

Barite and Witherite

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Mineralogically, barite (barium sulphate, BaSO_4) resembles celestite (strontium sulphate mineral, SrSO_4), not only in crystal habit, hardness and colour, but also chemically to some degree. Barium can substitute for strontium since the atoms have a similar ionic radius. Barite is also referred to as barytes or baryte.

The only other commercially available barium mineral is witherite (barium carbonate, BaCO_3). Witherite is a rare mineral, primarily since it easily alters to barite. It alters when sulphuric acid from sulphide minerals dissolves the witherite and the sulphur combines with the barium and forms barite. However, in some localities, such as Illinois in the United States, it occurs in relative abundance as new specimens are formed from calcite that lose calcium to barium, thus forming witherite.

Barite is most commonly coarse grained; it also occurs as platy crystals or fine-grained compact masses that may be white, light yellow, light grey, brown, pink or blue. When pure, barite contains up to 58.8% barium or 67.7% barium oxide, the balance being mainly sulphate, or carbonate. A commercially important characteristic of barite is its specific gravity of 4.5 g/cm^3 . Although heavy, it is soft with a hardness of 2.5 to 3.5 on the Mohs scale (i.e., a fingernail cannot scratch it, a copper penny may or may not, but a knife blade will). Some barite deposits may be classified as hard or soft depending on the ease with which the mineral may be ground. Although barite contains a heavy metal (barium), it is not a toxic chemical since it is relatively insoluble in water and acid, and therefore can be used as a chemically inert material.

Inclusions of other minerals may reduce the specific gravity of barite, but a high density, chemical inertness and widespread occurrences are the properties that are valued for barite's most important application as a weighting agent in drilling fluids. Colour and chemical purity are important properties when considering the suitability of

barite for small non-drilling higher-value applications such as fillers in marine and industrial paints, in brake lining/friction materials, and in plastics. It is also important in the manufacture of paper, glass and rubber. It is also used in radiology for x-rays of the digestive system.

BARITE DEPOSITS IN CANADA

Barite deposits have been found in all provinces except Alberta, Saskatchewan and Prince Edward Island. More than 150 have been identified in Canada and many of these are small and of limited commercial interest; however, some have been developed as producing mines.

Barite deposits can be classified into three groups: vein, replacement and residual. There are no known residual deposits in Canada. Residual deposits are formed by the weathering of barite-bearing rocks and consist of barite fragments in a layer of soil or clay. The barite is derived from vein or replacement bodies in soft sedimentary host rocks. Barite fragments from sand size to boulder size are usually concentrated in a zone overlying the source of barite.

Most of the known Canadian barite occurrences are of the vein type. The vein deposits in the Atlantic provinces contain barite that is mostly coarse grained with a platy texture. The barite-fluorite veins that comprise the Lake Ainslie system (Nova Scotia) are developed along strong fault cavities and subsidiary tension fractures. The majority of the veins are concentrated in three specific areas east of Lake Ainslie. The barite vein deposits of Ontario are compact, coarsely granular and massive. Barite from the Kootenay district of British Columbia varies from friable and finely granular to compact and platy, to fine grained and compact. Most domestic production has come from replacement deposits, which are similar in many respects to vein deposits but which replace in whole or in part certain beds of sedimentary formation. Limestone is often the host rock and these deposits are usually more extensive than vein types, although the BaSO_4 content may not be as uniform or as high. There are four main replacement orebodies in Canada: the Walton orebody in Nova Scotia, the Giant Mascot and Mineral King orebodies in British Columbia, and the Buchans orebody in Newfoundland and Labrador.

With respect to witherite, there are not many localities for this mineral, but a small deposit exists at Thunder Bay, Ontario.

CANADIAN SUPPLIERS

Newfoundland and Labrador

Barite has been produced intermittently in this province, most recently by Phoenix Minerals in 1998-99 (from small open-pit operations at Collier Point, Trinity Bay, and by Pennecon Ltd.), who in 1999 produced 35 000 t of barite and celestite from a quarry at Boswarlos in the western part of the province. Barite production was mostly produced as a weighting agent for the drilling mud used in petroleum exploration.

