

Magnesium

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By all accounts, 1995 was a record year for the international magnesium industry. According to the International Magnesium Association (IMA), Western World primary magnesium production totalled 227 400 t for the first three quarters of 1995, compared to 215 000 t during the same period in 1994. Despite the higher production, strong demand in several key sectors of the magnesium market resulted in tight supplies for most of the year. Prices for primary magnesium reflected the tight market, as did prices for the usually more stable die-cast alloys. Stocks fell from 23 300 t at the start of the year to 17 000 t in June, but increased again to 21 300 t by the end of the third quarter. While the strength of the magnesium markets weakened somewhat in the third quarter, overall market fundamentals indicate that magnesium markets will remain strong throughout 1996.

CANADIAN DEVELOPMENTS

The Canadian magnesium industry increased production in 1995 as economic activity increased in key sectors of the North American economy. This led to an increased demand for magnesium products, particularly in the automotive sector. Reported Canadian magnesium consumption increased in 1994 by 3576 t to 23 590 t, due mainly to increased consumption for aluminum alloys, which increased by 18% to 12 416 t. Demand for magnesium used in castings and wrought products also increased by 9.5% to 8940 t.

Production at Norsk Hydro Canada Inc.'s 40 000-t/y Bécancour smelter reached full capacity for the first time in 1995 as demand for its products increased. Production had been affected by countervailing and anti-dumping duties imposed by the United States in 1991. The process technology used at Bécancour involves leaching magnesite imported from China with hydrochloric acid to produce a brine of magnesium chloride ($MgCl_2$), and then reducing the $MgCl_2$

granules in electrolytic cells to produce metallic magnesium.

Timminco Metals, a division of Timminco Limited, produces high-purity metal (up to 99.98% pure) for specialized market applications at its 6000-t/y magnesium plant at Haley Station, Ontario. The company also produces highly corrosion-resistant magnesium die-casting alloys and extruded anode rods for hot water heaters. Timminco's magnesium products can be used for a variety of applications such as an alloying agent for aluminum and calcium, in Grignard reagents for the pharmaceutical industry, and in electronic products. Timminco uses the Pidgeon magnesium process in which calcined dolomite is reduced by ferrosilicon in a vacuum retort. Timminco mines the dolomite at the plant site but purchases the ferrosilicon feed on the open market.

Magnola Metallurgy Inc. announced its intention to enter the magnesium market by the year 2000. The project involves the development of a 58 500-t/y magnesium smelter using a unique proprietary process based on the tailings from local asbestos mines (containing 24% magnesium) in the Thetford Mines-Asbestos region of Quebec to serve as the plant's feedstock. In the fall of 1995, Magnola began construction of a pilot plant at Canadian Electrolytic Zinc in Valleyfield, Quebec. The pilot plant is expected to begin operating in the summer of 1996. Should tests at the pilot plant prove successful, Magnola plans to start construction in 1998 of a commercial plant at an estimated cost of about \$525 million. Noranda Metallurgy Inc. owns 52% of Magnola, with the remainder being shared between Japanese automotive parts manufacturers Aisin Seiki Company Limited, Aisin Takaoka Company Limited, and Aisin World Corporation of America (16%), the Montréal-based engineering firm SNC Lavalin Inc. (16%), and the Société générale de financement du Québec (SGF) (16%).

The former Magnesium Co. of Canada (Magcan) plant site, located near High River, was sold in 1995 and turned into an industrial park. Alberta Natural Gas Company Ltd. bid \$4.8 million for the idle plant and expects to recover this cost by selling the magnesium-producing equipment. The Magcan plant was originally built using a new technology to directly produce magnesium chloride from magnesite by carbochlorination. Alberta Natural Gas and

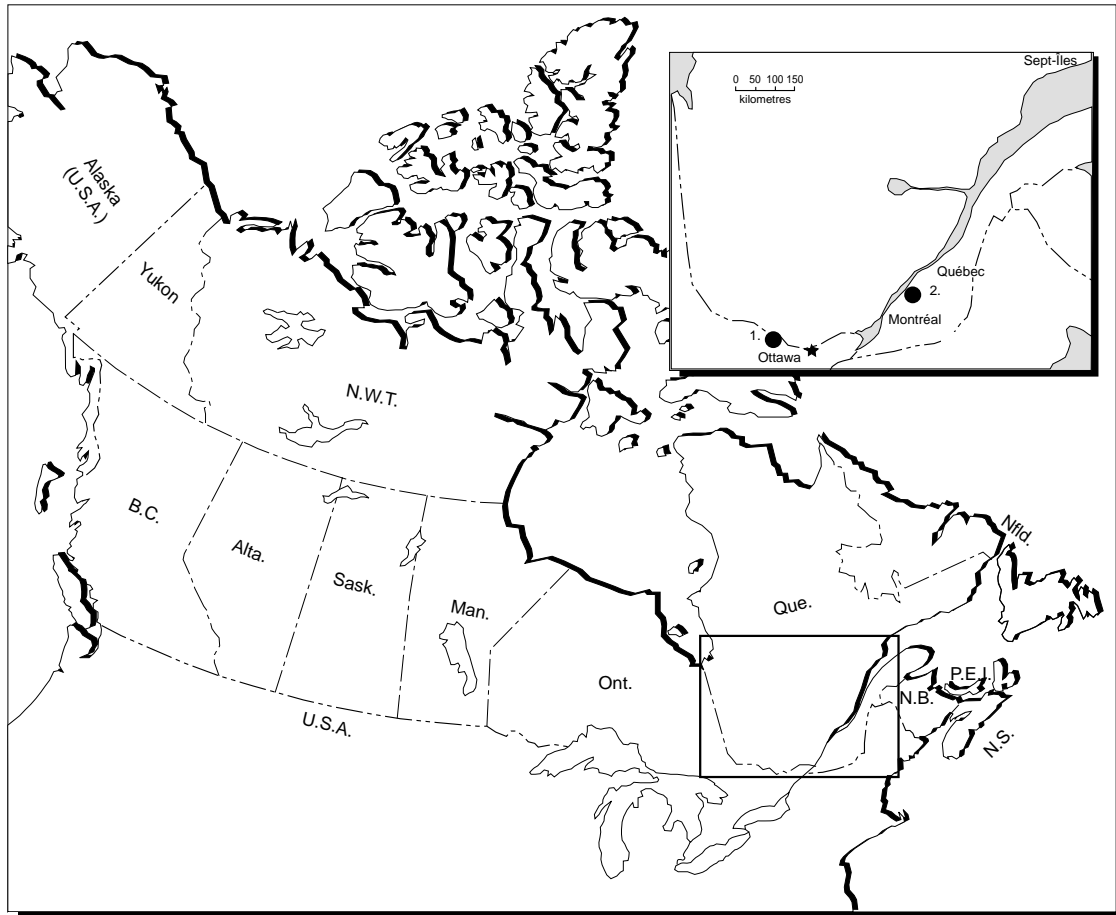
Magnesium International Canada Ltd. formed Magcan in 1986. The province of Alberta guaranteed a loan for \$103 million to build the first phase of the \$370 million smelter, which was completed in July 1990. The smelter closed in 1991 after one of the partners refused to invest more money in the project. As a result, the Alberta government became the owner of the facility, and costs to the government increased as efforts to find a buyer failed.

