GEOPHYSICAL REPORT

Lehto Group
Copper King M.C.'s Nos. 1-8, 11, 12
Harrymel Creek - 56° 130° SW

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104B/110E

July 14 - August 12, 1956

150

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NEWMONT EXPLORATION LIMITED

Box 366

JEROME, ARIZONA

September 19, 1956

REPORT ON GEOPHYSICAL SURVEY OF LEHTO GROUP

BRITISH COLUMBIA, CANADA

SUMMARY

A magnetic survey of the Lehto Group, in the Coast Range north of Stewart, British Columbia, was conducted by Newmont Exploration Limited during July and August, 1956. The survey included a general magnetic reconnaissance along the west slopes of the canyon of Harrymel Creek, partly onto its glacier, and a detailed investigation of the area around the main showing. The latter, though a mineralized fault zone, did not respond magnetically; nevertheless, a staggered pattern of large positive anomalies was found to parallel it to the east. These are believed to arise from pyrrhotite-bearing fractures known to accompany the fault. The largest of the suspected magnetized zones is estimated to be 75 feet wide, probably comprising a series of stringers rather then one uniformly magnetized body. All of these bodies appear to lie close to the surface. The fault can be traced by its related anomalies a distance of 2,000 feet northward from the showing. Negative anomalies, common along the canyon bluffs, are attributed to the steep terrain. Several possible magnetic zones appear to lie buried farther north; while nothing of interest showed up to the south, nor were anomalies found on the glacier. It proved impractical to attempt an electromagnetic survey in the Lehto Group.

SURVEY INFORMATION

A brief description of the geologic features of the Lehto Group is given below, some of which are outlined on the accompanying maps. For detailed geologic information, refer to the report being prepared by Dr. Donald Carlisle.

The Lehto claims are located at approximately 56 1/2° N. Lat., 130 1/2° W. Long., on the headwaters of Harrymel Creek, the north fork of the Unuk River, in the Coast Range of British Columbia. The locality is accessible only by air from Stewart, approximately 60 miles to the south. In early summer, while snow remains on the ice, planes can land on the north glacier, 3 miles north of base camp; later they must land on Tom MacKay Lake, about 6 miles by foot north-east of the camp.

The area surveyed lies at an altitude of approximately 3,000 feet, extending 12,200 feet north-south along Harrymel Creek. The vertical range of the east-west cross lines, beginning at the canyon bottom, is about 700 to 800 feet.

The area is bisected by a precipitous east-west gorge, which carries water from the "west glacier" to Harrymel Creek (see maps). The northeast corner of the grid lies on the "north glacier", 7,200 feet north of the gorge. For about 3,000 feet southward the valley slopes are open, and covered with morainal debris, talus, and scree, scored by swift streams. Here the slopes average 20 to 30°, with occasional steeper pitches and outcrop bluffs near the glacier and river. Southward, the slopes become steeper (30 to 40°) and increasingly more overgrown with brush and trees. Base camp was established in one of these groves. Immediately north of the gorge and extending along it, is a 500 foot wide, more or less open, undulating area of moraines and outcrop, in which occurs the main showing. This open area ends to the west at the west glacier, and to the east at densely overgrown cliffs dropping off towards the river.

South of the gorge the canyon slopes become steeper (up to 60°), with sheer cliffs on the east. The country is here more thickly overgrown with brush and trees, open grassy slopes being found only on the uphill ends of some of the lines. To commute from the north to the south half of the area, trail had to be cut along the side of the gorge to meet a snow bridge used to cross the glacial stream.

The maps show the principal geologic units in the region of the main showing; essentially the open area along the gorge. Southwest of the gorge and meeting the glacier is a body of diorite, which was explored on Line 28S. On the northwest side are found multiple flows of columnar basalt in contact with the ice, which are intercepted by Line 22S.

Immediately west of the north-south base line, a mineralized fault zone, trending approximately N 7° E, crosses the gorge. Its contact planes dip to the west 60 to 85°. To the west occur laminated flow breccias and felsite flows; to the east, limestone and siltstone, underlain by laminated felsite, and andesite flows grading into massive andesite flows and breccias. The showing, crossed by Line 22S, comprises small replacement bodies of massive, fine-grained pyrrhotite and chalcopyrite along the western break and in the adjacent felsite. These are lenses 10 to 30 feet long, and up to a foot wide. In addition, small stringers of pyrite, those on the east containing also pyrrhotite and chalcopyrite, occur in north-westerly fractures along both sides of the fault.

