Tin

Philip Wright

The author was with the Minerals and Metals Sector, Natural Resources Canada. Enquiries should be directed to the Nonferrous Division at tel. (613) 992-4402.

World mine production of tin was 204 000 t in 1996, with refined production reaching 209 000 t, according to *World Nonferrous Metal Statistics*. Tin metal consumption reached 218 000 t in 1996 with a consequent reduction in both London Metal Exchange (LME) and commercial tin metal stocks. For 1997, tin metal production and consumption were expected to be roughly in balance with the 2300-t increase in LME stocks being offset by lower commercial stock levels. The increasing use of tin in several applications to replace lead for environmental and health concerns was expected to bolster tin metal consumption for 1997.

The settlement price on the LME averaged US$2.56/lb in 1997, compared to $2.80/lb in 1996. The decline was mainly the result of speculative selling due to negative trends with other metals.

CANADIAN DEVELOPMENTS

In March, Adex Mining Corp. received the results of a feasibility study on its Mount Pleasant tin-tungsten-indium property in New Brunswick. The study concluded that the estimated $102 million capital cost of constructing a 2500-t/d tin concentrator and a bioleaching plant to recover indium metal was too high and that the mine life was too short to proceed with this option. Adex is currently considering a smaller concentrator and producing separate tin and indium-copper-zinc concentrates in order to reduce the capital cost by $30 million.

There are currently no tin mines or smelters operating in Canada. Canada's consumption of refined tin in 1996 was 2796 t.

WORLD DEVELOPMENTS

China

China was the world's largest producer of tin in concentrate in 1996, accounting for 57 000 t. For the January-October 1997 period, preliminary figures indicate that production was up a further 3% from the equivalent period in 1996. China also ranked first in tin metal production in 1996 with 55 800 t.

With increased tin production and falling domestic prices, China's exports of refined tin rose in 1997 by 14% over 1996 to 41 000 t, according to preliminary figures. Higher exports from China were a major reason why increases in tin stocks on the LME balanced out the decreases recorded in 1996.

Indonesia

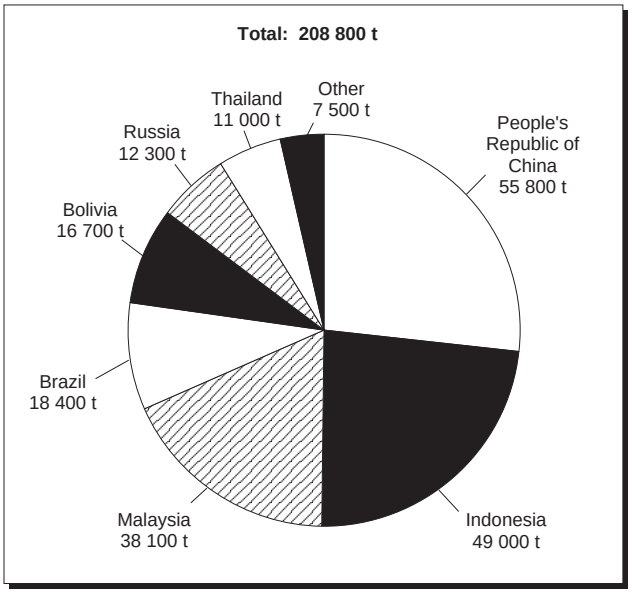
Indonesia was the second largest producer of tin in concentrate in 1996, accounting for 51 000 t as its tin mine production rose for the third consecutive year. The country's largest tin producer, P.T. Tambang Timah, increased inland mine production by 11% and offshore dredge production by 6% compared to its 1996 production level. Timah's output represented 83% of Indonesia's tin mine production with P.T. Koba Tin producing the remainder.

Indonesia's refined tin production in 1996 was 49 000 t, again ranking second behind China. The 1996 total represented an increase for the fourth consecutive year. P.T. Tambang Timah, Indonesia's predominant tin refiner, indicated in September that it planned to produce 45 000 t in 1997 which, along with production from P.T. Koba Tin, would indicate a further overall increase in Indonesia's refined tin production for 1997.

