

COPPER

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The copper market was plunged back into crisis in 2001, after an unexpectedly strong year in 2000. Consumption fell, and production continued to rise, causing the market to move from a deficit of nearly 400,000 t, to a surplus of over 800,000 t. Stocks rose more rapidly than ever before, reversing all of the drawdown seen the year before. This punctured the optimism which had become widespread in 2000 and prices fell sharply, averaging US\$0.10/lb less than the year before.

In 2001, Western world consumption fell for the first time since 1986, and the fall was a dramatic one with demand down by 7%. However former Eastern bloc demand rose rapidly, with China and Russia major contributors, and global demand fell by a much more modest 3%. US economic weakness triggered the fall in demand, with a contraction in stocks in the global supply chain contributing. But there was also home-grown weakness in Europe and Japan. The very sharp fall in Western demand partly reflected the unwinding of some exceptional factors (coinage, the late 1990s investment and IT boom), but also reflected the shift of industrial production to China, whose growth benefited correspondingly.

Refined production growth accelerated, but the growth in mine production slowed, as cutbacks continued to have an effect. Concentrate output was flat, the increase in mine output was entirely due to increases in SX-EW output. With smelter production growth outstripping mine production, concentrate stocks were drawn down and the concentrate market tightened during the year.

Having averaged US\$0.82/lb in 2001, the price briefly slipped below US\$0.60/lb in October. This finally triggered the fresh supply response needed to steer the market away

Copper Overview ('000 t)

	1999	2000	2001	% change
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Mine Production

NAFTA	2,582	2,472	2,336	-5.5
Latin America	5,221	5,337	5,687	6.6
Other Western	2,802	3,115	3,158	1.4
World				
Former Eastern Bloc	2,185	2,383	2,408	1.0
Total world	12,790	13,307	13,589	2.1

Refined Production

Europe	1,862	1,879	1,854	-1.3
NAFTA	3,069	2,753	2,805	1.9
Asia excl China	2,491	2,753	2,891	5.0
Latin America	3,304	3,323	3,586	7.9
Other Western	854	890	1,006	13.0
World				
Former Eastern Bloc	2,887	3,195	3,360	5.2
Total world	14,468	14,793	15,502	4.8

Consumption

Asia	3,850	4,060	3,800	-6.4
Europe	3,756	4,048	3,749	-7.4
NAFTA	3,614	3,679	3,330	-9.5
Other Western	770	819	858	4.8
World				
Former Eastern Bloc	2,035	2,562	2,907	13.5
Total World	14,025	15,168	14,644	-3.5

Global balance	443	-375	858	
LME Cash (c/lb)	71	82	71	

from further surpluses. From late October onwards a fresh set of production cuts were announced led by Phelps Dodge, bolstered by BHP Billiton, and rounded off by Codelco. These made little difference to current market conditions, but set the groundwork for copper production to fall in 2002, and set a clear floor under prices. In turn this helped market sentiment, and prices rose again on the back of short covering. The fact that some of the cutbacks were at lower-cost operations distinguished them from the many cuts which had already been made by copper miners since 1998, and this has raised hopes that the industry will be more active in managing supply to meet demand in the future.

The cash LME price started the year at about US\$0.80/lb, and maintained that level through the first quarter, but from March through October prices fell sharply, reflecting the deterioration in the world economic environment, which was magnified by the effects of September 11, and rapid stock increases. The cutbacks in October marked a turning point, although prices would only rise back above US\$0.70/lb in 2002.

Market, Prices and Stocks

2001 began with bullish expectations widespread. After a substantial deficit in 2000, on the back of rapid demand growth, another deficit looked likely, and prices were expected to increase again. At the start of 2001, forecasts of US\$0.90/lb or more for the year were common.

During the first quarter, prices marked time in the low US\$0.80/lb range. Sentiment was undermined by the gathering US economic slowdown. However, prices found support in a modest fall in exchange stocks in the first two months of the year, and the news in February that Phelps Dodge was considering production cutbacks in response to high energy prices. However, by March, fundamentals and sentiment deteriorated: the US slowdown spread to Asia; copper premia softened as demand weakened; LME stocks jumped. On the supply side, Phelps Dodge's

cutbacks were smaller than had been hoped for, and a merchant was looking at the possibility of re-opening the high-cost Minera Rio Tinto (MRT) operation in Spain, underlining the resilience of high-cost mines in the face of low dollar prices.