The fault zone has been traced northward in several outcrop bluffs to at least Line 6S, 2,400 feet north of the gorge. There it strikes approximately N 30° E, still dipping steeply westward. Scattered outcrops to the north consist of flow breccias and small lenses of limestone. Diorite bluffs lie up-mountain along the north end of the surveyed area.

Magnetics

Dates: July 14 to August 12, 1956.

Reconnaissance Survey:	Line interval 400 feet (North Half)
	800 feet (South Half)
	Station interval 100 feet
	Total length of line 39,700 feet
Detail Survey	Line interval 50 feet
	Total length of line 5,500 feet
	Total number of stations 119

The boundaries of the grid were selected by Dr. Carlisle as including in a minimum area the geologic features of most interest.

A Ruska magnetometer was used to record the vertical component of the magnetic field at each station. Because of the very large range of the magnetic readings, the slight diurnal variations due to fluctuations in the earth's field could be neglected. Though readings from one station to the next (in time) are accurate to 100 gammas, the overall accuracy of the survey is about 200 gamma, which is sufficient for the purpose.

The geophysical crew of four men arrived as flying conditions allowed during the first week. In addition there was a cook, and four men to serve as packers and line-cutters. Setting up camp, packing, and building trail prevented any line-cutting or surveying being done during this first week. Thereafter, the bad weather, packing time and rugged terrain slowed down the line-cutting, so that geophysical progress was seldom more than a day behind it. The geophysical work, too, proceeded at a much slower rate than in most localities owing to the steep slopes, cliffs, weather, commuting time, damage to the instrument, injuries, and time required for other tasks. Thus more man-hours-work was spent in chaining than in reading the magnetometer, and almost twice as much time expended in packing, trail-building, etc.

Electromagnetics

Because of the rugged terrain, inaccessibility, and weather conditions, it was deemed impractical to attempt an EM survey at Lehto. Since misorientation of the transmitter results in false readings at the receivers of magnitudes proportional to the slope angle, it would have been very difficult to avoid false anomalies on the 20 to 40° hill-sides. In order to run lines parallel to the contours (the alternative method) an entirely new set of lines would have had to be cut. Furthermore, the effort involved in bringing the equipment to the site was hardly justified by the uncertain readings which could have resulted.

PRESENTATION OF RESULTS

The magnetometer records essentially anomalies in the earth's magnetic field, due to the magnetic properties of the rock and its geologic orientation. On the maps, these magnetic readings (referred to an arbitrary base) are plotted as vertical bars, whose bases mark the stations at which the readings were taken. Positive anomalies are drawn upward; negative downward. The magnetic scale is 4,000 gamma per inch. The total earth's field in the area is 58,000 gamma. Where bars would have overlapped, they are drawn with dashed arrows and their full readings indicated numerically.

Profiles on the maps correspond to the actual lines on the ground except in the case of Line 26N, which, due to surveying difficulties, was found to run in a direction approximately S 83° E. The detailed survey is presented only on the larger scale map. On all lines plan distance was used.

THEORY AND DISCUSSION OF RESULTS

While individual stringers lying close to the surface can give strong positive anomalies, their effect must be very local, and even using a detail grid of 50 foot interval, some could be missed. Again, in interpreting successive highs, 50 feet apart, we assume that they are part of a continuous curve and that no intermediate dips occur. Only a still closer-spaced survey would resolve such very sharp anomalies. Several closely-spaced stringers, even at quite shallow depth, blend their individual anomalies, with the result that they behave like a zone of uniformly magnetized rock.

As shown on the reconnaissance map, Profiles 42N to 22N extend partway onto the ice of the north glacier, and it is seen that over the ice, within any given line, the range of readings does not exceed 200 gamma; over the ice as a whole, the range is only 400 gamma. Were the ice 100 feet thick, a mineralized zone, such as those believed to cause the moderate anomalies to the south (40 feet wide, 20,000 x 10^{-6} C.G.S. units susceptibility), would still show about a 900 gamma anomaly. A body such as is suspected to cause the largest Lehto anomaly (10 feet wide, 175,000 x 10^{-6} C.G.S. units) would appear as a 2,100 gamma anomaly. Under 200 feet of ice these would be about halved. We conclude, therefore, that no magnetic bodies of the magnitude of those farther south lie under the surveyed portion of the glacier.

