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MOLYBDENUM [ADVANCE RELEASE]

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MOLYBDENUM

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In the United States, mine production of molybdenum concentrate in 2009 decreased by 8,120 metric tons (t) to 47,800 t from that of 2008 (table 1). World mine production of molybdenum in 2009 was about 221,000 t, a slight increase from 218,000 t in 2008. The U.S. share of world production was about 22% in 2009. Reported U.S. consumption of molybdenum concentrate for roasting in 2009 decreased compared with that of 2008.

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 (MoO_3, called MoX) or ferromolybdenum (FeMo), is frequently used in combination with or added to chromium, manganese, nickel, niobium (columbium), 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 can sustain high stress, expanded temperature ranges, and highly corrosive environments. There is significant use of molybdenum as a refractory metal and in numerous chemical applications, including catalysts, lubricants, and pigments.

U.S. molybdenum reserves were estimated to be about 2.7 million metric tons (Mt), about 31% of the world molybdenum reserves. 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 are in Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, and Utah. Other molybdenum sources do not contribute significantly to U.S. reserves.

Production

Domestic molybdenum production data were derived from three separate voluntary surveys by the U.S. Geological Survey. These surveys are “Molybdenum Ore and Concentrate” (annual), “Molybdenum Concentrate” (monthly), and “Molybdenum Products and Molybdenum Concentrates” (monthly). Surveys were sent to all 12 U.S. operations that produce molybdenum concentrates and products from ore, and all responded, representing 100% of the U.S. production listed in table 1.

As of December 31, 2009, U.S. rated capacity for mines and mills was estimated to be about 73,200 metric tons per year (t/yr) of contained metal. Rated capacity was defined as the maximum quantity of product that could be produced in a period of time at 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 could be brought into production within a short period of time with minimal capital expenditure.

Primary molybdenum production continued at the Ashdown Mine in Nevada, the Henderson Mine in Colorado, the Questa Mine in New Mexico, and the Thompson Creek Mine in Idaho. The Ashdown Mine in Humboldt County, was placed on care and maintenance in November 2008 but resumed production in April 2009. In May, Golden Phoenix Minerals Inc. announced the sale of its interest in the Ashdown Mine to Win-Eldrich Mines Ltd. (Golden Phoenix Minerals Inc., 2009).

In February, Chevron Mining Inc. cut its workforce by 55% at its Questa Mine in northern New Mexico and announced that its molybdenum production would decrease accordingly. Questa has a production capacity of approximately 2,720 t/yr of molybdenum. Production capacity during the past several years has averaged about 1,800 t/yr of molybdenum. The size of the recent workforce reduction suggested that the company may be planning for an output of approximately 900 t/yr of molybdenum in 2009 (Metal-Pages, 2009i).

In April, Freeport-McMoRan Copper & Gold Inc. (FCX) announced that it expected to cut production to 40% of 2008 output levels (18,140 t) at its Henderson Mine. According to the company, Henderson has the capacity to produce approximately 18,100 t/yr of molybdenum. Most of the molybdenum concentrate produced at Henderson was shipped to a processing facility of FCX in Fort Madison, IA (Freeport-McMoRan Copper & Gold Inc., 2010, p. 15).

FCX announced that first quarter consolidated molybdenum sales from the Henderson Mine and its copper molybdenum mines totaled 4,535 t of molybdenum, a 50% decrease from those of the first quarter of 2008. FCX attributed this major decrease mainly to the reduced global demand from the metallurgical sector outside of China. FCX expected 2009 molybdenum sales from its mines to total 22,700 t of molybdenum compared with its January estimate of 27,200 t of molybdenum (Metal-Pages, 2009e).

FCX announced that it expected to double annual production to 27,200 t of molybdenum at its idle Climax molybdenum mine, without setting a date for restart. Production at the Climax Mine was originally expected to begin in 2010, but the mine has been under care and maintenance since 1995. FCX has spent $350 million on the project, establishing a mill and other facilities since acquiring the mine after a merger with former owner Phelps Dodge Inc. in 2007 (Metal Pages, 2009d).

Thompson Creek Metals Company Inc. (TCMC) owns the Thompson Creek open pit molybdenum mine and mill in Idaho, a metallurgical roasting facility in Langeloth, PA, and a 75% share of the Endako open pit mine, mill, and roasting facility in northern British Columbia, Canada. TCMC had two high-grade underground molybdenum deposits, the Davidson deposit near Smithers, British Columbia, Canada, and the Mount Emmons deposit near Crested Butte, CO.

TCMC announced that its Thompson Creek Mine produced 8,075 t of molybdenum compared with 7,620 t of molybdenum in 2008. Higher ore grade and a higher milling recovery rate during 2009 were the primary factors contributing to the increased production volumes in 2009 compared with those of 2008. The higher grade and recovery rate offset lower tonnage mined and milled. The lower tonnage milled was primarily the result of a planned change in the mill operating schedule. At the end of February, mill operation at the Thompson Creek Mine was reduced to a 10-day-on, 4-day-off operating schedule to adjust for the economic downturn. In September, the mill schedule changed to 11-days-on, 3-days-off, and in January 2010, the mill operating schedule returned to a full 7-day, 24-hour schedule (Thompson Creek Metals Company Inc., 2010, p. 16, 59).

