



## MOUNT BRUSSILOF MAGNESITE PROJECT, SOUTHEAST BRITISH COLUMBIA (82J/13E)

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**KEYWORDS:** Industrial minerals, magnesite, Mount Brussilof, Baymag, Cathedral Formation, Cambrian carbonates, Simpson Pass thrust.

### INTRODUCTION

The Mount Brussilof magnesite deposit (MINFILE 082JNE 001) is located in the East Kootenay region of the southern Rocky Mountains, about 30 kilometres northeast of Radium Hot Springs (Figure 3-5-1). The world-class deposit has been mined by open pit methods by Baymag Mines Co. Ltd. since 1982.

A proposed 2-year, 1:50 000-scale geological mapping project commencing in 1989, will outline the extent of the magnesite mineralization and the Cambrian hostrocks. The depositional controls for the magnesite will be established to serve as an exploration tool for similar deposits in the Rocky Mountains.

A preliminary examination of the property was carried out in September 1988. Samples of the magnesite from the main pit and the host dolomites and limestones were collected for petrographic study.

Support for this project is provided by a British Columbia Ministry of Energy, Mines and Petroleum Resources Geoscience Research Grant. Cooperation by Baymag staff is gratefully acknowledged. The project will form the basis of a Master's thesis at the University of Calgary.

### HISTORY AND PRODUCTION

The Mount Brussilof magnesite deposit was discovered in 1965 by a Geological Survey of Canada field party led by G.B. Leech. Baykal Minerals Ltd. and Brussilof Resources Ltd. subsequently staked over 300 claims in the area and drilling was carried out in 1970 and 1971. In 1971, Baykal and Brussilof amalgamated to form Baymag Mines Co. Ltd. and further drilling followed. The reserves were increased to 19 million tonnes grading 95.7 per cent magnesium oxide. In 1979, Baymag was acquired by Refratechnik GmbH, of Germany and production began in 1982. Proven and probable geological reserves calculated in 1980 were 9.5 million tonnes of 95 per cent (and greater) magnesium oxide in calcined product and 13.6 million tonnes of 93 to 95 per cent magnesium oxide in calcined product. Additional possible reserves were estimated at 17.6 million tonnes averaging 92.44 per cent magnesium oxide in calcined product (Schultes, 1986).

The magnesia being produced is caustic-calcined; the primary ore is roasted and then hydrated. The main uses for this product are in acid-neutralization processes in the pulp and

paper industry, and as an animal feed supplement. A more refined, high temperature product, "fused" magnesia, was introduced in 1983, and is used as a refractory in steel making.

### PREVIOUS MAPPING

The Cambrian formations of the southern Rocky Mountains have been extensively studied, most notably by Aitken (1966, 1968) and Cook (1970, 1975). Geological mapping by G.B. Leech (1966a, b) covers the west half of the Kananaskis Lakes sheet at a scale of 1:126 720 and includes the Mount Brussilof area (Figure 3-5-2). Since this time, several people have mapped the area immediately surrounding the magnesite showings, with significant contributions being made by Grove (1975), Baykal (1969), Godfrey (1969) and Leech (1977). Geological mapping at a scale of 1:50 000 will tie in these detailed studies to the regional setting and provide a framework for magnesite exploration.

### GEOLOGY

#### REGIONAL SETTING

The Mount Brussilof area is in the southern Main Ranges of the Rocky Mountains. The area lies in the Simpson Pass

