

Molybdenum

*Prepared by the Minerals and Metals Sector,
Natural Resources Canada
Telephone: (613) 947-6580
E-mail: info-mms@nrcan.gc.ca*

Molybdenum is a refractory metallic element used primarily as an alloying agent in cast iron, steel and super-alloys to enhance hardenability, strength, toughness and corrosion resistance. Molybdenum is also an important material for the chemicals and lubricant industries. It is typically produced from molybdenite ore (MoS_2). In ore-bodies, molybdenite is generally present in quantities from 0.01 to 0.50% and is often associated with the sulphide minerals of other metals, notably copper.

USES

Molybdenum and its compounds have a number of diverse uses. It is used as a pure metal, an alloy additive, a lubricant, a catalyst, and in a number of chemical compounds. In order of market share, these uses are discussed below.

Alloying Element

Molybdenum is a very versatile and cost-effective alloying element. It is added to steel and ferrous castings as molybdic oxide (MoO_3) or as ferromolybdenum (an alloy of iron and molybdenum). In this form, molybdenum is readily dissolved in molten steel with very little loss; therefore, ferromolybdenum is often used in making fine adjustments to the chemistry of batches of steel.

Metal

Molybdenum metal is the product of a rather sophisticated refining process. The metal oxide is refined to high levels of purity by precipitation from solution. The oxide powder is then reduced in hydrogen and the metal powder is compressed into billets prior to required forming operations. Molybdenum metal has a number of valuable properties. Specifically, it has a low coefficient of thermal expansion, the refractory property of a high melting temperature, corrosion resistance, low levels of erosion from

molten metal, low density, relatively high thermal conductivity, low specific heat, a high modulus of elasticity, relatively high electrical conductivity, and good electrical contact properties. It is used in such diverse end uses as glass melting electrodes, powder and spray coatings for high-wear engine parts, steel additives, disks for semi-conductors, and electrical products.

Chemical Compounds

Molybdenum is an element that is an important component of a wide variety of chemicals. These chemicals are used as lubricants, reagents, dyeing compounds, pigments, vitreous glazes and enamels, electroplating compounds, catalysts, fertilizers, flame retardants, and paints and inks.

Other Uses

Molybdenum is valued for its properties as a catalyst in the petroleum refining and chemical processing industries. Pure molybdenum disulfide is an excellent dry lubricant because it has a lamellar structure with a low coefficient of friction between the laminations and the property of bonding to other materials. Molybdenum can also be used in the production of rechargeable dry batteries. These lithium-molybdenum batteries have more power per cell volume than conventional nickel-cadmium or alkaline batteries.

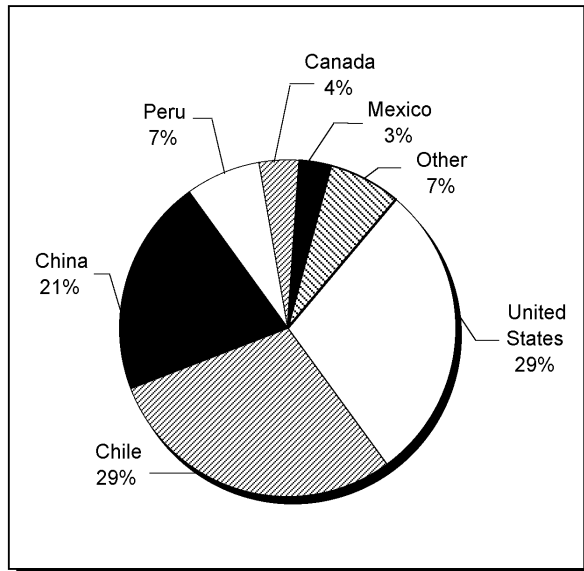
WORLD PRODUCTION

According to U.S. Geological Survey data, world molybdenum production reached 141 000 t in 2004, an increase of 11% from 2003 output. A few countries produce the majority of world molybdenum output (see Figure 1). In 2004, the United States, Chile, China, Peru and Canada were responsible for 90% of world output.

