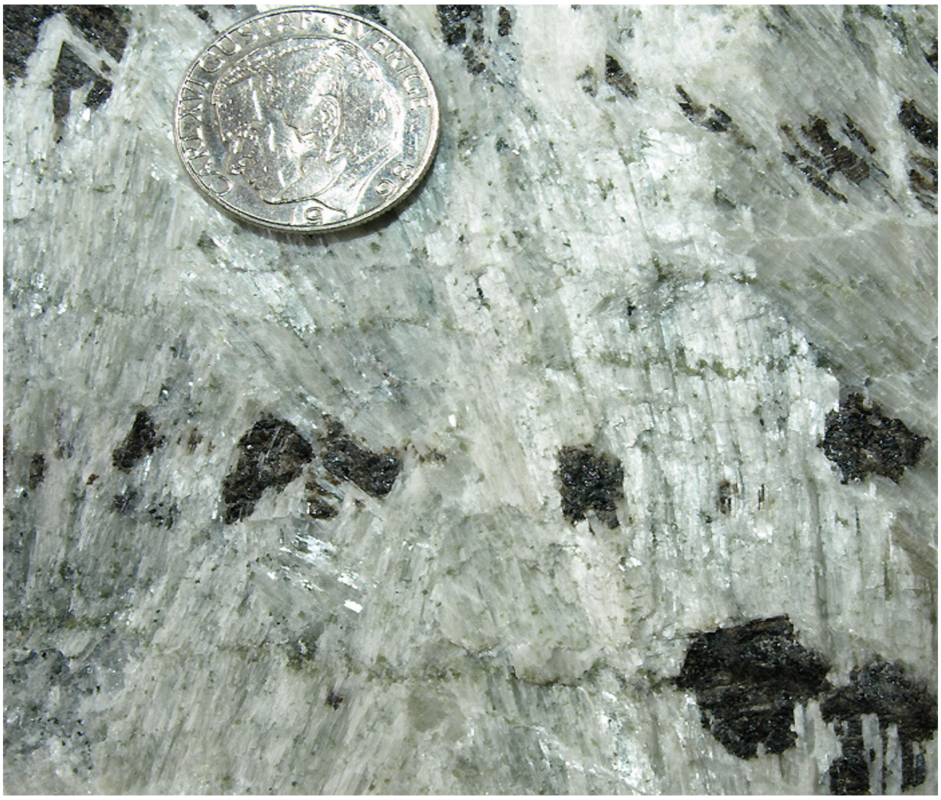
H G R AB (Ltd)

DESK STUDY ON WOLLASTONITE:

OCCURRENCE, MARKET, CONCENTRATION AND BENEFICIATION

MAY 2011



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CONTENTS

COMMISSION

The present report has been commissioned by Empire Mining Corporation, a company with an office at 307-475 Howe Street, Vancouver, British Columbia, V6C 2B3, Canada.

ASSIGNMENT

The assignment is to generate and deliver a desk study on wollastonite in terms of occurrence, market, concentration and beneficiation and what happens if it occurs substantively with copper sulphides in what looks like a clean mineralogy.

QUALIFIED PERSON

The person involved in the above assignment on behalf of HGRAB (Ltd) is Prof. Dr. Rob Hellingwerf, EuroGeol nr 465 (2003) and member of the Society of Economic Geologists (1988). RH's competence is based on more than 20 years of independent consulting in Europe, Russia and Africa, amongst others on wollastonite from Sweden, Greece, Siberia and Namibia. In addition, RH is attached to the Swedish School of Mining and Metallurgy in Filipstad and to the University of Gothenburg teaching advanced students in Ore Geology, Ore Microscopy, Exploration Geology, and Economic Geology.

BACKGROUND

Empire Mining Corporation is aiming to get hold of economic parameters surrounding the Bursa property located in western Turkey. Copper-molybdenum-gold seem to be the primary contributor to the project development. As wollastonite is a conspicuous constituent of the associated skarns, the question is whether wollastonite can be included in the economic class of minerals here. For this reason the present report contains information on uses, pricing mechanisms and beneficiation of wollastonite.

OCCURRENCE

Wollastonite commonly occurs in contact-metamorphic impure limestones, more rarely in high-grade metamorphic marbles (Hellingwerf, 1994; Hellingwerf et al., 1994) as the result of the following reaction:

$$CaCO_3 + SiO_2 \longrightarrow CaSiO_3 + CO_2$$

During contact-metamorphism silica is supplied by the intruding igneous bodies, and calc-silicate formation results in infiltration skarn development where the original sedimentary textures may have been enclosed by nematoblastic wollastonite (Figures 1 and 3).

During high-grade metamorphism silica is already present in the intercalated sediments such as chert, jaspilite, tuffite or sandstone, and calc-silicate formation results in a reaction skarn development (Figure 2).

