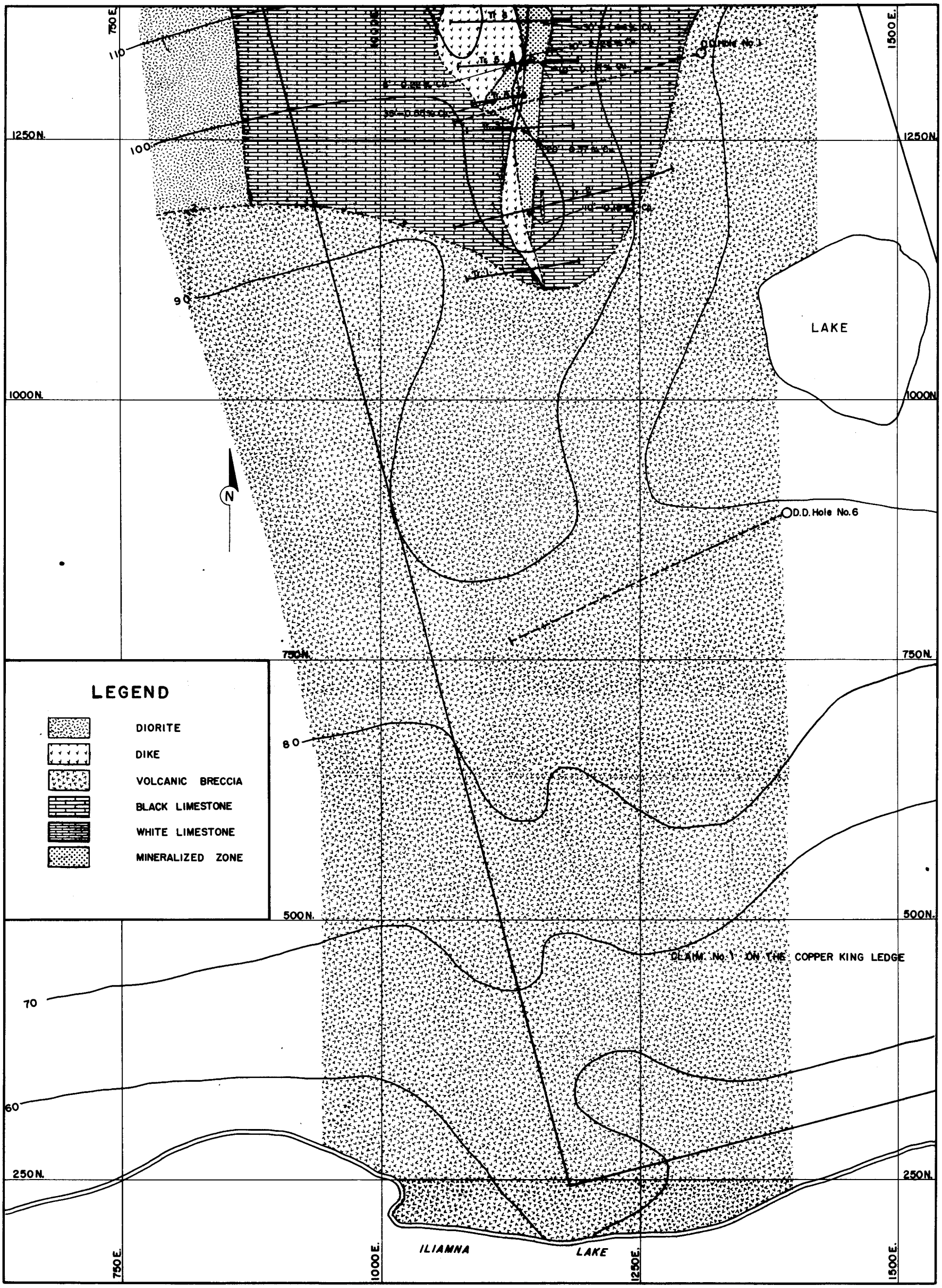

Figure 4. - Southern portion, Millett copper deposit.

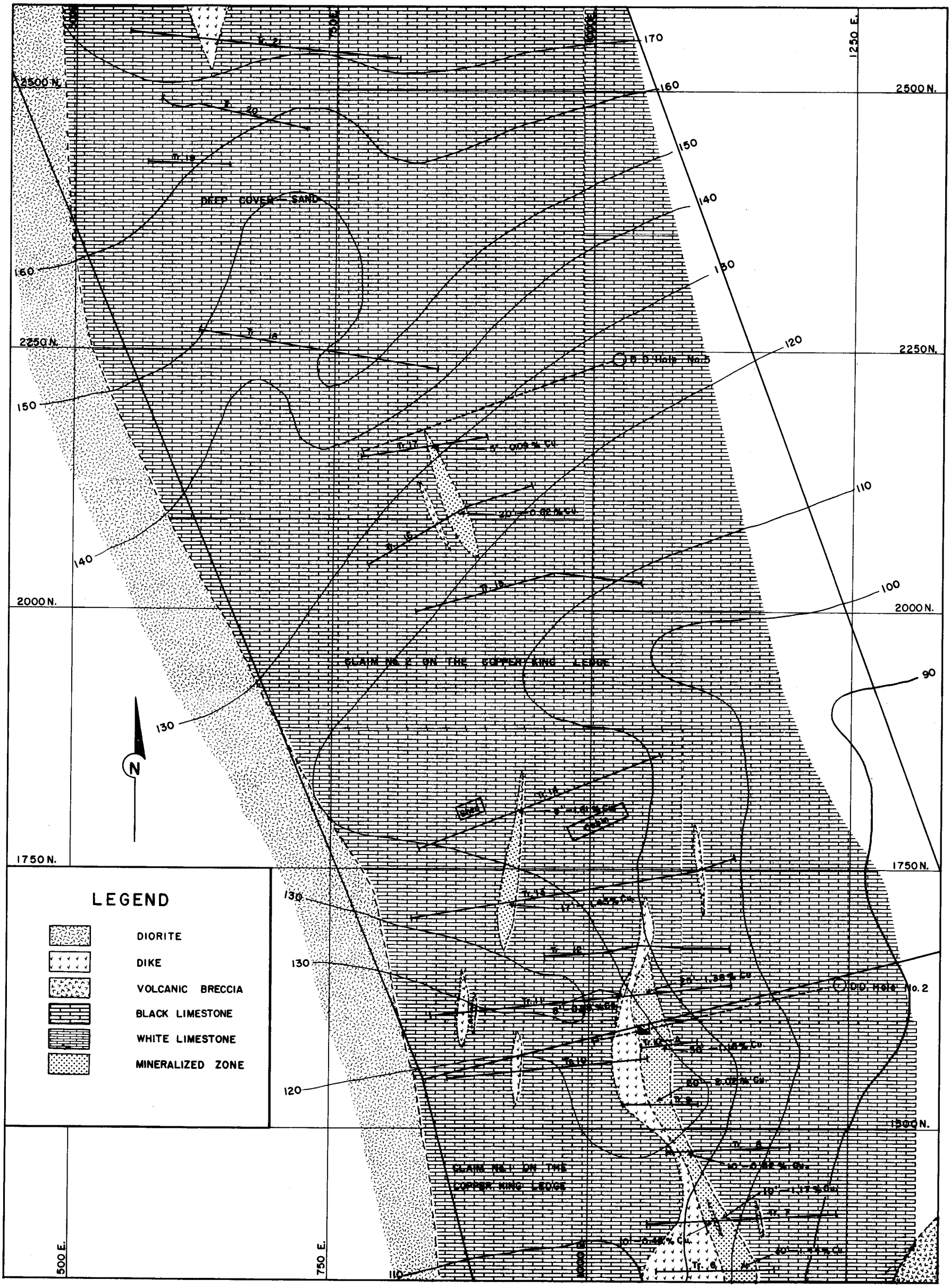

Figure 5. - Middle portion, Millett copper deposit.

