

Department of  
Mines and Petroleum Resources  
ASSESSMENT REPORT  
NO. **3535** MAP .....

GEOLOGICAL REPORT ON CLAIM GROUP 'B',  
MAGNUM PROPERTY, DELANO CREEK -  
58° 125° S.W. (94K/6W and 11W)  
LIARD M.D.

CHURCHILL COPPER CORPORATION LIMITED

JULY 19 - AUGUST 1, 1971.

By: J.M. Carr, P.Eng.

February, 1972. ,

**3535**

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### ILLUSTRATIONS:

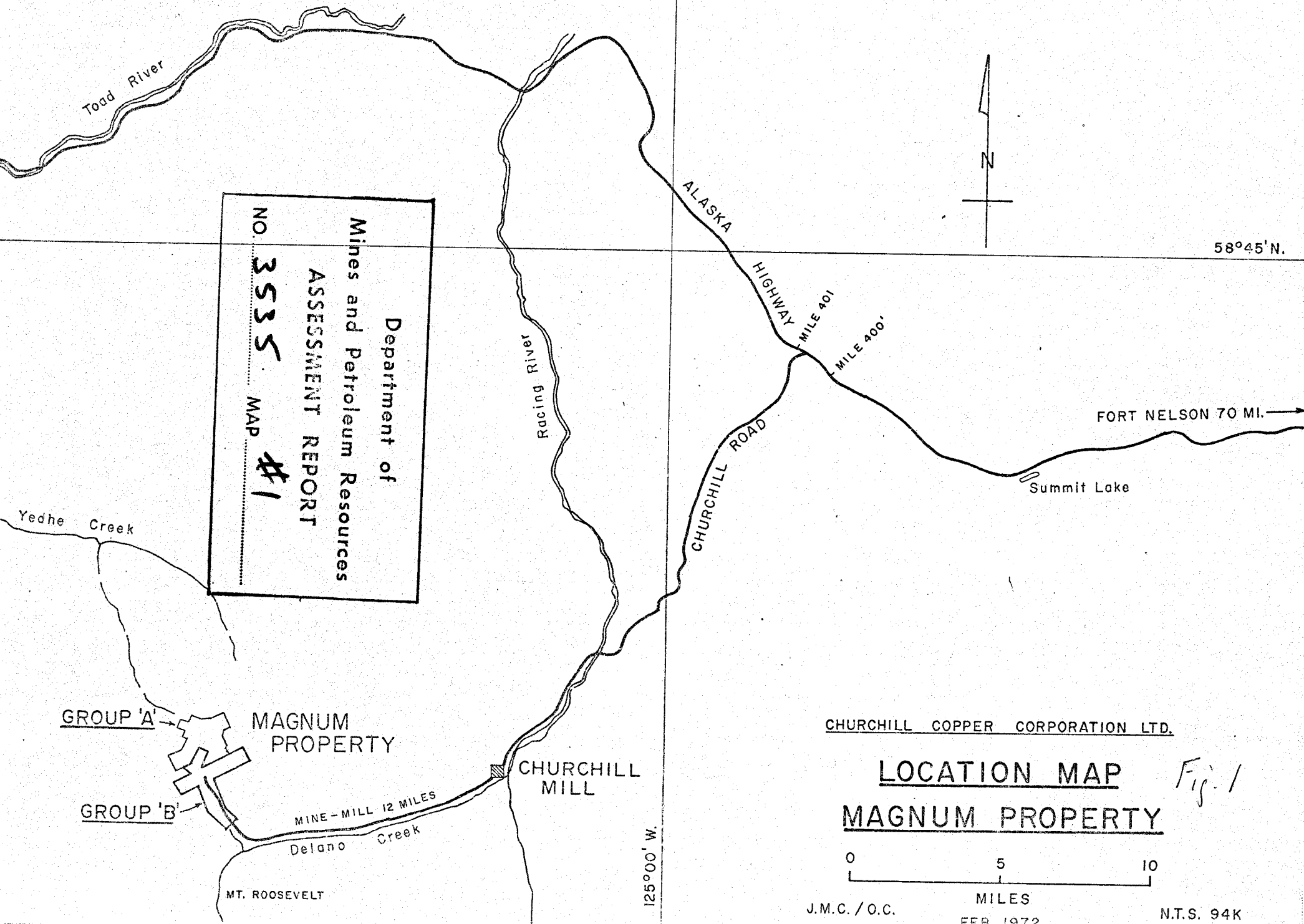
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## INTRODUCTION