Peru

Peru's tin mine production was 26 700 t in 1996, and a similar total was expected in 1997. Peru's only tin mine is Minsur's San Rafael mine. With the commissioning of Minsur's 15 500-t/y tin smelter at Pisco in 1996, Peru became a producer of refined tin for the first time with a nominal 800 t. However, with a full

Figure 1
World Production of Tin Metal, 1996[p]



Source: *World Nonferrous Metal Statistics.*
[p] Preliminary.

year's production at near capacity, the total is expected to reach 12 000 t in 1997. Feed for the increased production is obtained by exporting less of the company's mine production to Bolivia where most of it is currently toll smelted at that country's Vinto tin smelter. In early January 1998, Minsur announced that it plans to invest US$29 million for a further expansion of its Pisco smelter.

Brazil

Mamore Mineracao e Metalurgia SA, Brazil's largest tin producer and the tin subsidiary of the Paranapanema Group, planned to increase both refined tin and tin mine production in 1997. Mamore operates the Pitinga alluvial tin mine in Amazonas State and has a 69% share of production from the Bom Futuro alluvial tin mine in Rondonia State. Brazil was the world's fourth largest producer of both tin in concentrate and refined tin in 1996 with 20 300 t and 18 400 t respectively.

Bolivia

Canadian company Itec Mineral Inc. completed a feasibility study on recovering tin from mine tailings in the Potosi mining district. The study indicated that a 60% recovery would be obtained from a processing plant that would cost US$26 million. No decision on building the plant has yet been taken. Mining of silver and gold at Potosi has taken place since the days of the Inca empire, but tin mining became important only in the twentieth century. The major producer is state-owned Comibol. Bolivia was fifth in tin mine production with 14 800 t, and also fifth in refined tin production with 16 700 t in 1996.

Another unsuccessful attempt was made by the Bolivian government to privatize its 20 000-t/y Vinto tin smelter in 1997. No bids were received by the June 30 deadline. Vinto is facing increasing competition for concentrates from Minsur's new tin smelter in Peru and requires capital upgrades to remain competitive. Smelter operations are also being affected by labour unrest.

Malaysia

The decline in the Malaysian tin mining industry continued in 1996 as tin-in-concentrate production fell for the seventh consecutive year. A further 4% fall was recorded in the first eight months of 1997. Due to low tin prices and stagnant demand, Malaysian tin mining enterprises have diversified out of tin in recent years into other metals, as well as into the manufacturing sector.

Malaysia did remain the world's third largest producer of refined tin in 1996, with a total of 38 100 t, behind China and Indonesia. The tightness in local concentrates has, however, led Malaysian smelting company Escoy Smelting Sdn Bhd to consider the sale of its 60 000-t/y Georgetown tin smelter. Production at the smelter in 1996 was only 16 000 t, with 14 000 t planned in 1997.

Russia

Management of the Novosibirsk tin smelter has secured a US$4 million loan from Moscow's Tokobank to install a gas turbine in order to cut energy costs by 40%. The smelter, located in Siberia, is subject to high transportation and power costs. A further credit fund to allow the smelter to purchase concentrates is being studied. Refined tin production at Novosibirsk in 1997 is expected to be much lower than the 12 000 t originally forecast due to feed shortages.

Other

The South Crofty tin mine in Cornwall, England, faced closure at year-end. The mine's owner, South Crofty Holdings Ltd. of Canada, announced its intention to close the mine because of falling tin prices and the strength of the British pound sterling. Management at the mine has sought various options, including state or European Union financial assistance and hedging of the mine's production. Earlier in the year, workers agreed to a 10% pay cut. South Crofty was expected to produce 2300 t of tin in concentrate in 1997, a 200-t increase over the 1996 level.

Indian tin producer Hamco Mining and Smelting Co. Ltd. plans to increase its refined tin production by

several thousand tonnes in 1998 over its forecast production of 6000 t in 1997. The increase would be the result of a capital expansion at the company's tin mines and Bombay smelter.

The U.S. Defense Logistics Agency (DLA) sold 12 044 t of tin from its stockpile in fiscal year 1997 (ending October 1, 1997). A total of 1735 t (from an allocated 2000 t) was sold in monthly spot sales that replaced the daily sales format for the 1996 fiscal year. The remainder was sold under long-term contract.

RECYCLING

The recycling rate for steel cans continues to rise in the world's major tin-consuming regions. Japan had the highest recycling rate in 1996 at 77%, followed by the United States with 58% and Europe with 45%.

The recycling of tin-plated steel cans is accomplished by magnetic separation in municipal waste streams and through curbside recycling programs. Ontario was the first province in Canada to initiate a curbside collection system known as the Blue Box program. This initiative has resulted in the diversion of more than 350 000 t of steel cans from landfill to recycling facilities.

