MOLYBDENUM

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Molybdenum is a refractory metallic element used principally as an alloying agent in cast iron, steel, and superalloys to enhance hardenability, strength, toughness, and wear- and corrosion-resistance. To achieve desired metallurgical properties, molybdenum, primarily in the form of molybdic oxide (MoX) or ferromolybdenum (FeMo), is frequently used in combination with or added to chromium, columbium (niobium), manganese, nickel, tungsten, or other alloy metals. The versatility of molybdenum in enhancing a variety of alloy properties has ensured it a significant role in contemporary industrial technology, which increasingly requires materials that are serviceable under high stress, expanded temperature ranges, and highly corrosive environments. Moreover, molybdenum finds significant use as a refractory metal in numerous chemical applications, including catalysts, lubricants, and pigments. The variety of uses for molybdenum materials, few of which afford acceptable substitution, has resulted in an increase in Western molybdenum consumption to an estimated 144,000 metric tons per year (t/yr) (318 million pounds per year) in 2004 from about 68,000 t/yr (150 million pounds per year) in 1983 (Adams, 2004).

Molybdenum reserves and production capacity were concentrated in a few countries of the world. World mine output was estimated to be 141,000 metric tons (t) (molybdenum contained in concentrate), of which, in descending order of production, the United States, Chile, China, Peru, Canada, and Mexico provided about 93% (table 11). Chile, China, and the United States also held about 85% of the estimated 19 million metric tons (Mt) of molybdenum in the world reserve base.

Production

Domestic production data for molybdenum were derived by the U.S. Geological Survey by means of three separate voluntary surveys. These surveys are "Molybdenum Ore and Concentrate" (annual), "Molybdenum Concentrate" (monthly), and "Molybdenum Products and Molybdenum Concentrates" (monthly). Surveys are sent to all eight operations that produce molybdenum ore and products, and all responded, representing 100% of the U.S. production listed in table 1.

In 2004, U.S. mine production of molybdenum concentrate was 41,500 t, about a 24% increase from 33,500 t in 2003. World mine production of molybdenum in 2004 increased to 141,000 t, about an 8% increase from 130,000 t in 2003. The U.S. share of world production was about 29% in 2004. Net production of molybdenum products increased to 24,300 t in 2004 from 11,800 t in 2003 (table 2).

Primary molybdenum production continued at the Henderson Mine in Colorado, the Questa Mine in New Mexico, and the Thompson Creek Mine in Idaho. The Climax Mine in Colorado has been inactive since 1995. Molybdenum was produced as a byproduct of copper production at the Bagdad and Sierrita Mines in Arizona, the Continental Pit in Montana, the Chino Mine in New Mexico, and the Bingham Canyon Mine in Utah. Montana Resources' Continental Pit in Montana resumed operation in November 2003 and made the first shipments of molybdenite concentrate in early 2004 (Platts Metals Week, 2003). The byproduct molybdenum recovery circuit at the Chino Mine was restarted in the fourth quarter and produced a minor amount of concentrate in 2004.

With byproduct molybdenum recovery at a copper mine, all mining costs associated with producing the molybdenum concentrate are allocated to the primary metal (copper). Owing to this cost advantage, byproduct molybdenite recovery from copper circuits at selected porphyry copper mines was estimated to account for 79% of Western and 55% of worldwide molybdenum supply. Phelps Dodge Corp. and Kennecott Utah Copper Corp. increased copper production and byproduct molybdenum recovery, and Montana Resources resumed copper and byproduct molybdenum shipments in 2004. Kennecott Utah Copper increased molybdenum production by more than 35% compared with that of 2003.

Primary molybdenum mines operate in a swing capacity and have a limited ability to change production rate to meet spikes in demand. The Henderson Mine operated at about 75% of its 16,300-t/yr (36- million-pound-per-year) capacity, about a 24%, as compared with that of 2003. The Thompson Creek Mine produced at about 50% of its 9,000-t/yr (20- million-pound-per-year) capacity in 2004, and the Questa Mine continued to operate its mine and mill separately at intervals of about 6 months (Ryan's Notes, 2003). Phelps Dodge Corp. commissioned two 6-month-long studies to determine the economic feasibility of reopening the Climax Mine, but industry sources don't expect Climax to restart until the Henderson deposit in Empire, CO, about 100 kilometers east, is exhausted. Neither Montana Resources nor Questa Molycorp announced expansion plans.

In May, Thompson Creek informed some of its Japanese customers that it would be supplying some of their molybdenum oxide requirements from its U.S. facility rather than from its Endako Mine in Canada (Ryan's Notes, 2004f). The rock slides at Endako earlier in 2004 forced Thompson Creek to mine lower ore grades at the site, and consequently, production was lower than in 2003. Rather than delay shipping to Japan, Thompson Creek was to ship molybdenum oxide from its Langloth, PA, roaster to meet some customer requirements.