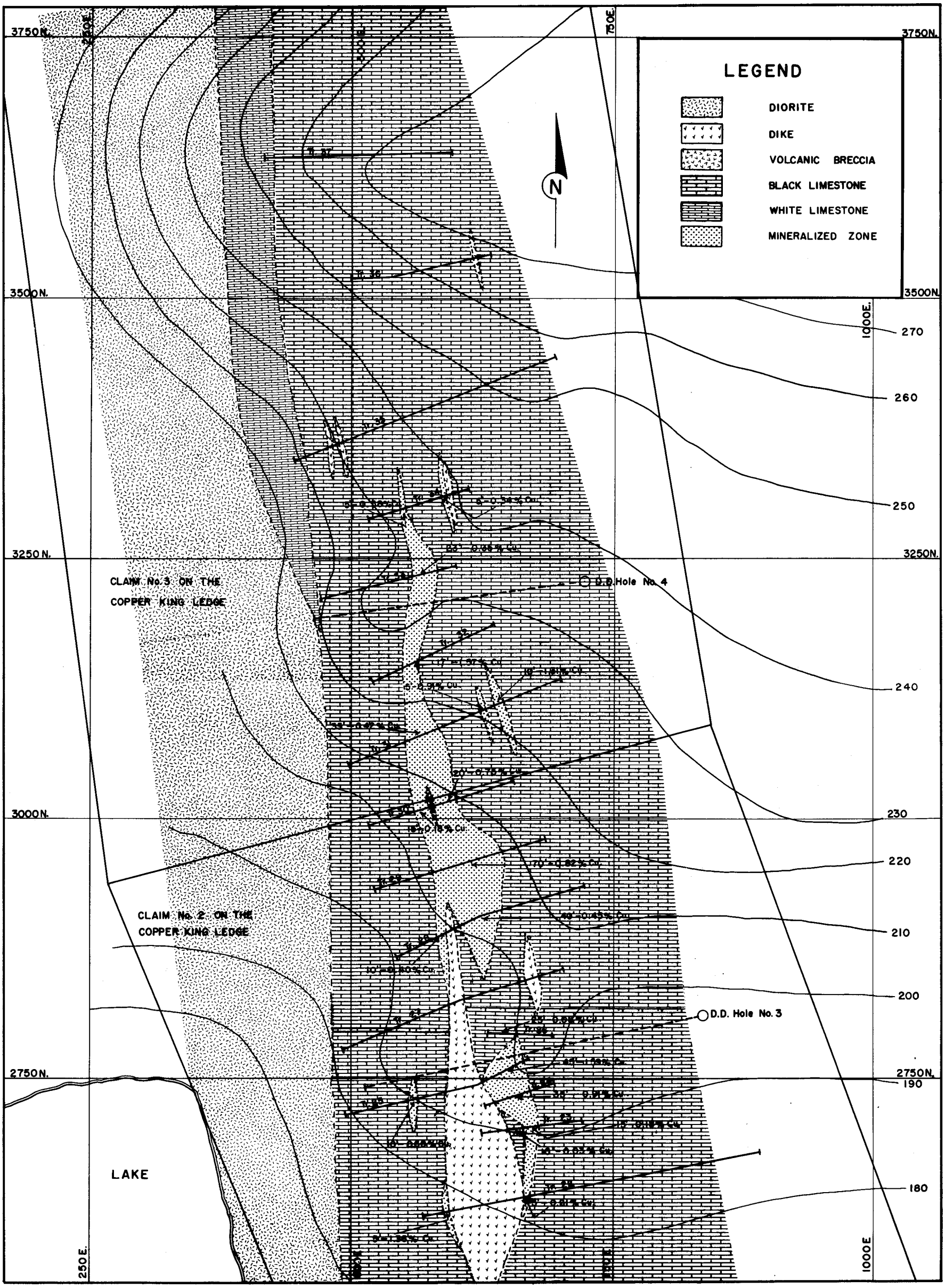

Figure 6. - Northern portion, Millett copper deposit.

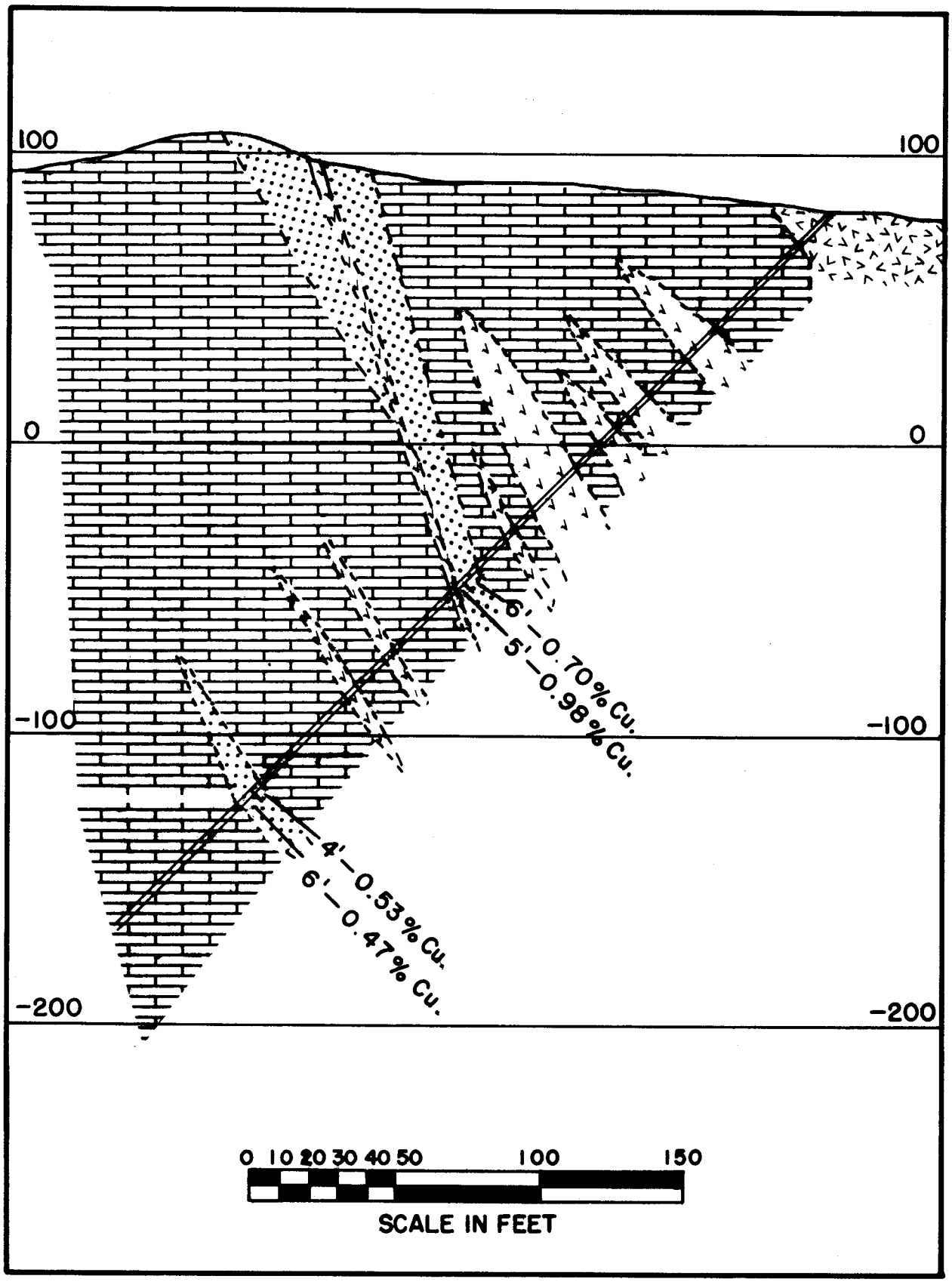

Figure 7. - Section through diamond-drill hole 1.

