Lime

Oliver Vagt

The author is with the Minerals and Metals Sector, Natural Resources Canada.
Telephone: (613) 992-2667
E-mail: ovagt@nrcan.gc.ca

"Lime" is a general term referring to burned or calcined limestone (burnt lime or quicklime) and its secondary products, including hydrated lime (calcium hydroxide), also referred to as slaked lime. In the calcining process, quicklime (CaO or CaO.MgO) begins to form at the dissociation temperature of limestone. Temperatures are maintained sufficiently long until there is a complete breakdown of the limestone and a release of the carbon dioxide content. High-calcium quicklime containing mainly CaO and less than 5% MgO is the most common type of lime produced. However, dolomitic quicklime (or dolime) and its hydrated products are also produced; these products contain 35-40% MgO.

CANADIAN INDUSTRY

Canadian shipments of all lime in 2000 amounted to 2.55 Mt valued at $240 million based on preliminary data. These amounts are essentially the same as in 1999 (Tables 1 and 2). Quicklime accounted for about 90% of the total volume and value of shipments. Production figures do not include some captive production from pulp and paper plants that burn sludge to recover lime for re-use in the causticization process. Similarly, beginning with 1996 data, General Chemical Canada Ltd. has not been included in the production figures because this company's main output is the manufacture of derived chemicals.

The lime industry in Canada comprises 17 operating plants from New Brunswick to British Columbia (Figure 1 and Table 3). Total employment in the industry in 1999 (the most recent year for which Statistics Canada data are available) was approximately 765 compared to 830 in 1998. Calcining capacity to produce quicklime did not change appreciably; the effective capacity utilization is estimated to be 80%.

The Graymont group of companies, with eight plants across Canada and several plants in the United States, now accounts for an estimated 30% of total lime capacity in North America. Official name changes relating to this group's operations became effective in mid-2000. Carmeuse North America Group, with complete or partial ownership of four plants in Ontario, is the leading producer of lime in North America. Chemical Lime Company of Canada Inc., with one operation in British Columbia, is the second largest lime producer in North America.

USE

The types or forms of lime commercially available are essentially the same as reported in detail in the chapter on lime appearing in the 1998 edition of the *Canadian Minerals Yearbook*.

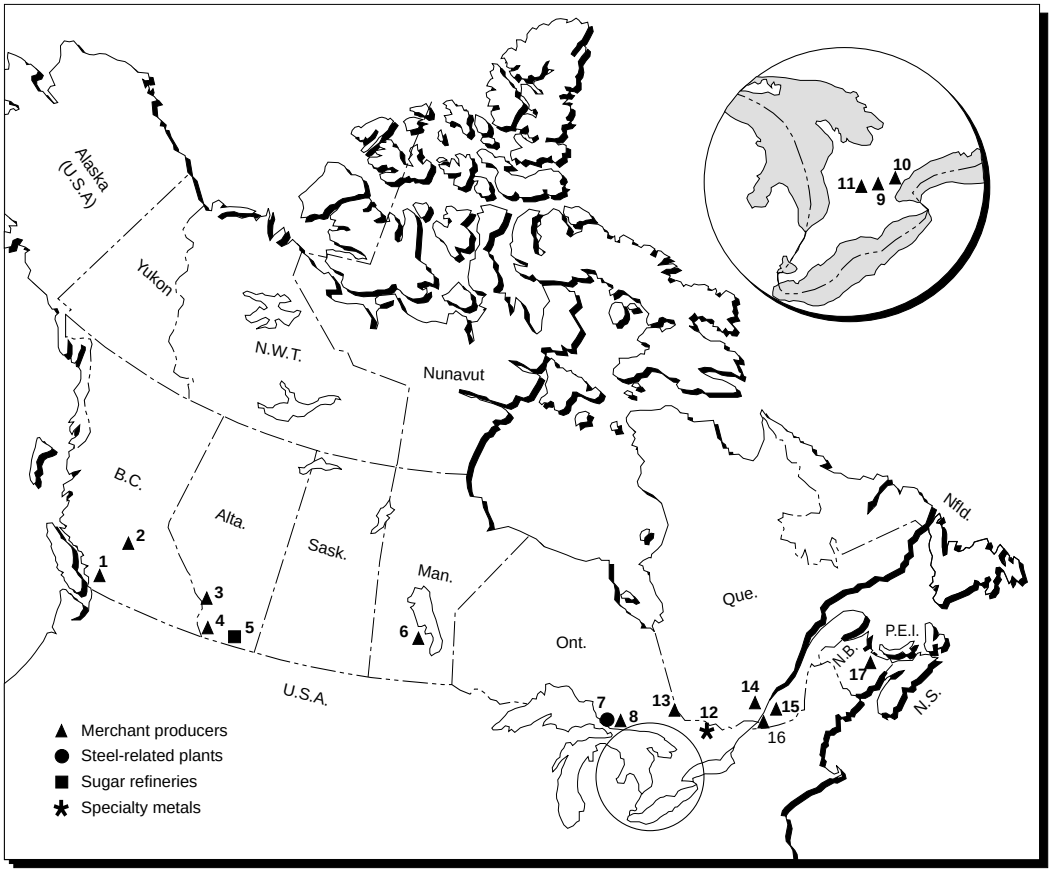
The use of lime in Canada, or essentially its complete consumption in the manufacture of numerous products, relates mainly to the merchant market, which is served by the mainstream lime producers.

