Dr. N. C. Carter, P. Eng.,
Senior Geologist
Mineral Resources Branch
Department of Mines & Petroleum Resources
Victoria, B. C.

PROPERTY VISIT

CONSOLIDATED CHURCHILL COPPER LTD.

JANUARY 8 - 9, 1975.

G. H. Klein, P. Eng.,
District Geologist
Prince George, B. C.

January 15, 1975

CONSOLIDATED CHURCHILL COPPER LTD.,

LIARD MINING DISTRICT, LAT. 58°30', LONG. 125°24'

PROPERTY VISIT, JAN. 8-9, 1975.

Introduction:

Consolidated Churchill Copper is a small copper producer about 130 road miles west of Fort Nelson, B. C. First production was from January 1970 to October 1971, at which time the mine was closed because of low copper prices. Production resumed in November 1973, under George Dvorak, Mine Manager and was producing in the order of 500 tons per day of near 3% copper at the time of the visit. Harry Skoglund was Mine Superintendent and Nick Andrade was Engineer-Geologist. All people contacted were cordial, busy, and sincerely trying to make a go of a tough situation. All geological information was made available for scrutiny. The work force of 130 men (118 hourly) produced over a million pounds of copper (over 3% Cu.) in December 1974.

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The geology and general setting has been adequately described by Tidsbury and Preto, with excerpts from Carr, G.E.M. P.81, 1971.

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The chalcopyrite, which is often massive, occurs almost entirely within the quartz veins, and is sometimes quite erratic, widths often one to two feet.

Geological records, considering the history of the deposit, were well kept.

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Mining has been carried out over a vertical height of 1500 feet and a strike length of 2500 feet in numerous small stopes. Shrinkage is the mining method now in use and is probably the best choice for the narrow veins. Small side dump cars and battery locos are used for hauling the muck from chutes to the orepass.

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Known ore reserves are nearly depleted. While an accurate calculation of tonnage and grade in such a deposit is extremely difficult, it is thought that under favorable conditions, a life of six months is possible. However, there is a very real possibility of an imminent closure because of low copper prices. At the time of the visit, spot copper on the L.M.E. (basis of settlement for C.C.C) was $0.51 and it was apparent that costs were higher. Management was pessimistic on the outlook to mine to completion the known ore.

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District Geologist.

Prince George, B. C.
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GHK:jt

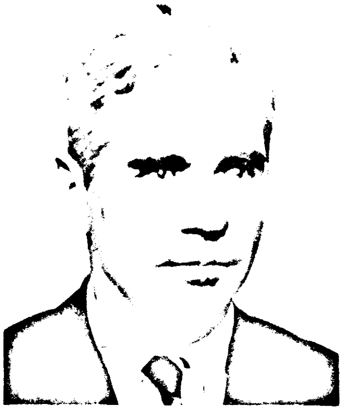
GEOLOGY OF THE CHURCHILL COPPER DEPOSIT

By

J. M. Carr
Brameda Resources Limited

ABSTRACT

The history, geological setting, and local geology of the Magnum vein system, 100 miles west of Fort Nelson in northeastern British Columbia, are described. The system comprises a number of quartz-ankerite veins mineralized with chalcopyrite and lesser pyrite, occurring in a steep northeasterly zone of deformation and subsequent dyke intrusion within otherwise little-deformed Precambrian sedimentary rocks. In April 1970, Churchill Copper Corporation began producing copper concentrates in a 750-ton per day mill fed from the Magnum mine.



J. M. Carr

Born and educated in Britain, Dr. Carr came to British Columbia in 1955 after periods of geological employment in Cyprus and the United States. He was employed as geologist with the B. C. Department of Mines and Petroleum Resources from 1956 to 1969, chiefly in the mapping and investigation of porphyry-type deposits. Joining Brameda Resources Limited in June, 1969, he spent the following three months studying the Churchill (magnum) ore deposit and other deposits in the Racing River area. He is a member of the C. I. M. M. (Geology Division) and of the Association of Professional Engineers of British Columbia.

INTRODUCTION AND LOCATION

The Churchill mine is the Province's newest copper producer and is located in the Liard Mining Division west of the Racing River in the Rocky Mountains of North-eastern British Columbia. (see Fig. 1) Access is by a road southward from Mile 401 on the Alaska Highway 100 miles west of Fort Nelson. This road leads to the Churchill mill and townsite on the Racing River after 19 miles, and then continues a further 12 miles westward up Delano Creek and its northern tributary, Magnum Creek, to the mine (see Fig. 2). The country is typically mountainous, with nearby peaks as high as 10,000 feet. The Churchill mine is at elevations between 5200 and 6300 feet, and the mill is at about 3100 feet elevation.