A geological survey was made of Claim Group 'B' in the south part of the Magnum property by Churchill Copper Corporation Ltd., from July 19 to August 1, 1971.

The Magnum property is 130 miles by road west of Fort Nelson and is reached by a 31 mile long truck road from Mile 401 on the Alaska Highway (see Figure 1). The property lies on Magnum Creek which is a south-flowing headwater of Delano Creek, that is itself a western tributary of Racing River. Claim Group 'B' is roughly T-shaped and comprises 22 claims in Mineral Lease No. M6 (Lot 829) and 13 additional claims all named on page 18 (and see Figure 2). On the Don Nos. 10 and 12 claims it contains parts of the 5100 ventilation adit and 5200 main haulage of the Churchill (Magnum) mine, whose productive workings lie farther north. The south area of the T follows Magnum Creek, and claims in this part of the group are readily accessible from the truck road alongside the creek. Least accessible are the easternmost claims which are at high elevations considerably distant from the road.

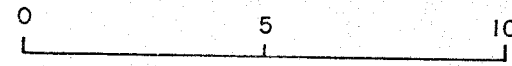
The geology of the Magnum mine has been described elsewhere (see References, page 17). Ore shoots containing chalcopyrite and some pyrite occur in steeply dipping sub-parallel veins of quartz-ankerite (or ferrodolomite) within a vertical, northeasterly-striking zone of deformation, alteration, mineralization, and subsequent dike intrusion that is productive for a length of nearly 3,000 feet and



CHURCHILL COPPER CORPORATION LTD.

LOCATION MAP  
MAGNUM PROPERTY

Fig. 1



J.M.C. / O.C.

