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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 2007 decreased by 2,800 metric tons (t) (5%) to 57,000 t. World mine production of molybdenum in 2007 was about 209,000 t, about a 12% increase from the 187,000 t in 2006. The U.S. share of world production was about 27% in 2007. Net U.S. production of molybdenum products increased to 31,100 t in 2007 from 30,600 t in 2006 (table 2). Reported 2007 U.S. consumption of molybdenum concentrate for roasting was 43,900 t, a decrease of about 400 t compared with that of 2006.

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, 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 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 U.S. molybdenum reserve base was estimated to be about 5.4 million metric tons (Mt), about 29% 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 are located in Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, and Utah. Other molybdenum sources contribute insignificantly to U.S. reserves.

Production

Domestic production data for molybdenum 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 twelve 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, 2007, U.S. rated capacity for mines and mills was estimated to be about 75,600 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 and 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. Molybdenum was produced as a byproduct of copper production at the Bagdad, Mission, Morenci, and Sierrita Mines in Arizona, the Continental Pit in Montana, the Robinson Mine in Nevada, the Chino Mine in New Mexico, and the Bingham Canyon Mine in Utah (table 10).

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 and 61% of the worldwide molybdenum supply in 2007. Kennecott Utah Copper decreased byproduct molybdenum production by more than 11% compared with that of 2006. Montana Resources increased production by about 14% compared with that of 2006.

In March 2007, Freeport McMoRan Copper and Gold Inc. (FCX) completed its acquisition of Phelps Dodge Corporation. The $26 billion merger created the world’s largest publicly traded copper company. FCX operates Bagdad and Sierrita, Arizona’s third and fourth largest copper mines. Both mines also recover large amounts of byproduct molybdenum. In December, plans were announced to convert its copper concentrate leach facility at Bagdad to a molybdenum concentrate leach facility by 2010. FCX has four additional molybdenum processing facilities at Green Valley, AZ; Fort Madison, IA; Stowmarket, United Kingdom; and Rotterdam, the Netherlands (Freeport McMoRan Copper and Gold, 2007b).

Mercator Minerals Ltd. is constructing a 50,000-metric-ton-per-day copper and molybdenum mill facility in a two-stage expansion at Mineral Park Mine (Arizona). The mine was expected to produce about 4,700 t/yr (10.3 million pounds) of molybdenum in concentrate for the first 10 years of its 25-year mine life (Ryan’s Notes, 2007a). The first stage of the expansion is scheduled for completion in the third quarter of 2008 with the second stage scheduled for completion in the middle of 2009.

Primary molybdenum mines operate in a swing capacity (filling the market gap between byproduct production and demand) and have a limited ability to change their production rate to meet spikes in demand. FCX’s Henderson Mine in Colorado increased its production by 8% compared with that of 2006. Thompson Creek Metals Co. (TCMC) reevaluated its reserves at its Thompson Creek Primary Mine in Idaho. The

revision showed measured and indicated resources of 232 Mt of molybdenum at a cutoff grade of 0.076% molybdenum, and proven and probable reserves of 98,800 t. The new mine plan for the 10-year period from 2008 to 2017 projected total molybdenum production of 177,580 t (Thompson Creek Metals Co., 2008). The previous estimates for the mine, compiled in 2006 with an assumed cutoff grade of 0.04% molybdenum, showed measured and indicated resources of 81,000 t with an average grade of 0.094% molybdenum (Platts Metals Week, 2007a; Ryan's Notes, 2007o).

At the end of 2007, FCX announced that it would reopen Climax Mine in Colorado and began placing orders for long-lead-time mining equipment. FCX expected to spend $500 million to bring the open pit mine back online and to build a new mill. Starting in 2010, the Climax Mine was expected to produce about 13,600 t/yr (30 million pounds per year) of molybdenum in concentrate, at an estimated cost of $3.50 per pound. Construction was expected to begin in the spring of 2008 (Ryan's Notes, 2007b). FCX determined that it would have more than enough roasting capacity to accommodate output from the Climax Mine, with a combined capacity of roughly 57,000 t/yr from roasters in Fort Madison, IA, Rotterdam, IA, and Sierrita, AZ. Climax Mine first processed ore in 1918. The mine and mill were last operated in 1995. According to the company, Climax is the world's largest, highest-grade, and lowest-cost molybdenum deposit (Platts Metals Week, 2007b).

FCX reported consolidated molybdenum sales volumes at 69 million pounds in both 2007 and 2006. Molybdenum ore grades for 2007 were similar to those of 2006. Consolidated molybdenum sales volumes were expected to reach 75 million pounds in 2008. The increase in projected molybdenum sales reflected additional production expected from the expanded Cerro Verde mill operations in Peru (Freeport McMoRan Copper and Gold Inc., 2007a, p. 8-14).