TCMC reevaluated its reserves at the Thompson Creek Mine and as a result, increased the proven and probable mineral reserves by 29,030 t, or 30%, and increased the life of the mine to 16 years. TCMC expected molybdenum production volumes at the Thompson Creek Mine to be between 13,000 t and 14,500 t of molybdenum in 2010 (Thompson Creek Metals Company Inc., 2010, p. 6–7, 47).

TCMC had also been involved in the Mount Emmons exploration project in Gunnison County, CO. According to the company, the Mount Emmons project has one of the largest, highest grade (0.438% molybdenum) undeveloped molybdenum deposits in the world (Thompson Creek Metals Company Inc., 2010, p. 15). The company expected to complete a prefeasibility study in 2010.

Molybdenum was produced as a byproduct of copper production at the Bagdad, Mineral Park, and Sierrita Mines in Arizona; the Continental Pit Mine in Montana; and the Bingham Canyon Mine in Utah (table 10). The Morenci and Mission Mines in Arizona as well as the Chino Mine in New Mexico did not produce molybdenum in 2009. FCX placed the Chino Mine on care-and-maintenance status in December 2008. In the case of 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 at selected porphyry copper mines was estimated to account for about 57% of the U.S. molybdenum supply in 2009.

The Sierrita operation of FCX includes a 102,000 metric-ton-per-day (t/d) concentrator that produces copper and molybdenum concentrates. It also has molybdenum facilities consisting of a leaching circuit, two molybdenum roasters, and a packaging facility. The molybdenum facilities process concentrate from Sierrita, concentrate from other FCX mines, and concentrate from third-party sources. Molybdenum production at Sierrita in 2009 was 8,620 t of molybdenum (Freeport-McMoRan Copper & Gold Inc., 2010, p. 11).

The Bagdad operation of FCX includes a 75,000-t/d concentrator that produces copper and molybdenum concentrates, as well as a pressure leach plant that processes molybdenum concentrate. Molybdenum production at Bagdad in 2009 was 2,720 t (Freeport-McMoRan Copper & Gold Inc., 2010, p. 12.)

Rio Tinto plc announced that molybdenum concentrate production at its Bingham Canyon Mine (operated by Kennecott Utah Copper) was 11,300 t of molybdenum compared with 10,600 t of molybdenum in 2008 (Rio Tinto plc, 2010, p. 68). Exploration at the Bingham Canyon Mine identified a new copper-molybdenum-gold porphyry system beneath the current open pit. The molybdenum deposit was expected to be between 450 Mt and 550 Mt of molybdenum at a grade of 0.1% to 0.15% molybdenum. The average grade of the molybdenum in the open pit reserve was 0.045% molybdenum. According to the company, current ore reserves were expected to enable open pit operations to continue until 2020 (Rio Tinto plc, 2010, p. 42).

Construction of a molybdenum autoclave process (MAP) at the Kennecott facility, approved during the second quarter of 2008, continued to be delayed owing to decreased molybdenum prices. The MAP was expected to enable lower-grade concentrate to be processed more efficiently than in conventional roasters, allow improved molybdenum recovery, and enable production of chemical-grade molybdenum products (Rio Tinto plc, 2010, p. 40).

General Moly Inc. announced that owing to the economic downturn and the continued uncertainty in the project finance market, it implemented a cash conservation plan to reduce expenditures for the development of the Mount Hope project in central Nevada. The company announced that once financing and all the necessary operating permits were obtained, it expected that the Mount Hope project could be constructed and in production within 20 months. According to the company, the Mount Hope project is one of the largest, highest grade, and most valuable undeveloped molybdenum projects in the world, containing 589,670 t of molybdenum in proven and probable reserves (General Moly Inc., 2010, p.11).

Consumption

In 2009, U.S. consumption of molybdenum contained in concentrate for roasting was less than that of 2008 (table 1). Domestic mine production of molybdenum concentrate was roasted, exported for conversion, or purified to lubricant-grade molybdenum disulfide (MoS_2). Technical-grade MoX consumption in 2009 was 9% less than that of 2008. MoX was the leading form of molybdenum used by industry, particularly in making stainless steel. Overall, total steel use in 2009 decreased by 19% from that of 2008, and total superalloy consumption decreased in 2009 by 22% from that of 2008 (table 3).

Metallurgical applications dominated molybdenum use in 2009, accounting for about 87% of 2009 grand total reported consumption (table 3). In 2009, FeMo accounted for 34% of the molybdenum-bearing materials used to make steel. Nonmetallurgical applications included catalysts, chemicals, lubricants, and pigments. The dominant nonmetallurgical use was in catalysts.