In 2001, Buchans Barite Co. Ltd., a private company, was awarded a three-year contract to supply barite to M-I LLC for the offshore drilling market after the withdrawal of United Bolero Development Corp. Buchans Barite was hoping to restart the barite mill in Buchans using material recovered from the Buchans base-metal tailings pile in Red Indian Lake located in the central part of the province. The deposit contains 1.5 Mt of recoverable material at 30% barite. The product was going to be shipped to a toll grinding facility in Musquodoboit, Nova Scotia (at Mosher Limestone plant), where it was to be ground to M-I's specifications.

Nova Scotia

E-Z-EM Canada, Inc. (Nystone Division) is the only barite producer in Nova Scotia. Nystone has a barite-siderite deposit in early carboniferous sediments located 1.6 km northeast of Brookfield at Upper Brookfield, Colchester County. During 1997, the surface mine was dewatered and approximately 1497 t of ore were mined from the pit that was crushed and screened. All of the material that had previously been mined and stockpiled at the mine was trucked to the company's plant at Debert. The mill circuit at the plant consists of gravity separation, magnetic separation, acid leaching, and ultra-fine grinding in a paddle mill to produce USP pharmaceutical-grade barium sulphate with a minimum purity of 97.7% that sells for over \$1200/t. During 2002, there was no production from the surface mine; however, 2369 t were processed at the company's plant. This product was shipped to the parent company, E-Z-EM, Inc. in Westbury, New York, until 2004, where it was prepared and packaged into barium kits that were sold to hospitals and medical clinics. Therapex in Montréal, Quebec, now replaces the Westbury plant for the global market. Present Nystone production is ongoing, although less than previous years, since formulations for medical barium kits require much less barium.

Lynx Minerals Corp. of Trenton had acquired the mineral rights and purchased the surface rights for the Lake

Ainslie barite-fluorite deposit (on Cape Breton Island) from Conwest Exploration Company Ltd. In 1998, Lynx produced and sold 5000 t (reserves of 200 000 t) of mud-grade barite in 1999 for the offshore drilling market before suspending operations. In 2002, Atlantic Industrial Minerals Inc. (AIM) of Halifax had entered into a memorandum of understanding to acquire the assets of Lynx but, in 2004, AIM decided not to proceed with its previously announced purchase of Lynx Minerals Inc.

Quebec

Although not a producing barite mine, Therapex (Division and Trademark of E-Z-EM Canada Inc., a global leader in the manufacture of barium products) is a provider of turnkey outsourced drug development and manufacturing services that produces high-purity barite for pharmaceutical use (main medical use is barium meals for X-rays of the intestinal tract); the company obtains its natural barite from Nystone, Nova Scotia, and also precipitated barite from Germany. A third source presently comes from the United States for which supply negotiations are in process. In 2004, E-Z-EM, Inc. closed its Westbury, New York, operations where it prepared and packaged barium kits sold to hospitals and medical clinics around the world and transferred all of its activity to Therapex in Montréal.

Ontario

Extender Minerals of Canada produces approximately 12 000 t of barite annually from the North Williams underground mine (brown barite vein deposit-type) and from processing operations close to Matachewan near Kirkland Lake. The company produces barite powder and aggregate (grades 93-97%) for the friction, plastic, rubber, paint, adhesives, casting and other specialized industries.

Dynatec Corporation of Richmond Hill (previously Highwood Resources Ltd.), under its Mineral Products Division, markets barium sulphate and barite produced in Marmora, Ontario. Dynatec has expanded production at the Canada Talc Division (CTD) in Madoc and upgraded the mill in Marmora to produce over 20 000 t annually. The company produces ground and micronized talc and dolomite products; it also processes other mineral filler products, principally all barite imported from China, at its CTD plant. This facility now produces all of its high-end barite (barium sulphate) filler products for the high-end manufacturing industries in the United States and South America that were previously produced by Mountain Minerals Division (i.e., paints and plastics grades).

Alberta

Dynatec Corporation operates a barite processing plant at Lethbridge. The product is used mainly in drilling muds. All of the barite comes from the U.S. state of Nevada.

