MOLYBDENUM

By Brian Nolk

Production cutbacks in US (and to a lesser extent Mexican) mines in 2001 and 2002 were the biggest single factors in the supply/demand equation which saw the molybdenum market fall into a shortfall in 2002. The US/Mexican cuts were offset to a degree by production increases in Canada and South America, but when combined with lower (and temporarily interrupted) shipments from China this created the tight market conditions which allowed merchants to drive up spot prices to new cycle highs in the second quarter of the year. The dramatic price spike started in mid-April and peaked in early June and prices dropped for the remainder of the year.

This was a dramatic turnaround for the molybdenum market, which had seen ample free-market supplies and steady low prices for some years. Until late 2001, the factors which kept molybdenum oversupply included strong by-product output from copper operations in the US, Canada, Chile and Peru, as well as continuing supplies from China. Free-market price indications were locked into a range of US$2.00 - 3.00/lb Mo for several years up to early 2002.

Since three quarters of the world's molybdenum enters the supply chain as a result of by-production from porphyry copper operations there seemed little the molybdenum industry could do directly to affect their own market balance.

As a result, the few but relatively large primary producers in the US were relegated in the 1990s to a position of ‘swing producers’, able to participate only during the brief periods of supply dislocation and price rises. Just such a price rise did occur in mid-2002.

The scene was set in North America in the late 1990s when large copper producers with significant molybdenum by-production merged. Asarco Inc. merged with Grupo Mexico and Phelps Dodge Mining Corp. (PDMC) with Cyprus Amax Inc., making Phelps Dodge the largest molybdenum producer in the world at that time. These copper groups were subjected to fierce pressures to reduce their costs at their operations by the concomitantly low prices for copper and molybdenum. Production cuts throughout the Cu-Mo mining industry in North and South America were the result of these groups and others responding to those pressures in 2001-02.

Supply

Since the last price spike in 1994 the molybdenum market has been in oversupply, as exports from the CIS producers entered the world market alongside increased output from China and South America. The North American primary producers and by-product producers have steadily cut back output since 1998 but this has been largely offset by new by-production from South American copper operations, such as Los Pelambres in Chile. Latin

American output jumped by one-third since the mid-1990s, offsetting cuts of one-third and one-half in Canada and the US, respectively.

Since 1997 (Table 1), world production has fallen from a peak of 138,820 t (306 Mlb) to a low of 125,070 t (276 Mlb) in 1999, before climbing back slightly to 130,000 t (286.6 Mlb) in 2001. Production in 2002 totalled 128,000 t (282 Mlb).

Some 6,500 t of production was taken out of the market in 2002 by producers in the US and Mexico alone, yet global production dropped by only 2,000 t from 2001. Some of the offsetting production increases can be traced to just two operations: Anaconda Chile's Los Pelambres operation and the Antamina mine in Peru, which saw its first full year of production in 2002. Los Pelambres produced 5,400 t in 2001 and it is thought production in 2002 was higher, while Antamina is only beginning to hit its stride. These two new entrants alone are expected to contribute over 7,500 t of molybdenum to the market when they hit full production.

Antamina is owned 33.75% by Noranda, 33.75% by BHP Billiton, 22.5% by Teck Corp. and 10% by Mitsubishi.

US

For many years the US has been the world's largest producer of molybdenum, although with cuts in US output in the past seven years and growth in other producing nations, the US has finally dropped to second place behind Chile. The US has enormous reserves and substantial copper-molybdenum production capacity in mothballs, so the potential is still present for the US to regain its production supremacy but this capacity is hostage to the long-term view of the copper price. Meanwhile, Chile's generally richer copper-molybdenum deposits and lower costs of production mean the medium-term dominance of Chilean molybdenum production is likely.

A significant proportion of mine capacity in the US is accounted for by primary molybdenum mines and output at these can fluctuate according to price and perceived demand. The primary mines at Henderson, Thompson Creek and Questa in the US, and Endako in Canada, have reduced output since the late 1990s to help offset rising stocks of molybdenum in the market. Also, many of the copper-molybdenum operations have curbed output in recent years.