Golden Phoenix Minerals, Inc. announced it could begin producing molybdenum by December at its Ashdown project in Nevada. A drill program began in mid-August to confirm past 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 about 0.125 troy ounces per metric ton. Golden Phoenix reported that water pollution control and reclamation permit applications had been submitted

to the Nevada Department of Environmental Protection in August. The permit applications stipulated that about 9,100 t of stockpiled material would be processed in an existing pilot mill to determine flow sheet design for a production mill. Golden Phoenix acquired a pilot test mill and was to deliver and commission the mill within 45 days upon receiving permits to operate (Platts Metals Week, 2004e).

Consumption

In 2004, reported consumption (roasting) of molybdenum concentrate was 38,700 t, an increase of about 11,200 t compared with that of 2003. The increase resulted from increased mine production and because molybdenum concentrates from Thompson Creek were roasted domestically in 2004. Domestic mine production of molybdenum concentrate was roasted, exported for conversion, or purified to lubricant-grade molybdenum disulfide. Technical-grade MoX consumption in 2004 was about 4% greater than that of 2003. Oxide was the chief form of molybdenum used by industry, particularly in making full alloy, stainless and tool steel, and superalloys; however, some of the oxide was converted to other molybdenum products, such as ammonium and sodium molybdates, FeMo, high-purity oxide, and metal powder (table 3).

Metallurgical applications continued to dominate molybdenum use in 2004, accounting for more than 82% of total consumption. In 2004, ferromolybdenum accounted for about 38% of the molybdenum-bearing materials used to make steel, a 1% decrease from that of 2003. Nonmetallurgical applications included catalysts, chemicals, lubricants, and pigments. The dominant nonmetallurgical use was in catalysts.

Stocks

At yearend, producer plus consumer industry stocks contained about 4,900 t of molybdenum, an increase of about 200 t compared with those at yearend 2003. Inventories of molybdenum in concentrate at mines and plants increased by about 100 t. Producer stocks of molybdenum in such products as FeMo, molybdates, MoX, metal powders, and other types increased by about 100 t compared with those of 2003. Total stocks of about 7,500 t represented about a 23-week supply. Supply was calculated as reported stocks divided by annual consumption (table 1).

Prices

Prices were reported in Platts Metals Week in dollars per kilogram of contained molybdenum. The annual time-average prices for 2004 were MoX, $36.729 per kilogram and FeMo, $40.452 per kilogram of contained molybdenum, which represented increases of 213% and 209%, respectively, compared with 2003 prices. Molybdenum prices rose steadily in 2004 from January through March, spiked in April, and then rose steadily through November before spiking again in December. The MoX monthly average price ranged from $17.499 per kilogram in January to $54.289 per kilogram in November, and the FeMo monthly average price ranged from $19.304 per kilogram in January to $57.458 per kilogram in November. In December the MoX monthly average price spiked at $68.861 per kilogram, and the FeMo price spiked at $76.500 per kilogram.

In March, molybdenum prices increased sharply in Europe, as output by producers appeared to lag the market (Ryan's Notes, 2004c). The bull market was driven by buyers looking for prompt material, which limited the number of suppliers and carried premium prices. This also meant the buyers had to come back on a regular basis, which kept the market buoyant (Platts Metals Week, 2004f).

In December, for the fourth consecutive month, European ferromolybdenum prices increased, trading in the range of $75 to $85 per kilogram in December compared with about $20 per kilogram in December 2003. The December price rise represented an increase of about 14% more than that of the previous month. Chinese ferromolybdenum prices continued to rise and traded at $65 per kilogram in December, about $5 per kilogram more than that of the previous month. Further price hikes were expected in 2005 as Chinese producers compensate for lost revenue owing to the removal of China's export tax rebate (Metal Bulletin Research, 2004c).

In mid-June, Chinese ferromolybdenum traders were concerned by the surge in price of Western ferromolybdenum as Chinese ferromolybdenum ranged from $31 to $33 per kilogram, while European ferromolybdenum rose to a range of $47 to $52 per kilogram. A U.S.-based trader agreed that a two-tiered market was in place, and a major reason for it was that the European Union (EU) was enlarged by 10 new countries in May. This reportedly had the effect of reducing Chinese ferromolybdenum consumption by the new Eastern European members owing to antidumping duties in place on Chinese ferromolybdenum imports into the EU (Platts Metals Week, 2004c).

Foreign Trade

In 2004, molybdenum-containing material exports collectively contained about 47,100 t of molybdenum and were valued at $554 million (table 6). Imports for consumption of molybdenum-containing materials (products) collectively were valued at $501 million (table 9).

