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Changing patterns in global lead supply and demand

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Abstract

The past decade has seen some very significant changes in the supply and the demand for lead. One of the most obvious developments is the emergence of China—both as the world's largest producer of primary lead and as a very significant consumer. Perhaps less obvious have been the increasing role of secondary lead in meeting demand for refined metal and the rapid growth in demand for industrial batteries, which have helped to sustain an annual average growth rate in Western World consumption of 3.4% between 1993 and 2000. Patchy knowledge about the lead industry in China has made it difficult to anticipate developments there and has created uncertainty in the global market. This uncertainty, and lead's poor environmental image, largely undeserved as it may be today, has meant few companies outside the lead business want to be seen participating in it. This is just one factor accounting for the very limited increase in lead mine production for the foreseeable future. With around 75% of lead now being used in batteries and a very high global scrap recycling rate, it is probable that most, if not all, growth in lead demand can be met without an overall increase in mine production. The challenge for the lead industry will be to ensure that sufficient recycling capacity is in place in the right parts of the world to process an increasing quantity of battery and other lead-bearing scrap. Huge investment in the world's telecommunications infrastructure and IT networks in the second half of the 1990s created a major market for industrial lead-acid batteries. With the collapse of the market for telecommunications equipment in 2001, lead consumption has fallen sharply and has revealed the extent to which demand growth in recent years has been dependent on this sector.

Keywords: Lead supply and demand; Primary; Recycling; Secondary; Lead-acid batteries

1. Introduction

Ten years ago, in 1992, the cash price of lead trading on the London Metals Exchange averaged US$ 623/t. Just 12 months later, the price had fallen to only US$ 375/t. In real terms, this was an all-time low. While supply and demand developments have not been as volatile as the swings in the lead price since the early 1990s, very significant developments have nonetheless unfolded over the past decade. These have permanently altered the structure of supply especially, but also affected the demand for lead. Though the price of lead recovered the ground lost in 1993 during the second half of the 1990s, in common with the other non-ferrous metals which are essential to most manufactured goods, it has, once again slumped to near its previous record low. This paper focuses on the structural developments that have influenced the supply and the demand of lead in recent years, but also casts a brief look at what the future may hold and how prices may be expected to react in the near term, as a consequence of these changes.

With regard to lead supply, there are three key developments that need to be considered. The first relates to the diminishing role of primary lead production in meeting demand. The second, a direct corollary of the first, has been the increasing share of total output accounted for by secondary production, both through the direct processing of scrap lead in recycling facilities and the increasing use of secondary lead-bearing feed by smelters that also treat lead concentrates. Third, the rise of China as a key global player in the lead market is examined.

Turning to demand, lead-acid batteries continue to dominate the use of lead. An assessment should, however, be made of the extent to which the increase in consumption growth rates seen during the 1990s reflected a one-off bubble in investment in telecommunications and IT network infrastructure. Consideration is given here to how forecasts of future demand growth should be viewed in the light of recent experience, but also given probable changes in vehicle electrical systems which will be introduced over the next few years. China has become a global force in lead supply and it is now also the second largest consumer of lead following the USA. Thus, no discussion of changes in lead demand can be complete without also looking at developments in China.

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2. Primary lead supply

Globally, lead recovered directly from lead and bulk concentrates accounted for only 42% of total refined production in 2001. This was down from an estimated 48% in 1990. Considering output in the West alone, the decline was even more dramatic—from an estimated 44% in 1990 to only 35% in 2001. This means that, while total refined lead production has increased by 17% globally (10% in the West) since 1990, lead mine production overall has not changed and has, in fact, fallen by 17% in the West.

What is even more remarkable is that mine production of zinc, the most common co- or by-product of lead mining, has actually increased by 28% globally since 1990. The clear implication is that there has been a sustained and significant fall in the ratio of lead to zinc mined. This is not a recent development. In the early 1960s, for every tonne of zinc mine production there was 700 kg of lead. Today only 340 kg of lead are mined for each tonne of zinc (Fig. 1). This has been due to the relative differences in the fortunes of lead and zinc prices: the value of lead is now at a large discount to zinc whereas, until the beginning of the 1980s, lead typically traded at a relatively small discount to zinc.

In practical terms, when old 'traditional' lead/zinc mines have closed in recent years because of reserve depletion, the zinc output has more often than not been replaced by mines that produce rather less lead per tonne of zinc or, in the case of mines such as Antamina in Peru, virtually no lead at all. The co-product in this case is copper. Moreover, there are no indications that this trend will be reversed. Indeed, given the current crop of mine projects that could be developed (although at present prices few, if any, are likely to attract financing), the ratio of lead to zinc mine production will fall further. For this reason, the forecasts of CHR Metals assume a decline in global lead mine production in the near term, with only a small increase thereafter. This means that future increases in lead demand can be met only by higher secondary production.