Tin-plated steel cans may either be detinned or reintroduced directly into the steel furnace if a high-purity steel is not required. In the detinning process, the tin-plated steel cans are introduced into a chemical bath, usually containing a caustic solution, where the tin coating is dissolved. The resulting pure steel is baled and resold to steelmakers. Tin is recovered from the pregnant solution by electroplating and is then refined to form secondary ingots.

INTERNATIONAL ORGANIZATIONS

The Association of Tin Producing Countries

The Association of Tin Producing Countries (ATPC) is an organization of tin-producing states formed in 1983 and based in Malaysia. In recent years, the ATPC maintained a supply rationalization scheme to absorb large tin metal stocks caused by the cessation of the International Tin Council buffer stock operations and to prevent further price declines. The rationalization scheme assigned export quotas to member countries in an attempt to lower stock levels. However, the plan was largely unsuccessful as some of the largest producing countries exported far in excess of their quotas. Once comprising eight nations, only China, Malaysia, Indonesia, Bolivia, Zaire and Nigeria remained ATPC members at the beginning of 1997.

The ATPC suspended its supply rationalization scheme in May 1996 and agreed to monitor the free market fortunes of tin. No decision was made at the organization's September meeting on whether to reinstate the quota system. At that meeting, Malaysia announced its intention to withdraw from the ATPC as the country was now a net importer of tin. However, Brazil, which has been an observer at the ATPC meetings for the past few years, reiterated its intention to join the organization.

ITRI Ltd.

ITRI Ltd., formerly the International Tin Research Institute, is entrusted with the task of maintaining and extending the use and effectiveness of tin in modern technology. Its headquarters and laboratories are in Uxbridge, England. Formerly funded by ATPC member countries, the organization was privatized as of January 1, 1995. As a result, private tin-producing companies are now responsible for its funding and any liabilities arising from research and development activities. At the end of 1997, ITRI had 14 tin industry members.

ITRI's mandate is to support and expand the use of tin metal through continuous development of the technological processes involved in its applications, the development of new uses, and promotion through conferences, seminars, training and technical support to industry. ITRI's current projects include the development of lead-free solders, tin shot as a non-toxic alternative to lead shot, and tin-based fire retardants and polymer stabilizers. The organization is also examining the increased use of high-tin alloys to improve the performance of lead-acid batteries.

ITRI has commercially developed several electroplating systems for producing environmentally acceptable corrosion-protection and decorative finishes. These include the alkaline stannate bath for plating pure tin, the first viable plating baths for tin-copper, tin-zinc, tin-nickel and tin-cobalt coatings, and the recent commercial development of new and improved tin-nickel and tin-zinc electrolytes. ITRI has also commercialized a cyanide-free tin-zinc plating system known as Stanzec (75% tin, 25% zinc).

CONSUMPTION

Solder is the largest market for tin. According to ITRI, solder alloys consume 31% of world tin production. In Canada, they accounted for about 55% of tin consumption in 1996. A composition of 60% tin and 40% lead is the most common alloy for electronics applications. However, environmental and health concerns over lead have resulted in alloys of higher tin content being used in the electronics industry in recent years. Examples are alloys comprising 95% tin and 5% antimony, as well as 96.5% tin and 3.5% silver. These solders have a high melting point.

Metals such as bismuth or indium may be added to tin-based solders to lower the melting point. Such solders are known as fusible alloys. One such alloy is Indalloy 227, which has a composition of 77.2% tin, 20% indium and 2.8% silver. Fusible alloys are used in safety mechanisms such as fire sprinklers and electrical fuses.

In tin-based solders, tin is the active metal forming the bond with the metals being joined by interacting with their surfaces. Tin is ideal for this application because of its ability to bond with a wide range of metals.

A recently developed use for fusible alloys is in the manufacture of plastic components with complex internal structures for use in the automotive and aerospace industries. These components are made using a casting of tin-bismuth or tin-lead-antimony alloy that can then be melted away without damaging the delicate internal configuration of the plastic part.

In recent years, the demand for tin with a purity of 99.99% has increased for electronic applications. Demand for lead-free solders using high-purity tin will likely increase in the automotive industry in light of the proposed European Commission Directive on end-of-life vehicles. The directive proposes that heavy metals such as lead, mercury, cadmium and hexavalent chromium be either recycled or phased out of new vehicles, thus diverting these metals from landfill.