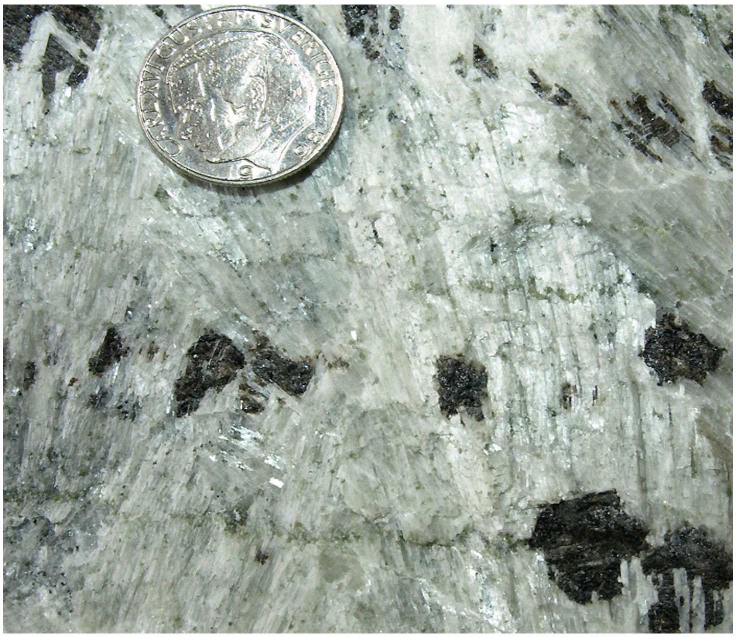

Figure 1
Contact-metamorphic wollastonite-(andraditic) garnet with enclosed relict sedimentary bedding expressed by green fine–grained diopside. Location: Gammalkroppa, C. Sweden (Olsson, 2002). (Photo Rob Hellingwerf)

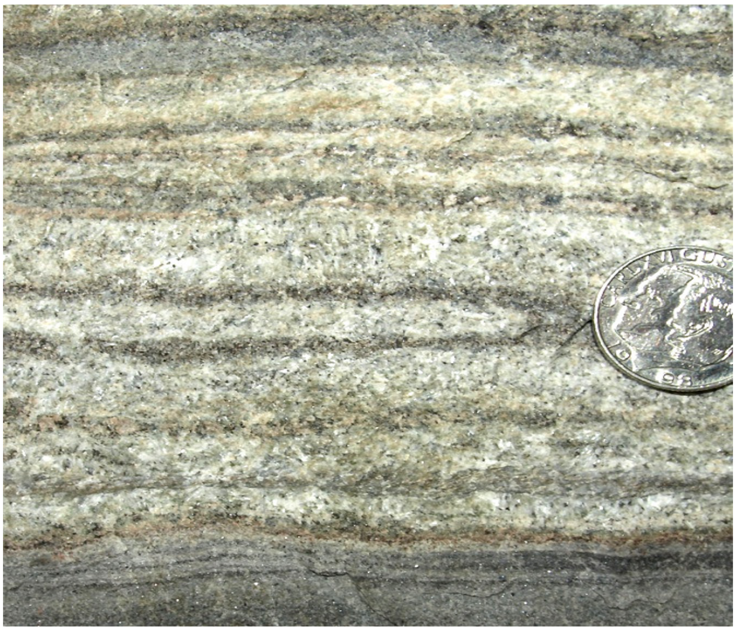

Figure 2
High-grade metamorphic volcanic-sedimentary sequence with silicates, carbonates and sulphides turned into wollastonite-diopside- garnet-sphalerite reaction skarn
Location: Zinkgruvan, Sweden
(Photo Rob Hellingwerf)

Figure 3
Contact-metamorphic off-white wollastonite with small amounts of manganese causing a brownish hue.
Location: Kimeria, N Greece
(Photo Rob Hellingwerf)

The wollastonite occurrences from e.g. Kimeria in Greece and Demirtepe in Turkey appear to be of the contact-metamorphic type (Figures 3 and 4).

Figure 4
Contact-metamorphic wollastonite accompanied by a.o. purplish bornite and yellow chalcopyrite. Location: Demirtepe, Turkey. (Photo Empire Mining Corporation)

In skarns around porphyry copper-molybdenum deposits wollastonite is locally encountered in skarns within the thermal aureoles of the intrusions. Examples of this type of wollastonite can be found e.g. in the Mines Gaspe skarns and porphyry copper mineralizations of Devonian age (Allcock, 1982), at the Commercial Limestone, Bingham, Utah (Reid, 1978), and in the Antamina Bornite-Wollastonite Zone (Peru) operated by CMA.

In particular, the paragenesis <u>bornite-wollastonite</u> has been predicted by Johnson & Norton (1985) as a result of hydrothermal conditions and chemical equilibria during skarn formation in porphyry copper systems.