HISTORY

Outcrops of chalcopyrite-bearing veins were discovered in 1943 by Mr. Albin Larsen on a steep hillside facing northwest to Magnum Creek, and were first staked by Messrs. Larsen and Lembke in 1950 (see Fig. 3). In 1958 and 1959 the deposit was sampled and drilled by Canex Aerial Exploration Limited on behalf of Magnum Consolidated Mining Company Limited. In 1964, Churchill Copper Corporation agreed to acquire the Magnum claims and a jeep road was built the following year from the Racing River bridge on the Alaska Highway at Mile 416. From 1967 to 1969 a program of underground exploration and additional surface drilling was conducted under the management of Chapman, Wood and Griswold Limited. This program, which included ring drilling at 100 foot spacing on line drives together with a certain amount of cross-cutting and raising, results in the delineation of ore reserves sufficient for production, namely: 1,178,100 tons proven and probable grading 3.92 per cent copper. These reserves included a 20 per cent dilution factor. The concentrator, of 750 tons per day rated milling capacity, began tune-up in April of this year and the first shipment of concentrates was made to Japan in June.

OPERATION

The deposit is a system of veins in a northeast-trending zone whose overall shape is tabular and steep. Development to date is on four levels, namely 5200, 5750, 5900 and 6100, and mining is variously by shrinkage, longhole sub-level, and open stull stopes (see Fig. 4). Ore is presently mainly drawn from the upper two levels of the northern part of the mine, and is trucked to the concentrator variously from the 5900 portal or the 5200 main haulage. Concentrates are trucked to Fort St. John for rail shipment to wharves in North Vancouver. A crew of 150 is employed at the mine and concentrator.

For the month of July 1970, the following production figures apply:

Tons mined	16,278
Tons milled	22,934
Mill Head Grade	2.86
Pounds Copper Produced	1,270,868
Concentrate Grade	30.71
Recovery	96.82

At this time a considerable part of the mill feed was derived from development ore which is lower in grade than the mine average. As underground production increases the mill head grade is therefore expected to increase.

GEOLOGIC SETTING

The copper-bearing veins of the region occur within Precambrian rocks which occupy a large area south of the Alaska Highway (See Fig. 2). These rocks form an unmetamorphosed succession, whose base is not exposed, of shales, limestones, dolomites and quartzites. They are traveersed by diabase dykes which post-date the ore veins at the Churchill and other deposits examined, and which provide a prospecting guide because some of these dykes occur close to veins. Paleozoic sedimentary formations, chiefly limestones sandstones and shales, rest unconformably on the Precambrian rocks and contain neither veins nor dykes. Although mainly flanking the Precambrian area to north and east, the Paleozoic strata occur partly inside the area in northwestward-trending belts that are overthrust along their southwestern margins by Precambrian rocks. The Precambrian and Paleozoic strata possess a regional northwesterly strike and they dip mainly southwestward at moderate angles, although panels with northeasterly dips occur also. Folding becomes intense near faults and locally elsewhere, and is largely asymmetric with steep eastern limbs. In the Precambrian rocks this folding largely preceded the dykes and veins and is therefore mostly of Precambrian age.

The veins and dykes are mostly steeper than 60 degrees and, where they exist adjacent to one another, they are commonly roughly parallel. This suggests that, since dykes are a tensional phenomena, the veins are located principally in tensional structures. According to the information available (see Fig. 2), the veins and dykes in a broad central belt strike mostly northeastward whereas dykes and several veins in the eastern and western flanking belts strike principally north-northwest. If the northeasterly tensional direction is simply related to the compressive northwesterly trend of regional folding, the other direction remains unexplained. More probably, the directions are related to stress patterns set up by movement of underlying basement blocks, at whatever depths from which the dykes come.

To date, the western half of the Precambrian area has given the best prospecting results. The Eagle vein of Davis-Keays Mining Company is reported to contain reserves of various categories including proven ore estimated at 1 million tons grading 3.56 per cent copper. The Bronson vein system of Windermere Explorations

Limited is reported, as a result of surface sampling, to contain at least 2,000 tons per vertical foot grading at least 3 per cent copper.

The Toad River Joint Property of Fort Reliance Minerals Limited and Churchill Copper Corporation possesses a vein for which the reserves indicated by drilling in 1958 and 1959 are 78,000 tons grading 5.15 per cent copper, and recent studies indicate that these reserves are capable of being increased. A number of other veins have been discovered and partly explored within the area. Southwest of the present area towards the Rocky Mountain Trench, additional areas of Precambrian rocks present problems of access but may prove to be suitable for prospecting.

GEOLOGY OF THE DEPOSIT

The zone containing the Magnum vein system is partly explored for a length of 4,500 feet and to a depth of 1,200 feet. It is a zone of deformation, alteration, mineralization and dyke intrusion that trends north 35 degrees east, dips steeply and is up to 300 feet wide. It occurs in a sequence of Precambrian limy strata which dip more or less uniformly at low to moderate angles southeastward and apparently form the southeastern limb of a broad anticline whose axis follows approximately Magnum Creek. The strata on either side of the zone are thin to medium bedded rocks which include grey and black limestone, limy argillite and limy shale. Westward across Magnum Creek, the opposite flank of the anticline consists of similar rocks which are locally folded sharply and traversed by dykes. One or more mineralized veins occur west of the creek on the Magnum property, and are to date unexplored.

