MAGNESIUM COMPOUNDS

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Although U.S. production of magnesium compounds in 2000 decreased from that in 1999, apparent consumption increased by about 7%. Production of dead-burned magnesia decreased by about 9%, mainly as a result of the closure of a plant in California, but net imports increased by 36%. Caustic-calcined magnesia production declined by about 4%, and net imports remained about the same. Of the total U.S. magnesium compounds production, about 60% came from seawater and well and lake brines. The remainder was recovered from magnesite, dolomite, olivine, and brucite. About 69% of the total consumption of magnesium compounds was for refractory applications. The remaining 31% was used in agricultural, chemical, environmental, and other applications.

Production

In 2000, domestic production of caustic-calcined magnesia declined slightly from that in 1999. U.S. production of dead-burned magnesia dropped by about 9% from that in 1999, mostly because of the closure of National Refractories and Minerals Corp.'s Moss Landing, CA, plant (table 3).

Data for magnesium compounds were collected by the U.S. Geological Survey from one voluntary survey of U.S. operations. Of the 17 operations canvassed, 71% responded, representing 65% of the magnesium compounds shipped and used (table 3). Data for the five nonrespondents were estimated on the basis of prior-year consumption levels and other factors.

Two companies in the United States produced olivine— Unimin Corp. and Olivine Corp. Unimin operated two mines, one in North Carolina and one in Washington, and processing plants in Indiana, North Carolina, and Washington. Olivine operated one mine and one processing plant in Washington.

Fused magnesia was produced by two companies in the United States—Newminco Inc. with a plant in Midway, TN, and Universal Ceramic Materials plc of the United Kingdom, which operated a plant in Cherokee, AL, through its Muscle Shoals Minerals Inc. subsidiary. The Tennessee plant had been owned by English China Clays International Ltd., which was required to sell the plant when it was acquired by Imerys (formerly Imetal). The plant was sold in June 2000 (Imerys, 2001, Annual report 2000, accessed May 17, 2001, via URL http://www.imerys.com).

The largest magnesite production facilities in the world are in China, North Korea, and Russia. Together, these three countries account for 68% of the world magnesite production capacity. Japan and the United States account for 54% of the world's magnesium compounds production capacity from seawater or brines. Fused magnesia is produced in Australia, Brazil, Canada, China, Israel, Japan, the Republic of Korea,

Magnesium Compounds in the 20th Century

Deposits of magnesite (magnesium carbonate) had been discovered in California in 1886, and by 1910, output of the ore from mines in Santa Clara County had reached 12,000 metric tons per year. Most of the ore was calcined and used by the manufacturers of paper in California and Oregon to treat wood pulp. In 1913, production of magnesia by precipitation of dolomite began in Pennsylvania, and in 1917, mining of magnesite began in Stevens County, WA. Imports of magnesite from Europe, which had been the dominant supplier to the United States, were cut off during World War I. Mining of the magnesite in the Nye County, NV, deposit began in 1937. At the outbreak of World War II, production of magnesian ores in the United States was accelerated to provide material not only for basic refractories but for magnesium metal as well. During World War II, almost 1 million metric tons of magnesite was mined and used to produce magnesium metal. Development of techniques to produce magnesium compounds other than magnesia, however, progressed slowly in the United States. By the end of 1959, more than 13 million tons of magnesite had been taken from the mines in the United States, but the deposits of easily recoverable magnesite in California had been worked out by 1950. In 1956, a broad expansion program began in the basic refractories industry in the United States. This included building new magnesia and basic-brick plants and installing new rotary kilns to burn dolomite, as well as improving and expanding production facilities already in operation. The greatest increase in production capacity was in plants to recover magnesia from seawater and brines. This production, which amounted to less than 40% of total domestic output in 1947, rose gradually to 66% in 1959. Domestic capacity for producing other magnesium compounds continued to increase steadily after World War II. Production of magnesium compounds in the United States peaked in 1966 and trended downward since then as imports replaced domestic production.

By 2000, only one magnesite mine was in operation in the United States in Nye County, NV. Magnesia and other magnesium compounds were produced from seawater at plants in Delaware and Florida, from well brines in Michigan, and from brines from the Great Salt Lake in Utah. Imports of magnesia, mainly from China, supplied about 48% of the total U.S. apparent consumption of magnesium compounds. About 69% of the magnesium compounds consumed in the United States was used for refractories. The remaining 31% was consumed in agricultural, chemical, construction, environmental, and industrial applications. U.S. imports for consumption continued to increase significantly in 2000.