World Industry Structure

Capacity.—As of December 31, U.S. rated capacity, for mines and mills, was estimated to be 75,000 t/yr of contained metal. Rated capacity was defined as the maximum quantity of product that can be produced in a period of time on a normally sustainable long-term operating rate based on the physical equipment of the plant and given acceptable routine operating procedures involving energy, labor, maintenance, and materials. Capacity included operating plants temporarily closed that can be brought into production within a short period of time with minimal capital expenditure.

Reserves.—The U.S. molybdenum reserve base was estimated to be about 5.4 Mt, about 28% of the world molybdenum reserve base. About 90% of U.S. reserves occur in large low-grade porphyry molybdenum deposits mined or anticipated

to be mined primarily for molybdenum and as an associated metal sulfide in low-grade porphyry copper deposits. These deposits were in Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, and Utah. Other molybdenum sources contribute insignificantly to U.S. reserves.

Most Canadian reserves of molybdenum were associated with porphyry molybdenum and porphyry copper-molybdenum deposits in British Columbia. Other Canadian reserves were associated with minor copper-molybdenum porphyry deposits in New Brunswick and Quebec.

Molybdenum reserves in Central America and South America were associated mainly with large copper porphyry deposits. Of several such deposits in Chile, the Chuquicamata and El Teniente deposits were among the world's leading deposits and accounted for 85% of molybdenum reserves in Chile. Peru also had substantial reserves, and the La Caridad deposit in Mexico was a leading producer. Numerous other porphyry copper deposits that may contain recoverable quantities of molybdenum have been identified in Central America and South America. Many of these deposits were being actively explored and evaluated and could substantially add to reserves in the future. Reserves of molybdenum in China and the Commonwealth of Independent States were thought to be substantial, but definitive information about the current sources of supply or prospects for future development in these two areas was lacking.

World Review

European Union.—European converters worked to produce more FeMo. Treibacher Industrie AG said it doubled its usual summer output. Phelps Dodge Corp. closed its Climax Molybdenum facility in Stowmarket, United Kingdom, for 3 weeks, starting the last week in July, to install production upgrades to increase FeMo capacity by 20%. The Stowmarket facility was believed to produce about 1,000 metric tons per month of FeMo. Belgian molybdenum processor Sadaci (a subsidiary of Chile's Molymet) maintained normal production levels at its FeMo unit and its roaster rather than taking its usual summer shutdown (Ryan's Notes, 2004a).

Germany's Steel Federation announced that it planned to open a review of the European Commission's antidumping duty on Chinese molybdenum imports. A duty of 22.5% was placed on Chinese-origin FeMo by the European Commission in January 2002 after a finding that dumping of Chinese material had caused harm to the European FeMo industry. Specialty steelmakers have been adversely affected by the current high prices and limited supply (Metal Bulletin Research, 2004b).

Armenia.—Comsup Commodities Inc., a U.S. company, became the holder of 100% of the shares of Agarak Copper-Molybdenum Complex for $600,000. In compliance with the contract, the company bound itself to invest $3.5 million for modernizing the facilities and to increase ore production within 2 years. Agarak planned to reach an ore production rate of 2.5 million metric tons per year, its rated capacity, by yearend. Agarak produced 2.3 Mt of ore last year (Metal-Pages, 2004§[1]).

Canada.—Roca Mines Inc. announced plans to study two development scenarios for its MAX molybdenum project in southeastern British Columbia, following completion of a resource estimate for the project. Roca planned studies of a fast-track mining and milling operation based on an estimated measured resource of 1.01 Mt grading 1.01% molybdenite at a 0.50% cutoff grade. The company also planned to study a large-scale mining and milling option that would process 2,000 to 3,000 metric tons per day (t/d) of ore from a 9.34-Mt resource grading 0.35% molybdenite at a 0.20% cutoff grade (Platts Metals Week, 2004a).

Chile.—Molibdenos y Metales (Molymet), Santiago, announced plans to boost molybdenum concentrate processing capacity at the San Bernardo plant by 18,000 t/yr (40 million pounds per year) and at its Sacaci subsidiary's plant in Ghent, Belgium, by 4,500 t/yr (10 million pounds per year). The expansion in Chile should be completed in 2007, but the expansion in Belgium may not be completed until 2009. Molymet expected to increase its ferromolybdenum conversion capacity in the first half of 2004 by 9,000 t/yr (20 million pounds per year) to about 23,000 t/yr (50 million pounds per year). Molymet produced ferromolybdenum and molybdenum oxide at plants in Belgium, Chile, Germany, and Mexico (Ryan's Notes, 2004d).