Strata in the zone are buckled by numerous small folds of diverse shapes and attitudes but mostly with plunges directed across the zone, generally southeasterly. An intense cleavage is developed, mainly in the least competent beds but locally pervasively in all strata. The cleavage is partly curved and wavy and it varies in attitude but is mostly south-southwest with a dip of approximately 60 degrees to the east. All strata in the zone are altered to non-limy rocks by decalcification. Alteration has in addition produced graphite liberally in the strongly cleaved rocks, and ankerite as coarse metacrysts and wholesale replacements in the buckled parts of beds. Probably as a result of alteration, pyrite forms seams and disseminations more or less concordant to bedding in strata of the west part of the zone.

The mineralized veins of the Magnum system lie more or less central in the zone and were formed later than the folds and cleavage, both of which they transgress. They consist in varying proportions of ankerite, quartz, chalcopyrite, and locally pyrite together with partly replaced remnants of the sedimentary host rock. The principal veins strike with the zone and possess dips that are mostly close to vertical. As many as ten such veins are numbered, although some may prove to be extension of the others. They vary in width from less than 3 feet to as much as 25 feet and they possess a continuity both on strike and in depth which is measured in hundreds of feet.

As many as three parallel principal veins may occur within a width across the zone of 150 feet or less. Numerous subsidiary veins are encountered, of which some are parallel to the principal veins and others of mainly northerly trend are oblique and partly are branches of the principal veins (see Fig. 5).

From their appearance, the veins were emplaced largely by replacement and in several stages. The first stage was principally ankerite with only minor quartz and sulphide, and the least mineralized portions of the veins apparently progressed little beyond this stage. One or more later stages caused introduction of quartz and sulphides, principally chalcopyrite, as veins and patches mostly within or adjoining the ankerite veins.

Pyrite is locally prominent but in general amounts to less than an estimated 10 per cent of the total sulphides in the ore. Precious metal content in the ore is negligible. The association of chalcopyrite with quartz is close, although in places the quartz is so subordinate in amount that veins, or parts of veins, appear comprised of massive chalcopyrite. Chalcopyrite is noticeably increased, for example, where a vein jogs or locally changes direction. Such jogs affect the vein only for a few feet and their shape is such as to displace the northern part of the vein westward or, alternatively, the upper part westward by a few feet. The latter sense of displacement is effected also by at least one of several minor intra- and post-mineral faults which occur in the north part of the mine. These mineralized faults dip at about 40 degrees southwestward, and the one in question displaces the upper parts of two principal veins a distance of about 30 feet west on the strike of the fault (see Fig. 6).

Although little in the nature of local controlling structures are seen which explain in detail the emplacement of the veins, the occasional preservation within or along the veins of septa composed variously of schistose wallrock and of brecciated vein quartz probably indicates the former existence of narrow shear zones where veins now exist. Elsewhere the veins partly formed apparently by the introduction of fine-scale stockworks of ankeriteand quartz in crackled and fractured rock, of which abundant remnants occur within parts of these veins.

A post-ore diabase dyke of irregular shape and generally steep dip closely follows the southeast side of the vein system and invades it progressively southward in the zone. The dyke is partly less than 10 feet wide in the north part of the zone, but it widens southward and splits locally into two or more parallel branches whose aggregate width may exceed 150 feet. In places the dyke becomes sill-like and its width increases markedly on the level. Subsidiary dykes extend westward across, the vein system (see Figs. 5 and 6). Along part of its length the main dyke is followed by one or more steep faults whose displacement is unknown and near to which the diabase is propylitically altered. The dyke is a hindrance because, in the north part of the mine, it adjoins one or more ore veins, and locally invades and destroys them. In the south part of the mine, the dyke is even more destructive since it is emplaced partly inside the vein system and either obliterates or displaces the greater part of the veins.

The Magnum vein system remains at present only partly explored. Ore intersections occur through a length of 2,800 feet and a depth of 1,200 feet, and the zone is considered open for extension at both ends and in depth. The presently indicated ore limits are shown approximately on Figure 4.

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Holland, S. S. (1959) <u>in</u> Ann. Report, <u>B. C. Minister of Mines</u>, 1959, p.21.

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Gabrielse, H. (1962) — Kechika Area, Geol. Surv. Canada, Map 42 - 1962.

Taylor, G. C. (1963) — MacDonald Creek Area, Geol. Surv. Canada, Map 28 - 1963.

