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DETAILED GEOLOGY OF THE TSAR CREEK - CUMMINS RIVER SHALPOUT

MGM PROPERTY GOLDEN MINING DIVISION BRITISH COLUMBIA \gg SUB-RECORDER (n 🖻 RECEIVED 90 OCT 2 6 1990 II mad S. 9 5 6 6 1 1 30 M.R. # \$ Prepared For 5.0 VANCOUVER, B.C. 5 \mathfrak{m} 2 30 WHITE KNIGHT RESOURCES LTD. 155 922-510 WEST HASTINGS STREET - **5** VANCOUVER, B.C. V6B 118 (604) 681-4462 , V 5) Z 20 = 1 83D/1 W NTS:

NIS: 83D/1 WLAT: $52^{\circ}03.5^{\circ}$ LONG: $118^{\circ}15.5^{\circ}$

> by: J.M. Leask, BaSc. October 10, 1990

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SUMMARY

White Knight Resources Ltd. has acquired the right to earn a 50 percent interest in the MGM claims owned by J.M. Leask. The property lies on the east side of the Rocky Mountain Trench, on the east side of McNaughton Lake.

The claims surround a residual block of 12 claims owned by Cominco which protect a lens of stratiform massive sulphide mineralization exposed in the canyon of the Cummins River (the Bend showing). Mineralization occurs in Cambrian metasediments. The sulphide layer is overlain by a distinctive lead/zinc bearing manganiferous dolomite horizon. A similar unit has been trenched on the MGM claims some 3 kilometres north of and on strike with the Canyon showing.

The property is viewed as a shale-hosted massive sulphide with known showings over a strike length of 4 kilometres. A significant sulphide bearing basinal structure has been delineated and the potential for an economic occurrence is good.

The deposit occurs where the Lower Tsar Creek formation thins abruptly from 500 metres in the Tsar Creek section to less than 50 metres in the Cummins River section and the Upper Tsar Creek formation correspondingly thickens from 300 metres in Tsar Creek to over 600 metres in the Cummins River Canyon.

Recent work has also identified a large gabbroic sill-dyke complex in the footwall section below the stratiform sulphide horizon near the projected sub-basin Hinge zone.

1.0 Introduction

The MGM property protects a shale-hosted massive sulphide occurrence on the east side of McNaughton Lake (Figure 1). The property is accessible by boat from Redrock Harbour, south-east of Mica Dam. The area is a two hour drive north of Revelstoke, BC. The claims are on a moderately steep southwest facing slope with a cover of tall timber. Access is provided by a former Forestry lookout road and a variety of recent logging roads and skidder trails.

This report summarizes the work done to date on the property between May 30th and August 1st and provides recommendations for further work.

2.0 Ownership and Claims

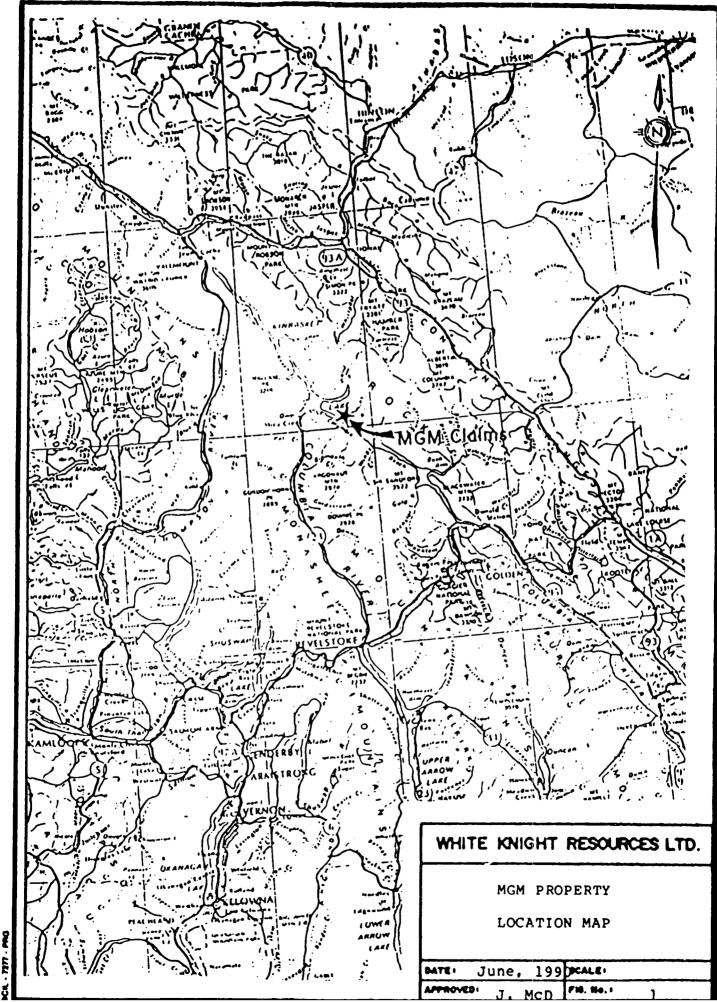
White Knight Resources Ltd. acquired the right to purchase a 50% interest in the MGM property from J.M. Leask in an agreement dated the 23rd day of February, 1990. After White Knight acquires a 50% interest in the property, the property will be operated on a joint venture basis, with White Knight having the right to acquire an additional interest in the property through a dilution clause.

