

Gypsum and Anhydrite

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INTRODUCTION

Pure gypsum, hydrous calcium sulphate ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$), is a fine-grained white mineral that occasionally is grey or brown in its impure state. When gypsum is processed, it is ground to a fine powder, called landplaster, and then heated in a calcining kettle at 280°-320°C to drive off 75% of the contained water, forming calcium sulphate hemihydrate ($\text{CaSO}_4 \cdot 0.5\text{H}_2\text{O}$), commonly called stucco. When stucco is recombined with water, it dries and hardens into a variety of shapes. The most common form of gypsum, β -gypsum (beta-gypsum), is calcined under atmospheric pressure. A more refined product, α -gypsum (alpha-gypsum), is produced in a reactor under elevated pressures. It is used for specialized applications such as dental molds. When it is applied between two layers of paper, calcined gypsum forms wallboard that has unique fire-resistance and insulation properties. Gypsum is one of the oldest building materials known, having first been used around 6000 B.C. in Anatolia (modern-day Turkey). The Egyptians used gypsum plaster as a jointing material during construction of the Pyramids. In the 1700s, France started to make extensive use of "Plaster of Paris" in the interior walls of wooden homes as a protection against fire. Uncalcined gypsum is used in cement manufacturing and as a fertilizer and soil conditioner.

CANADIAN INDUSTRY

Natural gypsum is mined in five provinces in Canada, as shown in Figure 1. Canadian shipments of natural gypsum totaled 8.33 Mt valued at \$105 million in 2003, based on preliminary data (Table 1). This amount compares to

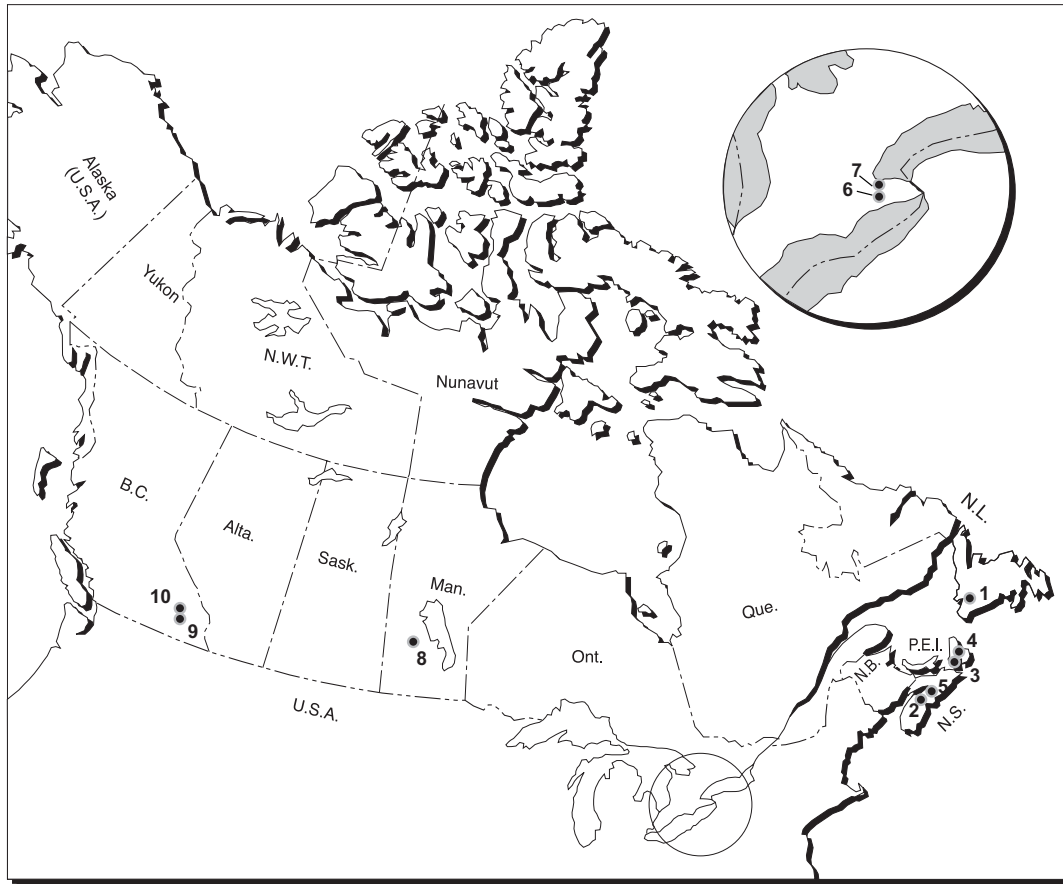
8.81 Mt valued at \$105.2 million in 2002, based on final data. This represents a 5.4% decrease in shipments that may be attributed in large part to the increased use of synthetic gypsum in wallboard, mainly in the United States. The trend in production of natural gypsum is illustrated in Figure 2. Since 1993, Canadian production has consistently been above 8 Mt/y, with a peak of 9.3 Mt in 1999.

