MAGNESIUM COMPOUNDS

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Even though refractory magnesia production was about 9% higher than that in 2000, imports, which supply a significant part of consumption, were down by about 27%, leading to an overall decline in U.S. consumption. According to preliminary data from the American Iron and Steel Institute, U.S. steel mill shipments in 2001 were 8.8% lower than those in 2000, and the U.S. steel industry's capability utilization rate through December 2001 was 75.6%, down from 84.4% in 2000. Total steel production in 2001 declined by 11.5% from that in 2000 (American Iron and Steel Institute, undated§[1]). Because refractory magnesia primarily is used as a lining in iron and steel furnaces, the drop in steel production resulted in a decline in refractory magnesia consumption of about 19% from the 2000 level.

A general economic downturn led to decreasing demand for caustic-calcined magnesia in many of its applications, and as a result, production and imports declined by 20% and 5%, respectively, from the 2000 levels. Domestic consumption of caustic-calcined magnesia fell by 17% from consumption in 2000.

Of the total U.S. magnesium compounds production, about 62% came from seawater and well and lake brines. The remainder was recovered from magnesite, dolomite, olivine, and brucite. About 66% of the total consumption of magnesium compounds was for refractory applications. The remaining 34% was used in agricultural, chemical, environmental, and other applications. China remained the dominant supplier of imports for caustic-calcined and refractory magnesias, with 60% and 67%, respectively, of the totals.

Production

Production of refractory magnesia and magnesium hydroxide increased in 2001, and production of all other compounds declined (table 3). Much of the production declines could be attributed to the poor economic conditions in the United States that persisted for most of the year. Even though refractory magnesia production was about 9% higher than that in 2000, imports, which supply a significant part of consumption, were down by about 27%, leading to an overall decline in U.S. consumption of refractory magnesia.

Data for magnesium compounds were collected by the U.S. Geological Survey from one voluntary survey of U.S. operations. Of the 18 operations canvassed, 78% responded, representing 64% of the magnesium compounds shipped and used (table 3). Data for the four 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 largest magnesite production facilities in the world are in China, North Korea, and Russia. Together, these three countries account for two-thirds of the world magnesite production capacity. Japan and the United States account for more than one-half 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, 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), including 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. Rudi (2001) estimated that total world production of olivine averaged about 4 million metric tons per year (Mt/yr), with about 3.3 Mt/yr consumed in Europe.

In November, IMC Global Inc. completed the sale of its salt and Ogden businesses to Compass Minerals Group Inc. (a subsidiary of privately held Apollo Management LP) in a merger transaction valued at about $640 million. Under terms of the sales agreement, IMC Global would receive about $600 million in cash and continue to have an economic interest in the operation. The Ogden facility produces magnesium chloride, solar salt, and sulfate of potash and will operate under the name of Great Salt Lake Minerals Corp., which is similar to its former name of Great Salt Lake Minerals and Chemicals Corp. (Fertilizer Markets, 2001). Dredging on the Great Salt Lake, which had begun in 2000, was completed early in 2001. The dredging, which involved deepening a breach in a railroad causeway, was undertaken to restore the salinity balance between the north and south arms of the lake; salinity in the south arm had increased to 9% from 7% in 1 year. State officials say that it will take 3 to 5 years to determine if these modifications, completed for about $1 million, are effective. IMC Global claimed that the attempt to restore the salinity balance would hurt production at its Ogden plant (Green Markets, 2001).

In March, Cookson Group plc completed the sale of its magnesia chemicals business to Premier Chemicals LLC for $30.75 million. The magnesia chemicals business originally was part of Premier Refractories Inc., acquired by Cookson in 1999, and this portion of the operations did not fit the core of Cookson's refractories business. Premier Chemicals produced

[1]References that include a section twist (§) are found in the Internet References Cited section.

magnesia from magnesite at Gabbs, NV, and magnesia and magnesium hydroxide from seawater in Port St. Joe, FL. The company also has six hydration plants for the production of magnesium hydroxide from caustic-calcined magnesia (Industrial Minerals, 2001a). Investors in Premier Chemicals include a group headed by the company's chief executive officer and Grecian Magnesite S.A., which is the second largest investor with 15% of the company (Grecian Magnesite S.A., 2001b§).