In the second quarter prices slipped below US\$0.80/lb, as evidence mounted of the poor fundamental state of the market. Large stock rises in April triggered fund short selling, pushing the price down to levels last seen in August 1999. For a while prices were volatile, with US interest rate cuts providing support, but demand continuing to weaken.

The third quarter saw prices fall below US\$0.70/lb. July saw an enormous leap in LME stocks, confirming that the fundamentals were awful. And it was unclear where the production cuts which were needed would come from. The terrorist atrocities in New York in September caused another downward lurch in sentiment, LME stocks leapt again, and fears over the economic environment grew, triggering another wave of short selling.

The rot stopped in October after prices had hit an all time low in real terms, at just under US\$0.60/lb in September. Fresh production cuts were announced by Phelps Dodge in late October and they were much more substantial than those announced in March. While the market was digesting the implications of the Phelps Dodge cuts, BHP Billiton surprised the market in early October by announcing major cuts, including the closure of Tintaya, and cutbacks at Escondida. Codelco announced the intention of making cutbacks, and then confirmed them in December. Rumours of additional cuts, many with little substance, swirled around the market and helped support a short covering rally.

In spite of the fresh cutbacks, and the resulting rally, the year ended on a sombre note. Enron collapsed, filing for Chapter 11 in December before finally imploding. It had become a major provider of LME liquidity through its Enrononline trading system, and

LME price volatility increased as a result of its demise. It had also been a major player in the physical market, both in cathode and concentrate, and there were fears that it would deliver large tonnages of cathode to the LME. Of more fundamental concern than the collapse of Enron, was a further sharp drop in consumption in December. In Europe many fabricators shut very early for Christmas. As a result, exchange stocks continued to rise rapidly through the end of the year.

Trends in Reported Stocks (‘000 t cathode)

	1998	1999	2000	2001	change in 2001
LME	592	790	357	799	442
Comex	85	83	59	244	185
Exchange stocks	677	873	416	1,043	627
Producer	289	234	244	279	35
Consumer	176	146	160	180	20
Merchant	30	22	21	23	2
Western Total	1,172	1,275	841	1,525	684
SHME*	88	63	108	94	-14

Data: WBMS

*Shanghai Metal Exchange

Exchange Rates and Prices

Before moving on to some more detailed description of changes in the fundamentals it is worth stressing the role of exchange rates. The US dollar was very strong during 2001, and had been rising since the mid 1990s. The strength of the dollar has been a factor in low copper prices, most directly because it means that prices have fallen less in their local currencies for many producers than in US dollars.

The dollar price fell from an average of US\$1.03/lb in 1997 to US\$0.72/lb in 2001, in real terms (after inflation) a fall of 35%. In euros and Chilean pesos the price fell by 16-17% in real terms in the same period, and in Australian

dollars 11%, because those currencies fell against the US dollar. Not all producers benefited as much, for instance, in Peruvian soles the price fell almost as much in real terms as it did in US dollars! Of course the relationship between costs and currencies is complex, there is a US dollar component in costs at mines outside the US, which may be large, so these calculations provide a very crude indication of the protection that the strong dollar afforded different producers. Nevertheless it is important to remember US dollar strength when looking at recent trends in prices.

Consumption

In 2001 consumption fell in all the old Western world industrial regions, varying from a fall of 15% in Japan to a 7% fall in the EU. And the newer but established Asian industrial countries, Taiwan and Korea, also saw sharp drops in usage. Elsewhere there was growth. It was rapid in China and also in India. There was also fast growth in Eastern Europe and Russia, which are included in the ‘Rest of the World’ in the table. The rapid fall in demand in industrial countries, and rapid growth elsewhere, partly reflects the ongoing relocation of industrial capacity to Asia, especially to China: Japan suffered particularly badly in this respect.

The fall in consumption in 2001 has to be seen against the background of exceptionally strong demand the year before, when it jumped nearly 8% globally. This followed a year of good growth in 1999, and so its strength cannot be explained as that of a recovery year. 2000 was an exceptional year, with several unsustainable factors driving consumption upwards. It was the final year of a three-year business boom, in Europe as well as the US. Growth in business investment in Europe and the US was twice as fast as general economic growth between 1998-2000, as overcapacity was developed. Copper was used in many fast-growing sectors, electronics, computing and telecommunications. This business/new economy boom was boosted for copper by growth use in coinage in Europe, Japan and the US, as new copper-based coins were

introduced. Apparent consumption was probably exaggerated in 2000 due to a build-up in unreported stocks towards the end of the year as well.