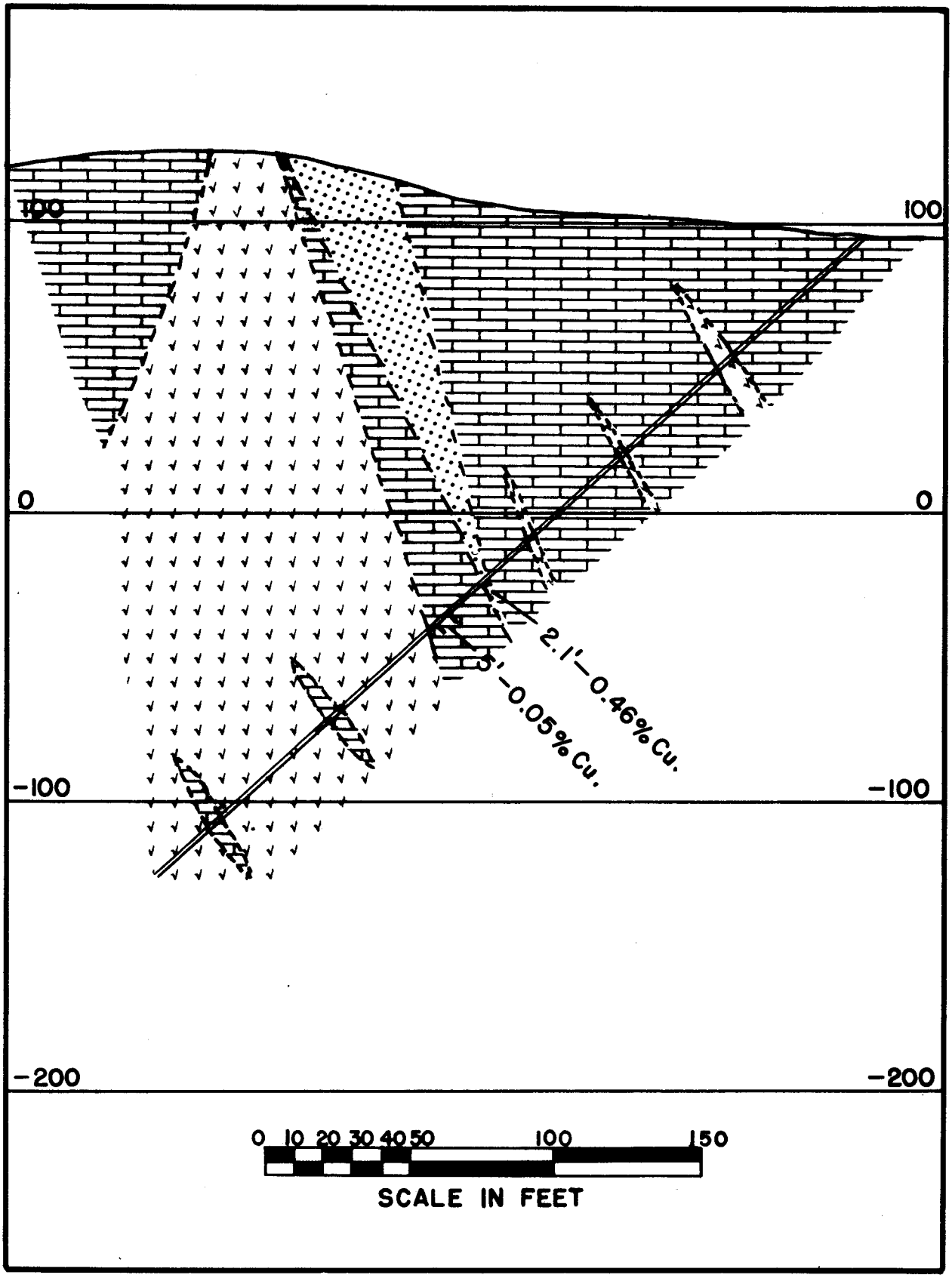

Figure 8. - Section through diamond-drill hole 2.

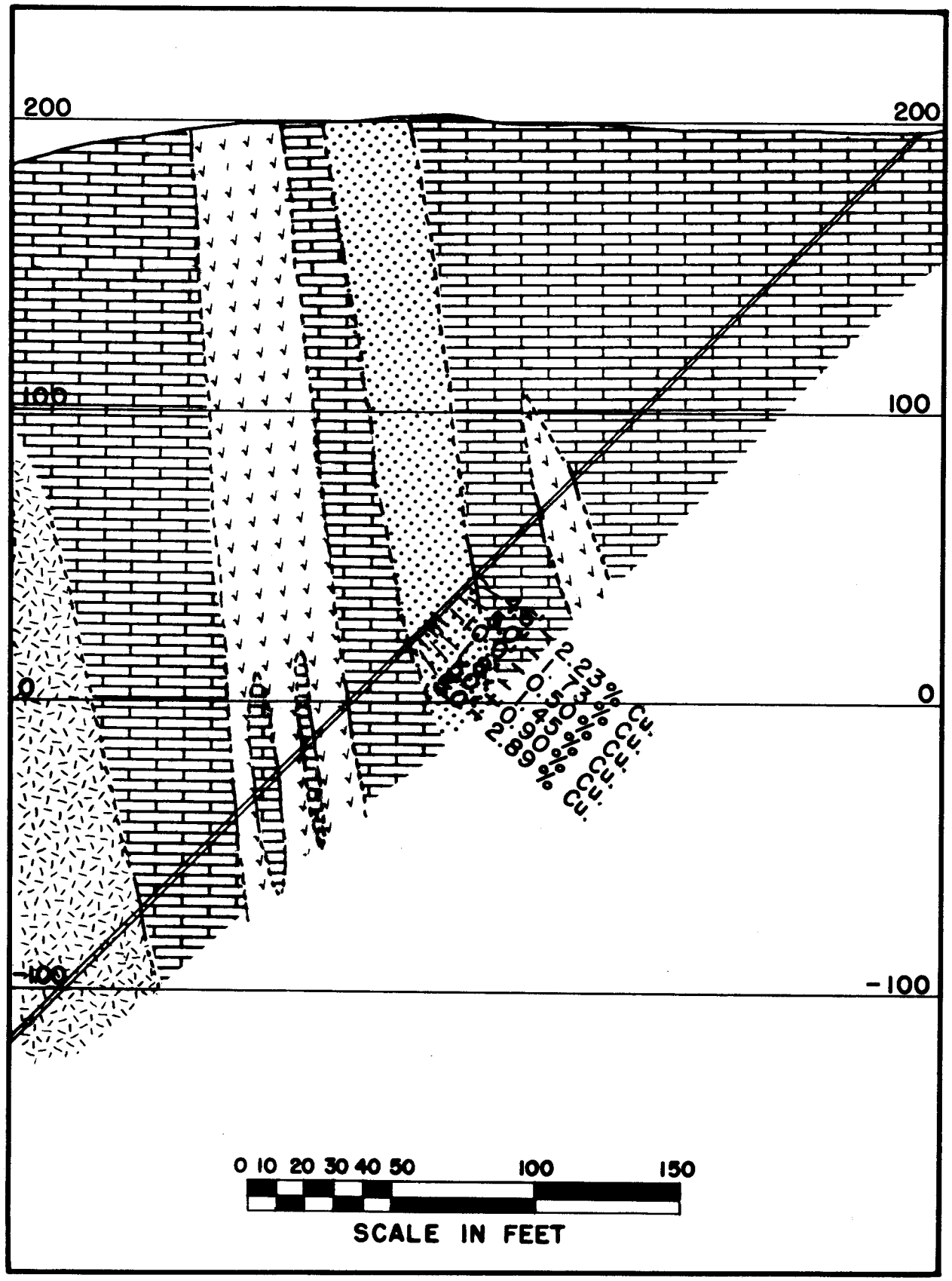

Figure 9. - Section through diamond-drill hole 3.

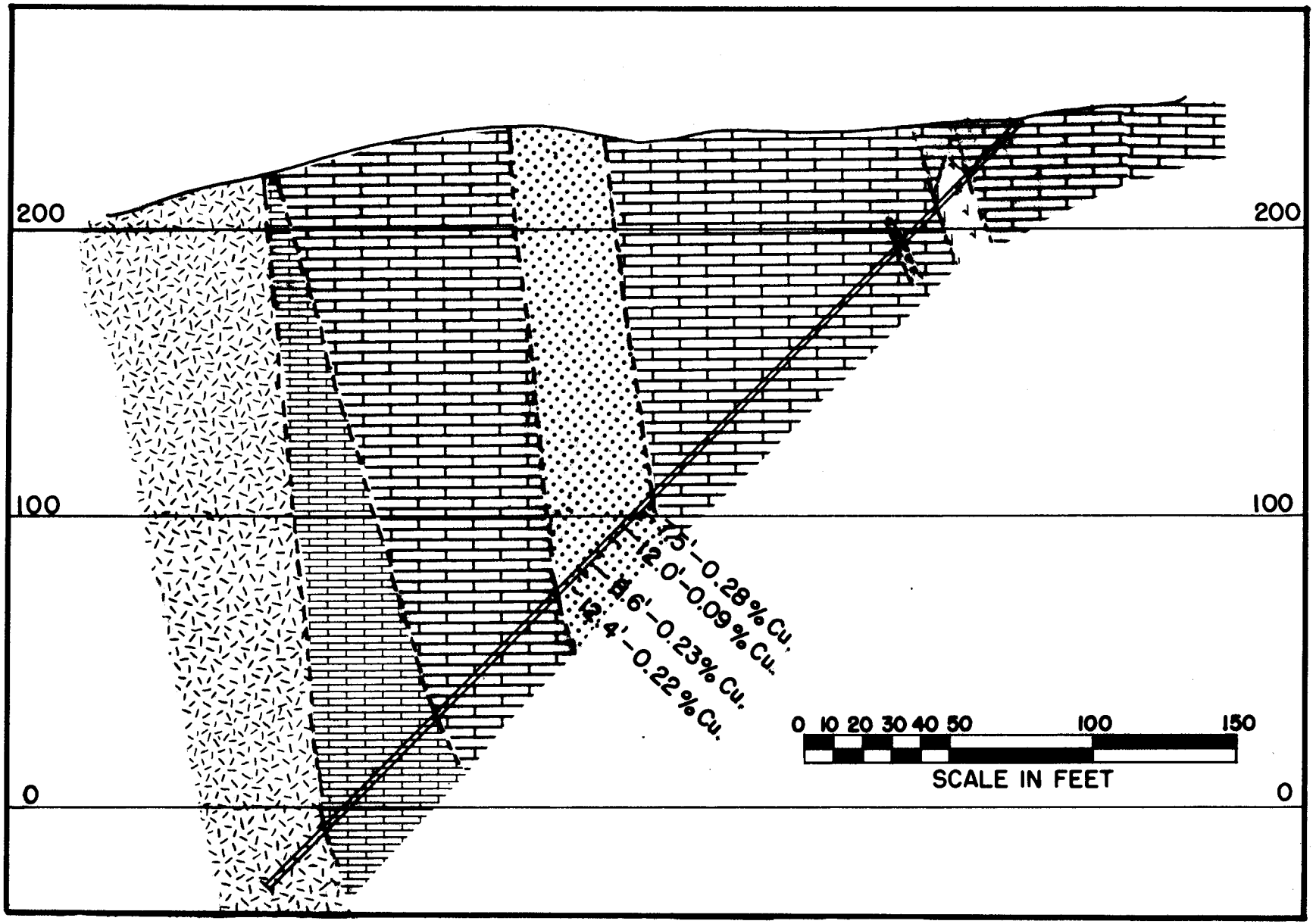

Figure 10. - Section through diamond-drill hole 4.