Meridian Technologies Inc. of Toronto obtained a contract worth \$35 million annually to supply magnesium instrument panels for General Motors Corp. (GM) trucks. Deliveries began in 1995 and will continue over a 10-year period. The contract represents the single largest magnesium contract awarded to a supplier in North America. Meridian also announced that it had received a letter of intent to supply magnesium transfer cases for all of GM's light trucks beginning in 1997. As a result of increased demand,

Meridian plans to build a third die-casting plant in North America. The company currently operates plants in Strathroy, Ontario, and Eaton Rapids, Michigan. The new plant will be located either in Ontario or Michigan.

Haley Industries Ltd. of Haley Station, Ontario, received ISO 9002 certification in 1995. The certification represents the result of a two-year effort by the company and its employees, and complements the company's continuous improvement program. Earlier in the year, Haley Industries announced that it had signed a five-year, \$85 million contract to supply magnesium parts for GM pick-ups and utility trucks. The company formed a joint venture with Amcan Castings Ltd. to build a new high-pressure die-casting operation near Haley's existing facilities. The operation, initially employing two 800-t die-casting machines, was scheduled for start-up in mid-1995.

Figure 1
Magnesium Smelters, 1995

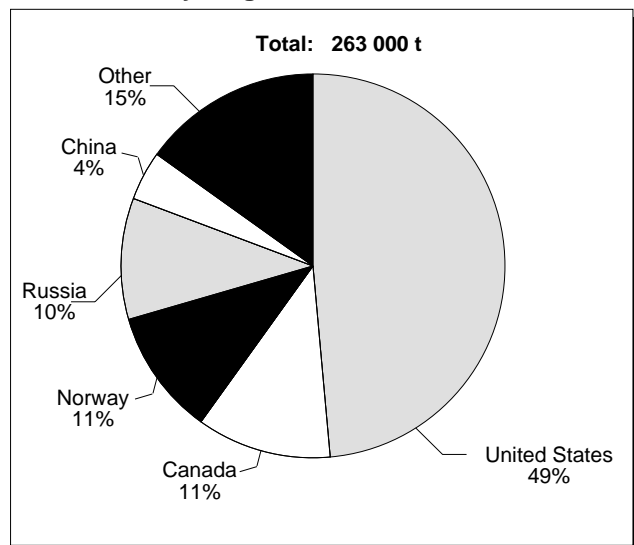


SMELTER	COMPANY	CAPACITY (t/y)
1. Haley Station, Ontario	Timminco	6 000
2. Bécancour, Quebec	Norsk Hydro	40 000

WORLD DEVELOPMENTS

Western World primary production of magnesium totalled 227 400 t in the first three quarters of 1995, compared to 161 900 t over the same period in 1994. The higher production was not enough, however, to meet the increased demand, particularly in North America and the Far East, resulting in prices reaching higher levels by year-end. Total magnesium shipments for the first nine months of 1995 increased 5.5% to 227 400 t compared to 215 000 t for the same period in 1994. Magnesium exports from the republics of the former Soviet Union and China remained strong in 1995, which led to the initiation of trade action in the United States, Europe and Brazil.

Figure 2
World Primary Magnesium Production, 1994



Source: Natural Resources Canada.

United States

The United States, the world's largest magnesium producer, has three primary magnesium smelters. The Dow Chemical Company, the largest U.S. producer, operates a 65 000-t/y electrolytic magnesium plant at Freeport, Texas. Magnesium chloride feedstock for the plant is derived from a seawater-dolomite process. Magnesium Corporation of America (Magcorp), the third largest magnesium producer in the world, operates a 38 000-t/y electrolytic plant in Rowley, Utah. Northwest Alloys Inc., a subsidiary of the Aluminum Company of America (Alcoa), operates a 38 000-t/y magnesium plant in Addy, Washington. The plant uses the Magnetherm silicothermic process by which magnesium is produced by reducing dolomite with ferrosilicon. The bulk of Northwest Alloy's production is shipped for use by subsidiaries of Alcoa. In March the company announced that it was bringing its sixth furnace on line. The plant has a total of

nine furnaces, but has been operating at a reduced capacity during the retrofitting period.

The U.S. International Trade Commission ruled in April that the U.S. magnesium industry had been injured by imports of pure magnesium from Russia, Ukraine and China, as well as from several traders. The same ruling dismissed the claim that injury had been caused by imports of magnesium alloy from the same countries. The decision confirms the final duties as announced by the U.S. Department of Commerce in March. Duties for pure magnesium were set at 108.26% for China, 103.27% for Ukraine and Gerald Metals, 79.87% for MG Metals, 92.21% for Hochschild Partners, and 104.27% for all others. Duties for Russian magnesium ranged from zero to 100.25% depending on the importer and the producer source.