The collapse in demand since 2000 reflects the reversal of these exceptional factors. Business investment fell sharply in 2001, and with widespread overcapacity and poor profitability, shows no sign of recovery at all. The immediate prospects are for it to grow more slowly rather than bounce back. The US housing market and consumer demand have remained strong throughout the recent 'recession', and therefore are unlikely to provide a boost to growth.

The impact of globalisation makes it increasingly difficult to isolate demand in individual countries, as supply chains stretch across the world, and final products also embark on long journeys. However, in light of our comments about 2001 being the pay-off after a boom, the pattern of German consumption is interesting. In 2001, Germany stood out by posting a 14% fall in consumption, twice the European average. However, it is really the 2000 figure of 1.3 Mt that stands out as the exception; in that year German demand rose by 14%, nearly twice as fast as the European average, and well ahead of any expectations. Germany's higher exposure to the capital goods market may help to explain why its demand was first so strong and then so weak.

Raw Materials

Although the concentrate market was in deficit in 2001 stocks built up in previous years were sufficient to bridge the gap between mine and smelter output, and terms moved modestly in favour of the smelters. The very successful start-up of Antamina was a key factor preventing further tightness developing. On the other hand, the surge in exports to China in the second half of 2001 helped concentrate sellers.

A clear divide has opened up between smelters in traditional custom smelting

Consumption ('000 t)

	1999	2000	2001	% change
Belgium	353	324	301	-7.1
France	550	564	538	-4.6
Germany	1,138	1,310	1,116	-14.8
Italy	635	674	683	1.3
Spain	255	289	299	3.5
UK	305	323	286	-11.5
Scandinavia	293	319	308	-3.4
Other	227	245	218	-11.0
Total Europe	3,756	4,048	3,749	-7.4
Total Africa	111	126	148	17.5
India	230	240	275	14.6
Japan	1,294	1,347	1,146	-14.9
Malaysia	158	166	160	-3.6
Saudi Arabia	160	160	170	6.3
South Korea	784	862	849	-1.5
Taiwan	655	628	540	-14.0
Thailand	110	151	167	10.6
Turkey	201	230	196	-14.8
Other	258	276	297	7.6
Total Asia	3,850	4,060	3,800	-6.4
Brazil	285	330	338	2.4
Canada	266	272	265	-2.6
Mexico	395	464	445	-4.1
US	2,953	2,943	2,620	-11.0
Total Americas	4,102	4,204	3,867	-8.0
Total Oceania	171	168	173	3.0
Western World	11,990	12,606	11,737	-6.9
China	1,484	1,932	2,244	16.1
Russia	175	210	250	19.0
Poland	246	290	268	-7.6
Other Former Eastern Bloc	130	130	145	11.5
Total Former Eastern Bloc	2,035	2,562	2,907	13.5
Total World	14,025	15,168	14,644	-3.5

areas (Japan, Europe and also Korea) which are well covered for their requirements by long term contracts, and the new plants in China and India which are heavily reliant on spot material. This was reflected in the concentrate market. Contract terms excluding price participation were about US\$0.19/lb combined TCRC, compared with US\$0.17/lb in 2000. Since the copper price was on average US\$0.10/lb lower than in the year before the difference narrows to about one cent after taking that into account. Spot terms were a little lower than in 2000, averaging just under US\$0.16 /lb combined versus over US\$0.16/lb, and the spot market tightened in the second half, falling to US\$0.14/lb towards the end of the year as there were heavy purchases by Chinese smelters.

Scrap remained tight in the US and Europe, with China importing large amounts of material for hand sorting, and Russia effectively cutting off scrap exports. With the closure of Chemetco's secondary refinery in Alton, Illinois, which produced 65,000 t in 2001, the US secondary copper sector has effectively ceased to exist. In Italy, the Porto Marghera secondary plant shut, having produced just over 20,000 t in 2001. Generally, scrap usage has fallen as a percentage of consumption in industrialised countries, partly reflecting increased product life (which reduces scrap availability), but also reflecting the surge in exports of complex scrap to China and other low labour cost countries, where hand sorting is economic.

Mine Production

Mine output grew by just over 2% in 2001, marking a further deceleration, as cutbacks continued to eat into underlying capacity increases. SX-EW output accounted for all the net growth, with a rise of 200,000 t, while concentrate production marked time.