After North American Refractories Co. (NARCO) filed for chapter 11 bankruptcy on January 4, 2002, RHI Refractories Holding Co. announced that it was restructuring its core business, which includes Harbison-Walker Refractories Co. and A.P. Green Refractories Co. in addition to NARCO (RHI Refractories Holding Co., 2002b§). But only a few days later, the parent company Germany's RHI AG announced that because of the increasing number of asbestos claims, which was the principal reason for NARCO filing for bankruptcy, it was discontinuing the restructuring and wanted to sell all the companies included under RHI Refractories Holding; these companies were deconsolidated from RHI AG retroactive to December 31, 2001 (RHI AG, 2002§).

In May, Martin Marietta Magnesia Specialties Inc. sold its refractory products business to Minteq International Inc. (a subsidiary of Minerals Technologies Inc.) for an undisclosed amount. Both Minteq and Martin Marietta produce monolithic refractory materials, which are used primarily in the steel industry to protect the interior of steelmaking vessels from extremely high temperatures. Martin Marietta had been looking for a buyer for its refractories business since mid-2000, but it retained its magnesia manufacturing operation in Manistee, MI, and its two magnesium hydroxide manufacturing operations in Pennsylvania and Tennessee. Martin Marietta will continue to manufacture refractory products for Minteq for up to 2 years in Manistee, in accordance with a manufacturing agreement (North American Minerals News, 2001).

Consumption

In 2001, environmental applications (water treatment and stack gas scrubbing, in descending order) consumed the most caustic-calcined magnesia, accounting for 37% of U.S. shipments, just slightly more than the second largest end use (chemical intermediates) with 36% of the 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: agriculture (animal feed and fertilizers), 20%; construction (primarily oxychloride and oxysulfate cements), 4%; manufacturing (rubber, fuel additives, and electrical), 2%; pharmaceuticals and nutrition (sugar and medicine and pharmaceuticals), 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, and pharmaceutical applications. Magnesium chloride was used mainly for ice control and as a chemical intermediate. 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 83% of consumption of domestically produced material. Slag conditioning accounted for 8% of U.S. consumption; sandblasting and other abrasive uses, 5%; and refractory applications, 4%.

Prices

Yearend 2001 prices for magnesium compounds quoted in Chemical Market Reporter and Industrial Minerals remained the same as those for 2000 (table 4).

Foreign Trade

In 2001, dead-burned magnesia exports from the United States increased by about 6% (table 5). Canada (64%) and Austria (12%) were the principal destinations. Caustic-calcined magnesia exports returned to normal levels after the significant jump in 2000. France (41%), Japan (14%), the Netherlands (13%), and Brazil (10%) were the main destinations.

Imports of caustic-calcined and dead-burned magnesias fell in 2001. U.S. imports of dead-burned magnesia in 2001 declined significantly, with the imports from China, the main source country, declining by more than 100,000 metric tons (t) (table 7). China (67%) and Australia (15%) continued to be the principal source countries. Imports of caustic-calcined magnesia declined by 5% from imports in 2000. China (60%) and Canada (33%) were the primary sources.

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. U.S. exports of olivine in 2001 were 1,010 t, with 51% of the material shipped to Venezuela and 44% shipped to Argentina. U.S. olivine imports totaled 97,800 t, all from Norway, which was less than one-half the level of imports in 2000. The 2000 imports, however, were significantly higher than in the preceding years. The 2001 import level was still significantly less than in 1999 (117,000 t) or 1998 (174,000 t). Because olivine's principal use is in the steel industry, the decline in U.S. steel production affected consumption of olivine, much of which is supplied by imported material.

