

# Zinc

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**W**orld zinc consumption reached 7 732 000 t in 1997, according to preliminary figures from the International Lead and Zinc Study Group (ILZSG), a total that was slightly more than world refined metal production of 7 726 000 t. A substantial Western World zinc metal deficit was largely offset by a large net export of zinc metal to the West by China. Consequently, zinc metal stocks fell by only 47 000 t during the year.

Zinc prices averaged US59.8¢/lb in 1997, a 29% increase over 1996, mainly because of a significant backwardation in the market in August and September when the cash prices rose well above the usually higher three-month forward prices.

## **CANADIAN DEVELOPMENTS**

Canada's provisional mine production of zinc in 1997 totalled 1 060 000 t. This represents a 13% decrease from 1996, due primarily to the closure of the Faro mine in the Yukon for most of the year and the Langlois mine in Quebec for the first six months of 1997, as well as lower production from several other operations. The Myra Falls mine in British Columbia was an exception, producing more zinc in 1997 from the mining of higher-grade orebodies.

Canada's zinc metal production totalled 701 000 t in 1997, compared to 716 000 t in 1996. The decrease was primarily due to start-up problems with the new Kivcet lead smelter in British Columbia, which treats zinc residues from the adjacent zinc plant.

### **British Columbia**

Cominco Ltd. commissioned its new Kivcet lead smelter at Trail in April, but experienced problems in the feed handling and cooling systems. Since residues from the adjacent zinc plant are fumed in the lead smelter, zinc production was affected.

However, the addition of a new zinc autoclave helped offset the losses. Cominco closed the new smelter for two weeks in November to make modifications to the peripheral systems. A further closure in December resulted from problems with the smelter's oxygen plant.

A two-day strike at Westmin Resources Limited's Myra Falls copper-zinc mine ended with the signing of a new three-year labour contract on September 12, 1997. At year-end, a takeover bid for all of the issued and outstanding shares of Westmin by Boliden Limited was in progress. Boliden, a subsidiary of Sweden's Trelleborg AB, moved its head office to Toronto in 1997.

### **Yukon**

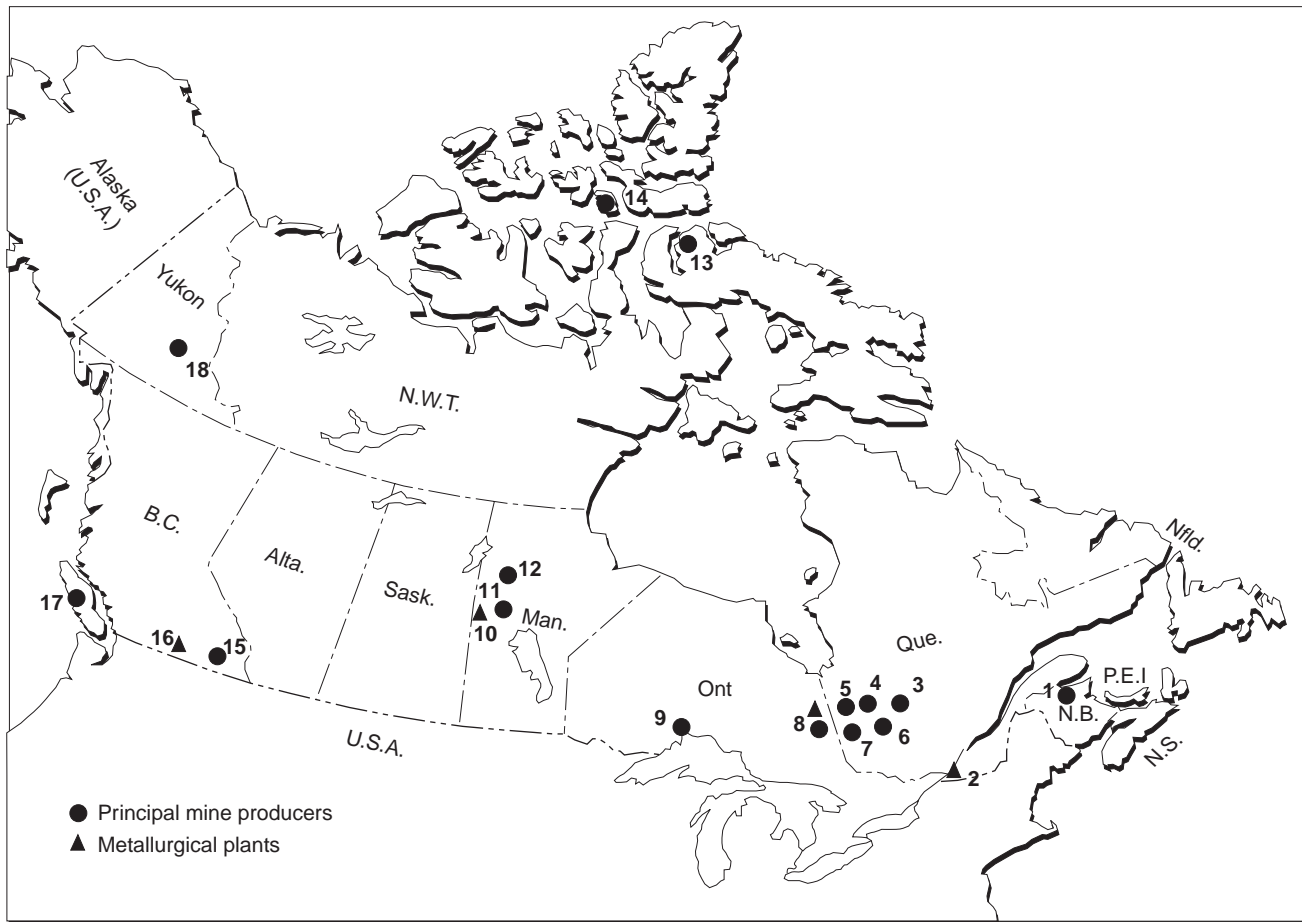
Anvil Range Mining Corporation ceased milling stockpiled ore at its Faro lead-zinc operations at the end of March. The mine re-opened in late October after Anvil Range secured enough capital to complete stripping the Grum orebody. Cominco acquired a 28% interest in Anvil Range in January for \$9.4 million and provided an additional \$20 million in loans. In addition, Swiss-based Glencore International AG entered into a contract to purchase the mine's concentrate production to March 1998 with an option to extend the arrangement beyond that date. However, Anvil Range shut the Faro operations again in January 1998 due to low metal prices.

In August, Cominco announced its intention to re-open the Sa Dena Hes zinc-lead mine near Watson Lake, subject to favourable metal prices. The company also signed a socio-economic participation agreement with the local Liard First Nation. In December, however, Cominco decided to postpone the re-opening of the mine, which has been on care and maintenance since 1992.

### **Saskatchewan/Manitoba**

Hudson Bay Mining and Smelting Co., Limited closed its Westarm mine at Flin Flon in January with a loss in capacity of 3000 t/y of zinc in concentrate. The company announced in August the commencement of the first phase of its nearby Konuto Lake project, which consists of underground development and diamond drilling. A production decision would be

**Figure 1**  
**Zinc Producers in Canada, 1997**



Numbers refer to locations on map above.