Mine Production by Country

The fact that mine production continued to rise in spite of very low prices reflects a number of

Mine Production by Country ('000 t)

	1999	2000	2001	% change
South Africa	163	160	130	-18.8
Zambia	271	290	330	13.8
Other Africa	69	50	42	-16.0
Africa Total	503	500	502	0.4
Indonesia	790	1,006	1,046	4.0
Other Asia	329	331	320	-3.2
Asia Total	1,119	1,336	1,366	2.2
Argentina	200	145	192	32.2
Chile	4,448	4,602	4,739	3.0
Peru	536	554	722	30.3
Other S America	38	36	34	-5.6
South America Total	5,221	5,337	5,687	6.6
Canada	611	634	633	-0.2
USA	1,632	1,473	1,336	-9.3
Mexico	339	365	367	0.5
North America Total	2,582	2,472	2,336	-5.5
Australia	737	832	877	5.4
Papua New Guinea	188	203	204	0.4
Oceania Total	925	1035	1081	4.4
Portugal	100	76	83	8.8
Other	155	168	126	-24.9
Western Europe	255	244	209	-14.3
Western World Total	10,605	10,924	11,181	2.3
China	520	589	565	-4.1
Russia	510	580	600	3.4
Kazakhstan	373	430	470	9.3
Poland	464	454	460	1.3
Other FEB	318	330	313	-5.2
Former Eastern Bloc Total	2,185	2,383	2,408	1.0
Total world	12,790	13,307	13,589	2.1

factors. As we have already seen, for many countries the US dollar was strong and so, converted back into their local currencies, prices were actually not bad. Lower treatment charges continued to help, with another year of low TCRCs feeding through contracts. Miners had also made great efforts to cut their costs, partly through temporary measures, but also some permanent cuts will have been made. This meant that whereas in 1997 many high-cost operations needed over US\$0.90/lb to survive, marginal costs were at least US\$0.20/lb lower in 2001.

The largest increase by country was in Peru, the only country to register a rise greater than 100,000 t. Antamina produced about 160,000 t in its first year of operation; capacity is over 300,000 t/y. Elsewhere in Latin America, Chile registered a modest rise, as falling ore grades and a cutback at Escondida caused output there to fall by 130,000 t but other mine increases, including the new El Tesoro SX-EW operation, outweighed that fall. Improvements at Alumbra, which had started up in 1997 and encountered metallurgical problems in 2000, accounted for the increase in Argentinian output.

African production grew slightly, with Zambian output rising as foreign investment continued, but South African output fell due to the run down of open-pit operations at Palabora in advance of the move to underground block caving. Several mines contributed to the growth in Zambian mine output, with none increasing output by more than 18,000 t of copper. But for a number of setbacks, notably a pit-wall failure at Nchanga, the growth would have been greater.

US output fell for the fourth successive year, and was more than 600,000 t lower in 2001 than it had been in 1997. Old, high-cost mines received little relief from the lower treatment charges that benefited many custom miners, and had costs in US dollars when many other currencies weakened significantly. Among the more important changes are the closure of concentrate operations at Phelps Dodge's Chino mine, and the net loss of 60,000 t of production at Morenci, as the concentrator was shut as the mine moved to SX-EW output exclusively. Other changes include further cuts at Grupo Mexico's Mission mine, and the lagged impact of the closure of Butte in the previous year. BHP Billiton has now stopped

Main Reductions in Production ('000 t contained copper)

	Country	1998	1999	2000	2001	% Change
Escondida (Conc)	Chile	850	827	776	645	-131
Morenci (Conc)	US	232	184	126	22	-104
Chino	US	80	70	80	19	-62
Palabora	S Africa	141	112	117	80	-37
Grasberg	Indonesia	809	767	769	749	-20
Mission	US	116	91	86	67	-19
Butte	US	43	37	18	0	-18
Cyprus Miami SX-EW	US	75	64	55	38	-17
Minas Rio Tinto	Spain	33	0	16	0	-16
Kidd	Canada	67	67	55	39	-16
Kolwezi	Congo	29	32	25	12	-13
Chuquicamata	Chile	515	517	527	515	-12
La Caridad	Mexico	157	153	137	125	-12
Los Bronces	Chile	147	162	170	160	-10
Tintaya	Peru	72	83	92	82	-10

all operations at Magma, with the closure of the small SX-EW plant which continued operating after the concentrator was shut. Lastly, Kennecott shut its old North concentrator at Bingham Canyon, initially temporarily, but now permanently.

Mine Closures and Cutbacks

The focus of this article is a review of events in 2001, with an indication of subsequent developments. However, it is worth briefly reviewing the size and status of closures to date even though many cuts were not made in 2001, as the existence of this idled capacity is an increasingly important factor in the copper market.