Five major companies operate a total of 10 mines and 13 wallboard plants, accounting for an estimated 1900 employees. The major gypsum mining and related production plants are listed in Table 2. National Gypsum (Canada) Ltd. is the leading producer of gypsum in Canada from its open-pit mine at Milford, north of Halifax, Nova Scotia. Other companies that mine gypsum in Nova Scotia include: Fundy Gypsum Co. and Little Narrows Gypsum Co., both subsidiaries of USG Canadian Mining Ltd., as well as Georgia-Pacific Canada Inc. The Georgia-Pacific mine at Sugar Camp has been closed and production now comes from the Melford deposit. BPB Canada Inc. (formerly BPB Westroc), Georgia-Pacific and CGC Inc. all have integrated gypsum mining and wallboard manufacturing facilities in various provinces.

In addition to natural gypsum production, two electric power utilities produce synthetic (FGD) gypsum via the wet limestone SO_2 scrubber process. Ontario Power Generation Inc. produces by-product gypsum at its Lambton Generating Station south of Sarnia, Ontario, and sells the product to the BPB Canada Inc. wallboard plant near Toronto. New Brunswick Power produces synthetic gypsum at its Belledune Generating Station near Bathurst, New Brunswick, and ships to the CGC Inc. wallboard plant in Montréal, Quebec. In Canada, all the by-product gypsum produced is used in the cement and wallboard industries, as shown in Table 4.

Nova Scotia accounts for about 81% of Canada's production of natural gypsum and for nearly all of its exports. The gypsum mines in Nova Scotia are open-pit mines that provide high-quality, low-cost raw material. The majority of Nova Scotia production is shipped by ocean freighter to wallboard plants along the U.S. eastern seaboard.

Figure 1
Gypsum Producers in Canada, 2003



1. Galen Gypsum Mines Limited, Coal Brook, N.L.
2. Fundy Gypsum Company, Wentworth and Miller Creek, N.S.
3. Georgia-Pacific Canada Inc., Melford, N.S.
4. Little Narrows Gypsum Company, Little Narrows, N.S.
5. National Gypsum (Canada) Ltd., Milford, N.S.
6. CGC Inc., Hagersville, Ont.
7. Georgia-Pacific Canada Inc., Caledonia, Ont.
8. BPB Canada Inc., Amaranth, Man.
9. Georgia-Pacific Canada Inc., Canal Flats, B.C.
10. BPB Canada Inc., Windermere, B.C.

Figure 2
Canadian Gypsum Production, 1992-2003



Source: Natural Resources Canada.

USE

The main uses for calcined gypsum are for wallboard (also known as drywall or plasterboard) and for art and dental plasters. Uncalcined gypsum (up to 5% by weight) is used as a set retarder in the manufacture of portland cement and as a soil conditioner and fertilizer additive in agricultural applications. The use of natural and synthetic gypsum in wallboard is largely driven by residential and commercial construction activity in Canada and the United States. According to the Gypsum Association, Canadian wallboard manufacturers shipped 3.42 billion square feet (sq. ft.) of wallboard in 2003, up 4.3% from 2002.