All claims are located in the Golden Mining Division. (Figure 2). The registered owner of the claims is Mr. J.M. Leask.

3.0 Optioned Claims

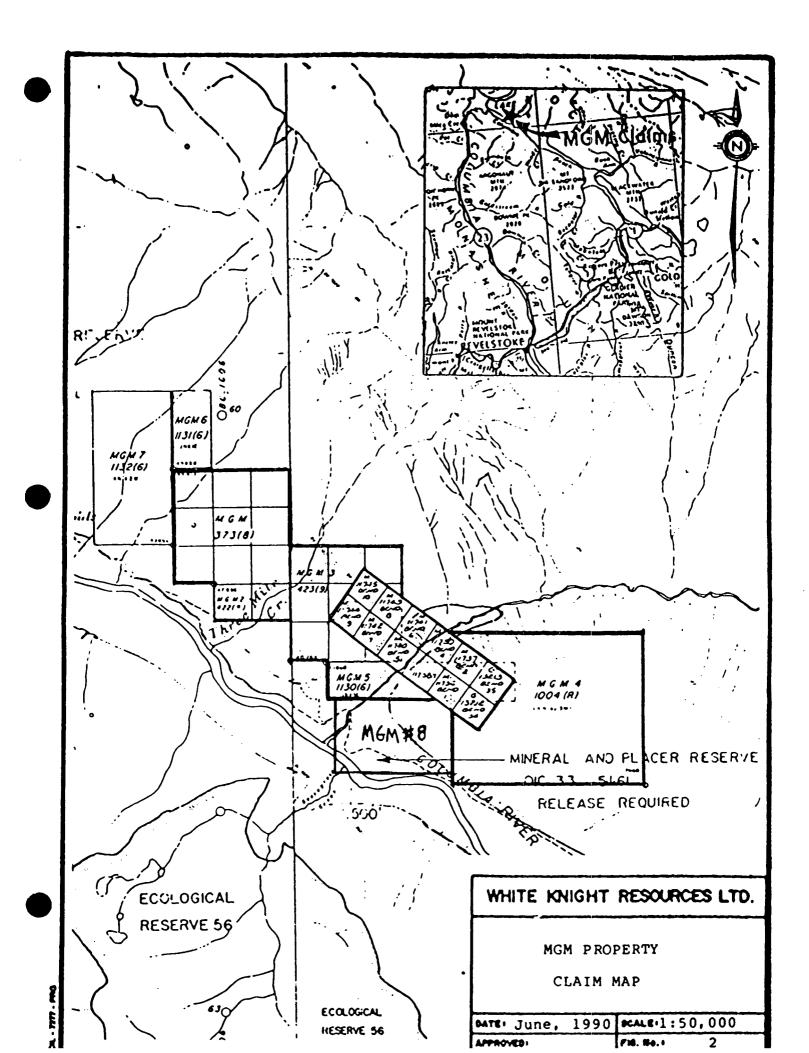
Claim Name	Record No.	Units	Expiry Date
MGM	373	9	Aug 20, 1990
MGM 2	422	2	Sept 19, 1990
MGM 3	423	6	Sept 19, 1990
MGM 4	1004	20	Aug 04, 1990
MGM 5	1130	5	June 28, 1990

The MGM 8 claim, consisting of 6 units was staked on May 27th, 1990 to protect a small area of prospective geology. This claim will be added to the property upon receipt of the record number from the Golden Mining Division.



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4.0 Location and Access

The claims are located on the eastern shore of McNaughton Lake about 130 kilometres north of Golden, BC., straddling the Cummins River canyon. Access to the property is via the Mica Highway north from Revelstoke to the Mica Dam site. A good gravel road extends to Redrock Harbour on McNaughton Lake. A boat or barge is required to access the eastern shore of McNaughton Lake. New logging development has extended north from Golden to the Sullivan River, about 20 kilometres south of the property.

Access on the property is provided by an old forestry lookout road and numerous logging roads and skidder trails.

5.0 Physiography

The property is located on the eastern flank of the Rocky Mountain Trench in the southern Park Range. The area is a region of rugged mountains dissected by steep walled river valleys. Relief is in the order of 1800 metres.

Steep to moderate slopes with a thin veneer of overburden characterize the property. Elevations on the property vary from 750 metres (McNaughton Lake level) to about 1800 metres.