Since the copper price collapsed in 1998 more than 1.3 Mt/y of copper mine capacity has been affected by closures and cutbacks, excluding closures which have already been restored, but including cutbacks announced in the final quarter of 2001 but mainly affecting 2002 of 400,000-500,000 t/y.

In contrast to earlier cutbacks, the most recent cuts for 2002 only include about 100,000 t/y in the US. The US cuts include a further reduction of output by Phelps Dodge, including further cutbacks at Bagdad and Sierrita and the closure of the Miami SX-EW mine. BHP Billiton is responsible for most of the remaining cuts, all of which are outside the US. They include a reduction in output from plan in Chile at Escondida, the world's largest copper mine and a low-cost producer. This cutback, first announced last year were extended in 2002, and will more than offset the impact of the Phase four expansion which is due on stream in the third quarter of this year. BHP Billiton also announced the closure of concentrator operations at Tintaya in Peru (90,000 t/y), and in mid-2002 confirmed the closure would last at least until 2003. Codelco made 100,000 t/y of cuts, mainly at concentrate operations. In percentage terms, the largest cut appears to be at the smaller, higher-cost Salvador mine. These major cuts were augmented by some more small mine

Main Increases in Production ('000 t contained copper)

	Country	1998	1999	2000	2001	% Change
Antamina	Peru	0	0	0	160	160
Morenci SX-EW	US	244	253	261	327	67
Radomiro Tomic SX-EW	Chile	162	190	191	255	64
Los Pelambres	Chile	0	18	309	370	61
Batu Hijau	Indonesia	0	23	236	286	50
Alumbrera	Argentina	154	200	145	190	45
El Tesoro SX-EW	Chile	0	0	0	40	40
Reward-Highway	Australia	27	24	23	47	24
Cananea	Mexico	106	84	97	120	23
Konkola	Zambia	50	40	40	58	18
Bingham Canyon	US	293	274	294	313	17
Nkana/Chibuluma	Zambia	35	39	35	51	16
Nchanga SX-EW	Zambia	56	55	55	70	15
Golden Grove	Australia	5	3	3	17	14
Cerro Colorado SX-EW	Chile	75	100	119	130	11
Mt Gordon SX-EW	Australia	7	32	40	50	10
Mount Lyell	Australia	25	26	24	34	10
Escondida SX-EW	Chile	8	132	140	150	10

closures. A large part of the 400,000-500,000 t of capacity shut this year will restart when market conditions are supportive.

However, much of the remaining 850,000 t of capacity will remain shut, unless prices bounce back to high levels. US mines account for over 500,000 t of this capacity. Some cuts are likely to be restored, notably at mines which have not actually shut yet but are operating at reduced rates, such as Phelps Dodge's Bagdad and Sierrita mines. Several US mines will never re-open, such as BHP Billiton's 100,000 t/y San Manuel mine. Others might recover if prices recover to high levels, but the prospects of this happening will become increasingly unlikely the longer the mines remain shut.

After accounting for US closures, and mines which have re-opened or are likely to re-open, about 350,000 t or so of capacity remains. This is accounted for by a large number of small, high-cost mines. Attempts have been made to revive some of these from time to time, and some may re-open again, but many of these operations are fundamentally uncompetitive, and likely to remain shut. Many of these had limited reserves left and simply closed early, for instance Mamut in Malaysia.

Projects

In spite of the long period of low US dollar prices that the industry has endured a number of new projects and expansions are either under construction or serious consideration. Taken together these are not of the same scale as in the 1990s, when foreign investment flooded into Chile, and the development of Grasberg in Indonesia offered exceptional opportunities. Therefore, they do not threaten a rerun of the over investment of the late 1990s. However, along with potential re-openings, they mean that there is no reason to think supply will be inadequate in the medium term, a view that had become widespread fairly recently.

Antamina in Peru is now in its first full year of production, and will produce over 300,000 t of

copper this year, an increase of 150,000 t over last year. Also in Peru, BHP Billiton has brought a 35,000 t/y SX-EW operation on stream at Tintaya, where its concentrator operation has been shut since early January. In Chile, Antofagasta's El Tesoro SX-EW mine will produce 80,000 t this year, its first full year of production. Chile is also home to two small mine projects. El Bronce came on stream late in 2001, and is building to capacity of about 25,000 t/y of copper in concentrate. There are reports that a 20,000 t/y SX-EW mine, Mantos de la Luna, is under construction, and planned to be on stream in 2003. In Canada, Anglo American is developing the Triple Seven mine, starting up in 2003, and building up to 30,000 t/y.