General Moly (formerly Idaho General) was expected to build its own roasting facility at Mount Hope, NV, where it was expected to produce 17,240 t/yr of concentrate for the first 5 years of operation, starting in the second half of 2010. General Moly's $852 million Mount Hope molybdenum project in central Nevada was expected to form a new entity with Pohang Iron and Steel Company (POSCO). POSCO was expected to support the joint venture with $170 million in equity contributions. In return for its investment, POSCO was expected to receive rights to 20% of production from the Mount Hope project. Steelmaker Arcelor Mittal signed an agreement to buy a 12.6% stake in General Moly for $70 million (Ryan's Notes, 2007c). As part of the deal, ArcelorMittal secured 2,700 t of molybdenum for 5 years starting in 2010 (Platts Metals Week, 2007c). General Moly confirmed that permitting had begun and was to be completed by first quarter of 2009. However, this timetable might be overly positive owing to opposition by environmentalists (Ryan's Notes, 2007d).

Golden Phoenix Minerals, Inc. continued its production at the Ashdown Project, a molybdenum mine owned by Golden Phoenix and Win-Eldrich Mines Ltd., located near Denio, NV. In September, the Ashdown mill returned to service following the successful relining of its ball mill. By October, the operation had generated consistent production of quality concentrates. Four shipments have been sold during this period bringing the cumulative total since startup in December 2006 to 14 shipments containing more than 280 t of concentrate (Golden Phoenix Minerals Inc., 2007).

Consumption

In 2007, reported U.S. consumption of molybdenum concentrate for roasting was 43,900 t, a decrease of about 400 t compared with that of 2006. 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 2007 was about 6% more than that of 2006. Oxide was the leading form of molybdenum used by industry, particularly in making stainless steel. Overall, total steel use from 2006 to 2007 increased by 31%, with most of this increase attributed to the 53% increase in full alloy use. However, there was a decrease of approximately 1 million kilograms (kg) in the miscellaneous other use category from 2006 to 2007 (table 3).

Metallurgical applications continued to dominate molybdenum use in 2007, accounting for about 82% of total consumption (table 3). In 2007, FeMo accounted for about 39% of the molybdenum-bearing materials used to make steel, which was a 2% decrease from that of 2006. Nonmetallurgical applications included catalysts, chemicals, lubricants, and pigments. The dominant nonmetallurgical use was in catalysts.

Molybdenum demand from catalyst makers increased in 2007 owing to increased use of hydroprocessing catalysts and also because the molybdenum content in the catalysts had increased. A strategic supply mananger for Albermarle reported that in 2006, molybdenum use in catalysts was 38 to 43 million pounds. He predicted that by 2010, molybdenum use in catalysts would rise to 50 to 55 million pounds. From 2005-10, hydroprocessing catalysts use was expected to increase by 6% to 8% (Ryan's Notes, 2007e).

Demand for molybdenum in superalloys increased in 2007 owing to greater use of superalloys in aircraft gas turbine engines and airframes and land-based gas turbines. The number of engines built for land-based turbines was expected to rise from 1,100 in 2006 to 1,850 in 2013 (Ryan's Notes, 2007g).

Another significant potential molybdenum demand was with lean duplex stainless steels containing about 0.3% molybdenum. Lean duplex stainless steels have started to substitute the traditional 304 stainless applications. It was estimated that for every 1% of the 304 stainless market converted to a typical 0.3% molybdenum lean duplex stainless steel, 370 t of molybdenum was needed. The strength of the duplex grade was much higher than that of the 304 traditional stainless and allowed use of considerably thinner gauge material, which resulted in meaningful weight reduction and cost savings. Some examples of where lean duplex stainless steels would be used are in tank construction for storage of biodiesel, ethanol, flour, palm oil, sewage water, wine, and white liquor. Road tankers can carry more payable freight by using stronger lean duplex stainless steels. A major U.S. shipper noted that deliveries of these new trailers was expected to begin in January 2008. They are already used heavily in Europe (Battrum, 2008).

Stocks

At yearend 2007, producer plus consumer industry stocks contained about 4,994 t of molybdenum, an increase of about 127 t compared with the stock level at yearend 2006. Inventories of molybdenum in concentrate at mines and plants increased by about 500 t. Producer stocks of molybdenum in such products as FeMo, molybdates, MoX, metal powders, and other types decreased by about 67 t compared with those of 2006. Total stocks of about 7,620 t represented about a 21-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 (kg) of contained molybdenum. The annual time-average prices for 2007 were MoX, $66.790 per kg, and FeMo, $73.705 per kg of contained molybdenum, which represented increases of about 22% and 25%, respectively, compared with 2006 prices. Molybdenum prices rose steadily from January through June, when they reached their highest point at $75.508 per kg for MoX and $82.673 per kg for FeMo. Prices followed a generally downward trend through October, spiked in November and dropped again in December to close at $72.201 per kg and $76.611 per kg, respectively. The MoX monthly average price ranged from a low of $55.13 per kg in January to a high of $72.81 per kg in November. The FeMo monthly average price ranged from a low of $59.66 per kg in January to a high of $81.02 per kg in June.