6.0 Climate and Vegetation

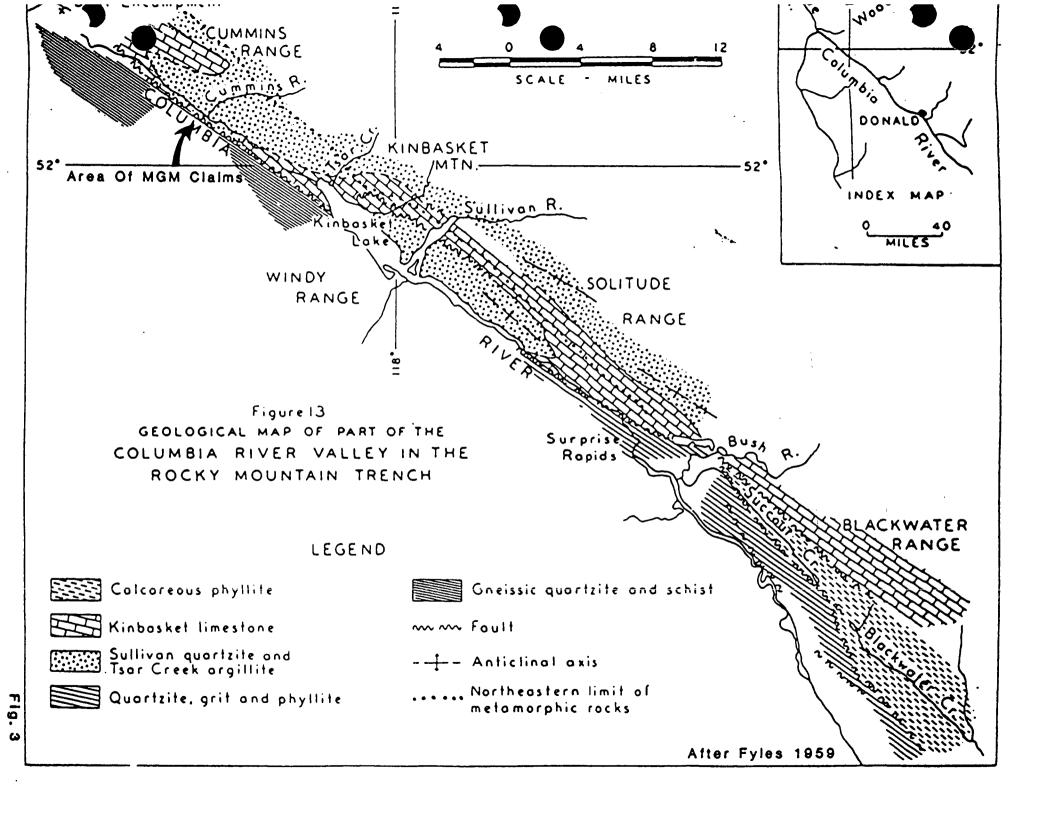
lies within the Interior Wet Belt. The property Precipitation is up to 150 cm per year with several metres of The snow free season is from mid-May to October. snowfall. Vegetation is thick and lush at lower elevations where devil's club constitutes a large portion of the undergrowth. Conifers are mostly hemlock, red cedar and douglas fir at lower elevations and lodgepole pine and balsam fir above 1500 metres. Treeline is about 1800 metres.

7.0 Regional Geology

The regional geology is summarized by Marr (1986):

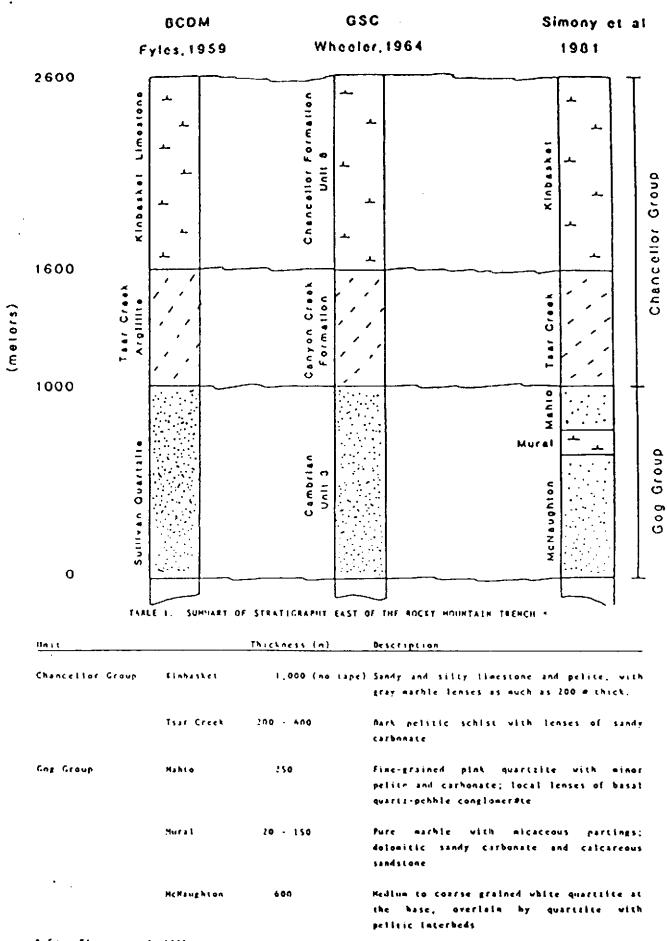
"The MGM property overlies a Mid-to-Lower Cambrian age sequence of metamorphosed clastic sediments. Figure 3. (Fyles, 1959)

"The Cambrian section is represented by these lithological elements: the Mid-to Upper Cambrian Kinbasket Limestone, the Midto Lower Cambrian Tsar Creek Argillites, and the Lower Cambrian Sullivan Quartzites. Brief lithological descriptions and correlative stratigraphic columns are shown on Figure 4. All of