Europe

The Commission of the European Communities imposed provisional anti-dumping duties on magnesium imports from Russia and Ukraine at the end of the year. The Commission found that magnesium imports had been dumped into Europe in 1993 at margins of 55% from Russia and 64% from Ukraine. The quantity of imports from Kazakhstan was found to be too small and therefore no duties were imposed. The suit was originally filed in 1993 on behalf of Pechiney, the sole magnesium producer in the European Union. At the time of the suit, imports of magnesium from the former Soviet Union were flooding the European market.

In Iceland, Sudunes Regional Heating Corporation completed a feasibility study for the proposed construction of a 25 000-t/y magnesium plant. The project will make use of geothermal power. The cost of the project is estimated to be US\$250 million and it will take two to three years to construct.

Norsk Hydro AS operates a primary magnesium smelter at Porsgrunn, Norway. The plant produces magnesium by the electrolysis of magnesium chloride derived from a seawater-dolomite process and from magnesium chloride brine imported from Germany. Norsk Hydro announced that it will increase magnesium output at its Porsgrunn plant in Norway by 8000 t/y by re-starting capacity that had temporarily closed in 1992. The extra capacity will be in place at the beginning of 1997, increasing the company's worldwide primary magnesium capacity to 80 000 t/y.

Magnesium Products of Italy, a subsidiary of Meridian Technologies, began trial operation of four magnesium die-cast machines in September at its new plant in Verres, Italy. The plant will produce a variety of magnesium parts for the European automotive industry, including seat frames and instrument panels. Full commercial production is expected to begin in 1996 and the plant will be the world's largest die-caster for the mass production of magnesium auto parts.

Russian Federation

Russian magnesium producer Solikamsk Magnesium Works completed a feasibility study on the possible expansion of the plant's capacity by adding an additional 25 000 t/y to its existing 20 000-t/y facility. The plans call for a new plant to be built next to the existing facilities and it could be on stream in two or three years. Financing for the project has not yet been arranged.

Avisma announced that its 1995 production was expected to be about 25 000 t, up from about 18 000 t in 1994. The company has reportedly not been selling to the free market, but has adopted a strategy targeting long-term contracts.

Israel

Germany's Volkswagen AG and the Israeli chemical company Dead Sea Works (DSW) announced a joint-venture investment of US\$600 million in a project to extract magnesium from the Dead Sea. The project will be built in two stages at Sdom. In the first stage, the 25 000-t/y plant will start producing magnesium at the end of 1996 and will reach full production in 1997. The second stage of the project will add another 25 000 t of capacity. Under the terms of the agreement, Volkswagen will maintain a 35% equity interest in the project and could take close to half of the plant's production. Dead Sea Works and Volkswagen are also reportedly examining options towards a possible further expansion. Other automotive companies, including Korea's Hyundai and GM in the United States, have indicated their intention to purchase magnesium from DSW.

China

China has been steadily increasing its magnesium production and may seek additional opportunities to expand even further in an effort to double its production capacity to about 80 000 t/y over the next few years. China currently operates some 40 small-scale plants, many of which are operating at only half capacity using the Pidgeon process.

China's largest magnesium producer, the Minhe magnesium smelter in Qinghai Province, was expected to nearly double its capacity to 30 000 t/y by the end of 1995. The northeastern province of Jilin plans to build four plants with a combined capacity of 8200 t/y beginning sometime in 1996. Elsewhere in the country, Japan's Liberty World Corp. and the Government of China's Henan Province established a joint-venture project to produce magnesium in Hebi, China. Hebi Four Seasons Metal Industry Corp. plans to increase capacity to 3500 t/y by fiscal year 1997/98.

The southern province of Guangxi is also seeking foreign investment to build a 3400-t/y smelter in

Lingyun County. The smelter would ship part of its production to the nearby Pingguo aluminum smelter, with the remainder targeting the export market. Neighbouring Hechi, also in Guangxi Province, is looking at plans to build a 3000-t/y magnesium smelter.

The Nanjing Ube Magnesium Company, a joint venture between China and Japan, was scheduled to start magnesium production in September at a new 4000-t/y plant located in Jiangsu Province.

India

India is reportedly reviewing the possibility of developing its large reserves of dolomite and increasing its magnesium metal production. Total recoverable reserves of dolomite in India are presently estimated at 5 billion t. There are two magnesium producers in India currently employing the Pidgeon process: Tamil Nadu Magnesium Limited and Southern Magnesium and Chemicals Limited. Each company is operating a smelter with a 600-t/y capacity; however, Southern Magnesium and Chemicals is reportedly expanding its operations to 2000 t/y.

Australia

A large-scale magnesium pilot plant to test technology for a magnesium plant is to be built at Gladstone, Queensland. The plans include provisions to build a 60 000-t/y smelter in Gladstone sometime in the next decade. The pilot plant was part of the Australian Magnesium Research Development Project.

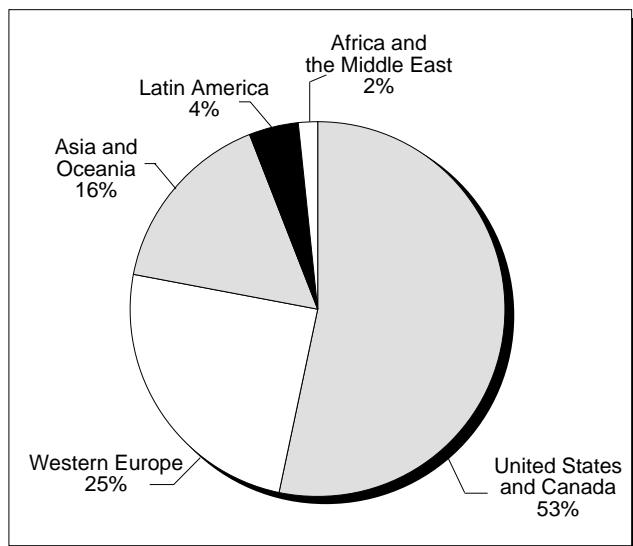
CONSUMPTION AND USES

Total world consumption of primary magnesium reached 317 000 t in 1994 compared to 275 900 t in 1993. Total reported Canadian primary magnesium consumption at the first processing stage was 23 590 t in 1994 compared to 20 014 t in 1993.

