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GEOLOGICAL, GEOCHEMICAL REPORT
NORTHSTAR COPPER MINES LTD. (N.P.L.)
OMINECA MINING DIVISION, B.C.

for

NORTHSTAR COPPER MINES LTD. (N.P.L.)

Toru Kikuchi, Ph.D., P. Eng.
Consulting Geological Engineer

November 10, 1969.

Vancouver, B.C.

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with three illustrations.

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I. INTRODUCTION AND GENERAL STATEMENT

At the request of Mr. R.M. Tait, President of Northstar Copper Mines Ltd. (N.P.L.), the writer was at the property during 9th - 12th September, 1969, with his partner geologist Motomu Kiyokawa, in the company of Mr. Tait for general investigation and its further consideration.

The following references are used by the writer:

C.S. Lord: McConnell Creek Map-Area, Cassiar District, B.C.
G.S.C., Memoir 251; 1948

W.H. White, Ph.D., P. Eng.: Report on Mining Property of Northstar Explorations Ltd., in Caribou Heart Range, July, 1966

Minister of Mines and Petroleum Resources, B.C.: Annual Report for the year ended Dec. 31, 1966. Pp. 82

W.H. White, Ph.D., P. Eng.: Northstar Copper Mines Limited. Progress Report #3, Dec. 15, 1967.

Minister of Mines and Petroleum Resources, B.C. by A. Sutherland-Brown, Ph.D., P.Eng.: Annual Report for the year ended Dec. 31, 1967. Pp 86-88.

W.H. White, Ph.D., P. Eng.: Report of Current Mineral Explorations for Further Development of the Mining Properties of Northstar Copper Mines Ltd. (N.P.L.) Oct. 4, 1968.

Minister of Mines and Petroleum Resources, B.C.: Annual Report for the year ended Dec. 31, 1968. Pp 118

The property investigated at this time consists of 1267 mineral

claims, wholly owned by Northstar Copper Mines Ltd. (N.P.L.), in good standing in the Omineca Mining Division, British Columbia, as listed below. The writer checked them at the Vancouver Mining Recorder's Office on October 30th, 1969.

| <u>Name of Mineral Claim</u> | <u>Record Number</u> |
|------------------------------|----------------------|
| Bobo 1 - 12 inclusive | 33706 - 33717 |
| Bobo 13 - 16 inclusive | 60731 - 60734 |
| Can 1 - 15 inclusive | 48584 - 48588 |
| May 1 - 4 inclusive | 59310 - 59313 |
| Fred 1 - 12 inclusive | 33694 - 33705 |
| Ged 1 - 12 inclusive | 40650 - 40661 |
| John 1 - 8 inclusive | 41222 - 41229 |
| Kiwi 1 - 8 inclusive | 42498 - 42505 |
| Marg 1 - 6 inclusive | 33718 - 33723 |
| Maori 1 - 8 inclusive | 42490 - 42497 |
| Ski 2 - 10 inclusive | 48590 - 48598 |
| Sun 1 - 8 inclusive | 42159 - 42166 |
| Tina 1 - 4 inclusive | 51846 - 51849 |
| Tina 9 - 13 inclusive | 51851 - 51855 |
| Tina 14 | 51857 |
| Har 1 - 14 inclusive | 60751 - 60764 |
| Wick 1 - 4 inclusive | 48580 - 48583 |
| Trail 1 & 2 | 48489 & 48490 |

This property is located at about $56^{\circ} 02' N$, $126^{\circ} 16' W$, in the Cariboo Heart Range, approximately 25 miles north of the north end of Takla Lake. That is, it is at the north of Kaza Lake, which is in the southeast corner of the McConnell Creek area, about 95 air miles north-northeast of Smithers. There is a cat road from Bulkley House at the north end of Takla Lake via Kaza property at the south of Kaza Lake. The last 10 miles is a good truck road. Access by float fixed-wing plane is convenient at the present. The property surface which ranges in elevation from 4,000' to above timberline at 5,500' is densely forested and bedrock is largely concealed beneath a comparatively thin mantle of soil and unconsolidated glacial till.