ILLUSTRATIONS

Figure 1. Location Map

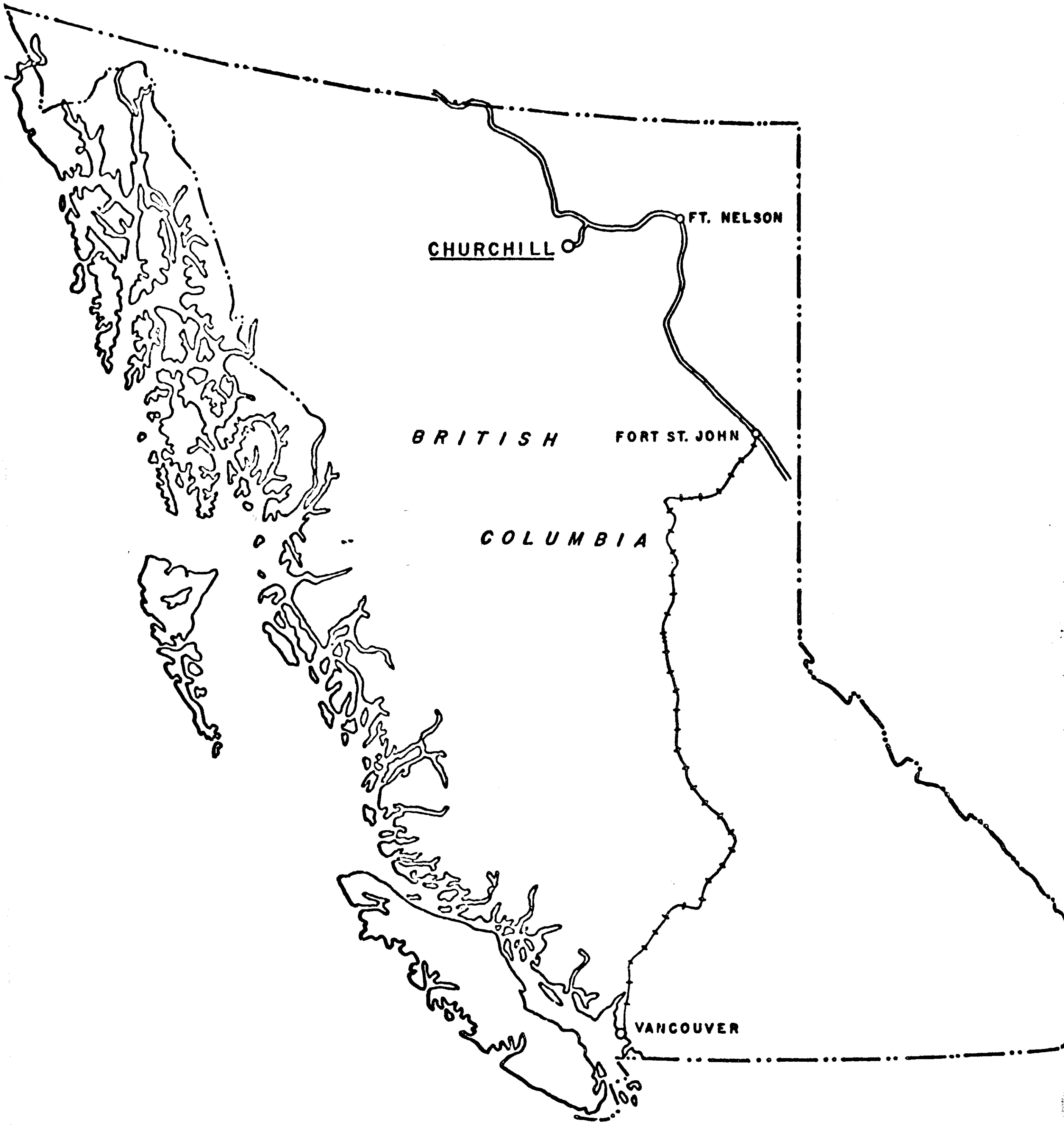
Figure 2. Property index map and simplified geology of the Racing River Area.

Figure 3. Map of the Magnum property showing the location of adits and the ore deposit.

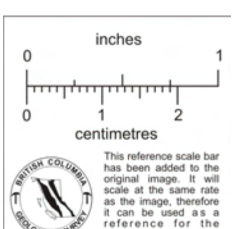
Figure 4. Longitudinal section of the Churchill Mine.

Figure 5. Surface geological map of the north part of the Magnum deposit.

Figure 6. Vertical geological cross section on 114N of the Magnum vein system, from surface to 5850 elevation.