Phelps Dodge, through its subsidiary Climax Molybdenum, is still the world's largest molybdenum producer. Its Henderson, Colorado underground primary molybdenum mine is supplemented by molybdenum units from its Sierrita and Bagdad, Arizona copper mines. It processes at Fort Madison, Iowa, Stowmarket, UK and Rotterdam. The company said it produced 44.9 Mlb of molybdenum from its own mines in 2002 (down from 55.5Mlb in 2001), while sales of its own production totalled 46.7 Mlb (55.1 Mlb).

Thompson Creek Metals operates the Thompson Creek mine near Clayton, Idaho, and the Endako joint venture (with Nissho Iwai) in British Columbia and conversion plant at Langeloth, Pennsylvania. Thompson Creek's production of

molybdenum in Idaho is thought to be below its stated 15 Mlb/y. Production at its Endako operation in Canada was expected to remain at the previous year's level of roughly 10 Mlb, the company said.

Rio Tinto's Kennecott operation is thought to have produced approximately 18 Mlb of molybdenum in 2002 despite the threat of a strike at its Utah operations in October.

Chile
Chile became the largest producer of molybdenum in the world in 2002 with about 34,000 t produced, almost all of which is exported. Production rose about 3% from 2001 levels, largely as a result of Los Pelambres.

In Chile, and indeed in the rest of Latin America, molybdenum is produced solely as a by-product of copper mining. Over the past 20 years, as the copper producers have increased their copper output, their molybdenum by-production has also risen. The increased molybdenum output from Latin America has, over time, offset the reduced output from 'swing' producers in North America and helped to keep molybdenum in oversupply but in 2002 the modest incremental production from Chile was insufficient to make up for the cuts in the US and Mexico.

China
China is the third-largest producer of molybdenum in the world and in the first ten months of 2002 it produced 54,534.8 t of molybdenum concentrate, 3.43% more than in the corresponding period in 2001. China's identified reserves of approximately 8.55 Mt puts it in second place in world ranking of reserves.

Three of the six largest molybdenum mines in the world are located in China: Luanchuan in Henan Province, containing reserves of 1.3 Mt; Daheishan in Jilin Province, with 1.1 Mt; and Jinduicheng in Shanxi Province, with around 970,000 t.

In China, molybdenum mining was for many years not subject to the usual economic pressures felt by producers in other nations, as state agencies pushed exports for foreign exchange purposes. In their defence the Chinese producers generally had a competitive cost base and there was, and is, a strong domestic demand from a fast-growing steel industry.

By the mid-1990s, exports of low-cost material from China were contributing to the world oversupply. However, domestic molybdenum output is now stabilising and demand from the Chinese steel industry is growing rapidly. In addition, the pressure of anti-dumping duties in the US and Europe also helped to curb China's export volumes. As a result, Chinese exports of molybdenum dropped in early 2002 but exporters quickly moved to take advantage of higher prices from June onwards.

Production from the large number of small companies throughout China is erratic and some could close under tightening pollution-related legislation and rising production costs, and others are looking to shift production away from

commodity grades to higher-value products. This is likely to have a major impact on China's molybdenum industry over the next three-five years.

Chinese ferro-molybdenum producers responded to the effective closure of the EU market against them by shifting some production facilities to other molybdenum products and shutting many of the older and higher cost FeMo units.

One major producer, Shanxi-based JDC, had announced in early 2001 it was to terminate an exclusive distribution agreement with Shangxiang Minmetals, which had been marketing JDC's high-soluble molybdenum oxide throughout much of the world market. The contract was terminated effective February 10, 2002. From that date, all new sales for JDC's oxide were handled by JDC's own trading arm, Jinduicheng Molybdenum Import & Export Corp., which was expanding its operations, including opening a Tokyo office.

JDC also said early in 2001 it would cut its production of ferro-molybdenum significantly and will only produce small volumes for its existing customers. In August, the firm admitted it had basically ceased to produce FeMo as a result of the European Commission's decision to introduce anti-dumping duties against Chinese ferro-molybdenum imports.

In February 2002, the European Union Council of Ministers voted to impose definitive 22.5% anti-dumping duties on all imports of ferro-molybdenum from China following a complaint from Euroalliages, a trade association of European ferro-alloys companies. The Commission found that dumping of Chinese FeMo had led to European producers cutting production by 44%. A provisional anti-dumping duty on imports from China had been imposed in August 2001, with varying rates up to 26.3%, but this was harmonised this year.