Mr. R.M. Tait, President of Northstar Copper Mines Ltd., first found the original showings in September of 1965, and staked the original claims. In 1966 preliminary exploration including geological mapping and some hand trenching in the vicinity of the main showing and further prospecting in the area had been done. In 1967 a field laboratory and camp were established at the north end of Kaza Lake and systematic grid soil-sampling was carried out with geological mapping. Nine holes (AQ) of diamond drilling, totalling 2091', had been finished in this season. In 1968 a tractor-trail from Bulkley House was built, about 30,000' of cat trenching was done, 2624' of diamond drilling was done in 11 holes (AQ), and about 50 shallow pits were blown. In 1969 4074' of diamond drilling (13 holes, AQ) has been done.

II. GEOLOGY, MINERALIZATION AND COPPER-DEPOSIT

This area is mainly underlain by Jurassic volcanics and marine sediments. There is some diorite intrusive in the area. They consist of shale, siltstone, phyllite, sandstone, slate, agglomerate, limestone, tuff, tuff-breccia, porphyritic basalt, porphyritic andesite, etc. (See pp. 86 - 87, Annual Report 1967, by Dr. Sutherland-Brown for more detailed academic lithological explanations.)

The first found copper showing which has been called "Main" showing (by Dr. White, 1966) or "A" showing (by Dr. Sutherland-Brown, 1967) is on the eastern slope of the mountain on the rim of a landslide scar around which exposure is good in contrast to the surrounding area. The rim consists of some alternated beds of limestone, agglomerate, shale, sandstone,

siltstone, tuff, basalt, andesite, etc. They are usually fine-grained and clastic. The general strike and dip are N 60° E and 45° - 60° SE respectively. Some faults which have their general strike and dip as N 70° E and 70° NW cut the beds.

The copper bearing bed of the "Main" or "A" showing is composed of mainly clastic shale or tuff, the thickness of which is not yet known. The color is green, brown or red. Some green copper stain can be seen, but bornite, chalcocite and chalcopyrite disseminated in the rock are too small to see by a hand lens. Some cuts of the copper bearing bed were sampled by the writer and assayed as on the next page. Dr. White (1966) informed an assay data of his sample from the same place as;

0.005 oz/t Au, 0.20 oz/t Ag, 2.65% Cu, for 6' true width and Dr. Sutherland-Brown (1967) reported his case as;

| Sample No. | Stratigraphic Thickness | Lithology | Copper Assay |
|------------|-------------------------|--|--------------|
| | Ft. | | Per Cent |
| 6968 | 3½ | Green lapilli tuff somewhat sheared | 0.48 |
| 6967 | 4 | Main beds - mostly laminated siltstone | 1.45 |
| 6966 | 4 | Main beds - mostly laminated siltstone | 2.79 |
| 6965 | 4 | Interlaminated siltstone and coarse tuff | 1.35 |
| 6964 | 3 | Laminated siltstone and sheared lapilli tuff | 1.01 |
| 6963 | 2 | Basal laminated siltstone and tuff | 0.65 |
| 6962 | 4 | Basal malachite - stained sheared lapilli tuff | 0.46 |

Gold and silver occur in trace amounts in each sample.

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Laboratories Limited

325 HOWE STREET - VANCOUVER 1, B.C.

TELEPHONE 688-3504

CERTIFICATE OF ANALYSISASSAYERS
CHEMISTS
GEOCHEMISTS

SAMPLE(S) FROM

DR. TORU KIKUCHI

REPORT NO.

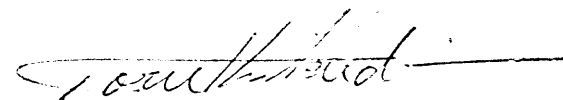
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SAMPLE(S) OF

ROCK from NORTHSTAR COPPER MINES LTD.

| Sample No. | Copper (Cu)% | Cut Length | Cut Direction |
|------------|--------------|------------|---------------|
| NS-1 | 1.50 | 5' | E-W |
| NS-2 | 2.33 | 4' | N80°W |
| NS-3 | 0.96 | 3' | N20°W |
| NS-4 | 0.89 | 15' | N20°W |
| NS-5 | 13.25 | 20' | E-W |

(See Fig.2 for locations.)