SCALE 1 inch = 120 miles



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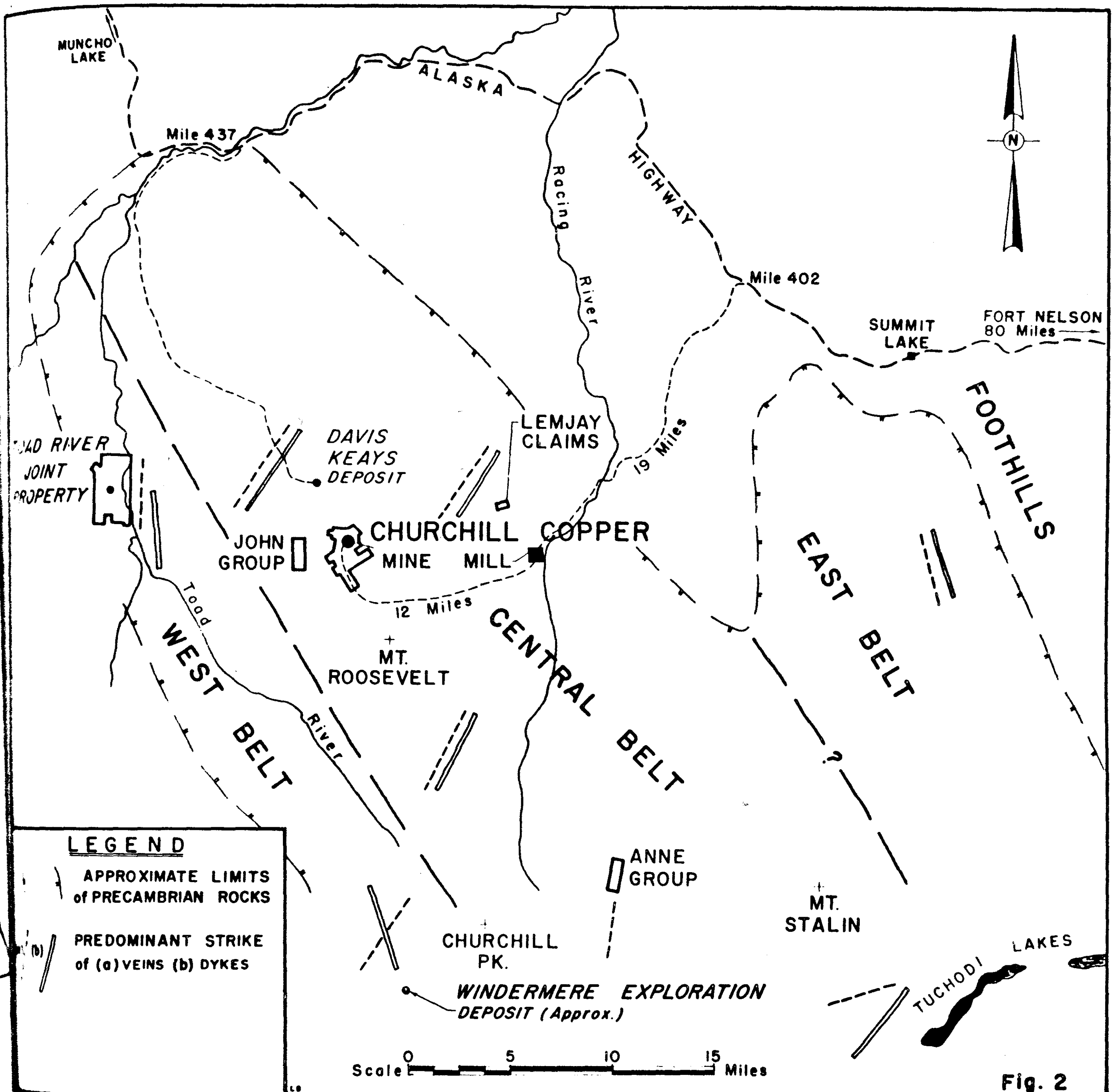

MUNCHO LAKE
ALASKA
HIGHWAY
Mile 437
Mile 402
Racing River
SUMMIT LAKE
FORT NELSON 80 Miles
FOOTHILLS
LEMJAY CLAIMS
DAVIS KEAYS DEPOSIT
ROAD RIVER JOINT PROPERTY
19 Miles
CHURCHILL COPPER
JOHN GROUP
MINE
MILL
12 Miles
Toad River
MT. ROOSEVELT
WEST BELT
CENTRAL BELT
EAST BELT
ANNE GROUP
MT. STALIN
CHURCHILL PK.
WINDERMERE EXPLORATION DEPOSIT (Approx.)
TUCHODI LAKES
LEGEND
APPROXIMATE LIMITS of PRECAMBRIAN ROCKS
PREDOMINANT STRIKE of (a) VEINS (b) DYKES
Scale 0 5 10 15 Miles