3. Distinction between primary and secondary lead

To date, the recycling industry and erstwhile smelters of primary materials which, through technical developments, have been able to treat increasing volumes of secondary feed, have been very successful in raising output to meet increases in market demand for lead (Fig. 2). Some might argue that they have been too successful, creating the expectation, certainly in more recent years, that consumers face no threat in the adequacy of supplies. This comforting view has been reinforced by the fact that stocks at the London Metals Exchange are perceived as being sufficiently high (although relatively modest compared with other metals) to meet any short-term disruptions to supply as well as slumping prices. Very weak prices have, however, brought many producers in the industry to the edge of bankruptcy. While this may be satisfactory from the point of view of the lead consumer, it is most clearly an unhealthy, and unsustainable, state of affairs for producers.

Analysing the increase in secondary lead production has become quite complicated in recent years as the distinction between primary and secondary output has become blurred. Increasingly, pure primary smelters have been forced by circumstances, i.e. largely by declining output of lead in concentrates, to treat an increasing proportion of secondary lead-bearing material, some of it battery scrap, in order to maintain production at optimum economic levels. This development has been enhanced by the adoption of smelter technologies such as Kivcet, QSL and Ausmelt, and by the abandonment of conventional blast furnace smelting at some sites. Though the ability of these technologies to process a wider range of raw materials may have been a feature in their

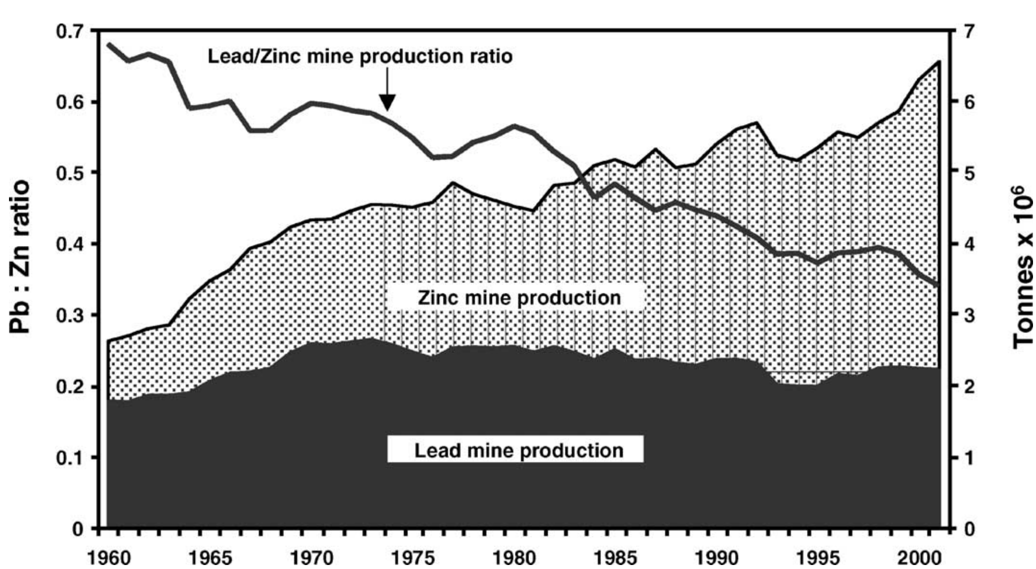

Fig. 1. Ratio of mined lead output to zinc, Western World only (*source*: ILZSG).