MINERALOGICAL PROPERTIES

Wollastonite is a triclinic inosilicate, usually white, but with small amounts of Fe, Mn and Mg substituting for Ca. These small amounts cause the colour to deviate from pure white (Figure 3). The luster is vitreous to pearly. Wollastonite has several characteristics that make it commercially valuable, including determined non-toxic, with good insulation, chemical resistance, thermal stability and good dimensional stability, some reinforcing effect, excellent electrical properties, high brightness and whiteness, low moisture and oil absorption properties, and low volatile content. Because of these attributes, wollastonite is presently used in a variety of industrial applications, including ceramics, friction products, metallurgy, paint filler, and plastics.

Wollastonite is commonly associated with silicates such garnet, vesuvianite, pyroxene, amphibole, epidote and feldspars, and sulphides such as galena, sphalerite, bornite and chalcopyrite.

CHEMICAL PROPERTIES

Pure wollastonite consists of 48.3 wt% CaO and 51.7 wt% SiO2. The minor amounts of Fe and Mn substituting for Ca represent parts of the solid solution series in the $CaSiO_3$ - $FeSiO_3$ and $MnSiO_3$ - $CaSiO_3$ systems (Figure 4).

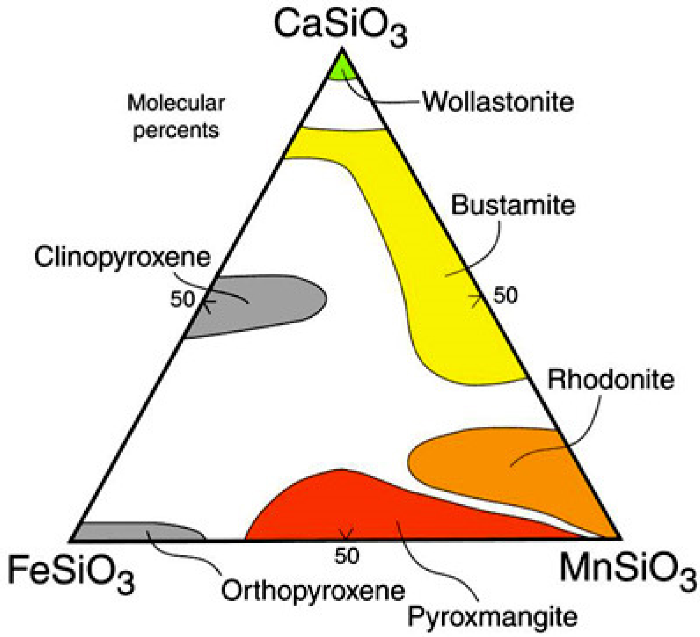

Figure 4
Solid solution series in the $CaSiO_3$ - $FeSiO_3$ and $MnSiO_3$ - $CaSiO_3$ systems. Wollastonite compositional variations are restricted (Source: www4.nau.edu).

PHYSICAL PROPERTIES

Wollastonite crystals display an acicular shape with two good cleavage directions (as a true pyroxenoid) and one imperfect direction. The crystals are often arranged in bladed crystal masses (see also Figures 1 and 3). The key properties are listed in Table 1 below.

Table 1 - Overview of Key Wollastonite Properties

Appearance	White
Morphology	Acicular
Aspect ratio	3:1 to 15:1
Molecular Weight	116
Specific Gravity	2.87 – 3.09
Refractive Index	1.63
pH (10% Slurry)	9.9
Water Solubility (grams/100 cc)	0.0095
Density (pounds per cubic foot)	181
Bulking Value (gallons per pound)	0.0413
Mohs Hardness	4.5 – 5.0
Coefficient of Expansion (mm/mm/º C)	6.5×10^{-6}
Theoretical Melting Point	1540 º C

The acicular morphology of wollastonite is displayed in Figure 5 below.

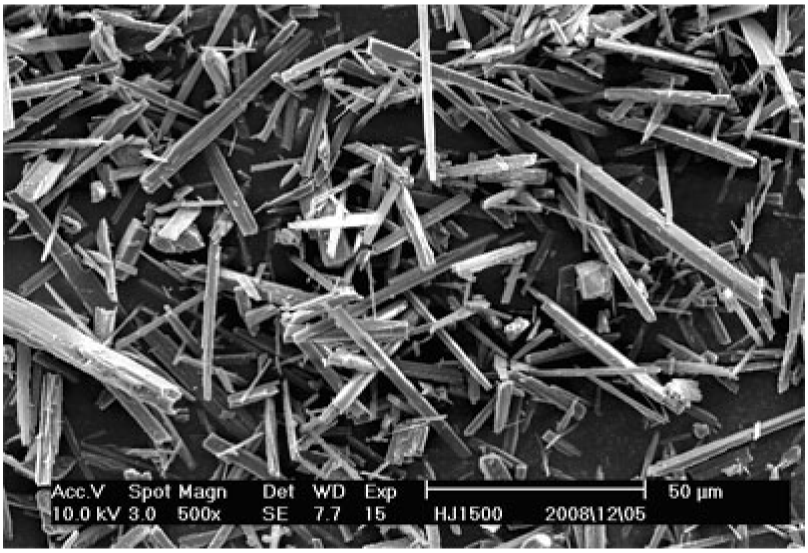

Figure 5
The acicular morphology of wollastonite

OPTICAL PROPERTIES

Wollastonite is optically biaxial (-), with 2V = 40 and a distinct dispersion r > v. Birefringence = 0.0140-0.0160.