World Review

Australia.—After an initial public offering to raise $2.4 million was completed in June, WestMag Ltd. planned to begin a feasibility study to build a 50,000-t/yr magnesia-from-seawater plant in Western Australia. The study was expected to be completed by June 2002, and plant construction, completed by March 2004. WestMag had negotiated with Cargill Australia Ltd. to use brine from its solar salt works in Port Hedland as the proposed plant's feed material, but in August, Cargill Australia sold the Port Hedland operation to Dampier Salt Ltd. At yearend, WestMag was negotiating with Dampier Salt for an option for the brines. In addition to magnesia from seawater, the company planned to produce magnesia from dolomite from its Governor deposit, which is about 350 kilometers (km) south of Port Hedland. The resource estimate for the dolomite is 7 million metric tons (Mt), and the company estimated that it could produce for 50 years at a rate of 50,000 t/yr from the deposit. WestMag's magnesia would be targeted primarily to

Australia's nickel industry, which uses magnesia as a neutralizing agent. In the nickel production process, 1.1 t of magnesia is required for each ton of nickel produced. WestMag already has letters of intent to supply magnesia to two of the country's proposed nickel projects. WestMag also was investigating the potential to supply magnesium hydroxide for flame-retardant applications and magnesia to the iron and steel industry for use as a binding agent in iron briquettes or as a flux or slag conditioner in the production of direct-reduced iron (Industrial Minerals, 2001e).

In October, Mt. Grace Resources NL announced that it negotiated an option agreement to purchase the Princhester magnesite deposit, located 95 km north of Rockhampton in Central Queensland. Resource definition work completed by previous owners delineated 5.4 Mt of very-high-grade (46.8% MgO) magnesite with a low silica (1.8% SiO_2) content. The deposit occurs as a near-surface horizontal sheet with an average thickness of about 12 meters. At yearend, Mt. Grace was in the final stages of awarding a contract to undertake a bankable feasibility study for its Batchelor project; plans were to begin production at a new 12,500-t/yr magnesium plant by early 2003 (Mt. Grace Resources NL, 2001§).

Canada.—Hatch Associates completed a scoping study in September on Globex Mining Enterprises Inc.'s Timmins magnesite-talc deposit. The study indicated that a mine, mill, and smelter complex producing 90,000 t/yr of magnesium metal would be an appropriate scale of project. According to the initial study, this proposed plant would be in the lowest cost quartile of world magnesium producers and would require an investment of $966 million to complete. The study also proposed that the mine-mill complex and talc upgrading facility would be near Timmins, Ontario, and the smelter complex would be west of Rouyn-Noranda, Quebec. The mine-mill complex would consist of mining and feed preparation, flotation to remove byproduct minerals and impurities, talc upgrading, and calcining to produce magnesia. The second portion of the complex would consist of a smelter to produce magnesium metal. Globex Mining reported that, based on previous drilling results, the property contains a large body (more than 100 Mt) of magnesite, talc, and quartz. The ore body is made up of roughly 54% magnesite, 27% talc, and 16% quartz, with 3% accessory iron oxides (Globex Mining Enterprises Inc., undated§).

China.—In February, the China Magnesite Export Association (CMEA) was formed, uniting the two separate export syndicates that were formed in 2000. A total of 23 companies are members of the CMEA, which represents most of the country's magnesia producers and exporters. The stated goals of the CMEA are to stabilize magnesia export prices and ensure supply of quality products (Industrial Minerals, 2001c). The accession of China to the World Trade Organization in September 2001 may affect the future of this association. In addition, it most likely will affect the export licensing policy, fees, and import duties that are imposed by the Chinese authorities.

Tateho Chemical Industries Co. Ltd. of Japan, in a joint venture with two other Japanese firms, planned to begin producing fused magnesia in Dalian, Liaoning Province, by July 2002. The new plant, which is estimated to cost $3.65 million to construct, will have the capacity to produce 10,000 t/yr of insulator-grade fused magnesia for the world market; construction was scheduled to begin in March 2002. Tateho, which will own 70% of the joint-venture company, already produces about 8,000 t/yr of fused magnesia for heater insulation and circuit boards, most of which is exported, and 7,000 t/yr of magnesium hydroxide for Japan's steel industry (Industrial Minerals, 2001d).