Molybdenum is playing a larger role in green technology than ever before, its use being focused on biofuels and ethanol, solar panels, and wind power. A new type of solar panel, copper-indium- gallium-selenide (CIGS) cells, utilizes molybdenum in a thin layer near the bottom of the cell. The molybdenum helps to transfer the electricity generated from the solar cell to circuits external to the panel. Although photovoltaic solar power capacity is still small, CIGS technology has demonstrated the highest conversion efficiency and the longest product life within the solar power industry. Analysts estimate that CIGS cells

utilize approximately 1,100 t of molybdenum per gigawatt of capacity (General Moly Inc., 2008).

Stocks

At yearend 2009, producer plus consumer industry stocks contained 5,250 t of molybdenum, a decrease of 40 t compared with the revised yearend 2008 stocks. Inventories of molybdenum in concentrate at mines and plants increased by about 720 t. Producer stocks of molybdenum in FeMo, molybdates, MoX, metal powders, and other products decreased by about 20 t compared with the revised producer stocks of 2008 (table 2). Total stocks of about 7,670 t represented about a 22-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 pound of contained molybdenum. In September 2008, the average prices for MoX and FeMo were almost $33 per pound and $36 per pound, respectively. Prices declined dramatically during the remainder of 2008 and the first four months of 2009, reaching a low of $7.70 per pound MoX and $8.60 per pound FeMo in April 2009. During June through August 2009, the price of MoX and FeMo rose sharply, reaching a year-to-date high of $18.30 per pound MoX and $20.00 per pound FeMo in August 2009. The prices of MoX and FeMo were volatile during the remainder of 2009, with an average price of $11.52 per pound MoX and $13.71 per pound FeMo for the fourth quarter of 2009 and $11.29 per pound of MoX and $13.10 per pound FeMo for the month of December 2009.

Foreign Trade

In 2009, molybdenum-containing material exports collectively contained about 15,100 t of molybdenum (gross weight) and were valued at $942 million (table 6). Imports for consumption of molybdenum-containing products collectively contained about 19,000 t of molybdenum (gross weight) and were valued at $269 million (table 9).

World Review

World molybdenum reserves and production capacity were concentrated in a few countries. World mine output in 2009 was estimated to have been 221,000 t (molybdenum contained in concentrate), of which, in descending order of production, China, the United States, Chile, Peru, and Canada provided about 89% (table 11). China and Canada were among the countries to increase molybdenum production from 2008 to 2009.

In North America, most Canadian reserves of molybdenum were contained in porphyry molybdenum and porphyry copper-molybdenum deposits in British Columbia. Other Canadian reserves were associated with minor porphyry copper-molybdenum deposits in New Brunswick and Quebec. The La Caridad porphyry copper-molybdenum deposit in Mexico was a leading producer. Molybdenum reserves in Central America and South America were associated mainly with large porphyry copper deposits. Of several such deposits in Chile, the Chuquicamata and El Teniente deposits were among the largest in the world and accounted for 85% of molybdenum reserves in Chile. Peru also had substantial reserves. Reserves of molybdenum in China and the Commonwealth of Independent States (CIS) 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.

Armenia.—Cronimet Mining GmbH (Germany) announced in July that it would resume expansion of the largest molybdenum-bearing deposit in the CIS, the Karajan copper-molybdenum mine managed by Zangezur Copper and Molybdenum Combine AG. The expansion project would increase production to approximately 14 Mt of molybdenum and copper concentrate in 2011, from approximately 12 Mt in 2008. According to the company, 50% of molybdenum production at Zangezur was sold to Asian countries (Metal-Pages, 2009c).

Agarak Copper and Molybdenum Combine (ACMC) in the southern Armenian Province of Syunik produced approximately 248 t of molybdenum concentrate. Owing to the economic downturn, the mine was idle for 5 months starting in February. GeoProMining Ltd. obtained shares of ACMC in 2007 and has begun implementing a reconstruction program to increase the extraction and processing of both copper and molybdenum ores at its mine (Metals Place, 2010).

Australia.—In November, Ivanhoe Mines Ltd. announced results from its initial resource estimate for the high-grade Merlin molybdenum and rhenium deposit, which comprises the Mt. Dore project in the Cloncurry District in northwestern Queensland, part of Ivanhoe Australia Ltd. At a cutoff grade of 0.4% molybdenum, estimated indicated resources total 5.2 Mt at a grade of 1.0% molybdenum and 16 grams per ton of rhenium, containing 52,000 t of molybdenum and 83 t of rhenium. Mt. Dore is a deposit containing copper, cobalt, gold, lead, molybdenum, rhenium, silver, and zinc within the Kuridala Formation. In December 2008, a drilling program in the northern part of the Mt. Dore area intersected significant molybdenum-rhenium mineralization. This mineralization represents a new discovery, now known as the Merlin deposit (Ivanhoe Mines Ltd., 2009).

In November, Moly Mines Ltd. announced that molybdenum production at its Spinifex Ridge molybdenum project in Western Australia was expected to start within 18 months after arrangement and approval of capital expenditure and financing. Hanlong Mining Investment Pty Ltd. (a subsidiary of Sichuan Hanlong Group Ltd.) was expected to invest $200 million in the company. Under the terms of the deal, Hanlong would get 207.1 million Moly Mines shares for $140 million and would provide Moly Mines with a 10-year, $60 million working capital fund, which would be used to repay interim debt (Metal-Pages, 2009h).