Toru Kikuchi, P.Eng.

DATE September 19, 1969.SIGNED R. J. Ditchie

Veinlets of calcite and limonite are common in the bed. There is epidote, but no magnetite nor pyrite.

There is a wide cat-strip at the "B" showing which is about 2,000' southeast of the Main showing above mentioned. The strip extends to the north up to the other chalcocite vein showing. At the southern place of the wide excavation, where the original natural "B" showing was seen and Dr. Sutherland-Brown reported (Annual Report, 1967) his sample of 20' cut as 1.98% Cu, there is a copper deposit exposure. Main rock of the exposure is clastic porphyritic andesite and some clastic shale/tuff at the west side. The writer took a chip sample of 15' cut length with an assay result of 0.89% Cu. (See page 5.) At the northern part of the excavation, there are some chalcocite parallel veins, NS - N 15° E of strike and Vertical - 80° E of dip in general, a half inch to three inches of width in general, in Porphyritic Andesite. The writer took a 20' wide cut across some parallel chalcocite veins and got 13.25% Cu. (See page 5.) The relationship of these two types of deposit has not yet been seen.

A number of other showings, mostly of small size at the moment, have been found in the property, but none of them has been explored.

Diamond drill holes which have been done by the company during 1967 to 1969 are seen on page 7, and their locations are in Fig. 2. The writer had no time to log the cores, but had a short look at some of them.

DIAMOND DRILLING DATA

NORTHSTAR COPPER MINES LTD. 1967 - 1969

(Hole Size: AQ)

| Hole No. | Depth | Angle | Azimuth | Remarks |
|---------------------------|------------|-------|---------|--|
| 1 | 248' | -50° | 295° | |
| 2 | 328 | -50 | 340 | |
| 3 | 468 | -45 | 290 | |
| 4 | 94 | Vert. | - | |
| 5 | 450 | -45 | 195 | 101' - 145'; 1.38% Cu |
| 6 | 125 | -30 | 295 | |
| 7 | 102 | -30 | 295 | 42 - 102 0.64 |
| 8 | 126 | -20 | 250 | |
| 9 | <u>150</u> | -20 | 350 | |
| Total, 1967 2091 | | | | |
| 10 | 306 | -45 | 240 | 140 - 188 1.68 |
| 11 | 355 | -45 | 130 | |
| 12 | 132 | Vert. | - | 0 - 7½ 1.52 |
| 13 | 490 | -45 | 195 | 17 - 25 0.40 |
| 14 | 80 | Vert. | - | |
| 15 | 271 | -45 | 240 | |
| 16 | 252 | -45 | 280 | |
| 17 | 105 | -30 | 290 | |
| 18 | 227 | -30 | 315 | |
| 19 | 174 | -30 | 285 | 110 - 111 0.85 |
| 20 | <u>178</u> | -45 | 270 | 0 - 10 0.28 |
| Total, 1968 2624 | | | | |
| 21 | 361 | -45 | 285 | 247 - 287 1.14 |
| 22 | 194 | -55 | 260 | 177 - 193 1.97 |
| 23 | 186 | -55 | 240 | 120 - 156 1.50 |
| 24 | 57 | -70 | 240 | |
| 25 | 324 | -45 | 165 | |
| 26 | 386 | -55 | 240 | { 237 - 239 4.32 311 - 317 1.35 |
| 27 | 427 | -65 | 240 | 268 - 294 2.79 |
| 28 | 496 | -65 | 285 | |
| 29 | 498 | -60 | 268 | |
| 30 | 51 | Vert. | - | |
| 31 | 193 | -60 | 45 | (71 - 85 0.83 126 - 135 0.35 149 - 159 1.51 |
| 32 | 447 | -60 | 200 | |
| 33 | <u>454</u> | -65 | 245 | |
| Total, 1969 4074 | | | | |
| Total, 1967 - 1969 8789'. | | | | |

(See Fig. 2 for locations)

(This data was given by Mr. R. Tait to the writer.)