Compania Minera Dona Ines de Collahuasi, one of Chile's leading copper producers, approved a $40 million project to produce molybdenum concentrate from its Collahuasi copper mine in northern Chile. Concentrates will be extracted from the new Rosario deposit owing to much higher molybdenum content in the ore than in the nearby Ujina pit. The plant, to be built at the company's Puerto Patache port facility, is expected to produce 4,500 to 7,000 t/yr of contained molybdenum, depending on ore grade, with production expected to commence in late 2006 (Platts Metals Week, 2004d).

Amerigo Resources Ltd. (Amerigo) received approval to construct a processing plant to extract molybdenum from a copper concentrate produced at Minera Valle Central (MVC) near Santiago (Ryan's Notes, 2004b). MVC recovers copper from tailings discarded from the El Teniente Mine, producing an average of 140 t/d of copper concentrate grading 0.894% molybdenum. Expected molybdenum production would be about 320 t/yr (700,000 pounds per year) contained in concentrate. Amerigo estimated operating costs to be about $2 per pound.

China.—Jinduicheng Molybdenum Mining Corp. acquired a 65% stake in a leading molybdenum mine in Ruyang County, Henan Province. The new mine has a molybdenum concentrate capacity of 600 to 800 t/yr, but was expected to expand to 2,500 to 3,000 t/yr by the end of 2004. Ruyang's molybdenum reserves were estimated to be 400,000 t (Platts Metals Week, 2004b).

Several Chinese molybdenum producers targeted China's domestic market in 2004 in response to the Government's decision to cut the export tax rebate on molybdenum concentrates to 8% from 14%, effective January 1, 2004 (Platts Metals Week, 2004b). This decision, combined with supply disruptions in China and Russia, likely caused molybdenum oxide quotes to rise in 2004. Growing demand from China's stainless steel mills curbed Chinese ferromolybdenum exports to

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

the Asian market, contributing to ferromolybdenum's price rise (Metal Bulletin Research, 2004a).

Russia.—Russia retained its 49% share in the Russian-Mongolian copper-and-molybdenum joint-venture Erdenet Mining Corporation. Erdenet has developed several ore deposits, which make up several fields, and is a leading Mongolian producer of raw copper. Reserves in the northwest mining sector are estimated to be 6 Mt of copper and 170,000 t of molybdenum. The company was attempting to raise processing capacity in 2004 and was considering building a 25,000-t/yr copper cathode plant (Metal Pages, 2003§).

Outlook

Phelps Dodge Corp. announced that it expected to achieve full capacity production at its Bagdad concentrator by the end of the second quarter of 2004 and at its Sierrita concentrator by the fourth quarter of 2004. Phelps Dodge expected to produce about 13,600 t (30 million pounds) of molybdenum concentrate in 2004 from the two operations, a slight increase from that in 2003. While achieving full capacity production at the two mines depended on the ore grades being mined, the output numbers showed that Phelps Dodge operated at about 80% of its historical high in 2004 (Ryan's Notes, 2004e). The Henderson Mine was expected to produce according to plan at about 12,700 t (28 million pounds) of molybdenum.

Growth in the production of stainless steel in China, Europe, and India was expected to continue, leading to strong molybdenum demand. The International Stainless Steel Forum had predicted that growth in Europe for 2004 would reach an estimated 5%. However, output increased sharply in the second half of the year, making it likely that the industry exceeded this target. In a separate development, China's National Development and Reform Commission completed a new policy for the Chinese steel industry, which is awaiting state approval. The policy is structured to increase the volume of high-technology flat products, which should reduce China's dependence on imported goods. This should have a positive effect on existing and planned stainless steel plants in China. In India, Jindal announced plans to expand its existing operations to 750,000 t/yr for hot rolling and 250,000 t/yr for cold rolling facilities. Currently, the company exports approximately 50% of its stainless steel output, predominantly to China (Metal Bulletin Research, 2004d).

Because of abundant resources and adequate production capacity in Chile, China, the United States, and other countries, world producers expected to readily meet the future requirement for molybdenum. The principal use for molybdenum will continue to be in chemicals and catalysts and as an additive in steel manufacturing in general, most importantly alloy and stainless steel.