Canada.—Roca Mines Inc. announced molybdenum production of approximately 1,080 t of molybdenum concentrate at its Max molybdenum mine near Trout Lake, British Columbia, from August 2008 to August 2009. The company reported production revenues of $26 million for the same time period, during which it made the transition from an exploration company to a molybdenum mining company. Roca Mines sells the molybdenum concentrates produced at its Max molybdenum mine to a British-based buyer (Roca Mines Inc., 2009).

In July, Adanac Molybdenum Corp. announced that its application to remain under protection from creditors had been extended for a third time until the end of August. The company filed for bankruptcy protection under Canadian laws, citing cash flow problems in December 2008. The company announced that its Ruby Creek molybdenum project near Atlin, British Columbia, had estimated measured resources of 43.6 Mt at an average grade of 0.078% molybdenum, with 34,200 t of contained molybdenum. Development costs for the project were estimated to be approximately $550 million (Metal-Pages, 2009a).

TCMC announced in August that the Endako Mine expansion project that was postponed in December 2008, owing to the economic downturn, was approved to resume. The Endako Mine is a fully integrated facility that includes a concentrator and a roasting facility. It is located near Fraser Lake, approximately 160 kilometers (km) northwest of Prince George, British Columbia. The expansion project was expected to include the construction of a new, modern mill, which would replace the existing 45-year-old mill and would raise ore processing capacity from the existing 31,000 t/d of molybdenum to 55,000 t/d of molybdenum. Annual molybdenum production, as a result of the expansion, was expected to be approximately 6,800 t to 7,260 t of molybdenum. Construction of the new mill building and installation of new processing equipment was expected to be completed by the end of 2011 (Thompson Creek Metals Company Inc., 2009).

Taseko Mines Ltd. announced that it produced 285 t of molybdenum in 2009 at its Gibraltar Mine located in south-central British Columbia. According to the company, the mine was undergoing a $250 million expansion and modernization that was expected to increase production to 635 t/yr of molybdenum. The company expected the project to be finished by the fourth quarter of 2010 (Taseko Mines Ltd., 2010).

Chile.—Molybdenum production rose to 34,954 t of molybdenum in 2009, a 3.9% increase compared with that of 2008. Corporación Nacional del Cobre de Chile (Codelco), the state-controlled copper and molybdenum producer, announced that it produced 21,500 t of molybdenum in 2009, a 2.4 % increase from the 21,000 t of molybdenum produced in 2008. According to the company, its molybdenum production was expected to increase during the next 3 to 5 years, as new ore zones containing more molybdenum were brought into production at its Andina, Chuquicamata, and El Teniente Mines in Chile (Metal-Pages, 2010b).

Antofagasta plc announced that molybdenum production at its Los Pelambres Mine totaled 7,800 t of molybdenum, unchanged from that of 2008. In May, Antofagasta announced that it had secured a 12-year, $1.05-billion financing deal to develop its Esperanza copper-gold mine in the Antofagasta Region. The company announced that there was potential for molybdenum production in 2015 at a rate of 2,000 t/yr of molybdenum for 10 years. As of yearend, overall construction was approximately 65% complete, with construction of the plant more than 40% complete (Antofagasta plc, 2009).

Molibdenos y Metales S.A. (Molymet) announced that it paid $74 million to acquire a 50% stake in Chinese molybdenum producer Louyang High Tech Molybdenum & Tungsten Material Co. Ltd. Molymet also announced that it was still in the process of seeking permission from Chilean environmental authorities to build a second molybdenum roaster furnace at its plant in Mejillones in northern Chile (Metal-Pages, 2009g). The new plant was expected to have an initial processing capacity of approximately 15,000 t/yr to convert molybdenum concentrate into MoX but had been designed to accommodate expansions of up to four times that capacity, if necessary.

China.— According to the China Nonferrous Metals Industry Association, China produced 93,508 t of molybdenum concentrates in 2009, a 15% increase from that of 2008. In its first year as a net importer of molybdenum, China imported 31,750 t of molybdenum compared with less than 4,535 t of molybdenum in 2008. Exports of molybdenum decreased to an alltime low of 6,800 t of molybdenum compared with 18,140 t in 2008 (Metal-Pages, 2010a). The surge in imports reflected the relatively high production costs of many small and medium-sized molybdenum mines in China.

The Ministry of Land and Resources in China granted Jinduicheng Molybdenum Group Co. Ltd. a mining and exploration license for 30 years at the Donggou molybdenum ore deposit in northern China. The deposit, in the western part of Henan Province, was estimated to have about 650 Mt of crude ore reserves, containing about 690,000 t of molybdenum (Metal-Pages, 2009f).

China Molybdenum Co. Ltd. announced the completion of its smelting plant with a capacity of 40,000 t/yr of molybdenum (Phase I), the Luoyang High Tech 1,500 t/yr molybdenum downstream processing production line at Luoyang High Tech, and the Yongning Gold Company 80,000-t/yr comprehensive smelting plant (Wonderful Sky Financial Group Ltd., 2010).