British Columbia

Dynatec Corporation operated an underground barite mine in Parson that closed in 1999. The ore from the mine was shipped to the processing plant at Lethbridge, Alberta. The product was used mainly in drilling muds, but also in paints and plastics.

Fireside Minerals Inc. of Red Deer, Alberta, operates a high-grade white barite mine near the Yukon border in a poorly exposed area in the Liard Plain and a processing plant at Watson Lake (125 km west of the mine), located in the Yukon. In 2001, Fireside mined 18 000 t of barite from the Bear vein at the Fireside mine; 15 000 t was also mined from the West Bear pit. The barite produced is suitable for filler applications or for use in drilling mud. The Fireside mine used jigs to recover 10 000 t of barite for the northwestern B.C. and Alberta oil and gas drilling industry. In 2002, Fireside shipped only 1500 t. In recent years, production has been intermittent.

MINING AND PROCESSING

Commercial barite is mined from surface or near-surface deposits by open-pit or underground mining methods. The broken ore is trucked to the processing plant where it may be washed by log washer or trommel screen to remove adhering clay and low-grade fines before reduction by jaw or impact crusher to 25 cm or finer for further processing. The degree of further processing and concentration depends on the grade of ore, identified end use, and liberation size (i.e., the size at which the barite is essentially free

of contaminating impurities). If further size reduction is required, this can be accomplished by jaw, impact, cone or roll crushers.

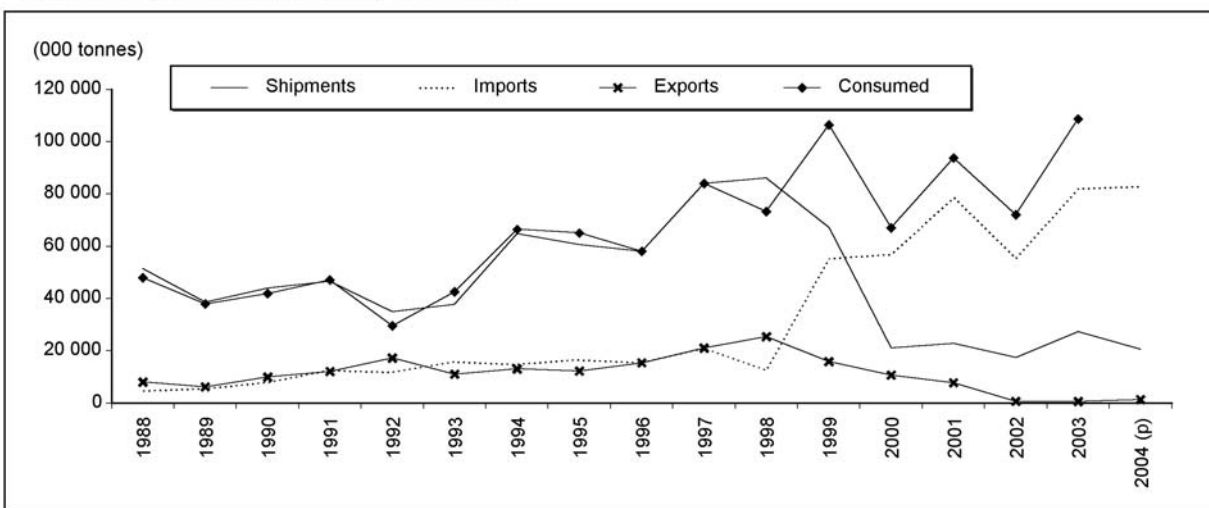
The concentrated barite may be ground to final size specifications by roller mill, paddle mill or other suitable unit. A 45-micron product is normally specified for drill-mud barite; however, a much finer product may be required for other applications, such as chemical and pharmaceutical preparations.

CANADIAN SHIPMENTS, CONSUMPTION AND TRADE

Preliminary data (Table 1) reported by Canadian producers for 2004 indicate shipments were valued at \$4.2 million, almost a \$1.0 million decrease from 2003, for a quantity of 20 601 t (a decrease of 6768 t from 2003). The statistical graph demonstrates that shipments from 1998 have declined dramatically (from 86 159 t in 1998 to 20 992 t in 2000) and stabilized in the 20 000-t range. The U.S. Geological Survey's 2003 review on barite shows that Canada's rank fell to 24th place in 2003, compared to its previous 8th place ranking in 1999 in terms of barite production. Global production for 2003 was estimated at over 6.5 Mt, led by China with 3.5 Mt followed by India with 700 000 t and the United States with 468 000 t.