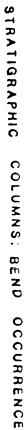


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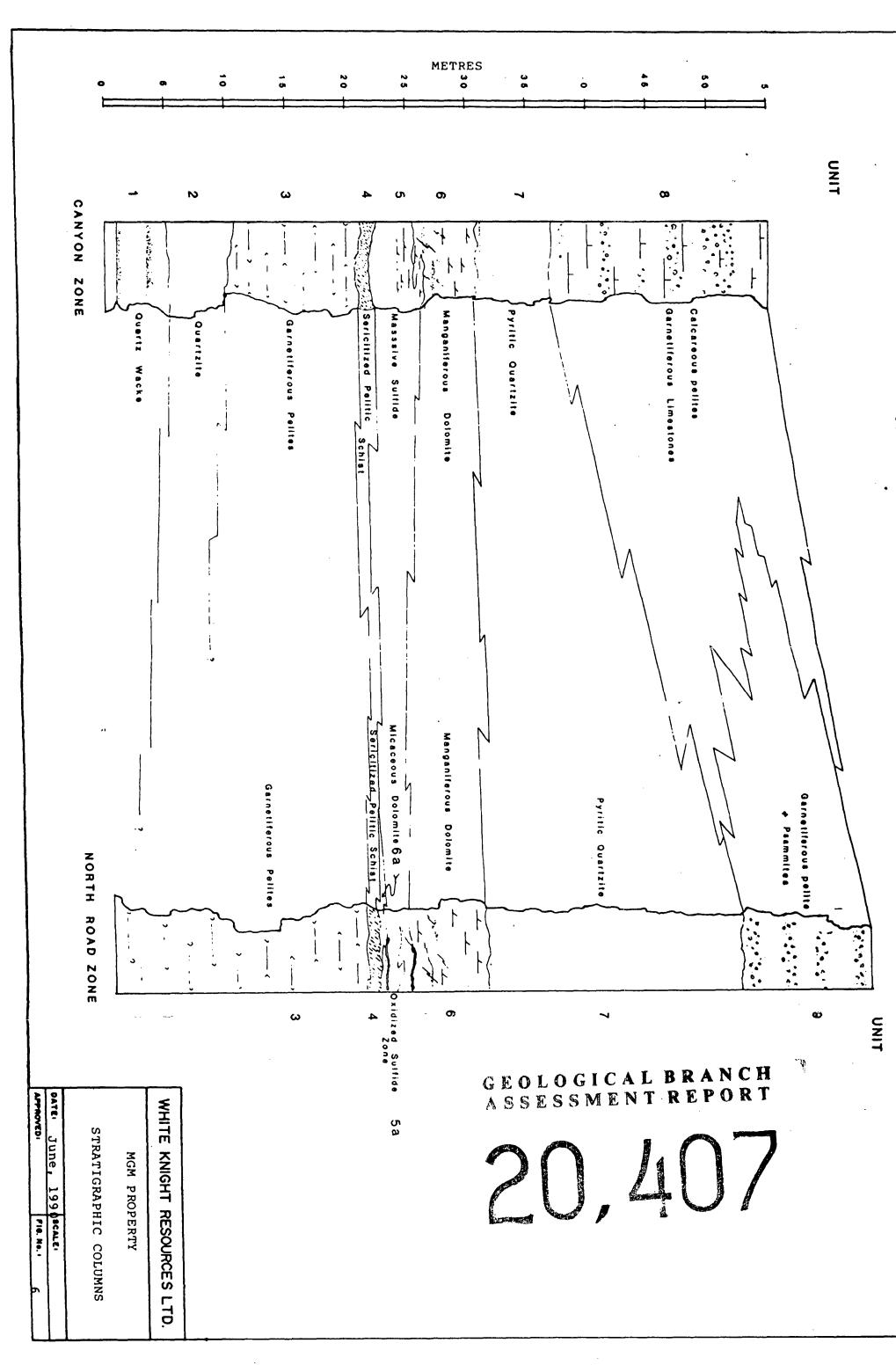
CUMMINS RIVER AREA



* from Sleony et al. 1980



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these lithologies have been metamorphosed to middle and upper greenschist assemblages. Under these conditions, the Kinbasket Limestone appears as a buff weathering, biotitic and locally garnet-rich unit. Dark to reddish grey mica schists characterize the Tsar Creek Argillites. Quartz mica schists, garnetiferous quartzites, pale pink grits and quartz wackes remain as the vestiges of the metamorphosed Sullivan Quartzite.

Regional structure in the area is dominated by the presence of the Columbia River-Purcell Fault systems. Within the Cummins River area, the Purcell Thrust juxtaposes Hadrynian Windermere Group lithologies against Cambrian sequences east of the Rocky Mountain Trench. The main thrust contact appears to be preceded, to the east, by an imbricate thrust zone confined entirely to Cambrian stratigraphy. One of these lesser thrusts occurs across the southwestern portion of the MGM claims."

8.0 History

Claims were first staked in the area by workers during construction of the Big Bend Highway in the 1940's.

In 1966 Cominco staked 45 units as the BEND claims. In 1967 Cominco carried out a program of geological mapping, trenching and x-ray drilling (13 holes, 240 metres total) on two areas of mineralization, the "Canyon" zone in Cummins River and the "Road" zone to the northwest. The Canyon showing yielded an average width of 6.5 metres with 3% combined Zn-Pb along with 0.25 oz/ton Ag, although there are local higher grade sections.

The property was optioned to Laura Mines Ltd. in 1970. Laura Mines drilled four holes in the Canyon showing for a total of 488 metres. The true width of the sulphide lens was 8.6 metres with slightly lower grades than those determined by Cominco.