Foreign Trade

In 2007, molybdenum-containing material exports collectively contained about 35,000 t of molybdenum and were valued at $2.28 billion (table 6). Imports for consumption of molybdenum-containing products collectively contained about 17,800 t of molybdenum and were valued at $938 million (table 9).

World Review

World molybdenum reserves and production capacity were concentrated in a few countries. World mine output was estimated to have been 209,000 t (molybdenum contained in concentrate), of which, in descending order of production, China, the United States, Chile, Peru, and Canada provided about 91% (table 11). Chile, China, and the United States also held about 77% of the estimated 19 Mt of molybdenum in the world reserve base.

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 also 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 world's largest 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 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.

European Union.—In October 2006, the European Commission (EC) suspended the 22.5% antidumping duty on FeMo imports from China into the European Union for 9 months. Then the EC undertook a 15-month sunset review of the antidumping duty, which was required to be completed by January 31, 2008. The EC proposed that the suspension, set to expire on July 24, 2007, be extended to coincide with the completion of the sunset review. The proposal was presented to the EC Antidumping Committee and none of the member States objected. The EC expected the full Council would vote to accept the extension (Ryan's Notes, 2007f).

Armenia.—Germany's Cronimet Mining GmbH managed Zangezur Copper and Molybdenum Combine AG, which operated the Karajan copper-molybdenum mine (the largest molybdenum-bearing deposit in the CIS). Cronimet has invested $70 million in Zangezur, making it the single largest investor in the Armenian economy. Molybdenum concentrates produced by the Zangezur plant were processed in Armenia, by Armenian Pure Iron Works (API) and Armenian Molybdenum Production Company. Zangezur reported an annual output of 8,000 t of concentrate. The second largest mine in Armenia is the Agarak Copper and Molybdenum Combine, located near Zangezur in southeastern Armenia. It is owned by U.S. company, Comsup Commodities Inc. and reported an annual output of 700 t of concentrate (Cronimet Group, 2007).

Russian state-controlled bank VTB, was expected to invest $260 million in the exploration of Armenia's second largest copper molybdenum deposit, Tekhut, which was expected to start mining ore in 2011 (Metals Place, 2007a).

Australia.—Moly Mines has entered into a strategic commercial alliance with Molymet under an agreement that called for converting 100% of molybdenum concentrates produced at Moly Mines' Spinifex Ridge molybdenum copper project into technical grade moly oxide powder and briquettes and into FeMo. The reserves and resources at Spinifex Ridge support a mine life of more than 20 years assuming average annual production at 11,000 t of molybdenum in concentrate. Moly Mines plans to construct a mine and concentrator but not a roaster. However, the possibility of constructing a roaster in the future has not been ruled out (Ryan's Notes, 2007f).

Brazil.—Carnavale Resources Ltd. of Australia signed a binding letter of intent in May with Metal Land Capital Brasil Mineracao Ltda. of Brazil to acquire 100% ownership of the Frei Martinho Molybdenum Project for $4 million. The Frei Martinho molybdenum project is located in Paraiba State of Brazil and contains 0.4% molybdenum (The TEX Report, 2007).

Canada.—Roca Mines Inc. began production at its Max Molybdenum Mine, Trout Lake, British Columbia, in late 2007. It was expected to produce 455 t of molybdenum in concentrate before yearend, with 2,270 t of molybdenum in concentrate

estimated to be produced annually thereafter (Metal Bulletin Research, 2007a).

The Endako molybdenum mine in British Columbia continued to produce molybdenum concentrate and roast it despite the rock slide on November 12. Since the rock slide occurred, the mill at Endako has used ore from the Denak West Pit and stockpiled ore, but the higher moisture content of the ore has prevented the mill from running at full capacity (Ryan's Notes, 2007h). The shovel that was partially covered by the slide was being repaired and was expected to be fully operational by yearend. Endako is operated by TCMC but TCMC only owns 75%, with Japan's Sojitz Corp. owning the remaining 25% (Ryan's Notes, 2007i).