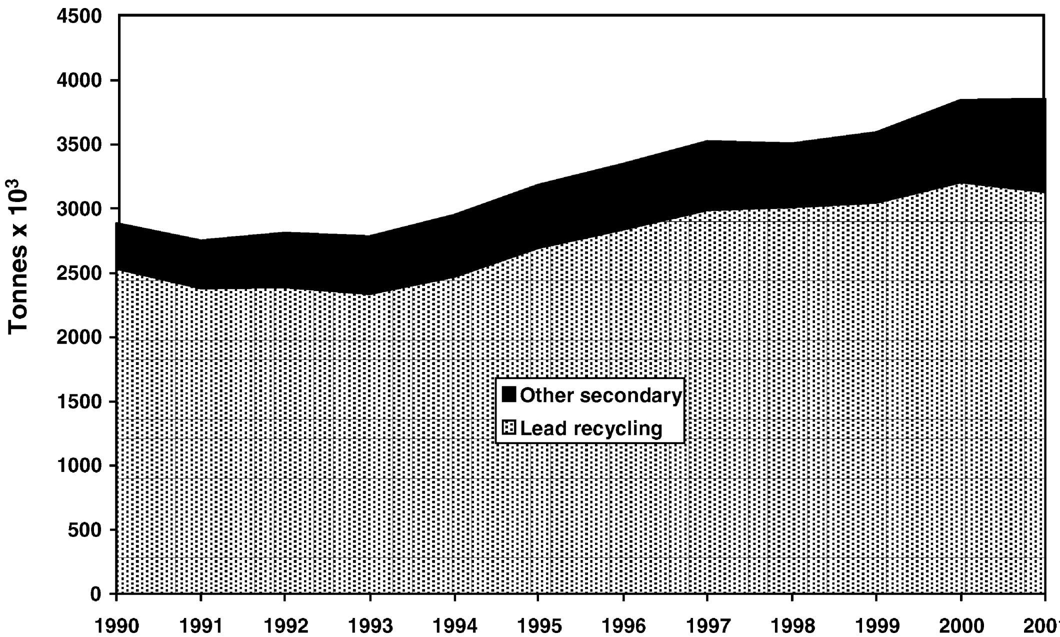

Fig. 2. Global secondary lead production (*source*: CHR Metals).

favour, the introduction of tighter environmental regulations has been the most significant factor which encourages the installation of new technology. The investment in Kivcet, QSL and Ausmelt technology at Porto Vesme, Stolberg and Nordenham, respectively, has helped operations at these sites meet the requirements of new regulations. At Trail, a Kivcet furnace was substituted following the failure of QSL technology to meet the full range of performance criteria, which required both compliance with more stringent environmental standards (the original reason for abandoning the blast furnace technology) and the ability to treat residues arising from zinc production at the same site. Given the relatively poor economics of the lead industry throughout most of the past decade, it is perhaps surprising that any new smelters were built, even on brownfield sites. One reason why new smelters have been built on brownfield sites is the very high cost of permanent closure and the associated site clean-up that is required.

Of the primary lead smelters that closed permanently in the 1990s, at three sites secondary smelting operations were established. Two of these were in Japan (Kamioka and Hosokura) and one in the USA (Viburnum). It has recently been announced that the Takehara smelter, operated by Mitsui Mining and Smelting, will also be converted to lead recycling next year. In another recent development Metaleurop announced that it is to cease primary lead and zinc smelting at its Noyelles–Godault ISF plant and will devote production to zinc recycling. Elsewhere, smelters that have closed over the past 10 years have been small (such as in Brazil and India), have been on sites where metallurgical operations continue (such as at Tsumeb), have been the result of war (Trepca) or, as at East Helena, have fallen into the category of indefinite suspension, just short of permanent closure which would trigger the requirement for a full environmental clean-up.

New smelters and existing plants that have been able to implement changes sufficient to satisfy local environmental regulations have faced a chronic shortfall in concentrate supplies since the first half of the 1990s. This structural deficit first became apparent in the West in 1993, and then acute in 1994, and forced smelters to look for alternative lead-bearing feed to supplement the units obtained from concentrates. CHR Metals estimates that, in the West, the amount of lead derived from secondary sources increased by over 100 000 t between 1992 and 1994, i.e. from under 300 000 to just over 400 000 t. This increased further to 450 000 t by 1997, but then fell back a little as pressure on concentrate supplies eased somewhat in 1998 and 1999 as the large Cannington mine was commissioned in Australia. By 2000, however, the lead concentrate market in the West was back in deficit and the volume of lead derived from secondary sources by primary smelters rose to over 500 000 t in 2001, and is likely to be 550 000 t in 2002.

4. Lead-bearing feed materials for primary smelters

What are these secondary materials? They comprise a mixture of industrial wastes and drosses, lead-bearing residues from zinc and flue dusts from copper-smelting operations, Waelz oxides, the lead content of zinc concentrates treated in ISF plants (not strictly a secondary feed) and, increasingly, pastes and metallics from scrap batteries. In Europe, especially, battery scrap is being directed to primary smelters due to the closing of conventional recycling operations. There is some debate as to whether or not primary smelters can increase any further their treatment of secondary materials. Some plants may not be able to increase the proportion of secondary feed from a technical point of view, but there is also concern about the availability of suitable materials. It is believed that at least some of the increase in the supply of secondary lead-bearing feed in recent years has reflected the drawdown of residue and/or waste stockpiles that have accumulated over several years. The availability of such material is finite.

With primary lead smelters processing an increasing quantity of lead scrap, especially in Europe, this has had some impact on the production of refined lead by pure secondary producers. Nevertheless, taking into account the scrap feed processed by primary smelters, it is estimated that, since the early 1990s, the increasing trend in global lead recycling (3.7% per annum between 1993 and 2001) has been not far short of the increasing trend in the consumption of lead in batteries (4.3% per annum over the same period). The slightly slower rate of increase for lead recycling compared with actual consumption of lead in batteries is almost certainly a function over this period of the increasing proportion of lead being used in industrial batteries, which have a significantly longer life than automotive batteries and therefore return to the recycling chain several years later than automotive batteries sold in the same year. In addition, there has also been a gradual improvement in the working life of automotive batteries themselves.