Cominco considered the occurrence to be of the "fissure vein" type and to have limited potential and claims were allowed to lapse. At present Cominco holds 12 one unit claims straddling the Cummins River and protecting the Canyon zone.

In 1979 a reinterpretation of the known Pb-Zn showings in the McNaughton Lake area as shale-hosted massive sulphides similar to the Cirque and Howards Pass deposits rather than "fissure vein" systems led Leask and Associates to conduct a preliminary reconnaissance in the area. The MGM group was staked as the result of this program.

In 1981 Cominco paid cash in lieu of work to hold the Bend group, and in 1987 Cominco carried out geological mapping, sampling, access road construction and drill site preparation on the Bend group. Four new base metal showings were uncovered south of the canyon. Detailed geological mapping of the MGM group was carried out by E and B Explorations Ltd, as part of the Wood River Joint Venture with Leask in 1981. Expenditures totalled \$15,660.

The property was optioned to Riocanex Inc. in 1983. Riocanex carried out electromagnetic and magnetic surveys on the northwest portion of the property, the Road showing. As stated in the report by P. Walcott, P.Eng., "the survey was plagued by numerous problems stemming from the inclement weather and equipment malfunction". The planned program was not completed. The survey outlined one magnetic anomaly and one EM conductor. A second EM survey using a different system was recommended. Costs of the geophysical survey was \$39,684. Riocanex subsequently returned the property to Leask.

The property was optioned to Esso Minerals in 1985. Esso carried out VLF-EM and EM 37 geophysical surveys, soil geochemistry surveys, geological mapping and drilling (211.9 metres, 2 holes) on the northwest portion of the property. The work identified a linear geochemical anomaly, fading at either end and sourced in part by sulphides in the Road zone. The EM-37 survey identified a flat to shallow-dipping conductive layer, but the results do not appear to be directly related to the Road zone. Three holes were targeted to test the stratigraphy down dip of the Road zone trenches. Due to equipment problems and early snow fall the drill program was not completed and only two shallow holes were Neither hole reached the target stratigraphy but completed. significant Pb-Zn mineralization with attendant anomalous gold values was intersected in stringers within the hangingwall section. expenditures on the MGM property in 1985 totalled Esso's \$200,068.22. The property was returned to Leask when Esso Minerals left the mineral exploration industry.

9.0 Property Geology

The property geology is presented in detail in the Esso Minerals Canada report of March, 1986 and is summarized below. Property geology is presented on Figure 5.

"In general, the central portions of the MGM ground northwest of the Cummins River expose a section of guartz-deficient garnet-mica schist. Lesser quartz wackes and grits may be interbedded within this sequence. The succession trends 120° - 140° and generally dips $40-65^{\circ}$ southwest, although there are local areas of opposed dip, for instance in Three Mile Creek, which indicate a degree of fold involvement.

"To the east and to the northeast, stratigraphy becomes progressively dominated by limestones which appear to be thickening in that direction. To the west and southwest, garnet-mica schists appear to grade into quartz-rich assemblages, generally cream to pink quartz wackes, quartzites and minor mica schists. "Correlations between published stratigraphic columns in the area are presented on Figure 4. Both the Road Zone and the Canyon sulphide occurrences occur within a transitional environment. As shown by the section through the Cummins canyon, this environment separates the pink quartzites and grits of the Mahto Formation (Gog Group) to the east from the pelites of the Tsar Creek Formation (Chancellor Group) to the west.

The zinc-lead-silver-gold mineralization on the MGM and Bend properties occurs at the contact between the Lower and Upper Tsar Creek formations.

"Figure 6 shows a more detailed stratigraphic comparison of the units hosting the mineralized horizon. These columns are based on a measured section of the Cummins River Canyon and a 1:1000 mapping of the Road Zone. Of the lithologies in the two mineralized zones, the hanging-wall pyritic quartzite and dolomite provide the most distinctive marker manganiferous horizons. Stratigraphy at both locations youngs to the southwest.

"As shown on Figure 6, the hangingwall quartzites are relatively thicked and carbonates suppressed."

9.1 <u>Structure</u>

Regionally, the rocks of the area lie on the western limb of the Porcupine Creek Anticlinorium (Craw, 1976), a broad structure with no local parasitic structures.

The dominant planar fabric in the area trends $120^{\circ}/56^{\circ}SW$. This is parallel to principal lithologic contacts and appears to be axial planar to the tight early fold structures which plunge at low angles to the southeast. There is good evidence for this phase or a younger coxial phase of folding in the northwesterly wedging of the limestone unit exposed in the Cummins Canyon. The anticline-syncline pair in the central part of Three Mile Creek may reflect this phase also, and be related to the anomalous flattening of foliation through the Road Zone trenches.

The major structural plunge undulates gently on the property from $10-15^{\circ}$ southeasterly to 5° northwesterly.

9.2 <u>Mineralization</u>

CANYON ZONE - The Canyon showing constitutes a 10 meter bed of massive pyrite with disseminated sphalerite and galena. A two meter thick siliceous bed with disseminated pyrite-sphaleritegalena overlies the pyrite. A six metre thick bed of chocolate weathering manganiferous dolomite occurs in the hangingwall. Primary sedimentary features include bedding, slump features, and soft sediment deformation. A wedge shaped turbidite splits the dolomite into upper and lower divisions. Lithologies in the canyon zone are shaly quartzites, garnet mica schists, carbonates with minor chert and thin ultramafic tuff units.