### ZINC MINES

- |                      |   |                 |   |
|----------------------|---|-----------------|---|
| 1. Brunswick #12     | Brunswick Mining and Smelting Corporation Limited | 10. Flin Flon   | Hudson Bay Mining and Smelting Co., Limited |
| Heath Steele         | Noranda Inc.                                      | Callinan        | Hudson Bay Mining and Smelting Co., Limited |
| Caribou/Restigouche  | Breakwater Resources Ltd.                         | Trout Lake      | Hudson Bay Mining and Smelting Co., Limited |
| 3. Gonzague-Langlois | Cambior Inc.                                      | 11. Photo Lake  | Hudson Bay Mining and Smelting Co., Limited |
| 4. Isle Dieu         | Noranda Inc.                                      | 12. Ruttan      | Hudson Bay Mining and Smelting Co., Limited |
| Norita-East          | Noranda Inc.                                      | 13. Nanisivik   | Nanisivik Mines Ltd.                        |
| 5. Selbaie           | Les Mines Selbaie                                 | 14. Polaris     | Cominco Ltd.                                |
| 6. Louvicourt        | Aur Resources Inc./Novicourt Inc.                 | 15. Sullivan    | Cominco Ltd.                                |
| 7. Bouchard-Hébert   | Audrey Resources Inc.                             | 17. Myra Falls  | Westmin Resources Limited                   |
| 8. Kidd Creek        | Falconbridge Limited                              | 18. Faro (Grum) | Anvil Range Mining Corporation              |
| 9. Winston Lake      | Inmet Mining Corporation                          |                 |   |

### ZINC METALLURGICAL PLANTS

- |                |   |
|----------------|---|
| 2. Valleyfield | Canadian Electrolytic Zinc Limited          |
| 8. Kidd Creek  | Falconbridge Limited                        |
| 10. Flin Flon  | Hudson Bay Mining and Smelting Co., Limited |
| 16. Trail      | Cominco Ltd.                                |

dependent upon the results of this initial work. Primarily a copper project, Konuto Lake would produce about 5000 t/y of zinc in concentrate.

## Ontario

Falconbridge Limited suspended mining operations on October 29 at its Kidd Creek mine near Timmins due to instability of the walls in the mine's open pit. The company subsequently restarted mining on November 3 after developing a new mining plan for the upper part of the underground mine that excludes ore extraction between the 2000 and 2500 levels. The new plan resulted in lower-than-expected copper and zinc production for November and December. The lower output is expected to continue for the first half of 1998 until mining resumes between the 2000 and 2500 levels. Falconbridge plans to make up the resulting concentrate shortages at its nearby zinc refinery from inventories and purchases of custom feeds.

Inmet Mining Corporation brought on stream the Pick Lake copper-zinc orebody at its Winston Lake mine near Schreiber to replace the original Winston Lake orebody which is nearing exhaustion. The Pick Lake Zone is accessible from the workings of the main Winston Lake mine.

## Quebec

Cambior Inc. re-opened its Langlois mine near Lebel-sur-Quévillon on July 1 after closing it in December 1996 due to low metal prices. During the closure Cambior completed additional development of, and changes to, the ore handling system in order to reduce ore dilution and increase efficiency. As a result, the mine's zinc capacity was revised to 36 000 t/y of zinc in concentrate.

Noranda Inc. ceased operations at Matagami in December with the exhaustion of the Isle Dieu and Norita East zinc-copper mines, which resulted in the loss of 50 000 t/y of zinc in concentrate. The nearby Bell Allard zinc-copper deposit is being developed for production but will not be ready until early 1999. The Mattagami mill will be placed on care and maintenance until that time.

Noranda re-opened its Gallen zinc mine near Rouyn-Noranda in October in order to temporarily compensate for lost production from Matagami. Gallen has a capacity of 28 000 t/y of zinc in concentrate.

Severe ice storms in southern Quebec in early January 1998 resulted in power outages at Canadian Electrolytic Zinc Limited's (CE Zinc) Valleyfield zinc refinery. About 5000 t of production were lost in the week-long shut-down, but CE Zinc was able to cast zinc cathodes from Falconbridge's Kidd Creek refinery to meet customer commitments.

Agnico-Eagle Mines Limited continued to develop zinc-rich lenses at its polymetallic LaRonde gold mine near Cadillac. The company plans to produce 52 000 t/y of zinc in concentrate by 2000.

## New Brunswick

Breakwater Resources Ltd. re-opened its Caribou open-pit lead-zinc mine in the Bathurst area in July. The mine had been closed since 1990. Feed to the Caribou mill includes that from the company's newly developed Restigouche underground lead-zinc mine which opened at the same time.

In addition to the Caribou mine, Breakwater operates the Nanisivik zinc mine on Baffin Island and the El Mochito lead-zinc mine in Honduras. In the latter half of 1997, the company acquired several additional zinc assets, including the presently closed Bougrine mine in Tunisia, the El Toqui zinc-gold mine in Chile, four operating zinc mines in Bolivia, and a zinc mine and 35 000-t/y zinc smelter in Argentina.

## Nova Scotia

Savage Resources Ltd. dewatered the Scotia (formerly Gays River) lead-zinc mine and began underground evaluation after purchasing the former producer in 1996. Excessive groundwater has been a major factor in past attempts to mine the orebody from underground. Savage plans to mine primarily by open-pit methods if prices improve enough to make a positive production decision.

## WORLD DEVELOPMENTS

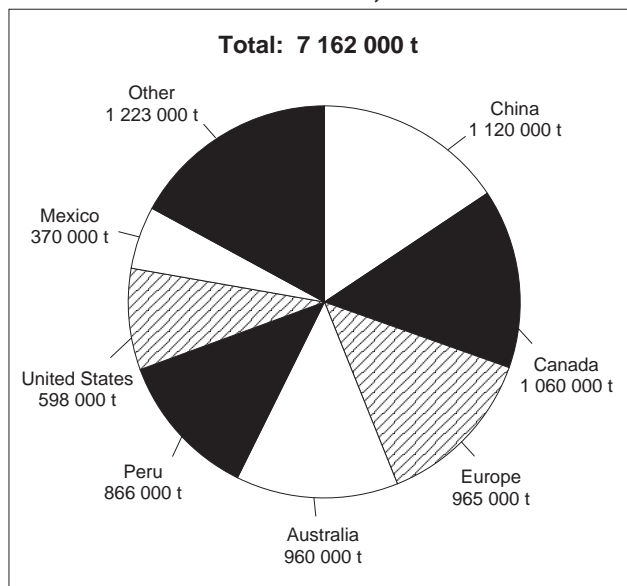
The world's mine production of zinc was 7 168 000 t in 1997, a decrease of 2% from 1996. The main decline was in Canada with lesser decreases in several other countries. These declines were partially offset by increases in Ireland, Spain and Peru. World zinc metal production reached 7 726 000 t, an increase of 4% over 1996, due largely to new capacity coming on stream in China and the Republic of Korea.

## Europe

ARCON International Resources Plc began shipping concentrates in March from its new Galmoy underground zinc-lead mine in Ireland. Galmoy, the first new mine in Ireland in over 20 years, has a capacity of 66 000 t/y of zinc in concentrate. Meanwhile, ongoing exploration has identified reserves in addition to the original mineable reserve of 6.2 Mt grading 11.3% zinc and 1.1% lead.

Also in Ireland, partners Minorco Lisheen Ltd. and Ivernia West Plc obtained planning permission for, and began development of, the US\$247 million

**Figure 2**  
**World Zinc Mine Production, 1997**



Source: International Lead and Zinc Study Group.

Lisheen underground zinc-lead mine. Ongoing diamond drilling has increased reserves to 18.9 Mt grading 12.8% zinc and 2.2% lead, most of which is in the proven and probable categories. When in full production in 1999, the mine will have a capacity of 175 000 t/y of zinc in concentrate.

Asturiana de Zinc S.A. announced plans to increase by 1999 the capacity at its 305 000-t/y Aviles electrolytic zinc refinery in Spain by 25 000 t/y through roaster modernization and minor investments. The Aviles refinery is the largest zinc plant in the world. Meanwhile, Glencore International AG increased its ownership in Asturiana de Zinc from 25% to 45%.

Boliden's Los Frailes lead-zinc mine in Spain reached its full capacity of 110 000 t/y of zinc in concentrate in November. The mine was opened in late 1996 to replace Boliden's nearby Aznalcollar mine, which had exhausted its reserves.

Italian state-owned Ente Nazionale Idrocarburi was unsuccessful in tendering its 100 000-t/y Crotone zinc refinery to Osmium Holdings and Russia's Norilsk Nickel Concern, which planned to convert the facility to process nickel, copper and platinum group metals. The Crotone plant faces closure due to escalating social, environmental and technological costs.