As the anomalies of the geochemical work done in 1967 were not sharp enough to guide further work, cat trenching and/or drilling, the writer had the idea of re-assaying the soil-rejects using a complete extraction method and an Atomic-Absorption method. This was because the writer supposed that there should be many fine un-oxidized (insoluble) copper minerals in the soil and lots of the organic material also. Thirty-two selected soil-rejects therefore were tested by two different kinds of method. The results are on page 9.

The basic differences between these three methods are:-

| | Method <u>A</u> | Method <u>B</u> | Method <u>C</u> |
|---------------|-----------------------|------------------------|------------------------|
| Extraction | Complete | Hot Acid | Complete |
| Determination | Color - Comparison | Atomic - Absorption | Atomic - Absorption |

("Complete Extraction" means a method which can dissolve all the copper minerals, even bornite, chalcocite and chalcopyrite, in the soil, being almost the same method as for rock assaying. "Hot Acid Extraction" means a method usually used by a commercial assayer and a common method for geochemical soil testing only for oxide (soluble) copper in the soil.)

COMPARATIVE RESULTS OF THE SAME SOIL SAMPLES

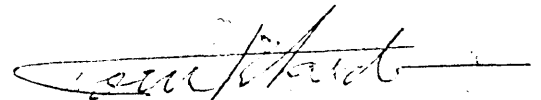
NORTHSTAR COPPER MINES LTD.

| Soil Sample No. | Method | Method | Method |
|--------------------|-----------|-----------|------------|
| | <u>A</u> | <u>B</u> | <u>C</u> |
| 116N, 36E | 90 ppm Cu | 98 ppm Cu | 236 ppm Cu |
| 116N, 38E | 60 | 165 | 373 |
| 116N, 40E | 50 | 96 | 230 |
| 116N, 42E | 40 | 43 | 45 |
| 116N, 44E | 80 | 87 | 226 |
| 116N, 46E | 35 | 48 | 62 |
| 116N, 48E | 15 | 27 | 40 |
| 116N, 50E | 50 | 19 | 39 |
| 116N, 51E | no data | 415 | 986 |
| 116N, 52E | 150 | 210 | 391 |
| 116N, 53E | 100 | 110 | 205 |
| 116N, 54E | 10 | 68 | 29 |
| 116N, 55E | 100 | 59 | 82 |
| 116N, 56E | 200 | 94 | 236 |
| 116N, 57E | 180 | 88 | 230 |
| 116N, 58E | 200 | 64 | 253 |
| 116N, 59E | 150 | 81 | 220 |
| 116N, 60E | 200 | 96 | 245 |
| 116N, 61E | 140 | 118 | 301 |
| 116N, 62E | 50 | 50 | 55 |
| 116N, 64E | 60 | 38 | 50 |
| 116N, 66E | 40 | 39 | 50 |
| 116N, 68E | 40 | 39 | 50 |
| 116N, 70E | 30 | 23 | 35 |
| 116N, 72E | 40 | 28 | 41 |
| 116N, 74E | 50 | 42 | 57 |
| 116N, 76E | 40 | 52 | 63 |
| 116N, 78E | 50 | 42 | 46 |
| 116N, 80E | 50 | 30 | 39 |
| 116N, 82E | 30 | 42 | 47 |
| 116N, 84E | 60 | 47 | 46 |
| 116N, 86E | 50 | 32 | 41 |

Method A: At the field laboratory, 1967.

Method B: By a commercial assayer in Vancouver, "Hot HCl Acid Extraction and determined by Atomic Absorption."

Method C: By M. Kiyokawa under supervision of the writer at Britton Research's Laboratory, Vancouver, complete extraction with HNO_3 and HClO_4 and determined by Atomic Absorption.



In comparative consideration of the results from the three methods, the writer found that there are some differences. There are reasons for the results of each method, i.e.:- Method A carries high extraction but cannot determine the higher ppm correctly by color comparison method. Method B does not extract all the copper in the soil. Therefore, with the permission of Mr. R. Tait, the writer tried to re-test all the available soil-rejects (449 soil-rejects including 32 above-mentioned) by Method C and got the new geochemi map (Fig. 3) with some sharper anomalies.