The average grade of this showing is 3% zinc, 1% lead and less than 16 grams of silver per tonne. (Mawer, 1987). However, one drill intersection on the south side of the canyon immediately above the present high water level of 760 metres has a grade of 3% lead, 12% zinc over 2.0 metres (silver not analyzed) and surface sampling of 2.1 metres of 8% lead, 2% zinc and 140 gm/tonne Ag. Individual bands (collected in 1987) 10 cm thick assayed 615 gm/tonne Ag, 25% Pb, 0.3% Zn and 130 gm/tonne Ag, 3.8% Pb and 14.4% Zn. (Mawer, 1987). New showings uncovered by Cominco in 1987 to the south of the Cummins Canyon assayed 3.0 m of 34.0 gm/tonne Aq, 1.2% Pb, and 2.2% Zn and 1.5 metres of 132 gm/tonne Aq, 7.0% Pb and 4.5% Zn at the 790 metre elevation. At the 870 metre elevation the manganiferous dolomite unit hosts five bands of sulphide mineralization across a 4.7 metre width with an average assay of 4.7 gm/tonne Ag, 1.2% Pb and 4.5% Zn. A second 2.0 metre section averages 136 ppb Au, 28 gm/T Ag. 2.2% Pb and 5.2% Zn. Individual sulphide bands assayed from 116 to 422 ppb Au, 4.3 to 55 gm/T Ag, 0.1 to 4.7% Pb and 6.1 to 12.4% Zn.

ROAD ZONE - The two road zone showings occur 3.5 kilometres north of the canyon at the same stratigraphic level as the Canyon Zone massive sulphide. The upper Road Zone showing consists of fine grained sphalerite and galena in manganiferous chocolate weathering dolomite. Mineralization is exposed on a dip slope with an extent of 300 meters x 150 meters x 2 meters. Massive chlorite is developed at the base of the upper showing and massive sulphide blebs are associated with silicification in tension cracks. Overall grade is 3% zinc and 1% lead.

The lower Road Zone showing consists of disseminated sphalerite-galena in a silicified manganiferous dolomite unit about 6 meters thick. Grades are 6% zinc, 2% lead and 0.8 oz/ton silver. The mineralization is underlain by a silicified, thinly laminated quartzite and overlain by garnet mica schist.

TSAR CREEK - Massive pyrrhotite with stockwork quartz veins are located in the Tsar Creek Canyon. Mineralization is up to 4 meters thick and roughly conformable with bedding. Lithologic units in Tsar Creek are correlatable to those in the Cummins Canyon and likewise thicken down-dip. Copper grades are about 0.3%.

10.0 Deposit Type and Origin

Geologic features and setting indicate that the MGM occurrence is a classic shale-hosted massive sulphide deposit related to basinal subsidence and subsequent growth fault development. The geologic features supporting this conclusion are:

- Stratiform pyrite-sphalerite-galena mineralization at the contact of the Upper and Lower Tsar Creek units.
- Anomalous thickening of Upper Tsar Creek sediments in the showing area and rapid depositional features (turbidites).
- Anomalous thinning of Lower Tsar Creek sediments in the showing area indicating a basin edge.
- Mineralized manganiferous dolomite stratigraphically correlated to massive sulphide is a classic example of proximal-distal relationships.
- The mineralized growth fault structure in Tsar Creek.

The genesis of mineralization involves the development of growth faults due to oversteepening of unconsolidated and partially consolidated basin slope sediments. Slump blocks are formed by movement along these growth faults. Rotation of the blocks results in the formation of sub-basins that can trap metal bearing Metal-rich brines derived from expulsion of connate precipitates. water within the slump block sediments by compaction travel laterally, within the sediments to the growth faults which serve as channelways to the surface. When these anoxic brines circulate and mix with oxygenated sea water colloidal precipitates of metallic hydroxides and sulphides result. Manganese-rich carbonate precipitates peripheral to the sulphide as a result of decreased solubility with decreased temperature. Within the conduit, conditions allow chalcopyrite and pyrrhotite to precipitate, but not sphalerite and galena. This is common in shale-hosted deposits.

11.0 Conclusions and Recommendations

The MGM property is interpreted as a shale-hosted massive sulphide with known showings over a strike length of 4 kilometres. Geologic features indicate that both the Canyon and Road zones are peripheral to a large sub-basin, although the Canyon Zone is more proximal to the hydrothermal source. It is possible that one or more penecontemporaneous local depressions acted as sediment and brine traps and host a thick accumulation of bedded sulphide colloids. The wedge-shaped nature of units in the Cummins and Tsar Creek sections indicate a steep-sided tectonically derived subbasin. Sulphides in the Canyon zone thicken rapidly down-dip. If this rate of thickening continues down-dip a major sulphide body Stratiform mineralization at the Canyon zone is will exist. believed to be genetically related to a basin edge Hinge zone (shale out) where the Lower Tsar Creek Formation thins abruptly of several hundred metres in thickness to tens of metres. Correspondingly, the Upper Tsar Creek Formation thickens by a factor of 3 in the immediate Cummins Canyon area. A mafic intrusive complex recently located in the vicinity of the Hinge zone is likely emplaced along a synsedimentary growth fault. Stockwork mineralization of pyrrhotite-chalcopyrite located in Tsar Creek Canyon is likely the growth fault which acted as a channelway for ore forming solutions. Geochemical conditions within the conduit allowed pyrrhotite to precipitate but not sphalerite or galena.