Tinplate is the second most important use of tin and accounts for almost one third of world tin metal consumption and 32% of Canadian consumption. Tinplate use in the canning industry has been under severe competitive pressures from aluminum, except for large containers where, due to rigidity problems with aluminum, tin-plated steel is still preferred. Can manufacturers in Canada and the United States have increasingly switched to aluminum in the production of beverage cans. However, the volatility of aluminum prices has led some can manufacturers to switch back to tin-plated steel.

The food packaging industry makes use of two types of tin-plated steel cans. The first is the three-piece can, which is used mostly to preserve foods such as fruits and vegetables. This type of can uses three pieces of tinplate. One piece is rolled into a cylindrical shape and the overlapping edges are welded to form the sides of the can. The bottom piece is then seamed into the can. The top of the can is attached in a similar fashion after the food is introduced. Two-piece cans are used in preserving beer and soft drinks, as well as some foods. In this type of can, a single piece of tin-plated steel is stretched and drawn to form the bottom and sides of the can. After the introduction of the food or beverage (usually under vacuum for foodstuffs or under pressure for beverages), the top is seamed in, as with the three-piece can.

Tinplate competition also comes from non-tin-coated steels, polymer-coated steel and tin-free steel (TFS). TFS is steel plate that is electrolytically coated with a thin layer of metallic chrome and chrome oxide.

Tin-based alloys are also used to plate steel. Terneplate is a tin-lead alloy that is used in such applications as fuel tanks. The future of terneplate in the automotive sector, however, is somewhat in doubt with the European Commission's proposed ban on lead in non-essential automotive applications. Other tin-based alloys such as tin-nickel and tin-zinc alloys are also used to tin or electroplate steel to give increased hardness, wear resistance and corrosion protection.

The fastest growing use for tin has been in chemical applications where consumption has risen steadily in the past few decades. Tin is used in an array of inorganic and organic chemicals, for application as plastic (polyvinyl chloride) stabilizers, in agricultural pesticides, and in anti-fouling paints for ships, ceramics, and biocidal compounds for the protection of materials such as paints, textiles and building materials.

Recent research has shown the effectiveness of tin-based compounds as flame and smoke inhibitors. As fire retardants, these compounds are non-toxic, safe and easy to handle, and have a wide range of applications. Two such compounds, zinc hydroxystannate and zinc stannate, are being marketed worldwide for use as fire retardants and smoke inhibitors for polymeric materials.

Indium-tin oxide is a vital component in computer display panels. A rapid expansion in the market for display technology in uses such as liquid crystal displays in laptop computers and televisions has increased the demand for tin.

Pewter is an alloy comprising about 92% tin with the remainder being antimony and copper. The addition of these other metals imparts a hardness to pewter as pure tin is relatively soft. Pewter has been used for decorative artifacts, drinking vessels and jewellery since Roman times, and continues to be popular for this purpose. The traditional method of casting pewter is by gravity casting where the molten alloy is poured into a mould or die. Recently, pressure die casting has become common. In this method, molten metal is forced under pressure into the die, allowing for faster production rates.

Other typical tin-based alloys are bronzes (alloys of mainly tin and copper), gunmetal (bronze with up to 2% zinc added), and babbitt (which includes alloys of tin, antimony and copper).

Environmental and health concerns over lead have resulted in the substitution of tin as a non-toxic alternative in many applications. For example, the use of tin capsules for sealing wines represents a promising new market for tin. In addition, tin shot has been

gaining acceptance as an alternative to lead for hunting waterfowl because of its non-toxic nature, resistance to oxidation and low mobility. The Canadian Wildlife Service has conditionally accepted tin shot as a non-toxic substitute for lead for hunting migratory game birds in Canada for the 1998/99 hunting season.

World tin consumption was about 218 000 t in 1996, a decline of almost 5% from the total in 1995.

PRICES AND STOCKS

The tin settlement price on the LME began 1997 at US$2.62/lb. It remained in the $2.60-$2.74/lb range through to early April, and reached the year's high of $2.74/lb on January 14 and again on February 18. Speculative selling due to negative trends with other metals took place in April because of the stock market falls in Europe and the United States. The tin price therefore found a new range of between US$2.50 and $2.65/lb until mid-June when it fell below $2.50/lb.

