

M. L. LARSON GEOLOGICAL CONSULTANTS LTD.

#640, 999 - 8th STREET S.W., CALGARY, ALTA. T2R 1J5

TELEPHONE (403) 228-6315

LOG NO: 0427	RD. 4
ACTION: Date received report back from amendments.	
FILE NO:	

0106	RD.
FILE NO:	

PRELIMINARY GEOLOGICAL SURVEY

EMBED

MAGNESITE CLAIMS

JOHNSON (#1664 and #1665)

BEN (#1662 and #1663)

GOLDEN MINING DIVISION

82J13

Long. 115 deg. 41 min. Lat. 50 deg. 49 min.

CLAIMS OWNER

ROBERT W. TERMUENDE

CLAIMS OPERATOR

ROBERT W. TERMUENDE

REPORT BY

M.L. LARSON, P. GEOL.

DECEMBER 30, 1988

18,203  
 GEOLOGICAL BRANCH  
 ASSESSMENT REPORT

## TABLE OF CONTENTS

	<u>Page</u>
1. INTRODUCTION	1
2. PROPERTY DESCRIPTION AND PHYSIOGRAPHY	1
3. ACCESS	2
4. PREVIOUS WORK	2
5. HISTORY OF CLAIMS	3
6. OBJECT OF PRESENT STUDY	3
7. GEOLOGY	3
8. THEORY	5
9. PROCEDURE	8
10. RESULTS	9
11. CONCLUSIONS	11
12. RECOMMENDATIONS	11
13. ESTIMATED COST OF RECOMMENDATIONS	11
14. STATEMENT OF QUALIFICATION	13
15. REFERENCES	14
16. ITEMIZED COST STATEMENT	15

### FIGURES

	<u>Following Page</u>
Figure 1      Location Map	Table of Contents
Figure 2      Summary of Stratigraphy East and West	3

### PLATES

	<u>Page</u>
Plate 1      Baymag Mine in relation to Johnson and Ben Claims	1
Plate 2      Cathedral Formation above Aurora Creek	5
Plate 3      Minor Thrust Faults and Contorted Beds in Cathedral Formation	7
Plate 4      Geologists	8
Plate 5      Looking east from campsite on Mitchell River	9
Plate 6      Looking north up Eon Creek	10

APPENDIX

Certificate of Assay - Loring Laboratories Ltd.

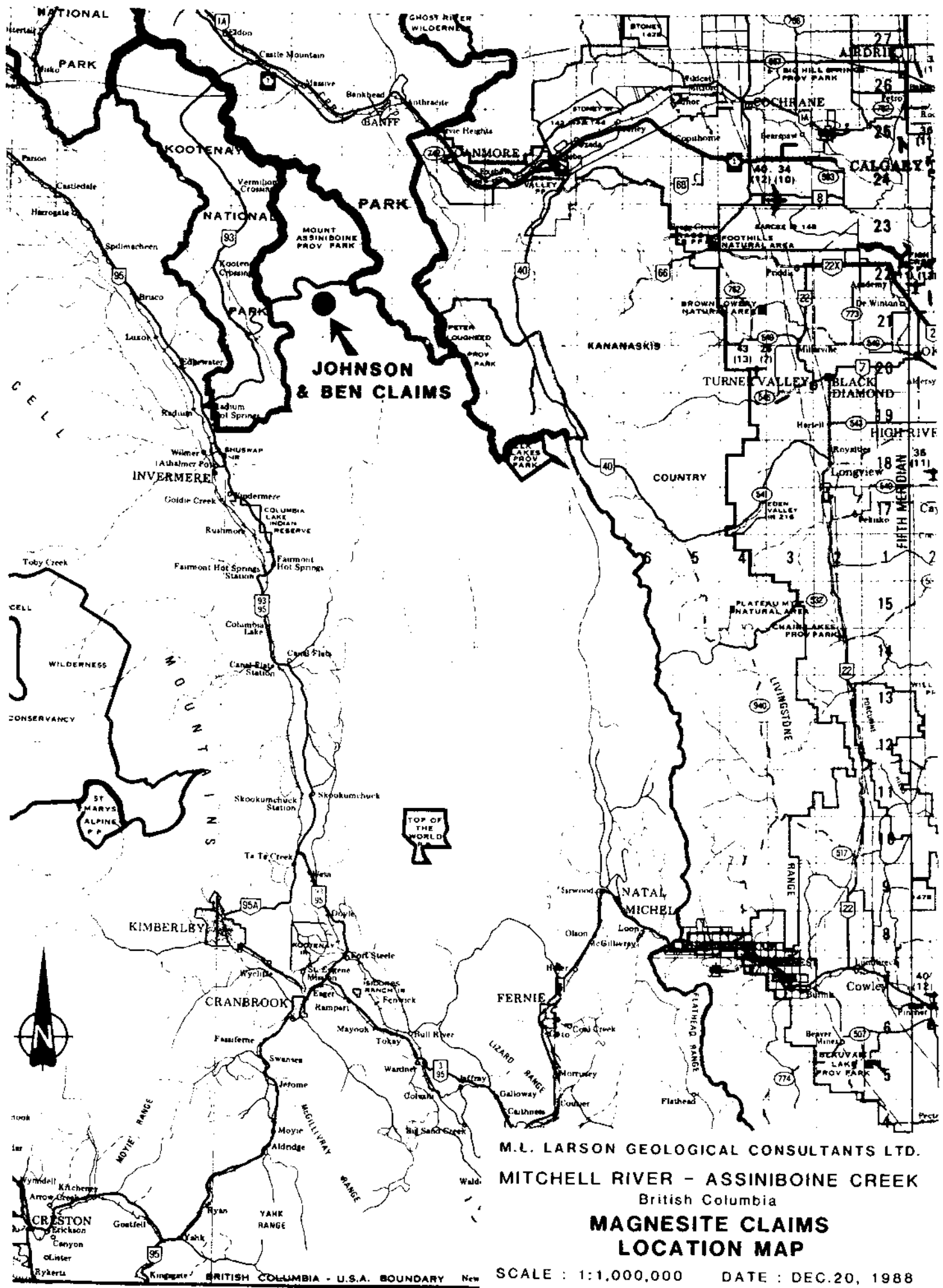
Ministry of Energy, Mines and Petroleum Resources: Assessment Report - Title  
Page and Summary Johnson Claim Block