Soil geochemistry over the Road Zone indicates a strike length in excess of 700 metres. The results do not indicate continuity of the sulphide between the Canyon Zone and the Road Zone. This could be due to the two zones having been deposited in discrete sub-basins, or to post mineral faults offsetting the mineralized strata or to areas with deeper overburden or till cover south of the road zone.

The VLF response shows a correspondence with the trenches and indicates a broad lithological trend. The EM survey indicates a flat to shallow-dipping conductive sheet that cannot be directly correlated with the mineralized horizon.

A work program consisting of mapping, geochemistry and drilling is recommended. Based on previous results, EM geophysical techniques seem to be of limited use in this environment and are not recommended. It is recommended that the grid between the Road zone and the Canyon zone be reestablished and extended up the hill to the east. Geochemistry at higher elevations may establish continuity of mineralization between the two zones. Based on the new higher grade showing uncovered by Cominco south of the Cummins Canyon and the potential for extending the mineralized horizon to the south, the grid should also be extended to the south onto the MGM 4 claims.

Diamond drilling consisting of 2-600 foot holes to test the road zone stratigraphy and 2-1200 foot holes to test the down dip extent of the Canyon zone are recommended. Drilling should preferably be carried out with HQ equipment to maximize core recovery.

A second phase drilling program to test geochemical targets to the south would be contingent on success of the phase 1 program.

14

Recommended 1991 Budget

Rehabilitating old roads, drill site preparation, trenching - allow 8 days @ 1200/day Geologist 40 days @ \$400/day Assistant 40 days @ \$250/day Assays Room/board 100 mandays @ \$50/day Vehicle/Fuel \$70/day Line cutting 20 km @ \$400/km Soil sampling 800 @ \$3.00/sample Soil analysis 800 @ 6.00 Drilling 3600 feet @ \$40/ft Drill mob/demob (barge) Report and map preparation	\$ 9,600 16,000 10,500 1,500 2,800 8,000 2,400 4,800 144,000 5,000 3,000 \$212,600
Contingency	31,400
Total budget	\$244,000

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12.0 Statement of Costs

Wages: Jim McDonald Terry Eldridge John Leask	May 26-27 2 days @ \$400/day Aug 3,4,5,6 4 days @ \$400/day May 26-27 Aug 3,4,5,6 6 days @ \$400/day	\$ 800.00 1,600.00 2,400.00
Boat Rental	6 days @ \$50/day	300.00
Vehicle Rental	4 days @ \$50/day	200.00
Supplies		245.50
Food		356.54
Gas		565.50
Drafting		300.00
Report Prep.	4 days @ \$500/day	2,000.00
		\$ 8,767.54



13.0 <u>References</u>

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STATEMENT OF QUALIFICATIONS

I, JOHN M. LEASK, do hereby certify that:

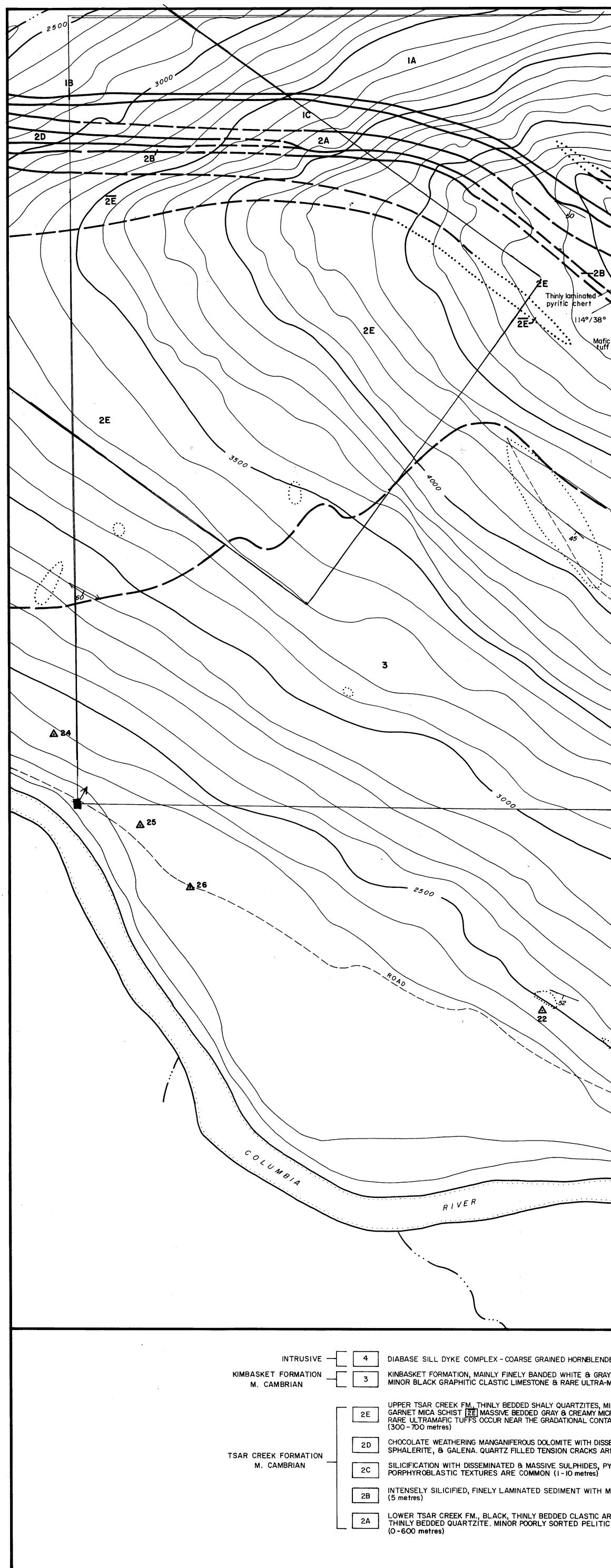
1. I am a geologist with residence at 4819 Underwood Avenue, North Vancouver, British Columbia, V7K 3A6.