The use of quicklime, based on reported shipments for the merchant market, amounted to 1 415 738 t in 2000. The major end uses were steel-making (45%), environmental control (13%), pulp and paper (15%), chemicals (11%), and other industrial uses, including metal concentration (16%). Hydrated lime shipments in the merchant market amounted to 155 555 t in 2000 and were sold mainly for environmental control (58%), other industrial uses (24%), agricultural uses (3%), and other miscellaneous uses related mainly to road and soil stabilization and other construction and masonry (14%).

ENERGY AND TECHNOLOGY

Energy costs to produce quicklime account for about 40% of total production costs, one of the highest ratios in the mineral processing sector. Calcining takes place mainly in vertical (shaft-type) kilns or rotary-type kilns, the latter technology being most common in North America. Preheater systems and computerized process control systems are now commonplace.

Figure 1
Lime Producers in Canada, 2000



Numbers refer to locations on map above.

MERCHANT PRODUCERS

1. Chemical Lime Company of Canada Inc., Fort Langley
2. Graymont Western Canada Inc., Pavilion Lake
3. Graymont Western Canada Inc., Exshaw
4. Graymont Western Canada Inc., Summit plant, Hazell
6. Graymont Western Canada Inc., Faulkner
8. Northern Lime Limited, Spragge
9. Global Stone Ingersoll Ltd.,[1] Ingersoll
10. Lafarge Lime (Canada) Inc., Dundas Division
11. Beachville Lime Limited, Ingersoll
13. Miller Minerals, Haileybury
14. Graymont (QC) Inc., Joliette
15. Graymont (QC) Inc., Marbleton
16. Graymont (QC) Inc., Bedford
17. Graymont (NB) Inc., Havelock

STEEL-RELATED PRODUCERS

7. Algoma Steel Inc., Sault Ste. Marie

SUGAR REFINERIES

5. Rogers Sugar Ltd., Taber

SPECIALTY METALS

12. Timminco Limited, Haley Station

[1] Closed in March 2000.

About 50% of the kilns in service in Canada use natural gas, with petroleum coke, coal and heating oils accounting for the energy inputs required for the calcining process. Kiln efficiencies depend on the type of design and generally range from 4 to 5 gigajoules per tonne (GJ/t) of calcined lime for shaft kilns to as much as 13 GJ/t for long rotary kilns not equipped with preheaters. Other types of kilns of comparatively recent design are the rotary hearth, travelling grate, fluo-solid, and inclined vibratory kiln. Dust-collecting equipment to meet current environmental control regulations is required for all systems.

PRICES

Published prices for lime represent only a broad range. Actual prices vary according to marketing strategies and supply and demand. Average prices for high-calcium quicklime and high-calcium hydrated lime, f.o.b. plant, in Ontario, in bulk, were quoted at $70.80/t and $80.40/t respectively at the end of 2000.

