

# **Molybdenum Supply Forecasting**

November 2008 Update

The original of the article below paper was published in the July of 2007 issue of “Mining Engineering” magazine. Since then there have been significant developments that make an update of the article appropriate. The major developments of the past year affecting markets, existing production, and potential new mines are listed below followed by the article which has been updated to reflect the new information.

## **Recent Developments – 2007 & 2008**

Molybdenum prices seemed to have found a home in the US\$30- to US\$35-per-lb. range for the past couple of years. Even as most other base metals went into freefall during past few months, moly prices held. However, as fears of world recession or depression spread in late October of 2008, the bottom dropped out. Moly prices fell swiftly through US\$20 all the way to US\$11 per lb., a level some market observers reckon may be very near the bottom.

Why the sudden price break? There is currently no futures market for moly, so prices are determined by current trades between consumers, producers and some traders. There is no buffering of pricing that might be expected if futures contracts were available for trading. About 80% of world moly production is consumed in the steel industry to make high-strength steel. Moly is bought primarily by steel mills in anticipation of, or as a result of, orders for specific jobs. With high world economic growth and lofty oil prices (moly is used in oil industry drill steel and pipelines), steel mill operators had been quite confident of a smooth stream of orders. However, as the U.S. credit crisis spread around the world and fears of a world recession have grown, there is a new level of uncertainty surrounding future projects that use large amounts of high-strength steel. So steel mills just stopped ordering moly and even cancelled some orders already placed. This left many moly traders with unsold inventory. Panic selling set in as the credit lines of these traders were revoked.

It is possible that this quick sell off could be followed by a fairly rapid recovery as the financial crisis is resolved, fears are soothed by actual knowledge of the extent of a possible world recession, and the order flow from steel mills resumes. In the longer term, the demand for moly should outpace world economic growth. There will be a need for new oil production and nuclear plants, both of which consume large quantities of moly. Governments around the world are considering economic stimulus plans that include large infrastructure projects. And new uses for the metal continue to be found. The case for a return to high long-term moly prices depends to some extent on continued high world economic growth. But the specifics of moly demand may support higher prices in the longer term, even if we see slower growth around the world.

Existing producers are not forecast to be able to increase molybdenum production and any increase in world consumption will require the opening of new mines. Conventional economic thought is that the price of a commodity in an expanding market will be set at the marginal cost of bringing in new production. The marginal cost of bringing the new moly projects on stream

is estimated at something north of \$15 per pound.

**2008 Moly Price & Production:** World production for 2007 was 444 million lbs. moly, an increase of 8.7% over 2006. World production in 2008 is estimated at 472 million lbs., up 6.3% over last year. There are some reports of moly stockpiling in China, so it could be that world consumption will grow by something less than 6.3% in 2008.

**Climax Mine:** In early November of 2008, Freeport announced its intention to delay construction at Climax and reduce production at its Henderson Mine by 10 million pounds per year. Earlier, Freeport had committed US\$500 million to reopen the Climax mine. Mill testing was scheduled for the fourth quarter of 2009, and 2010 production was estimated at 28 million lbs. moly. Announced full capacity is 30 million lbs. moly per year, or about 6% of world production. If markets grow by the historical average of 4.5%, the addition of Climax production to the moly market might have created an oversupply situation in 2010.

Many industry observers believe Freeport will use the Climax mine to meter production to levels that maintain good market prices. Together, Freeport's Climax and Henderson mines could produce about 70 million lbs. per year, or about 15% of world production (also located in Colorado, Henderson is the world's largest primary producer of molybdenum). Freeport's choice is to either produce at high levels and get depressed prices, or cut back production and get higher prices. Obviously, Freeport has made the decision to reduce moly production in the short term. Metering production at these mines is relatively easy as they are primary moly producers; it's more difficult at copper mines where moly is a byproduct. Freeport says that Climax production could be doubled to 60 million lbs. moly per year if market conditions warrant, though many market observers believe the odds of this expansion going forward are low. Their view is that Freeport is "sabre-rattling" to discourage the opening of other large moly mines.

**Mt. Hope:** General Moly has been working toward bringing its Mt. Hope project in central Nevada into production by late 2010 or early 2011. The company says the project will produce 40 million lbs. per year for its first five years, and capital costs are estimated at more than US\$1 billion. As is the case with Climax, this production may create an oversupply situation. However, unlike Climax, where Freeport has the financial strength and the market presence to meter production, it is likely Mt. Hope will be highly leveraged, thus making it difficult for General Moly to reduce production in the face of market surpluses.

**Chile:** In Chile, molybdenum production of state-owned Codelco is forecast to be much reduced in 2008 and 2009 due to lower moly grades in their copper-moly operations. Codelco produced 68 million lbs. moly in 2006, 60 million lbs. in 2007, and is projecting 50 million lbs. in each of 2008 and 2009.

**China:** The Chinese economy has grown at annual rates near 10% for the past 20 years. Data from the U.S. Geological Survey indicate that 2007 moly production in China increased by 36% over 2006, up 35 million lbs. to 132 million lbs. The USGS's explanation is that Chinese mines that were closed in 2005 for environmental and safety concerns are coming back into production. In July, Ryan's Notes reported that molybdenum production at China's state-authorized mines in the first half of this year totaled 68 million lbs., a 21% increase over 2007. If that rate continues

for 2008, China would produce 162 million lbs., a 23% increase over last year. However, because of the earthquake in Shaanxi province, mine shutdowns for safety checkups in Henan province, and the prohibition of the use of explosives near Beijing around the time of the Olympics, production of moly will likely slump in the third quarter.

The author's estimate for Chinese production is 145 million lbs. for 2008. Because of the uncertainty of production, consumption and export data that comes out of China, and the fact that China now accounts for about a quarter of world molybdenum production, the overall reliability of world production and consumption forecasts is much less than might otherwise be the case.

**New Projects Delayed:** The credit crisis has already had an impact on new moly projects. In addition to the delay of Climax, in early November, Inca Pacific Resources announced that it would cancel its orders for long-lead time equipment at its Magistral moly project in Peru, and focus on obtaining its permits before deciding on mine construction. Thompson Creek announced the suspension of the development of the Davidson Project in British Columbia and Quadra took a similar step at its Mamlbjerg Project in Greenland. It would not be unreasonable to assume that similar announcements will be forthcoming for most of the larger planned projects. This will certainly delay new moly production.

**2009 Through 2011 Forecast:** If moly markets grow by the historical average of 4.5% annually over the next three years, and no other new mines are developed between 2009 and 2012, it is estimated there will be supply deficits of 6, 6, 37, and 45 million pounds respectively between 2009 and 2012. If moly markets grow at 7% per year over the same period, it is estimated there will be a supply deficits of 18, 31, 76, and 191 million pounds respectively in 2009 through 2012. So production from new operations will be needed, or demand will need to grow at rates lower than the historical average.

### **Acquisitions:**

There have been some significant copper/moly company acquisitions during the past couple of years:

Aluminum Corp. of China (Chinalco) purchased Peru Copper, owner of the Toromocho copper-moly project in Peru, in August 2007. The price paid was \$6.60 per share, or **C36¢ per lb. of moly equivalent**. A scoping study for Toromocho may be developed over the next year. The porphyry copper deposit, in central Peru, hosts almost 1.4 billion tonnes of proven and probable reserves grading 0.51% copper, 0.018% moly and 7.1 grams silver per tonne. An additional measured and indicated resource of 601 million tonnes of 0.37% copper, 0.016% moly and 6.8 grams silver has also been calculated.

In March, China's Jinchuan Group acquired Tyler Resources, owner of the Bahuerachi copper-moly project, also in Peru. Jinchuan paid \$1.60 per share for a total of \$214 million, or **C51¢ per lb. of moly equivalent**. A scoping study was completed on Bahuerachi last year and a preliminary feasibility study is in progress.

The price paid for Bahuerachi was for a project that has one of the lowest moly-equivalent grades (0.068%) of all the copper-moly projects that could be in production within the next five to 10 years. For example, Inca Pacific's Magistral grades 0.129% moly equivalent, and Inca Pacific is currently valued by the market at about 3¢ per lb. of moly equivalent.

Western Troy Capital Resources has the MacLeod Lake moly-copper project in Quebec. Its moly-equivalent grade is 0.175% and Western Troy is valued by the market at about 5¢ per lb. of moly equivalent. For comparison, the weighted average moly equivalent grade of existing primary and byproduct surface moly producers is about 0.11 percent.