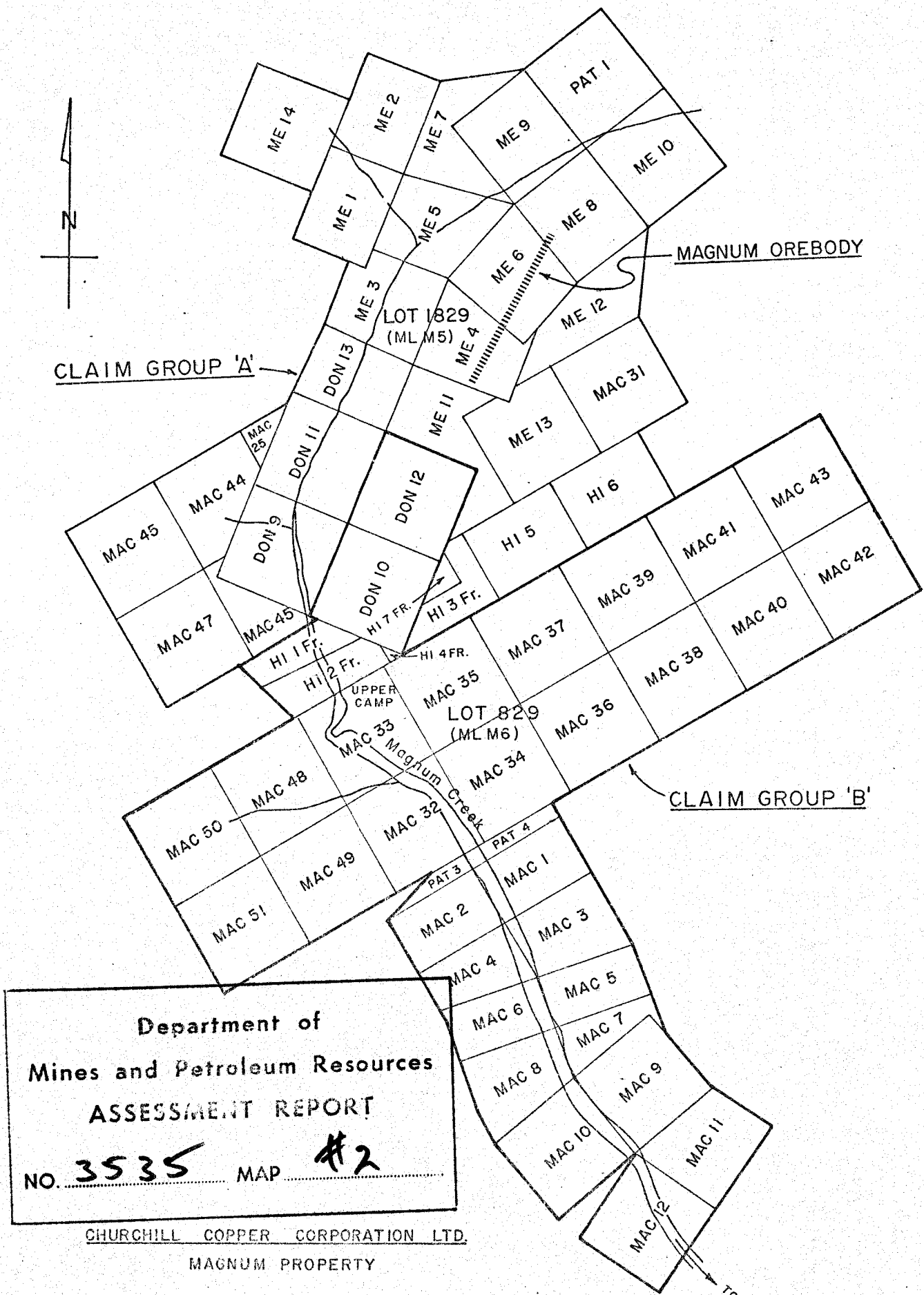
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N.T.S. 94K



CLAIM GROUP 'A'

MAGNUM OREBODY



Department of  
Mines and Petroleum Resources  
ASSESSMENT REPORT

NO. 3535 MAP #2

CHURCHILL COPPER CORPORATION LTD.  
MAGNUM PROPERTY

CLAIM MAP

0 2000 4000 6000  
FEET

FEB. 1972 N.T.S. 94K J.M.C./O.C.

Fig. 2

is up to 300 feet wide. Ore is found through a vertical range of 1,200 feet between elevations of 5100 feet and 6300 feet. The ore zone occurs in a sequence of Proterozoic limy strata which dip more or less uniformly at low to moderate angles south-eastward and apparently form the southeastern limb of a broad anticline the axis of which approximately follows upper Magnum Creek. All strata in the ore zone are altered to non-limy rocks by decalcification and the alteration has in addition produced graphite on the cleavage and along fault planes. Strata in the zone are buckled by numerous small irregular folds, most of which plunge across the zone in southeasterly directions, and a strong cleavage is developed which strikes chiefly south-southwest and dips at approximately 60 degrees to the east.

Production from the Magnum mine between start up in April 1970 and shut-down because of low copper prices in October 1971 totalled 32,296,654 lbs. copper from 346,645 tons milled of average grade 3.32% Cu. Proven and probable ore reserves calculated prior to this production were 1,178,000 tons grading 3.92% Cu and including a 20 per cent dilution factor.

#### TOPOGRAPHY

A topographic map of the claim group 'B' was made by Lockwood Survey Corporation employing aerial photographs and existing ground control. This map was combined with a reduced version of an existing

topographic map of the mine area, made by Co-ordinate Aerial Surveys Ltd. to produce the base map used in the geological survey (Figure 3).