Magnesium is the eighth most abundant element in the earth's crust, comprising over 2% of the total. It is the third most abundant element dissolved in seawater with a concentration averaging 0.14%. Unlike many major elements, magnesium does not occur in its native state, but is found in over 60 different minerals. The principal sources of magnesium are as a carbonate in dolomite and magnesite, as a silicate in olivine and brucite, and as a chloride in seawater, natural brines and evaporites, and salt deposits. Magnesium metal is currently produced from three major sources: dolomite/magnesite, seawater, and brines and bitterns.

Magnesium is best known for its light weight and high strength-to-weight ratio, making it suitable for a wide range of applications. When used as a structural material, magnesium is alloyed with several other

Figure 3
Magnesium Shipments by World Zone, 1995^e



Source: International Magnesium Association.

^e Estimated.

elements including aluminum, lithium, manganese, rare-earth metals, silver, thorium, zinc and zirconium. When alloyed with one or a number of these elements, the resultant alloys can have unusually high strength-to-weight ratios. Magnesium-aluminum alloys are the most common and are principally used in die-cast applications.

The main application of magnesium is as an alloying agent for aluminum, accounting for close to 53% of Western World consumption in 1995. According to the IMA, Western World magnesium shipments for this application reached 119 500 t in the first nine months of 1995, compared to 105 700 t for the same period in 1994. Magnesium consumption for this application is forecast to increase by 1% annually.

The second largest use of magnesium is in structural applications, of which pressure die-cast products is the most important use. The IMA reported that shipments of magnesium in the first nine months of 1995 for die-cast applications totalled 47 000 t. Total consumption of magnesium for this application is expected to exceed 100 000 t/y within the next five years. During the next decade, pressure die casting is expected to be the fastest growing sector, particularly in the United States and Europe.

The increased interest in magnesium metal in the automotive market is largely due to weight savings of about 33% compared to aluminum. Magnesium also has good vibration-dampening characteristics. Its lower heat of solidification, which increases die-casting

production capacity by 25%, results in major process energy savings. In addition, magnesium dies are reported to have more than twice the life of aluminum dies. Furthermore, at a magnesium-to-aluminum price ratio of 1.7:1.0, many magnesium metal parts can be fabricated at a lower cost than those made from aluminum.

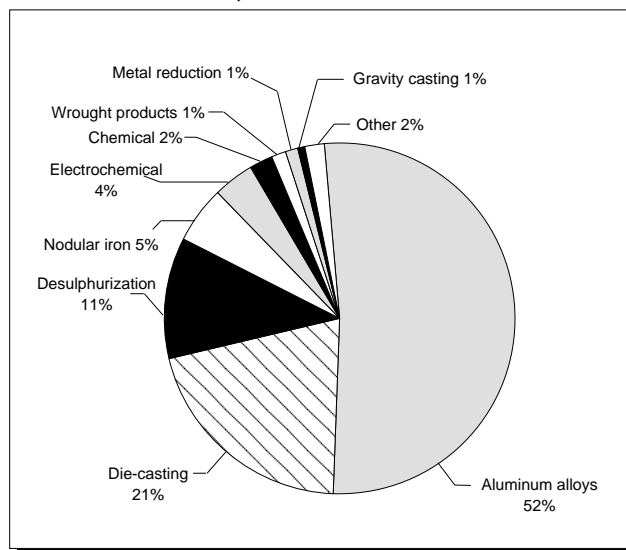
The enforcement of stricter fuel efficiency and emissions standards is encouraging many auto manufacturers to reduce their vehicles' weight. Increased consumer demand for cars with added luxury items is also driving manufacturers to find ways to reduce automobile curb-weight. Many automobile manufacturers in both the United States and Japan are looking to magnesium to help reduce total vehicle weight without sacrificing consumer demand for larger vehicles.

Besides automotive applications, die-cast magnesium products are widely used in the manufacture of portable tools and sporting goods. The use of magnesium in electronics equipment, particularly computer housings and components, has grown substantially. This trend is expected to continue. Magnesium's advantages for these applications are its good strength-to-weight ratio, good heat dissipation, electromagnetic field containment, and radio frequency interference dissipation.

The third largest use of magnesium is as a desulphurizing agent in the ferrous industry. Magnesium shipments in the first nine months of 1995 for desulphurization, as reported by the IMA, totalled 24 600 t. This sector, which grew at an average rate of 15%/y in the late 1980s, should see a more moderate growth rate because of the rationalization that took place in the steel industry.

Nodular iron production is used primarily for ductile iron pipes and die-cast parts for use in automobiles and farm equipment. Shipments in the first nine months of 1995 totalled 12 100 t. This application is not expected to grow as plastics increasingly penetrate the water pipe market. Magnesium is also used as a reducing agent in the production of titanium, beryllium, zirconium, hafnium and uranium. Electrochemical applications account for about 4% of magnesium consumption for use in the manufacture of batteries and in anodes for the cathodic protection of gas pipelines and water heaters. As with nodular iron, plastics in the gas pipeline market continue to penetrate this market. Chemical applications include the manufacture of pharmaceutical products, perfumes and pyrotechnics. Wrought products mainly include extruded products, except anodes, sheets and plates; gravity casting includes the production of complex or large parts by sand casting or casting with other materials.

Figure 4
Magnesium Shipments by Use,
First Nine Months, 1995



Source: International Magnesium Association.

RECYCLING

The anticipated growth for magnesium die-cast parts in the automotive sector should provide greater opportunities for magnesium recycling. Norsk Hydro Canada and Dow Chemical collect magnesium scrap from their clients. This source of supply is expected to increase as magnesium metal further penetrates the automobile market.