Earlier this year, Kobex Resources withdrew from its agreement with US Energy to develop the Lucky Jack (Mt. Emmons) moly project in Colorado. Kobex indicated it withdrew because of its perception that permitting the mine would take longer than first thought. In August, Thompson Creek Metals optioned the project from U.S. Energy, with Thompson Creek able to earn 75% of the project by spending US\$400 million.

**World Economics & Project Financing: The case for long term high molybdenum prices depends to a great extent on continued high world economic growth. The recent turmoil in world credit markets will likely impact this, but no one is certain of the extent of the problem. Even though there is uncertainty, the recent crisis may not have a huge impact on world molybdenum demand. The credit crisis may have a more immediate impact on molybdenum project developers where their projects must rely on debt for project financing. This could delay some of the larger planned projects such as Mt. Hope or Spinefex that are not controlled by the larger mining companies and this may constrain new production.**

## Introduction

The dramatic increase in molybdenum prices from the low of less than \$2.50/lb in 1999 to over \$40/lb in 2005 certainly caught the attention of molybdenum mine owners and exploration project developers. Since 2005, and up until October of 2008 prices stabilized in the low \$30 per pound area. The huge price increase has motivated most existing producers to expand production and is motivating those with molybdenum prospects to accelerate the development process for earliest possible production. Unknown is how much new production will come from existing mines, how much production will be needed from new mines if demand continues to grow and how many potential new mines might be available to meet future demand. And of course the billion dollar question is whether molybdenum prices will remain high, or will they fall back to the low levels seen during the 1980's and 1990's? This paper will attempt to answer these questions in a way that will help molybdenum project developers and financiers plan for the future.

## Molybdenum Markets

There are some unique characteristics of molybdenum markets that must be understood before looking at molybdenum production, demand and price data.

**By Product Producers:** About 52 percent of current molybdenum supplies are generated as a byproduct of copper mining. Many of the large copper mines around the world have small percentages of molybdenum in the ore, typically 0.02 to 0.03 percent Mo. It is relatively simple and cheap to recover the molybdenum. This means that a large portion of molybdenum supply comes from very low cost producers. During periods of low or declining demand, byproduct producers have been in control of prices. Primary producers have found it difficult to compete in such times since market prices are at or below their marginal cost of production (cash costs). It should be recognized that many of the new copper mines expected to be in production in the next few years will be producing copper from oxide ores using the low cost solvent extraction electrowinning (SX/EW) process. Mines using this process do not recover molybdenum. So even though recent high copper prices have encouraged expansion at existing mines and the opening of new copper mines, a proportionate increase in byproduct molybdenum production is not likely.

**Low Price Elasticity:** The molybdenum market has shown very low price elasticity in recent years. With the recent higher prices, there has actually been an increase in demand, just the opposite of what classical economics would predict. This is partially because about 80 percent of molybdenum production is used as an alloying additive in steel. Typical molybdenum steel may have only a quarter or one-half percent molybdenum. So even though molybdenum prices are high, these high prices don't translate into a substantial impact on the price of the steel to the consumer. Some consumers in this market have expressed the opinion that large changes in price cause more stress than the actual price level. Steel makers must bid jobs for future delivery. If the price of molybdenum increases dramatically between the bid date and the production date, the steel maker may be required to absorb the difference. Prices of alternative alloying agents

have also increased, but molybdenum is the only element that is suitable for a substantial number of applications.

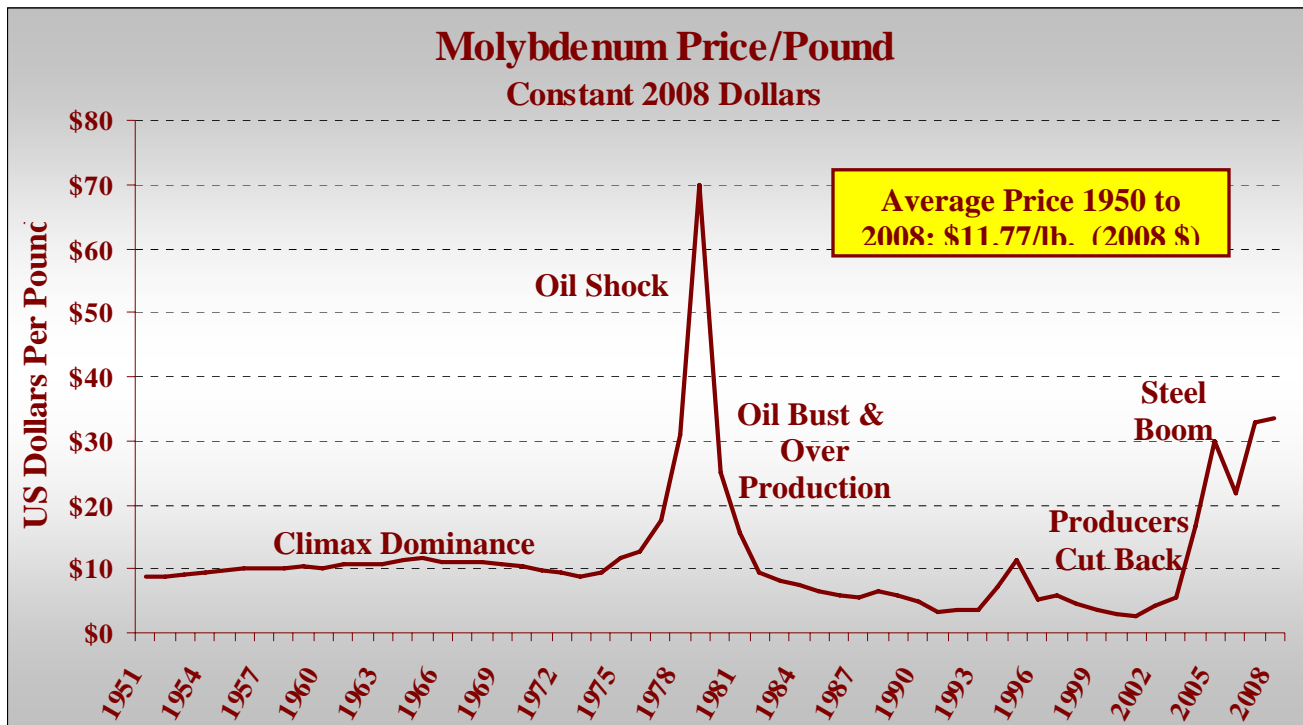
**No Futures Market:** There is currently no futures market for molybdenum. The prices listed in periodicals are based on actual sales for the prior week. There are a few molybdenum traders around the world that will inventory the metal, so this gives the market some stability. When commodity futures are available, current prices tend to be influenced by the expectations for future supply and demand. There tends to be some buffering of short-term supply shortages or surpluses and commodity markets are more efficient. For example, molybdenum prices have been somewhat more volatile and markets less efficient than copper markets. This may change soon as the London Metal Exchange (LME) has announced it will soon offer molybdenum contracts.

**Mo vs. MoS<sub>2</sub>:** We see MoS<sub>2</sub> grades quoted by some producers and project developers. In fact, some Chinese production figures are quoted in tonnes of MoS<sub>2</sub>. Mo is 60 percent by weight of pure MoS<sub>2</sub> (Atomic weights: Mo - 95.94, S - 32.06). Also be aware that the price quoted in magazines or newspapers is usually Molybdenum Oxide. The quoted price is only for the contained Mo by weight. This article will always use pounds of Mo for price and production statistics.

## Historic Data

The best source of free historical information on most commodities is the Minerals Information Team of the U.S. Geologic Survey (USGS). World molybdenum production and price data are collected and updated monthly, and data are available going back to early in the 20th Century. Figure 1 shows molybdenum prices between 1950 and 2008 in constant 2008 U.S. dollars. The Consumer Price Index was used to adjust real prices to 2008 dollars. The following section will look at some major time frames to see what may have influenced prices during those times.

Figure 1



**1950 to 1980:** Climax Molybdenum dominated markets up until about 1980. The Climax Mine in Leadville, Colorado, produced about 50 percent of the world supply during this period. In 1976, the Henderson Mine, also owned by Climax, began producing and reached full production in 1981. Prices were stable until the late 1970's as Climax based its pricing primarily on the cost of production at the Climax Mine. Prices rose above the stable trend in 1977 primarily in response a supply shortage and the belief at the time that demand would continue to increase at about 7 percent per year as it had over the period between 1962 and 1976. The oil boom of 1979 gave a boost to molybdenum demand as steel makers were asked to produce large amounts of molybdenum steel for drilling and pipelines. The supply shortage encouraged copper producers to add molybdenum circuits and new primary mines opened. The boom didn't last and there was a glut of drilling rigs for many years following the boom causing low demand for molybdenum from that market segment.