CANADIAN DEVELOPMENTS

Canada is the fifth largest producer of molybdenum in the world after the United States, China, Chile and Peru. In 2004, Canadian companies produced approximately 9500 t of contained molybdenum in the form of molybdenum ore

Figure 1
World Mine Production of Molybdenum



Source: U.S. Geological Survey molybdenum review, 2004, Table 11.

and concentrate, which was up from the 8900 t produced in 2003 and the 7950 t produced in 2002. In 2004, Canadian molybdenum use was 2330 t, a level that represents a 12.5% decrease from the 2003 level (Table 1).

Canada has four operating mines producing molybdenum, all located in British Columbia; one is a primary producer and the other three produce molybdenum as a by-product of copper mining.

The **Endako mine**, the sole primary molybdenum mine in Canada, is operated by joint-venture partners Thompson Creek Mining Limited and Sojitz Moly Resources Inc. The mine is located at Endako, British Columbia, just above the 54th parallel close to Fraser Lake (about 150 km west of Prince George). The deposit is mined from three pits and ore is fed to the mill at a rate of 28 000 t/d. The mill produces about 16 200 kg of molybdenum sulphide (MoS_2) a day, most of which is processed into molybdic oxide (MoO_3). Some of the molybdenum sulphide is further refined into an ultra-pure lubricant-grade molybdenum disulfide at Endako's 450-t/y Moly-Lube plant.¹

Highland Valley Copper (HVC) is owned 97.5% by Teck Cominco Limited and 2.5% by Highmont Mining Company. The open-pit mine is located about 80 km southwest of Kamloops, British Columbia. The 136 000-t/d concentrator produces a copper concentrate and a molybdenum concentrate using SAG mills and conventional flotation technology.

Molybdenum production in 2004 totalled 4853 t (molybdenum content in concentrate), a 47% increase in output from 2003. The higher output was a result of higher molybdenum grades and modifications to the molybdenum separation circuit that improved the recovery rate from 75% to over 90%. HVC expects 2005 output to decrease to 2268 t due to lower head grades.²

Production resumed in October 2004 at the **Gibraltar mine** near Williams Lake, British Columbia. The molybdenum circuit was scheduled to come on line in the second quarter of 2005. The open-pit operation ran from 1972 to 1998 when it was closed due to low prices and placed on care and maintenance. Taseko Mines Limited purchased Gibraltar from Boliden Westmin (Canada) Limited in 1999. The mine is operated by Ledcor Mining Ltd. under a joint-venture agreement with Taseko. Taseko has a 12-year mine plan to produce an average of 32 000 t of copper and 445 t of molybdenum annually from 148 Mt of sulphide.

Huckleberry Mines Ltd., owned 50% by Imperial Metals Corporation and 50% by the "Japan Group," is the operator of the **Huckleberry mine**, an open-pit operation that produces copper, gold, silver and molybdenum. The Japan Group consists of Mitsubishi Materials Corporation, Dowa Mining Co., Ltd., Furukawa Co. Ltd., and Marubeni Corporation. The Huckleberry mine is located near Houston, just below the 54th parallel. As a reference, it is located about 150 km southwest of the Endako mine. At the end of 2004, Huckleberry's estimated mine life was approximately three years. In 2004, the mine produced 194 t of molybdenum and 28 500 t of copper (metal in concentrates). In early 2005, a reserve recalculation was undertaken to determine how much additional copper could be produced at higher copper prices. As a result, the mine life was extended to late 2007. Exploration efforts continue in order to discover additional reserves that could extend the mine life.

Exploration Activity in Canada

British Columbia hosts many known molybdenum-containing ore deposits. British Columbia's Ministry of Energy, Mines and Petroleum Resources lists 1350 molybdenum-bearing occurrences, of which 430 contain molybdenum as the primary commodity.³ The recent price increases have created renewed interest in exploration activity in molybdenum-bearing deposits in British Columbia. Space and time preclude a review of all projects and exploration programs in Canada. The selection of the following projects does not imply that those discussed below are more or less advanced than others not included in this chapter.