Mexico, Russia, the United Kingdom, and the United States. World production capacity is estimated to be about 650,000 metric tons per year (t/yr), with about 500,000 t/yr of capacity in China (Pearson, 2000).

Norway is the world's principal producer and supplier of olivine. Other producers include Australia, Italy, Japan, Mexico, Pakistan, Spain, and the United States.

In August 2000, Premier Services Inc. increased the caustic-calcined magnesia capacity at its Gabbs, NV, magnesite facility by 20,000 t/yr to 140,000 t/yr. The capacity increase was in response to growing demand in the wastewater treatment market. About $1 million was spent on an incremental furnace expansion, and Premier Services said that the company may expand further in 2001 if the growth in the market continues (North American Minerals News, 2000c).

Aurora Partners Ltd. of the United States announced that it would form a joint venture with North Korea's Korea Magnesite Clinker Industry Group to mine, process, and ultimately export magnesia products from North Korea. This would be the first joint venture between U.S. and North Korean firms. Although North Korea has been allowed to export magnesite to the United States since 1995, no material has entered since then. An embargo preventing U.S. firms from establishing joint ventures with North Korean companies was lifted in June 2000 (North American Minerals News, 2000a).

Near the end of the year, the State of Utah began modifying the salinity levels in the Great Salt Lake by deepening a causeway opening by more than 2.4 meters (8 feet). The railroad causeway in the lake has been acting as a dam and creating essentially two separate bodies of water with different salinity levels. Deepening the breach in the causeway would allow for greater water flow between the two bodies, thereby equalizing the salinity levels. Although it could be 3 to 5 years before the effects of the causeway modifications are known, this could adversely affect companies that recover magnesium chloride from the higher salinity portion of the Great Salt Lake (Green Markets, 2001).

As part of RHI AG's 1999 acquisition of Global Industrial Technologies Inc., which was the parent company of Harbison-Walker Refractories Inc., RHI was required by the U.S. Federal Trade Commission (FTC) to divest itself of some of its assets. According to a consent agreement, RHI would be required to divest two refractory manufacturing plants in North America as well as assets related to certain refractory products produced at a third North American location. The divestiture was agreed to because, after the merger of RHI and Global, the two companies combined would control about 95% of the $30 million North American market for magnesia-carbon bricks for basic-oxygen furnaces (BOFs) used in the steelmaking industry. In addition, the merged company would hold 65% of the $58 million market for magnesia-carbon bricks for electric-arc furnaces, 40% of the $100 million market for magnesia-carbon bricks for steel ladles used with BOFs, 70% of the $50 million market for high-alumina bricks for steel ladles used with BOFs, 50% of the $23.5 million market for high-alumina bricks for torpedo cars, and 46% of the $5 million market for magnesia-chrome bricks for steel degassers. As a result of its market dominance in these sectors, the FTC ordered RHI to sell to Resco Products Inc. two magnesia-chrome-brick-producing plants (one in Hammond, IN, and one in Marelan, Quebec, Canada) and specific assets related to the production of high-alumina bricks at its Farber, MO, plant. Resco manufactures similar refractory products, but does not compete in the same markets (U.S. Federal Trade Commission, December 30, 1999, FTC clears proposed acquisition of Global Industrial Technologies by RHI AG, accessed March 14, 2001, at URL http://www.ftc.gov/opa/1999/9912/rhi1.htm).

Consumption

In 2000, environmental applications (water treatment and stack gas scrubbing, in descending order) consumed the most caustic-calcined magnesia, accounting for 41% of U.S. shipments; this was a 4% increase from the 1999 total. The following categories, with the individual components in descending order of consumption in parentheses, were the other end-use sectors for caustic-calcined magnesia: chemical, 34%; agriculture (animal feed and fertilizers), 18%; construction (primarily oxychloride and oxysulfate cements), 3%; manufacturing (rubber, fuel additives, and electrical), 3%; pharmaceuticals and nutrition (sugar, medicine and pharmaceuticals, and cosmetics), less than 1%; and unspecified uses, less than 1%.

Magnesium carbonate was used principally as a chemical intermediate, in medicines and pharmaceuticals, in rubber processing, and in cosmetics (uses are given in descending order of quantity). Magnesium hydroxide was used mainly in the chemical industries and for water treatment. Magnesium sulfate was used mostly for animal feed, pulp and paper, chemical, electrical, and pharmaceutical applications. Magnesium chloride was used mainly as a chemical intermediate and in pharmaceuticals. Magnesium chloride brines were used principally for road dust and ice control and as a chemical intermediate.