2. I am a graduate of the University of British Columbia with a Bachelor of Applied Science degree in Geological Engineering (1980).

3. I have been involved in mining exploration as an independent since 1979.

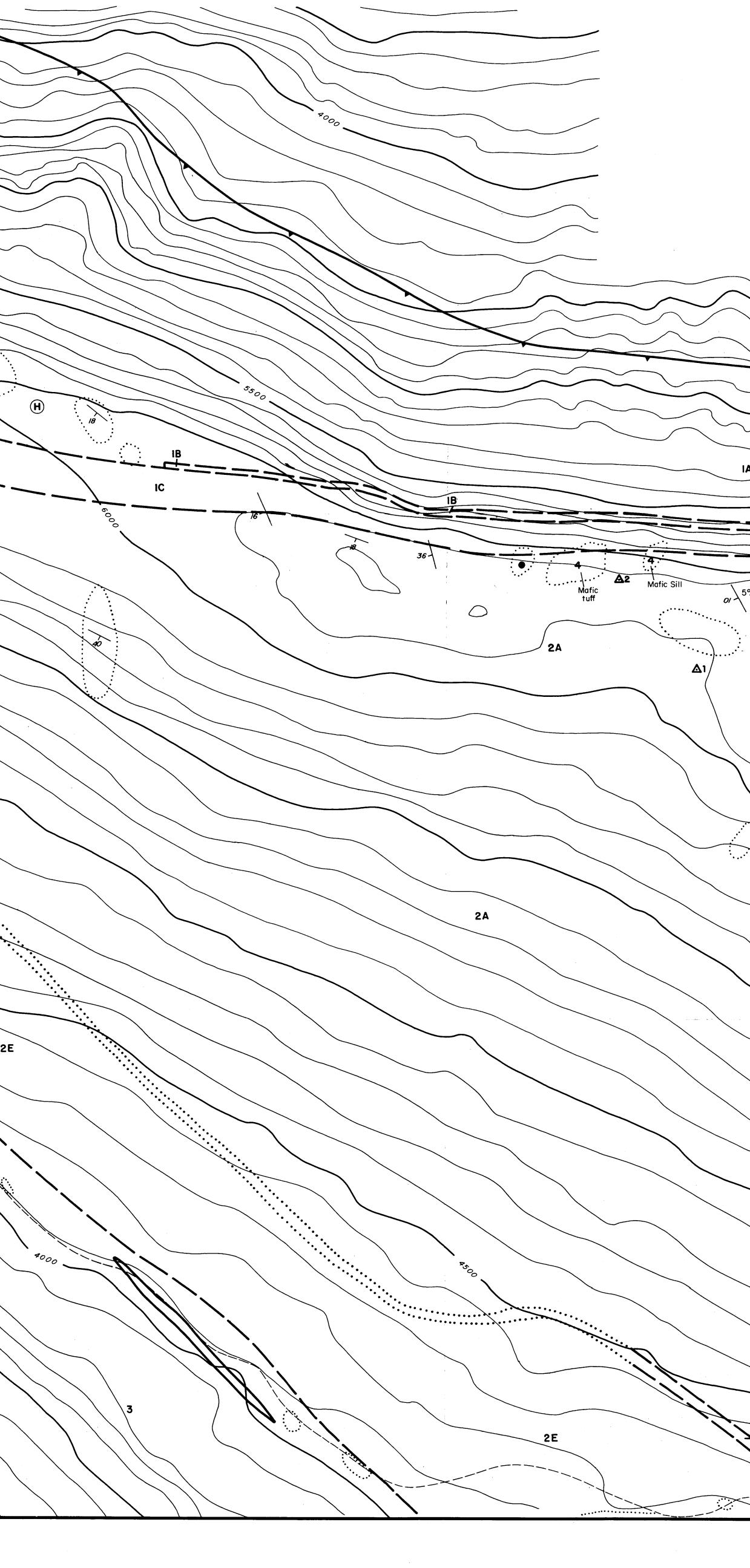
Respectfully submitted,

JOHN M. LEASK

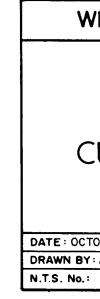


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