



Robyn Storer

Serious wake-up

The copper-mining industry faces a daunting challenge to meet the growth

THE base-metals industry is enjoying strong market fundamentals and should continue to do so for some time to come.

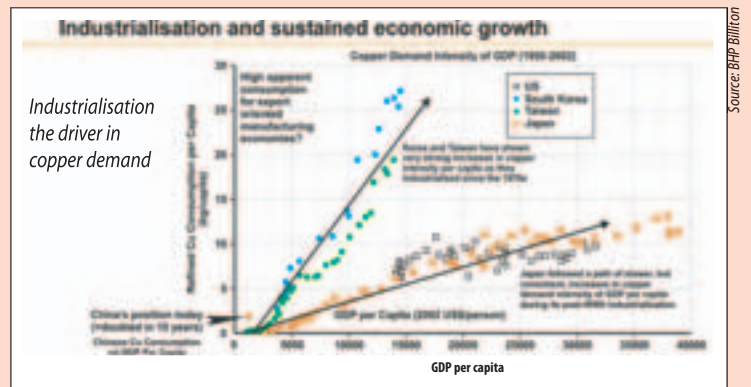
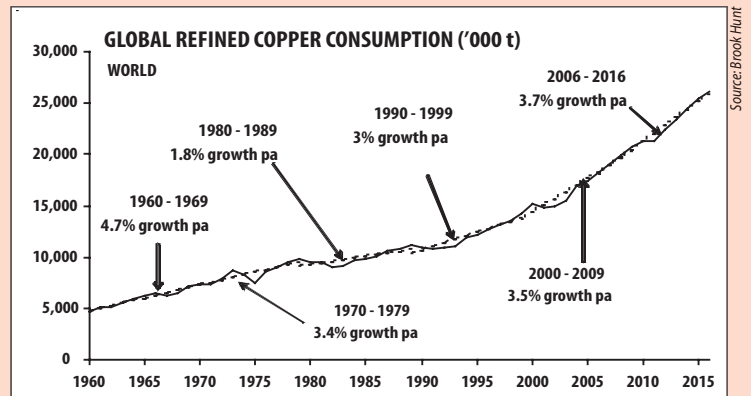
The combination of high demand growth and a prolonged period of under-investment in exploration and lack of major discoveries will continue to drive metals for decades to come.

Today's inventories of most base metals are at almost statistically insignificant levels, measured in just days of global consumption. Copper is a clear example of this trend.

Where is this demand for commodities coming from? Worldwide, is the simple answer. More specifically, China, India and elsewhere in Asia, Russia and Brazil. It is not surprising. GDP and investment are rising in these countries as people work towards bringing a North American and European standard of living to their families. There are over 2.3 billion Chinese and Indians today; nearly 40% of the world's population. By 2050, this figure is forecast to rise to 3.2 billion.

China's GDP has been growing at around 9% annually with an investment/GDP ratio of about 40%. China now accounts for 12% of global industrial production, up from 6% in 1995. Global copper demand growth rose 3% annually between 1990 and 1999, driven by urbanisation, industrialisation and infrastructure build-out largely in China. Analysts predict that copper demand in China will continue to grow at 8-10% per year to reach 6 Mt by 2010. Last year, China accounted for 20% of global refined copper demand and, by 2010, is forecast to account for 30%.

■ A 1 kg per-capita increase in China copper consumption



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Copper demand with countries in Asia: 1994-2003

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
China	798	1,143	1,193	1,270	1,402	1,484	1,928	2,307	2,737	3,065
Japan	1,375	1,415	1,480	1,441	1,255	1,293	1,349	1,145	1,164	1,202
Korea	476	540	598	621	560	784	862	849	936	901
Taiwan	547	563	544	588	584	655	628	540	656	619
India	137	116	140	160	200	263	240	293	295	312

translates into a supply requirement of 1.3 Mt/y, equivalent to the production from the development of six new major copper mines.

■ India GDP has been growing annually at about 6% with an investment/GDP ratio of around 25%. However, lagging China, India today accounts for only 2% of Asian copper demand.