CVRD is pressing ahead with its plan to build a copper business, based on resources in Brazil. It has started the development of Sossego, which will produce about 150,000 t/y of copper from 2004, and is now 100% owned by the company. A small SX-EW mine, 118, is likely to be developed soon after, as the two operations will have synergies. Other recently discovered deposits at Alemao and Cristalinho are also under consideration, for similar scale development. The company has also increased its share of the Salobo deposit from 50% to 100%, with Anglo relinquishing its holding, and is seeking a low capex route to develop a mine with potential to produce 200,000 t/y. Any decision is still some way off. CVRD is continuing to explore in Carajas, where its existing infrastructure gives it advantages in building and operating mines.

In clear contrast to the 1990s, there are few stand-out winners among Chilean greenfield prospects. BHP Billiton's Spence mine is likely to be developed at over 200,000 t/y as an SX-EW operation, but development is not imminent, and it would not be on stream before 2005. Codelco's 150,000 t/y Gaby Sur SX-EW prospect looks probable. Its 20,000 t/y bioleach joint venture with BHP Billiton at Mansa Mina near Chuquicamata is progressing, and success could open up other prospects.

The potential for expansion is more important in Chile than new mines. The largest is already under way at Escondida, with start up of the phase four expansion due on stream in the third quarter, which will add 400-500,000 t/y to output. However cuts are being made in line with current market conditions, and production this year will actually be lower than in 2001. There are additional resources for development at Escondida. Escondida Norte and additional marginal leach projects will at least maintain Escondida's expanded production rate, when grade declines start to hold back production. Codelco's major expansion project is under way at El Teniente, with another 100,000 t/y of output due on stream in 2003. This will be followed by a 140,000 t/y expansion at Andina. Codelco has also managed minor expansions at other operations, notably Radomiro Tomic, which started up as a 220,000 t/y SX-EW operation in 1997, produced 255,000 t, and is being expanded to over 300,000 t/y. A 25,000 t/y expansion was planned at Los Bronces, and with new ownership in the shape of Anglo American it is possible that further expansion will be contemplated.

Two other new Chilean mines, Antofagasta's Los Pelambres mine, and Collahuasi, are also likely to see large concentrator expansions, but these are designed to offset falling head grades, and will not result in the production of much more copper.

Elsewhere in Latin America expansions are occurring at Toquepala in Peru (plus 40-50,000 t/y) and at Cananea in Mexico, where both concentrate and SX-EW operations will be increased, giving a total gain of about 40,000 t/y.

Two small expansions are also due in Australia, a 25,000 t/y boost at the short life Golden Grove mine, and a minor expansion of under 30,000 t/y at WMC's Olympic Dam mine. The expansion at Olympic Dam may have been put off track by the fire which affected the refinery last year, but there is underlying potential for substantial further

expansion. One greenfield plant should be mentioned. Nifty is planning to develop a 50,000 t/y SX-EW operation, with hopes for further expansion.

Batu Hijau is continuing to increase its production in Indonesia, having been brought on stream in 1999. There are several other prospects in Asia. Two are seeking finance, the 100,000 t/y expansion of the Monywa SX-EW operation in Myanmar and the 60,000 t/y Sepon prospect in Laos. Oxiana hopes to be able to start work on the first stage at Sepon in August, but initial production will only be gold, with copper output scheduled for 2005.

In Zambia, Anglo's withdrawal has pretty much finished any prospect of Konkola Deeps' development, which would have faced an interesting challenge dealing with large amounts of water underground. However several smaller companies are actively looking at projects in Zambia and the Democratic Republic of Congo. Longer run, there is still interest in some larger prospects, including Lumwana and Kansanshi in Zambia.

In North America, activity has not quite ground to a halt. Phelps Dodge is continuing to examine the SX-EW prospects in the Safford District, and Inco seems finally to be making progress with the provincial government of Labrador and Newfoundland to develop Voisey's Bay, although this will be much more important for nickel than copper. Phelps Dodge is also building a demonstration plant for the concentrate leaching technology it has developed with Placer Dome. The plant is at Bagdad, and will produce about 15,000 t/y.

Elsewhere there are a few projects of note. In Europe, permitting for Las Cruces SX-EW prospect is continuing, and output of 60,000 t/y is possible. Development continues very slowly at the Iranian greenfield and expansion projects.