Ministry of Energy, Mines and Petroleum Resources: Assessment Report - Title  
Page and Summary Ben Claim Block

ENCLOSURES

Enclosure 1 Geologic Map Showing Configuration of Middle Cambrian Cathedral  
Formation

Enclosure 2 Structural Cross Section A-B Across Johnson and Ben Claims



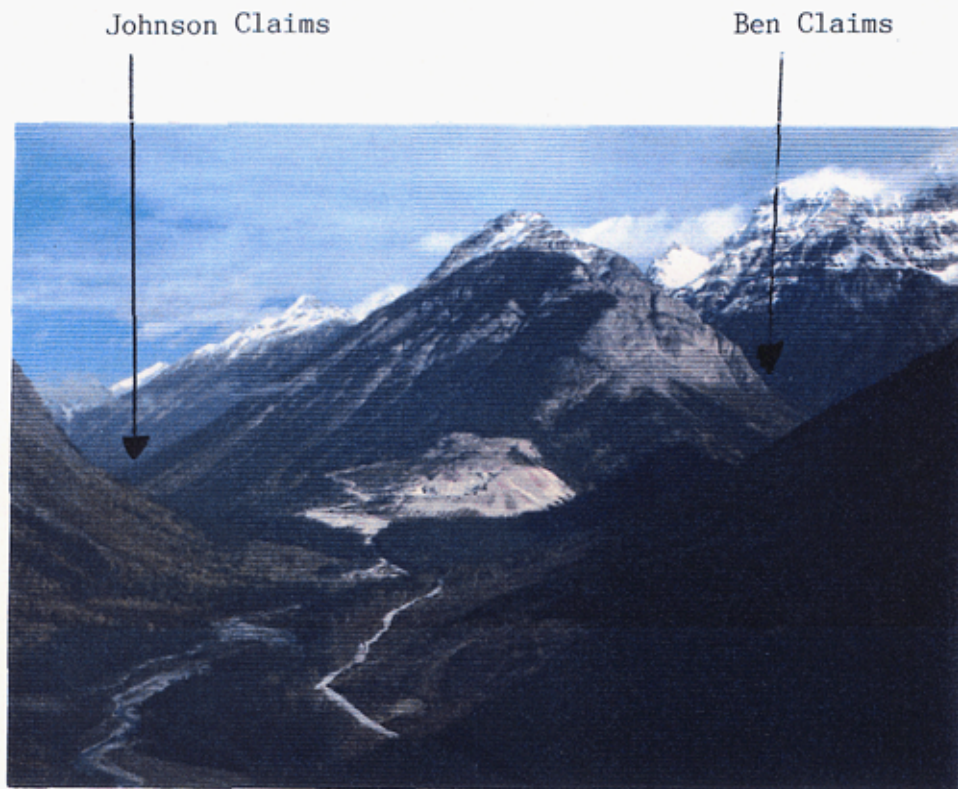
M.L. LARSON GEOLOGICAL CONSULTANTS LTD.  
 MITCHELL RIVER - ASSINIBOINE CREEK  
 British Columbia  
**MAGNESITE CLAIMS**  
**LOCATION MAP**

SCALE : 1:1,000,000 DATE : DEC.20, 1988  
 FIGURE NO. : 1

## INTRODUCTION

Recent advances in low cost magnesium metallurgy with expanding uses for the metal will create a stronger demand for high grade ore deposits. The premier source of magnesium is the magnesium carbonate, magnesite, particularly when it occurs as replacement bodies in carbonate sediments. One of these occurrences, the Baymag deposit, the world's largest and purest known magnesite body is located approximate five (5) kilometers south of the claim blocks in this study, and indeed, was the reason for staking these mineral claims which are situated on the same middle Cambrian Cathedral formation as in the Baymag deposit.