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TABLE 1
SALIENT MOLYBDENUM STATISTICS[1]

		2000	2001	2002	2003	2004
United States:						
Concentrate, Mo content:						
Production	metric tons	40,900	37,600	32,300 r	33,500	41,500
Shipments:						
Quantity	do.	40,400	37,000	32,300	33,600	42,000
Value	thousands	$210,000	$192,000	$232,000	$324,000	$1,420,000
Reported consumption[2]	metric tons	33,800	33,300	21,200	27,500	38,700
Imports for consumption	do.	6,120	6,010	4,710	5,190	8,780
Stocks, December 31, Mo content:						
Concentrate, mine and plant	do.	4,030	4,210	3,870	2,520	2,610
Product producers[3]	do.	5,360	5,600	4,300	2,760	2,840
Consumers	do.	2,050	869	1,800	1,900 r	2,030
Total	do.	11,400	10,700	9,970	7,180 r	7,480
Primary products, Mo content:						
Production	do.	42,900	40,300	31,300	41,400	66,300
Shipments	do.	34,600	32,600	27,500	30,100	39,300
Reported consumption	do.	18,300	15,800	15,300	16,400 r	17,400
World, mine production, Mo content	do.	135,000 r	132,000 r	121,000	130,000 r	141,000 e

eEstimated. rRevised.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Molybdenum concentrates roasted to make molybdenum oxide.

[3]Includes ammonium, calcium, and sodium molybdate; briquets; ferromolybdenum; molybdenum hexacarbonyl; molybdenum metal; molybdenum pentachloride; molybdic acid; pellets; phosphomolybdic disulfide; and technical and purified molybdic oxide.

TABLE 2
PRODUCTION, SHIPMENTS, AND STOCKS OF MOLYBDENUM PRODUCTS IN THE UNITED STATES[1]

(Metric tons of contained Mo)

	Metal powder		Other[2]		Total	
	2003	2004	2003	2004	2003	2004
Received from other producers	--	--	16,800	15,100	16,800	15,100
Gross production during year	3,490	4,210	37,900	62,000	41,400	66,300
Molybdenum products used to make other products	2,730	3,340	26,900	38,600	29,600	42,000
Net production	760	868	11,000	23,400	11,800	24,300
Shipments	739	889	29,300	38,500	30,100	39,300
Producer stocks, December 31	194	172	2,570	2,660	2,760	2,840

-- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes ammonium, calcium, and sodium molybdate; ferromolybdenum; molybdenum disulfide; molybdenum hexacarbonyl; molybdenum metal; molybdenum pentachloride; molybdic acid; molybdic oxides; pellets; and phosphomolybdic acid.

TABLE 3

U.S. REPORTED CONSUMPTION, BY END USES, AND CONSUMER STOCKS OF MOLYBDENUM MATERIALS[1]

(Kilograms of contained Mo)

End use	Molybdic oxides	Ferromolybdenum[2]	Ammonium and sodium molybdate	Molybdenum scrap	Other	Total
2003:						
Steel:						
Carbon	239,000	350,000	--	--	W	589,000
High-strength low-alloy	365,000	124,000	--	--	W	489,000
Stainless and heat-resisting	2,430,000	830,000	--	11,800	160,000	3,430,000
Full alloy	1,330,000	1,920,000	--	--	18,500	3,270,000
Tool	577,000	W	--	546	--	577,000
Total	4,950,000	3,230,000	--	12,400	178,000	8,360,000
Cast irons (gray, malleable, ductile iron)	W	995,000 r	--	--	27,000	1,020,000 r
Superalloys	676,000	19,500	--	(3)	1,250,000	1,950,000
Alloys (other than steels, cast irons, superalloys):						
Welding materials (structural and hard-facing)	--	43,600	--	--	424	44,000
Other alloys	W	34,600	--	882	1,140	36,700
Mill products made from metal powder[4]	--	--	--	--	1,090,000	1,090,000
Cemented carbides and related products[5]	--	--	--	--	79	79
Chemical and ceramic uses:						
Pigments	W	--	235,000	--	--	235,000
Catalysts	1,730,000	--	W	--	179,000	1,910,000
Other	--	--	--	--	14,400	14,400
Miscellaneous and unspecified uses:						
Lubricants	--	--	--	--	289,000	289,000
Other	214,000	99,200	888,000	--	206,000	1,410,000
Grand total	7,570,000	4,420,000 r	1,120,000	13,200	3,240,000	16,400,000 r
Stocks, December 31	460,000	478,000 r	41,100	51,300	866,000	1,900,000 r
2004:						
Steel:						
Carbon	362,000	378,000	--	--	W	740,000
High-strength low-alloy	426,000	168,000	--	--	W	594,000
Stainless and heat-resisting	2,630,000	836,000	--	22,700	117,000	3,610,000
Full alloy	1,760,000	2,200,000	--	--	18,100	3,980,000
Tool	603,000	W	--	442	--	604,000
Total	5,790,000	3,580,000	--	23,100	135,000	9,520,000
Cast irons (gray, malleable, ductile iron)	W	920,000	--	--	27,000	947,000
Superalloys	948,000	19,500	--	(3)	1,400,000	2,360,000
Alloys (other than steels, cast irons, superalloys):						
Welding materials (structural and hard-facing)	--	68,000	--	--	733	68,700
Other alloys	W	28,000	--	913	1,050	30,000
Mill products made from metal powder[4]	--	--	--	--	1,420,000	1,420,000
Cemented carbides and related products[5]	--	--	--	--	46	46
Chemical and ceramic uses:						
Pigments	W	--	207,000	--	--	207,000
Catalysts	1,010,000	--	W	--	179,000	1,190,000
Other	--	--	--	--	14,500	14,500
Miscellaneous and unspecified uses:						
Lubricants	--	--	--	--	350,000	350,000
Other	114,000	78,900	889,000	--	187,000	1,270,000
Grand total	7,860,000	4,690,000	1,100,000	24,000	3,710,000	17,400,000
Stocks, December 31	464,000	656,000	16,800	17,200	880,000	2,030,000