West of the glacier, in the region of morainal and talus slopes, where there are only occasional outcrops of flow breccias and limestone, we note definite undulations of the magnetic profiles. The readings are too regular to be random, yet they cannot be correlated with certainty from line to line. They probably represent lithologic changes of rock units containing different amounts of disseminated magnetic minerals. The low, broad anomaly centered about 150 feet east of the base line on Line 34N is such as could be produced by a nearly vertical unit of susceptibility 3,000 x 10^{-6} C.G.S. units, on the order of 250 feet wide, buried beneath about 30 to 40 feet of moraine. The more prominent rise around 800 east on Line 18N is such as would result from a narrower body (50 feet) of greater susceptibility (6,300 x 10^{-6} C.G.S. units) lying beneath about 15 feet of cover. Closer-spaced traverses over these anomalies would be needed to interpret these subtle anomalies without ambiguity. On the basis of the available readings it would be presumptuous to relate the latter anomaly to the fault zone farther south.

A strong (5,100 gamma) positive anomaly appears at 400 east on Line 2S, with a counterpart (1,900 gamma) at 200 east on Line 10S. It is difficult to say, on the basis of 100 foot readings, where these anomalies begin and where they end, particularly considering their negative nature to the east, so that a quantitative interpretation is unjustified. Their alignment along the fault strike, however, suggests that mineralization along the fault is producing the peaks. On Line 6S, the relative rise between two negative anomalies may also be an expression of the fault; on the other hand, the mineralization on Line 6S may be locally absent or too deep to register as a prominent positive.

Pronounced negative anomalies appear along the canyon bluffs from Line 2S southward. Negative anomalies could arise in three ways. Where they accompany a positive anomaly, as they do on lines 2S and 10S, they might be interpreted to be the negative loop of the cross-over characteristic of orebodies of gentle dip, but in such cases the positive peak exceeds the negative in amplitude, unlike that on 10S. The explanation is furthermore inappropriate here where the contacts dip at high angles. Remanent magnetization, or reversed polarization induced during the geologic past is another explanation, by which we would suspect genetically different mineralization between that causing the positive and that causing the negative anomaly. It is, however, more probable that the presence of the cliffs which are the topographic expression of the fault, result in the negative readings, since in reading against such cliff walls, mineralized zones and stringers would be lying above the instrument and thus attract its magnetical balance reversely. The strong negatives on Lines 2S and 10S all occur on the cliffs which make these the most precipitous of the lines surveyed north of the gorge. All along the steep canyon walls, from Line 2N southward, the readings become generally negative.

Line 14S is a very steep but unbroken line, mostly covered with morainal debris. Its western side follows the crest of an east-west moraine. Its profile, best seen on the detail map, is one of gentle anomalies whose limits are too indefinite for analysis. Again the interplay of the steep slope seems to appear in the negative eastern segment. The regular undulations to the west, which show also on Line 18S, may represent the effect of magnetized stringers greatly attenuated by the depth of overburden (up to 100 feet) on both these lines.

The series of major anomalies trending with the fault zone but displaced about 200 feet to the east, continue from Line 16S through Line 26S, and probably express the pyrrhotite-bearing fractures accompanying the fault zone on its eastern flank. No recognizable anomalies appear along the main showing, approximately 200 feet west of the base line, indicating that the mineralization there is non-magnetic, or at best very restricted.

On Line 16S the broad, flat anomaly suggests the coalescence of two anomalies having peaks situated about 125 and 175 feet east, midway between 50 foot stations. These are such as would result from mineralized zones about 40 feet wide, roughly 10 feet below the surface, and of effective susceptibility of 20,000 x 10^{-6} C.G.S. units. Probably, as in all the following interpretations, this "zone" is actually an assemblage of individual pyrrhotite stringers of higher susceptibility than their effective value. The terrain along the surveyed portion of this line is relatively flat, with shallow overburden and occasional outcrops.