Tin reached its lowest price of the year on August 19 at US$2.41/lb, before climbing back up on investment fund and consumer buying. However, a large stock increase in early December again depressed tin prices and tin closed the year at US$2.45/lb. The average price of tin for 1997 was US$2.56/lb.

Tin stocks on the LME stood at 10 600 t at the beginning of 1997. Stocks rose in the first five months of 1997 but fell again later in the year, especially in October. However, a 2600-t rise in stocks in mid-December resulted in the total reaching 12 900 t at the end of 1997, 2300 t higher than at the beginning of the year.

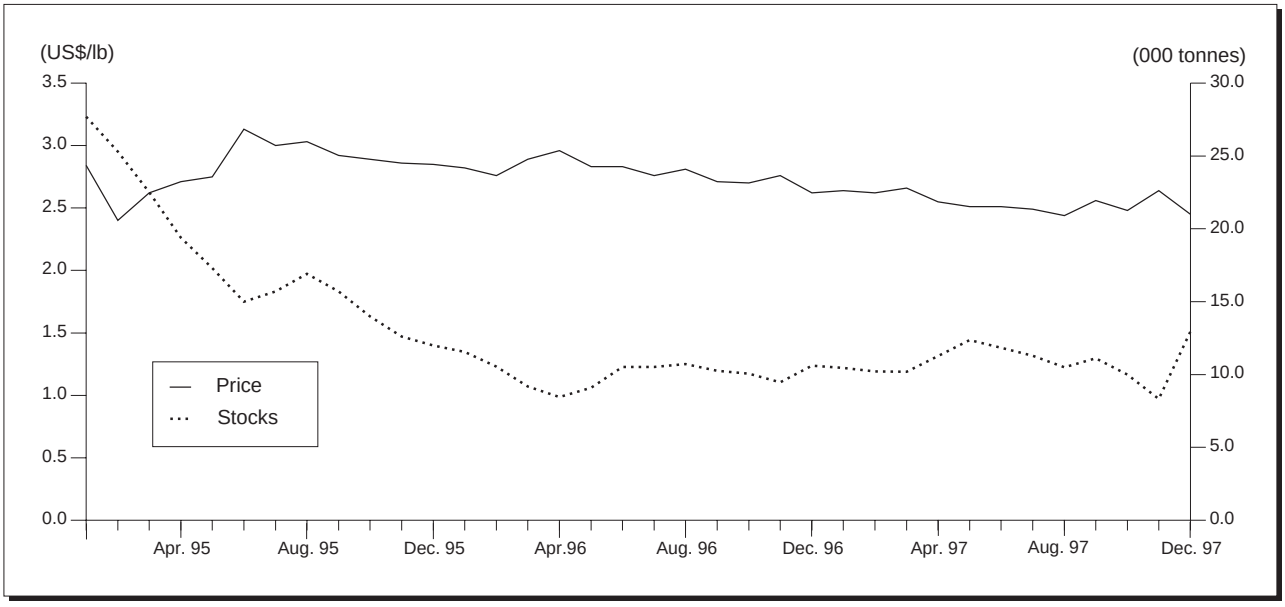
OUTLOOK

Demand for tin in 1998 is forecast to remain strong. Tin will find increased use in new applications such as tin shot for shotgun cartridges, tin chemicals in fire retardants, and tin additives in lead-acid batteries. Steady consumption is also expected for traditional uses such as tinplate, solder, bronzes and pewter. However, the increased demand is expected to be largely offset by greater metal production. The large number of mine closures seen in the past few years, particularly in Southeast Asia, has stabilized and major mine and smelter expansions have taken place in Indonesia and Peru.

With the tin market expected to be in balance again in 1998, tin prices will likely not improve significantly, and the average price forecast for 1998 is US$2.60/lb. Much will depend upon the level of tin metal exports from China.

Notes: (1) For definitions and valuaton of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of February 27, 1998.

Figure 2
LME Tin Stocks vs. LME Settlement Prices, 1995-97



Source: *Reuters.*
Note: End-of-month data.