WOLLASTONITE MARKET

PRODUCTION

World production data for wollastonite is not available for many countries and those that are available are 2 to 3 years old. Estimated world production of crude wollastonite ore was in the range of 530,00 to 550,000 tons in 2010, slightly greater than that of 2009 sales (Virta 2010, 2011, USGS).

Sales of refined wollastonite products probably were in the range of 450,000 to 490,000 tons in 2010 compared with 430,000 to 470,000 tons in 2009 (Virta 2010, USGS). On a global scale, China is the largest producer, followed by India and the USA (Figure 6). Production of wollastonite is presented in Table 2 below.

Table 2 : World Production of Wollastonite (In tonnes)

Country	2005	2006	2007	2008	2009	2010
China	350000	350000	350000	325000	300000	300000
India	128582	131572	118666	103459	132385	120000
USA	120000	125000	125000	90000	65000	67000
Mexico	27132	44280	50809	46844	29728	30000
Finland	15950	16200	16364	15600	16000	16000
Spain	30000	30000	10918	10100	7000	
Namibia	253	55	60	55	55	

Note: In addition to the countries listed, Turkey, Morocco, North Korea and Pakistan are believed to produce wollastonite. (*Source: World Mineral Production, 2003-2007).* A South African producer planned to mine wollastonite at Magata, Namaqualand.

Resources were estimated to be 3.2 million tons at an average grade of 52% wollastonite. Production was planned to be about 9,000 tons per year in 2011. The company constructed a mill on-site, with anticipated capacity to be 17,400 tons per year in 2012 and 23,300 tons in April 2014.

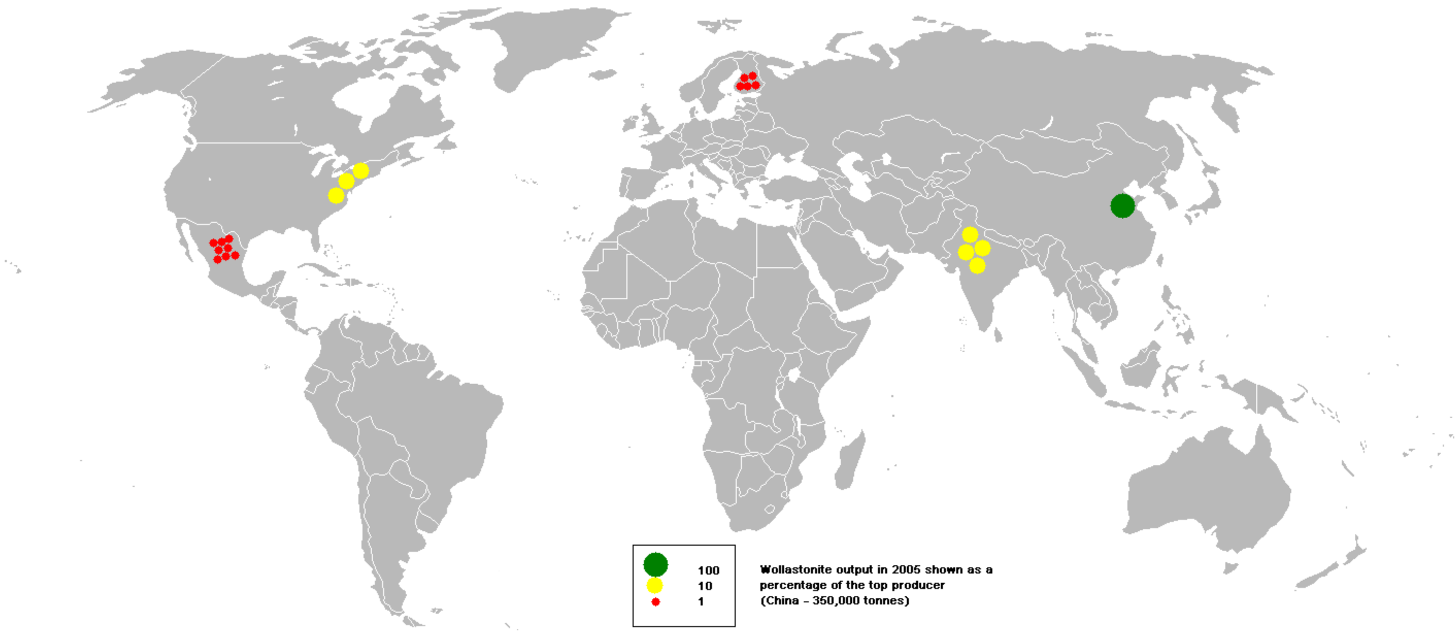

Figure 6 Wollastonite output in 2005 shown as a percentage of the top producer China (350,000 tonnes). Source: reference.findtarget.com

Additional data on the Indian wollastonite illustrates that for 2007-2008, exports of wollastonite amounted to 23,643 tonnes, mainly to Belgium (53%), Japan (15%), Germany (11%), the Netherlands (9%) and Italy (4%). India not only exported wollastonite for 2007-2008, it also imported 153 tonnes mainly from China.