The European Commission established anti-dumping duties early in 1997 on unwrought zinc imported into the European Union from Russia and Poland. For Poland, the rate ranges from 5.5% to 14.4%, while for Russian imports it is 5.5%. The international trading group Euromin plans to appeal the ruling in

the Court of First Instance of the European Communities.

## Australia

Settlement of native title claims affecting the huge Century zinc project in Queensland took place in early May, allowing the purchase of the project and the nearby Dugald River lead-zinc deposit by Pasmaenco Ltd. from Rio Tinto plc for A\$345 million. Approval of the A\$940 million Century project was granted by the Queensland Parliament in September. The agreement reached with Aboriginal groups will provide an A\$60 million compensation package from Pasmaenco for job creation and training activities and a further A\$30 million from the Queensland government for infrastructure development. Start-up of the Century project is expected in 2000 with full capacity of 450 000 t/y of zinc in concentrate by 2001. Half of this production will go to Pasmaenco's Budel zinc refinery in the Netherlands and the remainder will be sold on world markets.

Commissioning of the processing plant at The Broken Hill Proprietary Company Limited's Cannington mine in Queensland began in August with the first concentrate shipments taking place in January 1998. Although primarily a lead-silver mine, Cannington will produce 50 000 t/y of zinc in concentrate.

M.I.M. Holdings Limited undertook a feasibility study on mining its George Fisher zinc-lead-silver deposit north of Mount Isa in Queensland, but had made no production decision by year-end. George Fisher, with a reserve of 108 Mt grading 11.1% zinc, 5.4% lead and 93 g/t silver, could begin production in 2000, replacing M.I.M.'s Hilton mine. Lead-zinc mining at Mount Isa has been ongoing since 1931, but reserves are now nearing exhaustion.

Korea Zinc Co. Ltd. began construction of its A\$500 million Townsville, Queensland zinc refinery in July. The 170 000-t/y refinery, which is scheduled for completion in late 1999, will likely source most of its feed from Australian mines.

Pasmaenco's Elura lead-zinc mine in New South Wales closed for four weeks beginning April 30 following damage to an underground pillar during blasting activities. The weakened area had to be stabilized with backfill before production could resume.

Pasmaenco halted ocean dumping of jarosite residue from its Risdon zinc refinery in Tasmania in October, ahead of the London Convention's deadline of January 1, 1998. The company completed an A\$45 million co-treatment process involving modifications to both its Risdon and Port Pirie, South Australia, refineries. The new process will produce paragoethite at Risdon, which will be shipped to Port Pirie where a slag will be created and fumed to recover zinc and produce a chemically stable residual material.

Western Metals Ltd. opened the Kapok lead-zinc mine and acquired the Pillara (formerly Blendevale) lead-zinc deposit, both in the Leonard Shelf area of Western Australia. Kapok is gradually replacing the company's nearby Cadjebut lead-zinc mine which, at a capacity of 65 000 t/y of zinc in concentrate, is nearing exhaustion. Pillara, which is scheduled to open in mid-1998 at a cost of A\$73 million, will have a capacity of 100 000 t/y of zinc in concentrate. In preparation for increased lead and zinc concentrate production, Western Metals has renovated the port of Derby and built a self-discharging concentrate barge at a cost of A\$19.5 million.

## United States

Exploration drilling at Cominco's Red Dog mine in Alaska has expanded a mineralized zone that was discovered in 1996 immediately north of the Aqqaluk deposit, which itself contains an inferred reserve of 76 Mt grading 13.7% zinc, 3.6% lead and 66 g/t silver. An expansion of the Red Dog mine by 170 000 t/y should be completed in 1998 to bring its overall capacity to 500 000 t/y of zinc in concentrate.

A six-week strike at ASARCO Incorporated's Coy, Immel and Young mines in Tennessee ended on November 21 with salaried workers receiving increased wages and health benefits. During the dispute, supervisory personnel kept the Young mine operating on a reduced basis.

The U.S. Defense Logistics Agency (DLA) held an industry meeting on October 24 to hear views on its proposed new format for stockpile zinc sales for fiscal year 1998. The DLA plans to sell 2000 short tons (st) per month of zinc under sealed-bid format for a total of 24 000 st, with an additional two sales of 13 000 st each under a negotiated format. The reference price for the negotiated sales would be a fixed price using the monthly average of the official London Metal Exchange (LME) settlement price. The DLA is authorized to sell 50 000 st of zinc from the strategic stockpile in fiscal year 1998. It sold 41 477 st of zinc in fiscal year 1997.

## Latin America

Japan's Dowa Mining Co., Ltd. and Sumitomo Metal Mining Co., Ltd. established a joint venture with Mexican metals company Industrias Peñoles SA de CV to develop the US\$44 million Rey de Plata copper-zinc-lead mine in Guerrero State. Commercial mining would begin in 2000 with a capacity of 20 000 t/y of zinc in concentrate when in full operation. Peñoles is also developing the US\$70 million Francisco Madero open-pit copper-zinc-lead mine in Zacatecas State, which would add a further 120 000 t/y of zinc in concentrate. Meanwhile, Peñoles plans to increase capacity at its 135 000-t/y Torreon zinc refinery by 85 000 t/y of refined zinc.

Cominco announced approval in late September for a US\$300 million expansion of its 82%-owned Cajamarquilla zinc refinery in Peru to be completed by 2000. The company is currently expanding the refinery by 20 000 t to 120 000 t/y, and the second expansion will raise its capacity to 240 000 t/y of refined zinc. Cominco plans to source the additional zinc concentrates from within Peru.

Equal partners Rio Algom Limited and Inmet Mining Corporation of Canada purchased the Antamina copper-zinc project in July from Peruvian state-owned Centromin Peru S.A. for US\$20 million with a commitment to invest a further \$2.5 billion. By year-end the companies had completed a feasibility study on the huge deposit, which has a minimum in-pit resource of at least 500 Mt averaging 1.2% copper, 1.0% zinc, 11 g/t silver and 0.03% molybdenum. An open-pit mine at Antamina could possibly produce 240 000 t/y of zinc in concentrate early in the next millennium.

A consortium comprised of U.S. metals refiner The Doe Run Company and its parent Renco Group Inc. purchased a 51% interest in the La Oroya smelting complex, which includes a 70 000-t/y electrolytic zinc refinery, for US\$126 million, with Doe Run retaining an option to purchase the remaining stake for \$120 million. Doe Run promised to invest a further \$120 million in the complex over five years. Centromin also finalized the sale of its Mahr Tunel and Yauricocha lead-zinc mines to Peruvian companies.

The Zinc Corporation Plc of the United Kingdom and Peruvian company Cia Minera San Valentin SA have agreed to build the world's first commercial-scale Warner zinc plant at the latter's zinc mine in Peru. The ZincCo-Warner process would extract zinc from concentrate to produce between 25 000 and 50 000 t/y of Prime Western grade zinc by 1999.

## Asia

Exports of refined zinc from China to the West rose 158% in 1997 to 534 000 t, partly due to increased metal production from recently completed smelter projects. In addition, China was required to deliver up to 250 000 t of zinc metal to the LME in August and September to cover contracts negotiated in late 1996 at prices below US\$1200/t. Prices at the time of delivery ranged between \$1400 and \$1500/t. As a result of the loss-making positions and the subsequent difficulties in meeting delivery dates, the China National Nonferrous Metals Industry Corporation (CNNC) set up a lead and zinc trading centre to centralize hedging activities and to coordinate all long-term contracts signed by CNNC-operated enterprises.

China's zinc mine capacity rose by a modest 43 000 t/y of zinc in concentrate in 1997, mainly from an expansion of the state-owned Changba open-pit lead-zinc

mine in Gansu Province. Minor zinc smelting capacity was added with the opening of the 13 000-t/y state-owned Xijiangshan zinc refinery in Hunan Province. Construction also began on the new 25 000-t/y state-owned Longnan zinc refinery in Gansu Province, which is to be completed in 1998.