As noted above, mine production of lead now accounts for just over 40% of total refined lead production globally, but only 35% in the West. Given that mine production is likely to fall further in the near term and that no significant rise is foreseen, even over the medium term, it follows that virtually all future growth in lead demand must be met from battery recycling and the recovery of lead from any other secondary sources that might be available. There should be no problems. With batteries today accounting for three-quarters of global lead demand and mine production able to meet 40% of consumption, there might even be a surplus of scrap available to be recycled which, currently, is escaping from the recycling loop (Fig. 3).

5. Lead-acid battery recycling rates

It is very difficult to establish precisely how much battery scrap is generated over any particular period of time. This is because reliable and comprehensive data for replacement battery shipments are patchy (shipment of a replacement battery is a good indicator of a battery being scrapped) and there is considerable variation in the working lives of batteries, both automotive and industrial, that are used as original equipment. In more recent years, the calculation has become even more difficult as, increasingly, batteries and battery scrap cross national borders. The USA probably leads the field in publishing good data for the recycling of lead-acid batteries. There, the Battery Council International (BCI) calculates that, in the period 1995–1999, 93.3% of battery scrap was recycled. In the many countries where there is legislation governing the collection and recycling of lead-acid batteries, it is probable that similarly high rates of recycling are achieved. Moreover, in most poorer economies, very high rates of recycling are found although, with some of the batteries being processed through the informal sector, rates of metallurgical recovery for the scrap lead are almost certainly well below optimum.

When comparing the estimate of CHR Metals for the recovery of scrap lead with theoretical availability in any year there is, however, a sizeable discrepancy even after making allowances for variations in battery life in different markets. Over the past decade, apparent global recovery rates have varied between 70 and 80%, the upper level was recorded when lead prices were high in mid-decade. This

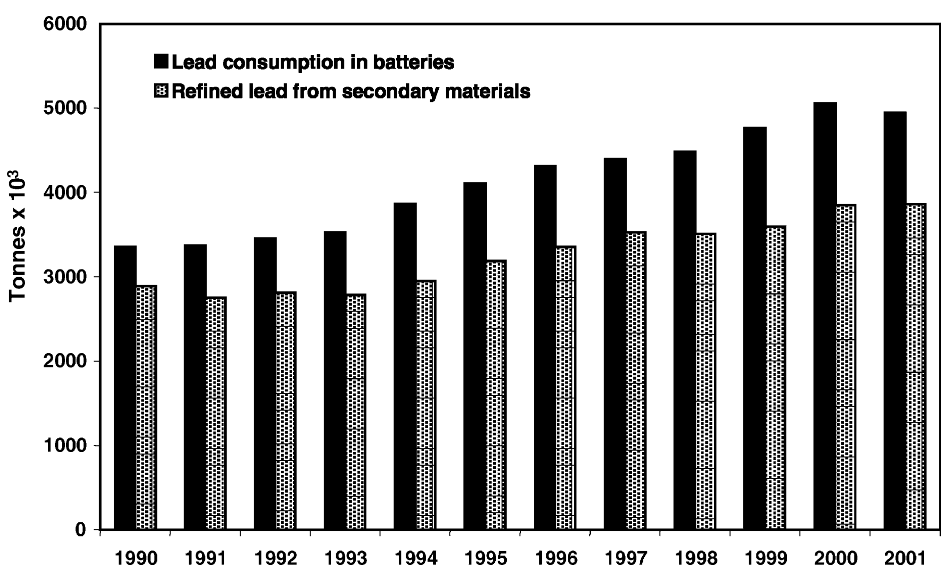

Fig. 3. Global lead consumption in batteries and secondary lead production (*sources*: ILZSG, CHR Metals).

suggests two possibilities. The first is that there are some areas where recycling rates are relatively low. This may be the case but, in all the world's major lead-consuming regions, it is highly probable that recycling rates are high, if not quite as high as in the USA. The second possibility, and this is quite likely, is that a considerable quantity of lead is recycled (and consumed) informally and is not captured in the reported data. This is certainly the case in Egypt and India, for example.

The conclusion drawn by CHR Metals is that, while recycling rates overall could be still be improved, it is probable that any gain in the amount of lead recovered relative to earlier consumption in batteries will be small. This returns this discussion to consideration of the adequacy of future supply given current trends and developments. Projecting forward the historical relationship between lead consumption in batteries and the recovery of recycled lead, a steady rise in the quantity of secondary lead produced is evident. A crude analysis of the raw data suggests that, if global recycling rates achieved in the period 1995–1997 could be maintained, then there will be little difficulty in meeting the present projected demand for lead, even if there is only a modest rise in lead mine production from today's depressed level. In more recent years, however, as lead prices have fallen, so too has the *apparent* recycling rate. If it does not recover then, within a few years, it is probable that pressure will begin to mount on the ability of the secondary industry to meet the demand for lead.