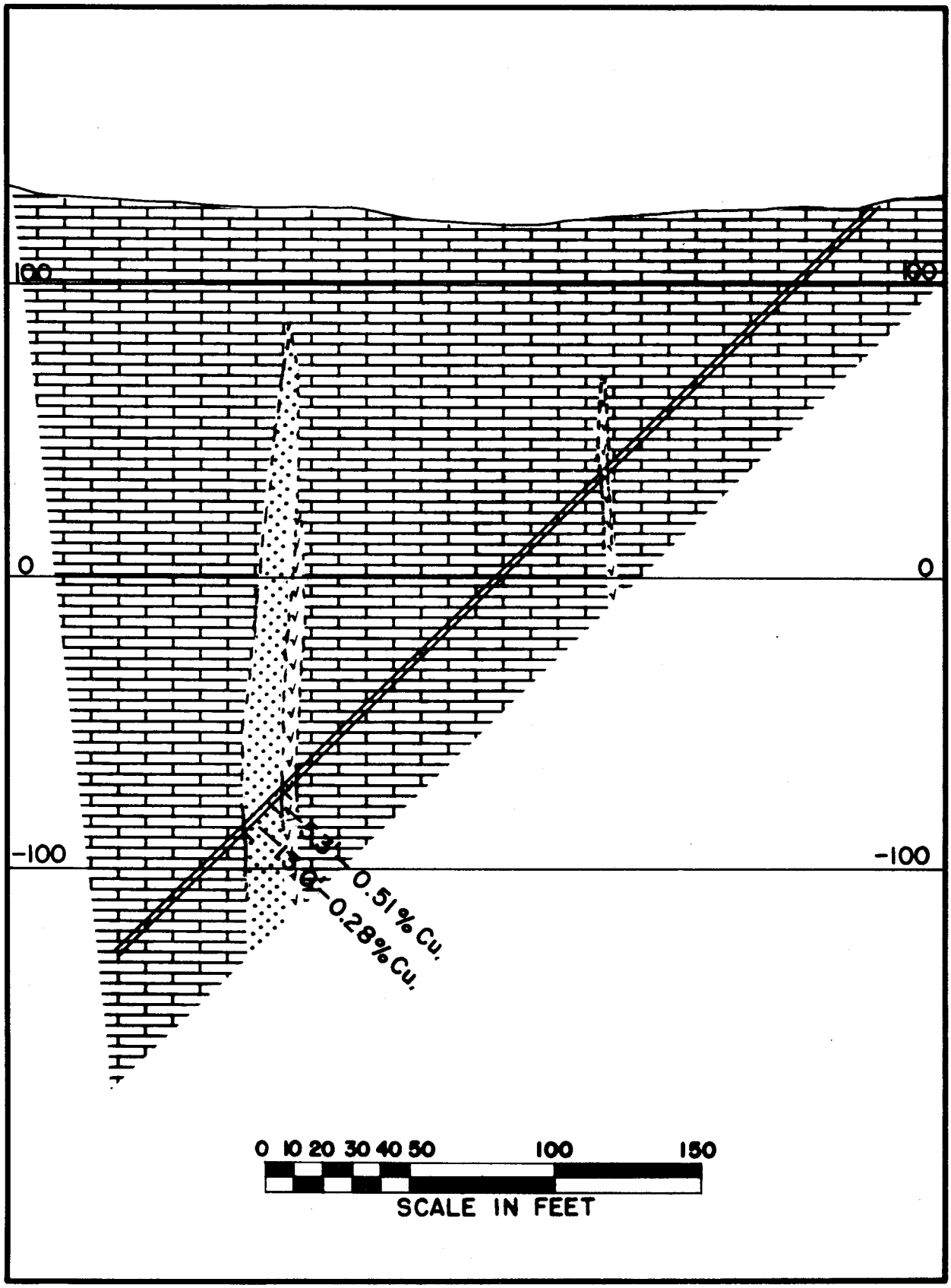

Figure 11. - Section through diamond-drill hole 5.

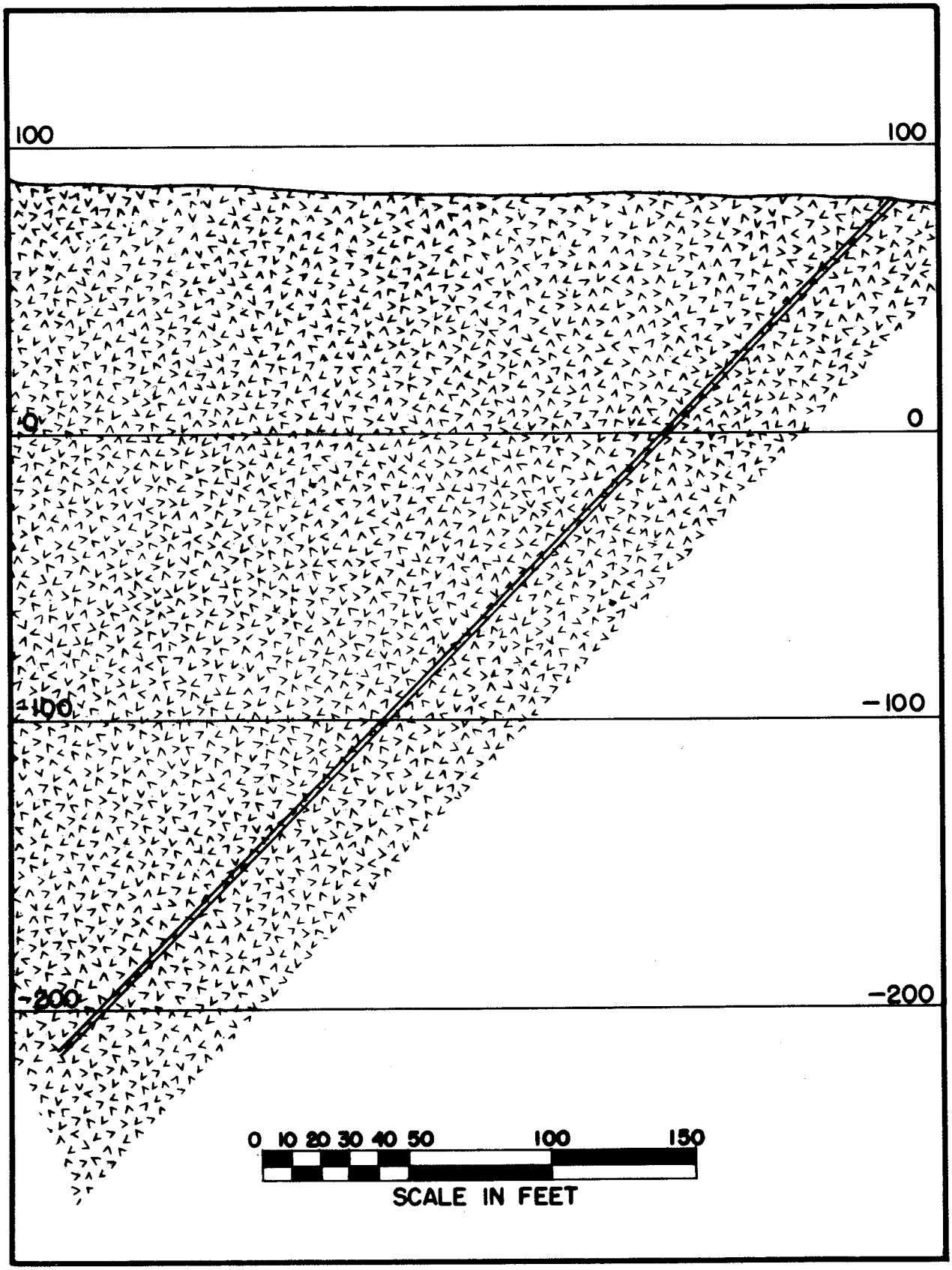

Figure 12. - Section through diamond-drill hole 6.

In addition, two small mineralized zones are exposed on the west side of the dike. The first, sampled in trench 4, is triangular and is 70 feet long, with a maximum width of 35 feet. The second zone, exposed in trench 11, is 5 feet wide by 50 feet long.

The strike and dip of the limestone in the mineralized area are not constant; the strike ranges from N. 17° W. to N. 16° E. The average strike of the beds is N. 05° W.; the dip ranges from 55° to 80° easterly.

The second main deposit is 1,250 feet north of the southernmost main deposit. It is on claims 2 and 3 of the Copper King Ledge (fig. 6). This deposit, 735 feet long, consists of two mineralized zones 500 and 185 feet long, respectively, separated by 50 feet of unmineralized black limestone. The smaller, southern mineralized zone is on the east side of a dike, which is incised into the south end of the main zone of mineralization. The average width of the smaller mineralized zone is 19.1 feet; its average grade is 0.98 percent copper. The larger mineralized zone, 500 feet long, averages 29.5 feet in width; its average copper content is 0.64 percent. Five small mineralized zones are in the same area (fig. 6).