With India's demand for zinc expected to rise well above its current domestic production in the next few years, a number of zinc mine and smelter projects are under way in that country. Hindustan Zinc Ltd. is expanding its open-pit Rampura Agucha zinc-lead mine in Rajasthan State by 51 000 t/y for a capacity of 141 000 t/y of zinc in concentrate. The company also plans 10 000-t/y expansions at both its Debari and Vishakhapatnam zinc refineries, to be completed in 2000. Meanwhile, Binani Zinc Ltd. is beginning a two-stage 30 000-t/y expansion of its zinc refinery in Kerala State. In addition to the expansions, the Indian government approved construction of a new 60 000-to-100 000-t/y smelter by Hindustan Zinc to be completed by 2002.

## Africa

An agreement with American Mineral Fields Inc. to carry out feasibility studies on rehabilitation and resumption of production at the Kipushi mine in the Democratic Republic of the Congo's Shaba Province was cancelled by state-owned La Générale des Carrières et des Mines (Gécamines) late in 1997. The agreement also included various options for processing the zinc and copper ore, and for the retreatment of existing tailings. The Kipushi mine was closed in 1993 due to a lack of spare parts and operating supplies, and is currently on care and maintenance. Reserves stand at 23 Mt grading 2.1% copper, 13.8% zinc and 1.5% lead, while 25 Mt of tailings grade 2.3% zinc, 0.4% copper and 1.6% lead.

Billiton International BVI Limited completed a feasibility study on development of a new 250 000-t/y zinc smelter in South Africa. A decision is expected in February 1998 after the South African government decides on whether to construct a deep water port at Coega in Eastern Cape Province.

## SECONDARY ZINC

Secondary zinc includes high-purity zinc refined from the treatment of electric arc furnace (EAF) dusts, remelted zinc with a purity less than 98.5% zinc, and scrap zinc used in the production of zinc alloys. According to ILZSG, the amount of secondary zinc recovered in the Western World has risen steadily in recent years, reaching 1.95 Mt in 1996.

The recycling of galvanized steel has become an important source of secondary zinc with processes developed to treat EAF dusts or to dezinc steel before it is remelted. The Waelz kiln is the most common method of processing EAF dusts. Waelz oxides are

treated in imperial smelting furnaces for the production of refined zinc. The requirement of Waelz kilns to be near their feed source, i.e., steel mill complexes, would suggest that treatment of these dusts will be most important in the United States, Japan and Western Europe.

Terra Gaia Environmental Group Inc. announced in July its intention to construct a facility in Contrecoeur near Montréal to recycle up to 20 000 t/y of currently produced and stockpiled EAF dusts at Stelco McMaster Ltée's nearby steel plant and other facilities. Terra Gaia's hydrometallurgical process would produce zinc sulphide for sale to zinc refineries and iron that would be sold back to the nearby steel companies. Construction of the plant is scheduled for the spring of 1998.

Metal Recovery Technologies Inc. (MRT), which operates a steel dezincing plant in Indiana in the United States, added a second electrowinning cell to bring its zinc capacity up to 2 st per day. The plant processes galvanized steel scrap to produce black scrap and zinc powder that is 99.8% pure. MRT is considering the construction of a second plant after receiving a request from General Motors Corporation to process 100 000-250 000 t/y of galvanized scrap. The MRT process, which was developed in partnership with U.S. federal agencies, uses a caustic solution to dissolve zinc, forming a sodium zincate solution that is then electrowinned to recover zinc.

The Basel Convention, under its Amendment III/1, bans all movements of hazardous wastes destined for final disposal and, by December 31, 1997, banned movements of hazardous recyclables destined for recovery operations to states not listed in Annex VII of the Convention. Annex VII now includes all OECD member states with the exception of the Czech Republic, and also includes Liechtenstein. In May, in advance of implementation of the ban amendment, India imposed a blanket ban on imports of hazardous wastes destined for recycling, including zinc and brass skimmings, which are not considered to be hazardous wastes under the Convention.

In hearing the case of an Indian importer of secondary zinc recyclables in September for a renewal of its import licence, the Indian High Court asked the Indian government to decide on whether it would allow the import of zinc ash and skimmings for recycling.

## CONSUMPTION AND USES

World zinc consumption grew by 2.8% in 1997 to reach 7 732 000 t despite the economic slowdown in parts of Asia late in the year as a result of weakening currencies. The Republic of Korea and Thailand were especially hard hit. However, continued strong demand was seen in Japan, Europe and the United States, particularly in the galvanizing sector.

Galvanic protection of steel has been the predominant end use of zinc in recent years and currently represents 47% of zinc consumption. Zinc is used extensively in the automotive and construction industries for corrosion protection and remains the most cost-effective means of protecting steel against corrosion. Zinc coatings act as a physical barrier and as a sacrificial oxidant. The oxide, in turn, acts as a further barrier to corrosion.

The desire to reduce weight and improve fuel efficiency has led to increased use of galvanized steel in the automotive industry to protect the thinner gauges of steel from corrosion. In North America, the consumer trend toward all-purpose vehicles or sport utility vehicles has increased the consumption of zinc-coated automotive sheet. Both hot-dipped and electro-galvanized steel are used, the thicker coating of hot-dipped steel giving more corrosion protection to unexposed surfaces and the thinner coating of electro-galvanized steel providing a smoother finish for exposed painted surfaces.

In December, Dofasco Inc. announced its intention to build a 72-inch-wide hot dip galvanizing line at its Hamilton plant at a cost of \$170 million-\$180 million. The line will produce galvanized and galvanized steel panels for the automotive industry. French steelmaker Usinor Sacilor SA is expected to purchase a 20% interest in the project, which is scheduled for start-up in mid-1999.

Galvanized steel is also used in construction for structural components, roofing, siding and reinforcement bars. Nails and other building materials are often hot dip galvanized. Zinc and zinc-aluminum thermally sprayed coatings are used for the long-term corrosion protection of large steel structures such as bridges and hydro-electric transmission towers.

With the relatively high cost of lumber, fabricated hot-dipped structural steel is becoming cost-competitive for use in residential home construction. The number of steel-framed homes built yearly in the United States has risen steadily and was estimated at 250 000 in 1997. The U.S. steel industry hopes to capture 25% of the housing market (350 000 homes per year) by 2000, which would require 200 000 t/y of zinc.

Galvanized steel studs have a number of advantages over wood, including less volatile prices, less weight, immunity to warping or termites, fire resistance, and recyclability. However, disadvantages include their tendency to bend or dent if improperly handled and the need for specialized training and tools.

A number of zinc alloy coatings have been developed over the years with superior qualities over pure zinc in specific applications. These include Galfan (90% zinc, 5% aluminum and the remainder rare earth elements) and Galvalume (55% aluminum, 43.4% zinc

and 1.6% silicon), as well as zinc-iron and zinc-nickel alloys. Galfan, for example, exhibits higher formability and paintability than other coatings, and zinc-nickel alloys reduce the reactivity of high-silicon steels.

Canada's hot-dip galvanized steel and Galvalume capacity of 1 902 000 t/y is located in Ontario at the facilities of Dofasco Inc. and Stelco Inc. in Hamilton and DNN Galvanizing Corporation in Windsor, and in Quebec at Sorevco in Coteau-du-Lac.

The manufacture of brass and bronze is the second most important use of zinc, accounting for 19% of consumption. Consumption of brass and bronze is highly dependent on the performance of the construction industry as these alloys are used in plumbing fittings, heating and air conditioning components, and other products. The addition of zinc to copper alloys improves their machinability, strength and resistance to corrosion.

The third most important use of zinc, accounting for 14% of consumption, is in zinc-based alloys for the creation of die-cast products such as builders' hardware and automobile fittings. The goal of weight reduction in automobiles for increased fuel efficiency has led to a reduction in the use of zinc die castings, although in the last few years zinc-based alloys have regained some of their former market share. The major reasons for this have been the development of direct injection die castings, the popularity of zinc-aluminum die-casting alloys, and diversification away from over-reliance on the automotive sector.