TARIFFS

Item No.	Description	Canada			United States	EU	Japan[1]
		MFN	GPT	USA	Canada	MFN	WTO
2609.00	Tin ores and concentrates	Free	Free	Free	Free	Free	Free
7204.30	Waste and scrap of tinned iron or steel	Free	Free	Free	Free	Free	Free
8001.10	Tin, not alloyed	Free	Free	Free	Free	Free	Free
8001.20	Tin alloys	Free	Free	Free	Free	Free	2.5%
8002.00	Tin waste and scrap	Free	Free	Free	Free	Free	Free
8003.00	Tin bars, rods, profiles and wire	Free	Free	Free	Free	1.3%	3%
8004.00	Tin plates, sheets and strip, of a thickness exceeding 0.2 mm	2%	Free	Free	Free	1%	3%
8005.00.10	Tin foil of a thickness (excluding any backing) not exceeding 0.2 mm	Free	Free	Free	Free	1.6%	3.8%
8005.00.20	Tin powders and flakes	2%	Free	Free	Free	1.2%	3.8%
8006.00	Tin tubes, pipes and tube or pipe fittings (i.e., couplings, elbows, sleeves)	2%	Free	Free	Free	1.8%	3.8%
8007.00	Other articles of tin	3%	Free	Free	Free	2.1%	4.1%

Sources: Customs Tariffs, effective January 1998, Revenue Canada; Harmonized Tariff Schedule of the United States, 1998; Worldtariff Guidebook on Customs Tariff Schedules on Import Duties of the European Union (37th Annual Edition: 1997); Customs Tariff Schedules of Japan, 1997.
[1] 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, TIN PRODUCTION AND TRADE, 1996 AND 1997, AND CONSUMPTION, 1994-96

Item No.		1996		1997p	
		(tonnes)	($000)	(tonnes)	($000)
PRODUCTION					
	Tin content of tin concentrates and lead-tin alloys	–	–	–	–
EXPORTS					
2609.00	Tin ores and concentrates				
	United States	–	–	13	121
	Total	–	–	13	121
7204.30	Waste and scrap of tinned iron or steel				
	United States	35 863r	4 850r	9 838	1 536
	Other countries	579	196	253	76
	Total	35 442r	5 046r	10 091	1 612
8001.10	Tin, not alloyed, unwrought				
	United States	270	2 359	144	1 281
	Korea, Republic of	2	15	–	–
	Total	272	2 374	144	1 281
8001.20	Tin alloys, unwrought				
	United States	1 110	7 067	744	5 158
	Cuba	. . .	6	–	–
	Total	1 110	7 073	744	5 158

TABLE 1 (cont'd)

Item No.		1996		1997p	
		(tonnes)	($000)	(tonnes)	($000)
EXPORTS (cont'd)					
8002.00	Tin waste and scrap				
	United States	5 898	1 745	740	785
	India	21	9	–	–
	Total	5 919	1 754	740	785
8003.00	Tin bars, rods, profiles and wire				
	United States	564	4 260	965	6 431
	Singapore	2	16	–	–
	Cuba	1	5	–	–
	Total	567	4 281	965	6 431
8004.00	Tin plates, sheets and strip, of a thickness exceeding 0.2 mm				
	United Kingdom	3	65	4	89
	United States	58	96	36	62
	Other countries	1	23	–	–
	Total	62	184	40	151
8005.00.10	Tin foil of a thickness (excluding any backing) not exceeding 0.2 mm				
	United States	8	77	109	156
	Other countries	1	12	1	4
	Total	9	90	109	160
8005.00.20	Tin powders and flakes				
	United States	2	30	1	7
	Other countries	–	–	. . .	. . .
	Total	2	30	1	7
8006.00	Tin tubes, pipes, and tube or pipe fittings (i.e., couplings, elbows, sleeves)				
	United States	–	–	. . .	10
	Total	–	–	. . .	10
8007.00	Other articles of tin				
	United States	. .	2 926	. .	2 690
	United Kingdom	. .	263	. .	141
	Other countries	. .	1372r	. .	387
	Total	. .	4 561r	. .	3 218
IMPORTS					
2609.00	Tin ores and concentrates	–	–	1	9
7204.30	Waste and scrap of tinned iron or steel	3110r	636r	7 386	1 741
8001.10	Tin, not alloyed, unwrought	4 092r	34 838r	4 145	31 098
8001.20.10	Tin-antimony alloys	35	273	21	64
8001.20.20	Tin-lead-antimony alloys	206	1 440	302	2 088
8001.20.90	Other tin alloys	129	1 079	191	1 457
8002.00	Tin waste and scrap	489	1 452	700	1 858
8003.00.10.10	Tin bars and rods, not alloyed	9r	71r	228	1 852
8003.00.30	Tin bars and rods, of phosphor-tin alloys	–	–	3	36
8003.00.50	Tin bars and rods, of other alloys; profiles; other wire	110	1 066	208	1 461
8004.00	Tin plates, sheets and strip, of a thickness exceeding 0.2 mm	79	728	82	688