A new resource estimate showed that Endako had 492 Mt of measured and inferred reserves, grading at 0.043% molybdenum, equating to about 208,650 t of contained molybdenum. Mine life was extended about 10 years to 19 years overall. A new mine plan, including new operating costs, was expected to be developed, assuming long-term molybdenum price of $10 per pound. TCMC's fourth quarter 2007 production was greater than anticipated in December. Total output in the fourth quarter was 1,450 t of molybdenum as opposed to the estimated 1,360 t. For all of 2007, TCMC moly production totaled 7,400 t compared with the previous estimate of 7,200 t. The feasibility of combining the three existing open pits into one super pit at Endako, and boosting mine capacity from 30,000 metric tons per day (t/d) to 50,000 t/d also was to be investigated (Ryan's Notes, 2007j).

Adanac Molybdenum received the Environmental Assessment Certificate from the government of British Columbia on September 10, allowing it to proceed with the development of the Ruby Creek molybdenum project. The community of Atlin and the Taku River Tlingit First Nations participated in all aspects of the environmental review. Adanac completed procurement of long-lead-time equipment, and onsite construction was expected to begin in the fall of 2007 after receipt of the preconstruction permit. Ruby Creek was expected to be the first new, large-scale primary molybdenum mine developed in 25 years. It was projected to operate at 20,000 t/d for 20 years (Ryan's Notes, 2007k).

Molybdenum production at Highland Valley Copper rose 6% in the third quarter to 484 t from 455 t in the third quarter 2006, but for the 9-month period, production was down 13% compared with the first 9 months of 2006 (Ryan's Notes, 2007l).

Chile.—Xstrata's North Chile division began a feasibility study into the possibility of doubling molybdenum production at its Altonorte metallurgical plant. The estimated $40 million expansion, which would involve the refurbishment of a molybdenum roaster, would increase the facility's processing capacity from 12,000 t/yr to 28,000 t/yr. Construction was expected to begin in late 2008, with commercial production commencing a year later (Metal Bulletin Research, 2007b).

Anglo American announced that it would continue its plans to increase production at its Los Broncos copper mine in Chile. The $1.7 billion development, which would take 3 years to complete, would significantly increase molybdenum output from 2,100 t/yr to 5,400 t/yr (Metal Bulletin Research, 2007b).

Codelco started the environmental applications to build a new 13,600-t/yr molybdenum roaster in the north of Chile. The $107 million plant would be built at the Port of Mejillones near Antofagasta. Construction was expected to take 1 year. The plant would be Codelco's second roaster (Ryan's Notes, 2007m). Molymet announced in 2006 plans to build a 14,000-t/yr roaster in the same region as Codelco. Molymet, however, was at least a year ahead of Codelco in its plans (Ryan's Notes, 2007n).

Japan planned to eliminate the duty on FeMo imported from Chile, effective September 3, 2007, after ratification of the Economic Partnership Agreement between Chile and Japan. Previously, Chile had been granted a preferred duty rate of 2.64% under Japan's Generalized System of Preferences. The move was expected to benefit Japanese FeMo consumers as Chinese FeMo exports were expected to decrease after imposition of export quotas and duties. Japanese FeMo imports from Chile rose to 570 t from 300 t, while imports from China dropped to 680 t from 1,741 t in the first half of 2007 (Ryan's Notes, 2007j).

The Comision Chilena del Cobre (Cochilco) expected its molybdenum production to decrease 12% to about 38,000 t (84 million pounds) in 2007 as compared with about 43,100 t (95 million pounds) in 2006. Molybdenum production by Corporacion Nacional del Cobre (Codelco) in Chile was expected to decrease to 25,000 to 30,000 t (55 to 66 million pounds) in 2007 as compared with about 30,800 t (68 million pounds) in 2006. Codelco produced about 36,700 t in 2005. Codelco attributed the reduced production to lower ore grades and repair of the broken conveyor belt at the Chuquicamata Mine, which was expected to be completed in May (Ryan's Notes, 2007p).

China.—The Chinese Government was expected to increase export taxes on FeMo from 10% to 20% effective January 1, 2008. The duty for molybdenum ores and concentrates was expected to increase by 5% to 10% (Ryan's Notes, 2007m).

Molybdenum mines in Huludau in northeast China's Liaoning Province were expected to produce again by yearend. Output was likely to be a maximum of 50% of that being produced before the shutdown in 2005. The Huludau mines were closed by the Chinese Government in February 2005 following problems with illegal mining, pollution, safety violations, and tax evasion. Mining was expected to resume once the Liaoning Provincial government granted a production safety certificate. Lianshan Molybdenum was established by the Lianshan District government in Huludau to hold a 51% stake in six molybdenum mining companies. Lianshan Molybdenum was expected to install environmental protection and safety facilities at the mines. The mines hold deposits of 65 Mt with an average grade of 0.24% molybdenum (Metal Bulletin, 2007).