Greece.—Grecian Magnesite S.A. increased its holding in the Spanish magnesite producer Magnesitas Navarras S.A. from 51% to 99.7% in March. Magnesitas Navarras operates a mine and plant near Zubiri that can produce 170,000 t/yr of caustic-calcined and dead-burned magnesias. In its formal business plan, the new management of Magnesitas Navarras plans to increase its market share, increase sales, improve product quality and customer satisfaction, decrease production cost, enhance environmental protection, and increase the lifespan of the mine (Grecian Magnesite S.A., 2001a§). In addition to its acquisition of the facilities in Spain, Grecian Magnesite's share of Premier Chemicals enables the company to enter the magnesium hydroxide market.

Russia.—JSC Kombinat Magnezit announced that an improvement plan, costing about $7.6 million, was approved in February. Plant improvements will include new press machinery, a new vacuum-press facility, and new mixing equipment. In addition, the company plans to develop a new shaft furnace that will be capable of producing 2.5 metric tons per hour of refractory articles (Industrial Minerals, 2001b). Magnezit also began mining from its Goluboe magnesite deposit that it acquired in 2000.

Ukraine.—After an antidumping investigation of imports of magnesia refractories from Germany, Russia, and Slovakia that began in 2000, the Ukrainian International Trade Commission decided to introduce quotas for magnesite refractories from these countries in June 2001. According to an official from the country's department for trade relations and control of economic activity, the imports were hurting Ukraine's refractory makers. Their profits and sales had fallen, and up to 60% of their production capacity was idle (Metals-Russia.com Ltd., 2001§). The investigation began when Ukrainian refractory makers complained to the Association of Ferrous Metallurgy Enterprises about the quantity of refractories being imported. The association said Ukraine imported $50 million per year in refractories, which was about one-third of the country's total market.

Current Research and Technology

The U.S. Department of Energy (DOE), in cooperation with Arizona State University and Science Applications International Corp., is investigating the use of serpentinite minerals, including olivine, as a means of carbon dioxide (CO_2) sequestration by direct mineral carbonation. The objective of this research is to reduce greenhouse gas emissions from coal-fired power plants. The process includes a two-stage reaction: hydration of CO_2 to form carbonic acid (H_2CO_3), followed by mineral carbonation. Olivine is reacted with the H_2CO_3 to form the magnesium carbonate mineral magnesite ($MgCO_3$). Thus, the CO_2 is converted into a solid form and is no longer free to escape into the atmosphere. Initial studies using subcritical CO_2 conditions achieved over 80% conversion of the olivine into $MgCO_3$, although reaction times were extremely slow. The DOE planned to continue the research using supercritical CO_2, which showed promise for reduced reaction times. Future program activities include pilot-scale

testing to produce realistic engineering design data by 2003 and completion of a technical and economic assessment by 2005 (U.S. Department of Energy, undated a§, b§).

Outlook

Demand for magnesia in the United States is directly affected by the health of the U.S. steel industry because most of the refractory magnesia produced is used in iron and steel furnaces. According to the steel industry, falling prices and rising imports have left only a few U.S. steel producers making profits, and 31 have filed for bankruptcy protection over the last 4 years, including Bethlehem Steel Corp., LTV Steel Corp., Republic Technologies International LLC, and Wheeling-Pittsburgh Steel Corp., which filed for bankruptcy in 2001. Because of these factors, the President decided to impose tariffs of up to 30% on imports of most steel products in March 2002 (Allen and Pearlstein, 2002). Under the decision, only steel imported from Canada and Mexico would be exempt from the duties because of these countries' status under the North American Free Trade Agreement, as would imports from developing countries, such as Argentina, Thailand, and Turkey, because they account for less than 3% of all total imports. This decision is expected to help the U.S. steel industry recover, and if that occurs, it could lead to an increase in consumption of magnesia refractories.