III. CONCLUSION AND RECOMMENDATIONS

The copper deposit of this property is not a simple one. All the data we have had indicates that there are three kinds of copper deposits, that is, (1) copper-bearing clastic shale/tuff bed of Main showing, (2) disseminated copper deposit in porphyritic-andesite/shale/tuff of the south of B showing and (3) clean cut chalcocite vein in porphyritic andesite north of B showing. These three types of copper occurrences seem to be, to the writer, not very much different in their genetical consideration. They are all some kind of epigenetic low temperature hydrothermal copper mineralization, though they have different modes of occurrence in their different host rocks. They should have some relationship and/or connection with each other under the ground, because they seem to the writer to be from almost the same source.

The copper mineralization of this property is strong, and the assay data we have had shows comparatively high copper content. 1 - 2% of copper is not high enough for underground mining, but it is high enough to consider open pit mining after getting further data of the

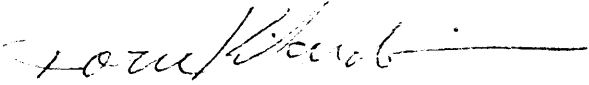
full mode of copper mineralization in the property.

The exploration work which had been done is only in the limited places of Main showing and B showing - therefore more systematic work will be needed to find the mode of copper mineralization, relationship and connection of showings and geochemi anomalies.

Therefore, the following is recommended for next season:-

| | |
|--|---------------------------|
| Preparation Topographical Map (1" = 500') from Government Air Photo (Contract) covering the Fig. 3 area | \$ 1,500.00 |
| Contract surveying for drill sites (#1 - 33) and trenches and stripping | 2,000.00 |
| Contract geological investigation for Fig. 3's anomalies and core logging (Holes #16 - 33 and #1 - 15 if possible) | 1,500.00 |
| Cat trenching and stripping for the anomalies of Fig. 3 | 5,000.00 |
| Some suitable kind of E-M survey on the limited areas | 3,000.00 |
| Systematic surface rock sampling in the trenches and stripping | 2,000.00 |
| Diamond drilling (BQ Wireline) for the recommended sites after all work above mentioned, 10 holes x 300' | 25,000.00 |
| Overhead, transportation, camp accomodation, consulting, etc. | <u>19,000.00</u> |
| TOTAL | <u><u>\$61,000.00</u></u> |

Repectfully submitted,

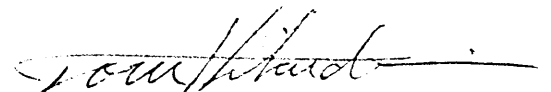

Toru Kikuchi, PH.D., P. Eng.
Consulting Geological Engineer

Vancouver, B.C.
November 10, 1969.