Preliminary imports (Table 1 "HS 251110 - natural barium sulphate - barite only") were valued at \$7.6 million for 2004, a decrease of almost \$0.8 million from 2003, even though the quantity of imports increased from 81 852 t in

Figure 1
Barite Statistics and Trends, 1988-2004



Source: Natural Resources Canada.
(p) Preliminary.

2003 to 82 888 t in 2004. The bulk of imports was supplied by the United States with 63 508 t (76.6%) valued at \$6.2 million (81.4%). As can be seen in the statistical graph, imports of barite increased dramatically (562.8%) during the 1998-2004 period (i.e., from 12 506 t to 82 888 t).

Preliminary imports (Table 1 “HS 251120 - natural barium carbonate - witherite only”) were valued at \$819 000 for 2004, a decrease of almost \$696 000 from 2003; the quantity imported decreased from 3397 t in 2003 to 1821 t in 2004.

As for the balance of imports (barium/strontium compounds), quantities increased to 19 457 t in 2004 from 16 883 t in 2003 while the value decreased from \$14.2 million to \$13.5 million, respectively.

Preliminary exports (Table 1 “HS 251110 - natural barium sulphate - barite only”) were valued at almost \$1.2 million for 2004, an increase of almost \$0.6 million from 2003; the quantity exported increased from 572 t in 2003 to 1310 t in 2004. The bulk of exports was delivered to the United States, amounting to 920 t (70.2%) valued at almost \$1.0 million (82.4%). As can be seen in the statistical graph, exports of barite have decreased continuously since the 1998 peak of 25 395 t to the low of 572 t in 2003 to rebound slightly in the preliminary reported figures of 1310 t for 2004.

Canada has no production of natural barium carbonate (witherite); therefore, it does not export this mineral. Nevertheless, the balance of export (barium/strontium compounds) quantities decreased to 203 t for 2004 from 1287 t in 2003, with values of \$2.2 million and almost \$1.3 million, respectively.

PRODUCTION AND MARKET CONSIDERATIONS

Barite originates in many countries. Various grades of barite are suitable for use in chemical markets, pigments applications, industrial fillers, and drilling muds. The economics of drilling barite’s low delivered cost rules out many of the world’s known deposits.

There is a direct relationship between barite demand and oil/gas exploration and production drilling activity, which in turn depends on the present and projected price of oil and, to a lesser extent, demand for gas. Reports of world drill rig counts are the main criteria for evaluating the potential demand for barite. Drilling activity is highly volatile.

Most barite is ground to a small uniform size before it is used as a filler, extender or additive to industrial products,

or as a weighting agent in petroleum well-drilling mud based on specifications set by the American Petroleum Institute (API).

PRICES

Oil and gas price levels are linked to factors like the state of the world economy, international politics, and changes in technology related to fuel burning.

According to *Industrial Minerals*, mid-year international barite prices were as follows: paint grade micronized, exports USA, min. 95%, US\$275-\$325/t; and drilling grade API, lump, c.i.f. U.S. Gulf Coast, US\$64-\$69/t.

MAJOR USES AND SPECIFICATIONS

Barite is used for both its physical attributes, such as relatively high specific gravity and/or chemical inertness (drilling mud additive, construction, functional filler), and for its chemical properties (source of BaO and chemical feedstock).

The principal worldwide uses of barite in 2004 (source: IM’s *World Metals & Minerals Review 2005*) are estimated as: 88% for additive to drilling fluids; 6% for chemicals, fillers, extenders and aggregates; and 6% for ceramic and glass.

OUTLOOK

North America’s energy demand has been driving up demand for drilling-grade barite as oil and gas exploration has increased. Drilling for oil and gas both onshore and offshore is booming.