INTERNATIONAL DEVELOPMENTS

In 2000, world lime production was an estimated 117 Mt, compared to 116 Mt in 1999 (Table 5). The United States and China, accounting for 20 Mt and 22 Mt respectively, were followed by Japan and Germany with 7.7 Mt and 7.6 Mt respectively.

Canada ranks in the top 10 lime-producing countries (2.6 Mt of lime shipped) because of relatively large chemical and industrial requirements. Reserves of limestone are relatively large and the proximity of lime plants to U.S. markets has resulted in a favourable balance of trade in lime products, as shown in Table 2.

The United States produced 20.1 Mt of lime in 2000 compared to 19.6 Mt in 1999, according to preliminary figures. Apparent use amounted to 20.3 Mt in 2000 compared to 19.7 Mt in 1999. Environmental uses for lime in the United States, which include flue gas sulphur removal, water treatment and wastewater treatment, have grown rapidly and are the third most important uses after metallurgical, chemical and industrial uses.

OUTLOOK

The production of lime in Canada in 2001 is expected to decrease by 10% compared to 2000 based mainly on weaker demand by steel and pulp and paper producers.

In the medium to longer term, demand for lime as a flux in steel-making is forecast to decline because of several factors. These include: improved efficiencies in steel production and energy inputs, the use of larger amounts of scrap in basic oxygen furnaces, improved ore grades, more use of fluxed iron ore pellets, and growth of the mini-mill sector, which makes steel from scrap iron in electric furnaces.

Lime is now marketed to several industries more as a specialty chemical than as a commodity because certain uses demand stricter specifications relating to ISO standards. In particular, these standards may apply to: 1) lime and dolime for steel-making; 2) the processing of lime for precipitated calcium carbonate (PCC) for a range of industrial uses; 3) lime for flue-gas desulphurization technology to make commercial-quality synthetic (FGD) gypsum; and 4) high-purity lime for water treatment. The use of lime in the environmental sector is expected to increase in the short term given the importance of treating effluents in the industrial and mining sectors.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of February 1, 2001. (3) This and other reviews, including previous editions, are available on the Internet at http://www.nrcan.gc.ca/mms/cmy/index_e.html.

PRICES

Canadian lime prices quoted in *Camford Chemical Report*	December 1999	December 2000
	($ per tonne)	
Lime, carload and truckload f.o.b. Ontario plant		
High-calcium quicklime, bulk	70.80	70.80
High-calcium hydrated lime, bulk	80.40	80.40

f.o.b. Free on board.

TARIFFS

Item No.	Description	Canada			United States
		MFN	GPT	USA	Canada
2522.10	Quicklime	Free	Free	Free	Free
2522.20	Slaked lime	Free	Free	Free	Free
2522.30	Hydraulic lime	Free	Free	Free	Free

Sources: *Customs Tariff*, effective January 2001, Canada Customs and Revenue Agency; *Harmonized Tariff Schedule of the United States*, 2001.

TABLE 1. CANADA, LIME PRODUCTION AND TRADE, 1999 AND 2000

Item No.		1999		2000p	
		(tonnes)	($000)	(tonnes)	($000)
PRODUCTION[1]					
	By type				
	Quicklime	2 299 705	209 843	2 292 900	212 289
	Hydrated lime	265 746	29 050	253 648	27 927
	Total	2 565 451	238 893	2 546 548	240 216
	By province/territory				
	Newfoundland	–	–	–	–
	Prince Edward Island	–	–	–	–
	Nova Scotia	–	–	–	–
	New Brunswick	x	x	x	x
	Quebec	x	x	x	x
	Ontario	1 380 321	121 950	1 313 140	117 105
	Manitoba	x	x	x	x
	Saskatchewan	–	–	–	–
	Alberta	x	x	x	x
	British Columbia	x	x	x	x
	Yukon	–	–	–	–
	Northwest Territories	–	–	–	–
	Total	2 565 451	238 893	2 546 548	240 216
IMPORTS[2]					
2518.20	Calcined dolomite				
	United States	3 078	615	3 810	761
	Canada	756	86	320	35
	Total	3 834	701	4 130	796
2522.10	Quicklime				
	United States	37 815	4 564	45 501	4 802
	Switzerland	129	22	218	23
	India	13	3	7	1
	Canada	22	4	1	. . .
	Pakistan	1	. . .	–	–
	Total	37 980	4 593	45 727	4 826