Imports of magnesite, mainly from China, are expected to continue to supply much of the U.S. demand for magnesia for refractory applications. Even though China already supplies a significant portion of the United States' refractory requirements, this percentage may increase in the near future. The two largest refractory magnesia producers, Martin Marietta and RHI Refractories Holding, are in transition. Martin Marietta sold its refractories business to Minteq in 2000, and although it has a magnesia supply agreement for 2 years, Minteq may choose to find another source of supply after the contract expires. The company could choose to import refractory magnesia, perhaps from China. In addition, RHI Refractories Holding filed for chapter 11 bankruptcy protection in February 2002 (RHI Refractories Holding Co., 2002a§). The future of the magnesia plant in Michigan will hinge on the outcome of the bankruptcy proceedings. RHI Refractories Holding is attempting to close or consolidate some facilities, although the magnesia refractory facility has not been targeted for closure. If, however, the company does close the plant, that would open up more markets for imported refractory magnesia.

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TABLE 1
SALIENT MAGNESIUM COMPOUND STATISTICS 1/

(Thousand metric tons and thousand dollars)

	1997	1998	1999	2000	2001
United States:					
Caustic-calcined and specified magnesias: 2/					
Shipped by producers: 3/					
Quantity	160	177	179	172	136
Value	$52,600	$76,700	$77,000	$46,000	$43,300
Exports 4/	5	5	3	12	4
Imports for consumption 4/	133	127	123	136	130
Refractory magnesia:					
Shipped by producers: 3/					
Quantity	283	215	216	196	213
Value	$97,500	$75,000	$75,300	$68,100	$71,300
Exports	66	63	67	60	63
Imports for consumption	279	427	392	501	363
World production (magnesite)	10,100 r/	11,400 r/	9,790 r/	11,100 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 2001

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 LLC	Gabbs, NV	140,000	Caustic-calcined and dead-burned magnesia.
Lake brines:			
Great Salt Lake Minerals Corp.	Ogden, UT	106,000	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:			
Premier Services LLC	Port St. Joe, FL	50,000	Caustic-calcined magnesia and magnesium hydroxide.
SPI Pharma Inc.	Lewes, DE	5,000	Magnesium hydroxide.
Western Salt Co.	Chula Vista, CA	3,000	Magnesium chloride brines.
Total		895,000	

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-capacity plant.
3/ In addition to its Michigan plant, Martin Marietta owned a 30,000-metric-ton-per-year-capacity magnesium hydroxide plant in Pittsburgh, PA, and a 15,000-metric-ton-per-year-capacity 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/

	2000		2001	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic-calcined and specified (USP and technical) magnesias 2/	172,000	$46,000	136,000	$43,300
Magnesium hydroxide [100% $Mg(OH)_2$] 2/	212,000	81,700	268,000	100,000
Magnesium sulfate (anhydrous and hydrous)	44,000	12,700	38,100	12,000
Precipitated magnesium carbonate 2/	1,960	4,650	1,750	4,170
Refractory magnesia	196,000	68,100	213,000	71,300

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		2000	2001
Magnesia, natural, technical, heavy, 85%, f.o.b. Nevada	per short ton	$232-$265	NA
Magnesia, natural, technical, heavy, 90%, f.o.b. Nevada	do.	265	NA
Magnesia, dead-burned	do.	350	$388
Magnesia, synthetic, technical	do.	385	NA
Magnesium chloride, hydrous, 99%, flake	do.	290	290
Magnesium hydroxide slurry, technical, 100% $Mg(OH)_2$	do.	NA	210
Magnesium carbonate, light, technical, freight equalized	per pound	0.73-0.78	NA
Magnesium chloride, anhydrous, 92%, flake or pebble	do.	NA	$0.1275-0.15
Magnesium hydroxide, powder, technical	do.	.45	.45
Magnesium sulfate, technical, epsom salts	do.	.18-.195	.18-.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

NA Not available.

Sources: Chemical Market Reporter and Industrial Minerals.