A senior representative from China's leading molybdenum producer, Jinduicheng Molybdenum Group, anticipated that only about one-half of the 54 molybdenum exporters currently listed with China's Ministry of Commerce would be selected as potential exporters of molybdenum products. Producers would be required to have had a combined production of at least 3,000 t of integrated MoX and FeMo products during the past 3 years, and exports of greater than 300 t/yr. Traders who wished to be selected would need to demonstrate total exports of MoX and

FeMo greater than 600 t/yr (Platts Metals Week, 2007c). China's MoX exports declined 14% in 2007 compared with those of 2006, but its FeMo exports rose by 14% during the same period.

Kazakhstan.—Kazakhstan-based uranium and molybdenum producer Stepnogorsk boosted commercial output at its Mining Chemicals Plant by 35% in the first half of 2007. The first stage of a concentrating plant for molybdenum ore was commissioned at Stepnogorsk in April 2006. The ore is mined at eastern Kazakhstan's Shorskoye Field, which contains 21,000 t of molybdenum. Eureka Mining Plc. (United Kingdom) and Kazakhstan's state-owned National Atomic Company, Kazatomprom, have formed a joint venture for the project. Kazatomprom planned to invest more than $180 million in the Stepnogorsk plant between 2005 and 2007 and to achieve commercial output of more than $200 million by 2010 (Metals Place, 2007b).

Mexico.—Creston Moly Corp. (Canada) discovered a new molybdenite-bearing quartz vein situated 1.5 kilometers northeast of the Creston Main Zone at their Creston molybdenum project in Sonora, Mexico. Before the discovery, the Creston molybdenum project contained 93 Mt of indicated molybdenum resources at a 0.035% cutoff grade (Creston Moly Corp., 2007).

Mongolia.—Climax Molybdenum Co. recommended that the U.S. International Trade Commission deny U.S. Generalized System of Preferences (GSP) for molybdenum ores and roasted concentrates from Mongolia. A new roaster with a 2,300 t/yr (5 million pounds) capacity began operation in Mongolia in the second quarter of 2007, and test quantities of molybdenum oxide reportedly were shipped to Japan and the Republic of Korea. Previously, all concentrates were shipped to China for roasting, but exports of concentrates to China dropped from 800 t in the first quarter to 350 t in the second quarter. Climax argued that granting GSP status to Mongolia was not necessary for Mongolian products to be competitive, as the standard duty was only 17.8 cents per kg of molybdenum in concentrate and 7.2 cents per kg of molybdenum in MoX (Ryan's Notes, 2007p).

Peru.—The recently expanded Cerro Verde Mine was expected to produce approximately 3,600 t of molybdenum for the next several years. FCX owns a 54% interest in Cerro Verde (Freeport McMoRan Copper and Gold Inc., 2007a).

Outlook

The principal use for molybdenum was expected to continue to be in chemicals and catalysts and as an additive in steel manufacturing in general, most importantly alloy and stainless steel. The global catalyst market was expected to reach $13 billion in sales in 2007. Of this, the petroleum refining sector was expected to consume about 15,900 t of molybdenum, as government regulations have required oil manufactures to remove sulfur from crude oil. Other plans for catalysts include using molybdenum-based catalysts to convert coal to liquid oil.

The imbalance between supply and demand has caused molybdenum prices to skyrocket in the past few years. Owing to the molybdenum price revival, dozens of exploration companies as well as current producers are looking for new molybdenum deposits. However, leading analysts think that there are few deposits with potentially viable high-grade molybdenum resources. Analysts expected that prices would not remain at their current high levels, which will curtail potential new mine developments such as at the Climax Mine. A decline in economic growth around the world in the upcoming years could also affect stainless and alloy steel demand, which in turn could affect molybdenum demand.

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TABLE 1
SALIENT MOLYBDENUM STATISTICS[1]

(Metric tons of contained molybdenum)

	2003	2004	2005	2006	2007
United States:					
Concentrate:					
Production	33,500	41,500	58,000	59,800	57,000
Shipments	33,600	42,000	57,900	60,100 r	57,100
Reported consumption[2]	27,500	38,700	46,600	44,400	43,900
Imports for consumption	5,190	8,780	11,900	10,900	12,400
Stocks, December 31:					
Concentrate, mine and plant	2,520	2,610	3,620	2,120	2,630
Product producers[3]	2,760	2,840	3,770	3,210	3,140
Consumers	1,900	2,040	2,030	1,660 r	1,850
Total	7,180	7,480	9,420	6,990 r	7,620
Primary products:					
Production	41,400	66,300	78,500	78,000	72,800
Shipments	30,100	39,300	46,700	51,000	48,700
Reported consumption	16,400	17,400	18,900	19,000 r	20,500
World, mine production	131,000	159,000	186,000	187,000	209,000