Mexico.—In October, Creston Moly Corp. (Canada) announced that the initial prefeasibility study was complete, and it was expected to start a first-phase drilling program in January 2010 at its El Creston molybdenum deposit located in the State of Sonora. The resource estimate in the study outlined a proven and probable reserve estimate of 146.7 Mt grading 0.077% molybdenum, with additional measured and indicated resources of 176.8 Mt grading 0.071% molybdenum (Creston Moly Corp., 2009).

Mongolia.—In August, Erdene Resource Development Corp. (Canada) announced a revised resource estimate for its Zuun Mod molybdenum project in southwestern Mongolia. According to the company, the deposit contained measured and indicated resources of 98 Mt at an average grade of 0.062% molybdenum, which at a cutoff grade of 0.05% molybdenum equated to 60,690 t of contained molybdenum. The deposit was considered one of the largest undeveloped copper-molybdenum deposits in Asia. Erdene was expected to continue the paperwork necessary to convert the Zuun Mod exploration license to a mining license, which was expected to be finalized in the second quarter of 2010 (Erdene Resource Devolopment Corp., 2009).

Peru.—The Cerro Verde Mine of FCX is an open pit copper and molybdenum mining complex 32 km southwest of Arequipa. The mine was shut down in the second quarter of 2009 owing to the economic downturn but reopened in September. In 2009, molybdenum production at Cerro Verde

was approximately 910 t of molybdenum, compared with 1,360 t of molybdenum in 2008 (Metal-Pages, 2009b).

Outlook

The principal uses for molybdenum were expected to continue to be in chemicals and catalysts and as an additive in steel manufacturing, most importantly alloy and stainless steel. Molybdenum plays a vital role in the energy industry but may become an increasingly essential factor in green technology, where it is used in high-strength steels for automobiles to reduce weight and improve fuel economy. Molybdenum may play a critical role in reducing sulfur in liquid fuels by acting as a cracking agent. Production of ultra-low-sulfur diesel fuels now required in the United States was expected to more than double the amount of molybdenum used in oil refineries. Analysts expected global demand for these types of catalysts to grow by more than 5% annually until 2013. The need for companies to reduce carbon dioxide emissions from coal-fired power stations will require plants to run at higher temperatures, resulting in greater demand for high-end molybdenum-bearing steels.

Historically, molybdenum consumption has shown a strong growth rate, primarily fuelled by rapid increases in China's industrial growth. Molybdenum demand continues to be driven largely by the steel sector. The fall in stainless steel production mainly took place in developed economies. As emerging economies, such as China and India, continue on the path to industrialization, they are expected to need increasing amounts of molybdenum, and this trend is expected to contribute to global demand growth in the coming years.

In 2009, there were significant production cuts at copper and molybdenum producers worldwide, as well as delays and difficulties in sourcing finance, which have delayed many potential projects. High molybdenum prices between 2004 and 2008 encouraged more deposits to be explored and/or reevaluated; however, with the reduction in molybdenum prices, financing has become much more difficult and expensive for these projects. Many analysts think that by the end of 2010, many operations may begin to resume production; however, potentially very little of the capacity in China will come back online in 2010 if molybdenum prices do not rise to levels that encourage high-cost Chinese operations to restart production. High-cost Chinese operations may continue to act as swing producers when molybdenum prices fluctuate (Virga and Horn, 2009).

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TABLE 1

SALIENT MOLYBDENUM STATISTICS[1]

(Metric tons of contained molybdenum)

	2005	2006	2007	2008	2009
United States:					
Concentrate:					
Production	58,000	59,800	57,000	55,900	47,800
Shipments	57,900	60,100	57,100	57,800	63,700
Reported consumption[2]	46,600	44,400	43,900	44,500 r	W
Imports for consumption	11,900	10,900	12,400	10,200	7,520
Stocks, December 31:					
Concentrate, mine and plant	3,620	2,120	2,630	1,690 r	2,420
Product producers[3]	3,770	3,210	3,140	3,680 r	3,660
Consumers	2,030	1,660	1,870	1,620	1,600
Total	9,420	6,990	7,640	6,990 r	7,670
Primary products:					
Production	78,500	78,000	72,800	72,900 r	59,900
Shipments	46,700	51,000	48,700	51,300 r	43,300
Reported consumption	18,900	19,000	21,000	21,100 r	18,100
World, mine production	186,000	186,000	213,000	218,000	221,000 e

[e]Estimated. [r]Revised. W Withheld to avoid disclosing company proprietary data.

[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	
	2008	2009	2008	2009	2008	2009
Received from other producers	3	--	19,000	12,700	19,000	12,700
Gross production during year	5,040	W	67,800	55,000	72,900 r	59,900
Molybdenum products used to make other products	3,400	W	36,300 r	W	39,700 r	W
Net production	1,640	W	31,500 r	32,100	33,200 r	W
Shipments	1,650	W	49,600 r	41,600	51,300 r	43,300
Producer stocks, December 31	285	W	3,390 r	3,610	3,680 r	3,660

[r]Revised. -- Zero. W Withheld to avoid disclosing company proprietary data.