- **Adanac Molybdenum Corporation** continued to develop its 100%-owned Ruby Creek project near

Atlin, British Columbia. The project is a proposed open-pit mine operating at a milling rate of 20 000 t/d for approximately 20 years. A \$2.6 million drilling program was completed in January 2005 and a final feasibility study is expected to be completed by the end of 2005. The prefeasibility study indicated a measured and indicated resource of 205 Mt grading 0.062% molybdenum using a cut-off grade of 0.04% molybdenum.

- **Roca Mines Ltd.** is working toward putting the Max deposit into production. The deposit is located at Trout Lake, 60 km south of Revelstoke, B.C. Previous exploration work had been carried out by Newmont Canada Limited and Esso Minerals Ltd. during the late 1970s. A scoping-level engineering report released in June 2005 indicated that the production scenario with the most positive economics would involve mining a 1.38-Mt measured and indicated underground resource at a rate of 500 t/d at a cut-off grade of 0.50% MoS₂.
- **Blue Pearl Mining** is advancing a feasibility study on the Davidson molybdenum deposit with a view to bringing it into production by mid-2007. The deposit is located 10 km west of Smithers, B.C., and hosts a resource of 75 Mt grading 0.295% MoS₂ based on a cut-off grade of 0.2% MoS₂. High-grade ore would be shipped by rail 3 km to the Endako mill. Blue Pearl estimates the capital costs of the project at US\$20 million.⁴
- **New Cantech Ventures Inc.** is exploring the Lucky Ship property near Houston, B.C. Previous work by Amex Exploration Inc. in the 1960s outlined a deposit estimated to contain a resource of 18 Mt grading 0.163% MoS₂. The project is a joint venture between New Cantech Ventures Inc. (50%) and Candorado Operating Co. (50%).⁵

WORLD DEVELOPMENTS

Chile

Chile's molybdenum production was 29 500 t in 2002, 33 400 t in 2003 (an increase of 13%) and an estimated 41 500 t in 2004 (an increase of 24%). Of the total 2004 output, 32 000 t was produced by four mines belonging to state-owned **Codelco**: Andina, El Teniente, Salvador and Codelco Norte. The remaining production came from the Los Pelambres mine (approximately 7800 t), operated by **Antofagasta Minerals S.A.** and from **Anglo American plc's** Los Bronces mine (approximately 1700 t). Output from Los Pelambres is expected to total 8200 t in 2005.

As part of an \$850 million expansion project, the Cerro Verde copper mine will produce 3650 t/y of molybdenum from a new plant starting in November 2006. The new

plant will produce 10 t/y of 85% molybdenum concentrate. The Cerro Verde mine is owned by **Phelps Dodge** (53.6%), **Sumitomo Metal Mining** and **Sumitomo Corp.** (21%), **Buenaventura** (18.2%), and other interests (7.2%).

Molibdenos y Metales (Molymet) announced plans to increase capacity at its Sanbernardo plant by 18 000 t/y by 2007.

Cia. Minera Dona Ines de Collahuasi SCM expects to start producing molybdenum at its new US\$38 million plant at the Collahuasi mine by November 2005, two months ahead of schedule. The plant will produce 4000 t of molybdenum during its first year of production. Output will rise to 8000 t/y as the grade of the ore increases. The plant will have an annual capacity of 12 000 t.⁶

Falconbridge Limited is installing a molybdenum recovery circuit at its Altonorte copper smelter near Antofagasta. The circuit will treat up to 10 000 t/y of molybdenum concentrates.

China

China's molybdenum production was 29 000 t in 2004, down 6.5% from 2003's output of 31 000 t. The reduced output reflects the imposition of controls on the processing of molybdenum by the Chinese government due to concerns about the environmental impact of the molybdenum-processing industry. These controls include curtailing imports of molybdenum concentrate and shutting down several small molybdenum mines.

Peru

Peru produced 9600 t of molybdenum in 2004 as a by-product from three copper mines: Toquepala, Cuajone and Antamina.