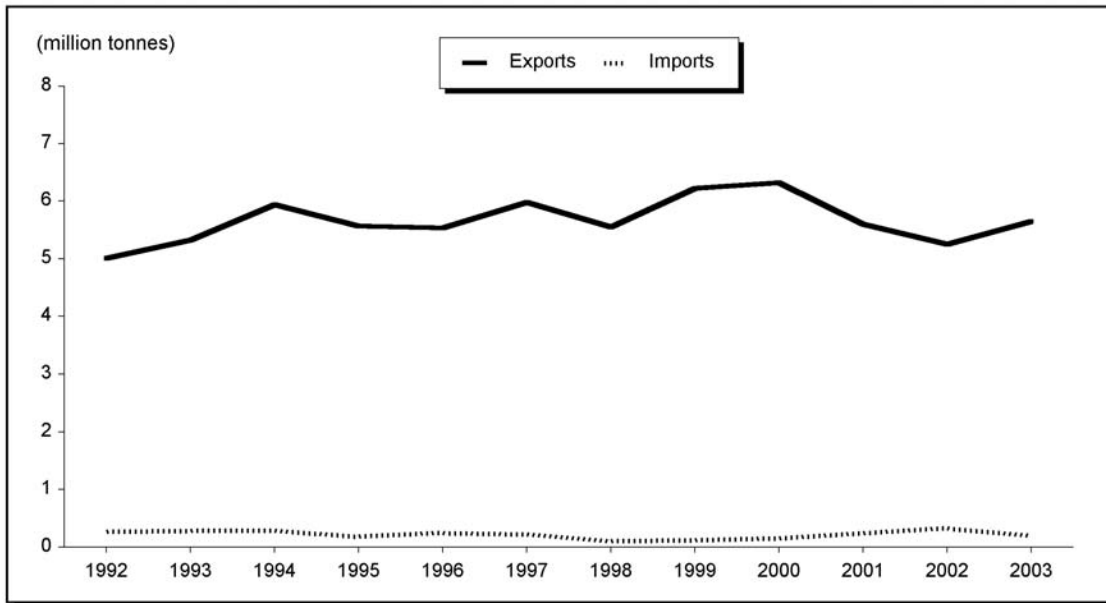
In North America, wallboard manufacturing accounts for an estimated 75% of gypsum use, cement manufacture accounts for 10-15%, and agricultural and industrial processes account for the remainder of uses. Waste wallboard derived from the construction and demolition industry continues to be recycled into new wallboard. It is estimated that 910 kg of waste wallboard is generated for each new home (185 m² or 2000 sq. ft.). New West Gypsum

Recycling Inc. operates wallboard recycling plants in New Westminster, British Columbia, and in Oakville, Ontario. Since 1985, the company has recycled 1.7 Mt of waste wallboard. The waste product can be re-used at a rate of 25% waste to 75% natural gypsum without affecting quality or specifications.

TRADE

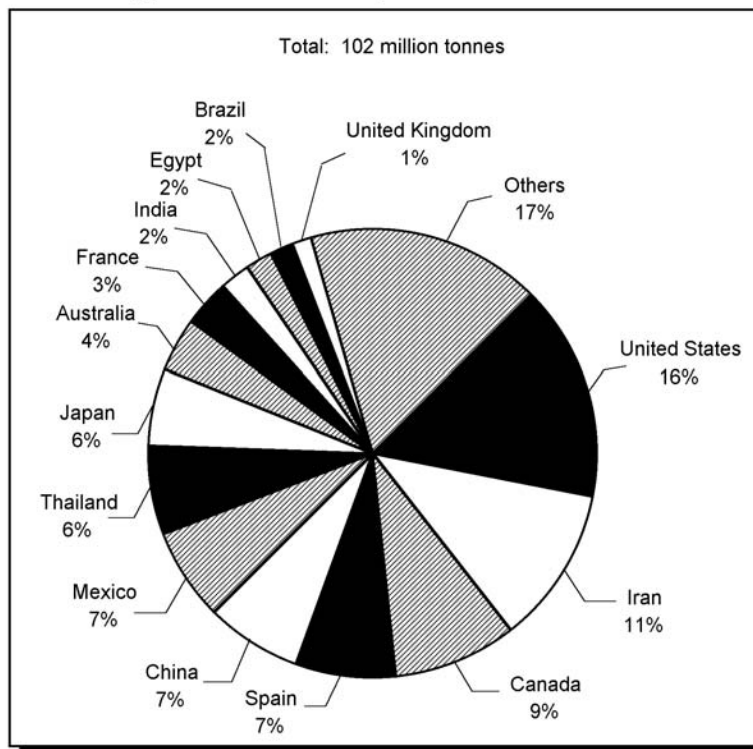
Canadian mines exported 5.65 Mt of raw gypsum to the United States in 2003, based on estimates, compared with 5.24 Mt in 2002, based on final data. The trend in Canadian gypsum exports for the period 1992-2003 can be seen in Figure 3. Canadian wallboard manufacturers exported 51.61 million m² of wallboard to the United States in 2003, based on preliminary data (Table 1). This is up very slightly from 2002. Imports of both raw gypsum and wallboard from the United States are small in relation to exports (Table 1). The apparent use of gypsum in Canada dropped by about 26% in 2003 due to a 5.4% decrease in shipments, coupled with a 41% decrease in imports of raw gypsum and a 7.7% increase in exports (Table 3).