Although an apparent decline in recycling rates in recent years can be observed in the data, it is far from clear where this might have occurred. One country where one can be fairly certain this has not been the case is China. Over the past decade, China has emerged as the world's largest producer of primary lead and research by CHR Metals suggests that it is now also the second largest producer of secondary lead, with an output which is significantly more than any other country with the exception of the USA.

6. China's role in the international lead industry

The development of the lead industry in China has been somewhat difficult to follow because of the paucity of reliable data, which is due to the very many participants in the industry. While, with careful research, it is now possible to be much closer to an accurate assessment of lead production and consumption in China, given that there are many hundreds of mines and smelters in operation and perhaps more than 1000 individual battery manufacturers and hundreds of producers of other lead products, any claim for total accuracy is spurious. What can be said is that China today accounts for almost a quarter of global lead mine production, and a little under 20% of refined (primary and secondary) output. Compared with 1990 when mine production represented 12% of the global total and refined output just 6%, this highlights a most profound and rapid shift in the pattern of global lead supply (Fig. 4). Moreover, this change may not yet have run its course.

One of the most significant developments of recent years has been the extent to which new lead-smelting and refining capacity has been built in China (Fig. 5). While in the West smelters have closed, been converted to secondary operation, or the technology has been revised to meet tougher environmental regulations, but certainly no greenfield plants have been constructed, China has witnessed massive investment in brand new facilities. Primary refined production (almost all of it electrolytic) rose from just 250 000 t in 1990 to over 900 000 t in 2001. Whereas in 1990 only two refineries had capacity in excess of 50 000 t per annum, there are now at least seven refineries each with a capacity over 50 000 t. These include three refineries each with a nominal capacity in excess of 100 000 t. This investment, which occurs in the state-owned and local/private sectors, has been possible because of very low capital costs in China. Furthermore, investment was encouraged during the greater

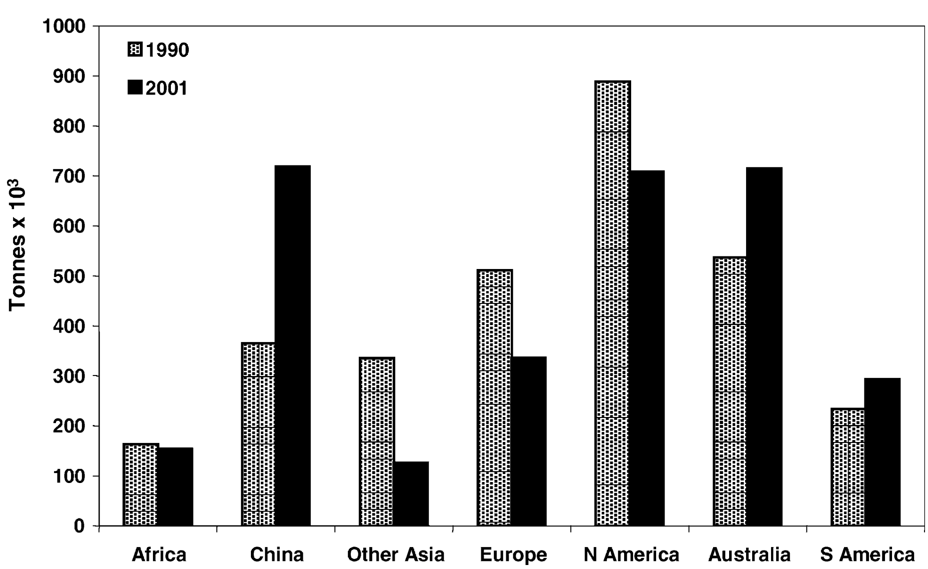

Fig. 4. Global lead mine production, i.e. lead in lead/bulk concentrate (*source*: CHR Metals).