Fig. 2

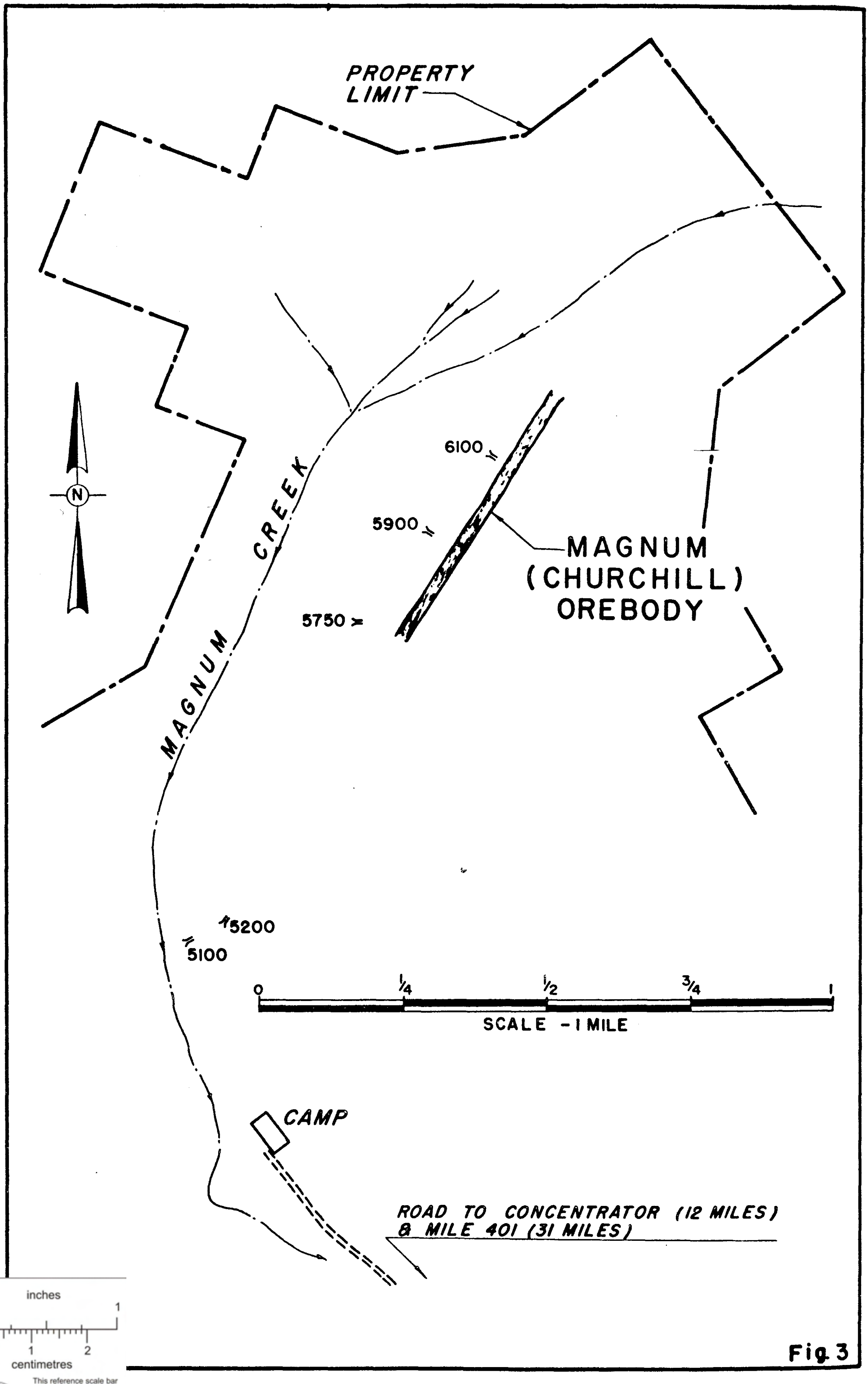