### Plate 1



Baymag Mine in relationship to the Johnson and Ben Claims.

### PROPERTY DESCRIPTION AND PHYSIOGRAPHY

The subject claims are located immediately south of Assinboine Provincial Park and immediately north of the Baymag Mine in the Main Ranges of the Rocky Mountains of southern British Columbia, centered at Longitude 115° 41'W and Latitude 50° 49'N (Figure 1).

One group of claims (Johnson) is located on the Mitchell River approximately five (5) kilometers north, on the west facing steep slope to the east of the Mitchell River, upstream, from the Baymag mine on a good horse trail (Encl. 1). This group consists of 36 units. The common Legal Corner Post is at an elevation of 4740 feet (1444.7 meters) on the east bank of the Mitchell River. The corner post can be seen from the air and good helicopter landing sites are plentiful on gravel bars of the Mitchell River.

The second claim group (Ben) consisting of 36 units is located partly in Assinboine Creek, Eon Creek and Aurora Creek, and their contiguous slopes approximately five (5) kilometers to the northwest of the Baymag mine. No good trails exist beyond the confluence of Assinboine and Aurora Creeks, however, some helicopter landing sites are available further upstream on Assinboine Creek and Eon Creek. The common Legal Corner Post is at an elevation of 5200 feet (1585 meters) on the west bank of Assinboine Creek and cannot be seen from the air. (Encl 1.).

#### ACCESS

The subject claims can be reached by road from Radium Hot Springs by continuing east on the Kootenay National Park Highway 93 towards Banff. At kilometer 18 on the main park road a turn off to the southeast is made at the Settlers Road turn off. Once on Settlers Road, following the posted signs, will lead to the Baymag Mine, situated at the confluence of the Mitchell River and Aurora Creek. The total road distance from Radium Hot springs to the Baymag Mine is 57 kilometers. The area can also be accessed by a one-half hour helicopter flight from Frontier Helicopters base at Fairmount Hot Springs or Radium Hot Springs. (Figure 1).

#### PREVIOUS WORK

The only previous work done was of a very preliminary nature during the staking of these claims on September 19 and 22, 1986. At this time the staker did not locate any in-situ exposures of magnesite but did find one piece of magnesite float on a side slope west of Assinboine Creek at an elevation of approximately 5500 feet (1676 meters). The cliffs above this location are the Cathedral formation and are presumed to be the source.

### HISTORY OF CLAIMS

1. Staked on September 19th and 22nd, 1986 - owner: Arjay Enterprises Ltd.
2. Sold to Robert W. Termuende September 15, 1988.
3. Transaction noted and transfer made to Robert W. Termuende at Cranbrook, B.C., September 26, 1988.
4. Claims were grouped on October 4, 1988:

RDS I (#1664) and RDS II (#1665) becoming the Johnson Claim blocks  
Solo (#1663) and Halo (#1662) becoming the Ben Claim blocks

### OBJECT OF PRESENT STUDY

The object of this field study was to examine and map the configuration of the Cathedral formation as it relates to the Baymag deposit and if possible to find occurrences of magnesite in situ on the subject claims.

### GEOLOGY

#### 1. Regional

This area is located in the Main Ranges of the Rocky Mountains with the exposed rocks being composed mainly of Lower, Middle and some Upper Cambrian stratified carbonates and shales ranging to over 3000 meters (10,000 feet) in thickness. These rocks can be separated into an eastern, dominantly carbonate, and a western, dominantly shale, facies. (Figure 2).

The eastern Main Ranges are characterized by broad open folds whose axial planes strike generally northward and are underlain by major west dipping thrust faults.