Like aluminum, recycled magnesium only requires about 5% of the energy required to produce primary magnesium. Currently, the magnesium contained in aluminum alloys (primarily beverage cans) accounts for approximately 75% of the magnesium recycled throughout the world. The recycling of magnesium is expected to increase with the expected growth in the use of magnesium die-cast automobile parts.

Norsk Hydro AS received final approval for construction of a 10 000-t/y magnesium recycling plant at its Porsgrunn smelter in Norway. The plant will be on line by January 1996 and will handle all types of scrap and produce material suitable for die casting, including high-purity magnesium alloys. Norsk Hydro also operates a 10 000-t/y recycling facility at its Bécancour smelter in Canada.

MSI Magnesium Services (US) Inc. has more than tripled its original capacity plans to build a magnesium scrap refining and alloy production facility in the state of Indiana by late 1996. The new plant will take in scrap from die casters and producers and recycle it into 24 000 t/y of high-purity alloy ingots for die casting and another 8000 t/y of magnesium

chips for desulphurization. In addition, the plant design will provide for an additional expansion to 56 000 t/y, depending on market conditions. There are currently three companies that recycle magnesium scrap in the United States: Garfield Alloys Inc. (10 000-t/y capacity), IMCO Recycling Inc., and Halaco.

PRICES AND STOCKS

According to the IMA, total magnesium stocks decreased from 23 300 t in December 1994 to 17 200 t in June 1995, only to rise again to 21 300 t by the end of September. Despite this rise in the third quarter, this level of stocks only represents 26 days of supply.

Prices for primary magnesium continued to rise throughout 1995 as stocks dwindled and demand strengthened, leading to a tight market. The main die-cast magnesium alloy also increased in price. In September, Norsk Hydro AS increased its North American producer price for pure magnesium to US\$1.94/lb. The price increase reflected the continued strong demand resulting in an increase in transaction prices in the North American market. Norsk Hydro's die-casting alloy price increased in October to US\$1.65/lb. Dow Magnesium followed by increasing its price to US\$1.70/lb effective November 1 for non-contract customers. Quoted primary magnesium prices increased significantly in the second quarter. The *Metals Week* U.S. spot Western price increased from US\$1.62/lb in January to \$1.98/lb by the end of September. Over the same period, the U.S. spot dealer import price rose from US\$1.57/lb to \$2.25/lb. In October, U.S. Primary Ingot prices were set at US\$1.93/lb, with spot market prices in the US\$2.25-\$2.35/lb range. European Free market prices traded in the US\$4000-\$4500/t range in October.

OUTLOOK

Canadian production of magnesium increased dramatically at the start of the decade with the opening of Norsk Hydro's 40 000-t/y Bécancour smelter in 1989. Production subsequently dropped in 1993 with the closing of Magcan and U.S. trade action against Norsk Hydro's exports. Shortages of supply and increased demand have since translated into production increasing to near capacity by the end of 1995. Production is expected to remain stable in 1996 as both producers continue to operate at or near capacity to meet demand. In the longer term, Magnolia Metallurgy Inc.'s 58 500-t/y magnesium smelter to be built in the Thetford Mines-Asbestos region of Quebec will increase Canadian magnesium production capacity to close to 105 000 t/y by the end of the decade. World magnesium production is expected to reach 360 000 t/y in 2000, and to increase further to 500 000 t/y by 2005.

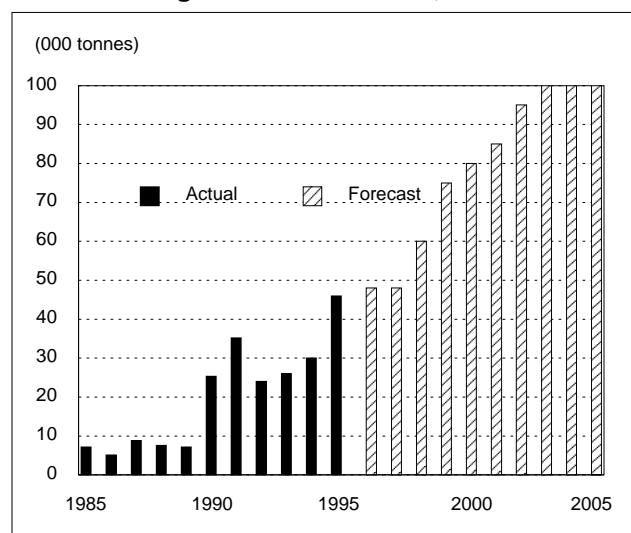
World primary magnesium consumption is forecast to increase to 375 000 t/y by the end of the decade and to 495 000 t/y by 2005. Western World primary magnesium annual growth in demand for this period is forecast to reach 5% in North America, 4% in Western Europe, and 9% in the Far East. Growth will be primarily fed by strong demand for magnesium in aluminum alloys, die-cast automotive parts and, to a lesser extent, desulphurization applications in the steel industry. Magnesium continues to face stiff competition from other materials, including aluminum and plastics, in the all-important automotive

parts sector. New applications and increased awareness of the advantages of magnesium in certain applications are growing, particularly in the North American automotive industry.

A major factor that will affect magnesium prices over the next decade will be the growth in supply from expansions or new capacity in Canada, the Middle East, Australia, and possibly China. This newer, low-cost supply is forecast to eventually cause prices to decline slightly, in constant dollar terms, over the next decade. Prices, in constant 1994 dollars, are forecast to average US\$1.80/lb in 1996, and to gradually decline to the \$1.50-\$1.60/lb range in the longer term.

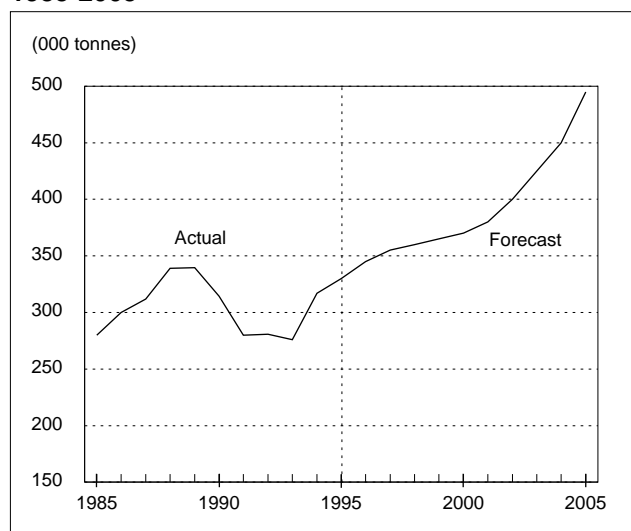
Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 70. (2) Information in this review was current as of February 16, 1996.