Southern Peru Copper Corporation (SPCC) contracted SNC Lavalin to complete a pre-feasibility study on the Toromocho deposit by early 2006. Measured and indicated resources at Toromocho stand at more than 1.8 billion t grading 0.47% copper, 0.016% molybdenum and 6.8 g/t silver.

United States

In 2004, U.S. mine production of molybdenum was 41 500 t, up 24% from 33 500 t in 2003. Primary production in 2004 came from three mines: the Henderson mine in Colorado, the Questa mine in New Mexico, and the Thompson Creek mine in Idaho. The Climax mine in Colorado has not operated since 1995. Molybdenum was also produced as a by-product of copper production at the Bagdad and Sierrita mines in Arizona, the Continental mine in Montana, the Chino mine in New Mexico, and the Bingham Canyon mine in Utah.

Joint-venture partners **Golden Phoenix Minerals Inc.** and **Win-Eldrich Mines Limited** announced that the Ashdown project in Nevada would begin production by December 2005. A drill program began in August 2004 to confirm previous evaluations by other operators that identified a 132 000-t molybdenum resource averaging 2.9% molybdenum and a separate 1.1-Mt gold resource averaging approximately 0.125 oz/t gold. A 100-t/d flotation mill is planned.

Northern Dynasty Minerals Ltd. continued to expand its 100%-owned Pebble copper-gold-molybdenum deposit in Alaska. By March 2005, the company had outlined a measured and indicated resource of 569 Mt grading 0.5 g/t gold, 0.46% copper and 0.021% molybdenum, or 0.88% copper-equivalent, plus an inferred resource of 143 Mt grading 0.56 g/t gold, 0.4% copper and 0.02% Mo, or 0.85% copper-equivalent, based on a cut-off grade of 0.7% copper-equivalent. Northern Dynasty plans to spend about \$44.7 million on drilling, engineering, environmental and socio-economic studies to advance the project to feasibility by the end of 2005.

PRICES

Prices for both ferromolybdenum and molybdic oxide rose spectacularly from the US\$8-\$9/lb level in December 2003 to the US\$34-\$37/lb range at the end of 2004. Demand growth has been strong and has outstripped

supply. A roasting capacity bottleneck has emerged and will likely not ease until a handful of new projects come on stream starting in late 2005 and 2006.

About 70% of world molybdenum is produced as a by-product or co-product of copper mining. By-product revenues received from molybdenum had such a significant impact on cash costs for copper miners that many of the larger copper producers changed their mine plans to maximize molybdenum production. Strengthening copper prices have brought some idled copper-molybdenum mines back into production (Gibraltar in B.C., and Bagdad and Sierrita in Arizona).

OUTLOOK

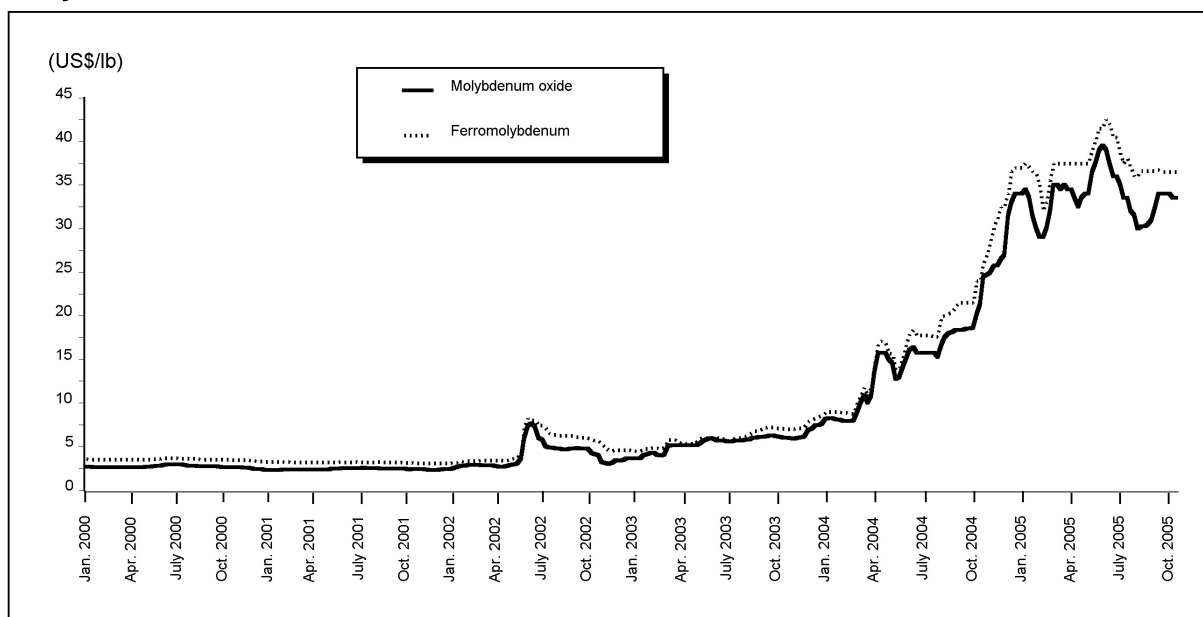
Growth in stainless steel production in China, Europe and India is expected to continue and, consequently, strong demand for molybdenum should continue. Prices should come off the historical highs witnessed in 2004 as additional capacity comes on stream.