Foundry uses remained the largest application for olivine in the United States, accounting for 87% of consumption of domestically produced material. Refractory applications accounted for 7% of U.S. consumption, and sandblasting and other abrasive uses accounted for 6%.

Prices

Yearend 2000 prices for magnesium compounds quoted in Chemical Market Reporter and Industrial Minerals remained the same as those for 1999 (table 4).

Foreign Trade

In 2000, dead-burned magnesia exports from the United States declined by about 10% (table 5). Canada, with 85% of the total, was the principal destination. Caustic-calcined magnesia exports, however, increased to nearly four times the 1999 level. Mexico (26%), Japan (19%), Brazil (11%), and the Netherlands (11%) were the main destinations.

U.S. imports of dead-burned magnesia in 2000 increased by 28% from those in 1999 (table 7). China (69%) and Australia (13%) were the principal source countries. One of the reasons for the significant increase in imports was to replace some of the domestically produced material that was lost when National Refractories and Minerals closed its magnesia plant in 1999.

Imports of caustic-calcined magnesia increased by 11% from imports in 1999. China (65%) and Canada (29%) were the primary sources. In spite of the export licensing requirements imposed by the Chinese Government, magnesia exports from

China to the United States continued to rise. For 2000, the Chinese export quota for magnesite was 1.6 million metric tons (Mt), and the license fee was about $43 per metric ton. Because of falling magnesite prices, many Chinese producers joined to form two separate export syndicates. The producers expected to be able to control prices and export volumes more easily through these syndicates (Industrial Minerals, 2000f).

Trade data for olivine are not available separately from the U.S. Census Bureau. The Journal of Commerce Port Import/Export Reporting Service (PIERS), however, provides data on material that travels by ship. PIERS data indicate that in 2000 the United States exported 871 metric tons (t) of olivine; Argentina (42%), Venezuela (12%), and Brazil (11%) were the principal destinations. U.S. olivine imports totaled 202,000 t, a 73% increase from imports in 1999. Norway (70%) and Poland (28%) were the major source countries.

World Review

Australia.—SAMAG Ltd., the 80%-owned subsidiary of Pima Mining NL, began trial mining of its magnesite deposit in South Australia. The company plans to mine about 2,000 t of ore for trial leaching tests. The company also selected Port Pirie as the site for its proposed 52,500-t/yr magnesium plant. This site was chosen because of its existing infrastructure (the Pasminco zinc smelter is located at the same site), the rail link between Port Pirie, and the location of the magnesite raw material near Leigh Creek. Initial investment in the plant was expected to begin in 2001, with commercial production scheduled for 2004. The company has licensed The Dow Chemical Co.'s electrolytic technology for magnesium production (Metal Bulletin, 2000). SAMAG also purchased the Myrtle Springs and the Huandot magnesite deposits from Unimin Australia Ltd., which increased the company's total magnesite resources in the Leigh Creek, Northern Territory, area to 579 Mt (Pima Mining NL, November 28, 2000, SAMAG purchases additional magnesite resources, accessed January 8, 2001, at URL http://www.pima.com.au/temp.asp?t=asx28nov00).

In October, Mt. Grace Resources NL began bulk magnesite mining operations at its Batchelor magnesium project. The company planned to mine and stockpile 2,000 t of magnesite to provide sample material for test work. An ore parcel was expected to be sent to Mintek in Johannesburg, South Africa, in January for testing (Mt. Grace Resources NL, October 30, 2000, Mt[.] Grace Resources mines ore at Batchelor, accessed November 8, 2000, at URL http://www.mtgrace.com/releases/oct_30_2000.html). Mt. Grace Resources plans to construct a 50,000-t/yr magnesium plant by 2006.

At the end of June, Unimin acquired Normandy Mining Ltd.'s mining assets, which included all its activities under its Commercial Minerals Ltd. subsidiary. Commercial Minerals operates a magnesite mining operation near Myrtle Springs, South Australia (Industrial Minerals, 2000h).

Canada.—Globex Mining Enterprises Inc. acquired the Deloro magnesite deposit after its previous owner, Royal Oak Mines Inc., filed for bankruptcy. Drilling on the property has delineated a resource of more than 100 Mt of ore, containing more than 50% magnesite, 25% to 30% talc, and 16% quartz. The company was reviewing test results conducted in 1991 and was planning to conduct bulk sampling tests before determining how it would develop the deposit (North American Minerals News, 2000b).