TABLE 1 (cont'd)

Item No.		1999		2000p	
		(tonnes)	($000)	(tonnes)	($000)
IMPORTS[2] (cont'd)					
2522.20	Slaked lime				
	United States	5 855	1 222	7 054	1 538
	France	–	–	51	15
	Total	5 855	1 222	7 105	1 553
2522.30	Hydraulic lime				
	United States	10 599	1 886	9 686	1 718
	United Kingdom	6	2	13	4
	Belgium	16	5	–	–
	Israel	66	13	–	–
	Pakistan	13	4	–	–
	Total	10 700	1 910	9 699	1 722
EXPORTS					
2518.20	Calcined dolomite				
	United States	29 466	6 696	15 749	4 112
	India	110	30	–	–
	Total	29 576	6 726	15 749	4 112
2522.10	Quicklime				
	United States	79 089	10 857	68 236	9 625
	Total	79 089	10 857	68 236	9 625
2522.20	Slaked lime				
	United States	16 943	2 353	12 382	1 801
	Total	16 943	2 353	12 387	1 802
2522.30	Hydraulic lime				
	United States	26	4	1	5
	China	–	–	7	3
	Total	26	4	8	8

Sources: Natural Resources Canada; Statistics Canada.
– Nil; **. . .** Amount too small to be expressed; **p** Preliminary; x Confidential.
1 Producers' shipments and quantities used by producers. **2** Includes re-imports.
Notes: Numbers may not add to totals due to rounding. HS code 2522.30, as interpreted, applies mainly to hydrated lime.

TABLE 2. CANADA, LIME PRODUCTION, TRADE AND APPARENT USE, 1975, 1980 AND 1985-2000

	Production[1]			Imports	Exports	Apparent Use[2]
	Quick	Hydrated	Total			
			(tonnes)			
1975	1 533 944	199 195	1 733 139	30 099	234 034	1 529 204
1980	2 364 000	190 000	2 554 000	40 901	403 166	2 191 735
1985	2 054 294	157 286	2 211 580	23 056	194 097	2 040 539
1986	2 069 043	173 534	2 242 577	46 917	189 512	2 099 982
1987	2 140 793	189 278	2 330 071	44 290	163 767	2 210 594
1988[a]	2 306 831	211 151	2 517 982	32 543	122 900	2 427 625
1989	2 349 312	202 622	2 551 934	39 095	83 608	2 507 421
1990	2 137 996	202 741	2 340 737	43 715	138 409	2 246 043
1991	2 184 836	190 424	2 375 260	45 012	134 405	2 285 867
1992	2 193 752	190 592	2 384 344	55 706	173 248	2 266 802
1993	2 186 749	192 247	2 378 996	52 690	190 068	2 241 618
1994	2 250 205	198 818	2 449 023	66 886	193 902	2 322 007
1995	2 244 800	216 916	2 461 716	52 884	266 475	2 248 125
1996	2 134 437	267 595	2 402 032	36 639	216 849	2 221 822
1997	2 219 385	257 186	2 476 571	47 382	224 232	2 299 721
1998	2 204 957	256 086	2 461 043	33 988	171 446	2 323 585
1999	2 299 705	265 746	2 565 451	54 535	96 058	2 523 928
2000p	2 287 143	254 142	2 541 285	62 531	80 626	2 523 190

Sources: Natural Resources Canada; Statistics Canada.
p Preliminary.
a Beginning in 1988, exports and imports are based on the new Harmonized System and may not be in complete accordance with previous method of reporting. Imports and exports include HS classes 2522.10, 2522.20 and 2522.30.
1 Producers' shipments and quantities used by producers. **2** Production plus imports, less exports.