The past 20 years has seen rapid growth in copper output using SX-EW output on oxidised material. Although new SX-EW operations will be built there is little doubt that

the days of rapid growth are over. Technology is not standing still, however, and various other leach technologies are being explored, with bioleaching and concentrate leaching both being brought to the pilot-plant stage.

Refined Output

Global refined copper production rose by just over 5% in 2001. The increase was almost entirely in less industrialised countries and the former Soviet Union (FSU). Output in Europe, Japan and the US fell slightly.

This pattern reflects two factors. Higher mine production in several areas fed through into refined output (often because the increase was in SX-EW production). For instance, the increase in Chilean output was largely SX-EW mine production. There was also an increase in custom smelter capacity in several countries in the Asia/Pacific region. It also reflects changes in scrap flows, which have reduced secondary refined production in the industrialised countries.

In Asia, the main production increases were at Gresik in Indonesia, and at the two new Indian custom smelters, Indogulf's Dahej smelter, and Sterlite's Tuticorin plant. Australian output also rose sharply, partly reflecting higher local mine output, but also due to an increase in production at Southern Copper's Port Kembla smelter, which has suffered ongoing problems since it restarted in 2000.

It is notable that although it declined, US refined output fell much less than local mine production, in spite of the run down in secondary refined production. US concentrate imports have increased sharply, moving from a net export of 170,000 t copper content in 2000, to a net import of 80,000 t in 2001. This has been another factor behind global concentrate market tightness.

Corporate Developments

The largest change in the corporate world of mining in 2001 was the merger of BHP and Billiton, which followed Billiton's hostile acquisition of Rio Algom the year before. In

Refined Output ('000 t)

	1999	2000	2001	% Change
South Africa	163	160	130	-18.8
Zambia	271	290	330	13.8
Other Africa	69	50	42	-16.0
Africa Total	503	500	502	0.4
Indonesia	790	1,006	1,046	4.0
Other Asia	329	331	320	-3.2
Asia Total	1,119	1,336	1,366	2.2
Argentina	200	145	192	32.2
Chile	4,448	4,602	4,739	3.0
Peru	536	554	722	30.3
Other S America	38	36	34	-5.6
South America Total	5,221	5,337	5,687	6.6
Canada	611	634	633	-0.2
US	1,632	1,473	1,336	-9.3
Mexico	339	365	367	0.5
North America Total	2,582	2,472	2,336	-5.5
Australia	737	832	877	5.4
Papua New Guinea	188	203	204	0.4
Oceania Total	925	1,035	1,081	4.4
Portugal	100	76	83	8.8
Other W. Europe	155	168	126	-24.9
Western Europe Total	255	244	209	-14.3
Western World Total	10,605	10,924	11,181	2.3
China	520	589	565	-4.1
Russia	510	580	600	3.4
Kazakhstan	373	430	470	9.3
Poland	464	454	460	1.3
Other Former Eastern Bloc	318	330	313	-5.2
Former Eastern Bloc Total	2,185	2,383	2,408	1.0
Total world	12,790	13,307	13,589	2.1

copper the merger created the world's third largest producer, although current cutbacks, discussed above, and the disposal of BHP's share of the Ok Tedi mine in Papua New Guinea have reduced production. BHP Billiton has taken a more active stance managing production in the face of weak demand, aiming to provide leadership to hasten the end of the extended downturn in the copper market.

The development of CVRD's strategy to enter the copper business has moved forward considerably in the past year, with the company taking full control of two prospects that were previously in joint ventures, and rapidly progressing its Sossego project. This is a reminder that, given the resources, new entrants can still appear in copper, just as Antofagasta and Freeport became major players in the past ten years. While some companies have disappeared through mergers and takeovers, others have grown, and copper mine industry concentration remains low.

Exxon's sale of its Chilean copper operations to Anglo American in 2002 also merits a mention. It marks the departure of the last oil company from the copper mining business, and the continued growth of diversified miners in the sector.

China

Chinese demand fell once again in 2001 and outstripped even the most bullish expectations, an even stronger performance against the background of the fall in global demand. China has been the one really bright spot in an otherwise dismal copper picture for the past 18 months. The speed of growth justifies a brief separate discussion of China in spite of uncertainties over data.

China is structurally short of copper. Its resource base is poor, and mine output has grown very slowly compared with demand. Smelter production has grown more rapidly than mine output but more slowly than consumption. As a result, concentrate

imports have soared, and most of the purchases are made on the spot market. The latest Five-Year plan aims to boost mine output by a modest 100,000 t/y and, with production now falling slightly, even that modest aim may be difficult to achieve. At the same time the government wishes to rein in smelter capacity growth but, with several smelters undergoing expansions, it is notably failing in this regard.