With China being the principal source of barite for U.S. drillers, demand for barite from China is so great that lower-grade reserves are being mined. While there is a large number of small Chinese mining companies, only a few key traders and direct exporters supply the main consumers in Europe and North America. Chinese production (source: February 2004 *Industrial Minerals* magazine) of drilling-grade barite is centred on Guangxi Province while much of the non-drilling-grade ore is mined in Guizhou in the Guiyang City area. Exports are still almost all lump barite with grinding conducted in the countries of consumption. The leading North American consumer of Chinese non-drilling barite is Cimbar Performance Minerals in the United States. In Canada, Dynatec imports lump barite for its Mineral Products Division from Guizhou. The best Chinese white barite is unequalled in terms of quality and available volume worldwide, so to fill any significant gap in the tonnages currently exported to Europe and North America would be a challenge.

Nevertheless, rising prices for Chinese drilling-grade barite as a result of high ocean freight rates, port congestion, hampered overland logistics, and the lowering of the value-added tax rebate on barite exports from China have made some North American suppliers competitive again in the drilling mud market.

Canada does not produce barite chemicals such as barium carbonate, barium oxide, barium chloride and barium nitrate. Specialized applications for barite offer little scope for significantly increased use. In these markets, barite tends to be chosen in preference to other minerals because it is cheap and readily available. The ability of barite to block X-rays (second only to lead) and the fact that it is the only X-ray-opaque material that is safe to use in the human body have led to the development of new applications.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 64. (2) Information in this review was current as of June 30, 2005. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/emv/com_e.html.

NOTE TO READERS

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TARIFFS

| Item No. | Description | Canada | | | United States | EU | Japan |
|------------|--|-----------|---------|------|---------------|-----------------------|-----------|
| | | MFN | GPT | USA | Canada | Conventional Rate (1) | WTO (2) |
| 2511.10 | Natural barium sulphate (barytes) | 4.5% | Free | Free | Free | Free | Free |
| 2511.20 | Natural barium carbonate (witherite) | Free | Free | Free | Free | Free | Free |
| 2816.40 | Oxides, hydroxides and peroxides, of strontium or barium | Free | Free | Free | Free | 5.5% | 3.3%-3.9% |
| 2827.39.20 | Barium chloride | 4% | Free | Free | Free | 5.5% | 3.3%-3.9% |
| 2833.27 | Barium sulphate | Free | Free | Free | Free | 5.5% | 3.9% |
| 2834.29 | Other nitrates | Free-5.5% | Free-3% | Free | Free | 3%-5.5% | Free-3.9% |
| 2836.60 | Barium carbonate | Free | Free | Free | Free | 5.5% | 3.9% |

Sources: Canadian *Customs Tariff*, effective January 2005, Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2005; *Official Journal of the European Union* (October 30, 2004 Edition); *Customs Tariff Schedules of Japan*, 2004.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, BARITE TRADE, 2002-04