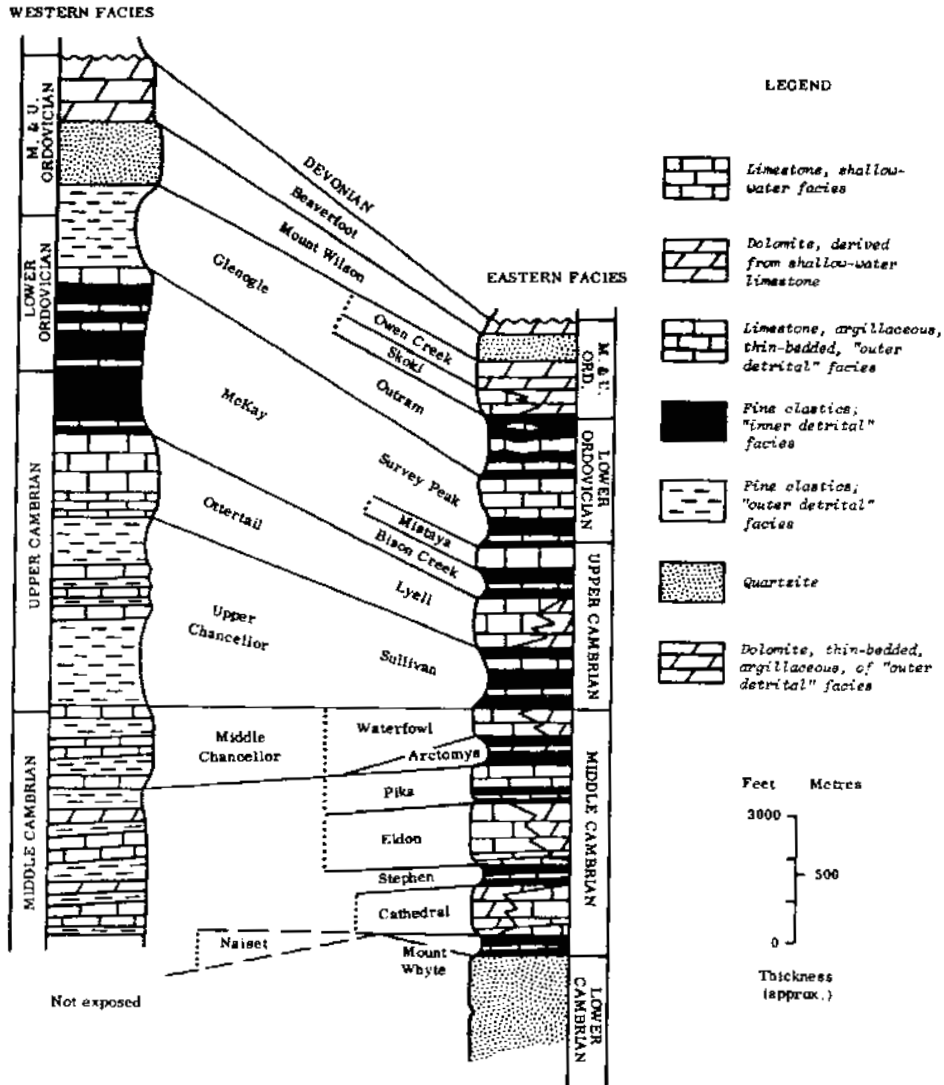


Fig. 2. Summary of stratigraphy east and west of the Kicking Horse belt (adopted in part from Cook, 1970, fig. 3-2).

## 2. Local

The subject Claims have cropping out on them, the Cathedral formation of Middle Cambrian Age. This formation is the host for the magnesite ore deposit at the Baymag Mine and in this area is approximately 450 meters (1500 feet) thick. Lithologically it consists of mainly thick-bedded dolomite and dolomite limestone with localized ? (more work needs to be done) magnesite of varying grade.

The Cathedral formation is overlain by the Middle Cambrian Stephen formation (shale) and underlain by the Middle Cambrian Naiset formation (shale), thus rendering it an easily identifiable and mappable unit.



It appears that the Cathedral formation in this area is near the boundary of facies change between the eastern carbonate and the western shale regimes.



Cathedral formation above Aurora Creek, overlain by the Stephen formation and underlain by the Naiset formation.

Plate 2

Structurally the claims are located on the west flank, core and east flank of the major Assinboine anticline and are underlain by the Main Ranges Fault, a major west-dipping thrust fault, whose surface trace is located 3.5 kilometers east of the eastern edge of the Ben Claim where Middle Cambrian rocks are thrust over Devonian Rocks (Encls 1 and 2).

THEORY

1. Field Identification of Magnesite

Magnesite is a white to buff colored carbonate having the composition  $MgCO_3$ . It is similar in appearance and crystal structure to other common carbonates such as dolomite. Its reaction to HCl is negative or weak, similar to dolomite, making it difficult to distinguish from this mineral.

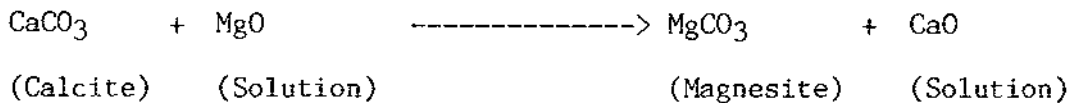
Staining techniques for identifying magnesite have been described (Fredman, 1959), but these are complicated and unreliable, particularly under field conditions. A technique developed by Dr. J.A. Chamberlain, Dolimage Campbell & Associates, works well in the field and is based on the fact that the specific gravity of magnesite 3.0 to 3.2 is significantly higher than calcite (2.7) and dolomite (2.85) and significantly less than barite (4.48). The method uses the liquid tetra bromo ethane which has a specific gravity of 2.96. When a chip of rock is placed in this solution, dolomite will float, barite will rapidly sink to the bottom and magnesite will slowly sink to the bottom.

## 2. Exploration Model

The Baymag deposit is located near the confluence of the Mitchell River and Aurora Creek (Encl 1). The magnesite deposit occurs on the west limb of a large anticline within Cambrian carbonate sediments, specifically the Cathedral formation of Middle Cambrian Age. The strike of the sediments is N30° W with southwest dips ranging from 13° near the crest of the anticline to 30° to 43° downdip from the crest. The magnesite occurs as massive lenses within coarsely crystalline carbonate rocks. No specific controls or origins for this extensive mineralization have been proposed in the literature.