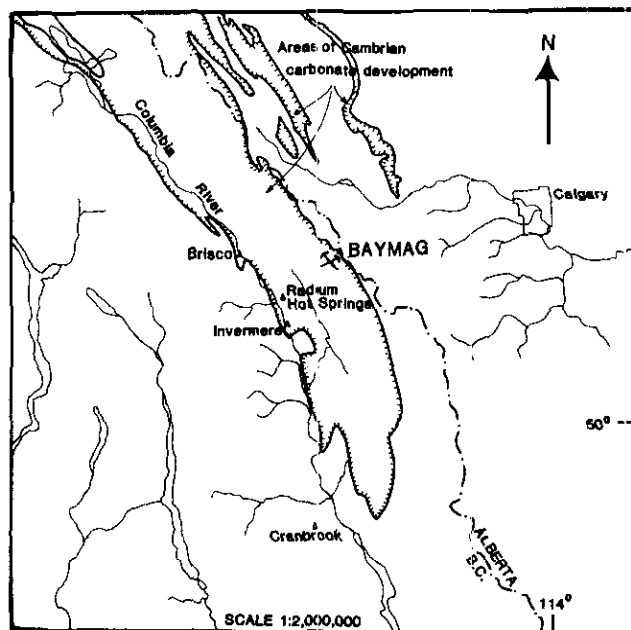


Figure 3-5-1. Location of Baymag Mount Brussilof magnesite mine.