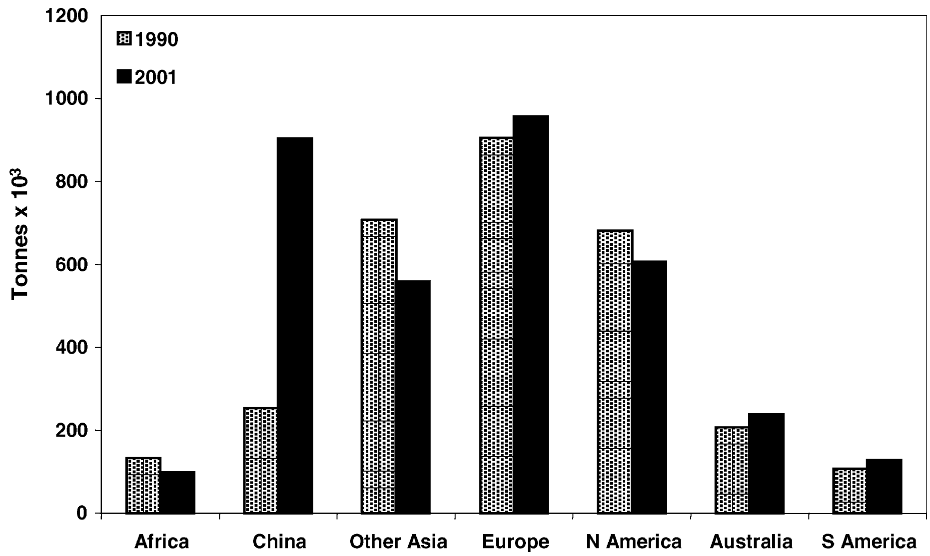

Fig. 5. Global production of primary refined lead in 1990 and 2001. Includes production at plants where both primary and secondary feed is processed (*source*: CHR Metals).

part of the 1990s by the ready availability and low price of domestic concentrate. Capital pay-back on a new lead-smelting operation in the latter years of the 1990s may have been less than 12 months. Although smelter capacity was expanding fast, a tightening in the market for cheap domestic feed was delayed until relatively recently by the availability of surplus concentrate in the West. But, since mid-2000, this situation has changed radically, and many lead smelters in China are presently finding that they cannot secure sufficient feed to operate at full capacity.

The lead concentrate market in China has tightened not only because of the massive increase in smelter capacity, but also as a result of the forced closure of many mines in the southern province of Guangxi following a series of accidents since mid-2001. Smelters, in their head-long rush to expand, gave little thought to the long-term sourcing of mine feed. For, at the same time as new smelters were being built, a chaotic and unregulated increase in mine production was also occurring. Many hundreds of small-scale workings were opened up across the country, usually selling run-of-mine ore to independently operated mills. Local officials turned a blind eye to unsafe and environmentally-damaging working conditions, given the boost that mining operations provided to local economies. This free-for-all came to a dramatic end in 2000 when about 80 people died in a mine in Nandan county, Guangxi, after miners had unexpectedly broke through into old, flooded workings. This, together with earlier concerns about the security of a communal tailings dam in the same area, landslides and subsequent cave-ins at another operation, compelled the authorities in Beijing to act. All mining operations in the region were suspended and most, to date, remain closed.

Smelters in China now face a prolonged period of tight concentrate supplies. With lower operating costs than in the West, however, it is anticipated that, over time, there will be an effective transfer of some of the West's smelting capacity to China. Indeed, this is already occurring with the recent announcements that primary smelting operations are to cease at Takehara in Japan and at the Noyelles–Godault ISF plant in France.

7. End-use patterns for lead

Have dramatic shifts in patterns of supply in recent years been matched by similarly dramatic changes in demand? In general, it can be surmised that developments in demand have been rather less significant although, once again, the emergence of China as a major force has to be noted. In addition, there has been a marked increase in the consumption of lead in industrial batteries since the mid-1990s. Nevertheless, it is possible that this was a temporary phenomenon spurred by the investment 'bubble' in telecommunications and it does not represent any long-term change in lead demand.

The use of lead continues to be dominated by the manufacture of lead-acid batteries, both for the vehicle industry (automotive batteries) and for other industrial uses. At present, around 75% of lead is consumed in batteries, an amount that has increased steadily since 1990 when batteries accounted for a little over 60% of global demand. Most other broad end-use categories of lead demand have seen an absolute decline in volume terms over the past decade, a trend evident, in some cases, since the mid-1980s (Table 1). This is the result of the long-standing campaign against the use of lead in any applications where there is some viable and economic alternative (especially where lead dissipates into the environment). Thus, little growth can be expected in lead consumption in any application, apart from batteries. In fact, continuing efforts to limit the use of lead imply that some applications will contract further while others will grow only very slowly.

Table 1
Lead consumption: global end-use breakdown ($\times 10^3$ t)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Total batteries	3349	3370	3452	3531	3864	4104	4311	4393	4484	4764	5054	4946
Pigments and chemicals	735	724	678	655	641	653	646	648	618	646	667	653
Rolled products	519	478	452	454	457	455	435	450	465	454	482	472
Alloys	176	162	164	179	184	182	169	205	201	209	223	212
Cable sheathing	303	268	239	221	204	188	168	143	129	127	119	113
Miscellaneous	300	299	284	259	256	264	259	250	249	276	288	272
Total	5383	5300	5269	5299	5605	5847	5988	6090	6146	6477	6833	6668

Sources: Derived from country and ILZSG data, as well as from estimates by CHR Metals.

Also, it is extremely doubtful that any new, *significant* end-use for lead will be accepted in the market. In applications where it is still being used, however, it appears few viable alternatives to lead and/or its compounds are available which do not themselves pose serious environmental risks. This means that, certainly over the medium term, no radical changes in the pattern of lead's 'other' uses are foreseen.