OTHER INFORMATION SOURCES

International Molybdenum Association

Detailed information about molybdenum can be found at www.imoa.info, the web site of The International

Figure 2
Molybdenum Prices, 2000-2005



Source: MetalPrices.com.

Molybdenum Association (IMOA). The IMOA was founded in 1989 by all sectors of the industry. Its activities focus on the collection of statistics on supply, demand and inventory; health, safety and the environment; the promotion of molybdenum uses; and providing assistance to its members. Several Canadian companies are members of the association.

U.S. Geological Survey (USGS) Mineral Commodity Reports

Monthly and annual reports on the molybdenum industry can be accessed at <http://minerals.usgs.gov/minerals/pubs/commodity/molybdenum/>.

⁵*Mining Journal*, London, August 5, 2005, pg. 19.

⁶*American Metal Markets*, October 24, 2005.

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 May 31, 2005, with price data to October 2005. (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

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

REFERENCES

¹Endako Mines web site (www.endakomines.com).

²Teck Cominco 2004 annual report.

³*Mining Journal*, London, August 5, 2005, pg. 18.

⁴*Northern Miner*, Volume 91, No. 18, June 27-July 3, 2005.

TARIFFS

Item No.	Description	Canada		USA	United States	EU	
		MFN	GPT		Canada	Conventional Rate (1)	Japan WTO (2)
26.13	Molybdenum ores and concentrates						
2613.10	Roasted	Free	Free	Free	Free	Free	Free
2613.90	Other	Free	Free	Free	Free	Free	Free
2825.70.10	Molybdenum oxides	3%	3%	3%	Free	5.3%	Free
2825.70.20	Molybdenum hydroxides	3%	3%	3%	Free	5.3%	Free
28.41	Salt of oxometallic or peroxometallic acids						
2841.70	Molybdates	Free-4%	Free-3%	Free-4%	Free	5.5%	3.3%
7202.70	Ferromolybdenum	2.5%	2.5%	2.5%	Free	2.7%	3.3%
81.02	Molybdenum and articles thereof, including waste and scrap						
8102.10.10	Powders, not alloyed	Free	Free	Free	Free	4%	Free
8102.10.20	Powders, alloyed	Free	Free	Free	Free	4%	Free
8102.94	Unwrought molybdenum, including bars and rods obtained simply by sintering						
8102.94.10	Unwrought molybdenum, not alloyed	Free	Free	Free	Free	3%	Free
8102.94.20	Unwrought molybdenum, alloyed	Free	Free	Free	Free	3%	Free
8102.95	Bars and rods, other than those obtained simply by sintering, profiles, plates, sheets strip and foil	3%	Free	Free	Free	5%	Free
8102.96	Wire						
8102.96.10	Not coated or covered	Free	Free	Free	Free	8%	Free
8102.96.20	Coated or covered	Free	Free	Free	Free	8%	Free
8102.99	Other	3%	3%	3%	Free	7%	Free