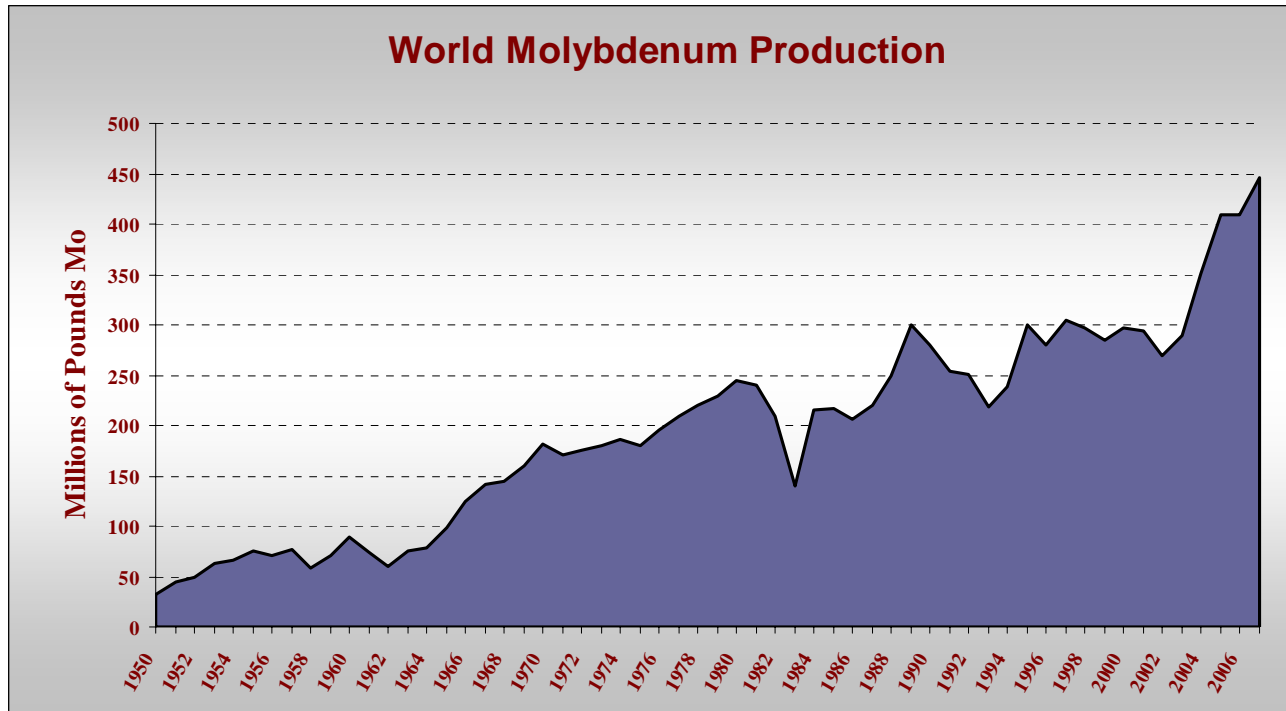
**1986 to 2001:** The high prices of 1977 to 1981 encouraged new production from both primary and byproduct mines and demand fell to levels in 1986 where byproduct producers dominated the market. The Climax Mine ceased production and was put on “care and maintenance” in 1986. Because byproduct producers’ costs were so low, molybdenum prices fell to levels well below the historical average of about \$12/lb (2008 dollars). During this period, Cyprus Minerals purchased Amax (parent of Climax Molybdenum), so Cyprus then controlled the Climax and Henderson Mines. The Climax Mine was reopened for a short period in 1995 during a period of price strength. In 1999, Phelps Dodge bought Cyprus. Phelps Dodge had a number of byproduct producing mines in Arizona and New Mexico. It recognized that high production of molybdenum was hurting the market. So in 2001, Phelps Dodge reduced production of molybdenum (along with reductions in copper production) at most of its mines, hoping to see higher prices. Kennecott and Chile’s Codelco also reduced production of molybdenum.

**2004 to 2008:** A world boom in steel production occurred in 2004 and has continued through 2008. Chinese steel production increased, the demand for pipeline steel and drill steel has been strong, and the use of molybdenum in the production of low-sulfur diesel fuel has been expanding. These effects on the demand side, along with earlier production cutbacks and constraints in molybdenum refining (roaster) capacity, sent the price of molybdenum to almost \$40/lb (2008 dollars) in mid-2005. Late in 2005, it was thought the high prices could not last as additional roaster capacity came on stream and production increased. The expectation was that prices would pull back and average about \$15/lb in 2006. This did not happen and prices were steady at the \$25/lb level throughout most of 2006 and into 2007.

Between 2006 and 2008 there have been production problems in Chile, Mexico, and China that were not foreseen. At Chuquicamata in Chile in 2007, the main conveyor was damaged by a rock slide. In Mexico in 2007, there were a number of strikes. In China, a number of small mines were temporarily closed in 2005 due to environmental and safety issues. So there was actually a slight reduction in overall supply in 2006, thus keeping supplies short and prices stable.

Figure 2 shows molybdenum production during the same period as the price chart above. USGS data was used through 2006. The USGS estimates for 2007 has been adjusted slightly by the author to reflect data gathered on a mine by mine basis. Molybdenum consumption for each year varies a bit from production, but not enough to be significant when looking at long-term trends. The author’s estimate for 2007 is based on the best information available from all sources as of August of 2008 and is within 1 million pounds of the USGS estimate for the year.

Figure 2

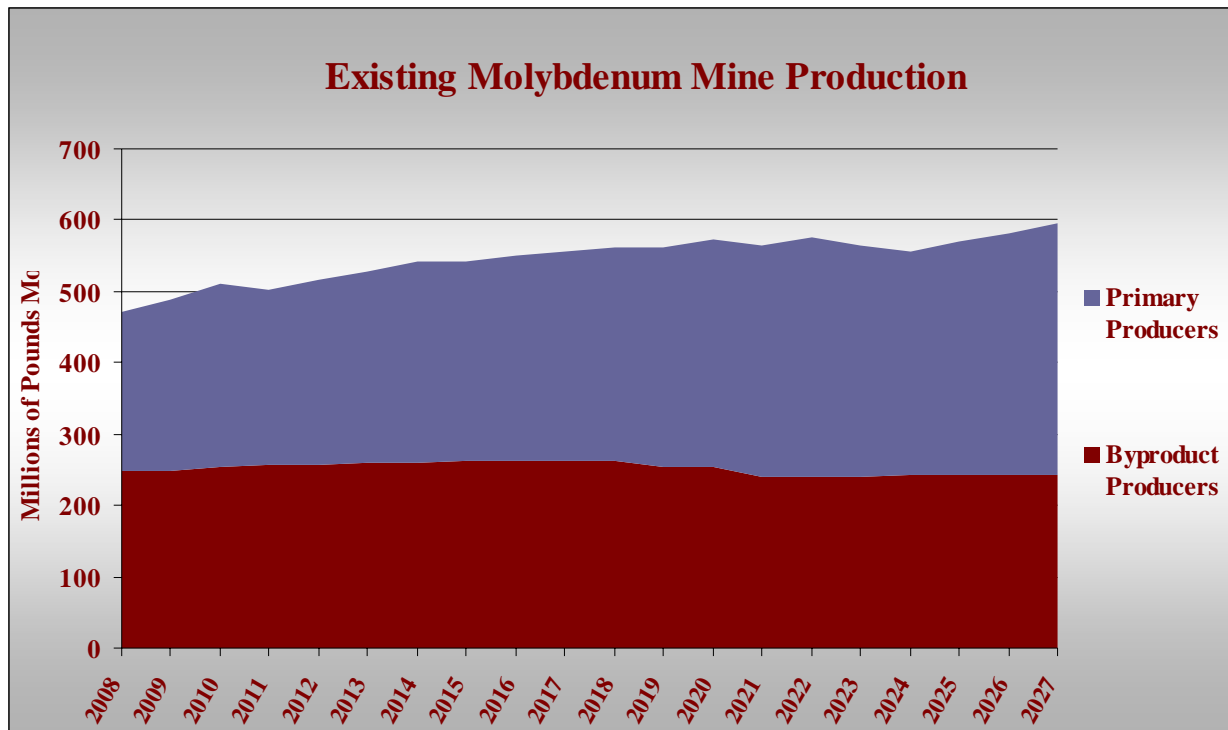


If just the 1990 to 2007 period is considered, it would look like there has been a huge increase and breakout from a trading range of around 300 million pounds per year. But a look at the trend since 1950, shows that the recent growth has not resulted in a breakout from the long-term trend of about 4.5 percent per year. Of course, the 4.5 percent average growth rate has not been smooth. Between 1963 and 1981, a period of almost 20 years the growth rate averaged 7.7 percent. From 1981 to 1983, there was a 42-percent drop. From 1989 to 1993 there was a 27-percent drop. And, from 2003 to 2007 there has been a 69 percent increase.