China.—For 2001, the quantity of magnesia available for export was the same as it was in 2000—1.6 Mt. The export license fee, however, decreased by approximately $1 per metric ton to $42 per metric ton (Houssa, 2001).

Greece.—Grecian Magnesite S.A. embarked on an investment program designed to improve processing at its operations in Greece and to internationalize the company. As part of its internationalization strategy, Grecian Magnesite acquired 40% of the Spanish holding company Magna Inversiones S.A., which owns the Spanish magnesite producer Magnesitas Navarras S.A. Grecian Magnesite also plans to add two new mineral processing lines that are intended to increase productivity, reduce production costs, and improve the company's environmental protection efforts. The total cost of the acquisition and the production modifications was estimated to be $7 billion, and part of this investment was expected to be financed through stock offering on the Athens Stock Exchange Market (Grecian Magnesite S.A., June 20, 2000, Investment program of Grecian Magnesite S.A., accessed February 12, 2001, at URL http://www.grecianmagnesite.com/Press/pr20062000.html). As part of Grecian Magnesite's modifications, Bateman Project Holdings Ltd. supplied a new 30-metric-ton-per-hour dense-media separation plant to its mine at Yerakini, which was designed to separate waste rock from magnesite.

India.—Almora Magnesite Ltd. was referred to India's Board of Industrial Finance and Reconstruction for assessment of its finances. As a result, the company was looking for foreign investment to develop its magnesite mines and to upgrade its beneficiation plant. Almora Magnesite produced about 50,000 t/yr of crude magnesite and 20,000 t/yr of dead-burned magnesia at its plant in Uttar Pradesh. Competition from imports of Chinese magnesite and a downturn in the domestic steel industry had put financial pressure on India's magnesite producers. In addition, the dead-burned magnesite produced in India has a high silica content, which makes it unsuitable for production of many higher value refractories such as magnesia-carbon brick (Industrial Minerals, 2000a).

Israel.—Dead Sea Periclase Ltd. announced that it would increase magnesium hydroxide production capacity at its Mishor Rotem plant to 9,000 t/yr, a 3,000-t/yr increase. The first phase of the two-phase expansion was completed in September; the remaining capacity was expected to be completed by early 2001. The company was increasing its capacity because of a successful audit from the country's Food and Drug Administration. The successful audit was expected to increase demand for the company's magnesium hydroxide from the food and pharmaceutical industry (Chemical Week, 2000).

Jordan.— Jordan Magnesia Co. received a $30-million loan from a syndicate of banks, which would allow it to proceed with construction of its planned magnesia plant. The company already had received $28 million from the Islamic Development Bank and the Islamic Portfolio. The total cost of the plant was estimated to be $101 million. Plant commissioning was scheduled for the beginning of 2001, and the annual plant capacity will be 50,000 t of dead-burned magnesia and 10,000 t of specialty magnesium compounds. About 489,000 cubic meters per year of magnesium chloride-rich brine from Arab Potash Co.'s existing solar ponds and 165,000 t/yr of limestone mined from a quarry at nearby Qatrana will supply the plant's feedstock (Fertilizer International, 2000).

Russia.—After celebrating a century of mining in September and extracting its 200 millionth metric ton of ore from the Satka magnesite deposits in August, JSC Kombinat Magnezit announced plans to improve its magnesite mining and processing operations. Magnezit operated two open pit mines, one underground mine, and two beneficiation plants with a capacity to produce about 2.5 Mt of magnesia products annually. The company planned to construct a briquetting and processing plant that can use dust from its magnesite beneficiation operation as feed material. The company also acquired the mining rights to the Goluboe magnesite deposit, which has reserves of 6 Mt, including 2 Mt of magnesite containing 45% MgO. Magnezit planned to construct a fused magnesia plant using magnesite from the Goluboe deposit as feed material. Magnezit also planned to prolong the life of its open pit mines by mining more ore from its underground mine (Industrial Minerals, 2000d, e).

Magnitogorsk Iron and Steel Works, one of Russia's largest steel producers, commissioned a new magnesia-dolomite refractories plant in 2000. The first stage of the new operation, with a capacity of 12,000 t/yr, began producing magnesia-carbon bricks to replace refractories previously purchased from Magnezit. The second stage was expected to add 18,000 t/yr of dolomite refractories production to the plant. Total cost of the project was estimated to be $40 million. When the plant is completed, Magnitogorsk will be able to supply about 70% of its refractories needs with material produced in-house (Industrial Minerals, 2000g).