Sources: Canadian *Customs Tariff*, effective January 2005, Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2005; *Official Journal of the European Union* (October 30, 2004 Edition); *Customs Tariff Schedules of Japan, 2004*.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA MOLYBDENUM PRODUCTION, TRADE AND USE, 2002-04

Item No.	2002		2003		2004 (p)	
	(kilograms)	(\$000)	(kilograms)	(\$000)	(kilograms)	(\$000)
PRODUCTION (Shipments) (1)						
British Columbia	7 952 874	x	8 887 011	x	9 506 082	x
EXPORTS	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
2613.10	Molybdenum ores and concentrates, roasted					
	Japan	5 767	34 048	4 918	42 107	3 513
	United States	3 211	23 099	2 209	19 648	1 442
	Netherlands	588	4 783	871	6 830	1 460
	Germany	183	891	1 006	9 539	1 058
	India	137	889	339	2 992	31
	Spain	—	—	116	1 104	22
	United Kingdom	—	—	39	321	19
	South Korea	1	17	2	26	1
	Belgium	632	2 254	—	—	—
	China	26	113	50	234	—
	France	6	66	—	—	—
	Mexico	181	1 137	—	—	—
	Sweden	—	—	19	138	—
	Taiwan	—	—	19	182	—
	Total	10 732	67 297	9 588	83 121	7 546
2613.90	Molybdenum ores and concentrates, other					
	United States	659	5 389	2 106	13 149	4 690
	Netherlands	1 329	8 022	4 571	29 833	7 013
	Mexico	816	6 252	759	4 479	2 782
	Belgium	2 210	11 878	19	149	529
	Chile	—	—	174	937	71
	China	—	—	26	144	9
	Japan	331	2 607	269	2 731	—
	South Korea	19	209	19	221	—
	Spain	—	—	3	26	—
	Total	5 364	34 357	7 946	51 669	15 094
2825.70	Molybdenum oxides and hydroxides					
	United States	—	—	...	5	19
2841.70	Metallic molybdates					
	United States	23	117	31	117	25
7202.70	Ferromolybdenum					
	United States	27	400	20	259	64
8102.10	Molybdenum powders					
	New Zealand	—	—	—	—	2
	South Korea	—	—	—	—	...
	United States	—	—	—	—	...
	India	—	—	—	—	...
	Japan	—	—	...	...	—
	Peru	—	—	1	17	—
	Total	—	—	1	17	2
8102.99	Molybdenum and articles thereof, n.e.s.					
	South Korea	—	—	—	—	...
	United States	...	19	...	4	—
	Total	...	19	...	4	...
	Total exports	16 146	102 190	17 586	135 192	22 750
						341 716

TABLE 1 (cont'd)