[r]Revised.
[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	
	2006	2007	2006	2007	2006	2007
Received from other producers	--	--	19,800	17,600	19,800	17,600
Gross production during year	5,170	5,090	72,800	67,700	78,000	72,800
Molybdenum products used to make other products	3,550	3,470	43,800	29,000	47,400	41,700
Net production	1,620	1,620	29,000	29,500	30,600	31,100
Shipments	1,490	1,650	49,500	47,100	51,000	48,700
Producer stocks, December 31	296	275	2,910	2,870	3,210	3,140

-- 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
2006:						
Steel:						
Carbon	255,000	384,000	--	--	W	639,000
High-strength low-alloy	533,000	154,000	--	--	W	687,000
Stainless and heat-resisting	2,080,000	776,000	--	33,700	78,100	2,970,000
Full alloy	2,020,000	2,570,000	--	--	18,100	4,610,000
Tool	628,000	W	--	442	--	629,000
Total	5,520,000	3,880,000	--	34,200	96,300	9,530,000
Cast irons (gray, malleable, ductile iron)	W	194,000	--	--	51,500	246,000
Superalloys	1,050,000	32,800	--	W	1,050,000 r	2,140,000 r
Alloys (other than steels, cast irons, superalloys):						
Welding materials (structural and hard-facing)	--	47,300	--	--	728 r	48,100
Other alloys	W	39,800	--	834	1,870	42,500
Mill products made from metal powder[3]	W	--	W	--	2,250,000	2,250,000
Cemented carbides and related products[4]	--	--	--	--	81 r	81 r
Chemical and ceramic uses:						
Pigments	W	--	110,000	--	--	110,000
Catalysts	1,010,000	--	W	--	179,000	1,190,000
Other	--	--	--	--	10,000 r	10,000 r
Miscellaneous and unspecified uses:						
Lubricants	--	--	--	--	283,000 r	283,000 r
Other	1,160,000	93,100	975,000	711,000 r	193,000 r	3,130,000 r
Grand total	8,730,000	4,290,000	1,080,000	746,000 r	4,120,000 r	19,000,000 r
Stocks, December 31	530,000	210,000 r	16,000 r	25,100	878,000	1,660,000 r
2007:						
Steel:						
Carbon	567,000	346,000	--	--	W	913,000
High-strength low-alloy	733,000	145,000	--	--	W	878,000
Stainless and heat-resisting	2,070,000	774,000	--	33,700	78,100	2,960,000
Full alloy	3,080,000	3,390,000	--	--	18,100	6,490,000
Tool	771,000	W	--	442	--	771,000
Total	7,230,000	4,650,000	--	34,200	96,300	12,000,000
Cast irons (gray, malleable, ductile iron)	W	345,000	--	--	51,500	396,000
Superalloys	900,000	36,800	--	W	1,050,000	1,990,000
Alloys (other than steels, cast irons, superalloys):						
Welding materials (structural and hard-facing)	--	51,700	--	--	728	52,400
Other alloys	W	51,500	--	904	909	53,400
Mill products made from metal powder[3]	W	--	W	--	2,400,000	2,400,000
Cemented carbides and related products[4]	--	--	--	--	79	79
Chemical and ceramic uses:						
Pigments	W	--	110,000	--	--	110,000
Catalysts	948,000	--	W	--	179,000	1,130,000
Other	--	--	--	--	7,200	7,200
Miscellaneous and unspecified uses:						
Lubricants	--	--	--	--	283,000	283,000
Other	133,000	91,000	879,000	779,000	216,000	2,100,000
Grand total	9,210,000	5,230,000	988,000	814,000	4,280,000	20,500,000
Stocks, December 31	599,000	329,000	17,200	28,400	880,000	1,850,000

[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.

TABLE 4

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

Product and country	HTS[2] code	2006 Quantity (metric tons)	2006 Value (thousands)	2007 Quantity (metric tons)	2007 Value (thousands)
Oxides and hydroxides, gross weight:	2825.70.0000				
Austria		2,460	$74,000	1,410	$39,600
Belgium		405	14,000	1,730	27,900
Canada		2,940	32,300	3,290	39,100
Chile		--	--	1,480	52,500
Finland		718	23,700	1,310	41,200
Germany		523	16,300	535	16,400
Japan		635	17,600	2,100	68,500
Mexico		81	1,720	118	1,910
Netherlands		838	27,200	229	7,910
United Kingdom		1,110	36,800	713	26,600
Other		1,900 r	56,700 r	1,940	56,600
Total		11,600	300,000	14,900	378,000
Molybdates all, gross weight:	2841.70.0000				
Canada		462	7,010	470	8,170
Japan		414	13,700	372	9,330
Mexico		221	5,770	14	425
Netherlands		779	22,400	320	15,300
Other		156	2,890	261	9,350
Total		2,030	51,900 r	1,440	42,500
Ferromolybdenum, contained weight:[3]	7202.70.0000				
Canada		1,760	35,200	838	44,700
Mexico		143	2,450	24	1,390
Netherlands		14	688	145	8,550
Other		91	4,170	215	13,200
Total		2,010	42,500	1,220	67,900
Molybdenum other, gross weight:[4]	Various[5]				
Brazil		89	6,560	94	7,980
Canada		105	4,560	102	4,890
France		27	2,730	51	4,260
Germany		252	17,600	136	10,900
Hungary		70	6,140	66	5,590
India		32	2,900	34	2,700
Japan		552	54,100	476	44,500
Korea, Republic of		84	7,070 r	228	20,200
Netherlands		8	269 r	108	6,790
Russia		4	384	35	2,850
Taiwan		168	7,780	197	8,880
United Kingdom		415	17,600	360	18,600
Other		200 r	15,500 r	250	18,400
Total		2,010	143,000	2,140	156,000