Turkey.—In May, Austria's Styromagnesit Steirische Magnesitindustrie GmbH (Styromag) purchased Comag Continental Mining Industry & Trade Co. Inc. The purchase included Comag's mine and plants in Middle Anatolia, Turkey, with a capacity of 50,000 t/yr of caustic-calcined magnesite, that had been shut since March. Styromag planned to restart the operation in July under the name Calmag. Previously, much of the operation's production had been used for animal feed, but Styromag wanted to concentrate on sales of fused magnesia. The acquisition would also broaden Styromag's product line of caustic-calcined magnesia products—Styromag produced crystalline magnesite at its Austrian operation, and the Calmag operation produced cryptocrystalline magnesite (Industrial Minerals, 2000i).

The Turkish refractories producer Haznedar Ates Tugla Sanayii A.S. planned to begin production in early 2001 at a new refractories operation in Istanbul. The new plant will replace an old 30,000-t/yr operation producing magnesia-carbon and alumina bricks. The new plant, which will produce about 50,000 to 60,000 t/yr of high-density alumina and magnesia bricks, will incorporate some of the old equipment into the new facility. The company hoped to improve product quality. About 75% of the refractories were used locally, and the rest were exported to neighboring countries (Industrial Minerals, 2000c).

Current Research and Technology

Krosaki Harima Corp. developed a new brand of refractory product that was considered to be more environmentally friendly than traditional refractories. In the alumina monolithics that the company produced, it replaced the Cr_2O_3 with MgO. Replacing the Cr_2O_3 with MgO eliminates the generation of hexavalent chromium, which can lead to environmental problems when discarding the refractories (Industrial Minerals, 2000b).

Outlook

Because the primary use of refractory magnesia is in iron and steel production furnaces, economic factors that influence the production of iron and steel will have a direct effect on the consumption of refractory magnesia. According to the International Iron and Steel Institute, the North American steel industry is concerned about higher energy prices and increased levels of imports (International Iron and Steel Institute, October 3, 2000, IISI survey reveals renewed world steel consumption growth, accessed April 16, 2001, at URL http://www.worldsteel.org/trends_indicators/demand.html). If energy costs remain high or increase, it could lead to closure of some North American steel production capacity. This, in turn, could lead to higher levels of imports, which would be required to supply the steel demand. Also, if the U.S. economy becomes stagnant or enters a recession, the total demand for steel is likely to decline as well. A decline in steel demand coupled with closure of U.S. capacity would lead to a significantly reduced demand for refractory magnesia.

Imports of magnesite, mainly from China, are expected to continue to supply much of the U.S. demand for magnesia for refractory applications. If material from North Korea becomes available on the U.S. market, it would probably provide an additional source of low-cost magnesia to U.S. refractories manufacturers at the expense of domestically produced material. Consumption of caustic-calcined magnesia, however, is expected to continue to be strong. Because it has such diverse applications, a decline in one particular industry sector is not as devastating as a drop in steel production is to the refractory magnesia industry. Such environmental applications as wastewater treatment are expected to continue to be the principal growth area for caustic-calcined magnesia.

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TABLE 1
SALIENT MAGNESIUM COMPOUND STATISTICS 1/

(Thousand metric tons, unless otherwise specified)

		1996	1997	1998	1999	2000
United States:						
Caustic-calcined and specified magnesias: 2/						
Shipped by producers: 3/						
Quantity		158	160	177	179	172
Value	thousands	$47,600	$52,600	$76,700	$77,000	$46,000
Exports 4/		20	5	5	3	12
Imports for consumption 4/		114	133	127	123	136
Refractory magnesia:						
Shipped by producers: 3/						
Quantity		269	283	215	216	196
Value	thousands	$96,800	$97,500	$75,000	$75,300	$68,100
Exports		73	66	63	67	60
Imports for consumption		271	279	427	392	501
World production (magnesite)		11,000	10,400	11,800 r/	10,500 r/	10,700 e/

e/ Estimated. r/ Revised.
1/ Data are rounded to no more than three significant digits.
2/ Excludes caustic-calcined magnesia used in the production of refractory magnesia.
3/ Includes magnesia used by producers.
4/ Caustic-calcined magnesia only.