Figure 3
Canadian Gypsum Trade, 1992-2003



Source: Natural Resources Canada.

Figure 4
World Gypsum Production, 2003



Source: U.S. Geological Survey.

WORLD OVERVIEW

World production of gypsum in 2003 is an estimated 102 Mt, according to the U.S. Geological Survey (USGS). The United States ranked number one with production of 16.0 Mt, followed by Iran, 11.5 Mt; Canada, 8.3 Mt; Spain, 7.5 Mt; and China, 6.9 Mt. Figure 4 shows a percentage breakdown of 2003 world production. According to the Gypsum Association, U.S. wallboard plants shipped a record 31.72 billion sq. ft. of wallboard in 2003 (82% of capacity), representing a 6.2% increase over 2002.

Electric utility companies in the United States continue to invest in plant modifications to deal with SO₂ abatement issues as part of stricter air pollution regulations. Lime or limestone scrubber systems are being installed at existing coal-fired generating stations. These units can produce wallboard-grade gypsum, depending on the abatement process selected. The gypsum is shipped to nearby wallboard plants. New high-speed wallboard plants are being constructed in close proximity to generating stations and under joint-venture agreements between the wallboard producer and the power company. For example, National Gypsum Co. has built three plants in the last five years that use 100% synthetic gypsum. These plants have annual capacities of 800 million sq. ft. National Gypsum recently signed an agreement with Duke Power for a new facility in the Charlotte, North Carolina, area.

According to the American Coal Ash Association, synthetic gypsum production in the United States in 2002 was 11.4 Mt. During the period 1999-2002, synthetic gypsum production in the United States increased 82% due to rapid adaptation of SO₂ abatement processes at power plants and the higher efficiencies of new high-speed wallboard plants (USGS figures). Synthetic gypsum is also produced at sulphate-route titanium dioxide plants in Canada at Varennes, Quebec, and in the United States. In 2002, about 68% of all synthetic gypsum produced in the United States was used primarily in wallboard production and in the cement manufacturing sector.

PRICES

Prices for gypsum in the merchant market are negotiated between the supplier and user and are not generally published. According to the USGS, crude gypsum f.o.b. mine averaged US\$6.90 per short ton in 2003, while calcined gypsum averaged US\$20 per short ton. Reported prices for wallboard in 2002 averaged US\$200 per 1000 sq. ft.

OUTLOOK

Canadian shipments of gypsum in 2004 are expected to improve slightly due to strong demand for wallboard in the United States. Housing starts in Canada are expected to

decline by about 6% in 2004. Housing starts were about 218 400 in 2003, according to Statistics Canada, an increase of 6.5% over 2002 starts. Non-residential construction should increase slightly in 2004, adding more demand for gypsum-based construction products.

The production of synthetic gypsum, mainly in the United States, is expected to continue to increase as electric utility companies add SO₂ scrubber systems to existing power plants. This will offset the use of natural gypsum in wallboard, potentially reducing exports of Canadian natural gypsum south of the border.

ANHYDRITE

Anhydrite (CaSO₄) is the anhydrous form of gypsum. It has a grey to blue-grey colour, a hardness of about 3.5 (compared to gypsum at 2), and is more dense than gypsum. It typically occurs below gypsum beds with the overlying gypsum having been formed by the weathering of a thicker anhydrite layer and is generally excluded from gypsum mining. Production and trade data for anhydrite are included with gypsum (Table 1). Anhydrite is produced by Fundy Gypsum Company at Wentworth, Nova Scotia, and by Little Narrows Gypsum Company at Little Narrows, Nova Scotia.