[r]Revised. --Zero.

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

[2]Harmonized Tariff Schedule of the United States.

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

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

[5]Includes HTS codes 8102.10.0000, 8102.94.0000, 8102.95.0000, 8102.96.0000, 8102.97.0000, 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]

Country	2006 Quantity (metric tons of contained Mo)	2006 Value (thousands)	2007 Quantity (metric tons of contained Mo)	2007 Value (thousands)
Australia	89	$4,810	1	$49
Belgium	7,490	327,000	6,730	360,000
Brazil	113	3,960	119	4,530
Canada	2,680	91,300	2,580	109,000
Chile	259	12,900	1,270	64,600
China	405	19,600	71	2,900
Germany	1	40	22	745
India	83	4,100	119	7,280
Japan	2,260	94,500	2,230	122,000
Korea, Republic of	45	2,500	232	11,900
Mexico	6,070	112,000	4,760	41,700
Netherlands	10,300	527,000	9,660	566,000
Taiwan	53	2,830	18	214
United Kingdom	7,280	252,000	5,800	339,000
Other	77 r	2,890 r	209	7,190
Total	37,200	1,460,000	33,800	1,640,000

[r]Revised.

[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]

Item	HTS[2] code	2006 Gross weight (metric tons)	2006 Contained Mo (metric tons)	2006 Value (thousands)	2007 Gross weight (metric tons)	2007 Contained Mo (metric tons)	2007 Value (thousands)
Molybdenum ore and concentrates, roasted	2613.10.0000	NA	18,200	$770,000	NA	17,100	$906,000
Molybdenum ore and concentrates, other	2613.90.0000	NA	19,000	687,000	NA	16,700	731,000
Molybdenum chemicals:							
Oxides and hydroxides	2825.70.0000	11,600	NA	300,000	14,900	NA	378,000
Molybdates, all	2841.70.0000	2,030	NA	51,900 r	1,440	NA	42,500
Ferromolybdenum	7202.70.0000	3,280	2,010	42,500	1,760	1,220	67,900
Molybdenum powders	8102.10.0000	688	NA	40,700	616	NA	35,900
Molybdenum unwrought, bars and rods	8102.94.0000	48	NA	2,420	86	NA	5,660
Molybdenum waste and scrap	8102.97.0000	525	NA	15,500	478	NA	18,200
Molybdenum wire	8102.96.0000	154	NA	14,900	253	NA	23,900
Molybdenum, other	Various[3]	590	NA	69,700	707	NA	72,900
Total		18,900	39,200	1,990,000	20,200	35,000	2,280,000

NA Not available. [r]Revised.

[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	2006 Quantity (metric tons)	2006 Value (thousands)	2007 Quantity (metric tons)	2007 Value (thousands)
Oxides and hydroxides, gross weight:	2825.70.0000				
Chile		322	$12,200	176	$7,610
China		216	8,840	--	9
Germany		67	2,430	13	143
Uzbekistan		18	737	--	--
Other		7	60	22	251
Total		629	24,300	211	8,020
Molybdates all, contained weight:	Various[3]				
Belgium		34	1,340	16	414
Canada		8	214	7	315
Chile		414	16,800	145	9,750
China		377	14,500	185	7,190
Germany		70	3,420	204	14,500
Other		13	682	9	352
Total		917 r	36,900	567	32,500
Molybdenum orange, gross weight:	3206.20.0020				
Canada		718	4,650	519	3,660
Korea, Republic of		3	14	1	6
Mexico		70	297	57	281
Other		33 r	153 r	23	93
Total		822 r	5,110	600	4,040
Ferromolybdenum, contained weight:[4]	7202.70.0000				
Canada		238	13,300	491	32,800
Chile		764	45,000	1,380	92,600
China		1,790	95,600	1,910	130,000
Korea, Republic of		15	582	72	4,640
Netherlands		25	1,450	26	1,890
Russia		26	1,510	--	--
United Kingdom		141	3,240	175	4,090
Other		58	3,790 r	48	3,100
Total		3,060	165,000	4,100	270,000
Other, gross weight:	Various[5]				
Austria		247	21,400	401	32,800
China		384	23,500	277	19,300
Germany		158	12,200	129	8,980
Hong Kong		67	4,560	2	123
Japan		63	4,920	46	3,160
Russia		12	1,910	32	4,670
Other		228 r	7,190 r	60	1,850
Total		1,160	75,700	947	70,900

[r]Revised. -- 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.