The survey area is in the rugged, glaciated terrain of the northern Rocky Mountains, whose peaks rise to elevations as high as 10,000 feet. On the claim group surface elevations range from 4,600 feet at Magnum Creek in the south to 7,680 feet on the easternmost claims. Magnum Creek is an undersized stream occupying a broad U-shaped glacial valley whose head is at the steep ridges north of the Churchill mine. The floor and lower slopes of the valley are mantled by hummocky moraine and more widely by extensive rock and mud slides descended from the upper slopes and periodically active (as shown by the steep, broken edges and disturbed vegetation at the toe of many slides). Bedrock exposures are lacking in the lower reaches of Magnum Creek valley in consequence of these surficial deposits. At intermediate higher elevations the valley slopes are partly mantled by talus slides derived from continuously exposed rock masses which make the adjacent precipitous hills and peaks. Entering the Magnum Creek valley at intervals on either side are hanging valleys such as the one which extends through the eastern arm of the claim group 'B' and whose floor above 6,000 feet elevation is entirely covered by ground moraine and large slabs of transported rock.

Permafrost is more or less general to depths which, except

at the highest elevations, probably do not exceed a few feet or tens of feet.

#### GENERAL GEOLOGY

Except rarely along creek beds, bedrock is not exposed on the claim group below an elevation of 5,000 feet. Above this elevation outcrops become progressively more abundant, except on the upland valley floors where outcrops are again entirely lacking. The southernmost claims on Magnum Creek are at low elevations and so contain almost no outcrops; consequently the mapping was extended upslope beyond the property in order to obtain some geological information (see geological map, Figure 3). Precipitous parts of the claim group were not closely examined; for example, on the easternmost claims of the group. Creek beds, slide rock and talus were routinely prospected during traverses. Accurate locating of outcrops was done using altimeter, Brunton compass, and chain, the latter being a "Topofil" device by which a thread is paid out and a mechanical tally shows the footage traversed. The available air photographs (at approximate scale 1 inch equals 2,000 feet, flown in 1968 by Co-ordinate Aerial Surveys Ltd. and earlier by the Canadian Government) were of limited use for location and geological interpretation because of extensive shadows on all north and west facing slopes.

Rock units in the mapped area are assigned as follows:

<u>Age</u>	<u>Rock Unit</u>	<u>Map Unit</u>	<u>Lithology</u>
CAMBRIAN	Sylvia Formation	4	Massive buff to purplish weathering, white quartzite and subordinate grey quartzitic shales.
UNCONFORMITY			
PROTEROZOIC	intrusive dikes	3	Diabase
DEFORMATION AND MINERALIZATION			
"	Aida Formation	2	Non-limy strata: buff weathering dolomites; grey dolomitic argillites, <u>also</u> altered (decalcified) equivalents of (1)
		1	Limy strata: thin to medium-bedded grey limestones, buff-weathering dolomitic limestones, or grey black limy argillites.
BASE NOT SEEN			

The Aida Formation, which underlies most of the property, has an exposed stratigraphic thickness of about 5,000 feet within the property limits, with the Magnum ore zone emplaced in the lowermost part of the section. The Formation is divided by present mapping into limy and non-limy strata, the latter being those which fail to effervesce freely on application of dilute HCl to a freshly-broken rock surface. The non-limy division was expected to include only hydrothermally altered rocks similar to those which encase the Magnum ore zone, but it was realized late in the mapping that unaltered

dolomite strata were also included in this division. Algal-bearing dolomite is recognized in outcrops in the creek on the Mac No. 11 claim, at the south end of the property (Dr. V. A. Preto, pers. comm.). These dolomite strata, which have no special prospecting significance and cannot be distinguished confidently from the hydrothermally altered rocks on the basis of the present map, now appear to include most of the non-limy strata within the claim group 'B' and to overlie stratigraphically the limy rocks, which probably occupy the valley of Magnum Creek. No record is available of the type of strata intersected on the 5100 and 5200 levels to the south of the Magnum ore zone.