| Item No. | 2002 | | 2003 | | 2004 (p) | |
|--|-----------|---------|------------|-----------|------------|-----------|
| | (tonnes) | (\$000) | (tonnes) | (\$000) | (tonnes) | (\$000) |
| PRODUCTION (all forms) | | | | | | |
| Northwest Territories | 4 936 616 | 791 821 | 10 755 654 | 1 587 738 | 12 618 080 | 2 140 121 |
| EXPORTS | | | | | | |
| 2511.10 | | | | | | |
| Natural barium sulphate (barytes) | | | | | | |
| United States | 574 | 857 | 406 | 508 | 920 | 959 |
| Cuba | - | - | - | - | 120 | 73 |
| Ecuador | 20 | 14 | 30 | 14 | 119 | 58 |
| Chile | 82 | 57 | 120 | 79 | 80 | 47 |
| Russia | - | - | - | - | 33 | 14 |
| Argentina | - | - | - | - | 28 | 10 |
| China | 6 | 3 | 10 | 4 | 6 | 2 |
| Brazil | - | - | - | - | 4 | 1 |
| United Kingdom | - | - | 6 | 2 | - | - |
| Total | 682 | 931 | 572 | 607 | 1 310 | 1 164 |
| 2816.40 | | | | | | |
| Oxide, hydroxide and peroxide of strontium or barium | | | | | | |
| Czech Republic | .. | 5 | .. | 2 | - | - |
| Latvia | - | - | .. | .. | - | - |
| South Africa | - | - | .. | 2 | - | - |
| Turkey | - | - | .. | 4 | - | - |
| Total | .. | 5 | .. | 8 | - | - |
| 2827.39 | | | | | | |
| Other chlorides: Other | | | | | | |
| Philippines | - | - | - | - | .. | 1 711 |
| Norway | - | - | - | - | .. | 136 |
| Japan | - | - | .. | 113 | .. | 85 |
| Germany | - | - | - | - | .. | 36 |
| United States | .. | 207 | .. | 68 | .. | 23 |
| France | - | - | .. | 10 | .. | 9 |
| Belgium | - | - | - | - | .. | 6 |
| Malaysia | - | - | - | - | .. | 3 |
| Mexico | - | - | .. | 1 | .. | 1 |
| Dominican Republic | - | - | - | - | .. | .. |
| Suriname | - | - | - | - | .. | .. |
| United Arab Emirates | - | - | - | - | .. | .. |
| Barbados | .. | 1 | - | - | - | - |
| Cuba | .. | 7 | .. | 22 | - | - |
| United Kingdom | .. | 74 | - | - | - | - |
| Israel | - | - | .. | 3 | - | - |
| South Korea | - | - | .. | 1 | - | - |
| Total | .. | 289 | .. | 218 | .. | 2 010 |
| 2833.27 | | | | | | |
| Other sulphates: Of barium | | | | | | |
| Australia | 36 | 25 | - | - | - | - |
| Austria | 5 | 53 | - | - | - | - |
| Chile | 41 | 33 | - | - | - | - |
| Italy | 51 | 60 | - | - | - | - |
| Netherlands | 42 | 113 | - | - | - | - |
| Portugal | 47 | 49 | - | - | - | - |
| South Africa | 30 | 22 | - | - | - | - |
| United Kingdom | 50 | 57 | - | - | - | - |
| Brazil | - | - | 2 | 1 | - | - |
| Total | 302 | 412 | 2 | 1 | - | - |
| 2834.29 | | | | | | |
| Nitrates: Other | | | | | | |
| United States | 383 | 686 | 693 | 1 060 | 198 | 224 |
| Japan | - | - | - | - | 4 | 10 |
| Russia | - | - | - | - | 1 | 2 |
| Mexico | - | - | .. | .. | .. | 1 |
| Suriname | - | - | - | - | .. | .. |
| Taiwan | 20 | 42 | - | - | - | - |
| Saint Pierre and Miquelon | - | - | .. | .. | - | - |
| Total | 403 | 728 | 693 | 1 060 | 203 | 237 |
| 2836.60 | | | | | | |
| Barium carbonate | | | | | | |
| Mexico | 22 | 11 | - | - | - | - |
| Trinidad and Tobago | - | - | .. | .. | - | - |
| Total | 22 | 11 | .. | .. | - | - |
| Total exports | 1 409 | 2 376 | 1 267 | 1 894 | 1 513 | 3 411 |

TABLE 1 (cont'd)