Figure 5
Canadian Magnesium Production, 1985-2005



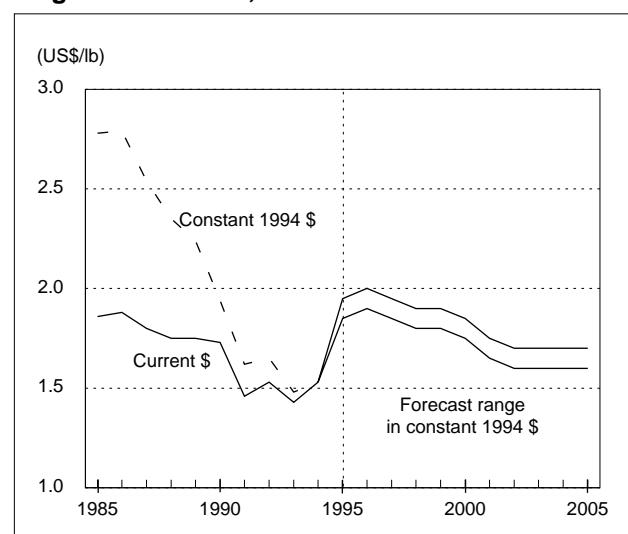
Source: Natural Resources Canada.

Figure 6
World Primary Magnesium Consumption, 1985-2005



Source: Natural Resources Canada.

Figure 7
Magnesium Prices, 1985-2005



Source: Natural Resources Canada.

TARIFFS

Item No.	Description	Canada			United States	EU	Japan ¹
		MFN	GPT	USA	Canada	MFN	GATT
8104.11	Magnesium unwrought, containing by weight at least 99.8% of magnesium	3.5%	1%	0.8%	1.6%	5.3%	5.8%
8104.19	Magnesium unwrought, n.e.s.	3.5%	Free	0.8%	1.3%	5%	5.8%
8104.20	Magnesium waste and scrap	Free	Free	Free	Free	Free	3%
8104.30	Magnesium raspings, turnings and granules, graded according to size; powders						
8104.30.10.00	Raspings, turnings and granules; powders, alloyed	7.3%	4%	2%	1.3%	5%	6.4%
8104.30.20.00	Powders, not alloyed	3.5%	1%	0.8%	1.3%	5%	6.4%
8104.90	Other magnesium						
8104.90.10	Bars, rods, plates, sheets, strip, foil, tubes and pipes, alloyed	3.5%	Free	0.8%	a	5.3%	6.4%
8104.90.90	Other	7.3%	4%	2%	a	5.3%	6.4%

Sources: Customs Tariff, effective January 1996, Revenue Canada; Harmonized Tariff Schedule of the United States 1996; The "Bulletin International des Douanes," Journal Number 14 (17th Edition), European Union, 1994-1995, "Conventional" column; Custom Tariff Schedules of Japan, 1995.

n.e.s. Not elsewhere specified.

a 2.9¢/kg on magnesium content plus 0.7%.

¹ GATT rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, MAGNESIUM EXPORTS AND IMPORTS BY COMMODITY AND COUNTRY, 1994 AND 1995

Item No.		1994		1995P	
		(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS					
8104.11	Magnesium unwrought, containing by weight at least 99.8% of magnesium				
	Japan	3 308r	12 717r	4 216	19 742
	Australia	1 029r	3 748r	1 854	8 396
	United Kingdom	759r	4 167r	1 247	7 474
	Germany	1 756r	5 798r	1 326	6 046
	United States	1 210	4 975	766	3 883
	Norway	1 776	6 307	514	2 413
	Venezuela	245	842	387	1 862
	Other countries	2 464r	8 807r	1 373	6 182
	Total	12 547r	47 369r	11 683	56 011
8104.19	Magnesium unwrought, n.e.s.				
	United States	8 591	35 881	13 890	58 269
	Australia	278r	1 728	620	3 530
	Netherlands	136r	1 061r	209	2 171
	Italy	173r	1 006r	178	1 127
	Japan	. . .	5	234	642
	Mexico	289	1 782	83	525
	Other countries	600r	2 649r	172	1 211
	Total	10 067r	44 120r	15 387	67 483
8104.20	Magnesium waste and scrap				
	United States	442	1 118	8 565	26 631
	Brazil	-	-	795	3 153
	Other countries	-	-	208	790
	Total	442	1 118	9 567	30 576
8104.30	Magnesium raspings, turnings or granules, graded according to size and powders				
	United States	460	2 708	629	3 756
	Ireland	108	665	231	1 434
	Other countries	44	227	120	812
	Total	611	3 601	980	6 003
8104.90	Magnesium and articles thereof, n.e.s.				
	United States	935	4 258	1 050	5873
	Taiwan	156	1 295	15	457
	Japan	14	126	89	272
	Netherlands	17	66	8	96
	Other countries	57	350	3	42
	Total	1 179	6 100	1 166	6 743
	Total exports	24 846r	102 308r	38 782	166 816

TABLE 1 (cont'd)

Item No.		1994		1995 ^p	
		(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS					
8104.11	Magnesium unwrought, containing by weight at least 99.8% of magnesium				
	Russia	133	527	1 445	7 401
	Ukraine	—	—	752	4 019
	People's Republic of China	—	—	337	1 825
	United Kingdom	1	4	249	1 322
	Other countries	2 684	9 648	459	2 336
	Total	2 818	10 182	3 242	16 906
8104.19	Magnesium unwrought, n.e.s.				
	United States	4 483	15 327	3 749	12 866
	Norway	409	1 544	1 659	7 281
	Russia	213	844	935	4 172
	Other countries	468	2 285	912	4 553
	Total	5 573	20 005	7 254	28 876
8104.20	Magnesium waste and scrap				
	United States	1 920	5 707	3 697	10 873
	United Kingdom	—	—	120	205
	Russia	19	72	20	119
	Other countries	223	696	1	3
	Total	2 161	6 477	3 838	11 202
8104.30	Magnesium raspings, turnings or granules, graded according to size and powders				
	United States	125	548	270	1 107
	Other countries	4	12	3	9
	Total	129	562	274	1 117
8104.90	Magnesium and articles thereof, n.e.s.				
	United States	714	3 576	927	5 840
	Other countries	.. .	1	2	12
	Total	714	3 577	929	5 853
	Total imports	11 395	40 803	15 537	63 954

Source: Statistics Canada.