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

Material and country	2000 Quantity (metric tons)	2000 Value (thousands)	2001 Quantity (metric tons)	2001 Value (thousands)
Caustic-calcined magnesia:				
Brazil	2,170	$2,980	367	$527
France	1,080	525	1,570	1,000
Germany	748	405	332	217
Japan	1,310	1,750	536	569
Mexico	3,020	983	93	83
Netherlands	1,280	717	476	321
Other	2,000	1,110	380	235
Total	11,600	8,470	3,750	2,960
Dead-burned and fused magnesia:				
Austria	28	9	7,270	1,780
Canada	50,300	14,800	40,600	12,300
Germany	155	90	5,310	1,850
Hong Kong	1,650	1,920	667	777
Japan	590	309	2,270	700
Korea, Republic of	2,140	1,570	683	582
Mexico	429	231	936	448
Netherlands	622	265	717	352
United Kingdom	181	351	87	60
Vietnam	--	--	1,120	322
Other	3,730 r/	2,900 r/	3,530	2,040
Total	59,800	22,400	63,100	21,200
Other magnesia:				
Canada	5,090	1,950	10,500	3,460
Colombia	839	880	1,550	585
Germany	56	124	1,470	11,400
Hong Kong	775	1,020	1,100	1,400
Indonesia	36	26	1,730	1,090
Japan	576	2,480	1,870	1,610
Mexico	5,610	4,680	11,600	6,930
New Zealand	2,120	1,980	117	184
Spain	671	812	143	138
Taiwan	245	218	2,150	1,280
Venezuela	2,670	712	980	363
Other	2,730 r/	4,080 r/	3,470	15,600
Total	21,400	19,000	36,600	44,100
Crude magnesite:				
Argentina	864	92	1,040	111
Brazil	2,870	306	2,400	256
Canada	3,520	504	2,950	406
France	733	78	1,470	157
Germany	5,740	621	551	59
Korea, Republic of	1,250	136	1,100	151
Mexico	2,750	311	746	132
Netherlands	3,130	424	430	46
Spain	2,960	316	2,870	332
United Kingdom	258	57	1,070	121
Venezuela	2,100	239	2,520	347
Other	3,330 r/	374 r/	1,650	179
Total	29,500	3,460	18,800	2,300

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	2000 Quantity (metric tons)	2000 Value (thousands)	2001 Quantity (metric tons)	2001 Value (thousands)	Principal destinations, 2001
Magnesium chloride, anhydrous and other	4,900	$15,800	3,630	$5,080	Canada, 78%; Japan, 8%.
Magnesium hydroxide and peroxide	20,200	10,600	20,800	9,630	Canada, 73%; Germany, 10%.
Magnesium sulfate, natural kieserite and epsom salts	453	224	406	223	Panama, 74%; Canada, 18%.
Magnesium sulfate, other	6,200	2,970	6,360	3,860	Canada, 77%; France, 7%.

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	2000 Quantity (metric tons)	2000 Value (thousands)	2001 Quantity (metric tons)	2001 Value (thousands)
Caustic-calcined magnesia:				
Canada	38,700	$6,760	42,500	$8,000
China	88,500	9,940	77,400	9,230
Greece	5,000	1,200	5,200	1,340
Other	4,070	4,170	4,780	4,830
Total	136,000	22,100	130,000	23,400
Dead-burned and fused magnesia:				
Australia	65,900	14,800	55,600	11,000
Austria	21,500	9,860	14,000	5,520
Brazil	10,000	990	9,500	994
China	345,000	44,600	245,000	36,400
Greece	3,030	558	--	--
Hong Kong	18,300	2,280	11,900	1,480
Israel	9,820	7,220	11,700	7,280
Other	27,100	7,860	15,400	4,570
Total	501,000	88,200	363,000	67,200
Other magnesia:				
Canada	6,250	1,180	3,160	775
Israel	2,870	5,130	2,410	5,280
Japan	1,680	3,150	1,670	3,220
Mexico	4,700	2,270	6,660	2,420
Slovakia	1,290	473	1,640	738
Other	2,120 r/	1,940 r/	1,620	1,030
Total	18,900	14,100	17,200	13,400
Crude magnesite:				
China	6,010	776	4,650	438
Israel	979	202	6	10
Japan	2,530	558	2,440	545
United Kingdom	3,520	953	3,210	690
Other	1,540	337	1,180	262
Total	14,600	2,830	11,500	1,950

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

	2000		2001		
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Principal sources, 2001
Magnesium chloride, anhydrous and other	35,800	$7,210	62,000	$8,840	Israel, 74%; Netherlands, 24%.
Magnesium hydroxide and peroxide	8,960	14,700	6,930	10,500	Israel, 36%; Netherlands, 28%; Japan, 14%.
Magnesium sulfate, natural epsom salts	85	23	77	20	Germany, 100%.
Magnesium sulfate, natural kieserite	27,000	831	22,500	640	Germany, 100%.
Magnesium sulfate, other	31,800	7,030	36,900	8,430	Germany, 58%; Canada, 30%.