JDC said it was concentrating on Mo oxide products, such as high-soluble molybdenum oxide, molybdenum powder and molybdenum wire production. The bulk of these products will be targeted at the export market, in Europe, the US and South Korea, and the rest will be sold inside China.

JDC said it expected to produce approximately 6,000 t of Mo oxide in 2002 and that despite disruptions by floods in the region in June its deliveries were back to normal by the year-end.

Jilin Nickel acquired Daheishan Mining Corp. in early 2002 and began the investment of Yu100 million (US$12 million), buying the formerly state-run mining operation in China's north-eastern Jilin province. Despite its large reserves Daheishan Molybdenum had run into difficulties in the past few years and was reorganised in June 2002. Out of it, Jilin Nickel Daheishan Ltd was established. Production was suspended until 2003 while the new owner made essential repairs.

Luoyang Luanchuan Molybdenum Group began an expansion of its mining and concentrating facilities in mid-2002, raising its output from 8,600 t/y of

molybdenum concentrate to 10,000 t/y in the second half of the year. The group said it intends to use all of its increased output for its own FeMo and molybdenum oxide plants. In 2001, the group had the capacity to produce 3,000 t/y of oxide and 8,000 t/y of FeMo, most of it destined for US and South Korean markets.

As European customers scrambled to find alternative sources of FeMo to replace the Chinese supply, European converters found themselves relying on Chinese Mo oxide sources for conversion into FeMo within the EU. A hitch developed with some shipments rejected for exceeding permitted lead levels. European converters said they were able to use 55% Mo oxide material with up to 0.2% Pb, but that several shipments had exceeded that level (with some reported as high as 0.4% Pb) and had been refused.

It appears primary output of molybdenum in China dropped by about 1% in 2002 to 28,000 t. Domestic consumption increased to 13,000 -14,000 t. On the other hand, the higher price levels in the merchant market seen in the second half of the year, as well as some opportunistic exports in the third quarter, meant the US dollar value of Chinese exports of molybdenum products in 2002 rose by 37.1% to US$359.21 million, according to China's National Customs and National Non-ferrous Information Center. The value of imports dropped by nearly 9% to US$51.92 million. Net exports rose in value by an impressive 50% from 2001 levels, to US$307.29 million.

CIS

Supply from the CIS also dipped in 2002. The producers in Armenia, Kazakhstan and Russia have had some difficulties in the past in getting their product to export markets but they were quick to spot the opportunity to sell FeMo into the EU market closed to Chinese material.

Chelyabinsk Electrometallurgical Works in Russia restarted ferro-molybdenum production after a two-year stoppage. The firm is toll-processing concentrates for FeMo for export. The plant has a capacity to produce 20,000 t/y of ferro-molybdenum.

Uzmetal Technology, a molybdenum joint venture between Israeli company Metek Metal Technology, and Almalyk and Uzbek Heat Resistant Metals, based at Almalyk Mining and Metallurgical Complex in Uzbekistan, commenced molybdenum production in 2002. The US$19 million project is reported to use 600 t/y of molybdenum concentrates supplied by Almalyk for further processing at the Uzbek Heat Resistant Metals Combine in the city of Chirchik near Tashkent. Uzmetal said it will produce finished molybdenum products and has begun modernising the plant's facilities. For its part, Amalyk said it would make cost savings by keeping the processing of concentrates close to its existing operations.

Western Europe

In early 2002, Chile's Molymet acquired Belgian alloys producer Sadaci for €8.5 million from French group Eramet. The purchase was handled through Molymet's Dutch subsidiary Strategic Metals BV. Sadaci roasts molybdenum

concentrates to produce a variety of products: oxides, FeMo and sodium molybdate (as well as ferro-vanadium and manganese alloys).

Molymet is now one of the major global producers, with operations in San Bernardo, south of Santiago, Chile, with annual capacity of 68 Mlb and in Cumpas, in northern Mexico, known as Molymex, with annual capacity of 22 Mlb of Mo oxide.

Molymet's acquisition raises a question mark over the European merchant market for molybdenum, since Sadaci has been largely used by traders as a tolling facility. Of the other three plants in Western Europe only Eastlink Lanker's plant in the UK is 100% dedicated to tolling. Climax in the Netherlands has some capacity currently used for tolling, and Treibacher in Austria is thought to use all its existing capacity for its own account.