THE 'OLD ECONOMY' IS PROVIDING THE BUILDING BLOCKS OF THE 'NEW ECONOMY'

The growing economies of Asia will need to consume mountains, or, in the mining context, great pits, of commodities to realise the dream of urbanisation, industrialisation and consumerism.

Commodities are a crucial component of our lives today. Our modern high-tech world relies heavily on commodities, from the silicon, silver and copper in our computer chips and the steel, aluminium, zinc and lead in our cars (a modern family car now consumes 50 lb of copper and contains over a mile of copper wiring, while, in new hybrid cars, this figure rises to 100 lb of copper metal) to the copper in our homes and electronics, nickel in stainless steel, lead in batteries, zinc galvanising, and the oil that gets all this delivered.

The means of producing these items consumes even more commodities. China, the world's leading exporter, is developing an enormous manufacturing base unequalled in history.

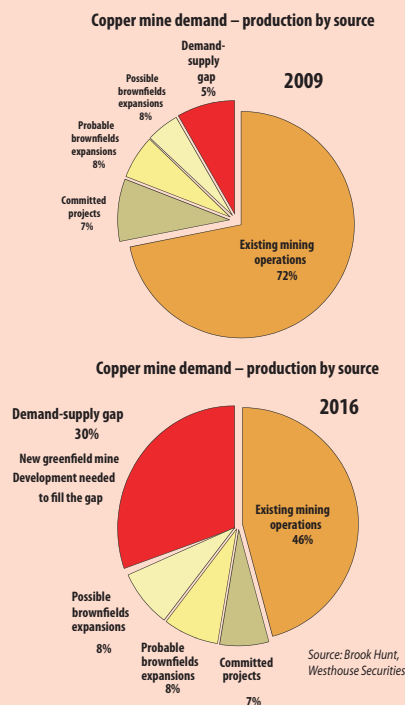
MAJOR NEW MINE DEVELOPMENTS ARE NEEDED

A projected growth in demand for copper-mine production of some 4.7% annually over the next decade translates into a growth from the current just under 13 Mt/y to a number approaching 20 Mt/y.

call for copper mining

in demand, says Westhouse Securities consulting mining analyst Robyn Storer

Copper: the challenge to meet demand



Allowing for the inevitable closure of some mines through reserve depletion means that, by 2016, only 46% of demand can be met by production from existing mines. It must also be remembered that around 20% of current production comes from solvent extraction-electrowinning (SX-EW) generally low-grade near-surface ores. While these ores have been the drivers for lower production costs over the past 20 years, they are being depleted faster than traditional sulphide ores.

The balance will need to be met from some of the already committed projects, such as the Voisey Bay nickel-copper mine development, brownfield expansion and new mine developments.

By 2016, based on the assumption that all possible brownfield expansions will go ahead, some 6 Mt/y, or just under one third of copper-mine production, will need to come from new, as yet uncommitted, copper-mine developments.

CHALLENGES TO MEET COPPER DEMAND

Can this challenge be met in the relevant time frame? The answer to this question has to be 'no'.

A period of prolonged underinvestment in exploration, and the lack of exploration success, has resulted in a dearth of greenfield projects ready to enter development. Commodities are not widgets. It takes more than capital to solve a supply shortfall. You need resources, or, more explicitly, in the mining context, reserves.

Also, in a concentrated industry with fewer and larger companies, more major mine development decisions are going to be in the hands of major mining companies which, by their very nature, tend to be more conservative decision-takers. In the case of copper, only

nine companies now produce half of the world's copper. Larger companies have less incentive to rush into new projects and are generally more disciplined when it comes to meeting investment criteria. This will be aided, no doubt, by the lessons of poor financial performance in the 1990s, the result of previous metal oversupply, which are still fresh in the memory of decision-makers. In addition, larger companies tend to focus on the more extensive, high-quality assets in their portfolios, indirectly keeping a lid on the development of marginal assets that could otherwise be put into production by smaller promoters.