— Nil; . . . Amount too small to be expressed; n.e.s. Not elsewhere specified; ^p Preliminary; ^r Revised.

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

TABLE 2. CANADA, CONSUMPTION¹ OF MAGNESIUM, 1988-94

	1988 ^a	1989 ^a	1990	1991 ^a	1992 ^a	1993 ^a	1994 ^p
	(tonnes)						
Castings and wrought products ²	5 067	5 661	5 849	4 604	6 915	7 678 ^r	8 940
Aluminum alloys	7 810	7 761	7 672	9 215	9 203	10 174	12 416
Other uses ³	1 189	1 985	1 603	1 926	2 005	2 162	2 234
Total	14 066	15 407	15 125	15 745	18 123	20 014 ^r	23 590

Source: Natural Resources Canada.

^p Preliminary; ^r Revised.^a Increase in number of companies being surveyed.¹ Available data as reported by consumers. ² Die, permanent mould and sand castings, structural shapes, tubings, forgings, sheet and plate. ³ Cathodic protection, reducing agents, desulphurizers and other alloys.

TABLE 3. WORLD MAGNESIUM PRODUCTION, 1991-94

Country	1991	1992	1993	1994 ^p
	(tonnes)			
Australia (secondary)	100	100 ^e	100	100
Brazil	7 800	7 300	9 600	8 800
Brazil (secondary)	1 600 ^e	1 600	1 600	1 600
Canada ^e	35 500	25 800	23 000	28 900
China ^e	8 600	10 500	11 800	11 000
France	14 000	13 700	10 900	12 500
India	1 000 ^e	1 000 ^e	1 000	1 000
Italy	3 900	1 200	–	–
Japan	11 600	7 100	7 500	3 400
Japan (secondary)	17 200	13 000	13 200	19 000
Kazakstan ^e	5 700	3 500	2 000	2 000
Norway	44 300	30 400	27 300	27 600
Russia ^e	39 500	32 900	32 200	27 000
Ukraine ^e	18 400	17 100	14 900	10 000
United Kingdom (secondary)	800	800	500	500
United States	131 200	136 900	132 100	128 500
United States (secondary)	50 500	57 000	58 900	62 100
Ex-Yugoslavia	5 400	4 100	–	2 000
Total (primary)	326 900	291 500	272 300	262 700
Total (secondary)	70 200	72 500	74 300	83 300
Total	397 100	364 000	346 600	346 000

Sources: Natural Resources Canada; International Consultative Group on Nonferrous Metals Statistics.

– Nil; ^e Estimated; ^p Preliminary.

TABLE 4. WORLD CONSUMPTION OF MAGNESIUM, 1991-94

Country	1991	1992	1993	1994 ^p
	(tonnes)			
Argentina	800	400	400	400
Australia	3 500	3 500	4 000	4 000
Austria	3 200	4 300	3 500	3 500 ^e
Belgium/Luxembourg	2 400	2 600	2 200	4 400
Brazil	8 100	8 500	10 000 ^e	10 500
Cameroon	100	200	100 ^e	100
Canada	15 700	18 100	20 000	23 600
China ^e	15 500	17 000	18 000	20 000
Czechoslovakia ^e	1 300	n.a.	n.a.	n.a.
Denmark	100	200	200	200
Egypt ^e	1 000	1 000	1 000	1 000
France	12 600	13 800	12 000	16 100
Germany	20 600	21 300	14 900	15 500 ^e
Ghana	500 ^e	100	100 ^e	100
Greece	1 000	600	1 000	1 000 ^e
Hungary ^e	500	200	200	200
India	1 800	1 600	1 800 ^e	1 800
Italy	4 800	5 500	3 800	4 700
Japan (primary)	27 200	27 000	27 000	41 800
Japan (secondary)	17 200	13 000	11 200	12 000 ^e
Mexico	900	1 300	1 000 ^e	1 000
Netherlands	1 000	1 000	1 000	1 000
New Zealand ^e	300	400	400	400
Norway ^e	6 000	8 000	5 800	6 000
Poland ^e	200	300	700	500
Romania ^e	700	500	500	400
Slovakia ^e	n.a.	n.a.	1 000	–
South Africa	800	600	500	800
South Korea	1 700	1 800	2 100	2 200
Spain	1 800	1 500	1 500 ^e	1 700 ^e
Sweden	1 300	1 700	1 800	1 800
Switzerland	2 100	2 600	1 800	2 300
Taiwan	1 700	1 700	1 600	1 900
Turkey	600	500	600	600
Ex-U.S.S.R. ^e	40 000	30 000	25 000	25 000
United Kingdom	3 200	5 800	6 300	6 000
United States (primary)	91 900	93 800	101 100	111 800
United States (secondary)	52 900	51 200	58 900	62 100
Venezuela	400	700	600	600
Ex-Yugoslavia	1 500	1 000 ^e	500	400
Other ^e	2 700	1 800	1 900	1 900
Total (primary)	280 000	280 900	275 900	317 000
Total (secondary)	70 100	64 200	70 100	74 100
Total	350 100	345 100	346 000	389 100

Sources: Natural Resources Canada; International Consultative Group on Nonferrous Metals Statistics.
 – Nil; ^e Estimated; n.a. Not applicable; ^p Preliminary.