## Supply & Demand Forecast

Figure 3 is a forecast for production or announced production expansion at existing mines until 2027. No new mines are included in the forecast. An exception to this is the inclusion of the Climax Mine with restart scheduled for 2010. Table 1 shows the forecast numbers by year for the next 12 years along with a tabulation of 4.5% and 7% growth rates in consumption. Obviously, if demand grows by the historical rate of 4.5 percent, the market will be in a deficit condition for all of the forecast years. If demand grows by 7%, the market will be even larger deficits.

**Figure 3**



	Millions of Pounds Mo												
	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>
<b>Byproduct Producers</b>	247	250	255	256	258	260	261	261	262	262	262	253	254
<b>Primary Producers</b>	<u>225</u>	<u>238</u>	<u>255</u>	<u>246</u>	<u>260</u>	<u>267</u>	<u>280</u>	<u>280</u>	<u>289</u>	<u>294</u>	<u>301</u>	<u>310</u>	<u>319</u>
<b>Total</b>	<b>472</b>	<b>487</b>	<b>510</b>	<b>502</b>	<b>518</b>	<b>527</b>	<b>541</b>	<b>541</b>	<b>550</b>	<b>556</b>	<b>563</b>	<b>563</b>	<b>573</b>
<b>4.5% Growth</b>	472	493	515	539	563	588	615	642	671	701	733	766	800
<b>Deficit/Surplus</b>	0	-6	-6	-37	-45	-61	-74	-101	-121	-145	-170	-203	-228
<b>7% Growth</b>	472	505	540	578	619	662	708	758	811	868	928	993	1,063
<b>Deficit/Surplus</b>	0	-18	-31	-76	-101	-135	-167	-217	-261	-311	-366	-430	-490

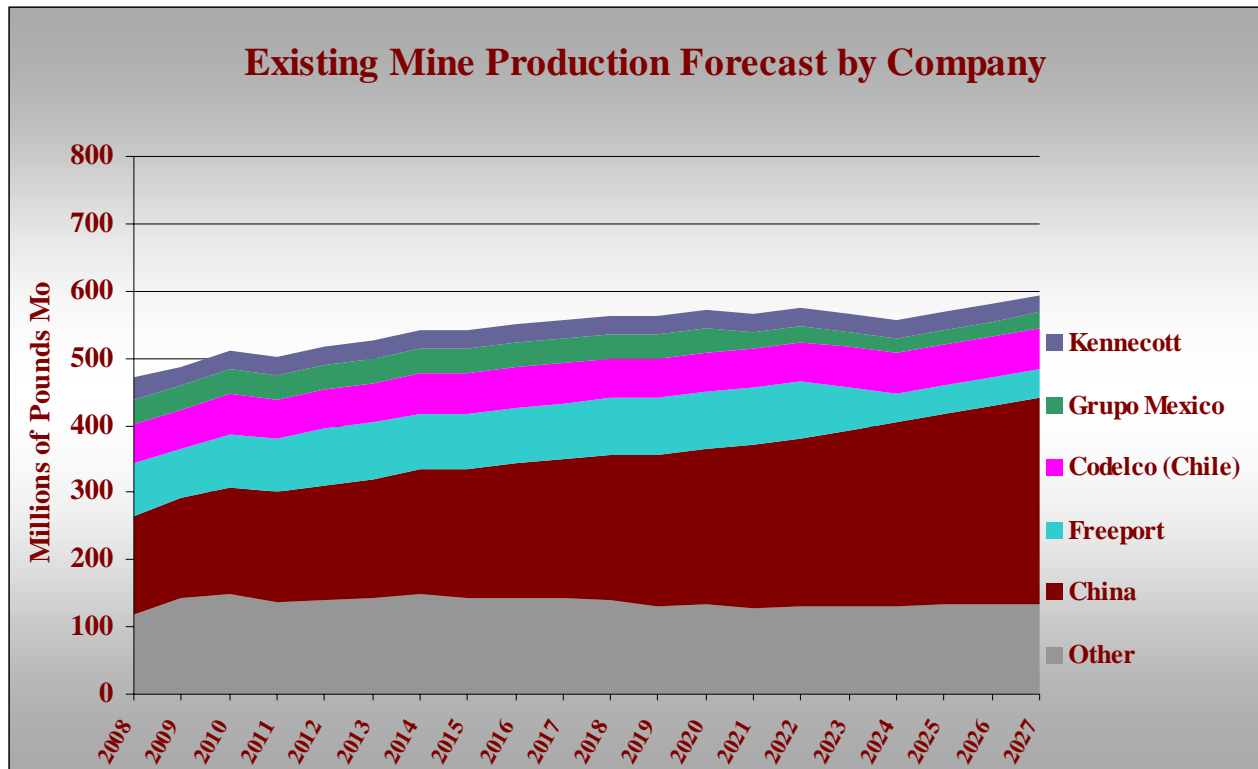
**Table 1: Existing Producers Forecast Production**

It should be recognized that published forecasts of current reserves or mine life are typically not an accurate reflection of the future production from a mine. More often, mine life is extended through improvements in mining methods, the discovery of new ore zones, or both. For example, Thompson Creek has redesigned its Thompson Creek Mine pit based on a projected molybdenum price of \$10/lb. Previous planning used a price of \$5/lb. This will allow higher strip ratios and the inclusion of lower grade ores that would have previously been considered waste. Many producers have published such plans and they have been included in the forecast for future production and mine life used in Figure 3. Where there is no production forecast or reliable reserve published by a particular source, such as China or other countries where reserve reports are not available, the author assumed there would be a 4-percent annual growth in production.

**One of the conclusions one might draw from Figure 3 is that demand would need to drop by 40 percent or so to reach a level where byproduct producers will again be dominant in setting prices. Production in 2007 and 2008 has grown at estimated rates of 8.7% and 6.7% respectively. It is evident that substantial production from new mines will be needed early in the next decade.**

Figure 4 is the same chart showing the share of the market held by the major producers. Note that currently, more than 50 percent of production is generated by Phelps Dodge, Codelco, Grupo Mexico and Kennecott. Note also that China is forecast to produce about 30 percent of world supply in 2008.

**Figure 4**



**Molybdenum Demand:** It is beyond the scope of this article to look into the details of all the market segments of molybdenum consumption to develop a forecast of molybdenum demand growth. However, it seems that market observers with expertise in molybdenum market segment consumption tend to fall back to a conclusion for overall demand that is based on the historical growth rate of approximately 4.5 percent a year. Apparently it is next to impossible to forecast demand in many market segments because it would require information on the future plans of all steel producers around the world – information that the producers are reluctant to share as it would likely end up in the hands of competitors.

**There are indications the growth rate during the next 10 years or so may be higher than the historical average due to the potential for higher levels of world economic growth, pipeline construction demand, atomic waste storage container demand, and increased use of molybdenum in petroleum refining and other new markets for the metal.** China's economy continues to expand at a high rate, although recent forecasts are lower than the 11 percent annual rate of prior years. China has more than 550 million tonnes of annual steel production capacity, as much as all of North American and Europe combined, and more is planned. This paper will use a 4.5 percent overall growth forecast as a base case and then look at a 7-percent growth rate for comparison.