In terms of the consumption of lead in batteries, there are two important developments to note. The first is that demand growth over the past decade has been much more rapid in Asia, excluding Japan but including China, than in the mature economies of North America and Europe. Analysis by CHR Metals shows that the use of lead in batteries in Asia has grown by 8% per annum between 1990 and 2001. This compares with 3.6% per annum in North America and only 1.6% per annum in Europe. The European result is distorted by the inclusion of Eastern European countries and Russia where demand collapsed in the opening years of the decade. Since 1993, the growth rate in Europe has averaged 4.5% per annum.

The remarkable performance in Asia owes a great deal to the rapid expansion in the vehicle fleet in the region—especially in China—the development of export markets for batteries and phenomenal growth in industrial battery manufacture in China. With vehicle fleets still growing rapidly and China continuing to invest heavily in the development of its infrastructure, Asia is expected to continue outperforming all other markets for some years to come (Fig. 6).

In North America and Europe, the significant growth in lead consumption (in Europe in the second half of the 1990s) owes much more to the increases in the production of industrial batteries than to those in automotive batteries. Compared with the total in 1993, lead consumption in batteries (automotive and industrial) in 2000, the peak in the recent cycle, was some 870 000 t higher in North America and Europe taken together. Of this increase, it is estimated that almost two-thirds was accounted for by industrial batteries. In terms of a shift in patterns of consumption, lead use in industrial batteries increased from under 20% of total usage in the early 1990s to well over 30% in these two regions in 2000.

8. The telecommunications 'bubble'

In the late 1990s, it appeared that the rapid increase in demand for industrial batteries was a sustainable trend.

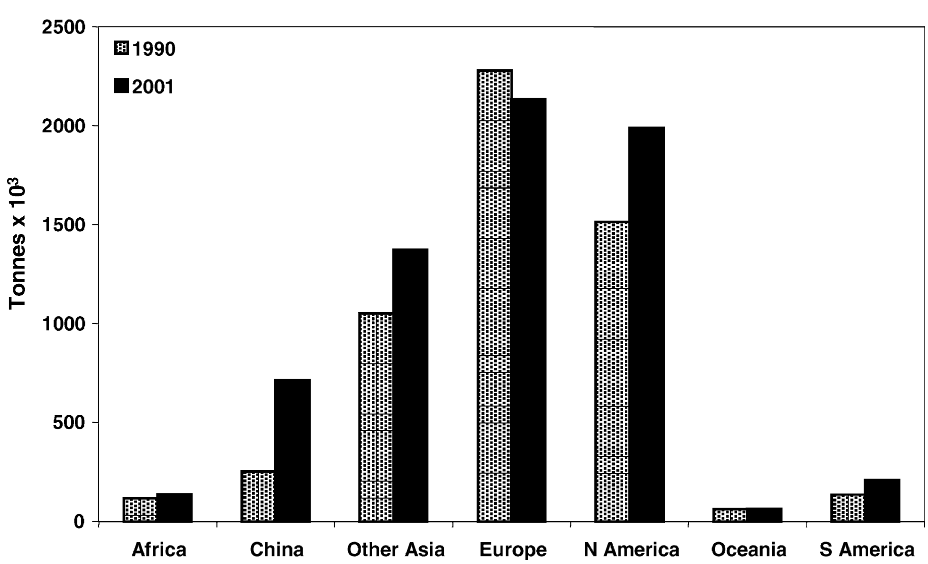

Fig. 6. Global consumption of refined lead (*sources*: ILZSG, CHR Metals).

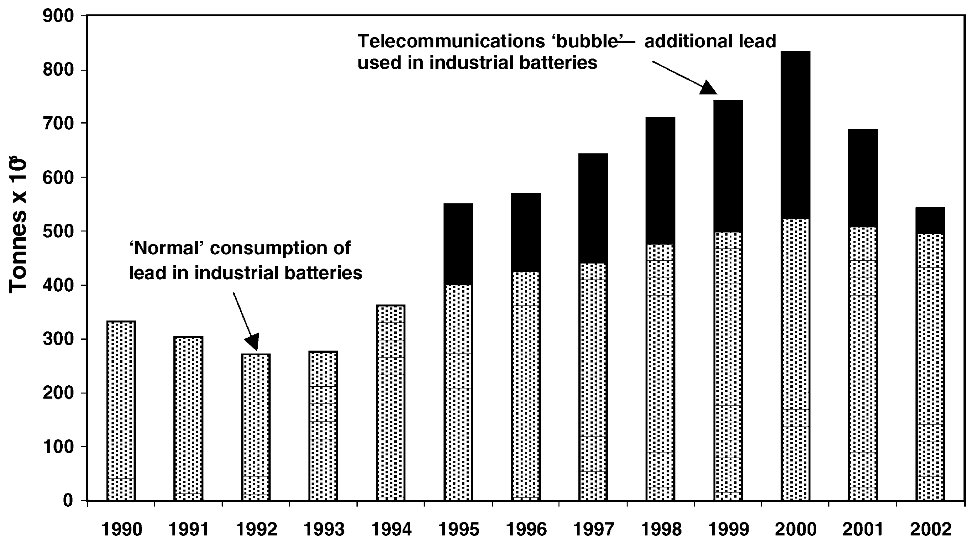

Fig. 7. Lead consumed in industrial batteries in Western Europe and USA (*source*: CHR Metals).