The mineralized zones in the area covering the northernmost main deposit are delimited by 13 trenches and 2 diamond-drill holes.

In addition, two other mineralized zones are in the area between the two main deposits. The first zone, northwest of the southernmost deposit, is 175 feet long; it averages 8.4 feet wide, with 1.43 percent copper. Two trenches were excavated through this deposit. The other mineralized zone is midway between the main deposits. It is 135 feet long, contains 0.54 percent copper, and averages 10.4 feet wide. Two trenches and one diamond-drill hole delimit this zone.

Idealized sections through the diamond-drill holes are shown on figures 7 through 12, inclusive.

WORK BY BUREAU OF MINES

The Bureau of Mines program of trenching, sampling, mapping, and diamond-drilling the contact deposits of copper mineralization at Millett Point was begun August 8, 1949. During the investigation, 38 trenches were excavated by tractor-dozer and cleaned by hand trenching before channel samples were taken. The total combined length of the trenches was 6,229 feet. From these trenches 165 channel samples, averaging 1 inch by 3 inches in cross section, were taken. As taken, the 5-foot channel samples weighed approximately 8 pounds per linear foot. The samples were crushed and reduced to an average of 8 pounds per sample before shipment.

Two diamond-drill holes were completed and a third was at a depth of 315 feet when the project was recessed November 28 because the source of drilling water was frozen.

Previously, a topographic and geologic map on a scale of 1 inch to 50 feet had been prepared. The locations of all trenches and diamond-drill holes are shown on this map.

Diamond drilling was resumed May 28, 1950, and completed July 3, 1950. Six holes were drilled during the project; their combined length was 2,298.5 feet. Twenty-eight samples of core were taken for analyses.

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ROEHM, J. C., Summary Report of Mining Investigations and Itinerary, in the Iliamna and Iniskin Bay Districts, Iliamna Precinct, Alaska. Territorial Dept. of Mines Rept., 1941.

APPENDIX I - Log of trenches

SAMPLING RECORDS
MILLETT COPPER

Trench 1

Sample No.	Footage From	Footage To	Sample length, feet	Position in excavation	Size of groove, inches	Est. weight, pounds	Assays, percent Cu	Remarks
	0.0	37.0	37.0	Floor	-	-	-	Volcanic breccia.
	37.0	63.0	26.0	do.	-	-	-	Black limestone.
	63.0	70.0	7.0	do.	-	-	-	Blasic dike.
	70.0	110.0	40.0	do.	-	-	-	Black limestone.
Trench 2								
	.0	47.0	47.0	do.	-	-	-	do.
	47.0	68.0	21.0	do.	-	-	-	Green dike.
1	68.0	73.0	5.0	do.	1 x 3	40	0.10	Mineralized limestone.
2	73.0	78.0	5.0	do.	1 x 3	40	.21	do.
	78.0	84.0	6.0	do.	-	-	-	Black limestone.
	84.0	88.0	4.0	do.	-	-	-	Green dike.
	88.0	200.0	112.0	do.	-	-	-	Black limestone.
	200.0	218.0	18.0	do.	-	-	-	Volcanic breccia.
Trench 3								
	.0	44.0	44.0	do.	-	-	-	Black limestone.
	44.0	47.0	3.0	do.	-	-	-	Green dike.
3	47.0	52.0	5.0	do.	1 x 3	40	.49	Mineralized limestone.
4	52.0	57.0	5.0	do.	1 x 3	40	.49	do.
5	57.0	62.0	5.0	do.	1 x 3	40	.34	do.
6	62.0	67.0	5.0	do.	1 x 3	40	.17	do.
7	67.0	70.0	3.0	do.	1 x 3	24	.03	do.
	70.0	104.0	34.0	do.	-	-	-	Black limestone.

SAMPLING RECORD
MILLETT COPPER

Trench 4

Sample No.	Footage From	Footage To	Sample length, feet	Position in excavation	Size of groove, inches	Est. weight, pounds	Assays, percent Cu	Remarks
	0.0	5.0	5.0	Floor	-	-	-	Black limestone.
	5.0	14.0	9.0	do.	-	-	-	Green dike.
8	14.0	19.0	5.0	do.	1 x 3	40	0.27	Mineralized limestone.
9	19.0	24.0	5.0	do.	1 x 3	40	.12	do.
10	24.0	29.0	5.0	do.	1 x 3	40	2.17	do.
11	29.0	34.0	5.0	do.	1 x 3	40	.34	do.
12	34.0	39.0	5.0	do.	1 x 3	40	.49	do.
13	39.0	44.0	5.0	do.	1 x 3	40	.26	do.
14	44.0	49.0	5.0	do.	1 x 3	40	.24	do.
	49.0	54.0	5.0	do.	-	-	-	Green dike.
Trench 5								
	.0	49.0	49.0	do.	-	-	-	Green dike.
15	49.0	54.0	5.0	do.	1 x 3	40	.22	Mineralized limestone.
	54.0	62.0	8.0	do.	-	-	-	Green dike.
16	62.0	67.0	5.0	do.	1 x 3	40	3.21	Mineralized limestone.
17	67.0	72.0	5.0	do.	1 x 3	40	1.35	do.
18	72.0	77.0	5.0	do.	1 x 3	40	.14	do.
19	77.0	82.0	5.0	do.	1 x 3	40	.18	do.
	82.0	117.0	35.0	do.	-	-	-	Black limestone.
Trench 6								
	.0	64.0	64.0	do.	-	-	-	Green dike.
20	64.0	69.0	5.0	do.	1 x 3	40	3.21	Mineralized limestone.
21	69.0	74.0	5.0	do.	1 x 3	40	1.98	do.
22	74.0	79.0	5.0	do.	1 x 3	40	.77	do.
23	79.0	84.0	5.0	do.	1 x 3	40	.42	do.
24	84.0	89.0	5.0	do.	1 x 3	40	1.92	do.
25	89.0	94.0	5.0	do.	1 x 3	40	.30	do.
	94.0	116.0	22.0	do.	-	-	-	Black limestone.

SAMPLING RECORDS
MILLETT COPPER

Trench 7

Sample No.	Footage From	Footage To	Sample length, feet	Position in excavation	Size of groove, inches	Est. weight, pounds	Assays, percent Cu	Remarks
	0.0	29.0	29.0	floor	-	-	-	Black limestone.
	29.0	54.0	25.0	do.	-	-	-	Green dike.
26	54.0	59.0	5.0	do.	1 x 3	40	0.78	Mineralized limestone.
27	59.0	64.0	5.0	do.	1 x 3	40	.15	do.
28	64.0	69.0	5.0	do.	1 x 3	40	.09	Green dike, schistose.
29	69.0	74.0	5.0	do.	1 x 3	40	1.93	Mineralized limestone.
30	74.0	79.0	5.0	do.	1 x 3	40	.40	do.
31	79.0	84.0	5.0	do.	1 x 3	40	.04	Black limestone, some Cu.
32	84.0	89.0	5.0	do.	1 x 3	40	.08	do.
	89.0	180.0	91.0	do.	-	-	-	Black limestone.
Trench 8								
	.0	5.0	5.0	do.	-	-	-	Black limestone.
	5.0	13.0	8.0	do.	-	-	-	Green dike.
33	13.0	18.0	5.0	do.	1 x 3	40	1.11	Mineralized limestone.
34	18.0	23.0	5.0	do.	1 x 3	40	.34	do.
35	23.0	28.0	5.0	do.	1 x 3	40	.05	Black limestone, some Cu.
36	28.0	33.0	5.0	do.	1 x 3	40	.04	do.
37	33.0	38.0	5.0	do.	1 x 3	40	.11	do.
38	38.0	43.0	5.0	do.	1 x 3	40	.03	do.
	43.0	120.0	77.0	do.	-	-	-	Black limestone.
Trench 9								
	.0	26.0	26.0	do.	-	-	-	Green dike.
39	26.0	31.0	5.0	do.	1 x 3	40	1.40	Mineralized limestone.
40	31.0	36.0	5.0	do.	1 x 3	40	2.78	do.
41	36.0	41.0	5.0	do.	1 x 3	40	2.60	do.
42	41.0	46.0	5.0	do.	1 x 3	40	1.32	do.
43	46.0	51.0	5.0	do.	1 x 3	40	.05	Black limestone
44	51.0	56.0	5.0	do.	1 x 3	40	.06	do.
45	56.0	61.0	5.0	do.	1 x 3	40	lost	do.
	61.0	73.0	12.0	do.	-	-	-	do.