Diabase dikes are emplaced in the Aida Formation but not in the Cambrian Sylvia Formation, and they are known regionally to be of pre-Cambrian age. Although in places conspicuously pyritized the dikes contain at best only trace amounts of chalcopyrite and on this property they post-date the commercial mineralization. They are dark green, fine grained rocks that weather brown and form conspicuous outcrops on hillslopes due to a greater resistance to erosion than the enclosing strata. The dikes range from a few feet to 100 feet wide and they possess glassy chilled selvages and rarely vesicles which are variously empty or filled by calcite. A crude columnar jointing may be present that extends across the dike. The principal dikes have steep dips and north-northeasterly strikes and it is generally only branch dikes that possess different attitudes.

The dikes are distributed more or less evenly throughout the

property and tend to occur in groups comprising several closely spaced dikes spaced across a hundred or two feet and probably interconnected at depth. Singly or in groups, dikes commonly occur in the vicinity of locally developed folds affecting the host strata. Dikes closely accompany all principal quartz ankerite veins each of which has much the same attitude as an adjoining dike. At the showing on the Magnum No. 51 claim and in the Magnum ore zone, mineralized veins are partly interrupted and overlapped by the adjoining dikes. Locally at both places a network of narrow unmineralized dike stringers is emplaced in silicified rock breccia that is well mineralized on the Magnum No. 51 claim. Faults and shears affecting the dikes are accompanied by a propylitic alteration causing a light-green or buff colour and the production of chlorite, calcite, minor amounts of epidote, and pyrite which is generally a sparse dissemination but locally in concentrations amounting to as much as 10 per cent. Quartz-ankerite veins rarely wider than an inch may ramify the dike at these places, and are scarcely mineralized.

From its single outcrop on the property, at the far southeast end on the Mac No. 11 claim, the Sylvia Formation extends widely to the north and east in a broad syncline with a steep east limb. The formation crops out also to the west of Magnum Creek southward from a point about one claim length south of the property, the dip apparently being southeastward toward Delano Creek at a moderate angle. On the Magnum No. 11 claim these Cambrian rocks rest with little angular unconformity on dolomite and dolomitic argillite of the Aida Formation

and are marked at their base by a ten or twenty foot thick zone of ankeritic quartzite, which weathers conspicuously brown and is abundantly traversed by veins a few inches wide or less of ankerite and minor quartz. In outcrop at the east corner of the claim this basal part is succeeded by a sedimentary breccia about 30 feet thick containing lesser numbers of veins and composed largely of rounded to subangular debris which is variously of dolomitic quartzite, grey sandstone and dark quartzitic siltstone. Farther north the sedimentary breccia is absent and the basal ankeritic quartzite is followed directly in succession by a white quartzite, weathered partly to green and purple and with a buff coloured patina, which forms the main rock type seen of this formation. Closely spaced bedding planes are visible on the outcrop surfaces and they show plications and drag folds with local overturning. The quartzite encloses lenses of grit whose pebbles are variously white, purple, and dark grey and partly of vein quartz. Narrow crystalline veins of ankerite and minor quartz cut the rock and appear unmineralized.

#### STRUCTURE

The Proterozoic strata are thrown into folds of three scales of magnitude, of which the smaller two certainly pre-date mineralization and dike intrusion. A single large fold exists on the property and is a broad south-plunging anticline whose curved axis follows approximately the valley of Magnum Creek for the full

length of more than 3 miles. Along the upper part of the creek (north roughly of the mine camp) the axial trend of this fold is south-southwest and farther south the trend is south-southeast. The angle of southerly plunge of the anticline is unknown but is probably low. It is reported that east and west of the property, respectively, there are large south to south-southeasterly plunging synclines which probably belong to the same major fold pattern (pers. comm. Dr. V. A. Preto).