30 NEW MAJOR MINES ARE NEEDED BY 2016

We need major mine and smelter developments to meet the growth in demand. The projected increase in copper-mine production needed by 2016 to bridge the gap between projected copper-mine supply and demand is some 6 Mt/y. This equates to some 30 of these new mine developments on stream by that time. This is based on the assumption that a major new mine produces around 200,000 t/y of copper in concentrate. At a grade of 0.4% Cu (at 95% recovery), this production rate equates to a mining rate of around 146,000 t/y of ore, or 53 Mt/y at a capital cost in the order of US\$1.5-2 billion (ignoring the cost of the needed increase in smelting or leaching capacity).

Based on demand forecasts, the mining industry needs to bring on the equivalent of:

- Two major mine developments per year until 2008 (assuming a major mine development of 220,000 t/y of copper).
- Four major mine developments per year from 2009-12.
- Five major mine developments per year from 2013-16.

BUT DISCOVERY RATE HAS FALLEN SHORT OF RESERVE REPLENISHMENT

According to a report by Metals Economics Group, significant copper discoveries between 1998 and 2004 have fallen well short of what is needed to replace the copper produced: a total of just 38.9 Mt of copper in reserves and resources has been discovered, while production totalled about 93.6 Mt. The statistics on copper reserves at existing copper mines indicate that there are only an estimated 27 years of reserves, and average remaining reserve grade has decreased as mines have been 'high grading'.

Taking into account market growth and reduced reserve grades, according to a recent report by Falconbridge, in 2005 the industry needed to find about 4 Mt/d of mineable copper reserves to replace daily consumption, whereas ten years ago it needed to find only 2.4 Mt/d.

The rate of discoveries needed to increase by about two-thirds; the reality is it has only increased 25%.

EXPLORATION SPEND RISING AGAIN, BUT...

World exploration budgets have risen again on the back of the resurgence in metal prices. However, the time it takes to discover, explore, engineer, permit and develop deposits has stretched. Economic hurdles are becoming

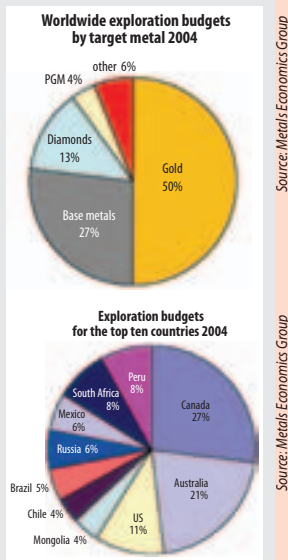
LACK OF DISCOVERIES

The lack of exploration success has stemmed from:

- Underinvestment in exploration. Faced with weak balance sheets, companies reduced both capital investments in new productive capacity and exploration budgets. In addition, consolidation in the metals and mining industry mirrored that occurring in other industries. The added motivation to consolidation was the weak cash flows from low metal prices and the synergies and resultant cost-cutting from, among others, cuts in exploration activity.

Although market capitalisation increased almost seven-fold over the past 20 years, there has been a 44% reduction in the total number of companies. Between 1997 and 2003 alone, the mining industry through mergers and acquisitions saw the demise of 39 significant mining and mineral exploration companies, effectively reducing annual world mineral exploration spending by about US\$400 million/y.

- A disproportionate allocation of exploration resources. In 2004, 63% of the world's exploration budget was spent on gold and diamonds, while 59% was spent looking in the already heavily-explored countries of Australia, the US and Canada.



higher, the result of steadily-increasing real operating costs and the sheer large size of deposits needed to keep up with production.

In addition, it is becoming more difficult to find deposits and lead times will protract, as projects enlarge and because of the need to explore and develop mines in China, Russia, South America and Asia, where infrastructure is not already in place.

NOT ALL BAD NEWS: SOME NEW MINE DEVELOPMENTS IN THE WINGS

- Northern Dynasty Mines' Pebble Cu-Au-Mo project in Alaska.
- Ivanhoe Mines' Oyu Tolgoi project in Mongolia.
- Monterra Metals' Rio Blanco project.
- Peru Copper's Toromocho project in Peru.
- The smaller copper production projects of Wolfden's High Lake and Ulu deposits in far northern Canada.