SAMPLING RECORDS
MILLETT COPPER

Trench 10

Sample No.	Footage From	Footage To	Sample length, feet	Position in excavation	Size of groove, inches	Est. weight, pounds	Assays, percent Cu	Remarks
	0.0	62.0	62.0	Floor	-	-	-	Black limestone.
	62.0	71.0	9.0	do.	-	-	-	Green dike.
	71.0	161.0	90.0	do.	-	-	-	Black limestone.
	161.0	189.0	28.0	do.	-	-	-	Green dike.
	189.0	195.0	6.0	do.	-	-	-	Mineralized limestone.
Trench 10A								
46	.0	5.0	5.0	do.	1 x 3	40	1.48	do.
47	5.0	10.0	5.0	do.	1 x 3	40	1.16	do.
48	10.0	15.0	5.0	do.	1 x 3	40	1.74	do.
49	15.0	20.0	5.0	do.	1 x 3	40	.62	do.
50	20.0	25.0	5.0	do.	1 x 3	40	1.03	do.
51	25.0	30.0	5.0	do.	1 x 3	40	1.04	do.
52	30.0	35.0	5.0	do.	1 x 3	40	.18	do.
	35.0	55.0	20.0	do.	-	-	-	Black limestone.
Trench 11								
	.0	25.0	25.0	do.	-	-	-	do.
	25.0	36.0	11.0	do.	-	-	-	Green dike.
	36.0	39.0	3.0	do.	-	-	-	Black limestone.
	39.0	44.0	5.0	do.	-	-	-	Green dike.
	44.0	182.0	138.0	do.	-	-	-	Black limestone.
53	182.0	187.0	5.0	do.	1 x 3	40	.25	Mineralized limestone.
	187.0	191.0	4.0	do.	-	-	-	Green dike.
54	191.0	196.0	5.0	do.	1 x 3	40	.33	Altered dike rock.
55	196.0	201.0	5.0	do.	1 x 3	40	1.05	Mineralized limestone.
56	201.0	206.0	5.0	do.	1 x 3	40	1.30	do.
57	206.0	211.0	5.0	do.	1 x 3	40	1.40	do.
58	211.0	216.0	5.0	do.	1 x 3	40	2.80	do.
59	216.0	221.0	5.0	do.	1 x 3	40	.09	Black limestone, some Cu.
60	221.0	226.0	5.0	do.	1 x 3	40	.03	do.
	226.0	292.0	66.0	do.	-	-	-	Black limestone.

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Trench 12

Sample No.	Footage From	Footage To	Sample length, feet	Position in excavation	Size of groove, inches	Est. weight, pounds	Assays; percent Cu	Remarks
	0.0	90.0	90.0	Floor	-	-	-	Black limestone.
	90.0	102.0	12.0	do.	-	-	-	Green dike.
	102.0	180.0	78.0	do.	-	-	-	Black limestone.
Trench 13								
	.0	85.0	85.0	do.	-	-	-	Black limestone.
61	85.0	90.0	5.0	do.	1 x 3	40	0.29	Mineralized limestone.
62	90.0	95.0	5.0	do.	1 x 3	40	.74	do.
63	95.0	100.0	5.0	do.	1 x 3	40	2.33	do.
64	100.0	102.0	2.0	do.	1 x 3	18	3.74	do.
	102.0	280.0	178.0	do.	-	-	-	Black limestone.
	280.0	286.0	6.0	do.	-	-	-	Green dike.
	286.0	319.0	33.0	do.	-	-	-	Black limestone.
Trench 14								
	.0	96.0	96.0	do.	-	-	-	do.
65	96.0	101.0	5.0	do.	1 x 3	40	.18	Mineralized limestone.
66	101.0	106.0	5.0	do.	1 x 3	40	1.61	do.
	106.0	251.0	145.0	do.	-	-	-	Black limestone.
Tronch 15								
	.0	110.0	110.0	-	-	-	-	Deep cover.
	110.0	225.0	115.0	Floor	-	-	-	Black limestone.
Trench 16								
	.0	75.0	75.0	do.	-	-	-	Black limestone.
	75.0	81.0	6.0	do.	-	-	-	Green dike.
	81.0	84.0	3.0	do.	-	-	-	Black limestone.
67	84.0	89.0	5.0	do.	1 x 3	40	.10	Mineralized limestone.
68	89.0	94.0	5.0	do.	1 x 3	40	.20	do.
69	94.0	99.0	5.0	do.	1 x 3	40	.74	do.
70	99.0	104.0	5.0	do.	1 x 3	40	1.36	do.
71	104.0	109.0	5.0	do.	1 x 3	40	.19	do.
72	109.0	114.0	5.0	do.	1 x 3	40	.03	Black limestone, some Cu.
	114.0	180.0	66.0	do.	-	-	-	Black limestone.

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Trench 17

Sample No.	Footage From	Footage To	Sample length, feet	Position in excavation	Size of groove, inches	Est. weight, pounds	Assays, percent Cu	Remarks
	0.0	55.0	55.0	Floor	-	-	-	Black limestone
73	55.0	60.0	5.0	do.	1 x 3	40	0.02	Black limestone - some Cu.
74	60.0	65.0	5.0	do.	1 x 3	40	.03	do.
75	65.0	70.0	5.0	do.	1 x 3	40	.09	Mineralized limestone.
76	70.0	75.0	5.0	do.	1 x 3	40	.02	Black limestone - some Cu.
	75.0	128.0	53.0	do.	-	-	-	Black limestone.
Trench 18								
	.0	236.0	236.0	-	-	-	-	Deep cover.
Trench 19								
	.0	80.0	80.0	-	-	-	-	do.
Trench 20								
	.0	48.0	48.0	Floor	-	-	-	Black limestone.
	48.0	101.0	53.0	-	-	-	-	Deep cover.
	101.0	148.0	47.0	Floor	-	-	-	Black limestone.
Trench 21								
	.0	67.0	67.0	do.	-	-	-	Black limestone.
	67.0	86.0	19.0	do.	-	-	-	Green dike.
	86.0	96.0	10.0	do.	-	-	-	Black limestone.
77	96.0	101.0	5.0	do.	1 x 3	40	.02	Black limestone - some Cu.
	101.0	265.0	164.0	do.	-	-	-	Black limestone.

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Trench 22

Sample No.	Footage From	Footage To	Sample length, feet	Position in excavation	Size of groove, inches	Est. weight, pounds	Assays, percent Cu	Remarks
	0.0	22.0	22.0	Floor	-	-	-	Dark limestone.
78	22.0	27.0	5.0	do.	1 x 3	40	1.36	Mineralized limestone.
	27.0	94.0	67.0	do.	-	-	-	Green dike.
79	94.0	99.0	5.0	do.	1 x 3	40	.21	Mineralized limestone.
80	99.0	104.0	5.0	do.	1 x 3	40	.02	Black limestone - some Cu.
	104.0	314.0	210.0	do.	-	-	-	Black limestone.
Trench 23								
	.0	25.0	25.0	do.	-	-	-	Green dike.
81	25.0	30.0	5.0	do.	1 x 3	40	.03	Black limestone - some Cu.
82	30.0	35.0	5.0	do.	1 x 3	40	.02	do.
83	35.0	40.0	5.0	do.	1 x 3	40	.05	do.
84	40.0	45.0	5.0	do.	1 x 3	40	.24	Mineralized limestone.
85	45.0	50.0	5.0	do.	1 x 3	40	.17	do.
86	50.0	55.0	5.0	do.	1 x 3	40	.11	do.
	55.0	97.0	42.0	do.	-	-	-	Black limestone.
Trench 24								
	.0	9.0	9.0	do.	-	-	-	Green dike.
87	9.0	14.0	5.0	do.	1 x 3	40	.71	Mineralized limestone.
88	14.0	19.0	5.0	do.	1 x 3	40	1.99	do.
89	19.0	24.0	5.0	do.	1 x 3	40	1.67	do.
90	24.0	29.0	5.0	do.	1 x 3	40	.58	do.
91	29.0	34.0	5.0	do.	1 x 3	40	.48	do.
92	34.0	39.0	5.0	do.	1 x 3	40	.46	do.
93	39.0	44.0	5.0	do.	1 x 3	40	.50	do.
	44.0	69.0	25.0	do.	-	-	-	Black limestone.

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Trench 25

Sample No.	Footage From	Footage To	Sample length, feet	Position in excavation	Size of groove, inches	Est. weight, pounds	Assays, percent Cu	Remarks
	.0.0	59.0	59.0	Floor	-	-	-	Black limestone.
94	59.0	64.0	5.0	do.	1 x 3	40	0.52	Mineralized limestone.
95	64.0	69.0	5.0	do.	1 x 3	40	.83	do.
	69.0	98.0	29.0	do.	-	-	-	Black limestone.
	98.0	132.0	34.0	do.	-	-	-	Green dike.
96	132.0	137.0	5.0	do.	1 x 3	40	.27	Mineralized limestone.
97	137.0	142.0	5.0	do.	1 x 3	40	1.32	do.
98	142.0	147.0	5.0	do.	1 x 3	40	2.58	do.
99	147.0	152.0	5.0	do.	1 x 3	40	3.96	do.
100	152.0	157.0	5.0	do.	1 x 3	40	1.24	do.
101	157.0	162.0	5.0	do.	1 x 3	40	.67	do.
102	162.0	167.0	5.0	do.	1 x 3	40	.21	do.
103	167.0	172.0	5.0	do.	1 x 3	40	3.56	do.
104	172.0	177.0	5.0	do.	1 x 3	40	.50	do.
	177.0	184.0	7.0	do.	-	-	-	Black limestone.
Trench 26								
	.0	2.0	2.0	do.	-	-	-	Black limestone.
105	2.0	7.0	5.0	do.	1 x 3	40	.06	Black limestone - some Cu.
106	7.0	12.0	5.0	do.	1 x 3	40	.08	do.
107	12.0	17.0	5.0	do.	1 x 3	40	.13	do.
108	17.0	22.0	5.0	do.	1 x 3	40	.09	do.
109	22.0	27.0	5.0	do.	1 x 3	40	.02	do.
	27.0	63.0	36.0	do.	1 x 3	40	-	Black limestone.