[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
2008:						
Steel:						
Carbon	547,000	W	--	--	W	547,000
High-strength low-alloy	806,000	150,000	--	--	136,000	1,090,000
Stainless and heat-resisting	2,200,000	799,000	--	W	114,000	3,110,000
Full alloy	3,290,000	3,640,000	--	--	18,100	6,950,000
Tool	W	W	--	W	--	W
Total	6,840,000	4,590,000	--	W	268,000	11,700,000
Cast irons (gray, malleable, ductile iron)	W	377,000	--	--	51,500	429,000
Superalloys	821,000 r	W	--	W	1,130,000	1,950,000
Alloys (other than steels, cast irons, superalloys):						
Welding materials (structural and hard-facing)	--	W	--	--	728	728
Other alloys	W	84,600	--	--	4,530	89,200
Mill products made from metal powder[3]	40,000	--	--	--	2,230,000	2,270,000
Cemented carbides and related products[4]	--	--	--	--	W	W
Chemical and ceramic uses:						
Pigments	W	--	W	--	--	W
Catalysts	945,000	--	W	--	W	945,000
Other	--	--	--	--	6,930	6,930
Miscellaneous and unspecified uses:						
Lubricants	--	--	--	--	279,000	279,000
Other	825,000 r	508,000	958,000	877,000 r	226,000	3,390,000 r
Grand total	9,470,000 r	5,560,000	958,000	877,000 r	4,200,000	21,100,000 r
Stocks, December 31	338,000	332,000	14,300	35,300	898,000	1,620,000
2009:						
Steel:						
Carbon	427,000	297,000	--	--	W	724,000
High-strength low-alloy	W	117,000	--	--	--	117,000
Stainless and heat-resisting	2,030,000	768,000	--	W	90,900	2,890,000
Full alloy	3,230,000	2,500,000	--	--	W	5,730,000
Tool	W	W	--	W	--	W
Total	5,690,000	3,680,000	--	W	90,900	9,460,000
Cast irons (gray, malleable, ductile iron)	W	314,000	--	--	W	314,000
Superalloys	483,000	15,400	--	W	1,010,000	1,510,000
Alloys (other than steels, cast irons, superalloys):						
Welding materials (structural and hard-facing)	--	36,500	--	--	W	36,500
Other alloys	1,020	38,400	--	--	W	39,400
Mill products made from metal powder[3]	W	--	--	--	W	W
Cemented carbides and related products[4]	--	--	--	--	W	W
Chemical and ceramic uses:						
Pigments	W	--	W	--	--	W
Catalysts	950,000	--	W	--	W	950,000
Other	--	--	--	--	W	W
Miscellaneous and unspecified uses:						
Lubricants	--	--	--	--	271,000	271,000
Other	1,450,000	85,600	W	729,000	2,420,000	4,680,000
Grand total	8,570,000	4,170,000	W	729,000	3,790,000	18,100,000
Stocks, December 31	370,000	325,000	1,960	(5)	(5)	1,600,000

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

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

[5]Withheld to avoid disclosing company proprietary data; included in "Total."

TABLE 4

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

Product and country	HTS[2] code	2008 Quantity (metric tons)	2008 Value (thousands)	2009 Quantity (metric tons)	2009 Value (thousands)
Oxides and hydroxides, gross weight:[3]	2825.70.0000				
Austria		1,610	$46,600	718	$10,400
Brazil		21	327	318	5,280
Canada		4,800	59,700	1,760	23,500
China		1	12	2,060	29,900
Germany		220	6,100	297	5,050
India		43	659	484	6,730
Japan		4,320	122,000	3,050	46,000
Korea, Republic of		429	13,800	650	9,060
Netherlands		1,230	45,100	526	9,200
United Kingdom		760	28,200	150	2,210
Other (20 countries)		3,230 r	106,000 r	564	11,900
Total		16,700	428,000	10,600	159,000
Molybdates, all, gross weight:[4]	2841.70.0000	.		.	
Belgium		221	2870	157	977
Brazil		40	1360	91	647
Canada		393	7,500	257	2,690
France		78	1,120	194	1,510
Netherlands		317	16,900	411	6,370
Other (6 countries)		493 r	17,000 r	394	5,180
Total		1,540	46,700	1,500	18,000
Ferromolybdenum, contained weight:[4, 5]	7202.70.0000				
Canada		933	42,900	581	16,100
China		--	--	25	531
India		1	108	65	1,550
Korea, Republic of		14	889	27	583
Mexico		59	3,760	55	1,670
Other (19 countries)		282 r	14,700 r	71	2,010
Total		1,290	62,400	827	22,400
Molybdenum, other, gross weight:[3, 6]	Various[7]				
Canada		149	7,270	84	3,090
Chile		(8)	30	240	6,740
Germany		171	12,300	137	6,280
Hungary		42	4,480	36	3,180
Israel		118	9,250	63	4,950
Japan		623	69,200	363	31,800
Korea, Republic of		165	21,900	208	23,300
Mexico		79	4,910	73	4,840
Taiwan		94	8,860	76	6,630
United Kingdom		273	16,900	294	6,800
Other (45 countries)		475 r	36,500 r	211	14,300
Total		2,190	192,000	1,790	112,000

[r]Revised. -- Zero.