Eastlink Ferro Alloys in Glossop, formerly known as Ferro Alloys & Metals Ltd, was purchased by Russia's Eastlink Lanker in 2000. The company said it intended to switch some of its 7,000 t/y FeMo capacity over to the production of FeV, using vanadium pentoxide feed from its parent group's Tula plant. FeMo production was intended to drop to 4,000-4,500 t/y.

Commet Holding of Hong Kong also plans to enter the molybdenum market with its acquisition of Golden Ferro-Alloys and USK Ferro-Alloys, both in southern India.

Although the major existing business is the production of 3,500 t/y of ferro-silicon, the company said it was planning to build a molybdenum conversion plant also in southern India to produce around 2,400 t/y of FeMo. Commet said it expects the plant to come into operation in the third quarter of 2003.The Mo oxide and concentrates will come from China.

Demand

In the past eight years, global molybdenum consumption has grown by approximately 2-3% per annum, and estimates for 2002 consumption generally fall in the range 127,000-135,000 t. The iron and steel industry accounts for about 75% of molybdenum consumption, of which 30-35% goes to the stainless steel sector. The stainless-steel industry has enjoyed an annual growth rate of around 4% over the same period and this had helped molybdenum demand.

The growing market for high-strength, low-alloy (HSLA) steels containing molybdenum has also been a good market for molybdenum and the International Molybdenum Association (IMOA) and others have promoted the use of duplex steels, which contain relatively high levels of molybdenum.

The second-largest consuming sector for molybdenum after iron and steel is the catalyst industry (including automotive catalysts as well as industrial catalysts for the petroleum and petro-chemical sectors). Catalyst demand has grown by over 5% annually since 1990 and Roskill said annual growth is set to continue at around 3-4% through to 2005.

Consumption by end-use

Although the stainless steel and catalyst sectors have been largely responsible for much of the growth in world molybdenum demand since the mid-1990s, demand from the superalloys and molybdenum metal markets has also shown significant growth. Superalloys are used in aerospace applications, which account for around 75% of this market, but large turbines for the gas industry are a high growth area as well.

Geographically, Europe is the world's largest molybdenum-consuming region, accounting for around one-third of total demand in 2002. The size of the European stainless- and special-steel industries, as well as a growing catalyst production, is largely responsible for its dominance in this market. The US still consumes about 22% of all molybdenum and Japan a little less than 15%.

China's consumption is now thought to be over 7% of the global total and still rising. It is expected that rising Chinese demand for molybdenum could see that nation emerge as a net importer, as its steel industry continues to expand.

Global molybdenum demand is predicted to grow by an annual 2-3% over the next few years. The highest growth rate is expected to come from non-metallurgical applications such as lubricants, pigments, water treatment, polymers and airbags, where demand is predicted to increase annually by about 3-4%, but these non-metallurgical applications still account for only about 7% of global demand at present. The petroleum refining and automotive catalysts sector continues to be a strong market for molybdenum.

The IMOA has been conducting workshops in the US to promote increased use of molybdenum-containing stainless steels in the construction industry. The IMOA estimates that the US construction industry uses approximately 6,000 t/y of 316-type stainless (which has a 2% Mo content) and the potential for that market is as high as 60,000 t/y.

The IMOA's work includes reaching thousands of construction industry decision-makers through publishing case studies, drawing up selection guidelines as well as conducting workshops.

Price

A look at the 20-year price graph for molybdenum shows it has a stable range of US$2.00-5.00/lb for oxide and US$6.00-12.00/kg (US$2.70-5.40/lb) for ferromolybdenum. This 'natural range' has been exceeded only rarely in the past 20 years, most notably in 1994-1995. This was caused by a sharp rise in demand from growing world steel production which molybdenum producers were unable to meet, coupled with delays and cancellations of exports from China.

The main reason behind the low molybdenum prices in the second half of the 1990s was the large stocks of material in the marketplace. The growing proportion of supply as a by-product of copper mining and the concomitant

reduction in the ability of primary mines to act as 'swing' producers was also an important factor.

In 1999, the supply-demand balance changed, and in that year it is thought demand exceeded supply by as much as 6,000 t, the first drop in the large surpluses, which dogged the late 1990s. Further cuts in North American production in 2000 and 2001, and some growth in demand, saw a steady drawdown in the large global stocks of molybdenum products. However, until stocks had dropped by a significant amount there had been almost no movement in prices.