STATEMENT OF QUALIFICATIONS

I, Toru Kikuchi of the City of Vancouver, B.C. hereby certify that:-

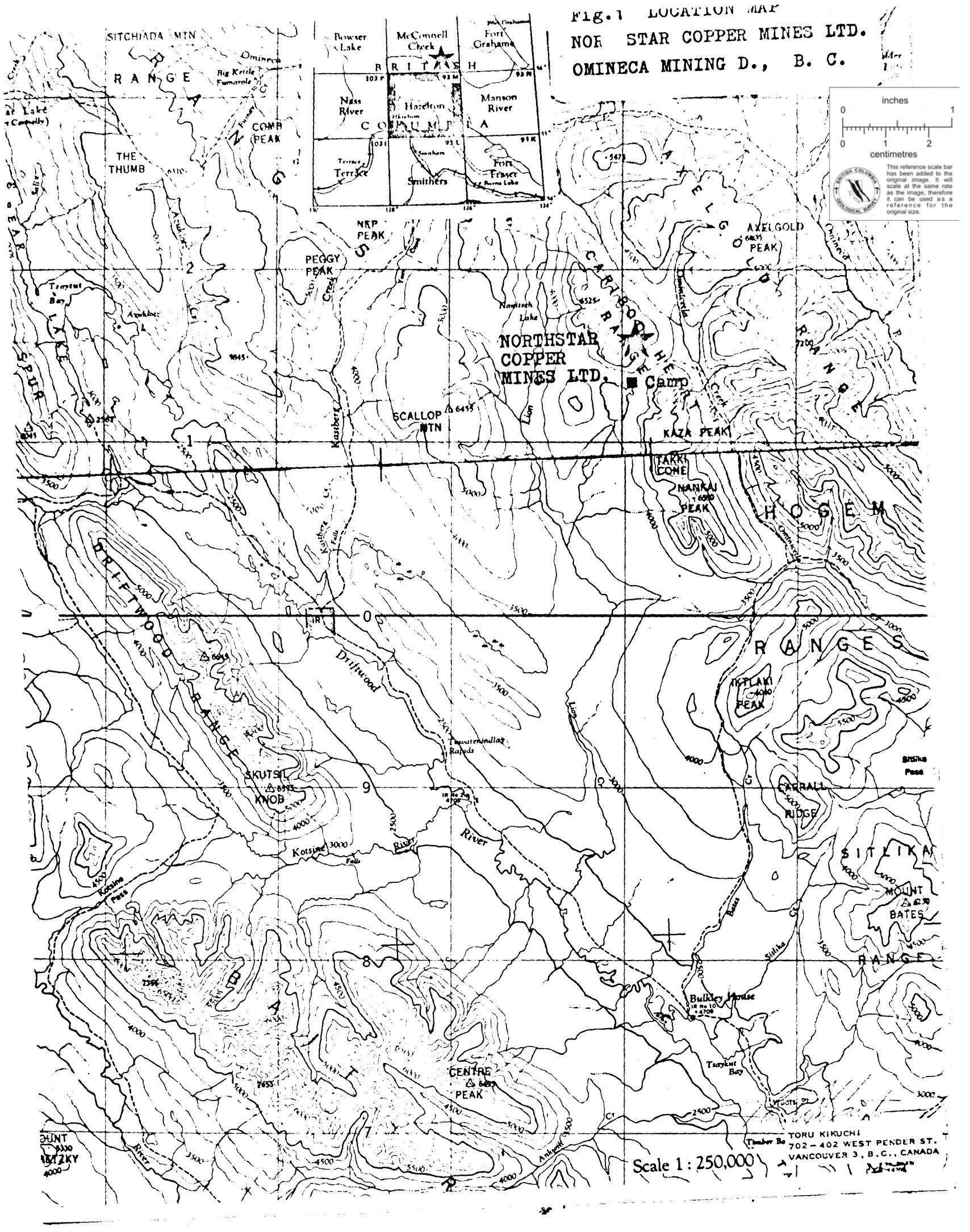
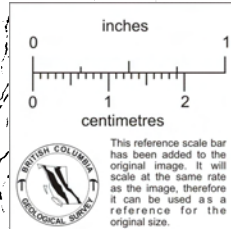
1. I am a graduate of the Hokkaido University, Japan (B.Sc., Geology and Minerology, 1946) and of the Tohoku University, Japan (Ph.D., Economic Geology, 1963).
2. I am a "GIJUTSUSHI" (a qualification for a consulting engineer authorized by the Japanese Government) and a member in good standing of The Association of Professional Engineers of the Province of British Columbia and of the Yukon Territory.
3. I am a member of The Society of Mining Geologists of Japan, and of The Canadian Institute of Mining and Metallurgy and of The Engineering Institute of Canada.
4. I have been practising my profession continuously for the past twenty-three years, and am an independent Consulting Geological Engineer with my office at Room 702 - 402 West Pender Street, Vancouver 3, B.C.
5. I have no direct or indirect interest in the property, nor do I anticipate receiving any such interest.
6. This report is based on my personal study and work at the property on September 9 - 12 inclusive, 1969.



Toru Kikuchi, P. Eng.

Vancouver, B.C.
November 10th, 1969.

FIG. 1 LOCATION MAP
 NOR STAR COPPER MINES LTD.
 OMINECA MINING D., B. C.



Scale 1 : 250,000
 TORU KIKUCHI
 702 - 402 WEST PENDER ST.
 VANCOUVER 3, B. C., CANADA