| Item No. | | 2002 | | 2003 | | 2004 (p) | |
|----------------|--|----------|---------|----------|---------|----------|---------|
| | | (tonnes) | (\$000) | (tonnes) | (\$000) | (tonnes) | (\$000) |
| IMPORTS | | | | | | | |
| 2511.10 | Natural barium sulphate (barytes) | | | | | | |
| | United States | 44 901 | 5 056 | 38 858 | 4 772 | 63 508 | 6 211 |
| | China | 10 000 | 717 | 31 885 | 2 513 | 18 575 | 1 242 |
| | Netherlands | 325 | 134 | 607 | 173 | 670 | 169 |
| | Austria | 16 | 6 | — | — | 133 | 10 |
| | Algeria | — | — | — | — | 2 | ... |
| | South Africa | — | — | — | — | .. | ... |
| | Germany | 5 | 1 | 2 | 1 | — | — |
| | Japan | 25 | 3 | — | — | — | — |
| | United Kingdom | 1 | ... | — | — | — | — |
| | Morocco | — | — | 10 500 | 947 | — | — |
| | Total | 55 273 | 5 917 | 81 852 | 8 406 | 82 888 | 7 632 |
| 2511.20 | Natural barium carbonate (witherite) | | | | | | |
| | Morocco | 13 325 | 1 099 | 3 361 | 1 498 | 1 819 | 818 |
| | United States | 5 | 1 | 1 | ... | 2 | 1 |
| | Hong Kong | — | — | — | — | ... | ... |
| | China | 412 | 131 | 25 | 12 | — | — |
| | Germany | — | — | 10 | 5 | — | — |
| | Total | 13 742 | 1 231 | 3 397 | 1 515 | 1 821 | 819 |
| 2816.40 | Oxide, hydroxide and peroxide of strontium or barium | | | | | | |
| | Germany | 93 | 84 | 75 | 76 | 296 | 287 |
| | Italy | 260 | 144 | 307 | 180 | 184 | 131 |
| | United States | 418 | 329 | 440 | 331 | 148 | 84 |
| | China | 137 | 136 | 536 | 319 | 40 | 36 |
| | Japan | ... | ... | ... | ... | 4 | 3 |
| | India | 80 | 36 | — | — | ... | ... |
| | Belgium | — | — | — | — | ... | ... |
| | Mexico | ... | ... | — | — | — | — |
| | Total | 988 | 729 | 1 358 | 906 | 672 | 541 |
| 2827.39.20.10 | Barium chloride, to reduce level of radium in liquid from uranium production | | | | | | |
| | United States | ... | ... | 2 | 1 | ... | ... |
| | Mexico | — | — | ... | ... | ... | ... |
| | India | — | — | — | — | ... | ... |
| | China | 87 | 53 | 55 | 34 | — | — |
| | Japan | 1 | 1 | 1 | 1 | — | — |
| | Germany | — | — | 1 | ... | — | — |
| | Total | 88 | 54 | 59 | 36 | ... | ... |
| 2827.39.20.90 | Other barium chlorides | | | | | | |
| | China | 1 230 | 407 | 291 | 272 | 218 | 303 |
| | United States | 92 | 106 | 115 | 162 | 90 | 158 |
| | India | ... | 1 | ... | ... | 2 | 9 |
| | Canada | — | — | — | — | 2 | 8 |
| | Germany | 2 | 8 | 1 | 8 | 1 | 4 |
| | Japan | 1 | 8 | 1 | 8 | 1 | 3 |
| | Mexico | ... | ... | ... | ... | ... | ... |
| | Sweden | — | — | — | — | ... | ... |
| | Austria | — | — | 5 | 22 | — | — |
| | Total | 1 325 | 530 | 413 | 469 | 314 | 485 |
| 2833.27 | Other sulphates: Of barium | | | | | | |
| | Germany | 1 812 | 2 261 | 2 606 | 2 011 | 2 508 | 2 498 |
| | United States | 298 | 279 | 260 | 247 | 622 | 480 |
| | Italy | 54 | 45 | 43 | 37 | 93 | 64 |
| | Japan | 47 | 47 | 58 | 56 | 44 | 44 |
| | United Kingdom | — | — | 6 | 7 | ... | ... |
| | Switzerland | — | — | — | — | ... | ... |
| | Taiwan | ... | ... | — | — | — | — |
| | China | — | — | ... | ... | — | — |
| | Ireland | — | — | 1 | 1 | — | — |
| | Total | 2 211 | 2 632 | 2 974 | 2 359 | 3 267 | 3 086 |

TABLE 1 (cont'd)