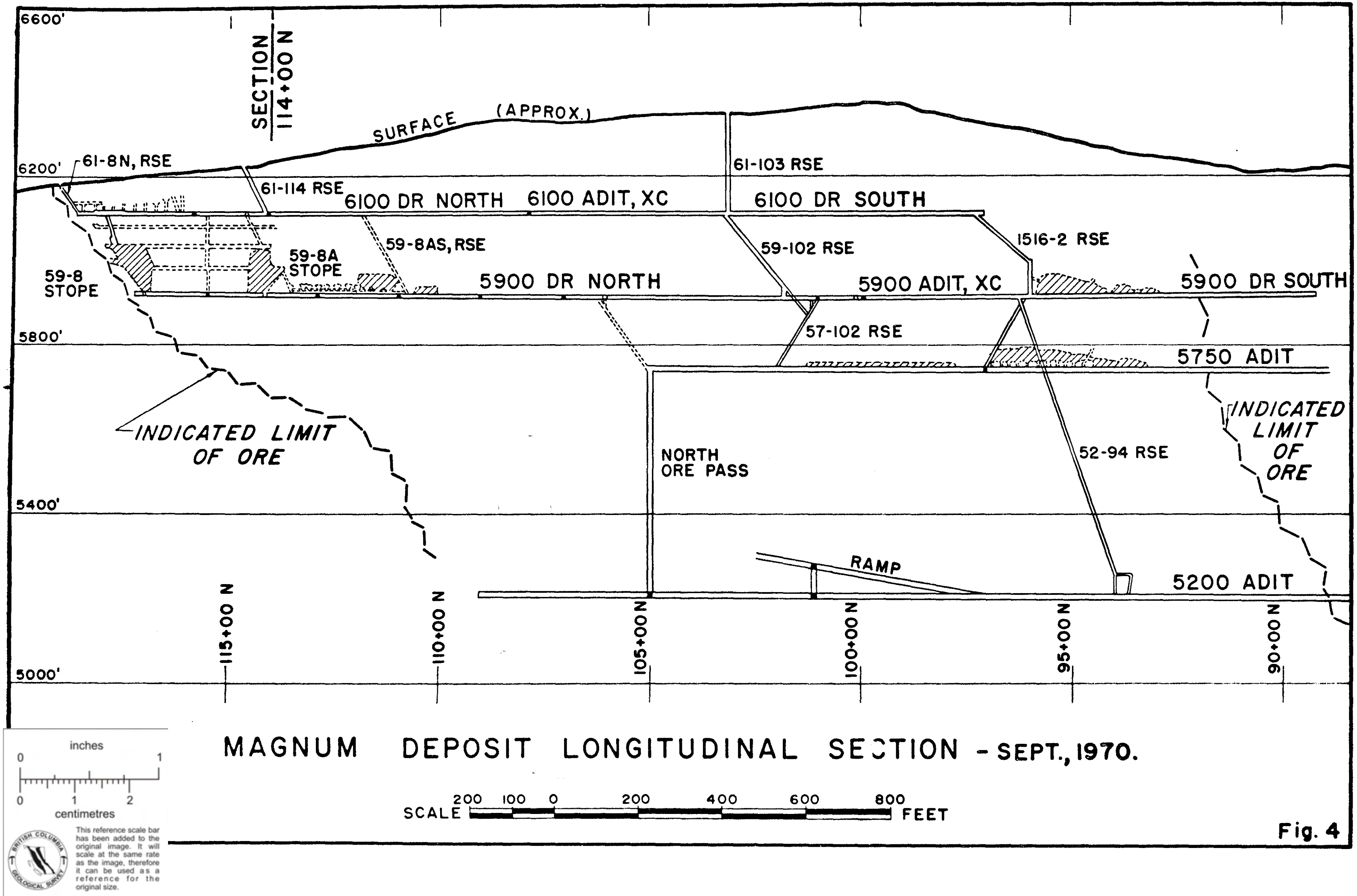
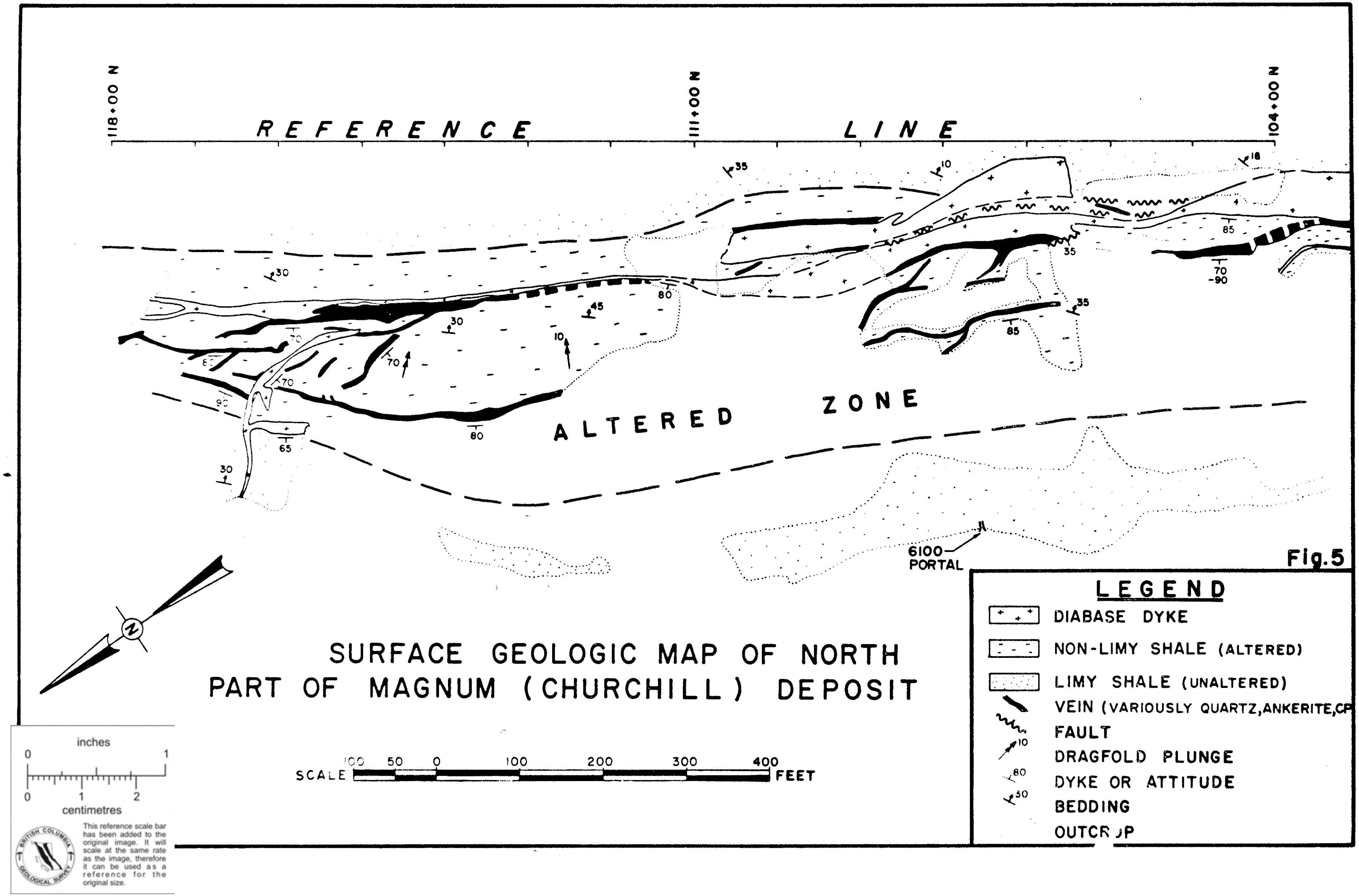