Item No.	2002		2003		2004 (p)		
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	
IMPORTS (2)							
2613.10	Molybdenum ores and concentrates, roasted						
	United States	828	6 289	456	4 220	1 338	18 774
	China	—	—	20	137	174	2 710
	Chile	—	—	—	—	92	1 664
	Mexico	109	516	—	—	—	—
	Netherlands	21	184	—	—	—	—
	Total	958	6 989	476	4 357	1 604	23 148
2613.90	Molybdenum ores and concentrates, other						
	United States	255	2 079	457	2 974	38	393
	Germany	—	—	...	...	...	1
	Peru	—	—	—	—	...	1
	Canada	...	...	—	—	—	—
	Chile	189	1 276	1	7	—	—
	Switzerland	—	—	...	...	—	—
	Total	444	3 355	458	2 981	38	395
2825.70.00.10	Molybdenum oxides						
	United States	1 319	13 194	1 563	18 787	2 405	31 148
	Mexico	11	133	—	—	148	1 883
	Switzerland	—	—	—	—	...	...
	Belgium	20	114	—	—	—	—
	United Kingdom	...	...	...	...	—	—
	Chile	—	—	...	1	—	—
	Total	1 350	13 441	1 563	18 788	2 553	33 031
2825.70.00.20	Molybdenum hydroxides						
	United States	...	1	...	2	...	1
	Germany	...	1	...	...	—	—
	Total	...	2	...	2	...	1
2830.90.00.00	Sulphides; polysulphides, whether or not chemically defined, other						
	United States	...	1 083	..	1 030	..	2 263
	Italy	...	3 165	..	3 790	..	2 163
	Austria	...	155	..	118	..	353
	China	...	146	..	21	..	284
	Japan	...	122	..	232	..	145
	Sweden	—	—	—	—	..	140
	Mexico	—	—	..	1	..	36
	India	—	—	..	1	..	20
	Germany	...	165	..	4	..	12
	Switzerland	...	...	..	...	..	...
	United Kingdom	...	...	—	—	..	...
	Canada	...	1	—	—	—	—
	Taiwan	...	...	—	—	—	—
	Total	..	4 837	..	5 197	..	5 416
2841.70	Metallic molybdates						
	United States	315	2 033	575	4 172	854	7 327
	China	20	132	34	228	14	122
	Japan	...	2	2	11	3	25
	Germany	2	16	1	4	...	3
	Switzerland	...	1	...	2	...	2
	United Kingdom	5	24	...	...	...	...
	Belgium	...	1	—	—	—	—
	Chile	—	—	...	...	—	—
	Total	342	2 209	612	4 417	871	7 479

TABLE 1 (cont'd)

Item No.	2002		2003		2004 (p)		
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	
IMPORTS (cont'd)							
7202.70	Ferromolybdenum						
	China	1 269	11 544	1 081	11 312	1 763	39 346
	United States	997	9 553	911	10 582	1 436	25 176
	United Kingdom	90	777	4	58	11	295
	Kazakhstan	—	—	1	17	8	78
	Canada	—	—	—	—	2	25
	Chile	224	2 329	241	2 766	—	—
	France	...	2	...	1	—	—
	Brazil	—	—	...	3	—	—
	Iran	—	—	12	187	—	—
	Total	2 580	24 205	2 250	24 926	3 220	64 920
8102.10.00.10	Molybdenum powders, not alloyed						
	United States	7	278	7	316	11	538
	Mexico	—	—	—	—	8	235
	Germany	...	20	...	3	...	5
	Japan	—	—	...	...	...	2
	Switzerland	...	...	—	—	—	—
	China	—	—	...	1	—	—
	Total	7	298	7	320	19	780
8102.10.00.20	Molybdenum powders, alloyed						
	China	...	...	1	37	4	205
	United States	4	198	2	125	3	140
	Belgium	1	25	1	23	1	45
	Germany	...	28	—	—	—	—
	Total	5	251	4	185	8	390
8102.94.00.10	Unwrought molybdenum, not alloyed						
	United States	...	15	1	59	3	148
	Austria	1	20	1	25	—	—
	Total	1	35	2	84	3	148
8102.94.00.20	Unwrought molybdenum, alloyed						
	China	—	—	—	—	60	2 474
	United States	4	193	2	77	3	162
	United Kingdom	—	—	...	...	...	...
	Austria	1	20	1	36	—	—
	Belgium	1	24	—	—	—	—
	Total	6	237	3	113	63	2 636
8102.96.00.10	Molybdenum wire, not coated or covered						
	United States	7	214	8	253	3	73
	South Korea	...	...	—	—	—	—
	Canada	—	—	...	4	—	—
	United Kingdom	—	—	...	3	—	—
	Total	7	214	8	260	3	73
8102.96.00.20	Molybdenum wire, coated or covered						
	United States	5	182	5	164	5	173
	Australia	—	—	—	—	...	...
	Austria	...	...	—	—	—	—
	Belgium	...	3	...	13	—	—
	China	...	...	—	—	—	—
	Netherlands	...	...	...	...	—	—
	Taiwan	...	...	—	—	—	—
	Japan	—	—	...	...	—	—
	Mexico	—	—	...	1	—	—
	Total	5	185	5	178	5	173

TABLE 1 (cont'd)