**Probable and Possible New Molybdenum Production:** It is evident that a substantial amount of new molybdenum production will be needed, even if demand grows at only the historical average of 4.5 percent a year. What molybdenum projects are available to meet this demand? The author searched the InfoMine.com database for worldwide projects that have at least an inferred resource defined. The assumption is made that these are the projects that have a chance to be developed within the next 10 years. The author has chosen to create two categories of potential new mines that might be developed. "Probable" new mines are those that either have very high ore grades, or they have average or above average grades and are being developed by companies that clearly have the financial strength to obtain funding. "Possible" new mines are those that have average or below average grades and/or are being developed by junior companies with limited access to financial markets. Table 3 is a list of the existing molybdenum mines, Table 4 lists the "probable" new mines, and Table 5 lists the "possible" new mines.

The author has ranked the potential new projects according to type (byproduct surface, primary surface, and underground), and within each type, by moly equivalent ore grade. A copper price of \$2/lb and a molybdenum price of \$14/lb are used to calculate Mo equivalent grade (\$5/lb or \$100 per short ton unit was used for the tungsten projects). Obviously, other factors will come into play when determining which projects may make it into production. These include reserve size, location, management capability, the availability of financing, and permitting. However, when evaluating whether a particular project has relative merit, the place to start is resource quality, including grade, reserve size, location, and whether the resource can be surface mined.

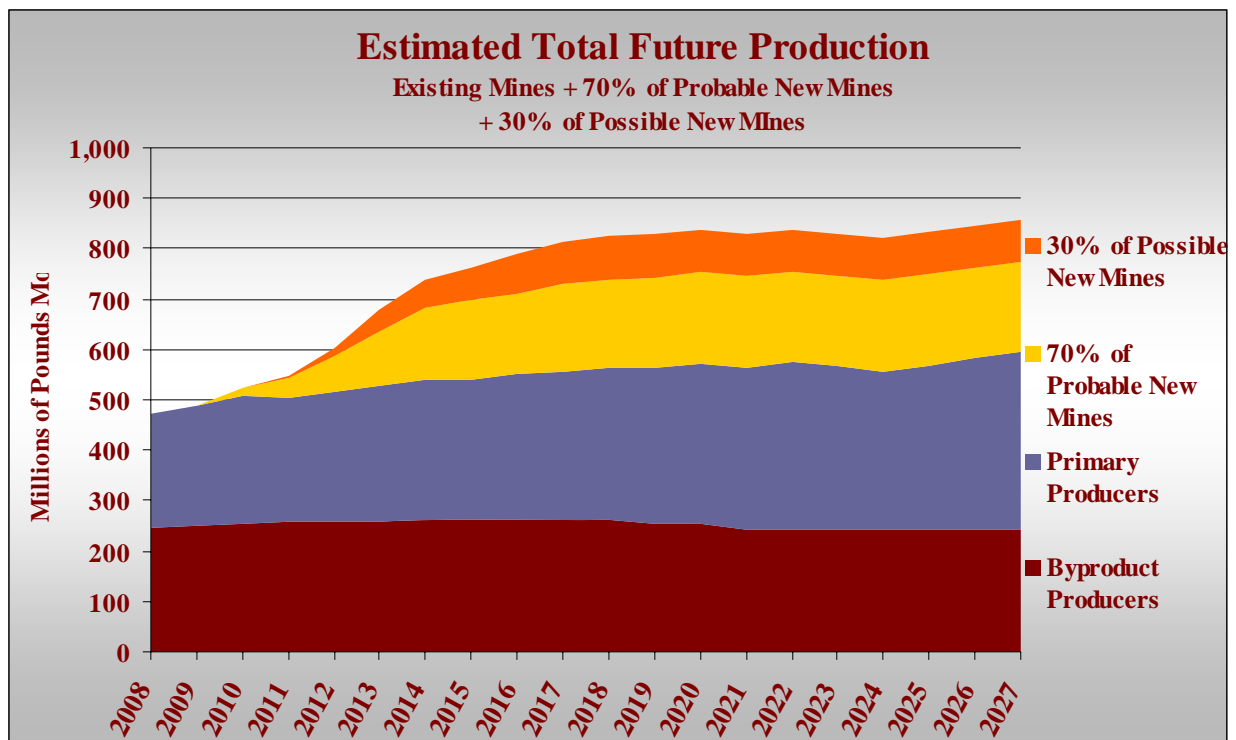
Tables 6, 7, and 8 show estimated future production by year for existing mines, probable mines, and possible mines respectively, based on the owners' published expectations. Since many of the potential new mines are controlled by companies that have yet to secure financing for development, these companies tend to present their projects in the most favorable light and thus publish optimistic schedules for production. The author has in most cases used the companies'

forecasts for future production, but in some cases the published production schedule has been delayed a year or two.

If prices for molybdenum remain at current levels, it can be assumed that most, if not all the potential new mines are economic and have a good probability of coming on stream. However, it should also be recognized that the process for bringing any new mine into production is filled with difficult hurdles and challenges. Another factor is that the first projects to obtain financing will likely bump other large projects back at least a few years. Once a few large projects are committed, the remaining large projects will find it more difficult to secure financing.

Figure 5 adds potential new mine production to existing mine production. Rather than passing judgment on individual potential new mines, the author has chosen to account for the uncertainty of specific projects by including 70 percent of probable new mine production and 30 percent of possible new mine production in the forecast of overall mine production. Table 2 shows the forecast numbers by year until 2020 along with a tabulation of 4.5% and 7% growth rates in consumption. **If demand grows at the historical average of 4.5 percent, the market will have surpluses between 2010 and 2019, after which, it will be in a deficit condition. If demand grows at 7 percent, the market will be in a surplus condition between 2012 and 2015 and all other years the market will have deficits.**

Figure 5



**Table 2: Existing, Probable & Possible Forecast Production**

	Millions of Pounds Mo												
	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>
<b>Byproduct Producers</b>	247	250	255	256	258	260	261	261	262	262	262	253	254
<b>Primary Producers</b>	225	238	255	246	260	267	280	280	289	294	301	310	319
<b>70% of Probable New Mines</b>	0	0	14	42	70	109	143	156	161	173	176	180	181
<b>30% of Possible New Mines</b>	0	1	1	5	15	41	55	66	79	85	85	85	84
<b>Total</b>	<b>472</b>	<b>488</b>	<b>525</b>	<b>549</b>	<b>602</b>	<b>677</b>	<b>739</b>	<b>763</b>	<b>790</b>	<b>814</b>	<b>824</b>	<b>828</b>	<b>838</b>
<b>4.5% Growth</b>	<b>472</b>	<b>493</b>	<b>515</b>	<b>539</b>	<b>563</b>	<b>588</b>	<b>615</b>	<b>642</b>	<b>671</b>	<b>701</b>	<b>733</b>	<b>766</b>	<b>800</b>
<b>Deficit/Surplus</b>	<b>0</b>	<b>-5</b>	<b>9</b>	<b>11</b>	<b>39</b>	<b>89</b>	<b>124</b>	<b>121</b>	<b>119</b>	<b>113</b>	<b>91</b>	<b>62</b>	<b>38</b>
<b>7% Growth</b>	<b>472</b>	<b>505</b>	<b>540</b>	<b>578</b>	<b>619</b>	<b>662</b>	<b>708</b>	<b>758</b>	<b>811</b>	<b>868</b>	<b>928</b>	<b>993</b>	<b>1,063</b>
<b>Deficit/Surplus</b>	<b>0</b>	<b>-17</b>	<b>-16</b>	<b>-29</b>	<b>-16</b>	<b>16</b>	<b>31</b>	<b>5</b>	<b>-20</b>	<b>-53</b>	<b>-105</b>	<b>-165</b>	<b>-224</b>