<u>The Chinese product</u>

The Chinese wollastonite is of superior quality in terms of whiteness, purity, morphology and aspect ratio (Figures 7 - 10).

Figure 7
Wollastonite pieces from a Chinese producer (Photo Jilin Shanwei Wollastonite Mining Co., LTD).

Note the whiteness, purity and morphology.

Figure 8 Wollastonite lump ore stock piled for transport (Photo Jilin Shanwei Wollastonite Mining Co., LTD).

Figure 9 Wollastonite lump ore stock piled for transport (Photo Jilin Shanwei Wollastonite Mining Co., LTD).

Figure 10 In-pit crushing of wollastonite (Photo Jilin Shanwei Wollastonite Mining Co., LTD).

<u>The Indian product</u>

The Wolkem wollastonite from Rajasthan is very pure (Figure 11) though sorting is occasionally done by hand (Figure 12). Large bundles of thin prismatic crystals up to 8 cm long occur with a minimum of associated silicates.

Figure 11 Wolkem's wollastonite

Figure 12
Hand sorting of wollastonite at Wolkem's facility near Udaipur, Rajasthan

The NYCO product

The NYCO wollastonite (Figure 13) from the Willsboro operation (Figure 14) is processed into a variety of grades to suit a wide range of applications. The special attrition milling and air classifying systems result in consequent particle sizes and aspect ratios, with aspect ratios ranging from 20:1 to 5:1. The powder grade product is ground to mesh size specifications (200, 325 and 400 mesh) using ball or pebble mills. Their aspect ratios range from 5:1 to 3:1.

Figure 13
Wollastonite with diopside (green) and andradite (red) from the Willsboro operation, Essex County, New York

The fine particle size grades are produced by milling and air classifying to a top and medium specification with a typical aspect ratio of 3:1. Mesh sizes include 475, 1250 and 5000.

Figure 14
NYCO's U.S. operations are headquartered in Willsboro, New York, in the Adirondack Mountains near the southwestern shore of Lake Champlain.

The Partek product

The Finnish wollastonite in Lappeenranta is not one of the biggest deposits, but certainly one with the cleanest mineralogies (Figure 15). Large bundles of prismatic crystals up to 10 cm long occur with a minimum of associated silicates. The wollastonite appears as a narrow and steeply dipping sheet embedded by marbles.

Figure 15
The Finnish wollastonite from Parteks operation in Lappeenranta.

RESERVES

World reserves of wollastonite were estimated to exceed 90 million tons, with probable reserves estimated to be 270 million tons. However, many large deposits have not been surveyed, so accurate reserve estimates are not available (Virta 2010, 2011, USGS).

The Finish Lappeenranta wollastonite deposit reports that with the current production level (only ca 16.000 tonnes), the exploitation of the deposit (wollastonite and limestone) is expected to continue for at least another 100 years.

GLOBAL RESOURCES

World resources have not been estimated for wollastonite. The larger reserves are in China, Finland, India, Mexico, Spain, and the United States, which account for most of the global wollastonite production. Significant wollastonite resources also are in Canada, Chile, Kenya, Namibia, South Africa, Sudan, Tajikistan, Turkey, and Uzbekistan (Virta 2010, USGS).

RECYCLING

No documents are published on the recyclability of wollastonite. However, Hannu Venalainen, Marketing Manager of Nordkalk (operating the Lappeenranta wollastonite deposit in Finland), mentions in an interview with Automotive Industries that as wollastonite is a natural mineral, compounds containing wollastonite can be recycled. Wollastonite has a status of being a harmless mineral. When considering thermoplastic, the compounds can be used and moulded again. The needle shape structure of the particles may however experience minor damage.

SUBSTITUTES

The acicular nature of many wollastonite products allows it to compete with other acicular materials, such as ceramic fiber, glass fiber, steel fiber, and several organic fibers, such as aramid, polyethylene, polypropylene, and polytetrafluoroethylene in products where improvements in dimensional stability, flexural modulus, and heat deflection are sought.

Wollastonite also competes with several nonfibrous minerals or rocks, such as kaolin, mica, and talc, which are added to plastics to increase flexural strength, and such minerals as barite, calcium carbonate, gypsum, and talc, which impart dimensional stability to plastics. In ceramics, wollastonite competes with carbonates, feldspar, lime, and silica as a source of calcium and silica. Its use in ceramics depends on the formulation of the ceramic body and the firing method (Virta 2010, USGS).

MINING

Following the mining steps of the Antamina Bornite-Wollastonite zone, Bucyrus International 49RIIIs are used to drill 31.1-cm-diameter blastholes. The ore is blasted using ANFO and emulsion at a powder factor of 0.23 kg/tonne. The benches are 15 m deep, and the ultimate pit wall slope will be between 43^{o} and 57^{o} from horizontal.