Forecasts, especially for the USA, projected continuing double-digit growth. It can now be seen that the peak of this market was achieved in 2000, and the subsequent collapse has been both swift and steep. It is probably not too dramatic to say that demand for industrial batteries destined for telecommunications and IT networks all but evaporated in North America in the second half of 2001, without any sign of recovery in 2002, and is also extremely weak in Europe.

The consumption of lead in industrial batteries in Western Europe and the USA has been analysed in order to gauge the scale of the telecommunications 'bubble' in lead demand (Fig. 7). The best estimate is that in 2000 around 300 000 t of lead was consumed in these two regions in the manufacture of batteries destined for the original equipment telecommunications and IT network markets. There is little doubt that investment in these markets will be very limited over the next few years in the USA and Europe, given the massive over-capacity that is now in place. What is less clear is how long it will take for this activity to return, even to half of its former level.

Although industrial battery production has slumped in Europe and the USA from the high levels seen in the latter years of the 1990s, this experience is not universal. In parts of Asia, China especially, significant investment is still being made in basic infrastructure, including telecommunications, IT and power-distribution networks. Moreover, the Chinese authorities are also making money available for state-owned companies to upgrade their technology, as well as to encourage greater computerisation, including, presumably, the purchase of back-up power supplies. Analysis by CHR Metals of the Chinese market suggests that over 40% of lead used in batteries is for industrial batteries. It should be noted, however, that not all these batteries are destined for the domestic market; China has also developed a very considerable export market, especially for small VRLA batteries which are shipped mainly to the USA and to Europe.

The very rapid growth in lead demand in Asia in recent years means that, as a share of the global market, consumption of lead in the region, excluding Japan, has increased from just 16% in 1990 to almost 30% in 2002. This is a most significant shift in regional demand and mirrors the changes in supply. The implication of recent developments is that most growth in demand over the next few years will occur in Asia while there will be only modest increases elsewhere.

It should also be noted that, as lead use in batteries grows rapidly in Asia, an increasing share of lead scrap will also arise in the region. In the case of China, no problems are foreseen in this regard as sufficient recycling capacity is coming on-stream to treat a higher tonnage of scrap. The few existing sizeable plants are already hard pressed to obtain sufficient feed but are, nevertheless, expanding. In total, CHR Metals estimates that secondary lead production in China is now around 300 000 t per annum, i.e. over 40% of total secondary lead output in Asia excluding Japan. Elsewhere the situation is less clear cut. Lead recycling in the informal sector is undoubtedly taking place in many countries, but it also appears that there is reluctance and difficulty, in some respects related to establishing a plant of an economic scale, for producers in the formal sector to build new recycling capacity or to increase the size of existing operations.

9. The 42-V battery systems for automobiles

In this paper, a broad review of the major trends in global supply and demand in recent years has been presented. Looking forward over the next 5 years or so, developments already evident today will shape the market. One issue is the likely introduction of 42-V electrical systems for vehicles in the relatively near future. This will, undoubtedly, have very profound implications for the lead industry, although the impact, in terms of actual consumption of lead, will unfold over many years and is unlikely to be of real significance until well into the second half of the present decade. At this stage, it is too early to predict how 42-V systems will be implemented and what power storage technology will succeed in meeting the requirements of the automakers. If lead-acid wins the day, then the increased requirements for lead will almost certainly result in a period of supply shortfall and higher prices. This, however, will be alleviated in due course as higher volumes of recycled lead become available.

Of rather more immediate importance is the likelihood of a shortfall in lead supplies over the next few years. As discussed previously, there is already an acute shortage of lead concentrates for primary producers, and this has resulted in a number of plants converting to secondary feed. The very low metal prices that have characterised the last 4 years have proved a massive disincentive to investment in new mining ventures everywhere, except in China. There is a considerable risk that mine production will continue to fall over the next year or two. This will place further pressures on primary producers and overall supplies of refined metal.

Low prices also appear to have an effect on recycling rates in the short term. Unless secondary production continues to expand, lead supplies will rapidly fall short of meeting demand, even if only a modest growth in consumption is assumed. The price of lead has been near historical lows on a number of occasions during 2002. Some of the biggest producers have been forced into negotiations with their creditors and bankers to stave off bankruptcy. To date, production losses have been relatively minimal but the clearest message possible has been given that lead prices witnessed during much of 2002 are simply unsustainable.