Intermediate and small folds are local structures parasitic on the large fold and mostly accompanied by dikes, which clearly post-date these folds. The only intermediate folds exposed on or near the property are those seen in natural cross-section at a south-facing bluff immediately to the north of the Mac No. 25 claim, west of upper Magnum Creek. Here a family of cascading similar folds with steep east limbs and gently dipping west limbs is controlled by axial planes that dip fairly steeply westward and axes that plunge gently south-southeastward. The amplitude of each fold is estimated as less than one or two hundred feet. One or more diabase dikes of steep westerly dip cut obliquely through the folds arrayed in the bluff. Small folds which occur at scattered localities throughout the property generally possess gently southeasterly plunges and amplitudes measured in tens of feet, or less. They have no particular shape but are commonly tight

and partly sheared, with the least competent beds exhibiting cleavage strongly. Countless irregular small folds occurring in the highly crumpled Magnum ore zone belong to this category, and they are evidently the result of very localized forces since the folds are confined to the zone. A progressive change in the strike of south-dipping non-limy strata adjoining the east wall of the Magnum ore zone, from northeasterly at the north end to southeasterly at the south end remains unexplained and is not matched on the west side, where the strata dip uniformly east-southeasterly into the zone. Cleavage in the Proterozoic strata has a fairly uniform attitude throughout the mapped area. It strikes southeastward and dips southward at between 45 and 60 degrees. The intensity varies from place to place and is strongest where folding is present.

No major faults are recognized in the area. In the Magnum mine steep faults that strike north 35 degrees east are parallel to the ore zone and lie partly in the dikes, being therefore post-mineral. Other faults, which are probably intra-mineral, strike northwestward and dip at about 40 degrees southward; two or more of these faults are suspected to shift the ore shoots in a reverse sense. Exploration northward on the 5900 level showed that one of the principal ore veins becomes progressively discontinuous along a narrow vertical shear zone that appears partly pre-mineral in age and is considered probably to be the "tight" extremity of the Magnum

ore zone on this level.

Minor faults of unknown movement occur in the Lady mine on the Largo property.

The unconformity below the Cambrian quartzite is probably a locus of shearing where examined. The basal Cambrian rocks possess a strong cleavage roughly parallel to the unconformity and minor but intense folding is evident locally in these rocks. Seen from a distance, the plane of the unconformity becomes progressively steeper in the mountains to the east of the property and has the appearance of a rupture.

In summary, the axes of small folds lie normal to the planes occupied by dikes and veins throughout the property and probably all these structures, and possibly also cleavage, appear to have originated in a single stress field whose compressive component acted northeast-southwestward. Because the mapped structures are highly localized in their intensity it may be inferred that the stress field operated in these rocks through the medium of localized underlying structures such as faults and shear zones in the basement.

#### MINERALIZATION

Quartz-ankerite veins, some of them mineralized by chalcopyrite and pyrite, occur at several places on the property elsewhere than in the Magnum ore zone, whose presently indicated ore limits are at

90 + 00N and 119 + 00N.

On claim group 'B' the 5200 level intersects only weak, poorly mineralized veins in strata heavily intruded by dikes. Nearby to the west, on section 66 + 00N, the most southerly surface drill hole (No. S-25) intersected both limy and non-limy strata, the latter containing an 8-inch wide vein that assayed 2 per cent copper. Thus work to date has discovered no important southerly extension of the Magnum ore zone. Orientation Radem, self-potential and magnetometer surveys conducted across well-mineralized unmined parts of the Magnum ore zone in August 1971 failed to recognize either the graphitic altered zone or the ore shoots.

The only showings of consequence known elsewhere on claim group 'B' are on the westernmost claim Mac No. 51. Although roughly on the projected strike of the Magnum zone the showings lie 8,000 feet southward of the productive part of that zone and have no evident structural connection with it. The main showing on the claim is at 6,250 elevation, midway up a north-facing rock slope and at the intersection of a north-striking vein and a northeast-striking vein and dike structure. It comprises a silicified, quartz-veined rock breccia that is mineralized by chalcopyrite and lesser pyrite and is largely enclosed between dikes, from which stringers extend as an irregular intrusive network in the mineralized breccia.