The price for molybdic oxide in drums started 2002 at about US$2.60-2.65/lb in Europe and slightly higher in the North American market. The FeMo price started the year at about US$7.20/kg with Chinese material fetching a lower price of perhaps a dollar less per kg. However, the trend line was already well established, and starting from a low of US$2.30-2.35/lb in November 2001 for Mo oxide until June 2002 the price mounted steadily.

The shortage seemed visible earliest in the spot market for concentrates in Asia and by April concentrates were reportedly selling in China for over Yu23,500/t compared with Yu23,000/t in March. There were reports of Chinese mines holding back on deliveries in the second quarter. Chinese FeMo was changing hands in April for US$6.60-6.80/kg fob.

By late May, the free market in Europe had become excited as merchants bid up the price of near-term material. German consumers were reported to be buying small amounts of FeMo for US$12/kg duty paid. Arcelor was tendering for 300 t of oxide and 250 t of FeMo in late May for July/August and that background demand saw some merchants report transactions in excess of US$13.80/kg on May 31, while oxide prices were said to be nearing the US$6/lb level.

It was dubbed ‘moly mania’ and by June the spot market was peaking as traders talked of shortages and pointed to the annual four-week shutdown from mid-June at Belgium's Sadaci toll-conversion facility as the crunch period for any summer spot business. The market peaked with reports of FeMo changing hands in the range of US$17-20/kg duty paid. Oxide offers were said to be in the range of US$6.50-8.00/lb in Europe.

Those much-talked-about benchmark prices – US$20 for Western grades of FeMo and US$8/lb for Mo oxide – may never have been actually achieved in the June madness. What is clear is that most consumers stayed out of the market that month and the inter-merchant frenzy died away.

Major stainless-steel mills, whilst buying as little as they could in the June frenzy, were quick to establish ‘molybdenum surcharges’ for third quarter and fourth quarter sales of their stainless products, atop their existing nickel and chrome surcharges. This all came at a time when base prices for many stainless products were on the rise anyway.

As an example, the world's biggest stainless-steel producer, Arcelor, raised its prices in early July for austenitic and ferritic stainless for the fourth quarter. Arcelor increased prices for austenitic material by around €50/t for 304 material, and €100-150/t for 316. The increases took the base price for CR 304 sheet to €1,450/t, and 316 sheet to €2,000/t. Ferritic stainless prices increased to an average of €1,300/t.

The price increases came on the back of previous rises in the first and second quarter, and were based on improving demand. Alloy surcharges were also set to increase, particularly for 316 material because of the spike in molybdenum prices. ThyssenKrupp Stainless quickly followed but with a slightly different alloy surcharge mechanism.

Anglo-Dutch steelmaker Corus announced new rates later in the year for its alloy and scrap surcharges for deliveries within the European Coal and Steel Community area and Norway. The surcharge for molybdenum was set at £4.65/t and its surcharge for nickel at £2.25/t; surcharges for vanadium and chromium remain unchanged at £0.00. The surcharges applied to alloy hot-rolled narrow strip and included high-strength alloy, medium- and high-carbon alloy and stainless steels produced at the company's Brinsworth Strip Mill in Rotherham, UK.

Meanwhile the spot markets retraced their price rises back down throughout the second half of 2002, and, by October, FeMo spot prices had dropped back to around US$10/kg, and oxide was changing hands at US$4.20-4.40/lb.

By November spot oxide prices in Europe had dropped to US$3.16-3.50/lb and FeMo was selling at under US$7/kg. The sudden collapse of a lucrative spot market in Europe apparently prompted some Chinese suppliers to tighten up sales late in the year and the prices rallied again. Chinese FeMo parcels were once again reported to be fetching US$8.50-9.50/kg fob early in 2003.

Outlook

After years of ample supplies it is now clear that the molybdenum market entered a period of relative shortage in 2001 after drifting into a supply shortfall against consumption perhaps as far back as 1999.

The large overhang of stocks which kept prices low in the period raises the biggest question in the molybdenum market. These stocks were suggested to be as much as 18,000-20,000 t at the end of 2000. Are they really all gone? Or is the fact the market fell back so sharply in July-November proof that there was more material in warehouse than the merchants were admitting back in May and June? How much is still in the market now ready to come out at a higher price? These uncertainties dog the market into 2003.