TABLE 3. CANADIAN LIME INDUSTRY, 2000

Company	Plant Location	Calcining Capacity	Market	Type of Quicklime and Other Products
		(000 t/y)		
NEW BRUNSWICK				
Graymont (NB) Inc.	Havelock	175	Merchant	High-calcium[1]
QUEBEC				
Graymont (QC) Inc.	Marbleton	330	Merchant	High-calcium[1]
Graymont (QC) Inc.	Joliette	200	Merchant/captive	High-calcium[1]
Graymont (QC) Inc.	Bedford	200	Merchant	High-calcium
ONTARIO				
Algoma Steel Inc.	Sault Ste. Marie	200	Captive	High-calcium and dolomitic
Beachville Lime Limited	Ingersoll	600	Merchant	High-calcium[1] and dolomitic
Miller Minerals, a division of Miller Paving Limited	Haileybury	40	Merchant	High-calcium
Northern Lime Limited	Spragge	200	Merchant	High-calcium and dolomitic
Lafarge Lime (Canada) Inc., Dundas Division	Dundas	345	Merchant	High-calcium and dolomitic
Global Stone Ingersoll Ltd.[2]	Ingersoll	215	Merchant/captive	High-calcium
Timminco Limited	Haley Station	53	Captive	Dolomitic
MANITOBA				
Graymont Western Canada Inc.	Faulkner	117	Merchant	High-calcium
ALBERTA				
Rogers Sugar Ltd.	Taber	66	Captive	High-calcium
Graymont Western Canada Inc.	Exshaw	130	Merchant	High-calcium[1]
Graymont Western Canada Inc., Summit plant	Hazell	50	Merchant	High-calcium and dolomitic[1]
BRITISH COLUMBIA				
Graymont Western Canada Inc.	Pavilion Lake	235	Merchant	High-calcium
Chemical Lime Company of Canada Inc.	Fort Langley	135	Merchant	High-calcium[1]

Source: Natural Resources Canada.
[1] Production of hydrated lime. [2] Closed in March 2000.
Note: Lantic Sugar Limited operates sugar refineries in Quebec and New Brunswick.

TABLE 4. CANADA, USE[1] OF DOMESTIC LIME, QUICK AND HYDRATED, 1997-2000

End Uses	1997	1998	1999	2000
		(tonnes)		
CHEMICAL AND INDUSTRIAL				
Steel-making	807 000	707 482	780 877	632 284
Water and sewage treatment	278 986	310 510	296 053	224 074
Water purification	52 026	48 366	51 323	37 445
Gas scrubbing	9 376	15 060	16 309	7 629
Metal concentration	151 258	158 482	138 431	153 469
Pulp and paper mills	225 363	200 824	213 627	218 878
Chemicals	126 375	193 693	194 362	161 408
Other industrial uses	73 879	96 416	101 102	109 645
CONSTRUCTION				
Road and soil stabilization	12 458	14 323	15 810	9 586
Mason and finishing lime	7 252	1 684	1 591	917
Other	13 851	17 807	22 126	11 259
AGRICULTURE	4 509	1 051	2 512	4 699
Total use	1 762 334	1 765 697	1 834 124	1 571 293

Source: Natural Resources Canada, based on producing companies' surveys, 1997-2000.
[1] Includes merchant market only; excludes companies that are completely captive producers/users.

TABLE 5. WORLD PRODUCTION OF QUICKLIME AND HYDRATED LIME, INCLUDING DEAD-BURNED DOLOMITE SOLD AND USED, 1996-2000

	1996	1997	1998	1999	2000p
			(000 tonnes)		
Canada	2 400	2 500	2 460	2 570	2 550
Brazil	5 700	5 700	5 700	5 700	5 700
China	20 000	20 500	21 000	21 500	22 000
France	3 000	2 800	2 800	2 400	2 400
Germany	8 000	8 000	7 600	7 600	7 600
Italy[1]	3 500	3 500	3 500	3 500	3 500
Japan[2]	7 676	7 850	8 100	7 750	7 700
Mexico	6 600	6 600	6 600	6 600	6 600
Poland	2 500	2 500	2 500	2 500	2 500
United Kingdom	2 500	2 500	2 500	2 500	2 500
United States	19 100	19 700	20 100	19 600	20 100
Other countries	40 200	37 850	33 050	33 650	33 900
Total	121 180	120 000	115 910	115 870	117 050

Sources: Natural Resources Canada; Statistics Canada; U.S. Geological Survey.
p Preliminary.
1 Includes hydraulic lime. 2 Quicklime only.