CLASSIFICATION OF MAGNESITE DEPOSITS WITH EMPHASIS ON THE MOUNT BRUSSILOF AND KUNWARARA TYPES

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Major magnesite deposits are hosted either by ultramafic or sedimentary rocks. Ultramafic rock-hosted magnesite ores consist mainly of talc-magnesite rocks (Simandl and Ogden, 1999) or they form "Kraubath-type" high-grade magnesite veins and stockworks (Zachman and Johannes, 1989; Paradis and Simandl, 1999).

Sedimentary-hosted magnesite deposits, discussed below, are either so-called "sparry" (Mount Brussilof - type) or "nodular/cryptocrystalline" (Kunwarara - type) deposits. Well-documented examples of sparry magnesite deposits are the Eugui deposit in Spain (Lugli *et al.*, 2001), the Mount Brussilof, Driftwood Creek and Marysville deposits of southeastern British Columbia (Simandl and Hancock, 1996; Simandl *et al.*, 1996), and the Veitsch deposit in Austria (Pohl and Siegl, 1986). Typically, sparry magnesite deposits are stratiform or lens-shaped and hosted by carbonates deposited on the continental platform. In many cases the magnesite-bearing horizon can be traced for several to tens of kilometres along strike (Simandl and Hancock, 1999). Most bodies are a few to tens of metres thick. The magnesite rocks are characterized by pinolitic, zebra-like (Figure 1) or xenotopic textures, and monopolar and antipolar growths (Pohl and Siegl, 1986; Simandl and Hancock, 1991, 1999; Lugli *et al.*, 2001). Typical grades for sparry magnesite deposits are 90 to 95% magnesite with resource estimates ranging from several million to hundreds of millions of tonnes. Although magnesite in some of these deposits has elevated iron content, magnesite from British Columbia deposits have very low iron in its crystal structure (Simandl and Hancock, 1996). High iron content adversely affects the refractory properties of the final product.

At Mount Brussilof (Figure 2), which is the only magnesite deposit currently in production in Canada, the high-grade ore is delineated by closely spaced drill holes, sampled, and selectively mined by open pit. Computer modeling, followed by controlled blasting maximizes the blending potential of the ore. Six daily production piles exist at any given time on the mine site. Subsequently, the ore is trucked to the processing plant where it is blended again if required (Knuckey, 1998). Typical grades of marketed products are given in the Table 1.

The Kunwarara orebodies in Queensland (Figure 3) are economically significant parts of an extensive nodular/cryptocrystalline deposit. The deposit is subhorizontal, extends over 63 square kilometres, and averages more than 10 metres in thickness within a

Figure 1. Sparry magnesite, zebra texture, Mt. Brussilof Mine.

tertiary sedimentary basin. Magnesite ore is overlain by dark humus-rich clay sediment. The waste to ore ratio is 0.4 to 0.5. Proven reserves at sites KG1, KG2 and KG3 orebodies are estimated at 18.6 million tonnes and the total resource is estimated at 75.8 million tonnes, including the nearby Oldman deposit (Queensland Metals Corporation Ltd, 2000). Magnesite nodules make up 20 to 95% by volume of the ore and range from 1 millimetre to 50 centimetres in diameter. They consist of either bone or porous magnesite. Analyses of nodules (four representative samples) collected by Burban (1990) indicate 94.4 to 98.2% MgO, 0.82 to 2.04% CaO, 0.69 to 2.76 % SiO_2, 0.17 to 0.29 % Fe_2O_3, 0.08 to 0.29% Al_2O_3, and 0.06 to 0.2 % MnO on LOI free basis. The boron content averages 0.002%. Mining is carried out by open pit; no blasting is needed. The ore is washed, crushed, screened, and further upgraded by scrubbing, heavy media separation and cyclones. If necessary, it is sorted

Figure 2. Mt. Brussilof, sparry magnesite deposit, southeastern British Columbia.

optically. Other Kunwarara-type deposits are Yaamba and the Triple Four deposits. The latter is reported to consist of 77 million tonnes of material containing 35 million tonnes of magnesite.

Unbeneficiated magnesite nodules contain 92.3% MgO (Anonymous, 1987). After processing, similar to the Mount Brussilof operation, the ore is carefully stockpiled and blended.

Mining of the nodular ores of the Kunwarara deposit is inexpensive because blasting is not required; however, ore processing from this type of deposit is more complex than for ore from Mount Brussilof-type deposits. Both deposit types provide sources of raw materials for calcined, deadburn and electrofused magnesia, magnesium hydroxide, and other value-added products. They have also proven to be good starting

TABLE 1. CHEMICAL COMPOSITION (WT %) OF SELECTED PRODUCTS MARKETED BY BAYMAG INC.

Product	Fused MgO[1]	Baymag 30[2]	Baymag 40[3]	Baymag 96[4]	Baymag 58[5]
MgO*	97.2	97.2	97	97	96.5
CaO*	1.7	1.8	1.9	1.8	2.2
Fe_2O_3*	0.5	0.6	0.6	0.6	0.6
Al_2O_3*	0.2	0.1	0.1	0.2	0.2
SiO_2*	0.4	0.3	0.4	0.4	0.5
LOI		2	5		0.1
Mg					58.2

1. Magnesia carbon bricks and other high performance refractory applications where resistance to chemical attack is needed.
2. Acid neutralizer in manufacturing of MgO compounds, water treatment agent, gas desulphurization and fuel additive.
3. Applications where high reactivity is critical.
4. Cellular acetate, specialty refractories, Epsom salt, mag-sulfate cements
5. Mainly in animal feed industry.

* Reported on loss free basis in wt%.

Figure 3. One of the Kunwarara mines, Queensland, Australia (nodular magnesite deposit).

material for production of magnesium metal.

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