It would appear that in such an environment the traditional 'swing' producers, such as the Henderson, Thompson Creek, Questa and Endako mines will have a great deal of control over the future supply/demand balance for molybdenum. It was largely those operations, and others within Phelps Dodge and Grupo Mexico which cut back sufficiently in 1999-2001 to help the market

recover from the huge overhang of stocks which had caused the poor prices of the preceding six years. The cutbacks have at long last had a significant impact on prices. Conversely, should the 'swing' producers jump back into higher production rates on the back of improved prices there is little doubt that the balance could be tipped back towards oversupply.

Oversupply drifted into undersupply in 1999 when demand exceeded supply for the first time in several years, by as much as 6,000 t (13 Mlb). Production cuts in North America in 2000 helped to accelerate the undersupply but it was not until 2001 that this global stock reduction was acknowledged and led to higher prices for molybdenum products in the free market.

The other significant factor in the supply/demand balance and equally slow to be acknowledged, is the changing levels of Chinese molybdenum exports.

Primary output of molybdenum in China dropped by about 2.84% in 2001 to 28,200 t and another 1% to about 28,000 t in 2002 while domestic consumption steadily increased to 13,000-14,000 t. China's special steel production was estimated to have risen by almost 7% last year, to about 15 Mt and accounted for over 10,000 t of molybdenum consumption nationally.

The higher levels of domestic consumption meant lower Chinese exports in 2002 of approximately 14,000-15,000 t of net molybdenum production but this net figure masks a complex trade of imports and exports of the various molybdenum products. For example, imports of molybdenum concentrate, and exports of roasted Mo sand and ferro-molybdenum, increased.

The growing steel sector in China is expected to consume a progressively greater amount of domestic production so it is possible that China may eventually become a net importer of molybdenum products. Certainly, as Chinese exports slow (even temporarily as in mid-2002) there is already a significant effect on free-market price levels.

The percentage of molybdenum production coming from copper-mining operations has grown by an annual average of around 2.5% since 1980 and was estimated at about 76% in 2000. Clearly, if this rising trend continues and prices remain in the range that has typified the past 20 years, the future of some primary mines looks uncertain, particularly those in areas with high labour and energy costs. But a mothballed primary capacity, which is quick to jump on the prospect of higher prices, is also the immediate answer to any cries of shortage in the market.

The final factor on the supply side is recycling. Recovery of molybdenum units from spent catalysts is increasing because of environmental legislation that prevents the disposal of such catalysts. Catalyst recycling is estimated to be growing at 5% annually in Europe and North America, and by as much as 8% annually in the Asia/Pacific region. This is now equivalent to approximately 3,000 t/y of molybdenum.

In the five years following 2000, world molybdenum demand is predicted to grow by 2-3% each year. The expansion in demand is not likely to be evenly spread, however, with European growth estimated at 5% annually, Asian (including China) at more than 8%, while in the US and Japan demand is expected to grow by around 2-2.5%.

World demand for stainless steel is approaching 17 Mt/y, and for flat products is close to 13 Mt/y. It has enjoyed 5% growth over the past 20 years, ahead of other metals and a forecast for growth from 2001 to 2005 indicates that stainless is expected to average over 5% per annum.

The highest growth rate is expected to come from non-metallurgical applications where demand is predicted to increase annually by about 3-4% on the back of the continued growth in the petroleum refining and automotive catalysts sector.

Growth will also continue to be heavily influenced by stainless and special steel producers, who will continue to be the dominant consumers. Growth in other steel sectors may be quite flat, although current preferences for HSLA steels will contribute towards moderate growth in the alloy steel sector.

Superalloys are highly dependent on aerospace applications, which account for around 75% of this market. However, large industrial turbines, notably for the gas industry, could become more important as this industry is predicted to grow rapidly, particularly in Europe and Central Asia where new large gas pipelines are needed.

Research into new applications continues, particularly in high-molybdenum duplex steels, and in the industry itself there is innovation. Treibacher of Austria has developed a new product called Molybdenumquick. Described as more homogeneous and less dense than standard molybdenum the product comes in briquettes, so there are less fines, and it is said to dissolve faster in the steel melt.

In August 2002, just as the molybdenum mania was ebbing in the spot markets, Alcoa Inc. announced that it had developed three new aluminium alloys for use in the Airbus A380 super-jumbo airliner scheduled to debut in early 2006. The Alcoa alloys combine aluminium with metals such as cobalt, hafnium, molybdenum and titanium.