The mineralization on Line 18S responds as a rather broad zone (on the order of 75 feet width), located 25 feet below the surface, just east of the base line, with an effective susceptibility of 20,000 x 10^{-6} C.G.S. units. Actually, however, the broadening might be due to the presence of minor zones on either side of the peak, making a compound anomaly. The overburden on this line ranges from heavy on the west to light in the region of the anomaly, with outcrop over the fault zone, and steep cliffs toward the river.

A single and a compound anomaly appear on Line 20S. The first, at about 50 east, would result from a 25 foot wide zone, 25 feet below the surface, of effective susceptibility of about 50,000 x 10^{-6} C.G.S. units. The double-peaked anomaly to the east could result from zones similar to those suspected on Line 16S, with centers spaced about 100 feet apart.

The very large anomaly at the base line on Line 22S (10,200 gamma) suggests a zone at about 15 to 20 feet depth, less than 10 feet in width, with a susceptibility of about 175,000 x 10^{-6} C.G.S. units, which seems rather high for pyrrhotite. The eastern anomaly appears due to a wider zone (about 35 feet) about 15 feet underground, of susceptibility approximately 42,000 x 10^{-6} units. A "step" in the profile to the east, suggests another minor zone. The topography in the region of the anomalies is gentle, with thin cover and outcrops. The showing is exposed at 200 feet west. Beyond 250 east, the line drops off in steep bluffs, and there the readings become negative. Westward, where the line extends along the side of the gorge, the readings undulate as on Lines 14S and 18S, and are generally negative. Where the line approaches the buried diorite contact, it becomes more strongly negative. A sharp peak of 8,100 gamma at 2,100 west marks the presence of the columnar basalt there exposed.

Anomalies continue in the region of the fault zone southward to the gorge, but because of cliffs the lines are too short to allow much analysis. All of the lines on the south side of the gorge terminate at cliffs on the east. Lines 40S and 48S, which were carried partway down the cliffs, again suggest a negative trend, as on the north, ascribed to topography. Line 28S, which was carried to 3,400 west in order to cross the exposed diorite, shows nothing of interest except a general negative level perhaps characteristic of the lithology.

The mineralized zones indicated by the anomalies in the region of the showing cannot be correlated from line to line as continuous bands. They rather appear to be disconnected zones, which, except for that of the largest anomaly on Line 22S, are all fairly broad; from 25 to 75 feet in width, and all lying within 25 feet of the surface. Their staggered arrangement implies an origin in the minor fractures accompanying the fault zone.

ACKNOWLEDGMENT

We wish to thank Dr. Carlisle and Mr. Don Cannon for their great help in the Lehto project. We wish also to acknowledge Granduc Mines for their many supply flights and the use of their office facilities while in Stewart.

(Signed) Arthur L. Lange

Geophysical Engineer.