## Conclusions

- 1) The moly supply and demand balance may be maintained for at least a few years if demand grows at around 4.5% per year. The reopening of the Climax Mine in Colorado, if it begins production in 2011, should allow this to continue through the end of 2011 or 2012. After that, production will be needed from new mines and it will take a market price of at least \$15 per pound to open these new mines.
- 2) It would take a drop in demand of 30 to 40 percent in order for byproduct producers to become dominant in setting molybdenum prices. Current molybdenum producers' operating costs have risen dramatically over the past few years. So even if oversupply conditions develop in the short term, it is unlikely we will see prices below \$10/lb for the foreseeable future.
- 3) At current prices, most all of identified potential new mines will be economic and could come into production by 2015 or sooner. However, the financial community will likely not support any project that requires \$25/lb molybdenum prices for the life of the potential mine. There is a race among the junior molybdenum companies to see who can get financed first. Once one or two large projects are financed, the supply of molybdenum should be able to meet demand and securing financing for the larger potential primary molybdenum mines will be more difficult. These will need to be delayed, but they will eventually be needed as even at the lower growth rate of 4.5%, supply shortages will occur within the 20 year forecast. Of course potential byproduct mines may have less difficulty in securing financing as there will be less molybdenum price risk. Also, those projects that are controlled by large mining companies will have less difficulty in securing financing.
- 4) The potential new sources to watch are the Climax Mine in Colorado, Mt. Hope in Nevada, Bugdainskoye in Russia, and Spinefex in Australia. These are all large potential producers that could come on stream between 2009 and 2011. If all four of these mines come on stream along with a number of the byproduct and smaller projects, and demand does not grow at a rate above 4.5 percent, an oversupply condition will develop between 2010 and 2020. If a significant percentage of future production comes from highly leveraged operations, there is a risk that when oversupply market conditions occur, highly leveraged producers will face difficult choices and may have trouble meeting debt payments. Such producers may have little choice but to continue producing, even if market prices are weak. So moly prices may fall regardless of the attempts of the financially strong producers to meter production..
- 5) One of the big factors driving the large price increases seen in 2004 and 2005 was the shortage of molybdenum refining (roaster) capacity. Additional roasting capacity has been added in recent years so there is no longer this constraint. However, total worldwide roasting capacity is now at approximately 480 million pounds of moly. Since we are estimating total world consumption to exceed 480 million pounds in 2009, we may see another squeeze on moly consumers and thus another price spike.
- 6) A good case can be made for the view that, because of high economic growth rates in China,

India and other third world countries, we may be experiencing a quantum shift in world economic growth. This, in combination with the dramatic growth in new uses for molybdenum, may challenge the assumption that molybdenum demand will grow at the historic average of 4.5 percent. We may be in the beginning of one of the long periods of much higher than average growth rates that molybdenum markets have experienced. So a growth rate of seven percent or higher is not out of the question over the next 10 to 20 years.

7) The current turmoil in world credit markets may stall world economic growth but, on the other hand, new moly projects that must rely on debt for project financing are unlikely to be able to raise money for development. One industry player characterized the prospects for obtaining project financing in the current environment as “moribund.”

8) After 2020, all bets are off. It is unlikely we will see one of the 30-40% decreases in demand that have occurred in the past. If we experience even the average 4.5% growth in demand, it is unlikely that known sources will produce enough moly to meet growing demand and prices are likely to remain above US\$20 per lb. for many years.

Up until the past few weeks, most observers did not see a world recession or even a return to historically average world economic growth rates. However, this view is obviously changing and we are now seeing a much greater chance that world economic growth may stagnate in the short term. But even with a world recession, demand for moly may continue to rise and new mine production will be needed -- although certainly not as soon as what was being forecast just a month or so ago. With the delay of many new projects, maxed out production or declines expected at existing mines, and even minimal growth in moly demand, prices north of \$15 per pound are likely in the long term.

**Table 3: Existing Molybdenum Producers**

<u>Property</u>	<u>Company</u>	<u>Country</u>	<u>Tonnes Reserves</u>	<u>Grade %Mo</u>	<u>Grade %Cu (W)</u>	<u>Mo Equiv. Grade</u>
<b><u>Byproduct Producers</u></b>						
Sierrita	Freeport	US - Arizona	1,053,000,000	0.030%	0.260%	0.067%
Bagdad	Freeport	US - Arizona	590,000,000	0.022%	0.350%	0.072%
Chino	Freeport	US - New Mexico	56,000,000	0.016%	0.630%	0.106%
Cerro Verde	Freeport	Peru	1,456,000,000	0.014%	0.443%	0.077%
Morenci	Freeport	US - Arizona	235,000,000	0.022%	0.530%	0.098%
Toquepala	Grupo Mexico (SCC)	Peru	1,940,000,000	0.036%	0.598%	0.121%
Cuajone	Grupo Mexico (SCC)	Peru	1,595,000,000	0.020%	0.566%	0.101%
La Caridad	Grupo Mexico (SCC)	Mexico	932,000,000	0.026%	0.348%	0.076%
Mission	Grupo Mexico (Asarco)	US - Arizona	n/a	n/a	n/a	n/a
Bingham	Kennecott (Rio Tinto)	US - Utah	612,000,000	0.045%	0.510%	0.118%
Codelco Norte (Chuququi.)	Codelco	Chile	5,163,000,000	n/a	0.660%	0.094%
Salvadore	Codelco	Chile	63,000,000	n/a	0.610%	0.087%
Andina	Codelco	Chile	5,698,000,000	n/a	0.780%	0.111%
El Teniente	Codelco	Chile	4,204,000,000	n/a	0.910%	0.130%
Los Pelambres	Antofagasta	Chile	1,667,000,000	0.017%	0.640%	0.108%
Highland Valley	Teck/Cominco	Canada - BC	451,000,000	0.007%	0.380%	0.061%
Antamina	Mitsubishi/Xstrata/Teck/BHP	Peru	303,000,000	0.035%	1.110%	0.194%
Collahuasi	Anglo/Xstrata	Chile	1,017,000,000	0.025%	1.010%	0.169%
Continental Pit	Montana Resources	US - Montana	364,000,000	0.027%	0.340%	0.076%
Minera Valle Central	Amerigo Resources Ltd.	Chile	700,000,000	0.001%	0.032%	0.005%
Agarak/Zangezur	Adarak/Zangezur	Armenia	n/a	n/a	n/a	n/a
Erdenet	Erdenet Mining Corp.	Mongolia	1,300,000,000	0.013%	0.460%	0.079%
Gibraltar	Taseko	Canada - BC	384,000,000	0.090%	0.310%	0.134%
Sarcheshmeh	National Iranian Copper	Iran	1,000,000,000	0.030%	0.737%	0.135%
Huckleberry	Imperial Metals	Canada - BC	165,060,000	0.005%	0.352%	0.055%
Shorskoye	Celtic Resources Holdings	Kazakhstan	20,000,000	0.970%	0.057%	0.978%
<b>Total/Average</b>			<b>29,951,060,000</b>			<b>0.109%</b>
<b><u>Primary Producers (Surface)</u></b>						
Ruyang/Luanchuan/Huludau	Jinduicheng Molybdenum Corp.	China	900,000,000	0.100%		0.100%
Thompson Creek	Thompson Creek Mining	US - Idaho	232,100,000	0.076%		0.076%
Endako	Thompson Creek Mining	Canada - BC	492,100,000	0.043%		0.043%
Almalyk	Almalyk	Uzbekistan				
Zhirekensky + Kyrgystan		Russia Kyrgystan				
<b>Total/Average</b>			<b>1,624,200,000</b>			<b>0.079%</b>
<b><u>Primary Producers (Underground)</u></b>						
Henderson	Freeport	US - Colorado	122,000,000	0.193%		0.193%
Questa	Molycorp (Chevron)	US - New Mexico	125,000,000	0.330%		0.330%
MAX (Trout Lake)	Roca Mines Inc.	Canada - BC	42,940,000	0.200%		0.200%
Ashdown Mine	Golden Phoenix	US - Nevada	132,000	2.900%		2.900%
<b>Total/Average</b>			<b>290,072,000</b>			<b>0.254%</b>