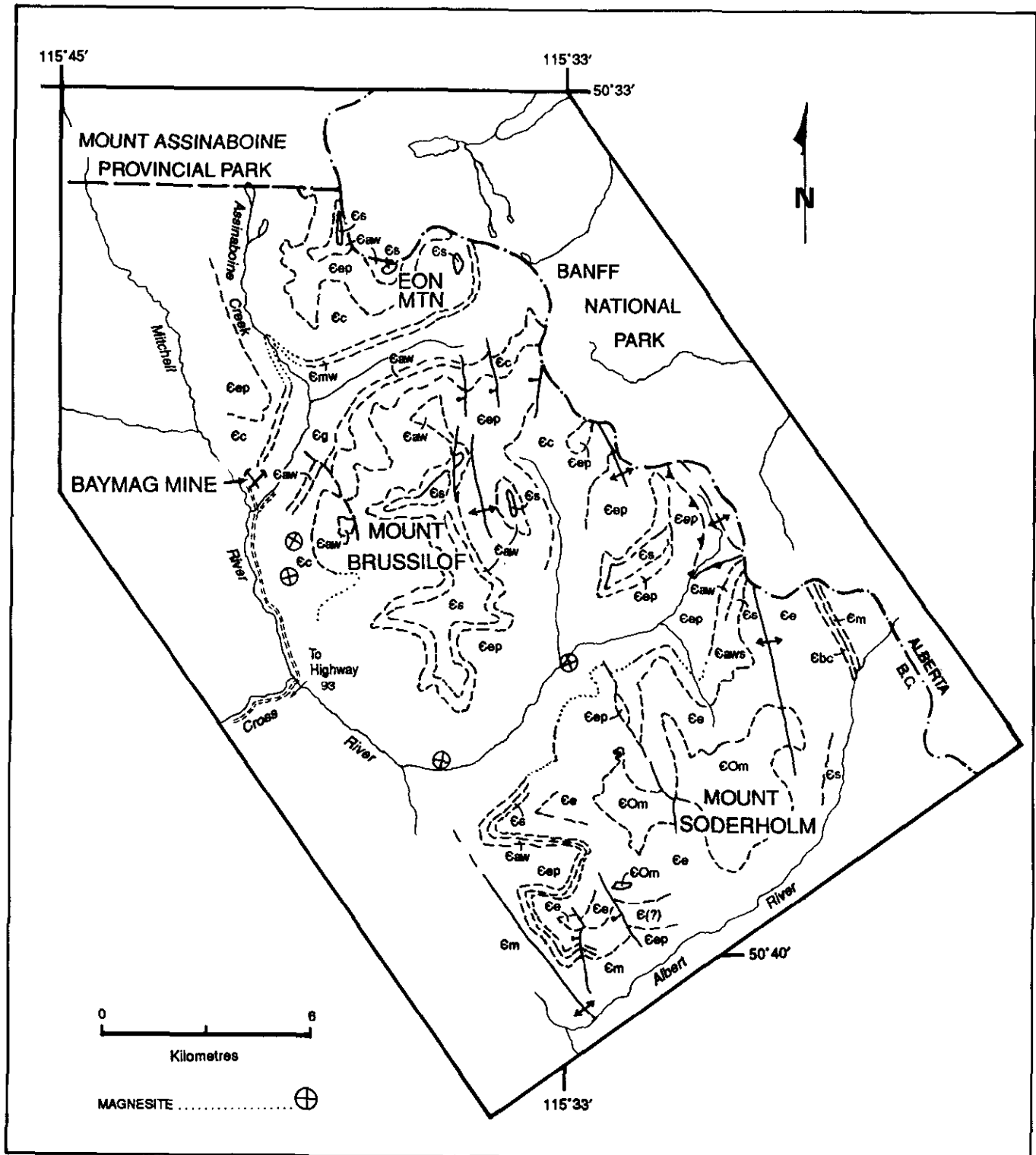


Figure 3-5-2. Geology of the project area (from Leech, 1966b). For map unit symbols refer to Table 3-5-1.

thrust sheet and contains rocks ranging in age from Early Cambrian to Early Ordovician (Table 3-5-1, Figure 3-5-2). Middle Cambrian deposits are extensive as they represent the period of maximum Lower Paleozoic marine transgression. Cook (1970) studied the Cambrian sequence in detail in the

Kicking Horse Pass region northeast of the study area. He correlated the eastern, mainly carbonate, facies with western shales, depicting a basin deepening to the west. The western correlative facies (Chancellor Formation) occurs west of the western boundary (Mitchell River) of the study area.

TABLE 3-5-1  
TABLE OF FORMATIONS\*

Period	Epoch	Formation	Lithology	Map Symbols (Fig. 3-5-2)	
Ordovician	Lower Ordovician	Survey Peak Fm. min. 240 m	green shale, siltstone, limestone, limestone nodules at top	€Osp	
		McKay Group.	undivided shale, limestone	€Om	
Cambrian	Upper Cambrian	Mistaya Fm. 150 m	thin-bedded limestone, dolomite partings, stromatolites	€m	
		Bison Creek Fm. 120 m	brown, grey shale, limestone interbeds	€bc	
		Lyell Fm. 300 m	thick-bedded limestone, dolomite, silty in part	€l	
	Middle Cambrian	Sullivan Fm. 90 m up 210 m md 150 m lw		shale	€s
				limestone, dolomite	
				shale, minor limestone, base silty	
		Waterfowl Fm. 150-210 m		thick-bedded dolomite, limestone	€aw
				shale, siltstone, dolomite, purple at base	
				limestone, dolomite, flaggy limestone with shale partings	
				massive dolomite, limestone	
				facies, undivided	
				green siliceous argillites, shale, thin-bedded limestone	
Lower Cambrian	Gog Group 600-900 m		massive dolomite, limestone, minor magnesite	€c	
			altered green silty shale, dark grey limestone, minor siltstone		
			thick-bedded quartz siltstone, shale interbeds, limestone at top		

\* From Cook (1970) Table 1. Eastern facies only. Map units from Leech (1966).

## STRUCTURE

The rocks in the Mount Brussilof area, east of the Mitchell River, are broadly concentrically folded, with axes trending northwest. The Baymag magnesite deposit lies on the western limb of one of these folds. Crumpling in the core of an anticline east of the deposit displays tighter folding and anomalously steep-dipping strata in an otherwise very gently dipping sequence.

## MAGNESITE DEPOSITS

The magnesite occurs with limestones and dolomites of the cliff-forming Middle Cambrian Cathedral Formation (Table 3-5-1) which ranges from 240 to 580 metres in thickness. The magnesite is coarse grained, white to buff coloured, weathering buff to rusty. At the Baymag deposit, the main pit contains very pure white magnesite. Several other magnesite beds were mapped in the area by Leech (1966b), and those opposite the mine, on the flanks of Mount Brussilof, were studied in detail by Godfrey (1969).