Item No.	2002		2003		2004 (p)		
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	
IMPORTS (cont'd)							
8102.97	Molybdenum waste and scrap						
	5	142	10	151	11	322	
	–	–	–	–	3	142	
	–	–	14	159	1	16	
	–	–	...	1	...	2	
	–	–	–	–	
	Total	5	142	24	311	15	482
8102.99	Molybdenum and articles thereof, other						
	9	527	14	710	15	836	
	–	–	...	2	2	134	
	2	140	2	138	1	46	
	–	–	–	–	...	9	
	–	–	–	–	
	...	1	...	4	–	–	
	–	–	...	1	–	–	
	Total	11	668	16	855	18	1 025
	Total imports	5 721	57 068	5 428	62 974	8 420	140 097
		2001	2002	2003			
			(kilograms)				
USE (3) (Mo Content)							
	Carbon steel	820 552	972 170	1 340 052			
	Stainless steel	288 444	298 121	87 493			
	Other steel	814 696	847 899	351 669			
	Cast iron	343 271	340 424	337 476			
	Other uses (4)	187 198	205 147	214 326			
	Total	2 454 161	2 663 761	2 331 016			

Sources: Natural Resources Canada; Statistics Canada.

– Nil; . . Not available; . . . Amount too small to be expressed; (p) Preliminary; x Confidential.

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

(1) Producers' shipments (Mo content of molybdenum concentrates, molybdic oxide and ferromolybdenum). (2) Imports from "Other countries" may include re-imports from Canada. (3) Available data as reported by users. (4) Nonferrous alloys, electrical, pigments, and other uses.

TABLE 2. CANADA, MOLYBDENUM PRODUCTION, TRADE AND USE, 1988-2004

	Production (1)	Exports (2)	Imports		Use (7)
		Molybdenum Ores and Concentrates, Oxides and Hydroxides (3)	Molybdc Oxides and Hydroxides (4,5)	Ferro-molybdenum (6)	
(kilograms)					
1988	13 535 186	14 026 855	187 691	345 664	1 213 248
1989	13 542 984	16 131 760	123 707	1 150 139	1 382 505
1990	12 188 487	11 086 429	176 481	581 782	1 179 374
1991	11 436 809	10 305 832	304 869	544 300	1 643 170
1992	8 870 267	7 138 674	249 767	493 260	1 534 941
1993	10 250 004	9 977 571	200 190	699 141	1 837 852
1994	9 758 885	8 964 904	502 529	886 302	2 163 560
1995	9 112 733	9 021 654	1 175 928	1 414 171	2 065 867
1996	8 789 335	8 511 505	884 071	1 283 132	2 305 439
1997	7 593 758	11 257 152	648 395	1 663 897	2 544 836
1998	8 099 267	10 748 462	663 731	1 846 323	2 573 367
1999	6 250 168	10 557 799	1 073 134	1 839 295	3 179 516
2000	6 979 838	10 632 405	1 028 501	1 885 044	2 912 571
2001	8 556 338	13 407 284	953 583	1 659 006	2 454 161
2002	7 952 874	16 097 239	1 350 505	2 579 758	2 663 761
2003	8 887 011	17 536 879	1 562 831	2 251 605	2 331 016
2004 (p)	9 506 082	22 657 243	2 553 456	3 219 667	..

Sources: Natural Resources Canada; Statistics Canada.

.. Not available; (p) Preliminary.

(1) Producer's shipments (Mo content of molybdenum concentrates, oxide and ferromolybdenum). (2) Exports include H.S. classes 2613.10, 2613.90 and 2825.70. (3) Mo content, oxides, ores and concentrates. (4) Molybdc oxide includes H.S. Classes 2825.70.00.10 and 2825.70.00.20 (before 1998, these numbers were 2825.70.10 and 2825.70.20). (5) Gross weight. (6) Ferromolybdenum includes H.S. Class 7202.70. (7) Mo content of molybdenum products reported by consumers.

Notes: Numbers may not add to totals due to rounding. Beginning in 1988, exports and imports are based on the Harmonized System and may not be in complete accordance with previous method of reporting.