One promising series of alloys is ACuZinc, which contains 5-11% copper and 2.8-4.0% aluminum, with the balance being zinc. These alloys increase the durability and performance, and reduce the thickness, of automotive die castings compared to many other zinc alloys.

Zinc semi-manufactures represent about 8% of zinc consumption and include rolled zinc for roofing applications and the production of coinage. Rolled zinc roofing is especially popular in Europe.

The remainder of zinc consumption is for oxides and other chemicals and zinc dust. Zinc oxide has a variety of applications, the most important of which is as an accelerator in the curing of rubber. High-purity zinc oxide is used in the pharmaceutical industry and zinc oxide-based salves and ointments have long been known for their healing properties. Other grades are used in the zinc plating industry, as an anti-corrosion agent in lubricants, and in paints, animal feeds and a variety of chemicals.

Zinc-air batteries are a promising development in the race to create viable electric vehicles. The zinc-air battery has a range three to four times that of comparatively sized lead-acid batteries. Its slow recharge time can be overcome by the introduction of replace-



able cassettes that house a zinc anode and two cathodes that extract oxygen from air to fuel the chemical reaction. When removed, these cassettes can be taken to a regeneration facility where electrowinning cells turn zinc oxide back into zinc. Such a system is ideal for fleet vehicles that return to a centralized location each day, but for passenger vehicles the plan requires considerable infrastructure.

Zinc-air batteries are being tested for use in electric vehicle fleets in Germany and Sweden. The Electric Power Research Institute (EPRI) in the United States agreed in June to introduce the zinc-air battery in North America. The EPRI will assess the performance, market acceptance and environmental impact of the battery, as well as the feasibility of establishing a zinc regeneration infrastructure in the United States. In September, the New York Power Authority agreed to start a test program to fit New York City buses with zinc-air batteries.

## INTERNATIONAL LEAD AND ZINC STUDY GROUP

The International Lead and Zinc Study Group was formed in 1959 to improve market information and to provide opportunities for regular intergovernmental consultations on lead and zinc markets. Particular attention is given to providing regular and frequent information on supply, demand, and the outlook for lead and zinc.

The Study Group is headquartered in London, England. Its membership includes most major lead- and zinc-producing and consuming countries. While it has an extensive information-gathering and dissemination role, the Group has no market intervention powers. It holds a general session each year in the fall. Member countries' delegations include industry representatives as advisors. Canada has been an active member since its inception.

The 42nd Session of the Study Group was held in Dublin, Ireland, in October 1997 and was attended by representatives of 22 member countries and observers from several nations and organizations. The 1997 session examined statistical trends, current new mine and smelter projects, increased focus on consuming industries, the implications of the Basel Convention, and proposed European Commission directives involving the use of metals in products.

The Recycling Committee reviewed progress in the organization of the Study Group's 7th international recycling conference to be held in Toronto, Canada, in May 1998. The conference will examine the recycling of lead and zinc from the aspects of efficiency, competitiveness and environmental responsibility toward the goal of metals sustainability.

## PRICES AND STOCKS

Zinc began 1997 at a price of US\$47¢/lb, its lowest level of the year. With falling LME zinc stocks and speculative buying, prices rose in the first part of the year to reach 58.3¢/lb in mid-March and then ranged slightly below this through April. In early May, speculators began to drive up zinc prices by buying LME zinc ahead of Chinese delivery dates to the LME. China had negotiated in late 1996 to deliver up to 250 000 t of zinc to the LME in August and September at prices in the 50¢/lb range. It was believed by some that China would have difficulty delivering that much metal and would have to buy it at current spot prices, thereby incurring great losses.

Zinc prices rose through June and July and a backwardation developed whereby the price of zinc for immediate delivery reached almost US\$200/t above the three-month price. The zinc price reached its high for the year on July 28 at 79.8¢/lb and then fell by 9.5¢ the next day in a major market correction. The backwardation continued through August with volatile prices ranging from 69¢-79¢/lb. In early September the LME set a limit on the backwardation to 1% of the previous day's settlement price.

With Chinese delivery dates met, prices began a gradual decline throughout the remainder of the year as stocks rose and speculators withdrew from the market due to the developing Asian currency crisis. Zinc prices ended the year at US\$49.5¢/lb and averaged 59.8¢/lb for 1997.

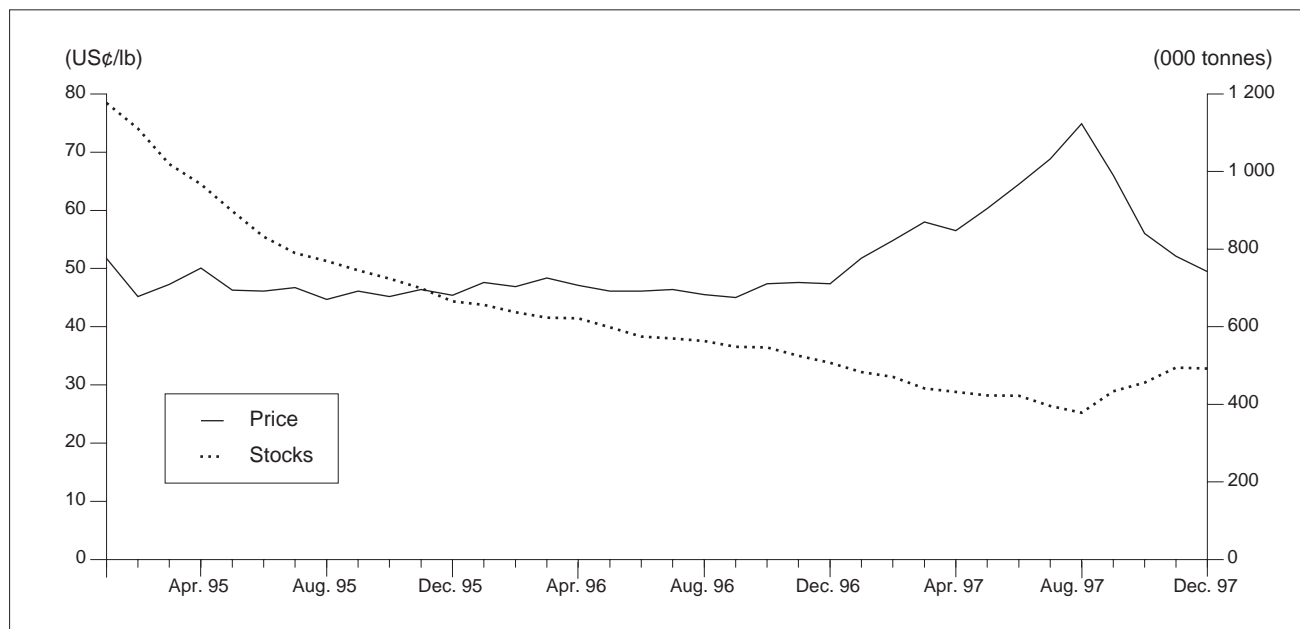
Zinc stocks stood at 1 100 000 t at the end of 1996, which included 506 800 t on the LME. Although LME stocks continued their fall throughout much of 1997, the rate of decline began to slow in May. From September onward, zinc stocks increased when zinc withdrawn during the market squeeze was returned to the LME. Stocks stood at 1 053 000 t at the end of 1997, including 492 000 t on the LME.

## OUTLOOK

In 1998, world consumption of zinc is forecast to increase by 1.9% from the 1997 level to 7 880 000 t. Lower zinc consumption in several Asian countries is forecast due to reduced demand for automobiles and a slowing of infrastructure projects in countries such as Thailand, the Republic of Korea (South Korea), and Indonesia. The economic slowdown will be a result of austerity measures in response to continuing financial market pressures and currencies linked to an appreciating U.S. dollar. However, demand in China is expected to remain strong. Zinc demand should also remain relatively strong in North America and Europe in the automotive and construction sectors.



**Figure 3**  
**LME Zinc Stocks vs. LME Settlement Prices, 1995-97**



Source: Reuters.