The question of why the Baymag orebody exists where it does would indeed aid in predicting other magnesite occurrences in the area.

It is generally agreed that magnesite deposits are not syngentic, in other words, were not deposited during the initial sedimentary deposition. Most theories call for replacement of primary calcite as the result of magnesium-rich circulating ground water.







Minor thrust faults and contorted beds in the Cathedral formation northwest and above the Baymag mine.

Plate 3

Carbonate rocks tend to be relatively impermeable except when conduits develop by solution along faults, fractures, intraformational boundaries and reefal development. Thus the presence of such features in the Mitchell River-Assiniboine Creek Area would encourage the theory that they have played a role in the formation of the Baymag magnesite deposit. Although Shultes (1986) specifically mentioned that no major faulting has been found in the Baymag deposit itself, it is noted that the deposit occurs on the west limb of a major anticline and that the entire area is underlain by a major thrust fault in which Cambrian rocks are thrust over Devonian rocks (Cross Section A-B). It is not uncommon for splay-faults to be associated with major low angle thrust faults such as the one underlying this area. Indeed, minor thrust faults and contortions occur updip from the Maymag mine as seen in the above plate. Another factor that may have influenced the presence of the Baymag deposit is that it is located near a facies change from the clean carbonates of the Cathedral formation



to shallier rocks of the equivalent Chancellor formation to the west. The western Chancellor formation contains chlorite (a ferro-magnesium mineral) which may have been the source and during the tectonism (faulting and folding) associated with the formation of the Rocky Mountains, heated ground water, rich in Magnesium Oxide may have moved along major thrust faults and associated splay faults and reacted with calcite in the Cathedral formation resulting in the formation of magnesite.

Geologists (left to right)



D. Lockie, M. Larson, R. Termuende at campsite on Mitchell River.

Plate 4

PROCEDURE

Between September 28 and October 3, 1988, three geologists, R.W. Termuende, D.A. Lockie, and M.L. Larson flew by helicopter into a campsite on the Mitchell River on the Johnson block of claims. Traverses from the campsite eastwards to the west limb of the Assinboine Anticline and along strike down the Mitchell River were carried out in order to gain structural and stratigraphic data pertaining to the Cathedral formation. Also during this time most of a day was

spent mapping from a helicopter along with a traverse down and across the Cathedral formation in Eon Creek on the Ben block of claims.

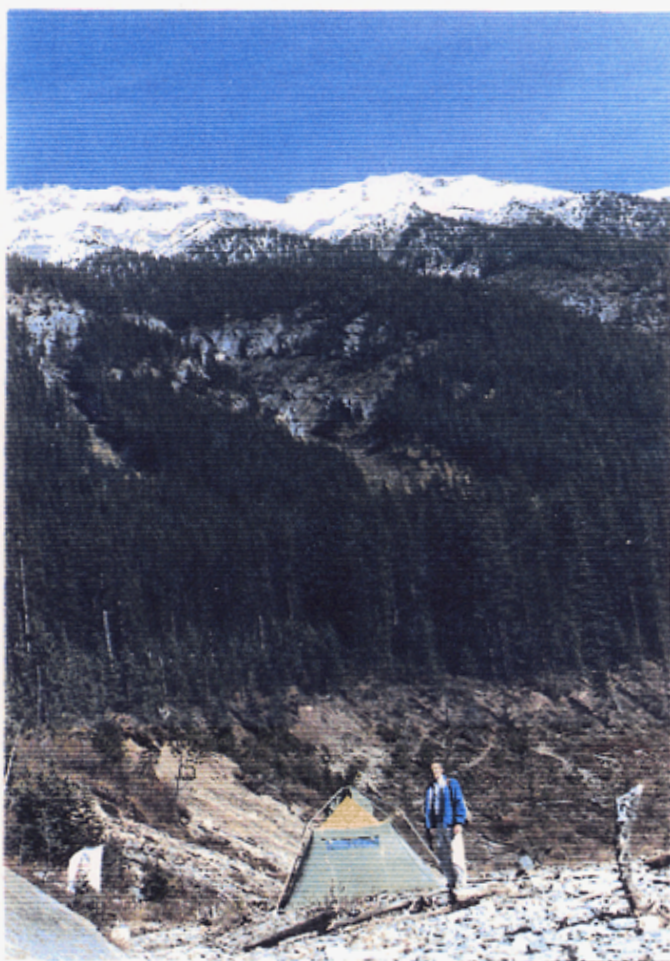


Plate 5

Looking East from campsite  
on Mitchell River up west  
flank of Assinboine  
Anticline.