**Table 4: Probable New Molybdenum Producers**

<u>Property</u>	<u>Company</u>	<u>Country</u>	<u>Tonnes Reserves</u>	<u>Grade %Mo</u>	<u>Grade %Cu</u>	<u>Mo Equiv. Grade</u>
<b><u>Probable Future Byproduct Mines</u></b>						
Los Verdes	Virgin Metals	Mexico	7,050,000	0.137%	0.657%	0.231%
MacLeod Lake	Western Troy	Canada - QC	20,042,000	0.093%	0.577%	0.175%
Las Bambas	Xstrata	Peru	860,000,000	0.020%	0.930%	0.153%
Pashpap	Northern Peru Copper	Peru	101,400,000	0.049%	0.640%	0.140%
Los Chancas	Southern Copper	Peru	355,000,000	0.050%	0.620%	0.139%
Robinson	Quadra	US - Nevada	146,000,000	0.030%	0.690%	0.129%
Magistral	Inca Pacific Resources	Peru	195,500,000	0.052%	0.510%	0.125%
Pebble East	Northern Dynasty	US - Alaska	3,860,000,000	0.033%	0.580%	0.115%
Quellaveco	Anglo American	Peru	761,000,000	0.023%	0.570%	0.104%
Agua Rica	Yamana Gold	Argentina	730,700,000	0.030%	0.500%	0.101%
El Pachon	Xstrata	Argentina	980,000,000	0.016%	0.580%	0.099%
Sierra Gorda	Quadra Mining	Chile	715,935,000	0.027%	0.480%	0.096%
Toromocho	Peru Copper (Alum. Corp. of China)	Peru	1,200,000,000	0.019%	0.528%	0.094%
Tampakan	Xtrata	Philippines	2,200,000,000	0.007%	0.600%	0.093%
Quebrada Blanca (hypogene)	Teck/Cominco	Chile	1,030,000,000	0.020%	0.500%	0.091%
Esparanza	Antofagasta PLC	Chile	535,000,000	0.011%	0.550%	0.090%
Relincho	Teck/Cominco	Chile	876,000,000	0.023%	0.450%	0.087%
Petaquilla	Teck, Inmet, Petaquilla	Panama	1,115,000,000	0.015%	0.500%	0.086%
Cananea	Grupo Mexico (SCC)	Mexico	2,511,000,000	0.000%	0.577%	0.082%
Mineral Park	Mercator Minerals	US - Arizona	864,499,000	0.039%	0.150%	0.060%
Tintaya	Xstrata	Peru	n/a	n/a	n/a	n/a
<b>Total/Average</b>			<b>19,064,126,000</b>			<b>0.100%</b>
<b><u>Probable Future Primary Surface Mines</u></b>						
Malmbjerg	Quadra	Greenland	216,800,000	0.198%		0.198%
Climax	Freeport	US - Colorado	165,000,000	0.165%		0.165%
Mt. Hope	General Moly	US - Nevada	1,000,000,000	0.110%		0.110%
Bugdainskoye	Norilsk Nickel	Russia	627,000,000	0.090%		0.090%
<b>Total/Average</b>			<b>2,008,800,000</b>			<b>0.118%</b>
<b><u>Probable Future Underground Mines</u></b>						
Resolution (Cu/Mo)	Rio Tinto/BHP	US - Arizona	1,340,000,000	0.040%	1.510%	0.256%
Davidson	Thompson Creek Mining	Canada - BC	77,200,000	0.169%		0.169%
<b>Total/Average</b>			<b>1,417,200,000</b>			<b>0.251%</b>

**Table 5: Possible New Molybdenum Producers**

<u>Property</u>	<u>Company</u>	<u>Country</u>	<u>Tonnes Reserves</u>	<u>Grade %Mo</u>	<u>Grade %Cu</u>	<u>Mo Equiv. Grade</u>
<b><u>Possible Future Byproduct Mines</u></b>						
Rio Blanco	Monterrico Metals	Peru	498,000,000	0.022%	0.630%	0.112%
Cobre Grande	Linear Metals Corp.	Mexico	49,800,000	0.040%	0.500%	0.111%
Ikiztepe/Demirkoy	Anatolia Mineral Development	Turkey	200,000,000	0.050%	0.410%	0.109%
Liberty	General Moly	US - Nevada	150,000,000	0.091%	0.070%	0.101%
Ann Mason	MacMag Metals Ltd.	US - Nevada	810,000,000	0.040%	0.400%	0.097%
Galeno	Northern Peru Copper	Peru	765,000,000	0.014%	0.490%	0.084%
Rosemont	Augusta Resource	US - Arizona	493,000,000	0.015%	0.470%	0.082%
Berg	Terrane Metals Corp.	Canada - BC	513,400,000	0.037%	0.290%	0.078%
Ochtina*	Mega Moly	Slovakia	125,134,000	0.062%	0.046%	0.078%
Northern Dancer*	Largo Resources Ltd.	Canada - BC	242,000,000	0.031%	0.130%	0.077%
Getty North	Getty Copper	Canada - BC	25,650,000	0.015%	0.432%	0.077%
Red Bird	Torch River Resources	Canada - BC	81,500,000	0.065%	0.070%	0.075%
Costancia	Norsemont Mining	Peru	320,000,000	0.011%	0.430%	0.072%
Bahuerachi	Jinchuan Group (Tyler Resources)	Mexico	524,510,000	0.008%	0.400%	0.065%
Schaft Creek	Copper Fox Metals Inc.	Canada - BC	812,231,000	0.020%	0.301%	0.063%
Yandera	Marengo Mining	Papua New Guinea	660,000,000	0.013%	0.340%	0.062%
Vizcachitas	Los Andes Copper	Chile	572,000,000	0.013%	0.340%	0.062%
Morrison	Pacific Booker Minerals	Canada - BC	206,869,000	0.005%	0.390%	0.061%
Spinefex	Moly Mines Ltd.	Australia	450,835,000	0.050%	0.080%	0.061%
Okeover	Eastfield Resources	Canada - BC	56,800,000	0.014%	0.310%	0.058%
Copacquire	International PBX Ventures	Chile	396,000,000	0.043%	0.102%	0.058%
Sisson Brook*	Geodex Minerals	Canada - NB	147,900,000	0.034%	0.067%	0.058%
Pebble West	Northern Dynasty	US - Alaska	3,026,000,000	0.015%	0.280%	0.055%
Cuatro Hermonos	Virgin Metals	Mexico	763,772,000	0.021%	0.180%	0.047%
Louise Lake	North American Gem	Canada - BC	151,000,000	0.009%	0.237%	0.043%
<b>Total/Average</b>			<b>12,041,401,000</b>			<b>0.069%</b>
<b><u>Possible Future Primary Surface Mines</u></b>						
Kitsault	Avanti Mining	Canada - BC	291,000,000	0.091%		0.091%
CUMO	Mosquito Gold	US - Idaho	444,000,000	0.081%		0.081%
Creston	Creston Moly Corp	Mexico	176,900,000	0.071%	0.046%	0.078%
Bald Butte	Bolero Resources	US - Montana	105,000,000	0.071%		0.071%
Storie	Columbia Yukon	Canada - BC	85,000,000	0.068%		0.068%
Lucky Ship	Nanika Resources	Canada - BC	61,500,000	0.068%		0.068%
Chu	TTM Resources	Canada - BC	456,800,000	0.065%		0.065%
Ruby Creek	Adanac Moly Corp	Canada - BC	212,907,000	0.063%		0.063%
Ajax	Tenajon Resources	Canada - BC	552,000,000	0.062%		0.062%
Cannivan Gulch	United Bolero	US - Montana	324,300,000	0.060%		0.060%
<b>Total/Average</b>			<b>2,709,407,000</b>			<b>0.070%</b>
<b><u>Possible Future Underground Mines</u></b>						
Lucky Jack	Thompson Creek	US - Colorado	22,500,000	0.701%		0.701%
Silver Creek	Bolero Resources	US - Colorado	44,000,000	0.300%		0.300%
Kingsgate	Auzex	Australia	5,000,000	0.300%		0.300%
Copper Creek	Redhawk Resources	US - Arizona	110,000,000	0.014%	0.700%	0.264%
Victorio*	Galway Resources	US - New Mexico	28,500,000	0.130%	0.120%	0.173%
Red Mountain	Tintina Mines Ltd.	Canada - Yukon	187,000,000	0.160%		0.160%
<b>Total/Average</b>			<b>397,000,000</b>			<b>0.238%</b>