Shipments of anhydrite, mainly to the United States, are used as a soil conditioner and fertilizer and in portland cement manufacture. The mineral has also been used for roof support in underground mining applications, where it sets up like cement and can be blown into mining cavities that need to be sealed.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 64. (2) Information in this review was current as of June 30, 2004. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

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TARIFFS

Item No.	Description	Canada			United States
		MFN	GPT	USA	Canada
2520.10	Gypsum; anhydrite	Free	Free	Free	Free
2520.20	Plasters	Free	Free	Free	Free
68.09	Articles of plaster or of compositions based on plaster; boards, sheets, panels, tiles and similar articles, not ornamented				
6809.11	Faced or reinforced with paper or paperboard only				
6809.11.10	Gypsum wallboard	6%	Free	Free	Free
6809.11.90	Other	6%	Free	Free	Free
6809.19.00	Other	6.5%	3%	Free	Free
6809.90	Other articles				
6809.90.10	Models and casts, of a kind used in the manufacture of dental prostheses	Free	Free	Free	Free
6809.90.90	Other	6.5%	3%	Free	Free

Sources: Canadian Customs Tariff, effective January 2004, Canada Border Services Agency; Harmonized Tariff Schedule of the United States, 2004.

TABLE 1. CANADA, GYPSUM PRODUCTION AND TRADE, 2001-03

Item No.	2001		2002		2003		
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	
PRODUCTION							
	All forms						
	Newfoundland and Labrador	x	x	-	-	x	x
	Nova Scotia	6 397 057	75 468	7 341 583	84 477	6 753 212	82 654
	Ontario	x	x	x	x	x	x
	Manitoba	x	x	x	x	x	x
	British Columbia	x	x	x	x	x	x
	Total (1)	7 821 013	95 965	8 809 102	105 234	8 330 315	104 996
IMPORTS							
2520.10	Gypsum, anhydrite						
	United States	155 882	12 224	257 443	14 013	130 970	13 089
	Mexico	87 204	1 424	75 015	1 078	65 233	1 049
	Other countries	59	19	50	32	39	30
	Total	243 145	13 667	332 508	15 123	196 242	14 168
2520.20	Gypsum; anhydrite; plasters						
	United States	36 916	11 958	60 039	14 610	51 624	11 953
	Italy	68	49	226	100	304	157
	United Kingdom	34	16	89	24	159	101
	Other countries	552	381	251	149	310	151
	Total	37 570	12 404	60 605	14 883	52 397	12 362
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
6809.11	Plasterboards, etc., not ornamental; faced or reinforced with paper or paperboard						
	United States	n.a.	15 487	n.a.	31 382	n.a.	37 296
	Other countries	-	268	-	158	-	22
	Total	n.a.	15 755	n.a.	31 540	n.a.	37 318
6809.19	Plasterboards, etc., not ornamental; faced or reinforced, n.e.s.						
	United States	n.a.	13 275	n.a.	15 277	n.a.	16 413
	Mexico	n.a.	134	n.a.	378	n.a.	151
	Other countries	-	111	-	207	-	28
	Total	n.a.	13 520	n.a.	15 862	n.a.	16 592

TABLE 1 (cont'd)