TABLE 2
U.S. MAGNESIUM COMPOUND PRODUCERS, BY RAW MATERIAL SOURCE, LOCATION, AND PRODUCTION CAPACITY, IN 2000

Raw material source and producing company	Location	Capacity (metric tons of MgO equivalent) 1/	Products
Brucite: Applied Chemical Magnesias Corp.	Van Horn, TX; and Bullhead City, AZ	25,000	Magnesium hydroxide.
Magnesite: Premier Services Inc.	Gabbs, NV	140,000	Caustic-calcined and dead-burned magnesia.
Lake brines:			
IMC Kalium Ogden Corp.	Ogden, UT	105,700	Magnesium chloride and magnesium chloride brines.
Reilly Industries Inc.	Wendover, UT	45,000	Magnesium chloride brines.
Well brines:			
The Dow Chemical Co. 2/	Ludington, MI	214,000	Magnesium hydroxide.
Martin Marietta Magnesia Specialties Inc. 3/	Manistee, MI	297,000	Caustic-calcined and dead-burned magnesia.
Rohm and Haas Co.	do.	10,000	Magnesium carbonate, magnesium hydroxide, and caustic-calcined magnesia.
Seawater:			
Barcroft Co.	Lewes, DE	5,000	Magnesium hydroxide.
Premier Services Inc.	Port St. Joe, FL	50,000	Caustic-calcined magnesia and magnesium hydroxide.
Western Salt Co.	Chula Vista, CA	3,000	Magnesium chloride brines.
Total		894,700	

1/ Data are rounded to no more than three significant digits; may not add to total shown.
2/ Most of Dow's production was shipped to RHI Refractories America Inc. in Ludington, MI, where it was converted to dead-burned magnesia at a 200,000-metric-ton-per-year plant.
3/ In addition to its Michigan plant, Martin Marietta owned a 30,000-metric-ton-per-year magnesium hydroxide plant in Pittsburgh, PA, and a 15,000-metric-ton-per-year magnesium hydroxide plant in Lenoir City, TN, which used imported magnesite as a raw material.

TABLE 3
U.S. MAGNESIUM COMPOUNDS SHIPPED AND USED 1/

	1999		2000	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic-calcined and specified (USP and technical) magnesias 2/	179,000	$77,000	172,000	$46,000
Magnesium hydroxide [100% Mg(OH)2] 2/	233,000	44,100	212,000	81,700
Magnesium sulfate (anhydrous and hydrous)	47,100	14,500	44,000	12,700
Precipitated magnesium carbonate 2/	2,190	4,890	1,960	4,650
Refractory magnesia	216,000	75,300	196,000	68,100

1/ Data are rounded to no more than three significant digits.
2/ Excludes material produced as an intermediate step in the manufacture of other magnesium compounds.

TABLE 4
YEAREND MAGNESIUM COMPOUND PRICES

Material		1999	2000
Magnesia, natural, technical, heavy, 85%, f.o.b. Nevada	per short ton	$232-$265	$232-$265
Magnesia, natural, technical, heavy, 90%, f.o.b. Nevada	do.	265	265
Magnesia, dead-burned	do.	350	350
Magnesia, synthetic, technical	do.	385	385
Magnesium chloride, hydrous, 99%, flake	do.	290	290
Magnesium carbonate, light, technical, freight equalized	per pound	0.73-0.78	0.73-0.78
Magnesium hydroxide	do.	0.45	0.45
Magnesium sulfate, technical, epsom salts	do.	0.18-0.195	0.18-0.195
Olivine, aggregate, f.o.b. plant or mine	per metric ton	50-78	50-78
Olivine, foundry grade, f.o.b. plant or mine	do.	60-110	60-110

Sources: Chemical Market Reporter and Industrial Minerals.