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

[2]Harmonized Tariff Schedule (HTS) of the United States.

[3]Presentation of annual data is based on the quantities (gross weight) of the 10 leading countries in 2009.

[4]Presentation of annual data is based on the quantities (gross weight) of the five leading countries in 2009.

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

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

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

[8]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 5

U.S. EXPORTS OF MOLYBDENUM ORE AND CONCENTRATES

(INCLUDING ROASTED AND OTHER CONCENTRATES), BY COUNTRY[1, 2]

Country	2008 Quantity (metric tons of contained Mo)	2008 Value (thousands)	2009 Quantity (metric tons of contained Mo)	2009 Value (thousands)
Belgium	6,910	$479,000	7,060	$165,000
Canada	2,030	92,400	1,070	26,600
China	365	6,630	6,680	145,000
Japan	2,220	132,000	912	23,100
Korea, Republic of	694	36,900	884	19,900
Mexico	4,470	60,400	2,870	20,300
Netherlands	9,960	615,000	6,510	153,000
South Africa	11	290	431	6,340
United Kingdom	5,080	352,000	2,440	61,100
Vietnam	341	5,770	229	2,350
Other (19 countries)	634 r	34,600 r	506	7,460
Total	32,700	1,810,000	29,600	631,000

rRevised.

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

[2]Presentation of annual data is based on the quantities (gross weight) of the 10 leading countries in 2009.

Source: U.S. Census Bureau.

TABLE 6

U.S. EXPORTS OF MOLYBDENUM PRODUCTS[1]

Item	HTS[2] code	2008 Gross weight (metric tons)	2008 Contained Mo (metric tons)	2008 Value (thousands)	2009 Gross weight (metric tons)	2009 Contained Mo (metric tons)	2009 Value (thousands)
Molybdenum ore and concentrates, roasted	2613.10.0000	NA	17,800	$1,140,000	NA	18,000	$393,000
Molybdenum ore and concentrates, other	2613.90.0000	NA	14,900	677,000	NA	11,600	238,000
Molybdenum chemicals:							
Oxides and hydroxides	2825.70.0000	16,700	NA	428,000	10,600	NA	159,000
Molybdates, all	2841.70.0000	1,540	NA	46,700	1,500	NA	18,000
Ferromolybdenum	7202.70.0000	1,840	1,290	62,400	1,200	827	22,400
Molybdenum powders	8102.10.0000	543	NA	34,800	592	NA	21,100
Molybdenum unwrought, bars and rods	8102.94.0000	47	NA	2,910	25	NA	1,300
Molybdenum waste and scrap	8102.97.0000	280	NA	7,360	373	NA	7,010
Molybdenum wire	8102.96.0000	235	NA	23,500	155	NA	12,000
Molybdenum, other	Various[3]	1,080	NA	123,000	641	NA	70,400
Total		22,200	NA	2,540,000	15,100	NA	942,000

NA Not available.

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

[2]Harmonized Tariff Schedule (HTS) 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	2008 Quantity (metric tons)	2008 Value (thousands)	2009 Quantity (metric tons)	2009 Value (thousands)
Oxides and hydroxides, gross weight:[3]	2825.70.0000				
Chile		143	$6,110	148	$2,360
China		--	--	20	605
Japan		9	54	23	148
Mongolia		126	5,140	18	209
United Kingdom		1	13	(4)	11
Other (4 countries)		56	1,610	--	--
Total		336	12,900	209	3,330
Molybdates, all, contained weight:[3]	Various[5]				
Belgium		11	405	4	587
Canada		4	172	4	116
Chile		110	8,310	434	14,800
China		80	4,270	198	4,270
Japan		7	357	17	663
Other (5 countries)		22	1,770	(4)	32
Total		235	15,300	657	20,500
Molybdenum orange, gross weight:[3]	3206.20.0020				
Canada		324	2,840	227	1,960
Colombia		12	29	12	64
Japan		--	--	1	5
Mexico		31	203	25	134
Netherlands		--	--	4	13
Other (2 countries)		6	40	--	--
Total		373	3,110	269	2,170
Ferromolybdenum, contained weight:[3,6]	7202.70.0000				
Canada		267	19,400	87	2,790
Chile		1,650	119,000	1,730	41,200
China		318	22,100	47	1,230
Japan		5	323	27	962
Russia		--	--	27	853
United Kingdom		--	--	72	2,140
Other (8 countries)		78	5,300	35	922
Total		2,320	166,000	2,030	50,100
Other, gross weight:[7]	Various[8]				
Austria		370	32,200	387	18,800
Canada		8	638	5	526
China		645	47,400	408	15,700
France		(4)	24	19	95
Germany		165	8,600	59	2,530
Hong Kong		17	1,120	9	424
Japan		84	7,940	24	1,460
Russia		27	4,500	12	1,350
United Kingdom		9	741	28	1,140
Uzbekistan		--	--	18	394
Other (16 countries)		97	2,350	1	549
Total		1,420	105,000	970	43,000

-- 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.