TABLE 5. WORLD PRIMARY MAGNESIUM SMELTER CAPACITY, 1995

Country	Smelter Location	Company	Capacity (t/y)
Brazil	Bocaiuva	Rima Industrial S.A.	12 000
Canada	Bécancour	Norsk Hydro Canada Inc.	40 000
	Haley Station	Timminco Metals	6 000
China	Baotou	Nei Mongol Province	3 500
	Dancheng	Henan Province	1 000
	Fushun	CNNC	5 000
	Guigang	Gaungxi Province	1 000
	Hengyang	Hunan Province	3 000
	Huinong	Ningxia Province	1 000
	Jinzhou	Liaoning Province	1 000
	Minhe	CNNC	4 000
	Nanjing	Nanjing Ube Magnesium	14 000
	Shanxi (7 plants)	Shanxi Province	1 900
	Tongxin	Ningxia Province	1 700
	Yinchuan	Ningxia Province	1 000
	Yunnan	Yunnan Province	200
France	Maringnac	Pechiney	18 000
India	Valinokkam	Tamil Nadu	600
	Hyderabad	Southern Magnesium	600
Kazakstan	Ust Kamenogorsk	Ust Kamenogorsk Works	40 000
Norway	Porsgrunn	Norsk Hydro AS	55 000
Russia	Solikamsk	Solikamsk Magnesium Works	20 000
	Berezniki	Avisma	25 000
Serbia	Bela Stena	Magnohrom	9 000
Ukraine	Kaluzh	Kaluzh Works	24 000
	Zaporozhyre	Zaporozhyre Works	45 000
United States	Freeport	Dow Chemical	65 000
	Addy	Northwest Alloys	38 000
	Rowley	Magnesium Corp of America	38 000
Total			474 500

Source: Natural Resources Canada.
CNNC China National Nonferrous Metals Industry Corporation.

TABLE 6. PRIMARY MAGNESIUM SHIPMENTS BY WORLD ZONE, 1985-95^e

Period	Area 1 United States and Canada	Area 2 Latin America	Area 3 Western Europe	Area 4 Africa and Middle East	Area 5 Asia and Oceania	Area 6 COMECON C.I.S. & PRC	Total
(000 tonnes)							
1985	102.4	9.4	72.2	2.4	38.4	—	224.8
1986	103.3	11.3	73.6	3.2	35.0	—	226.4
1987	113.7	8.3	66.9	5.2	28.7	13.2	236.0
1988	125.0	11.7	70.6	3.8	33.8	6.2	251.2
1989	127.9	9.4	69.5	2.6	33.7	4.1	246.2
1990	127.3	11.6	68.7	4.0	37.6	2.8	252.0
1991	121.3	10.3	66.6	4.5	40.1	0.7	243.5
1992	139.5	10.3	67.9	3.8	35.0	0.8	257.3
1993	143.1	12.3	58.1	3.6	35.0	—	252.1
1994	152.7	14.5	76.0	4.6	39.6	—	287.4
1995 ^e	162.0	13.0	75.0	5.0	49.0	—	304.0

Source: International Magnesium Association.
— Nil; ^e Estimated.

TABLE 7. PRIMARY MAGNESIUM SHIPMENTS BY WORLD ZONE AND CATEGORY, 1995 (JANUARY TO SEPTEMBER)

Use	Area 1 United States and Canada	Area 2 Latin America	Area 3 Western Europe	Area 4 Africa and Middle East	Area 5 Asia and Oceania	Area 6 Other	Total
(000 tonnes)							
Aluminum alloying	59.4	2.2	26.5	3.1	28.3	—	119.5
Die casting	30.6	5.8	9.2	—	1.4	—	47.0
Desulphurization	14.6	—	8.9	0.6	0.5	—	24.6
Nodular iron	4.8	0.9	3.8	—	2.6	—	12.1
Electrochemical applications	5.0	0.6	1.4	—	1.1	—	8.1
Chemical applications	0.9	—	2.2	—	1.7	—	4.8
Wrought products	2.1	—	0.9	—	0.2	—	3.2
Metal reduction	2.0	—	0.7	—	0.2	—	2.9
Gravity casting	0.5	—	0.8	—	—	—	1.3
Other	1.6	0.3	0.9	0.2	0.9	—	3.9
Total	121.5	9.8	55.3	3.9	36.9	—	227.4

Source: International Magnesium Association.
— Nil.

TABLE 8. PRIMARY MAGNESIUM SHIPMENTS BY CATEGORY, 1985-95^e

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995 ^e
(000 tonnes)											
Aluminum alloying	121.0	122.1	122.1	134.3	130.8	130.6	137.9	133.8	126.0	143.0	158.0
Die casting	29.7	26.8	26.6	28.5	28.6	36.3	30.7	34.5	38.6	51.2	63.0
Desulphurization	19.1	20.3	21.9	28.6	32.3	28.0	28.1	36.6	40.6	42.5	34.0
Nodular iron	11.3	12.3	14.2	15.8	16.9	14.4	13.7	13.3	13.4	16.2	16.0
Electrochemical applications	9.1	8.3	8.0	8.0	8.1	9.6	9.2	9.5	9.4	11.7	11.5
Chemical applications	8.0	8.0	7.2	8.1	5.5	7.1	7.1	7.3	6.5	6.2	6.5
Wrought products	4.8	5.4	8.4	7.4	6.2	6.7	5.7	6.8	5.8	5.3	4.0
Metal reduction	10.3	9.6	8.8	10.2	9.4	8.8	5.6	7.4	5.1	3.8	3.5
Gravity casting	1.2	1.6	1.8	2.1	2.5	3.3	2.2	2.6	1.5	1.8	2.0
Other	10.3	10.0	17.0	8.2	6.9	7.2	3.3	5.5	5.2	5.7	5.5
Total	224.8	226.4	236.0	251.2	247.2	252.0	243.5	257.3	252.1	287.4	304.0

Source: International Magnesium Association.
^e Estimated.