TABLE 5
U.S. EXPORTS OF CRUDE AND PROCESSED MAGNESITE, BY COUNTRY 1/

	1999		2000	
Material and country	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic-calcined magnesia:				
Brazil	122	$126	2,170	$2,980
France	95	42	1,080	525
Germany	689	339	748	405
Japan	--	--	1,310	1,750
Mexico	1,220	613	3,020	983
Netherlands	573	294	1,280	717
Other	492 r/	265 r/	2,000	1,110
Total	3,190	1,680	11,600	8,470
Dead-burned and fused magnesia:				
Canada	51,800	15,700	50,300	14,800
Hong Kong	176	213	1,650	1,920
Korea, Republic of	998	543	2,140	1,570
Mexico	690	339	429	231
Netherlands	6,460	2,100	622	265
Philippines	2,000	600	--	--
United Kingdom	1,380	3,140	181	351
Other	3,270 r/	2,620 r/	4,500	3,310
Total	66,700	25,200	59,800	22,400
Other magnesia:				
Canada	5,180	2,040	5,090	1,950
Hong Kong	1,580	1,900	775	1,020
Mexico	4,790	4,590	5,610	4,680
New Zealand	146	217	2,120	1,980
Spain	961	1,080	671	812
Taiwan	454	254	245	218
Venezuela	2	$25	2,670	$712
Other	2,660 r/	3,230 r/	4,230	7,590
Total	15,800	13,300	21,400	19,000
Crude magnesite:				
Brazil	1,140	129	2,870	306
Canada	3,490	540	3,520	504
Germany	6,520	796	5,740	621
Korea, Republic of	4,500	512	1,250	136
Mexico	6,140	699	2,750	311
Netherlands	740	79	3,130	424
Spain	168	25	2,960	316
Venezuela	2,950	323	2,100	239
Other	3,220 r/	419 r/	5,180	601
Total	28,900	3,520	29,500	3,460

r/ Revised. -- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 6
U.S. EXPORTS OF MAGNESIUM COMPOUNDS 1/

Material	1999 Quantity (metric tons)	1999 Value (thousands)	2000 Quantity (metric tons)	2000 Value (thousands)	Principal destinations, 2000
Magnesium chloride, anhydrous and other	4,420	$2,310	4,900	$15,800	Canada, 79%; India, 14%.
Magnesium hydroxide and peroxide	18,900	7,540	20,200	10,600	Canada, 70%.
Magnesium sulfate, natural kieserite and epsom salts	393	210	453	224	Honduras, 44%; Ireland, 27%.
Magnesium sulfate, other	5,140	2,260	6,200	2,970	Canada, 87%.

1/ Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

TABLE 7
U.S. IMPORTS FOR CONSUMPTION OF CRUDE AND PROCESSED MAGNESITE, BY COUNTRY 1/

Material and country	1999 Quantity (metric tons)	1999 Value (thousands)	2000 Quantity (metric tons)	2000 Value (thousands)
Caustic-calcined magnesia:				
Canada	43,100	$7,630	38,700	$6,760
China	71,500	7,650	88,500	9,940
Greece	5,080	1,220	5,000	1,200
Other	2,950	2,590	4,070	4,170
Total	123,000	19,100	136,000	22,100
Dead-burned and fused magnesia:				
Australia	45,400	11,900	65,900	14,800
Austria	19,800	11,400	21,500	9,860
Brazil	15,500	2,790	10,000	990
China	275,000	34,900	345,000	44,600
Greece	7,740	1,340	3,030	558
Hong Kong	4,000	368	18,300	2,280
Israel	3,400	4,000	9,820	7,220
Other	21,400	8,360	27,100	7,860
Total	392,000	75,000	501,000	88,200
Other magnesia:				
Canada	4,550	$925	6,250	$1,180
China	1,670	832	275	209
Israel	4,330	7,190	2,870	5,130
Japan	1,670	2,880	1,680	3,150
Mexico	3,440	1,930	4,700	2,270
Other	2,230	1,100	3,130	2,200
Total	17,900	14,900	18,900	14,100
Crude magnesite:				
China	4,080	708	6,010	776
Israel	639	203	979	202
Japan	962	212	2,530	558
United Kingdom	1,210	291	3,520	953
Other	1,010 r/	305 r/	1,540	337
Total	7,900	1,720	14,600	2,830

r/ Revised.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 8
U.S. IMPORTS FOR CONSUMPTION OF MAGNESIUM COMPOUNDS 1/

	1999		2000		
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Principal sources, 2000
Magnesium chloride, anhydrous and other	24,500	$5,600	35,800	$7,210	Israel, 91%.
Magnesium hydroxide and peroxide	7,440	12,600	8,960	14,700	Japan, 35%; Israel, 28%; Netherlands, 12%.
Magnesium sulfate, natural epsom salts	82	64	85	23	Germany, 90%.
Magnesium sulfate, natural kieserite	23,800	595	27,000	831	Germany, 100%.
Magnesium sulfate, other	26,700	5,170	31,800	7,030	Germany, 56%; Canada, 33%.