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Trench 27

Sample No.	Footage From.	Footage To	Sample length, feet	Position in excavation	Size of groove, inches	Est. weight, pounds	Assays, percent Cu	Remarks
	0.0	110.0	110.0	Floor	-	-	-	Black limestone.
	110.0	126.0	16.0	do.	-	-	-	Green dike.
	126.0	187.0	61.0	do.	-	-	-	Black limestone.
	187.0	201.0	14.0	do.	-	-	-	Green dike.
	201.0	226.0	25.0	do.	-	-	-	Black limestone.
Trench 28								
	.0	44.0	44.0	do.	-	-	-	Black limestone.
110	44.0	49.0	5.0	do.	1 x 3	40	0.53	Mineralized limestone.
111	49.0	54.0	5.0	do.	1 x 3	40	.28	do.
112	54.0	59.0	5.0	do.	1 x 3	40	.05	Green dike.
113	59.0	64.0	5.0	do.	1 x 3	40	.11	Black limestone - some Cu.
114	64.0	69.0	5.0	do.	1 x 3	40	.07	do.
115	69.0	74.0	5.0	do.	1 x 3	40	1.00	Mineralized limestone.
116	74.0	79.0	5.0	do.	1 x 3	40	.28	do.
117	79.0	84.0	5.0	do.	1 x 3	40	.48	do.
118	84.0	89.0	5.0	do.	1 x 3	40	.16	do.
119	89.0	94.0	5.0	do.	1 x 3	40	.03	do.
120	94.0	99.0	5.0	do.	1 x 3	40	.03	do.
121	99.0	104.0	5.0	do.	1 x 3	40	.48	do.
122	104.0	111.0	7.0	do.	1 x 3	56	1.17	do.
	111.0	194.0	83.0	do.	-	-	-	Black limestone.

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Trench 29

Sample No.	Footage From	Footage To	Sample length, feet	Position in excavation	Size of groove, inches	Est. weight, pounds	Assays, percent Cu	Remarks
	0.0	59.0	59.0	Floor	-	-	-	Black limestone.
123	59.0	64.0	5.0	do.	1 x 3	40	0.15	Mineralized limestone.
124	64.0	69.0	5.0	do.	1 x 3	40	.53	do.
125	69.0	74.0	5.0	do.	1 x 3	40	.30	do.
126	74.0	79.0	5.0	do.	1 x 3	40	.60	do.
127	79.0	84.0	5.0	do.	1 x 3	40	.88	do.
128	84.0	89.0	5.0	do.	1 x 3	40	.24	do.
129	89.0	94.0	5.0	do.	1 x 3	40	2.02	do.
130	94.0	99.0	5.0	do.	1 x 3	40	.91	do.
131	99.0	104.0	5.0	do.	1 x 3	40	.51	do.
132	104.0	109.0	5.0	do.	1 x 3	40	.50	do.
133	109.0	114.0	5.0	do.	1 x 3	40	.96	do.
134	114.0	119.0	5.0	do.	1 x 3	40	.86	do.
135	119.0	124.0	5.0	do.	1 x 3	40	1.26	do.
136	124.0	129.0	5.0	do.	1 x 3	40	1.81	do.
	129.0	173.0	44.0	do.	-	-	-	Black limestone.
Trench 30								
	0.0	45.0	45.0	do.	-	-	-	do.
137	45.0	50.0	5.0	do.	1 x 3	40	.16	Mineralized limestone.
138	50.0	55.0	5.0	do.	1 x 3	40	.25	do.
139	55.0	60.0	5.0	do.	1 x 3	40	.13	do.
	60.0	65.0	5.0	do.	-	-	-	Black limestone.
140	65.0	70.0	5.0	do.	1 x 3	40	.62	Mineralized limestone.
141	70.0	75.0	5.0	do.	1 x 3	40	1.12	do.
142	75.0	80.0	5.0	do.	1 x 3	40	1.01	do.
143	80.0	85.0	5.0	do.	1 x 3	40	.25	do.
	85.0	144.0	59.0	do.	-	-	-	Black limestone.

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Trench 31

Sample No.	Footage From	Footage To	Sample length, feet	Position in excavation	Size of groove, inches	Est. weight, pounds	Assays, percent Cu	Remarks
	0.0	58.0	58.0	Floor	-	-	-	Black limestone.
144	58.0	63.0	5.0	do.	1 x 3	40	0.39	Mineralized limestone.
145	63.0	68.0	5.0	do.	1 x 3	40	1.08	do.
146	68.0	73.0	5.0	do.	1 x 3	40	.62	do.
147	73.0	78.0	5.0	do.	1 x 3	40	.26	do.
148	78.0	83.0	5.0	do.	1 x 3	40	.17	do.
149	83.0	88.0	5.0	do.	1 x 3	40	.02	do.
150	88.0	93.0	5.0	do.	1 x 3	40	.43	do.
	93.0	136.0	43.0	do.	-	-	-	Black limestone.
151	136.0	141.0	5.0	do.	1 x 3	40	.91	Mineralized limestone.
	141.0	150.0	9.0	do.	-	-	-	Black limestone.
152	150.0	155.0	5.0	do.	1 x 3	40	2.41	Mineralizes limestone.
153	155.0	160.0	5.0	do.	1 x 3	40	.22	do.
	160.0	220.0	60.0	do.	-	-	-	Black limestone.
Trench 32								
	.0	32.0	32.0	do.	-	-	-	Black limestone.
154	32.0	37.0	5.0	do.	1 x 3	40	.28	Mineralized limestone.
155	37.0	42.0	5.0	do.	1 x 3	40	1.51	do.
156	42.0	49.0	7.0	do.	1 x 3	56	2.53	do.
	49.0	130.0	81.0	do.	-	-	-	Black limestone.
Trench 33								
	.0	81.0	81.0	do.	-	-	-	Black limestone.
157	81.0	86.0	5.0	do.	1 x 3	40	.04	Black limestone - some Cu.
158	86.0	91.0	5.0	do.	1 x 3	40	.03	do.
159	91.0	96.0	5.0	do.	1 x 3	40	.12	Mineralized limestone.
160	96.0	101.0	5.0	do.	1 x 3	40	.25	do.
161	101.0	106.0	5.0	do.	1 x 3	40	.49	do.
162	106.0	111.0	5.0	do.	1 x 3	40	.60	do.
163	111.0	116.0	5.0	do.	1 x 3	40	.23	do.
	116.0	134.0	18.0	do.	-	-	-	Black limestone.

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Trench 34

Sample No.	Footage From	Footage To	Sample length, feet	Position in excavation	Size of groove, inches	Est. weight, pounds	Assays, percent Cu	Remarks
	0.0	32.0	32.0	Floor	-	-	-	Black limestone.
164	32.0	37.0	5.0	do.	1 x 3	40	0.58	Mineralized limestone.
	37.0	75.0	38.0	do.	-	-	-	Black limestone.
165	75.0	80.0	5.0	do.	1 x 3	40	.34	Mineralized limestone.
	80.0	86.0	6.0	do.	-	-	-	Green dike.
	86.0	101.0	15.0	do.	-	-	-	Black limestone.
Trench 35								
	.0	11.0	11.0	do.	-	-	-	White limestone.
	11.0	34.0	23.0	do.	-	-	-	Black limestone.
	34.0	38.0	4.0	do.	-	-	-	Green dike.
	38.0	46.0	8.0	do.	-	-	-	Black limestone.
	46.0	51.0	5.0	do.	-	-	-	Green dike.
	51.0	271.0	220.0	do.	-	-	-	Black limestone.
Trench 36								
	.0	114.0	114.0	do.	-	-	-	Black limestone.
	114.0	118.0	4.0	do.	-	-	-	Green dike.
	118.0	133.0	15.0	do.	-	-	-	Black limestone.
Trench 37								
	.0	9.0	9.0	do.	-	-	-	White limestone.
	9.0	181.0	172.0	do.	-	-	-	Black limestone.