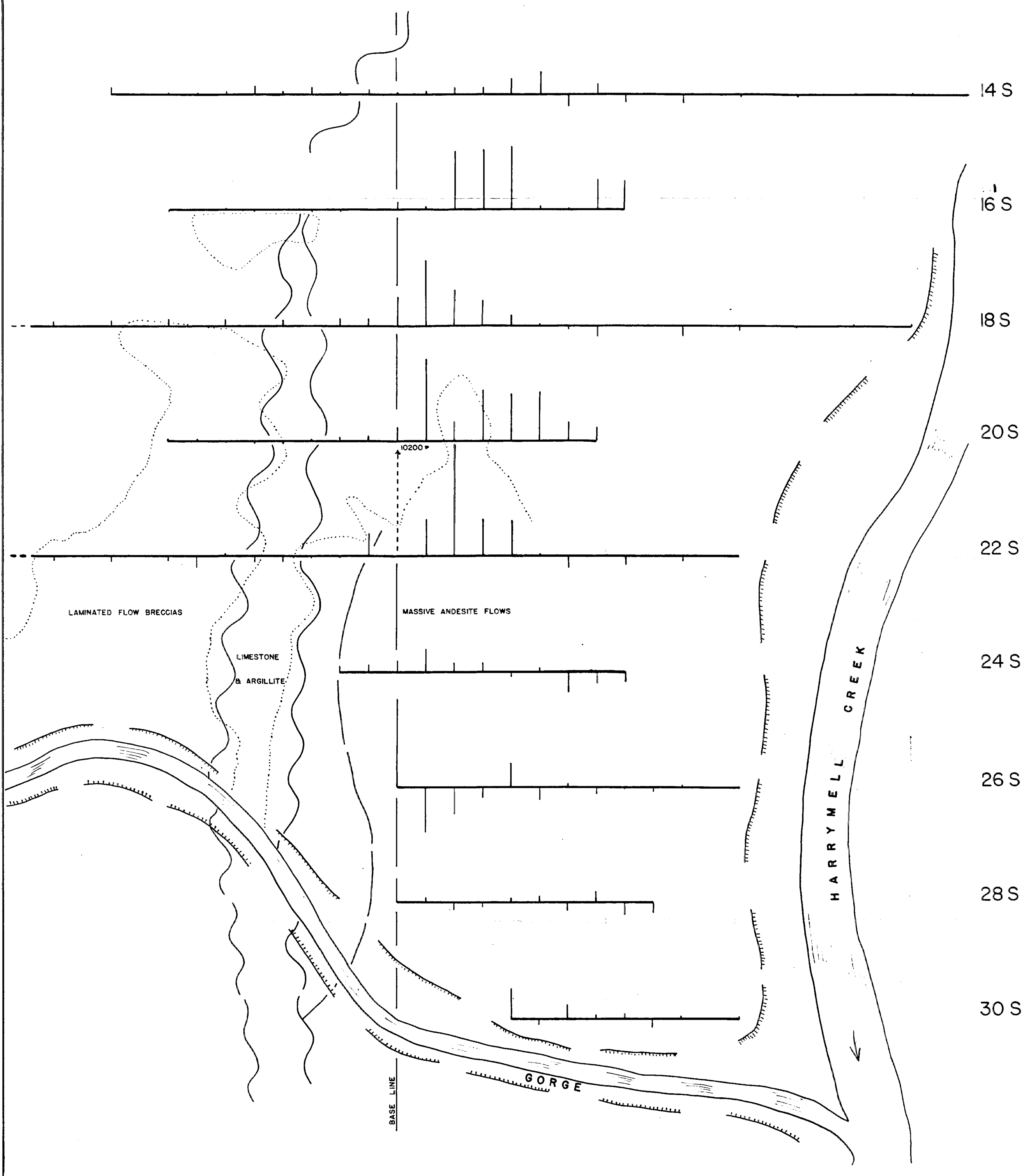
ALL:lu

Maps enclosed.

Supervision by:

D. M. Cannon, Prof. Eng.

TN
MN
LEGEND
BLUFFS
FAULT ZONE
APPROXIMATE CONTACT
ALLUVIUM BOUNDARY
400 0 400 800 1200
SCALE IN FEET
MAGNETIC SCALE: 4000 GAMMAS/IN
42 N
38 N
34 N
30 N
26 N
22 N
18 N
14 N
10 N
6 N
2 N
2 S
6 S
10 S
14 S
18 S
22 S
26 S
28 S
30 S
32 S
40 S
48 S
56 S
64 S
72 S
80 S
NORTH GLACIER
COPPER KING 7
C.K. 8
C.K. 5
C.K. 6
C.K. 3
C.K. 4
COPPER KING 1
C.K. 2
C.K. 11
C.K. 12
HARRYMEL CREEK
5100 γ
5100 γ
8100 γ
10200 γ
7800 γ
BASALT
BASALT
GORGE
DIORITE
FLOW BRECCIA
ARGILLITE & L.S.
ANDESITE FLOWS
WEST GLACIER
COPPER KING Nos 1 - 8, 11, 12.
RECONNAISSANCE MAGNETIC SURVEY
JULY, AUGUST 1956
Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 150 MAP #1
#150
MAP 1
A.L. LANGE



LEGEND

BLUFFS

FAULT ZONE

APPROXIMATE CONTACT

ALLUVIUM BOUNDARY

TN

MN

100 0 100 200 300

SCALE IN FEET

MAGNETIC SCALE: 4000 GAMMAS/IN.

COPPER KING M.Cs.

SKEENA MINING DIVISION

DETAIL MAGNETIC SURVEY

JULY, AUGUST 1956

#150
MAP 2

A.L.LANGE Supervised by [signature], Prof. Eng.