1/ Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

TABLE 9
WORLD MAGNESIUM COMPOUNDS ANNUAL PRODUCTION CAPACITY, DECEMBER 31, 2000 1/ 2/

(Thousand metric tons, MgO equivalent)

	Raw material				
	Magnesite		Seawater or brines		
Country	Caustic-calcined	Dead-burned	Caustic-calcined	Dead-burned	Total
North America:					
Canada	100	--	--	--	100
Mexico	--	--	20	95	115
United States	NA	NA	NA	NA	895 3/
Total	100	NA	20	95	1,110
South America, Brazil	58	276	--	--	334
Europe:					
Austria	35	250	--	--	285
France	--	--	30	--	30
Greece	120	80	--	--	200
Ireland	--	--	--	90	90
Italy	25	--	5	130	160
Netherlands	--	--	--	150	150
Norway	--	--	25	--	25
Poland	--	10	--	--	10
Russia	100	2,670	--	--	2,770
Serbia and Montenegro	40	200	--	--	240
Slovakia	--	440	--	--	440
Spain	155	60	--	--	215
Turkey	50	324	--	--	374
Ukraine	--	120	20	80	220
United Kingdom	--	--	70	80	150
Total	525	4,160	150	530	5,360
Africa:					
Kenya	NA	NA	--	--	170
South Africa	7	--	--	--	7
Total	7	NA	--	--	177
Asia:					
China	200	2,480	--	10	2,690
India	25	257	--	--	282
Iran	--	30	--	--	30
Israel	--	--	10	60	70
Japan	--	--	65	265	330
Korea, North	--	500	--	--	500
Korea, Republic of	--	--	--	50	50
Total	225	3,260	75	385	3,950
Oceania, Australia	48	120	--	--	168
Grand total	963	7,810	245	1,010	11,100

NA Not available. -- Zero.

1/ Data are rounded to no more than three significant digits; may not add to totals shown.

2/ Includes capacity at operating plants, as well as at plants on standby basis.

3/ Includes capacity for production of magnesium chloride, magnesium chloride brines, magnesium carbonate, magnesium hydroxide, and caustic-calcined and dead-burned magnesias.

TABLE 10
MAGNESITE: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1996	1997	1998	1999	2000 e/
Australia	237,707	245,192	360,115 r/	280,505 r/	349,783 3/
Austria	624,000	650,000 e/	723,000 r/	769,000 r/	750,000
Brazil (beneficiated) 4/	305,737	294,629	308,300	310,000 e/	310,000
Canada e/ 5/	180,000	180,000	180,000	180,000	180,000
China e/	2,100,000	2,400,000	2,400,000	2,450,000	2,500,000
Colombia e/	12,634 r/ 3/	10,500	10,500	10,500	10,500
Greece	682,346	623,050	650,000 e/	650,000 e/	650,000
India	373,306	362,929	355,033	360,000 e/	365,000
Iran 6/	55,000 r/ e/	55,000 r/ e/	109,597 r/	141,081 r/	141,000
Korea, North e/	1,600,000	1,600,000	1,600,000	1,000,000	1,000,000
Mexico	200	231	274	308 r/	335 3/
Pakistan	3,202	4,057	3,157	3,000 e/	3,100
Philippines e/	700	700	700	700	700
Poland	19,300	6,403	5,745	6,000 e/	--
Russia e/	1,000,000	1,040,000	851,845 3/	900,000	1,000,000
Serbia and Montenegro	89,000	95,000	81,000 r/	22,000 r/	40,000
Slovakia	824,800	863,600	877,840	850,000 e/	850,000
South Africa	71,358	76,669	74,300	74,000 r/	74,000
Spain e/	483,726 3/	500,000	500,000	500,000	500,000
Turkey (run of mine)	2,339,138	1,409,768	2,703,343	2,000,000 r/ e/	2,000,000
United States	W	W	W	W	W
Zimbabwe	10,659	13,050	4,321	4,000 e/	4,000
Total	11,000,000	10,400,000	11,800,000 r/	10,500,000 r/	10,700,000

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data; not included in "Total." -- Zero.

1/ World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

2/ Figures represent crude salable magnesite. In addition to the countries listed, Bulgaria produced magnesite, but output is not reported quantitatively, and available information is inadequate for formulation of reliable estimates of output levels. Table includes data available through May 18, 2001.

3/ Reported figure.

4/ Series reflect output of marketable concentrates. Production of crude ore was as follows, in tons: 1996--1,268,265; 1997--1,030,171; and 1998-2000--1,050,000 (estimated).

5/ Magnesitic dolomite and brucite. Figures are estimated on the basis of reported tonnage dollar value.

6/ Year beginning March 21 of that stated.