Note: End-of-month data.

Worldwide, galvanizing will continue to be the dominant end use for zinc as it remains the most cost-effective means of corrosion protection for steel. Galvanizing will be followed by brass and bronze manufacture and then zinc-based alloys, including die casting. In Canada, galvanizing will again be followed in importance by die casting.

The world's mine production of zinc is forecast to reach 7 600 000 t in 1998, an increase of 6% over 1997 due to new mine openings in Ireland and Australia, and expansions in the United States and India. World zinc metal production is expected to total 7 900 000 t, an increase of 2.3% over 1997 and slightly more than 1998 metal consumption. However, when U.S. stockpile sales are included, a zinc metal surplus of 60 000 t is forecast for 1998. Surplus zinc in the Western World is expected to be higher, but that will depend on Chinese export levels, which will be determined by domestic demand and prices, the value of the Chinese yuan, and demand levels in other Asian countries as a result of the current currency crisis.

With an expected small zinc metal surplus in 1998, any further fall in LME zinc stocks during the year will likely be modest. The price of zinc is therefore predicted to remain in the US50¢-55¢/lb range for the first half of the year, before rising in the second half as a result of rebounding demand in Asia; it is forecast to average US58¢/lb for 1998.

Beyond 1998, investments made in the zinc industry in recent years will result in large increases in mine and smelter capacity near the turn of the century. This situation, combined with a cyclical economic downturn, is expected to lead to weakening zinc prices in the first few years of the next decade, followed by a gradual rise through to 2005. Prices are forecast to range between US49¢ and 57¢/lb (in constant 1997 cents) during this period.

*Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of January 31, 1998.*

## TARIFFS

Item No.	Description	Canada			United States	EU	Japan <sup>1</sup>
		MFN	GPT	USA	Canada	MFN	WTO
2603.00 2603.00.00.30	Copper ores and concentrates Zinc content	Free	Free	Free	Free	Free	Free
2607.00 2607.00.00.30	Lead ores and concentrates Zinc content	Free	Free	Free	Free	Free	Free
2608.00 2608.00.00.30	Zinc ores and concentrates Zinc content	Free	Free	Free	Free	Free	Free
2616.10 2616.10.00.30	Silver ores and concentrates Zinc content	Free	Free	Free	Free	Free	Free
26.20	Ash and residues (other than from the manufacture of iron or steel) containing metals or metallic compounds containing mainly zinc						
2620.11	Hard zinc spelter	Free	Free	Free	Free	Free	Free
2817.00	Zinc oxide; zinc peroxide	Free-8.5%	Free	Free	Free	9.4%	4.7%
28.33	Sulphates; alums; peroxosulphates (persulphates)						
2833.26	Of zinc	Free	Free	Free	Free	6.9%	4.2%
79.01	Unwrought zinc						
7901.11	Zinc, not alloyed: Containing by weight 99.99% or more of zinc	Free	Free	Free	Free	2.5%	5.78 yen/kg
7901.12	Containing by weight less than 99.99% of zinc	Free	Free	Free	Free	2.5%	5.78 yen/kg
7901.20	Zinc alloys:						
7901.20.00.10	Containing by weight 90% or more but less than 97.5% of zinc	Free	Free	Free	Free	2.5%	5.4-5.7 yen/kg
7901.20.00.20	Containing by weight less than 90% of zinc	Free	Free	Free	Free	2.5%	Free-5.4 yen/kg
7902.00	Zinc waste and scrap	Free	Free	Free	Free	Free	0.8%
79.03	Zinc dust, powders and flakes						
7903.10	Zinc dust	Free	Free	Free	Free	3.3%	4.1%
7903.90	Other:	Free	Free	Free	Free	3.3%	4.1%
7904.00	Zinc bars, rods, profiles and wires	Free	Free	Free	Free	6.2%	3.7%
7905.00	Zinc plates, sheets, strip and foil	Free	Free	Free	Free	6.2%	4.7%
7906.00	Zinc tubes, pipes, and tube or pipe fittings (for example, couplings, elbows, sleeves)	3%	Free	Free	Free	6.2%	3.7%
7907.00	Other articles of zinc						
7907.00.10	Anodes for electroplating	Free	Free	Free	Free	5.8%	4.1%
7907.00.20	Discs or slugs, containing by weight 90% or more of zinc; gutters, roof capping, skylight frames and other fabricated building components	3%	Free	Free	Free	5.8%	4.1%
7907.00.90	Other	3%	3%	Free	Free	5.8%	4.1%

Sources: Customs Tariff, effective January 1998, Revenue Canada; Harmonized Tariff Schedule of the United States, 1998; Worldtariff Guidebook on Customs Tariff Schedules of Import Duties of the European Union (37th Annual Edition: 1997); Customs Tariff Schedules of Japan, 1997.

<sup>1</sup> WTO rate is shown; lower tariff rates may apply circumstantially.

Note: Where there is a tariff "range," a complete match of the HS code was not available; therefore, the high and low for the product in question are shown.

TABLE 1. CANADA, ZINC PRODUCTION AND TRADE, 1996 AND 1997, AND CONSUMPTION, 1994-96

Item No.	1996		1997P	
	(tonnes)	(\$000)	(tonnes)	(\$000)
<b>PRODUCTION</b>				
All forms <sup>1</sup>				
New Brunswick	289 483	404 697	269 938	497 766
Quebec	194 784	272 309	181 863	335 355
Ontario	118 802	166 086	115 655	213 267
Manitoba	84 856	118 629	80 813	149 019
British Columbia	153 478	214 563	162 155	299 014
Yukon	146 190	204 374	38 734	71 426
Northwest Territories	175 126	244 826	167 923	309 650
Total	1 162 720	1 625 482	1 017 081	1 875 497
Mine output <sup>2</sup>	1 222 386	..	1 059 952	..
Refined <sup>3</sup>	716 467	..	701 172	..
<b>EXPORTS</b>				
2608.00.30	Zinc content in zinc ores and concentrates			
	Sweden	15 463	21 125	43 800
	Spain	100 581	66 284	97 545
	Germany	113 749r	115 531r	44 822
	Belgium	136 130r	84 465r	70 219
	Finland	28 521	36 050	27 294
	Italy	51 241	31 921	38 886
	Japan	34 569	22 448	39 068
	Norway	16 221	16 654	23 826
	Netherlands	19 956	15 031	21 765
	France	18 764	13 137	23 094
	Other countries	133 895r	86 212r	42 405
	Total	669 090r	508 858r	472 724
2600.00	Zinc content in other ores and concentrates <sup>4</sup>	1 699	878	324
2603.00.30	Zinc content in copper	-	-	-
2607.00.30	Zinc content in lead	1 608	717	324
2616.10.30	Zinc content in silver	91	161	-
2620.11	Ash and residues containing hard zinc spelter			
	United States	176	192	82
	India	59	52	-
	Total	235	244	82
2620.19	Ash and residues containing mainly zinc, n.e.s.			
	United States	10 907r	10 127r	10 389
	India	235	199	145
	Other countries	92	73	78
	Total	11 234r	10 399r	10 612
2817.00	Zinc oxide; zinc peroxide			
	United States	28 561	43 749	33 003
	Germany	-	-	493
	Japan	219	394	160
	France	10	17	118
	Hong Kong	72	118	54
	Other countries	516r	862r	129
	Total	29 378r	45 140r	33 957
2833.26	Zinc sulphate			
	United States	41	148	59
	Total	41	148	59
7901.11	Zinc, not alloyed, unwrought, containing by weight 99.99% or more of zinc			
	United States	367 667	549 101	342 401
	Indonesia	9 836	15 464	8 625
	Philippines	12 103	18 230	9 029
	Taiwan	13 452	19 878	9 124
	Japan	6 826	10 208	6 193
	Hong Kong	3 757	5 523	4 251
	Malaysia	2 719	4 236	3 699
	Singapore	2 783	3 918	1 266
	Kenya	799	1 140	1 158
	Other countries	4 315	6 516	1 149
	Total	424 257	634 214	386 895
				729 607