The BI 495 rope shovels, with an 80-tonne bucket capacity, can fill the 232-tonne Caterpillar 793C trucks in just three passes. The heavy diesel equipment suffers in the thin air at high altitude. The engines have to be turbocharged, and a special blend of fuel is being used to reduce carbon build-up.

An in-pit 150-cm x 226-cm gyratory crusher reduces the ore to -15 cm. It is stored on the pit floor in stockpiles of up to 3 million tonnes, divided into six types: chalcopyrite copper ore with low or high bismuth (48%); chalcopyrite copper-zinc ore with low or high bismuth (42%); and bornite copper ore with low or high zinc (10%). Material between 0.7 and 1.0% Cu equivalent, is being stockpiled for processing at the end of mine life. (Source: Canadian Mining Journal)

BENEFICIATION

NYCO WOLLASTONITE

In case wollastonite can be mined selectively, it needs to be processed and milled in the following steps: 1) Jaw crusher as the primary crushing process, 2) Cone crusher 10 - 30 mm in secondary or tertiary crushing processes, 3) Mill for wollastonite powder down to 200 - 325 mesh, 4) Ultrafine grinding mill for ultra-fine wollastonite powders down to 800, 1250, 2000 and 2500 mesh.

The NYCO wollastonite from the Willsboro operation is extracted by conventional surface mining methods. Mining is followed by several stages of crushing for initial size reduction. The wollastonite is then separated from its associated minerals by one of the following methods as follows:

1. Successive stages of fine crushing followed by dry magnetic separation to remove minerals such as garnet and diopside. These minerals are to varying degrees magnetic and generally several steps of magnetic separation is required. Here also bornite and chalcopyrite would be removed. Thermal drying of the ore is carried out to ensure effective magnetic separation.

2. Alternatively, initial grinding is followed by flotation to remove minerals such as calcite, diopside, and feldspars. The flotation separation can be achieved by using dodecylamine or tallow-1,3-diaminopropane as collector and sodium hexamctaphosphate or starch as depressants (Weiquan, 1991; Prabhakar et al., 2003, 2005).

3. Filtration and thermal drying of the resulting wollastonite concentrate is required after wet processing.

4. After the wollastonite ore has been beneficiated, grinding to preserve the aspect ratio is carried out by a variety of specialized grinding techniques. Specialized air classification also plays an integral part in these processes.

THE ANTAMINA BORNITE-WOLLASTONITE

The Antamina operation has been selected as a reference for ore processing, as the mineralogy and general geological situation (Figure 16) seems to display a number of similarities with the Bursa occurrence. However, mineral processing of the Antamina Bornite-Wollastonite aims at concentrating the metal sulphides while treating wollastonite as waste. The line involves a 1.8-m-wide conveyor that moves the crushed ore from the pit to the concentrator.

The grind size is relatively coarse at 100 µm for zinc ore and 150 µm for copper-only ore. Grinding consists of a single closed circuit SAG mill without pebble crushing, followed by three ball mills in parallel. The mills are from FFE Minerals Canada, and Technequip supplied the hydrocyclones.

The material is amenable to conventional flotation as the base metal sulphides are coarse grained and the iron sulphide content is low.

The ball mill discharge enters three rows of seven copper (bulk) flotation rougher cells. The overflow goes to the zinc flotation side. The underflow follows the copper side, passing through five cleaner scavenger tank cells and two stages of cleaners, plus regrind in two vertical grinding mills. Minnovex supplied the column flotation cells.

The bulk concentrate product (30% Cu and up to 3% Zn) is thickened and then retreated in a reverse flotation circuit to recover a separate molybdenum concentrate and/or to remove a bismuth/lead concentrate. The copper concentrate slurry, at 42% water, is ready for shipment via pipeline.

The slurry entering the zinc side is conditioned and then passes through a similar route of roughers, cleaners and scavengers, with regrind. The zinc concentrate (54% Zn and up to 1.8% Cu) is thickened for transport via pipeline. Reject from the zinc roughers forms the final tails. The expected metal recoveries are 89-95% for copper, 80-86% for zinc, 65-90% for silver and 65-70% for molybdenum (Source: Canadian Mining Journal).