Source: U.S. Census Bureau.

TABLE 8

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

Country	2006 Quantity (metric tons of contained Mo)	2006 Value (thousands)	2007 Quantity (metric tons of contained Mo)	2007 Value (thousands)
Canada	3,190	$163,000	1,520	$97,200
Chile	2,420	131,000	5,740	333,000
China	5	114	1	16
Mexico	3,400	43,300	3,910	78,700
Peru	1,830	54,000	1,130	38,800
Other	58	2,910	85	5,330
Total	10,900	395,000	12,400	553,000

[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	2006 Gross weight (metric tons)	2006 Contained Mo (metric tons)	2006 Value (thousands)	2007 Gross weight (metric tons)	2007 Contained Mo (metric tons)	2007 Value (thousands)
Molybdenum ore and concentrates, roasted	2613.10.0000	9,570	5,900	$167,000	8,680	5,430	$181,000
Molybdenum ore and concentrates, other	2613.90.0000	10,900	5,000	227,000	15,000	6,960	372,000
Molybdenum chemicals:							
Oxides and hydroxides	2825.70.0000	629	NA	24,300	211	NA	8,020
Molybdates, all	Various[3]	1,670	917	36,900	1,090	567	32,500
Molybdenum orange	3206.20.0020	822	NA	5,110	600	NA	4,040
Ferromolybdenum	7202.70.0000	4,810	3,060	165,000	6,360	4,100	270,000
Molybdenum powders	8102.10.0000	367	270	17,600	73	61	4,990
Molybdenum unwrought, bars and rods	8102.94.0000	191	191	10,800	117	117	7,460
Molybdenum waste and scrap	8102.97.0000	452	445	27,800	574	554	34,800
Molybdenum wire	8102.96.0000	19	NA	2,550	18	NA	2,740
Molybdenum, other	Various[4]	130	NA	17,000	164	NA	20,900
Total		29,600	15,800	701,000	32,900	17,800	938,000

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 2007

State and mine	County	Operator	Source of molybdenum
Arizona:			
Bagdad	Yavapai	Freeport McMoRan Copper & Gold Inc.	Copper-molybdenum ore, concentrated.
Mission Complex	Pima	Asarco LLC	Do.
Morenci	Greenlee	Freeport McMoRan Copper & Gold Inc.	Do.
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.
Nevada:			
Ashdown	Humboldt	Golden Phoenix Minerals, Inc.	Molybdenum ore, concentrated.
Robinson	White Pine	Quadra Mining, Ltd.	Copper-molybdenum ore, concentrated.
New Mexico:			
Chino	Grant	Freeport McMoRan Copper & Gold Inc.	Do.
Questa	Taos	Molycorp, Inc.	Molybdenum ore, concentrated.
Utah, Bingham Canyon	Salt Lake	Kennecott Utah Copper Corp.	Copper-molybdenum ore, concentrated.

Do., do. Ditto.

TABLE 11

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

(Metric tons of contained molybdenum)

Country[3]	2003	2004	2005	2006	2007[e]
Armenia	2,763	2,950 [e]	3,000 [e]	3,900 [r]	4,080
Canada	9,092	9,519	7,935	7,842	12,000
Chile	33,374	41,883	48,041	43,278	44,912 [4]
China[e]	31,000	38,500	40,000	43,900	59,800
Iran[e]	2,200	1,800	2,476 [r, 4]	2,500 [r, 4]	2,600
Kazakhstan	230	230 [e]	230	250	400
Kyrgyzstan[e]	250	250	250	250	250
Mexico	3,524	3,730	4,246	2,519 [r]	6,159 [4]
Mongolia	1,793	1,141	1,188	1,404 [r]	1,300
Peru	9,561	14,246	17,325	17,209	16,737 [4]
Russia[e]	2,900	2,900	3,000	3,100	3,300
United States	33,500	41,500	58,000	59,800	57,000 [4]
Uzbekistan[e]	500	500	575	600	600
Total	131,000	159,000	186,000	187,000 [r]	209,000

[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 July 13, 2008.

[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.