[r]Revised. W Withheld to avoid disclosing company proprietary data; included with "Other" of the "Miscellaneous and unspecified uses" category. -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes calcium molybdate.

[3]Included with "Superalloys, other alloys."

[4]Includes construction, mining, oil and gas, and metal working machinery.

[5]Includes ingot, wire, rod, and sheet.

TABLE 4

U.S. EXPORTS OF MOLYBDENUM PRODUCTS, BY PRODUCT AND COUNTRY[1]

Product and country	HTS[2] code	2003 Quantity (metric tons)	2003 Value (thousands)	2004 Quantity (metric tons)	2004 Value (thousands)
Oxides and hydroxides, gross weight:	2825.70.0000				
Brazil		3	$46	(3)	$3
Canada		1,560	13,300	2,340	23,100
Japan		123	1,360	661	12,500
Mexico		59	383	3	56
Other		837	4,840	2,280	44,700
Total		2,580	20,000	5,280	80,300
Molybdates all, gross weight:	2841.70.0000				
Australia		10	110	14	131
Brazil		(3)	4	6	117
Canada		574	3,060	845	5,800
Colombia		10	91	6	41
Honduras		2	12	--	--
Japan		332	3,360	279	2,650
Korea, Republic of		36	346	3	43
Mexico		262	3,390	370	5,240
Netherlands		1,000	5,870	876	13,400
Taiwan		25	177	6	113
Other		20	261	278	955
Total		2,270	16,700	2,680	28,500
Ferromolybdenum, contained weight:[4]	7202.70.0000				
Canada		547	7,690	870	18,700
Mexico		43	688	34	1,130
Netherlands		26	255	--	--
Other		1	21	21	1,400
Total		617	8,660	925	21,200
Molybdenum other, gross weight:[5]	Various[6]				
Australia		10	156 r	(3)	43
Brazil		59	1,730	89	3,680
Canada		69	2,030	77	2,850
France		25	1,060	42	1,770
Germany		66	1,510	100	3,970
Hungary		5	158	84	3,180
India		29	752	37	1,520
Italy		8	322	25	1,010
Japan		238	6,990	442	22,800
Mexico		14	1,000	13	1,270
Netherlands		42	1,550	24	1,760
Spain		7	189 r	14	717
Sweden		2	144 r	24	461
Taiwan		117	2,200	101	4,140
United Kingdom		279	4,230	246	7,690
Other		87	4,440 r	203	9,150
Total		1,060	28,500	1,520	66,000

rRevised. -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Harmonized Tariff Schedule of the United States.

[3]Less than ½ unit.

[4]Ferromolybdenum contains about 60% to 65% molybdenum.

[5]Includes powder, unwrought, waste and scrap, wire, wrought, and other.

[6]Includes HTS codes 8102.10.0000, 8102.94.0000, 8102.97.0000, 8102.96.0000, 8102.95.0000, and 8102.99.0000.

Source: U.S. Census Bureau.

TABLE 5
U.S. EXPORTS OF MOLYBDENUM ORE AND CONCENTRATES
(INCLUDING ROASTED AND OTHER CONCENTRATES), BY COUNTRY[1]

	2003		2004	
Country	Quantity (metric tons of contained Mo)	Value (thousands)	Quantity (metric tons of contained Mo)	Value (thousands)
Australia	102	$1,200	30	$322
Austria	--	--	1,310	$6,460
Belgium	3,190	30,200	6,470	57,900
Brazil	43	484	31	462
Canada	910	5,080	1,370	14,700
Chile	368	4,470	1,380	23,100
China	83	254	36	98
Costa Rica	23	46	27	67
Finland	--	--	638	3,990
Germany	1	4	295	1,000
Japan	2,000	21,200	5,730	26,000
Korea, Republic of	61	675	95	890
Mexico	3,730	17,300	3,910	26,500
Netherlands	10,900	60,900	14,100	125,000
Slovenia	--	--	815	3,610
Spain	4	57	765	3,760
Sweden	26	228	38	650
United Kingdom	7,880	49,500	8,910	61,000
Other	206 r	2,390 r	279	1,760
Total	29,500	194,000	46,200	358,000

rRevised. -- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 6
U.S. EXPORTS OF MOLYBDENUM PRODUCTS[1]