The breccia body measures about 25 feet across and is roughly equi-dimensional in plan. The dike material is locally mineralized, mainly by pyrite and weakly by chalcopyrite. Sample No. 5809 was chipped in a northeasterly direction for 15 feet excluding a number of intervening dike stringers, which were not sampled, and it assayed 6.18% Cu. Southwestward across a covered interval of about 450 feet steeply-dipping panels of poorly mineralized, northeast-striking veins apparently represent preserved parts of a vein system extending toward the main showing. Northward of the main showing beyond an 80 foot interval occupied partly by dike and partly by soil and talus, a vein of quartz and lesser ankerite contains partly oxidized chalcopyrite and pyrite mainly near the west wall. The vein strikes south 10 degrees east toward the main showing and it dips westward at 70 degrees. Sample No. 5810 taken across the full 30 inch width of the vein near its southernmost limit of outcrop assayed 1.52% Cu. For 170 feet downhill to the north the vein averages 3 feet wide and is mineralized somewhat less than where sampled. For a further 130 feet of downhill outcrop the vein averages 1 foot wide and is mineralized sporadically. At 5800 feet elevation and about 600 feet distant from the main showing, the vein after first a covered interval and then exposures of a similar kind to those last seen above, becomes weak and scarcely mineralized and it appears to die out. In its lower exposures the vein is partly rocky and is

adjoined on either side by 5 feet of cleaved and crumpled graphitic shale.

Quartz-ankerite veins found at the base of outcrop on the Mac No. 49 claim lie 1,200 feet north-northeast of the Mac No. 51 main showing and are no more than 1 foot wide, irregular in attitude, and mineralized only sporadically.

Exploration by Largo Mines Ltd. of well-mineralized veins in the Lady mine, which lies 1,000 feet west of the claim group, in general has shown their continuity to be limited. Observations made during the present mapping indicate that the north-northwesterly trending Lady vein system is disrupted southward by dikes. A second vein system, more dispersed than the other, strikes north-northeast and includes veins 2 or 3 foot wide. One such vein, estimated to contain 1.5% Cu and ranging in width up to 3 feet, is exposed in hand trenches north of Lady Creek within 600 feet of the Mac No. 10 claim. Any northerly extension of this vein into the latter claim would be covered by considerable overburden.

Although mineralized float was found at various places in the claim group almost all is believed to come from known sources in or near the property.

Some whose source remains uncertain is found in the bed of a branched creek that drains through the Mac Nos. 3 and 5 claims east of Magnum Creek in the south part of the claim group. This

material is of two kinds, that found on the north branch being a greenish, siliceous breccia with quartz veins, minor ankerite and pyrite, and with abundant specular hematite accompanying chalcopyrite, malachite and limonite. That on the south branch is quartz-ankerite vein material with chalcopyrite, malachite and limonite. The creek branches drain from high country to the east, where a small showing of bornite and specular hematite in a braided siliceous, north-trending shear zone is reported to occur in dolomitic shale about 100 feet below the Cambrian quartzite (Dr. V. A. Preto, pers. comm.). Seen from a distance, the rocks below the quartzite include a prominent layer (noted as lying an estimated 100 feet below the unconformity) whose greenish colour resembles that of celadonite or glauconite. Rich bornite-hematite float that was picked up east of Magnum Creek in 1969 by Messrs. Ewin and Townley may derive from showings such as that discovered by Dr. Preto.

Dolomite carrying minor amounts of malachite was found in slide rock at the base of steep outcrops 900 feet south of the south branch of the creek discussed.

Farther south, at the extreme limit of the property on the Mac No. 11 claim, float of quartzite containing disseminated specks of chalcopyrite and bornite was observed in slide rock. Elsewhere, quartzite float containing only disseminated pyrite is commonly found.