Item No.	2001		2002		2003		
	(m ²)	(\$000)	(m ²)	(\$000)	(m ²)	(\$000)	
IMPORTS (cont'd)							
6809.90	Articles of plaster or compositions based on plaster						
	United States	n.a.	2 010	n.a.	2 855	n.a.	2 829
	United Kingdom	n.a.	245	n.a.	2 035	n.a.	790
	Thailand	n.a.	53	n.a.	364	n.a.	379
	Mexico	n.a.	2 639	n.a.	935	n.a.	371
	China	n.a.	1 111	n.a.	540	n.a.	141
	Other countries	-	143	-	243	-	192
	Total	n.a.	6 201	n.a.	6 972	n.a.	4 702
	Total imports of gypsum and gypsum products						
		n.a.	61 547	n.a.	84 380	n.a.	85 142
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS							
2520.10	Gypsum, anhydrite						
	United States	5 596 557	83 356	5 244 145	68 184	5 651 752	70 306
	Latvia	-	-	457	42	825	170
	Australia	-	-	-	-	588	66
	Czech Republic	-	-	832	56	282	41
	United Kingdom	-	-	-	-	320	20
	Other countries	-	-	226	16	504	37
	Total	5 596 557	83 356	5 245 660	68 298	5 654 271	70 640
2520.20	Gypsum; anhydrite; plasters						
	United States	2 118	1 897	4 488	2 530	1 693	951
	Ireland	-	-	125	70	306	171
	Cuba	79	119	4	3	115	101
	Other countries	69	84	130	107	405	262
	Total	2 266	2 100	4 747	2 710	2 519	1 485
6809.11	Plasterboards, etc., not ornamental; faced or reinforced with paper or paperboard						
	United States	72 511 762	82 971	51 542 296	61 384	51 612 649	55 385
	Cuba	24 040	87	6 767	26	134 158	150
	Portugal	-	-	-	-	17 118	132
	Saint Kitts and Nevis	29 680	74	134 238	374	30 135	121
	Other countries	44 734	155	83 700	133	95 845	199
	Total	72 610 216	83 287	51 767 001	61 917	51 889 905	55 987
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
6809.19	Plasterboards, etc., not ornamental; faced or reinforced, n.e.s.						
	United States	n.a.	29 694	n.a.	27 689	n.a.	9 956
	United Arab Emirates	-	-	n.a.	135	n.a.	91
	Chile	n.a.	491	-	-	n.a.	79
	France	n.a.	39	n.a.	3	n.a.	15
	Other countries	-	302	n.a.	333	-	232
	Total	n.a.	30 526	n.a.	28 160	n.a.	10 373
6809.90	Articles of plaster or compositions based on plaster						
	United States	n.a.	35 570	n.a.	37 955	n.a.	32 709
	Other countries	-	303	-	1 307	-	2 477
	Total	n.a.	35 873	n.a.	39 262	n.a.	35 186
	Total exports of gypsum and gypsum products						
		n.a.	235 142	n.a.	200 347	n.a.	173 671

Sources: Natural Resources Canada; Statistics Canada.

- Nil; n.a. Not applicable; n.e.s. Not elsewhere specified; (r) Revised; x Confidential.

(1) Totals do not include gypsum produced or shipped for use by Canadian portland cement producers.

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

TABLE 2. CANADA, GYPSUM MINING AND GYPSUM PRODUCTS MANUFACTURING OPERATIONS, 2003

Company	Location	Operation
NEWFOUNDLAND AND LABRADOR		
Galen Gypsum Mines Limited	Coal Brook	Open-pit mining
Lafarge Gypsum Canada Inc.	Corner Brook	Wallboard manufacture
NOVA SCOTIA		
Fundy Gypsum Company	Wentworth and Miller Creek	Open-pit mining of gypsum and anhydrite
Georgia-Pacific Canada Inc.	Melford	Open-pit mining
Little Narrows Gypsum Company	Little Narrows	Open-pit mining of gypsum and anhydrite
National Gypsum (Canada) Ltd.	Milford	Open-pit mining
NEW BRUNSWICK		
BPB Canada Inc.	McAdam	Wallboard manufacture
QUEBEC		
CGC Inc.	Montréal	Wallboard manufacture
Georgia-Pacific Canada Inc.	Montréal	Distribution terminal only
BPB Canada Inc.	Montréal	Wallboard manufacture
ONTARIO		
CGC Inc.	Hagersville	Underground mining and wallboard manufacture
Georgia-Pacific Canada Inc.	Caledonia	Underground mining and wallboard manufacture
BPB Canada Inc.	Mississauga	Wallboard manufacture
MANITOBA		
BPB Canada Inc.	Amaranth Winnipeg	Open-pit mining Wallboard manufacture
ALBERTA		
Georgia-Pacific Canada Inc.	Edmonton	Wallboard manufacture
BPB Canada Inc.	Calgary	Wallboard manufacture
BRITISH COLUMBIA		
Georgia-Pacific Canada Inc.	Canal Flats Vancouver	Open-pit mining Gypsum products manufacture
BPB Canada Inc.	Vancouver Windermere	Gypsum products manufacture Open-pit mining

Source: Natural Resources Canada.