		2003			2004		
Item	HTS[2] code	Gross weight (metric tons)	Contained Mo (metric tons)	Value (thousands)	Gross weight (metric tons)	Contained Mo (metric tons)	Value (thousands)
Molybdenum ore and concentrates, roasted	2613.10.0000	NA	18,100	$116,000	NA	33,800	$237,000
Molybdenum ore and concentrates, other	2613.90.0000	NA	11,400	78,500	NA	12,400	121,000
Molybdenum chemicals:							
Oxides and hydroxides	2825.70.0000	2,580	NA	20,000	5,280	NA	80,300
Molybdates, all	2841.70.0000	2,270	NA	16,700	2,680	NA	28,500
Ferromolybdenum	7202.70.0000	1,030	617	8,660	1,540	925	21,200
Molybdenum powders	8102.10.0000	308	NA	6,770	478	NA	18,200
Molybdenum unwrought, bars and rods	8102.94.0000	94	NA	2,160	181	NA	3,510
Molybdenum waste and scrap	8102.97.0000	294	NA	2,370	216	NA	4,330
Molybdenum wire	8102.96.0000	111	NA	4,730	177	NA	8,540
Molybdenum, other	Various[3]	252	NA	12,400	469	NA	31,400
Total		6,940	30,100	268,000	11,000	47,100	554,000

NA Not available.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Harmonized Tariff Schedule of the United States.
[3]Includes HTS codes 8102.95.0000 and 8102.99.0000.

Source: U.S. Census Bureau.

TABLE 7

U.S. IMPORTS OF MOLYBDENUM PRODUCTS, BY PRODUCT AND COUNTRY[1]

Product and country	HTS[2] code	2003 Quantity (metric tons)	2003 Value (thousands)	2004 Quantity (metric tons)	2004 Value (thousands)
Oxides and hydroxides, gross weight:	2825.70.0000				
Belgium		9	$66	--	--
Chile		279	2,570	231	$6,270
China		664	4,600	216	3,600
Kyrgyzstan		151	775	--	--
Russia		--	--	36	499
Other		196	1,600	339	5,460
Total		1,300	9,600	822	15,800
Molybdates all, contained weight:	Various[3]				
Belgium		6	188	--	--
Canada		12	93	2	33
Chile		575	7,630	850	11,400
China		468	4,440	425	5,770
Germany		7	95	140	2,120
Other		13	167	27	477
Total		1,080	12,600	1,440	19,800
Molybdenum orange, gross weight:	3206.20.0020				
Canada		871	4,030	945	4,520
Colombia		46	121	43	86
Korea, Republic of		1	4	--	--
Mexico		22	50	28	65
Philippines		1	4	--	--
United Kingdom		20	13	--	--
Other		25	87	17	89
Total		987	4,310	1,030	4,760
Ferromolybdenum, contained weight:[4]	7202.70.0000				
Belgium		62	509	12	719
Canada		14	185	44	1,370
Chile		13	153	116	3,860
China		3,400	35,000	4,850	148,000
Korea, Republic of		--	--	12	560
United Kingdom		198	1,630	231	2,520
Other		5	54	35	811
Total		3,690	37,500	5,310	158,000
Other, gross weight:	Various[5]				
Austria		149	5,440	268	14,200
Canada		(6)	16	33	852
China		345	4,330	265	7,250
Germany		61	1,320	32	2,580
Hong Kong		41	346	21	415
Japan		28	1,190	87	3,640
Korea, Republic of		--	--	(6)	8
Russia		19	1,110	90	2,600
United Kingdom		10	272	16	599
Other		60	1,410	84	2,240
Total		712 r	15,400	896	34,300

rRevised. -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Harmonized Tariff Schedule of the United States.

[3]Includes HTS codes 2841.70.1000 and 2841.70.5000.

[4]Ferromolybdenum contains about 60% to 65% molybdenum.

[5]Includes HTS codes 8102.10.0000, 8102.94.0000, 8102.95.3000, 8102.95.6000, 8102.96.0000, 8102.97.0000, and 8102.99.0000.

