

Molybdenum (Mo)

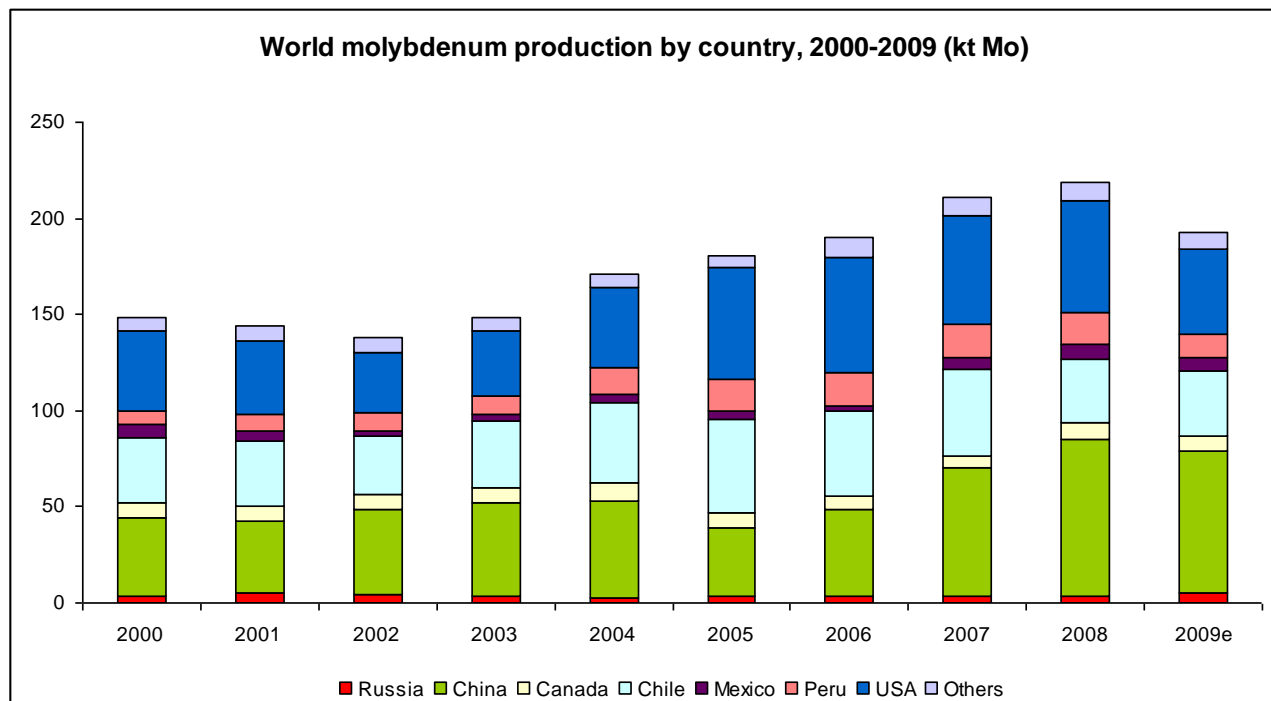
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Molybdenum **production** is concentrated in a relatively few countries, with China, the USA and Chile accounting for 80% of total world production in 2009. US production historically dominated world molybdenum production, but as it declined Chilean output increased. Chinese molybdenum production was the largest in the world from 2002 to 2004 but fell sharply in 2005 because of government-enforced mines closures. It then more than doubled between 2005 and 2008, to again become the largest in the world. US production, the second largest, rose steeply in 2004 and 2005, but is estimated to have fallen sharply in 2009. Chilean production also increased in the mid 2000s, but has since declined because of falling grades in copper ores.

Primary production of molybdenum is concentrated in North America, China and Russia. Although Russian production comes from copper molybdenum porphyries, copper output is minimal, and the deposits are worked for their molybdenum content. In Chile and Peru, molybdenum is produced as a by-product of copper mining and mine output is dependent on the copper market, although molybdenum recovery can be optimised sometimes at the expense of copper recovery.



Source: Roskill "Molybdenum: Market Outlook to 2014"

Eleven companies producing between 2.5kt and 35ktpy of molybdenum accounted for about two thirds of world molybdenum mine production in 2008, a further nine or ten companies produced more than 1kt, with the remainder coming from numerous small producers, mainly in China. Freeport McMoRan in the USA and Codelco in Chile are the biggest producers.

World molybdenum production by company, 2008

Freeport McMoran	16%
Codelco	9%
Southern Copper	8%
China Molybdenum	7%
Jinduicheng	6%
Thompson Creek	5%
Rio Tinto	5%
Antofagasta	4%
Xstrata	2%
Others	38%