### RESULTS

The traverses on the Johnson claims (Mitchell River) were in general disappointing in that glacial drift has covered the bedrock exposures in the Mitchell Creek valley although certain strikes and dips were attained both on the



foot traverses and with helicopter landings at higher elevations. Additionally, traversing down the dip slope of the anticline precluded examining the total section of the Cathedral although the traverse down Eon Creek on the Ben claims enabled the examination and sampling of the lower 150 meters (500 feet) of the Cathedral section. To examine the Cathedral section in the core of the Assinboine anticline (on the west side of Assinboine Creek) would have necessitated the use of experienced mountain climber/geologists (which none of us are) because the formation is exposed on a very steep cliff face. Nonetheless by using the helicopter, elevations of the formation contacts were gained which enabled the production of a geological map and an associated structural cross section (Encls 1 and 2).

From a landing spot at the 6500 feet elevation a traverse, was made down Eon Creek through the lower part of the Cathedral formation, across the Cathedral and Naiset formation contacts at 6000 feet to the helicopter pick up at 5500 feet.

Four samples of carbonate rock from the Cathedral formation on the Eon Creek traverse collected from between the 6500 foot and 6000 foot elevations were analyzed by Loring Laboratories of Calgary resulting in magnesite grades of between 43.01% and 44.81% (See Appendix).

Plate 6



Looking North up Eon Creek from helicopter pickup site.

CONCLUSIONS

1. The Johnson Claim blocks fit the Exploration Model but lack of exposure on the west flank of the Assinboine anticline will necessitate one or two core holes penetrating the complete Cathedral section to prove or disprove the presence of ore grade magnesite deposits.
2. The Ben Claim blocks fit the Exploration Model to a lesser degree, however, samples with magnesite percentages of up to 44% indicate that magnesite is present (albeit not the 95% grade at the Baymag Mine) some 5 kilometers northwest of the mine.

RECOMMENDATIONS

1. Johnson Claim Block

Drill a 500 metre core hole located on this claim block in the Mitchell River valley at an angle such that the true thickness of the Cathedral formation will be penetrated.

2. Ben Claim Block

Carry out a detailed geologic sampling program of the Cathedral formation on the east side of Assinboine Creek and in Eon Creek.

ESTIMATED COST OF RECOMMENDATIONS

1. Johnson Claim Block

Mobilization, demobilization	\$ 2,000.00
Drilling/coring: 500 meters at \$50/meter	25,000.00
Geological supervision	4,000.00
Assays and core analyses	3,000.00
Vehicle (4 X 4)	4,000.00
Geological report	2,000.00
Food and supplies	1,000.00
2.5 kilometers of access road building or helicopter support.	<u>20,000.00</u>
Subtotal	\$ 61,000.00
10% contingency	<u>6,100.00</u>
TOTAL	<u>\$ 77,100.00</u>

2. Ben Claim Block

14 man days, senior geologist at \$400/day	\$ 5,600.00
14 man days, junior geologist at \$200/day	2,800.00
Helicopter: 28 hours at \$600/hour	16,800.00
Camp costs: 28 man days at \$40/day	1,120.00
Assaying: 100 samples at \$10/sample	1,000.00
Vehicle (4 X 4) at \$40/day	560.00
Trailer rental	500.00
Geological report	<u>3,000.00</u>
Subtotal	\$ 31,380.00
10% contingency	<u>3,100.00</u>
TOTAL	<u>\$ 34,480.00</u>

TOTAL COST - BOTH CLAIM BLOCKS \$111,580.00



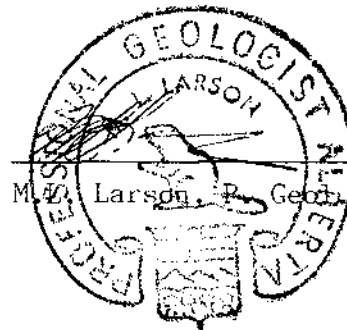


STATEMENT OF QUALIFICATION

I, MURRAY L. LARSON, of 230 - 19 Avenue, N.W., Calgary, Alberta, do hereby declare that:

- 1) I graduated from the University of Saskatchewan with a B.A. in Geology in 1963 and from the University of Alberta with as M.Sc. in Geology in 1965.
- 2) I have been a practicing geologist in Western Canada for 23 years, 16 of which as a consulting geologist, mostly in the Petroleum industry with a certain amount of time being spent on Mining projects as they pertained to sedimentary deposits.
- 3) I have had extensive experience in structural and stratigraphic projects and field partics in the Rocky Mountains of Western Canada.
- 4) That I am a member in good standing of the Association of Professional Engineers, Geologist and Geophysicists of Alberta.

DECLARED THIS 20th DAY OF DECEMBER, 1988.



REFERENCES

- Aitken, J.D., 1966, Middle Cambrian to Middle Ordovician Cyclic Sedimentation, Bulletin. Can. Petrol. Geol.
- Aitken, J.D., 1971, Control of Lower Paleozoic Sedimentary Facies by the Kicking Horse Rim, Southern Rocky Mountains, Canada, Bulletin Can. Petrol Geol.
- Bokovay, G., 1986, Magnesium in Canadian Minerals Yearbook, 1985.
- Cook, D.G., 1970, A Cambrian Facies change in G.A.C. Special Paper No. 6
- Friedman, G.M., 1959, Identification of Carbonate Minerals by Staining Methods, Jour. Sed. Pet.
- Kananaskis Lakes, Open File Map 634, Geological Survey of Canada
- Leech, G.B., 1966, Geological Survey of Canada Paper 66-1
- Schultes, H.B., 1986, Baymag - High Purity Magnesium Oxide from Natural Magnesite, C.I.M. Bulletin, Volume 79.