[6]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 8
U.S. IMPORTS OF MOLYBDENUM ORE AND CONCENTRATES (INCLUDING ROASTED AND OTHER CONCENTRATES), BY COUNTRY[1]

	2003		2004	
Country	Quantity (metric tons of contained Mo)	Value (thousands)	Quantity (metric tons of contained Mo)	Value (thousands)
Belgium	22	$172	--	--
Canada	2,580	23,600	2,680	$76,900
Chile	280	3,270	3,570	110,000
China	57	513	18	608
Italy	--	--	5	38
Japan	3	15	5	38
Mexico	2,250	23,700	2,210	70,300
Netherlands	--	--	37	217
Other	--	--	258	9,300
Total	5,190	51,300	8,780	268,000

-- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 9
U.S. IMPORTS FOR CONSUMPTION OF MOLYBDENUM PRODUCTS[1]

		2003			2004		
Item	HTS[2] code	Gross weight (metric tons)	Contained Mo (metric tons)	Value (thousands)	Gross weight (metric tons)	Contained Mo (metric tons)	Value (thousands)
Molybdenum ore and concentrates, roasted	2613.10.0000	6,310	3,960	$41,800	7,580	4,720	$133,000
Molybdenum ore and concentrates, other	2613.90.0000	2,870	1,230	9,570	9,330	4,070	135,000
Molybdenum chemicals:							
Oxides and hydroxides	2825.70.0000	1,300	NA	9,600	822	NA	15,800
Molybdates, all	Various[3]	1,940	1,080	12,600	2,200	1,440	19,800
Molybdenum orange	3206.20.0020	987	NA	4,310	1,030	NA	4,760
Ferromolybdenum	7202.70.0000	5,740	3,690	37,500	8,310	5,310	158,000
Molybdenum powders	8102.10.0000	57	43	1,950	139	95	4,930
Molybdenum unwrought, bars and rods	8102.94.0000	139	136	1,680	151	151	3,520
Molybdenum waste and scrap	8102.97.0000	425	388	4,900	454	415	10,200
Molybdenum wire	8102.96.0000	11	NA	751	20	NA	2,010
Molybdenum, other	Various[4]	80	NA	6,160	132	NA	13,700
Total		19,900	10,500	131,000	30,200	16,200	501,000

NA Not available.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Harmonized Tariff Schedule of the United States.

[3]Includes HTS codes 2841.70.1000 and 2841.70.5000.

[4]Includes HTS codes 8102.95.3000, 8102.95.6000, and 8102.99.0000.

Source: U.S. Census Bureau.

TABLE 10
MOLYBDENUM-PRODUCING MINES IN THE UNITED STATES IN 2004

State and mine	County	Operator	Source of molybdenum
Arizona:			
Bagdad	Yavapai	Phelps Dodge Corp.	Copper-molybdenum ore, concentrated.
Sierrita	Pima	do.	Do.
Colorado, Henderson	Clear Creek	do.	Molybdenum ore, concentrated.
Idaho, Thompson Creek	Custer	Thompson Creek Metals Co.	Do.
Montana, Continental Pit	Silver Bow	Montana Resources	Copper-molybdenum ore, concentrated.
New Mexico:			
Chino	Grant	Chino Mines Co.	Do.
Questa	Taos	Molycorp, Inc.	Molybdenum ore, concentrated.
Utah, Bingham Canyon	Salt Lake	Kennecott Utah Copper Corp.	Copper-molybdenum ore, concentrated.

TABLE 11
MOLYBDENUM: WORLD MINE PRODUCTION, BY COUNTRY[1, 2]

(Metric tons of contained molybdenum)

Country[3]	2000	2001	2002	2003	2004[e]
Armenia	3,820 [r]	2,943 [r]	2,884 [r]	2,763 [r]	2,950
Canada	7,457	8,556	7,953 [r]	8,887 [r]	5,681 [p]
Chile	33,639 [r]	33,492	29,467 [r]	33,375 [r]	41,483 [4]
China[e]	28,800	28,200	29,300	31,000 [r]	29,000
Iran[e]	1,600	1,500	1,400	1,400	1,500
Kazakhstan	215	225	230	230	230
Kyrgyzstan[e]	250	250	250	250	250
Mexico	6,886	5,518	3,428	3,524 [r]	3,730 [p]
Mongolia	1,335	1,514	1,590	1,793 [r]	1,650
Peru	7,193	9,499	8,613 [r]	9,561 [r]	9,600
Russia[e]	2,400	2,600	2,900	2,900	2,900
United States	40,900	37,600	32,300 [r]	33,500	41,500
Uzbekistan[e]	500	500	500	500	500
Total	135,000 [r]	132,000 [r]	121,000	130,000 [r]	141,000

[e]Estimated. [p]Preliminary. [r]Revised.

[1]World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Table includes data available through July 13, 2005.

[3]In addition to the countries listed, North Korea, Romania, and Turkey are believed to produce molybdenum, but output is not reported quantitatively, and available general information is inadequate to make reliable estimates of output levels.

[4]Reported figure.