CONCLUSIONS

- (i) Large parts of the claim group 'B' are covered by surficial deposits of unknown thickness.
- (ii) The Magnum ore zone is believed unlikely to extend southward into the claim group.
- (iii) On the Mac No. 51 claim at 6200 feet elevation a small pipe-like mineralized body, some 25 feet by 25 feet across, occurs at a vein intersection and contains as much as 6.18% Cu across the 15 feet sampled. If persisting to 200 feet depth and not terminated by dikes, the body could contain 12,000 tons of material accessible by driving an adit and raise. The body should be explored with a light diamond drill, transported by helicopter.
- (iv) Magnum-type mineralization has been found difficult to detect by SP or Radem surveys. Consequently additional exploration targets are unlikely to be found on the claim group.

REFERENCES

Carr J.M. (1971) Geology of the Churchill Copper Deposit,  
CIM Bull., June 1971, pp. 50-54.

Taylor G.C. and Stott D.F. (1971) Tuchodi Lakes, British  
Columbia, Geol. Surv. Canada, open file  
Report no. OF.79 (1971).

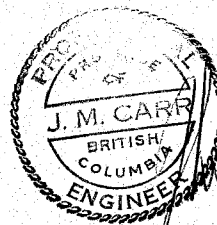
LIST OF CLAIMS AND WORK DISTRIBUTION

<u>Claim</u>	<u>Mining Div.</u>	<u>Record No.</u>	<u>Present Expiry Date</u>	<u>No. of Years Applied For</u>
(a) Mineral Lease No. M6 (Lot 829) comprising:				2
Mac #1 - 9 inc.	Liard	21352-21360	March 16, 1970	
Mac #32 - 35 inc.	"	21383-21386	"	
Mac #48 - 49 inc.	"	21399-21400	"	
HI #1 - 2 Fr. Fractional	"	28782-28783	"	
HI #4	"	34209	"	
Pat #3 Fr. Fractional	"	28232	"	
Pat #4	"	28233	"	
Don #10	"	7042	"	
Don #12	"	7044	"	
(b) Mac #10 - 12 inc.	"	21361-21363	March 11, 1973	nil
Mac #36 - 43 inc.	"	21387-21394	"	nil
Mac #50 - 51 inc.	"	21401-21402	"	2

Certificates of Work are applied for as indicated in last column.

STATEMENT OF COSTS

Preparation of Topographic Map (Lockwood Survey Corp. Job No. 70-188)		\$ 987.50
Field Wages:		
July 19 - August 1: S. D. Devries - 14 days @ \$30 per day	\$ 420	
July 19 - August 1 : J. M. Carr - 14 days @ \$80 per day	<u>1,120</u>	1,540.00
Room and Board:		
2 men for 14 days @ \$12.00 per man/day		336.00
Transportation etc. on property		250.00
Report preparation		350.00
		<hr/>
TOTAL		<u>\$ 3,463.50</u>



Vancouver, B.C.  
February 29, 1972.

J. M. Carr, P. Eng.

Declared before me at the *City*  
of *Vancouver*, in the  
Province of British Columbia, this *2nd*  
day of *March*, 1972, A.D.

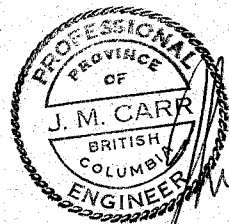
*[Signature]*  
A Commissioner for taking Affidavits within British Columbia or  
A Notary Public in and for the Province of British Columbia

SUB-MINING RECORDER

CERTIFICATE

I, John M. Carr, do hereby certify that:

1. I am a geologist residing at 3896 Scolton Road, Victoria, British Columbia and employed by the Teck Group of Companies.
2. I am a graduate of the University of Oxford with a B.A.(Hons.) degree in Geology and a D.Phil degree in Geology obtained at the same University.
3. I am a Professional Engineer registered in the Province of British Columbia.
4. I have practised my profession in geology continuously for the past 20 years and since 1955 in British Columbia.
5. Between July 19 and August 1, 1971 I was engaged in geological mapping of claim group 'B' of the Magnum property and its vicinity on behalf of Churchill Copper Corporation Ltd.



J. M. Carr  
February 29, 1972.