TABLE 1 (cont'd)

Item No.		1996		1997P	
		(tonnes)	(\$000)	(tonnes)	(\$000)
<b>EXPORTS (cont'd)</b>					
7901.12	Zinc, not alloyed, unwrought, containing by weight less than 99.99% of zinc				
	United States	135 208	204 152	128 824	237 388
	Taiwan	3 472	5 344	7 674	14 872
	Japan	3 529	5 673	5 180	10 554
	Philippines	1 137	1 859	4 886	10 012
	New Zealand	4 147	5 791	4 036	7 286
	Indonesia	2 110	4 819	3 580	6 849
	Hong Kong	5 723	8 965	2 684	5 516
	Other countries	2 021	3 744	3 206	6 993
	Total	157 347	240 347	160 070	299 470
7901.20	Zinc alloys, unwrought				
	United States	21	42	27	63
	China	127	213	21	37
	Other countries	42r	59r	-	-
	Total	190r	314r	48	100
7902.00	Zinc waste and scrap				
	United States	27 587	15 009	26 276	18 159
	Taiwan	681	666	699	849
	Other countries	340r	274r	277	243
	Total	28 608r	15 949r	27 252	19 251
7903.10	Zinc dust				
	United States	4 567	9 582	5 344	13 555
	Total	4 567	9 582	5 344	13 555
7903.90	Zinc powders and flakes				
	United States	1 662	2 998	2 604	7 125
	Other countries	69	144	297	542
	Total	1 731	3 142	2 901	7 667
7904.00	Zinc bars, rods, profiles and wire				
	United States	64	303	102	461
	Other countries	57	59	-	-
	Total	121	362	102	461
7905.00	Zinc plates, sheets, strip and foil				
	United States	29	224	59	508
	Total	29	224	59	508
7906.00	Zinc tubes, pipes and tube or pipe fittings (for example, couplings, elbows, sleeves)				
	United States	638	6 198	759	6 869
	Total	638	6 198	759	6 869
7907.00	Other articles of zinc				
	United States	1 705	9 735	2 802	16 406
	Other countries	171r	420r	38	204
	Total	1 876r	10 155r	2 840	16 610
<b>IMPORTS</b>					
2608.00.00.30	Zinc content in zinc ores and concentrates	181 783	86 660	181 668	166 571
2603.00.00.30	Zinc content in copper ores and concentrates	31	19	-	-
2607.00.00.30	Zinc content in lead ores and concentrates	362	312	699	614
2616.10.00.30	Zinc content in silver ores and concentrates	4 711	3 410	12 474	11 147
2620.11	Ash and residues containing hard zinc spelter	...	1	-	-
2620.19	Ash and residues containing mainly zinc, n.e.s.	178	159	375	289
2817.00	Zinc oxide; zinc peroxide	6 357	7 432	7 256	9 039
2833.26	Zinc sulphate	4 581	2 894	3 707	2 602
7901.11	Zinc, not alloyed, unwrought, containing by	1 585	2 405	5 980	9 862

TABLE 1 (cont'd)

Item No.		1996		1997 <sup>p</sup>	
		(tonnes)	(\$000)	(tonnes)	(\$000)
<b>IMPORTS (cont'd)</b>					
7901.11	Zinc, not alloyed, unwrought, containing by weight 99.99% or more of zinc	1 585	2 405	5 980	9 862
7901.12	Zinc, not alloyed, unwrought, containing by weight less than 99.99% of zinc	655	957	1 144	1 736
7901.20	Zinc alloys, unwrought	9 411	15 836	11 825	22 432
7902.00	Zinc waste and scrap	2 132	1 970	2 233	2 209
7903.10	Zinc dust	536	1 154	3 532	6 839
7903.90	Zinc powders and flakes	822 <sup>r</sup>	1 689 <sup>r</sup>	522	1 126
7904.00	Zinc bars, rods, profiles and wire	691	1 714	2 387	4 930
7905.00	Zinc plates, sheets, strip and foil	720	2 098	1 506	5 271
7906.00	Zinc tubes, pipes and tube or pipe fittings (for example, couplings, elbows, sleeves)	1 217	6 248	1 420	7 317
7907.00	Other articles of zinc	3 950 <sup>r</sup>	16 154 <sup>r</sup>	5 295	21 493
	Total Imports	219 722	151 112	242 023	273 477

	1994			1995			1996 <sup>a</sup>		
	Primary	Secondary	Total	Primary	Secondary	Total	Primary	Secondary	Total
	(tonnes)								
<b>CONSUMPTION<sup>5,6</sup></b>									
Zinc used for or in the production of:									
Copper alloys (brass, bronze, etc.)	x	x	3 536	x	x	3 402	x	x	3 018 <sup>r</sup>
Galvanizing: electro	x	x	1 746	x	x	1 923	x	x	2 159
hot dip	x	x	67 179	x	x	72 419	x	x	79 047
Zinc die-cast alloys	x	x	25 936	x	x	29 206	x	x	25 451
Other products (including rolled and ribbon zinc, zinc oxides)	x	x	26 494	x	x	26 406 <sup>r</sup>	x	x	27 786 <sup>r</sup>
Total	122 502	2 388	124 890	131 212 <sup>r</sup>	2 145 <sup>r</sup>	133 357 <sup>r</sup>	132 932 <sup>r</sup>	4 528	137 460 <sup>r</sup>
Consumer stocks, year-end	8 093	414	8 507	8 583	60	8 643	7 640 <sup>r</sup>	292 <sup>r</sup>	7 932 <sup>r</sup>

Sources: Natural Resources Canada; Statistics Canada.

– Nil; . . Not available; . . . Amount too small to be expressed; n.e.s. Not elsewhere specified; <sup>p</sup> Preliminary; <sup>r</sup> Revised; x Confidential.<sup>a</sup> Increase in number of companies being surveyed.

<sup>1</sup> New refined zinc produced from domestic primary materials (concentrates, slags, residues, etc.) plus estimated recoverable zinc in ores and concentrates shipped for export. <sup>2</sup> Zinc content of ores and concentrates produced. <sup>3</sup> Refined zinc produced from domestic and imported ores. <sup>4</sup> Includes HS classes 2603.00.30, 2607.00.30 and 2616.10.30. <sup>5</sup> Consumer survey does not represent 100% of Canadian consumption and is therefore consistently less than apparent consumption. <sup>6</sup> Due to sensitivity in some end-use categories, a breakdown of primary and secondary sources is not provided in order to be consistent.

Note: Numbers may not add to totals due to rounding.

**TABLE 2. CANADA, ZINC PRODUCTION AND EXPORTS,<sup>1</sup> 1975, 1980 AND 1985-97**

	Production		Exports		
	All Forms <sup>2</sup>	Refined <sup>3</sup>	In Ores and Concentrates	Refined	Total
	(tonnes)				
1975	1 055 151	426 902	705 088	247 474	952 562
1980	883 697	591 565	434 178	471 949	906 127
1985	1 049 275	692 406	396 103	555 621	951 724
1986	988 173	570 981	450 249	427 176	877 425
1987	1 157 936	609 909	613 185	441 227	1 054 412
1988	1 370 000	703 206	816 885	551 521	1 368 406
1989	1 272 854	669 677	614 223	495 061	1 109 284
1990	1 179 372	591 786	716 185	452 251	1 168 436
1991	1 083 008	660 552	566 815	520 508	1 087 323
1992	1 195 736	671 702	678 172	509 744	1 187 916
1993	990 727	659 881	455 953	493 264	949 217
1994	976 309	690 965	450 320	551 168	1 001 488
1995	1 094 703	720 346	609 575	533 179	1 142 754
1996	1 162 720	716 467	670 789 <sup>r</sup>	581 604	1 252 393 <sup>r</sup>
1997 <sup>p</sup>	1 017 081	701 172	473 048	546 965	1 020 013

Sources: Natural Resources Canada; Statistics Canada.

<sup>p</sup> Preliminary; <sup>r</sup> Revised.