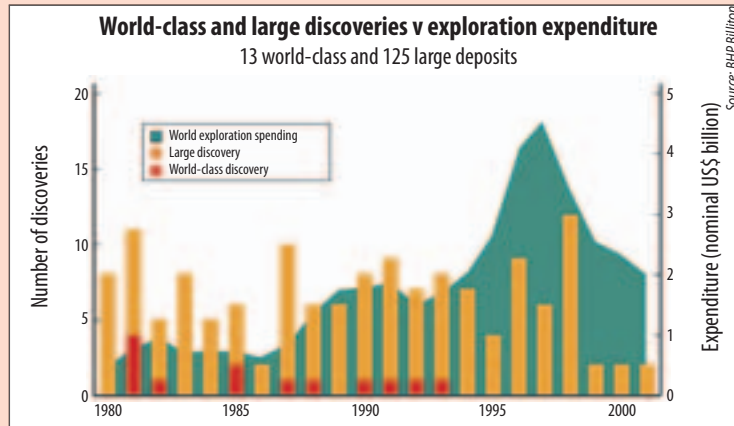
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- Continental Minerals' Xeitongmen project in Tibet.
- Gold Fields' Cerro Corona project in Peru.
- Compass Resources' Browns project in northern Australia.
- Frontera Copper's Piedras Verdes deposit in Mexico.
- Philex Gold-Anglo American's Boyongan project in the Philippines.
- Tethyan Copper's/Antofagasta's Reko Diq project in Pakistan.

There are a number of advanced exploration projects in Peru which could lead to mine development in the neighbourhood of Xstrata's Chalcobamba

project. Of the known porphyry copper deposits in British Columbia: Taseko Mines' Prosperity; BC Metals' Red Chris; Northgate's North Kemess; Placer Dome's Mt Milligan, along with the redevelopment of the Afton mine, may squeeze into production before 2016. Some of the African copper belt projects, Copper Resources' Kinsenda and Musoshi mines, and Equinox's Lumwana project, are likely to see development, although new smelting capacity in Zambia, not yet on the drawing board, would alleviate the very high transportation costs incurred to take these concentrates to a port.



Other projects – for example CVRD's Salobo, Finders Resources' Wetar, and Xstrata's Tampakan deposits, due to difficult metallurgy – will require a new approach to treatment, possibly the application of new hydrometallurgical processes to treat concentrates if they are to be in production by 2016.

More esoteric is the likes of Nautilus Minerals' proposed mining of copper-zinc from the sea floor off the coast of Papua New Guinea. Perhaps a more likely development to go ahead than the Falconbridge-Highlands Pacific Frieda River project onshore Papua New Guinea.

or Peru. Recent conflicts, some violent, have put mining companies working in Peru on alert.

In the DRC, the political turmoil of recent decades will see the need for imaginative financing and development to realise this region's undoubted strong copper production potential.

In conclusion, the metals and mining industry needs to accelerate exploration efforts if it is to meet the challenge of rising copper demand. In the meantime, metal prices will stay high, driven by strong demand that cannot be met by increased production.

Revett Silver's Rock Creek project, and, on a larger scale, Rio Tinto/BHP-Billiton's Resolution Copper project in Arizona, are likely to have environmental hurdles to overcome.

Resolution Copper is currently evaluating several mining processes to minimise environmental impact. However, based on its own projected timeline for development, Resolution is unlikely to be in production by 2016.

A cause for consternation in the list of projects which may make the grade to mine development is that a disproportionate number are in the Democratic Republic of Congo (DRC)

Robyn Storer is a consultant mining analyst at Westhouse Securities in London, and is a director of AIM-listed Maghreb Minerals, which is exploring for copper and gold at its Tan Chaffao project in Algeria and for lead and zinc at its Djebba and Fej Lahdoum projects in Tunisia. She is also a director of Siberian Copper, which has exploration properties in Russia's Far East. Westhouse Securities is nominated AIM adviser and broker to Copper Resources, Compass Resources and Maghreb Minerals, broker to Finders Resources and an adviser to Northern Dynasty Minerals, Continental Minerals and Taseko Mines



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