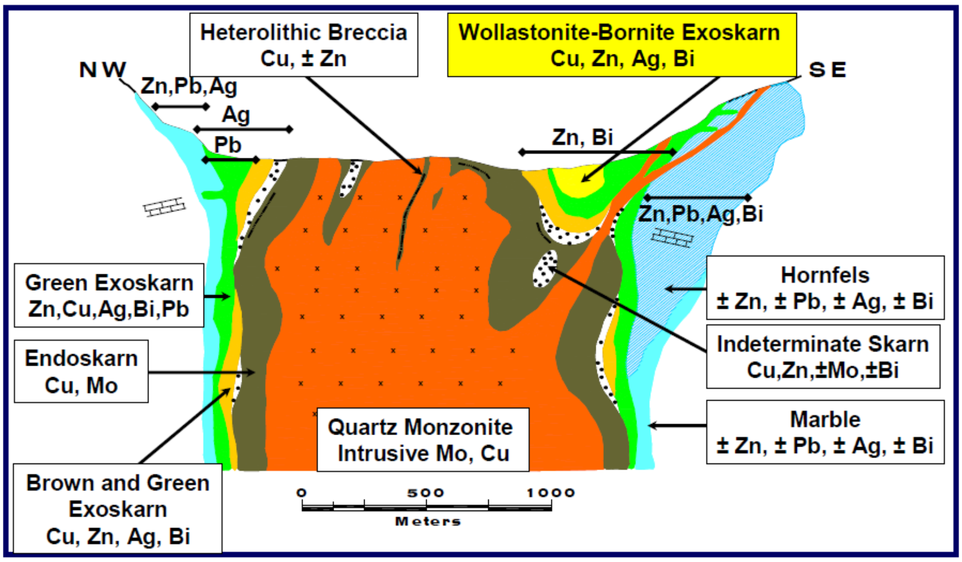

Figure 16 Schematic cross section, Antamina Bornite-Wollastonite looking NE (after Lipten & Pacheco, 2004).

THE JOKKMOKK CALCITE-WOLLASTONITE OCCURRENCE

The complexly interlayered calcite-rich wollastonite, microcline, and iron-garnet ore of Jokkmokk Hhas been tested with stepwise grinding, wet high intensity magnetic separation (WHIMS), reverse flotation and starvation flotation.

Stepwise grinding avoids the overgrinding of soft calcite. WHIMS removes the colored iron-garnet impurity and thereby increases the whiteness of the product.

Reverse flotation enables a simple flotation circuit and starvation- flotation helps to optimize the physicochemical conditions in cleaner flotation by giving rougher products of narrow particle size distributions.

PROPOSED BENEFICIATION FOR THE BURSA WOLLASTONITE

Based on the commercially applied beneficiation processes in the above operations, the following rough scheme is proposed for the Bursa wollastonite:

1. Stepwise fine crushing/grinding, avoiding the overgrinding of soft calcite
2. Dry magnetic separation (loose garnet, diopside, bornite, chalcopyrite)
3. Flotation (loose calcite, diopside, feldspars; small amounts of quartz, if present, may co-float with wollastonite)
4. Filtration
5. Thermal drying
6. Grinding with preservation of the aspect ratio
7. Air classification

TAILINGS DISPOSAL

The tailings disposal facility of Antamina comprises a 230-m-tall impermeable dam wall is the highest rock-filled dam in the world. Because the tailings are rich in suphides, they could be acid-generating. Therefore, disposal will be subaqueous until beaches are established. Most of the disposal will eventually be subaerial from the beaches.

About 80-90% of the water used in the concentrator is recycled, including water reclaimed from the tailings facility. Diversion ditches constructed around the facility minimize natural water inflow. In average years, there will be little or no water discharge during the dry season. Seepage from the tailings facility can be collected in a downstream pond and pumped back to the tailings pond if needed to maintain downstream water quality (Source: Canadian Mining Journal).

INDUSTRIAL USES

The mineral properties of wollastonite make the mineral suitable for many different types of industrial applications. At present, the mineral is used in six main types of applications:

Ceramics: Wollastonite is currently used in structural clay products, such as bricks, sewer pipes, and tiles; whiteware products, such as floor and wall tile and porcelain; and various kinds of advanced ceramics. The use of wollastonite in these products offers benefits such as enhanced mechanical reinforcement and strength, shorter drying times, reduced expansion during exposure to heat, and improved surface integrity and appearance.

Construction Products: In the construction industry, wollastonite is finding growing acceptance in many types of products, including concrete, mortar, sanitary pipes, wood composites, caulking and sealants, and calcium silicate board. In addition to providing improved strength and dimensional stability, the use of wollastonite in construction products has also been found to offer other important advantages such as improved weather resistance, greater resistance to mildew, and diminished vulnerability to surface and structural damage such as scratches and cracks.

Paints and Coatings: Wollastonite has been used in many types of industrial and marine paints, as well as in powder, architectural, and roof and underbody coatings. The benefits that result depend on the nature of the specific application, but some of the more common advantages the wollastonite offers include greater durability and corrosion resistance, improved film integrity and adhesion properties, increased resistance to cracking and chipping, better scrub and weather resistance, enhanced colour fastness, and reduced susceptibility to ultraviolet degradation.

Metallurgy: As a natural low temperature fluxing mineral, wollastonite is well-suited to metallurgical applications. Currently the most important of these applications are found within the steel industry, where the mineral has been found to be highly effective in enhancing continuous casting processes. Key benefits resulting from the use of wollastonite have included prevention of re-oxidization, improved lubrication, better absorption of non-metallic inclusions, and more uniform heat transfer.