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, 2001 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	150	--	--	--	150
Mexico	--	--	15	95	110
United States	NA	NA	NA	NA	895 3/
Total	150	NA	15	95	1,160
South America, Brazil	80	291	--	--	371
Europe:					
Austria	35	250	--	--	285
France	--	--	30	--	30
Greece	120	80	--	--	200
Ireland	--	--	--	90	90
Italy	25	--	5	70	100
Netherlands	--	--	--	150	150
Norway	--	--	25	--	25
Poland	--	10	--	--	10
Russia	100	2,670	--	--	2,770
Serbia and Montenegro	40	200	--	--	240
Slovakia	--	330	--	--	330
Spain	150	70	--	--	220
Turkey	50	309	--	--	359
Ukraine	--	120	20	80	220
United Kingdom	--	--	70	80	150
Total	520	4,040	150	470	5,180
Africa:					
Kenya	NA	NA	--	--	170
South Africa	7	--	--	--	7
Total	7	NA	--	--	177
Asia:					
China	200	2,480	--	10	2,690
India	25	261	--	--	286
Iran	--	30	--	--	30
Israel	--	--	10	60	70
Japan	--	--	50	250	300
Korea, North	--	500	--	--	500
Korea, Republic of	--	--	--	50	50
Total	225	3,270	60	370	3,920
Oceania, Australia	48	120	--	--	168
Grand total	1,030	7,720	225	935	11,000

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	1997	1998	1999	2000	2001 e/
Australia	245,192	360,115	280,505	349,783	540,000
Austria, crude	650,000 e/	723,000	749,000 r/	726,000 r/	700,000
Brazil, beneficiated 3/	294,629	308,300	259,834 r/	279,876 r/	280,000
Canada e/ 4/	180,000	180,000	180,000	180,000	180,000
China e/	2,400,000	2,400,000	2,450,000	2,500,000	2,600,000
Colombia e/	44,517 r/ 5/	10,500	10,500	10,500	10,500
Greece, crude e/	623,050 5/	650,000	495,144 r/ 5/	500,000 r/	500,000
India	362,929	355,033	360,080 r/	365,080 r/	370,000
Iran 6/	55,000 e/	109,597	141,081	141,000 e/	150,000
Korea, North e/	1,600,000	1,500,000 r/	1,000,000	1,000,000	1,000,000
Mexico	231	274	308	335	350
Pakistan	4,057	3,157	2,175 r/	4,192 r/	4,200
Philippines e/	700	700	700	700	700
Poland, concentrate	6,403	5,745	-- r/	-- e/	--
Russia e/	1,040,000	851,845 5/	900,000	1,000,000	1,000,000
Serbia and Montenegro, crude	95,000	81,000	31,000 r/	11,000 r/ e/	36,000 5/
Slovakia, concentrate	863,600	877,840	918,000 r/	1,001,000 r/	1,000,000
South Africa	76,669	74,300	73,900 r/	74,700 r/	75,000
Spain, calcined	171,000 r/	201,000 r/	211,000 r/	266,000 r/	260,000
Turkey (run of mine)	1,409,768	2,703,343	1,724,744 r/	2,672,089 r/	2,000,000
United States	W	W	W	W	W
Zimbabwe	13,050	4,321	5,356 r/	4,000 e/	4,000
Total	10,100,000 r/	11,400,000 r/	9,790,000 r/	11,100,000 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 20, 2002.

3/ Series reflect output of marketable concentrates. Production of crude ore was as follows, in tons: 1997--1,030,171; 1998--1,109,351 (revised); 1999--868,604 (revised); 2000--1,006,654 (revised); and 2001--1,100,000 (estimated).

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

5/ Reported figure.

6/ Year beginning March 21 of that stated.