| Item No. | 2002 | | 2003 | | 2004 (p) | | |
|-------------------------|------------------|---------|----------|---------|----------|---------|--------|
| | (tonnes) | (\$000) | (tonnes) | (\$000) | (tonnes) | (\$000) | |
| IMPORTS (cont'd) | | | | | | | |
| 2834.29 | Nitrates: Other | | | | | | |
| | United States | 2 824 | 4 295 | 2 954 | 4 503 | 4 612 | 3 953 |
| | China | 2 512 | 1 760 | 2 573 | 1 839 | 1 977 | 1 903 |
| | Norway | 640 | 990 | 770 | 1 212 | 2 625 | 1 017 |
| | Chile | 239 | 143 | 201 | 116 | 462 | 226 |
| | Poland | — | — | 36 | 26 | 319 | 194 |
| | Sweden | 21 | 24 | — | — | 44 | 137 |
| | Israel | 352 | 282 | 395 | 254 | 227 | 110 |
| | Mexico | 27 | 119 | 5 | 103 | 5 | 90 |
| | France | 553 | 613 | 80 | 131 | 27 | 64 |
| | Japan | 6 | 22 | 23 | 42 | 34 | 44 |
| | Germany | 11 | 21 | 10 | 16 | 17 | 35 |
| | Netherlands | 193 | 139 | 8 | 5 | 46 | 22 |
| | Belgium | 10 | 12 | — | — | 19 | 18 |
| | Portugal | — | — | 21 | 33 | 10 | 17 |
| | India | 1 | 2 | 28 | 65 | 2 | 8 |
| | Switzerland | 2 | 3 | 1 | 2 | 1 | 2 |
| | United Kingdom | ... | 1 | 2 | 3 | 1 | 1 |
| | Azerbaijan | — | — | — | — | ... | ... |
| | Hungary | — | — | — | — | ... | ... |
| | Macedonia | — | — | — | — | ... | ... |
| | Italy | ... | 1 | 17 | 410 | — | — |
| | Spain | ... | 1 | — | — | — | — |
| | Czech Republic | — | — | 10 | 20 | — | — |
| | Ireland | — | — | ... | 6 | — | — |
| | South Africa | — | — | 1 | 1 | — | — |
| | Turkey | — | — | 3 | 7 | — | — |
| | Total | 7 031 | 8 428 | 7 138 | 8 794 | 10 428 | 7 841 |
| 2836.60 | Barium carbonate | | | | | | |
| | United States | 2 043 | 921 | 1 975 | 842 | 1 762 | 822 |
| | China | 1 916 | 559 | 2 898 | 779 | 2 958 | 736 |
| | Germany | — | — | 67 | 32 | 41 | 16 |
| | Japan | ... | ... | 1 | ... | 12 | 6 |
| | Italy | — | — | — | — | 3 | 1 |
| | Turkey | 126 | 27 | — | — | — | — |
| | Total | 4 085 | 1 507 | 4 941 | 1 653 | 4 776 | 1 581 |
| | Total imports | 84 743 | 21 028 | 102 132 | 24 138 | 104 166 | 21 985 |

Sources: Natural Resources Canada; Statistics Canada.

— Nil; . . Not available; . . . Amount too small to be expressed; (p) Preliminary.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, BARITE PRODUCTION, BY PROVINCE, 2002-04

| Production (shipments) | 2002 | | 2003 | | 2004 (p) | |
|------------------------|----------|---------|----------|---------|----------|---------|
| | (tonnes) | (\$000) | (tonnes) | (\$000) | (tonnes) | (\$000) |
| Nova Scotia | x | 523 | x | 362 | x | 755 |
| Ontario | x | 2 000 | x | 3 000 | x | 2 000 |
| Alberta | x | 160 | — | — | — | — |
| British Columbia | x | 600 | x | 1 770 | x | 1 400 |
| Total | 17 417 | 3 283 | 27 369 | 5 132 | 20 601 | 4 155 |

Sources: Natural Resources Canada; Statistics Canada.

— Nil; (p) Preliminary; x Confidential.

Note: Numbers may not add to totals due to rounding.

TABLE 3. CANADA, REPORTED USE OF BARITE, 1998-2003

| Reported Use (1) | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|--------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | (tonnes) | | | | | |
| Well drilling | x | x | x | x | x | x |
| Paint and varnish | x | x | x | x | x | x |
| Other products (2) | 7 404 | 8 753 | 8 577 | 6 295 | 5 751 | 4 198 |
| Total | 16 206 | 15 161 | 16 062 | 27 517 | 14 840 | 28 820 |

Source: Natural Resources Canada.

x Confidential.

(1) Available data reported by consumers. (2) "Other products" include plastics, bearings and brake linings, nonferrous smelting and refining, etc.

Note: Numbers may not add to totals due to rounding.