\* Co-Product is Tungsten

## Table 6: Forecast of Existing Molybdenum Mine Production

	Millions of Pounds Mo																			
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
<b><u>Byproduct Producers</u></b>																				
Sierrita	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Bagdad	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Chino	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cerro Verde	8	8	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Morenci	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Toquepala	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Cuajone	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
La Caridad	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Mission	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Bingham	33	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27
Codelco Norte (Chuququi.)	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Salvadore	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Andina	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
El Teniente	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Los Pelambres	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Highland Valley	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Antamina	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Collahuasi	7	12	13	14	15	16	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Continental Pit	7	9	9	9	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Minera Valle Central	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Agarak/Zangezur	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Erdenet	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Gibraltar	1	2	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Sarcheshmeh	5	5	5	5	6	6	6	6	6	7	7	7	7	8	8	8	9	9	9	10
Huckleberry	0																			
Shorskoye	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
<b>Sub Total</b>	<b>247</b>	<b>250</b>	<b>255</b>	<b>256</b>	<b>258</b>	<b>260</b>	<b>261</b>	<b>261</b>	<b>262</b>	<b>262</b>	<b>262</b>	<b>253</b>	<b>254</b>	<b>240</b>	<b>241</b>	<b>241</b>	<b>241</b>	<b>242</b>	<b>242</b>	<b>242</b>
<b><u>Primary Producers (Surface)</u></b>																				
Ruyang/Luanchuan/Huludau	145	151	157	164	170	177	184	191	199	207	215	224	233	242	252	262	272	283	295	306
Thompson Creek	17	29	30	12	16	17	22	14	15	13	12	12	12	12	12	12	12	12	12	12
Endako	9	10	15	17	17	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Almalyk	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2
Zhirekensky +	7	7	7	7	8	8	8	9	9	9	10	10	11	11	11	12	12	13	13	14
Kyrgystan	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<b>Sub Total</b>	<b>180</b>	<b>199</b>	<b>211</b>	<b>202</b>	<b>213</b>	<b>220</b>	<b>233</b>	<b>232</b>	<b>241</b>	<b>248</b>	<b>256</b>	<b>265</b>	<b>274</b>	<b>284</b>	<b>294</b>	<b>305</b>	<b>316</b>	<b>327</b>	<b>339</b>	<b>352</b>
<b><u>Primary Producers (Underground)</u></b>																				
Henderson	36	30	35	35	40	40	40	40	40	40	40	40	40	40	40	20				
Questa	5	5	5	5	5	5	5	5	5	5	5	5	5							
MAX (Trout Lake)	2	2	2	2	2	2	2	2	2	2										
Ashdown Mine	2	2	2	2																
<b>Sub Total</b>	<b>45</b>	<b>39</b>	<b>44</b>	<b>44</b>	<b>47</b>	<b>47</b>	<b>47</b>	<b>47</b>	<b>47</b>	<b>47</b>	<b>45</b>	<b>45</b>	<b>45</b>	<b>40</b>	<b>40</b>	<b>20</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Total Existing Mines</b>	<b>472</b>	<b>487</b>	<b>510</b>	<b>502</b>	<b>518</b>	<b>527</b>	<b>541</b>	<b>541</b>	<b>550</b>	<b>556</b>	<b>563</b>	<b>563</b>	<b>573</b>	<b>564</b>	<b>575</b>	<b>566</b>	<b>557</b>	<b>569</b>	<b>581</b>	<b>594</b>

## Table 7: Probable New Molybdenum Mine Production

Millions of Pounds Mo

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
<b>Probable Future Byproduct Mines</b>																				
Los Verdes					1	2	2	2	2	2	2	2								
MacLeod Lake						3	4	4	4	4	3	3	3	2						
Las Bambas								4	8	10	15	15	15	15	15	15	15	15	15	15
Pashpap						1	2	3	3	3	3	3	3	3	3	3	3	3	3	3
Los Chancas				3	5	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Robinson		1	1	1	1	1	1	1												
Magistral					2	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Pebble East								5	10	20	20	20	20	20	20	20	20	20	20	20
Quellaveco					3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Agua Rica					5	10	15	15	15	15	15	15	15	15	15	15	15	15	15	15
El Pachon										5	10	14	14	14	14	14	14	14	14	14
Sierra Gorda				2	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Toromocho						5	10	14	14	14	14	14	14	14	14	14	14	14	14	14
Tampakan							2	4	4	4	4	4	4	4	4	4	4	4	4	4
Quebrada Blanca (hypogene)					2	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Esparanza								2	2	2	2	2	2	2	2	2	2	2	2	2
Relincho				1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Petaquilla			2	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Cananea			4	6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Mineral Park		8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Tintaya		2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
			20	30	52	77	95	113	121	138	147	151	149	148	146	146	146	146	146	146
<b>Probable Future Primary Surface Mines</b>																				
Malmberg					7	15	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Climax				28	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Mt. Hope					3	20	40	40	40	40	35	33	31	31	31	31	31	31	31	31
Bugdainskoye					5	10	15	15	15	15	15	15	15	15	15	15	15	15	15	15
			0	28	45	75	105	105	105	105	100	98	96	96	96	96	96	96	96	96
<b>Probable Future Underground Mines</b>																				
Resolution (Cu/Mo)													5	10	15	15	15	15	15	15
Davidson				1	2	4	4	4	4	4	4	4	4	4	3	0	0	0	0	0
			0	1	2	4	4	4	4	4	4	4	9	14	18	15	15	15	15	15
<b>Total Probable New Production</b>			20	60	100	156	204	222	230	247	251	258	259	262	257	257	257	257	257	257

## Table 8: Possible New Molybdenum Mine Production

Millions of Pounds Mo

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
<b><u>Possible Future Byproduct Mines</u></b>																				
Rio Blanco						4	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Cobre Grande								1	1	1	1	1	1	1	1	1	1	1	1	1
Ikiztepe/Demirkoy								2	4	4	4	4	4	4	4	4	4	4	4	4
Liberty						19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
Ann Mason							7	14	20	20	20	20	20	20	20	20	20	20	20	20
Galeno						2	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Rosemont				3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Berg						2	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Ochtina*				2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Northern Dancer*				2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Getty North						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red Bird					3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Costancia					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Bahuerachi				1	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Schaft Creek								3	5	7	7	7	7	7	7	7	7	7	7	7
Yandera								9	9	15	15	15	15	15	15	15	15	15	15	15
Vizcachitas									2	2	2	2	2	2	2	2	2	2	2	2
Morrison				0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Spinefex				8	15	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Okeover									1	1	1	1	1	1	1	1	1	1	1	1
Copaquire										3	6	6	6	6	6	6	6	6	6	6
Sisson Brook*									1	2	2	2	2	2	2	2	2	2	2	2
Pebble West								3	6	10	10	10	10	10	10	10	10	10	10	10
Cuatro Hermonos																				
Louise Lake								1	0	1	0	1	0	1	0	1	0	1	1	1
<b>Sub Total</b>			<b>0</b>	<b>15</b>	<b>32</b>	<b>68</b>	<b>81</b>	<b>107</b>	<b>124</b>	<b>139</b>	<b>142</b>	<b>142</b>	<b>142</b>	<b>142</b>	<b>142</b>	<b>142</b>	<b>142</b>	<b>142</b>	<b>142</b>	<b>142</b>
<b><u>Possible Future Primary Surface Mines</u></b>																				
Kitsault						5	10	10	10	10	10	10	10	10	10	10	10	10	10	10
CUMO							5	10	15	15	15	15	15	15	15	15	15	15	15	15
Creston						6	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Bald Butte						3	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Storie						3	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Lucky Ship				1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Chu				2	14	14	10	11	11	9	9	8	7	8	9	9	9	9	9	9
Ruby Creek				2	14	14	10	11	11	9	9	8	7	8	9	9	9	9	9	9
Ajax								5	10	10	10	10	10	10	10	10	10	10	10	10
Cannivan Gulch					3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
<b>Sub Total</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>54</b>	<b>73</b>	<b>76</b>	<b>88</b>	<b>88</b>	<b>84</b>	<b>83</b>	<b>83</b>	<b>81</b>	<b>81</b>	<b>83</b>	<b>84</b>	<b>85</b>	<b>84</b>	<b>82</b>
<b><u>Possible Future Underground Mines</u></b>																				
Lucky Jack							8	12	15	15	15	15	15	15	15	15	15	15	15	15
Silver Creek									8	12	15	15	15	15	15	15	15	15	15	15
Kingsgate		2	3	3	3	3	3	3	3	3	1									
Copper Creek								1	1	1	1	1	1	1	1	1	1	1	1	1
Victorio*						3	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Red Mountain					7	10	13	17	20	20	20	20	20	20	20	20	20	20	20	20
<b>Sub Total</b>		<b>2</b>	<b>3</b>	<b>3</b>	<b>10</b>	<b>16</b>	<b>30</b>	<b>39</b>	<b>53</b>	<b>57</b>	<b>58</b>	<b>57</b>	<b>57</b>	<b>57</b>	<b>57</b>	<b>57</b>	<b>57</b>	<b>57</b>	<b>57</b>	<b>57</b>
<b>Total Possible New Production</b>	<b>2</b>	<b>3</b>	<b>18</b>	<b>49</b>	<b>137</b>	<b>184</b>	<b>221</b>	<b>264</b>	<b>283</b>	<b>284</b>	<b>282</b>	<b>281</b>	<b>279</b>	<b>280</b>	<b>282</b>	<b>283</b>	<b>284</b>	<b>283</b>	<b>283</b>	<b>280</b>