The magnesite is stratabound, forming bands 65 to 75 metres thick separated by well-bedded limestone and dolomite. The discrete beds have led to speculation whether the magnesite is primary in origin or the result of complete replacement of the original sediments by either hydrothermal or diagenetic processes.

Baykal (1969) and Jenkins (1973) both support a sedimentary origin for the magnesite, that is, deposition from concentrated brines in a shallow, saline environment. Evidence

for a sedimentary origin is seen in the sharp conformable contacts between magnesite and dolomite and limestone beds. Cook (1975) also noted that the thickness of the magnesite bed varies similarly to the other strata, which may reflect cycles of sedimentary deposition. Cook proposes, however, that the magnesite is secondary, and that the conformity results from preferential replacement of specific beds.

Leech (1977) noticed frequent lenticular pods of pyritized, coarse-grained white to pinkish dolomite within the magnesite, and Schultes (1986) also comments on the occurrence of dolomite and dolomite/limestone lenses. In September of 1988, the open-pit operation at Mount Brussilof had exposed a lens of well-bedded dolomite and silty limestone in sharp but irregular contact with the surrounding magnesite. Original bedding remains visible, coarse-grained magnesite crystals are seen growing in the sediments and locally completely replace the original dolomite. The dolomite/limestone beds form a discontinuous lens in the centre of the main mass of magnesite, suggesting it is a remnant of an original complete sequence which has been almost totally replaced. Further evidence for the magnesite being secondary is the presence of pyrite-filled veins which may indicate hydrothermal activity (Schultes, 1986).

## REFERENCES

- Aitken, J.D. (1966): Middle Cambrian to Middle Ordovician Cyclic Sedimentation, Southern Rocky Mountains of Alberta, *Canadian Petroleum Geology, Bulletin*, Volume 14, pages 405-41.

- (1968): Cambrian Sections in the Eastermost Southern Rocky Mountains and the Adjacent Sub-surface, Alberta, *Geological Survey of Canada*, Paper 66-23, 96 pages.
- Baykal, O. (1969): Preliminary Geological Report on the Mag 1 to 36 Mineral Claims, Mount Brussilof, Radium, British Columbia, Assessment Report 2040, 13 pages.
- Cook, D.G. (1970): A Cambrian Facies Change and its Effect on Structure, Mount Stephen–Mount Dennis Area, British Columbia, in Structure of the Southern Canadian Cordillera, J.O. Wheeler, Editor, *Geological Association of Canada*, Special Paper 6, pages 27-39.
- (1975): Structural Style Influenced by Lithofacies, Rocky Mountain Main Ranges, Alberta–British Columbia, *Geological Survey of Canada*, Bulletin 233, 73 pages.
- Godfrey, J.O. (1969): The Mount Brussilof Magnesite Project, British Columbia. A Preliminary Field Investigation, for *Baykal Minerals Ltd.*, Private report, December 1969, 63 pages.
- Grove, E.W. (1975): Summary Report, Mount Brussilof Magnesite Deposit (NTS 82J/13E), *Canex Placer Inc.*, Private Report, 10 pages.
- Jenkins, D.M. (1973): Baymag Property, 1972 Summary Report on Geology, for J.W. Ondrack, Private Report February 1973, 35 pages.
- Leech, A.P. (1977): Assessment Report, Yelo Claims, Cross River–Mitchell River Area of British Columbia, Assessment Report 6565, 10 pages.
- Leech, G.B. (1966a): Geological Map, Kananaskis Lakes West Half NTS 82J, *Geological Survey of Canada*, Open File 634.
- (1966b): Kananaskis Lakes Area West Half, *Geological Survey of Canada*, Paper 66-1, pages 65-66.
- Schultes, H.B. (1986): Baymag - High Purity MgO from Natural Magnesite, *Canadian Institute of Mining and Metallurgy*, Bulletin, May 1986, pages 43-47.