APPENDIX II - Log of diamond-drill holes

Millet Property, Millett Point, Iliamna, Alaska
Log of Bureau of Mines diamond-drill hole 1
(Logged by W. S. Twenhofel, Geological Survey)

Bearing S. 75° W., inclination - 45°

Footage	
0 - 17	Dike rock; porphyritic, dark-green, fresh-appearing.
17 - 57	Limestone; fine-grained, dark-gray to black, massive, no apparent bedding, a few scattered cubes of pyrite.
57 - 71	Dike rock; porphyritic, dark-green, fresh-appearing, with chilled borders.
71 - 90	Limestone; fine-grained, dark-gray to black, massive, no apparent bedding.
90 -100	Dike rock; green, slightly altered to chlorite, no phenocrysts.
100 -105	Limestone, same as above.
105 -115	Chlorite schist; highly altered, green.
115 -126	Limestone; same as above.
126 -147.5	Dike rock; brecciated including fragments of limestone, unaltered, porphyritic, medium-grained.
147.5-155	Limestone; same as above.
155 -159	Dike rock; porphyritic, dark-green, fresh-appearing.
159 -174	Limestone; same as above.
174 -183	Limestone; contains some chlorite, brecciated, contains less than 1 percent of disseminated chalcopyrite.
183 -186	Chlorite schist; a little chalcopyrite to 184'.
186 -213	Limestone; same as 159' - 174'
213 -219	Dike rock; same as 155' - 159'
219 -233	Limestone; same as above, but with a very few disseminated pyrite cubes.
233 -237	Dike rock; same as above.
237 -266	Limestone; same as above.
266 -298	Limestone; same as above, with approximately 5-10 percent of pyrite and a trace of chalcopyrite.
298 -308	Limestone; same as above, without sulfide minerals.
308 -315	Fault gouge and breccia; consists of limestone fragments (both rounded and angular) cemented in an altered groundmass of green clay, no sulfide minerals.
315 -350T.D.	Limestone; same as above.

Log of Bureau of Mines diamond-drill hole 2
Bearing S. 77° W., inclination - 42°

Footage	
0 - 62	Limestone; argillaceous, dark-gray, massive with no apparent bedding, well-cemented, cut by a few very thin white calcite stringers, a few scattered grains of pyrite, a few zones of white chalky limestone.
62 - 69	Dike rock; medium-grained, pale-green, frosh-appearing.
69 -112	Limestone; same as above.

Log of Bureau of Mines diamond-drill hole 2 (Cont.)
Bearing S. 77° W., inclination - 42°

Footage	
112 -113.5	Dike rock; same as above.
113.5-154	Limestone; dark-gray to black, fine-grained, dense, massive, no bedding.
154 -156	Altered dike rock; white chalky, calcareous. Resembles a chalk in appearance, but remnants of original dike rock are still present.
156 -203.5	Limestone; massive, black, with a few zones of scattered grains of pyrite and chalcopyrite.
203.5-244	Chlorite schist; green, compact.
244 -249.5	Basalt dike; very fresh appearing, amygdaloidal.
249.5-300	Chlorite schists; same as above.
300 -305	Limestone; brecciated and recemented.
305 -329	Dike rock; green, medium-grained, relatively unaltered.
T.D.	

Log of Bureau of Mines diamond-drill hole 3
Bearing S. 79° W., inclination - 45°

Footage	
0 -170	Limestone; dark-gray, fine-grained, dense, massive, no apparent bedding, very little scattered pyrite. Very few recemented breccia zones a few inches wide. From 94.5' to 96' and at 159' about 5-10 percent of disseminated pyrite.
170 -187	Dike rock; green, fresh, medium-grained, somewhat porphyritic.
187 -218	Limestone; same as above.
218 -249	Contact rock, consists of considerable fine-grained amphibole, garnet, and an unidentified amber colored mineral and a little hematite and calcite. About 1-3 percent of disseminated chalcopyrite.
249 -280	Limestone; same as above, with a trace of chalcopyrite.
280 -297	Diorite; medium- to coarse-grained, feldspars altered.
297 -302	Limestone; same as above.
302 -314.5	Dike rock; fresh, green, fine-grained
314.5-315	Limestone, same as above.
314.5-325.5	Limestone, dark-gray, fine-grained, dense, massive, no apparent bedding, veined with a few stringers of white calcite, no sulfide minerals.
325.5-335.5	Dike rock, green porphyritic with white feldspar phenocrysts about 1/16 inch across. White altered gouge at 333-333.5.
335.5-383	Limestone, gray-white, dense, fine-grained, massive, no bedding, no sulfide minerals.
383 -411	Dike rock, same as above.
411 -419.1	Dike rock, chloritic basalt, fine-grained, purple-green, slightly veined with calcite.
419.1-435	Dike rock, same as 383-411.
435 -468.5	Dike rock, chloritic basalt, fine-grained, purple-green, veined with thin epidote stringers.
T.D.	

Log of Bureau of Mines diamond drill hole 4
Bearing S. 82° W., inclination - 45°

Footage	
0 - 27	Limestone, gray-black, fine-grained, dense, massive, veined with a few stringers of white calcite, no sulfide minerals.
27 - 42	Dike rock, green, medium-grained, fresh, dense, porphyritic with white feldspar phenocrysts about 1/16 inch across.
42 - 59	Limestone, same as above.
59 - 60	Limestone, black, veined with thin stringers of white calcite, contains about 5 percent very fine grained disseminated pyrite, no other sulfide minerals.
60 -182	Limestone, same as 42-59.
182 -201.5	Contact rock; consists of fine-grained amphibole, epidote, garnet, calcite, and hematite. 195-196.5 contains 5-10 percent pyrite, no other sulfide minerals.
201.5-202.5	Limestone, fine-grained, dense, gray.
202.5-228.5	Contact rock, same as above but with trace of chalcopyrite from 207.5-228.5.
228.5-288	Limestone, gray-black, fine-grained, dense, slightly veined with white calcite.
288 -342.5	Limestone, white, fine-grained, dense, massive.
342.5-345	Dike rock, green, fine-grained, dense.
345 -351.5	Dike rock, greenish-white, medium-grained, porphyritic.
351.5-371 T.D.	Dike rock, green, dense, fine-grained, slightly veined with white calcite.

Log of Bureau of Mines diamond-drill hole 5
Bearing S. 70° W., inclination - 44°

Footage	
0 -130	Limestone, black, fine-grained, dense, massive veined with a few white calcite stringers, graphite partings.
130 -131	Dike rock, greenish white, porphyritic, slightly altered.
131 -279.8	Limestone, same as above.
279.8-286.7	Dike rock, dark-green, dense, fine-grained, chloritic.
286.7-305	Contact rock, fine-grained amphibole, epidote, garnet, calcite, and hematite, contains about 5 percent pyrite and less than 1 percent chalcopyrite.
305 -365	Limestone, same as above.

Log of Bureau of Mines diamond-drill hole 6
Bearing S. 65° W., inclination - 45°

Footage	
0 - 50	No core recovery.
50 -415 T.D.	Volcanic breccia, consists of angular and rounded volcanic fragments ranging in size from pinhead to over 1/2 inch across cemented in a fine- to medium-grained matrix of volcanic material, slightly chloritic, with a few bands of graphitic material and limestone.

APPENDIX III

Analyses of core samples

Millett property, Millett Point, Iliamna, Alaska, Analyses of drill holes

Hole 1

From-	To-	Feet	Sample No.	Cu, percent	Au, oz./ton	Ag. oz./ton
174.0	180.0	6.0	208	0.70	∠ 0.005	0.1
180.0	185.0	5.0	209	.98	∠.005	.1
265.0	269.0	4.0	210	.03	∠.005	∠ .1
269.0	274.0	5.0	211	.09	∠.005	.2
274.0	280.0	6.0	212	.08	∠.005	.1
280.0	284.0	4.0	213	.53	∠.005	.2
284.0	290.0	6.0	214	.47	∠.005	.2
290.0	294.0	4.0	215	.05	∠.005	.1
294.0	298.0	4.0	216	.17	∠.005	.1
298.0	305.0	7.0	217	.02	∠.005	.2
305.0	309.0	4.0	218	.02	∠.005	∠ .1
			Hole 2			
177.0	179.1	2.1	201	.46	<.005	.1
195.0	200.0	5.0	202	.05	<.005	∠.1
			Hole 3			
85.0	86.0	1.0	221	.01	∠.005	∠.1
94.0	100.0	6.0	222	.03	∠.005	∠.1
158.5	160.5	2.0	223	.05	.005	.1
215.5	220.0	4.5	224	2.23	.005	.1
220.0	225.0	5.0	225	1.73	.005	.1
225.0	235.0	10.0	226	.50	.005	.1
238.2	240.0	1.8	227	1.45	.005	.1
240.0	245.0	5.0	228	.90	.005	.2
245.0	250.0	5.0	229	2.89	.005	.1
			Hole 4			
182.0	189.5	7.5	231	0.28	∠.01	∠.05
189.5	201.5	12.0	232	.09	∠.01	∠.05
207.5	216.1	8.6	233	.23	∠.01	∠.05
216.1	228.5	12.4	234	.22	∠.01	∠.05
			Hole 5			
286.7	292.0	5.3	235	.51	∠.01	∠.05
292.0	305.0	13.0	236	.28	∠.01	∠.05

∠ Less than

Int. - Bu. of Mines, Pgh., Pa.