PROPERTY
LIMIT
6100
5900
5750
MAGNUM
(CHURCHILL)
OREBODY
MAGNUM CREEK
5200
5100
0
1/4
1/2
3/4
1
SCALE - 1 MILE
CAMP
ROAD TO CONCENTRATOR (12 MILES)
& MILE 401 (31 MILES)

Fig. 3



MAGNUM DEPOSIT LONGITUDINAL SECTION - SEPT., 1970.

Fig. 4



SURFACE GEOLOGIC MAP OF NORTH PART OF MAGNUM (CHURCHILL) DEPOSIT

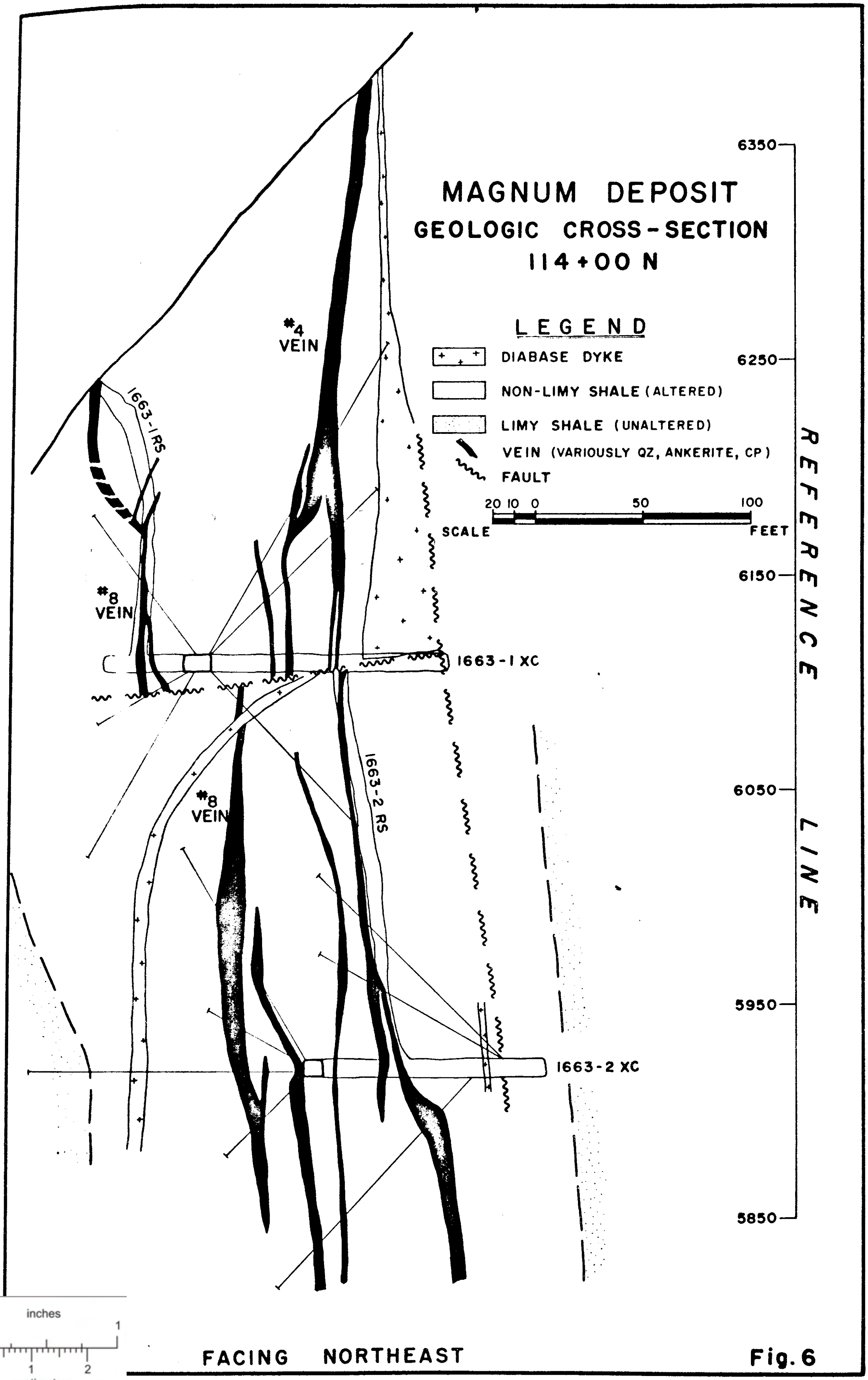
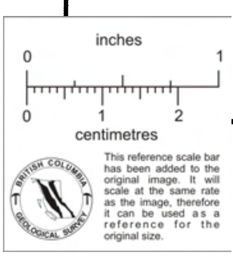

MAGNUM DEPOSIT
GEOLOGIC CROSS-SECTION
114+00 N
LEGEND
DIABASE DYKE
NON-LIMY SHALE (ALTERED)
LIMY SHALE (UNALTERED)
VEIN (VARIOUSLY QZ, ANKERITE, CP)
FAULT
20 10 0 50 100
SCALE
FEET
6350
6250
6150
6050
5950
5850
REFERENCE LINE
#4 VEIN
#8 VEIN
#8 VEIN
1663-1RS
1663-2 RS
1663-1 XC
1663-2 XC
FACING NORTHEAST

Fig. 6


inches
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centimetres
This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.

94K/6W Prop Y ~~A-1b~~
CHURCHILL
(MAGNUM)

Mr. J.E. McMynn,
Deputy Minister.

January 20th '75

Attached is a copy of G.H. Klein's report on the current status of Consolidated Churchill Copper Limited.

N.C. CARTER,
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NCC/jr

Attd: Report

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