ITEMIZED COST STATEMENT

Labour, Supervision, Food and Accommodation:

Field program carried out from September 28, 1989 to October 3, 1989 inclusive by:

Murray M. Larson, P. Geol. Supervisor  
Douglas A. Lockie, P. Geol.  
Robert W. Termuende, P. Geol.

6 man days @ \$350. per day                      \$2,100.  
12 man days @ \$250. per day                     \$3,000.

Food & Accommodation:

12 man field days @ \$40. per day                    \$480.  
6 man commercial days @ \$60. per day                 \$360.

Transportation:

Helicopter support in B. C.                             \$3,000.90

Rentals:

4-wheel drive jeep 6 days @\$40.00                    \$240.

Preparation of Field Report:                             \$1,900.

---

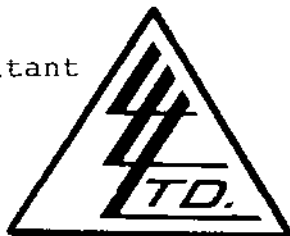
Total                      \$11,080.90

---

Approximately 2/3rds of the work was carried out on the Johnson Claim, and 1/3rd on the Ben Claim.

## APPENDIX

To: M.L.Larson Geological Consultant  
#640, 999 - 8th Street S.W.,  
Calgary, Alberta T2R 1J5  
Attn: Mr. M. L. Larson

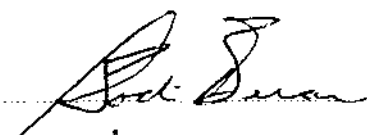


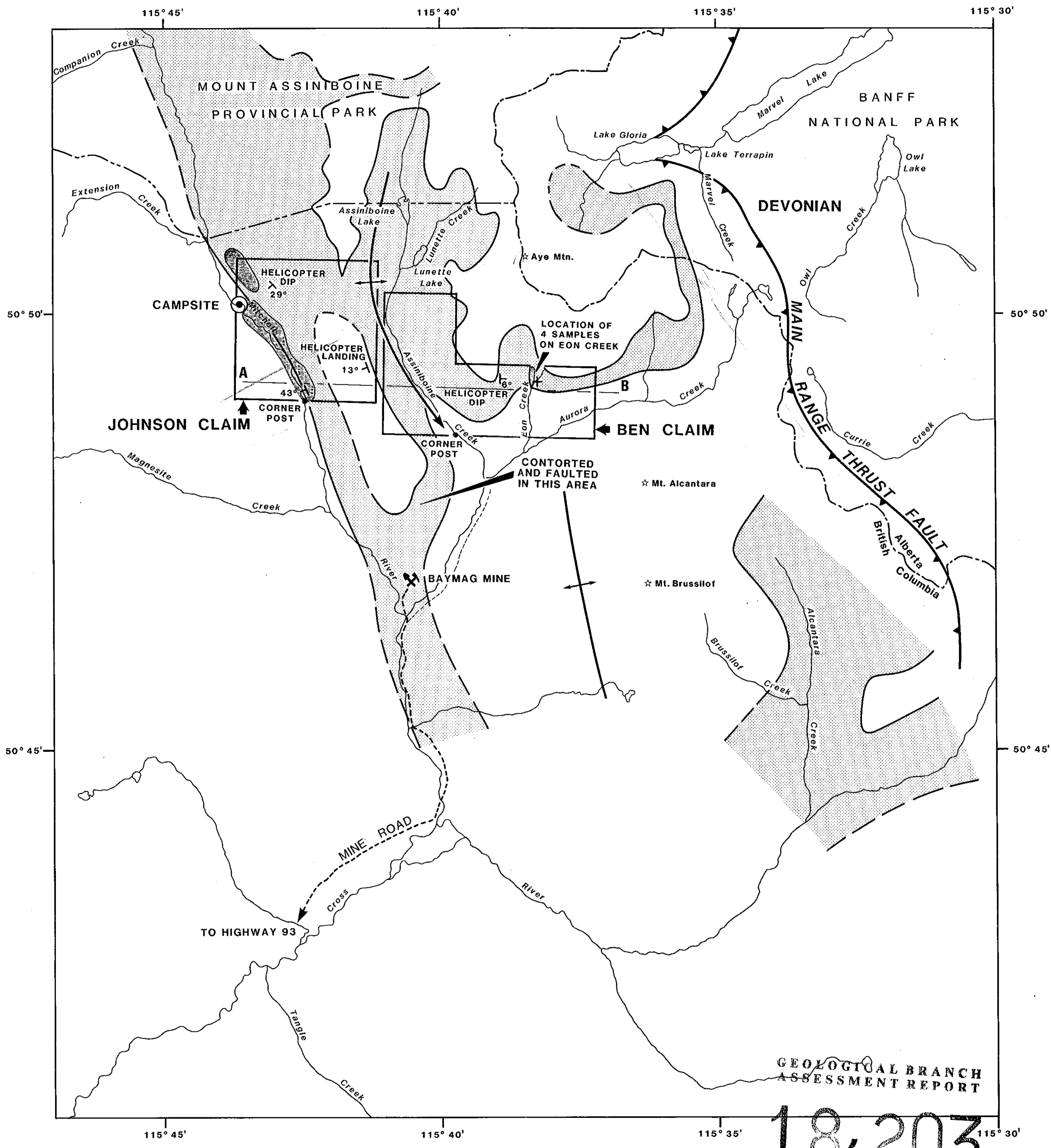
File No. ....32093.....  
Date .... December 30, 1988  
Samples . Rock. ....