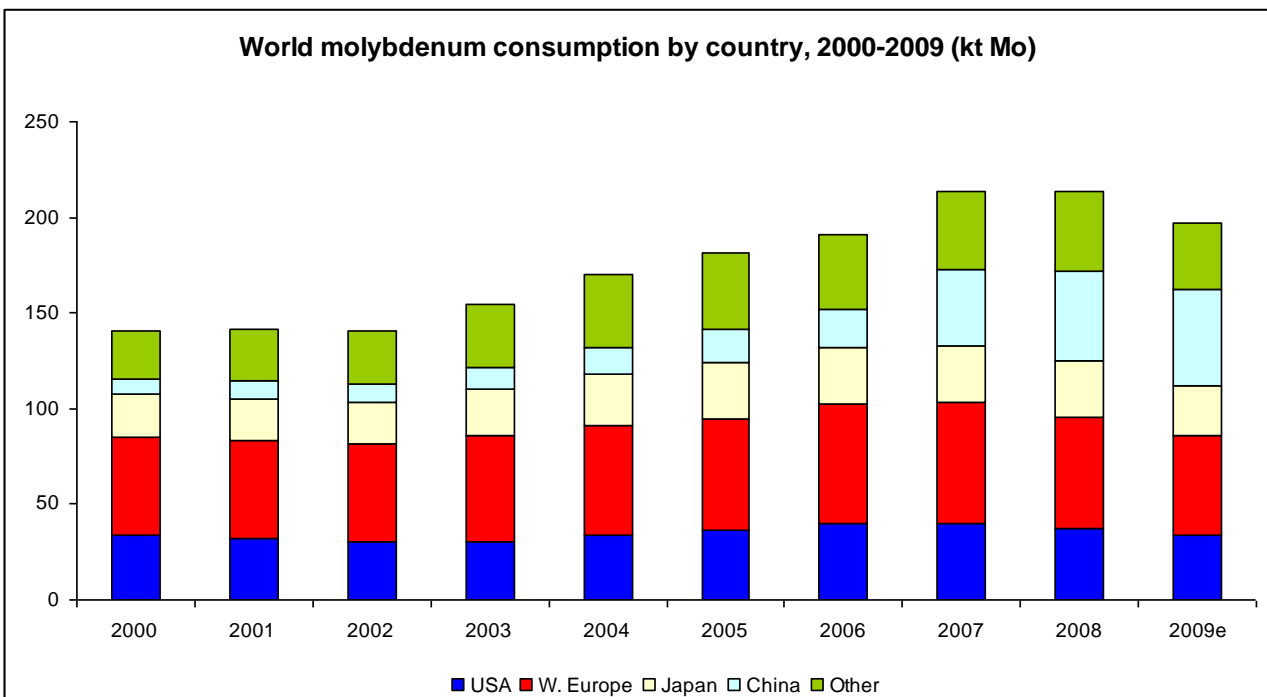
Source: Roskill "Molybdenum: Market Outlook to 2014"

Development of **new mine capacity** to meet future demand is concentrated in North America, Australia and China. Potential new mine projects include Eureka Moly, Mount Hope; Northern Dynasty, Pebble; Freeport McMoRan, Climax mine; Avanti Mining, Kitsault and Moly Mines, Spinifex Ridge.

World **consumption** has grown strongly since 2000, with an annual average growth rate of 5.4% for the period 2000 to 2008, compared with global GDP growth of 3.4%py over the same period.

In 2009 China was the only country/region where consumption increased year-on-year. Indeed, Chinese demand is estimated to have risen by 5.3% in 2009, compared to an overall decline in world consumption of 7.5%.

World molybdenum consumption by country, 2000-2009 (kt Mo)



Source: Roskill "Molybdenum: Market Outlook to 2014"

The principal drivers in the molybdenum market are as follows:

- increased use of stainless and other steels containing molybdenum in process, power and desalination plants.
- greater use of Advanced High Strength Steels (AHSS) in pipelines and motor vehicle components.

- the ability of alloy steels containing molybdenum to function in harsh conditions leading to increasing use in drill rods and bits used to access oil and gas reserves thousands of metres underground.
- growth in nuclear power generation and replacement of components in existing nuclear power stations providing significant markets for high grade molybdenum-containing stainless steel.
- demand for nickel-molybdenum and cobalt-molybdenum catalysts in the production of ultra low sulphur diesel as production of diesel fuelled cars and light trucks has increased consistently over the past 10 to 15 years in both North America and Europe.

Molybdenum consumption by end-use, 2009	
Stainless Steel	24%
Full Alloy Steel	16%
Tool & High-Speed Steel	11%
High Strength Low Alloy (HSLA)	10%
Carbon Steel	9%
Catalysts	8%
Metal & Alloys	6%
Cast Iron	6%
HPA/Superalloys	5%
Others	5%

Source: Roskill "Molybdenum: Market Outlook to 2014"

Chemical composition of some typical molybdenum-containing stainless steel (wt% balance Fe)						
Type	Mo	Cr	Ni	N	C	Other
Austenitic:						
434L	1.0	17	-	0.35	0.02	0.18Mn
Nirosta 4113	1.15	17	-	-	0.08	1.0Mn, 1.0Si
S31050	2.0	24	21	0.10	0.02	-
Nirosta 4521	2.15	18.5	-	-	0.03	1.0Mn, 1.0Si
Nirosta4561	2.25	17.8	12.5	-	0.02	2.0Mn, 0.5Si
316/316L/LN	2-3	16-18	10-14	-	0.03	2.0Mn, 1.0Si
S31653	2.5	16.5	11.0	0.12	0.03	-
317L	3.0	17.5	13	-	0.03	-
Duplex:						
S32205	3.2	21-23	4.5-6.5	0.08-0.20	0.03	2.0Mn, 1.0Si
Nirosta 4539	4-5	20	25	≤0.15	0.02	2.0Mn, 0.7Si
S32507	4.0	25	7	0.27
FS10	4.0	29	2
Super grades:						
NO8904	4.3	20	25	0.05	0.02	-
836L	5.4	23.1	24.9	0.17
254 SMO	6.1	20	18	0.2	...	0.75Cu
AL-6XN	6.0	20	24	0.2
NO8926	6.4	20.5	25	0.20	0.01	Cu
654 SMO	7.3	24	22	0.50	0.01	3.5Mn,Cu

Source: Roskill "Molybdenum: Market Outlook to 2014"

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