TABLE 7—Continued

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

[3]Presentation of annual data based on the quantities (gross weight) of the five leading countries in 2009.
[4]Less than ½ unit.
[5]Includes HTS codes 2841.70.1000 and 2841.70.5000.
[6]Ferromolybdenum contains about 60% to 65% molybdenum.
[7]Presentation of annual data based on the quantities (gross weight) of the 10 leading contries in 2009.
[8]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.

Source: U.S. Census Bureau.

TABLE 8

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

	2008		2009	
Country	Quantity (metric tons of contained Mo)	Value (thousands)	Quantity (metric tons of contained Mo)	Value (thousands)
Armenia	124	$7,470	--	--
Canada	2,440	155,000	2,000	$45,700
Chile	2,380	170,000	1,910	54,100
Mexico	3,180	58,200	1,910	17,000
Peru	2,090	120,000	1,690	32,900
Other	17	1,020	--	--
Total	10,200	512,000	7,520	150,000

-- 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]

Item	HTS[2] code	2008 Gross weight (metric tons)	2008 Contained Mo (metric tons)	2008 Value (thousands)	2009 Gross weight (metric tons)	2009 Contained Mo (metric tons)	2009 Value (thousands)
Molybdenum ore and concentrates, roasted	2613.10.0000	9,950	6,060	$249,000	7,780	4,800	$94,800
Molybdenum ore and concentrates, other	2613.90.0000	9,140	4,170	263,000	5,590	2,720	54,900
Molybdenum chemicals:							
Oxides and hydroxides	2825.70.0000	335	NA	12,900	209	NA	3,330
Molybdates, all	Various[3]	452	235	15,300	1,170	657	20,500
Molybdenum orange	3206.20.0020	373	NA	3,110	269	NA	2,170
Ferromolybdenum	7202.70.0000	3,470 r	2,320	166,000	3,040	2,030	50,100
Molybdenum powders	8102.10.0000	76	64	7,070	60	52	2,870
Molybdenum unwrought, bars and rods	8102.94.0000	256	255	15,800	107	98	2,880
Molybdenum waste and scrap	8102.97.0000	588	546	30,900	482	473	15,300
Molybdenum wire	8102.96.0000	20	NA	3,060	15	NA	2,120
Molybdenum, other	Various[4]	483	NA	48,700	306	NA	19,800
Total		25,100 r	NA	814,000	19,000	NA	269,000

[r]Revised. NA Not available.

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

[2]Harmonized Tariff Schedule (HTS) 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.

TABLE 10

MOLYBDENUM-PRODUCING MINES IN THE UNITED STATES IN 2009

State and mine	County	Operator	Source of molybdenum
Arizona:			
Bagdad	Yavapai	Freeport-McMoRan Copper & Gold Inc.	Copper-molybdenum ore, concentrated and leached.
Mineral Park	Mohave	Mercator Minerals Ltd.	Do.
Sierrita	Pima	Freeport-McMoRan Copper & Gold Inc.	Do.
Colorado, Henderson	Clear Creek	do.	Molybdenum ore, concentrated.
Idaho, Thompson Creek	Custer	Thompson Creek Metals Co. Inc.	Do.
Montana, Continental Pit	Silver Bow	Montana Resources	Copper-molybdenum ore, concentrated and leached.
Nevada, Ashdown	Humboldt	Win-Eldrich Mines Ltd.	Molybdenum ore, concentrated.
New Mexico, Questa	Taos	Chevron Mining	Do.
Utah, Bingham Canyon	Salt Lake	Kennecott Utah Copper Corp.[1]	Copper-molybdenum ore, concentrated and leached.

Do., do. Ditto.

[1]Fully owned subsidiary of Rio Tinto plc.

TABLE 11

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

(Metric tons of contained molybdenum)

Country[3]	2005	2006	2007	2008	2009[e]
Armenia	3,000 [e]	3,900	4,080	4,250	4,150
Canada	7,667	7,117	6,819	7,724	8,836 [4]
Chile	48,041	43,278	44,912	33,687	34,925 [4]
China[e]	40,000	43,900	66,700	81,000	93,500
Iran[e]	2,476 [4]	2,500	3,600	3,800 [r]	3,700
Kazakhstan	230	250	400	400	380
Kyrgyzstan[e]	250	250	250	250	250
Mexico	4,246	2,519	6,159	7,812	7,800
Mongolia	1,188	1,404	1,978	1,899 [r]	3,000
Peru	17,325	17,209	16,737	16,721	12,295 [4]
Russia[e]	3,000	3,100	3,300	3,600	3,800
United States	58,000	59,800	57,000	55,900	47,800 [4]
Uzbekistan[e]	575	600	600	500	550
Total	186,000	186,000	213,000	218,000	221,000

[e]Estimated. [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 June 16, 2010.

[3]In addition to the countries listed, North Korea, Romania, and Turkey are thought 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.