*Certificate of*  
**ASSAY of**  
**LORING LABORATORIES LTD.**

SAMPLE No.	% MgCO <sub>3</sub>
<u>"ASSAY ANALYSIS"</u>	
EON - 1	44.81
EON - 2	43.01
EON - 3	44.26
EON - 4	43.98
<p><b>I Hereby Certify</b> THAT THE ABOVE RESULTS ARE THOSE ASSAYS MADE BY ME UPON THE HEREIN DESCRIBED SAMPLES . . . .</p>	

Rejects Retained one month.  
Pulps Retained one month  
unless specific arrangements  
made in advance.

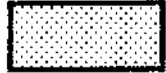



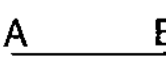

  
Assayer



GEOLOGICAL BRANCH  
ASSESSMENT REPORT

**18,203**

LEGEND

-  CATHEDRAL FORMATION (MIDDLE CAMBRIAN)
-  THRUST FAULT (MARKERS ON UPTHROWN SIDE)
-  STRIKE & DIP
-  FLAT LYING
-  A B STRUCTURAL CROSS SECTION
-  GROUND TRAVERSES

M.L. LARSON GEOLOGICAL CONSULTANTS LTD.

MITCHELL RIVER - ASSINIBOINE CREEK  
British Columbia

**GEOLOGIC MAP SHOWING  
CONFIGURATION OF THE  
MIDDLE CAMBRIAN  
CATHEDRAL FORMATION**

SCALE : 1:50,000

DATE : DEC. 20, 1988

ENCLOSURE NO. : 1

WEST  
**A**

EAST  
**B**

ASSINIBOINE ANTICLINE

JOHNSON CLAIM BLOCK

BEN CLAIM BLOCK

FEET

FEET

8000

8000

7500

7500

7000

7000

6500

6500

6000

6000

5500

5500

5000

5000

4500

4500

4000

4000

3500

3500

3000

3000

2500

2500

2000

2000

1500

1500

1000

1000

500

500

MITCHELL RIVER

ASSINIBOINE CREEK

EON CREEK

MCs

MCs

MCc

MCc

MCn

MCn

LrC

LrC

MCe

MCs

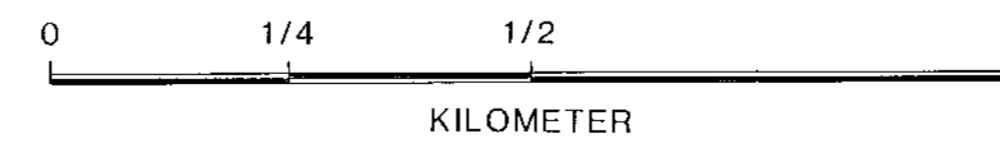
5 KMS N.W. ALONG STRIKE  
FROM THE BAYMAG  
MAGNESITE DEPOSIT

FAULT POSSIBLE CONDUIT  
FOR MAGNESIUM RICH WATERS

FLAT LYING

APPROXIMATE LOCATION OF THE MAIN RANGE THRUST FAULT WHOSE TRACE IS AT 7300 FT. - 3.5 KMS EAST OF THE END OF THIS CROSS SECTION

DEVONIAN



LEGEND

- MCe : ELDON
  - MCs : STEPHEN
  - MCc : CATHEDRAL
  - MCn : NAISSET
  - LrC : LOWER CAMBRIAN
- MIDDLE CAMBRIAN
- ANTICLINE
- THRUST FAULT
- POSSIBLE FRACTURE ZONES
- POTENTIAL MAGNESITE DEPOSITS

GEOLOGICAL BRANCH  
ASSESSMENT REPORT

18,203

M.L. LARSON GEOLOGICAL CONSULTANTS LTD.  
 MITCHELL RIVER - ASSINIBOINE CREEK  
 British Columbia

**STRUCTURAL CROSS SECTION A-B  
ACROSS JOHNSON AND BEN CLAIMS**

VERTICAL SCALE : 1" = 500'  
 HORIZONTAL SCALE : 1" = 200 METERS  
 INTERP. BY : M.L. LARSON  
 DATE : DEC. 20, 1988

ENCLOSURE NO. : 2