Demand growth has been astonishing, even allowing for suspicions that it may have been exaggerated last year by apparent consumption calculations which ignore a build-up in unreported stocks. Investment in infrastructure, power, tele-communications and construction, has been the backbone of growth. This has been augmented by the emergence of a large domestic market in the fast-growing coastal provinces for electrical goods and above all air conditioning. Large inflows of foreign investment have also been a major factor, boosting growth in commercial construction, and building fabricating operations. This latter source of growth has been at the cost of manufacturing elsewhere, with Japan notably hard hit in this regard, and it is important that this is recognised, otherwise looking at China alone will exaggerate its contribution to world growth.

Net Chinese Imports ('000 t)

	1998	1999	2000	2001	% change
Concentrate *	1,186	1,250	1,801	2,255	25
Blister and anode *	83	126	123	89	-28
Cathode	250	367	548	783	43
Semis *	428	488	565	574	2
Scrap *	944	1700	2494	3332	34
Copper content (excluding scrap)	1,040	1,264	1,673	2,023	21

Data: China Trade Statistics

* gross weight

Even disregarding the beggar-my-neighbour element of growth, China has been a rare source of strength in the copper market. If there is a demand pause, for whatever reason, it would be felt throughout the market. How China reacts to its raw material shortage is of longer-term significance. In the medium term it will remain resource short, although in the much longer run it hopes to develop mines in the West. This is stimulating interest in overseas ventures, but so far involvement has been very limited (Zambia and Pakistan), and not entirely happy.

Forecast

If nothing else, the past three years has taught us the fragility of forecasts, as the market has swung from surplus to deficit and then back into surplus, paying little regard to market expectations. However, taking a step back from these swings however it is clear that the market has suffered a lasting hangover from the party years of the 1990s when high prices encouraged over-optimism and over-investment. The fall in demand last year did not create oversupply, although it contributed. The root cause has been overcapacity.

Large cutbacks seen since the market turned down in 1997-98 have helped the copper market avoid even greater surpluses. In 2002, we should see the first fall in mine and refined output for ten years, as cutbacks announced in the final quarter of last year take effect.

So far this year, demand has remained weak. Underlying economic activity has not recovered as had been hoped for. Although the US appears to be making a slow but steady recovery, and several Asian countries have shown a marked improvement, Europe has remained weak, and overall there have been disappointments as well as positive developments. More specifically for copper, there has been little sign yet of any substantial bounce back in pipeline consumer stocks, which might have been expected after last year's awful demand performance. Demand has lagged general economic growth rather than outstripped it. As a result, in the first half

of the year, exchange stocks have risen again, although prices have managed to move above the mid US\$0.70/lb range in anticipation of improved fundamentals.

Forecasts made so far this year by the International Wrought Copper Council (IWCC) and the International Copper Studies Group (ICSG) suggest the market is likely to be in surplus again this year, although the second half could move into deficit, and the annual surplus will be much smaller than last year. China remains a wild card. Rumours that the government is planning to build a stockpile of 300,000-500,000 t have been widespread and, if correct, could result in a substantial stock reduction in the West, even if market fundamentals remain poor.

Projection for Total World Copper Balance ('000 t)

	2000	2001	2002	2003
Mine Production	13,307	13,589	13,440	13,879
year on year change	4.0%	2.1%	-1.1%	3.3%
Refined Production	14,793	15,502	15,192	15,645
Year-on-year change	2.2%	4.8%	-2.0%	3.0%
Consumption	15,168	14,644	15,010	15,686
Year-on-year change	8.1%	-3.5%	2.5%	4.5%
Balance	-375	858	182	-41

Source: WBMS, ICSG, Rio Tinto.

In 2003, there should be a further improvement in fundamentals, barring hasty re-openings or a fresh downward lurch in economic activity. The underlying trend in production is still upwards and growth in mine output should resume next year under all but the gloomiest scenarios. However, with raw materials very tight, it may be that refined copper production is held back more, and any further cuts or disruptions would be quickly felt.

Demand growth should accelerate further in 2003. Optimists say that when demand recovers it always grows more strongly than anyone expects. True, but it is very surprising

that there are few signs of this at the moment, given how poor demand was last year. It is possible that demand will provide the next surprise for copper, one way or another.