TABLE 3. CANADA, GYPSUM PRODUCTION, TRADE AND USE, 1985-2003

	Production (1)	Imports (2)	Exports	Apparent Use (3)
	(tonnes)			
1985	7 760 783	121 802	5 879 664	2 002 921
1986	8 802 805	221 644	5 921 982	3 102 467
1987	9 093 926	217 625	5 704 853	3 606 698
1988 (a)	8 813 760	274 917	5 651 286	3 437 391
1989	8 179 588	291 373	5 357 055	3 113 906
1990	7 977 685	318 114	5 757 327	2 538 472
1991	6 727 221	259 863	4 940 193	2 046 891
1992	7 294 700	260 505	5 010 649	2 544 556
1993	7 563 369	280 581	5 315 618	2 528 332
1994	8 587 303	292 156	5 942 572	2 936 887
1995	8 054 741	177 327	5 565 427	2 666 641
1996	8 201 774	247 208	5 526 010	2 922 972
1997	8 627 772	220 914	5 981 974	2 866 712
1998	8 306 534	96 593	5 552 146	2 850 981
1999	9 345 342	121 048	6 224 830	3 241 560
2000	8 572 464	154 604	6 318 686	2 408 382
2001	7 821 013	243 143	5 596 557	2 467 616
2002	8 809 102	332 508	5 245 660	3 895 950
2003 (p)	8 330 315	196 242	5 654 271	2 872 286

Sources: Natural Resources Canada; Statistics Canada.

(p) Preliminary.

(a) Beginning in 1988, imports and exports are based on the new Harmonized System and may not be in complete accordance with previous method of reporting. Imports and exports include H.S. class 2520.10.00 (gypsum, anhydrite).

(1) Producers' shipments of crude gypsum. (2) Includes crude and ground, but not calcined.

(3) Production plus imports minus exports.

TABLE 4. CANADA, PRODUCTION AND USE OF COAL COMBUSTION PRODUCTS (CCPs), 2003 (1,2)

	Fly Ash	Bottom Ash	FGD Gypsum	Other (3)	Total CCPs
(000 tonnes)					
PRODUCTION					
Produced	4 685	1 980	x	x	7 239
Disposed/stored	3 696	x	–	x	5 679
Removed from disposal	x	–	–	–	x
USE (DOMESTIC)					
Cement	403	x	x	–	523
Concrete/grout	531	–	–	–	531
Mining applications	x	x	–	–	96
Roadbase/subbase	x	x	–	–	42
Wallboard	–	–	x	–	x
Other (4)	x	x	–	–	112
Total use	1 149	x	x	–	1 673
Individual use percentage	25	8	100	–	23

Sources: Compiled by Natural Resources Canada in cooperation with the Canadian Electricity Association and the Association of Canadian Industries Recycling Coal Ash (CIRCA).

– Nil; FGD Flue-gas desulphurization; x Confidential.

(1) Reported production of CCPs may include both dry and ponded categories. (2) Use (domestic), as reported, includes amounts imported (assumed H.S. codes 2621.00 relating to fly ash and H.S. 2520.10 relating to gypsum). (3) Cfb (circulating fluidized bed) fly ash and bottom ash. (4) Includes waste stabilization and specialty uses such as mineral filler and flowable fill.

TABLE 5. WORLD PRODUCTION OF GYPSUM, 2002 AND 2003

	2002	2003 (e)
(000 tonnes)		
Canada	8 809	8 330
Australia	4 000	4 000
Austria	1 000	1 000
Brazil	1 510	1 650
China	6 850	6 900
Egypt	2 000	2 000
France	3 500	3 500
India	2 300	2 300
Iran	11 500	11 500
Japan	5 900	5 700
Mexico	6 500	6 800
Poland	1 100	1 100
Spain	7 500	7 500
Thailand	6 330	6 500
United Kingdom	1 500	1 500
United States	15 700	16 000
Uruguay	1 130	1 100
Other countries	13 871	14 620
Total world	101 000	102 000

Sources: Natural Resources Canada; U.S. Geological Survey.
(e) Estimated.