Plastics: Wollastonite has proven to be an ideal additive for enhancing the performance of fibre-reinforced polymer composites and engineered plastics that are used in a wide variety of industries. When used in these products, the mineral serves to help improve dimensional stability, enhance strength and stiffness properties, reduce susceptibility to heat distortion and shrinkage, and provide improved surface quality and durability.

In addition, wollastonite has also been shown to improve electrical insulation properties and in many cases has resulted in both attractive cost savings and greater scrap reduction.

Friction Materials: Wollastonite is finding growing acceptance as a source of reinforcing fibres and fillers in various types of friction materials. Increasingly, it is being used as a replacement for more traditional materials such as asbestos, chopped or milled glass fibres, or synthetic materials.

Common applications include friction papers and vehicle components such as drum linings and disc pads. When used in these applications, benefits that result include improved physical and mechanical properties, reduced susceptibility to cracking, noise reduction, and in many cases, noticeable cost savings.

According to statistics of the USGS, the applications in plastics and rubber products are estimated to account for 25% to 35% of U.S. consumption, followed by ceramics with 20% to 25%; paint, 10% to 15%; metallurgical applications, 10% to 15%; friction products, 10% to 15%; and miscellaneous, 10% to 15%.

EMERGING APPLICATIONS

The versatility of wollastonite suggests that as time passes and new technologies are developed many new applications for the mineral will continue to emerge. Some of the applications that are now in their infancy but which show great promise for the future include the following:

Health Care: In recent years, wollastonite has shown very encouraging results when used as a bioactive ingredient in applications such as bone cement, ceramic joint replacement, and dental reconstruction.

Agriculture: Wollastonite has been successfully used to help reduce acidity in crop lands.

Environmental Management: Impressive successes have been achieved in using wollastonite to restore forests and wetlands that have been damaged by acid rain. Additionally, a recent application is its use in so called water pollution control systems, in which wollastonite absorbs heavy metals from polluted aqueous solutions (Lifvergren, 1997; Andersson, 1999; Hult, 1999; Jonsson, 1999). The underlying mechanism is probably the high alkalinity of wollastonite when in contact with water, causing the heavy metals to precipitate as metal hydroxides onto the wollastonite powdered surfaces.

Waste Management: Through its effectiveness in helping to remove phosphorous content, wollastonite has contributed to improving the management of human and animal waste.

SYNTHETIC WOLLASTONITE

Synthetic wollastonite is manufactured in countries that either do not possess the natural mineral or for whom the cost of importing natural wollastonite is uneconomic. The sintering process developed at Wülfrath in Germany is the most economic process. It requires quartz flour and finely ground limestone or dolomite, which are mixed and heated in a rotary kiln to a temperature below the melting point of wollastonite (Dumont, 2004).

The main use of synthetic wollastonite is in ceramic applications, such as earthenware. It is also used in fast-firing bodies for wall tiles, porcelain and sanitaryware, as a rheological additive for resins and paints, as a reinforcing agent for different polymer matrices, as a carrier for dry liquids, as a component in asbestos-free friction materials, as a carrier in chemical and biochemical catalytic reactions, and in flooring and roofing felt (Dumont, 2004).

PRICES

Prices for wollastonite were reported in the trade literature to range from $80 to $1,984 per ton (2010). Products with finer grain sizes and being more acicular in morphology sold for higher prices. Surface treatment, when necessary, also increased the selling price.

Quoted prices (detailed for 2004) should be regarded as guidelines because actual prices depend on the terms of the contract between the seller and the buyer:

US$ / t	Product
50 - 60	Chinese powder
1700	ultrafine surface-treated wollastonite
205	acicular wollastonite, 200-mesh
248	acicular wollastonite, 325-mesh
275	acicular wollastonite, 400-mesh
345	acicular, high-aspect ratio
80 – 100	free on board, in bulk, 200-mesh
90 – 110	free on board, in bulk, 325-mesh
89 – 510	filler grade from Asia and Africa
58 – 137	ceramic grades from Asia.

FUTURE OUTLOOK

There is an increasing demand for wollastonite in the international markets, especially in ceramic and plastic industries and in construction activities. The use of wollastonite in water pollution control systems is limited at this moment, but expected to expand in the light of stricter water quality regulations and re-use of the wollastonite fractions after the water-cleaning processes.

RECOMMENDATIONS

At present, the global supply of wollastonite is condensed, and has been for many years. Outside China there are only a handful of producers in North America, Europe and India. This is due to the high technical and commercial barriers that potential producers have to overcome to penetrate wollastonite markets, rather than to a lack of suitable reserves.

A potential producer will have to offer an extremely high-quality product and a cost-effective processing line. The alternative is to exploit a niche market if it is to compete with established producers. A possible alternative would be to supply a lower-grade product in a local or regional market that would be located some distance from its usual source of supply.

Cost-effective processing techniques and proximity to consuming markets will, however, be the key factors contributing to the success or failure of any potential development.

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For ***HGRAB****:*
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