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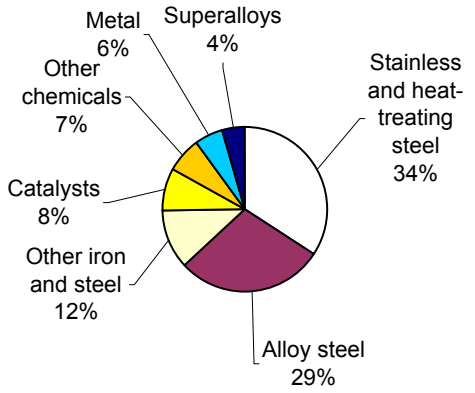
Table 1
Molybdenum Production ('000 t)

	2000	2001	2002e
Canada	6.83	7.0	8.2
Chile	29.1	33.0	34.0
China	28.9	28.2	28.0
CIS[1]	6.3	7.0	6.5
Mexico	6.8	7.0	5.5
Peru	7.1	7.5	9.5
US	41	37.6	32.6
Others[2]	2.94	3.0	3.5
Total	**128.9**	**130.0**	**128.0**

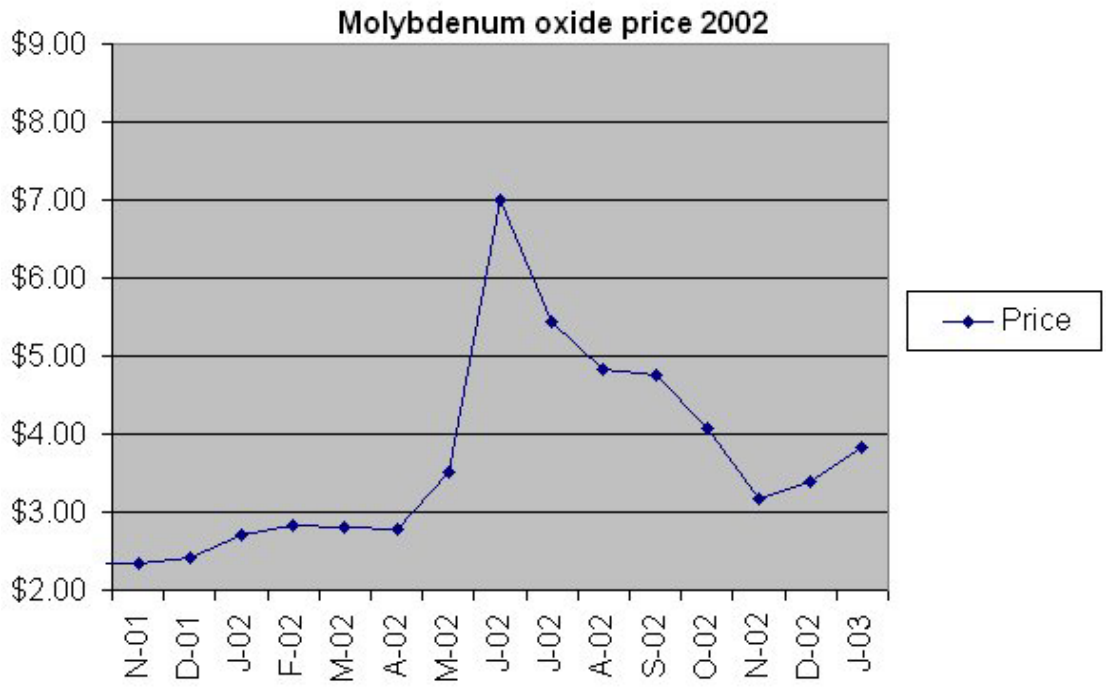
Source: USGS Mineral Commodity Summaries. Notes: Production from North Korea, Romania, Turkey and the former Yugoslavia is not included.
[1] Armenia, Kazakhstan, Kyrgyzstan, Russia and Uzbekistan. [2] Chiefly Mongolia and Iran.
e estimate.

Consumption Pie Chart



Source: Industry estimates.
Notes: Other iron and steel includes tool steel, high-speed steel, cast iron and welding rods. Other chemicals include lubricants, pigments, water treatment, polymers and airbags.

2002 price chart next page



Drummed molybdic oxide free market price per lb Mo