<sup>1</sup> Beginning in 1988, exports are based on the new Harmonized System and may not be in complete accordance with previous method of reporting. Ores and concentrates include HS classes 2608.00.30, 2603.00.30, 2607.00.30 and 2616.10.30. Refined includes HS classes 7901.11 and 7901.12. <sup>2</sup> New refined zinc produced from domestic primary materials (concentrates, slags, residues, etc.) plus estimated recoverable zinc in ores and concentrates shipped for export. <sup>3</sup> Refined zinc produced from domestic and imported ores.

**TABLE 3. WESTERN WORLD, PRIMARY ZINC STATISTICS, 1993-97**

	1993	1994	1995	1996	1997 <sup>p</sup>
	(000 tonnes)				
Mine production (zinc content)	5 249	5 172	5 361	5 584	5 456
Metal production	5 453	5 375	5 466	5 499	5 569
Metal consumption	5 554	5 862	6 233	6 196	6 366

Source: International Lead and Zinc Study Group.

<sup>p</sup> Preliminary.

**TABLE 4. WORLD MINE PRODUCTION OF ZINC, 1993-97**

	1993	1994	1995	1996	1997P
	(000 tonnes)				
<b>EUROPE</b>					
Finland	22	17	16	26	31
Ireland	194	194	184	164	193
Poland	151	151	155	159	147
Russia	154	147	131	126	130
Spain	171	151	172	140	166
Sweden	167	160	169	160	157
Others	181	150	147	130	141
Subtotal	1 040	970	974	905	965
<b>AFRICA</b>					
Morocco	66	79	80	82	90
Namibia	28	33	30	35	40
South Africa	78	76	74	77	71
Others	31	17	45	35	6
Subtotal	203	205	229	229	207
<b>OCEANIA</b>					
Australia	1 007	928	882	1 008	960
<b>AMERICAS</b>					
Bolivia	123	101	146	145	160
Brazil	138	146	136	128	128
Canada	1 004	1 011	1 121	1 235	1 060
Mexico	370	381	364	379	370
Peru	668	690	692	761	866
United States	513	598	644	628	598
Others	85	81	94	104	97
Subtotal	2 901	3 008	3 198	3 380	3 279
<b>ASIA</b>					
China	775	990	1 011	1 121	1 120
India	156	147	154	154	146
Iran	77	75	95	76	75
Japan	119	101	95	79	72
Kazakistan	207	152	155	157	155
Korea, D.P.R.	110	90	90	80	70
Thailand	69	59	14	19	11
Turkey	32	34	65	68	70
Others	62	53	40	39	32
Subtotal	1 607	1 701	1 719	1 793	1 751
Total world	6 758	6 812	7 001	7 315	7 162
Total Western World	5 249	5 172	5 361	5 584	5 456

Source: International Lead and Zinc Study Group.  
P Preliminary.



**TABLE 5. WORLD ZINC METAL PRODUCTION, 1993-97**

	1993	1994	1995	1996	1997P
	(000 tonnes)				
<b>EUROPE</b>					
Belgium	210	211	211	207	214
Finland	170	173	177	179	177
France	310	309	314	324	317
Germany	381	360	322	328	318
Italy	254	256	260	269	267
Netherlands	214	212	208	207	201
Norway	134	137	131	135	145
Poland	149	158	165	165	169
Russia	203	138	166	172	180
Spain	342	296	364	363	373
Others	272	261	268	299	307
Subtotal	2 639	2 511	2 586	2 648	2 668
<b>AFRICA</b>					
Algeria	29	24	27	30	30
South Africa	96	94	99	101	108
Others	15	1	—	—	—
Subtotal	140	119	126	131	138
<b>AMERICAS</b>					
Argentina	31	35	36	36	39
Brazil	194	199	194	187	172
Canada	670	691	720	716	701
Mexico	209	209	223	222	128
Peru	159	161	159	176	169
United States	382	356	363	366	377
Subtotal	1 645	1 651	1 695	1 703	1 696
<b>ASIA</b>					
China	857	1 017	1 077	1 185	1 409
India	150	157	159	149	154
Japan	666	666	664	599	603
Kazakstan	224	172	169	169	180
Korea, D.P.R.	115	100	100	90	75
Korea, Republic of	270	271	279	287	329
Others	157	149	150	140	178
Subtotal	2 439	2 532	2 598	2 619	2 928
<b>OCEANIA</b>					
Australia	317	318	322	327	307
Total world	7 180	7 131	7 327	7 428	7 733
Total Western World	5 453	5 375	5 466	5 499	5 569

Source: International Lead and Zinc Study Group.  
 — Nil; P Preliminary.

**TABLE 6. WORLD ZINC CONSUMPTION, 1993-97**

	1993	1994	1995	1996	1997 <sup>P</sup>
	(000 tonnes)				
<b>EUROPE</b>					
Belgium	211	225	250	235	240
France	219	241	272	248	255
Germany	495	519	505	480	485
Italy	300	320	345	336	340
Russia	164	114	130	130	142
Spain	119	140	159	150	150
United Kingdom	196	206	224	226	226
Others	568	552	589	602	623
Subtotal	2 272	2 317	2 474	2 407	2 461
<b>AFRICA</b>					
South Africa	87	92	95	95	98
Others	64	55	61	60	60
Subtotal	151	147	156	155	158
<b>OCEANIA</b>					
Australia	142	173	180	177	176
New Zealand	21	22	20	20	20
Subtotal	163	195	200	197	196
<b>AMERICAS</b>					
Brazil	135	151	179	185	185
Canada	134	147	149	149	158
Mexico	120	132	119	152	178
United States	1 223	1 176	1 234	1 214	1 280
Others	144	138	138	149	153
Subtotal	1 656	1 744	1 819	1 849	1 954
<b>ASIA</b>					
China	530	655	750	829	850
India	155	192	202	214	225
Japan	719	721	752	736	746
Korea, Republic of	301	318	350	364	359
Taiwan	171	170	205	194	228
Others	488	520	577	578	546
Subtotal	2 364	2 576	2 836	2 915	2 954
Total world	6 606	6 979	7 458	7 523	7 723
Total Western World	5 554	5 862	6 233	6 196	6 366

Source: International Lead and Zinc Study Group.  
<sup>P</sup> Preliminary.

**TABLE 7. CANADA, ZINC METAL CAPACITY, 1997**

Company and Location	Annual Rated Capacity
	(000 tonnes of slab zinc)
<b>PRIMARY</b>	
Canadian Electrolytic Zinc Limited Valleyfield, Quebec	230
Falconbridge Limited Timmins, Ontario	133
Hudson Bay Mining and Smelting Co., Limited Flin Flon, Manitoba	95
Cominco Ltd. Trail, British Columbia	272
Total primary, Canada	730
<b>SECONDARY</b>	
Federated Genco Limited Burlington, Ontario	Closed
Purity Zinc Metals Co. Ltd. Stoney Creek, Ontario	Phasing out secondary refining
Total secondary, Canada	-

Source: Natural Resources Canada.  
- Nil.

**TABLE 8. MONTHLY AVERAGE ZINC PRICES, 1996 AND 1997**

	North American Special High Grade	LME Special High Grade Settlement
	(US¢/lb)	
<b>1996</b>		
January	50.6	46.2
February	50.7	47.0
March	51.2	48.3
April	50.6	47.4
May	50.5	47.0
June	49.6	45.8
July	49.9	45.4
August	51.3	45.7
September	51.4	45.4
October	51.1	45.5
November	53.3	47.5
December	52.8	47.0
Yearly average	51.1	46.5
<b>1997</b>		
January	55.2	49.3
February	59.3	53.5
March	62.7	56.9
April	62.0	56.3
May	64.9	59.5
June	66.1	61.4
July	73.3	68.9
August	79.1	75.0
September	78.5	74.5
October	62.1	58.1
November	57.4	53.2
December	54.2	50.0
Yearly average	64.6	59.8

Sources: *Metals Week*; *Reuters*.