TABLE 1 (cont'd)

Item No.		1996		1997p	
		(tonnes)	($000)	(tonnes)	($000)
IMPORTS (cont'd)					
8005.00.10	Tin foil of a thickness (excluding any backing) not exceeding 0.2 mm	9	90	109	160
8005.00.20	Tin powders and flakes	2	30	1	7
8006.00	Tin tubes, pipes, and tube or pipe fittings (i.e., couplings, elbows, sleeves)	14	136	9	85
8007.00	Other articles of tin	. .	12 683r	. .	14 388

		1994	1995	1996p
			(tonnes)	
CONSUMPTION[1]				
	Solder	1 608	1 570	1 546
	Tinplate and tinning	1 145	1 056	887
	Babbit	157	164	174
	Bronze	120	155	102
	Other uses (including collapsible containers, foil, etc.)	112	99	88
	Total	3 142	3 044	2 796

Sources: Natural Resources Canada; Statistics Canada.
– Nil; . . Not available or not applicable; . . . Amount too small to be expressed; n.e.s. Not elsewhere specified;
p Preliminary; r Revised.
1 Available data as reported by consumers.
Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, TIN PRODUCTION, TRADE[1] AND CONSUMPTION, 1975, 1980 AND 1985-97

	Production[2]	Exports[3]	Imports[4]	Consumption[5]
		(tonnes)		
1975	319	1 052	4 487	4 315
1980	243	883	4 527	4 517
1985	119	358	3 696	3 511
1986	2 356	3 727	3 925	3 270
1987	3 388	2 778	3 792	3 780
1988	3 787	3 591	4 004	3 489
1989	3 479	2 790	4 020	3 567
1990	3 844	2 828	3 625	3 600
1991	4 392	3 716	3 176	3 178
1992	58	401	3 195	3 042
1993	–	–	3 793	3 250
1994	–	37	4 438	3 142
1995	–	47	4 291	3 044
1996	–	–	4 092r	2 796
1997p	–	13	4 145	. .

Sources: Natural Resources Canada; Statistics Canada.
– Nil; . . Not available; p Preliminary; r Revised.
1 Beginning in 1988, exports and imports are based on the new Harmonized System and may not be in complete accordance with the previous method of reporting. 2 Tin content of tin concentrates shipped plus tin content in lead-tin alloys produced. 3 Tin in ores and concentrates (HS class 2609.00). 4 Tin metal (HS class 8001.10).
5 Available data as reported by consumers.

TABLE 3. WORLD TIN PRODUCTION, CONSUMPTION AND PRICES, 1986-97

	Production			Prices[2]	
	Tin in Concentrates	Metal[1]	Consumption	LME[3]	N.Y. Dealer
		(000 t)		(US$/lb)	
1986	183	206	221	2.87	2.94
1987	186	203	227	3.10	3.15
1988	205	259	237	3.25	3.31
1989	232	262	237	3.93	3.97
1990	216	238	235	2.82	2.88
1991	192	201	222	2.54	2.59
1992	194	195	210	2.77	2.83
1993	193	197	210	2.34	2.39
1994	190	197	217	2.48	2.55
1995	193	206	229	2.82	2.95
1996	204	209	218	2.80	2.88
1997	. .	. .	. .	2.56	2.65

Sources: *World Nonferrous Metal Statistics; Metals Week*.
. . Not available**.**
1 From primary and secondary material. **2** *Metals Week*. **3** London Metal Exchange. For 1987, 1988 and part of 1989, the "Europe Free Market" in-warehouse Rotterdam prices were used to calculate averages.

TABLE 4. WORLD CONSUMPTION[1] OF TIN METAL, 1992-96

	1992	1993	1994	1995	1996**p**
			(tonnes)		
WESTERN WORLD					
United States	33 500	34 700	33 000	36 400	36 500
Japan	31 000	28 600	28 700	28 200	26 900
Germany	20 300	18 600	19 800	20 400	19 300
United Kingdom	10 400	10 400	10 400	10 500	10 500
Korea, Republic of	8 000	9 100	9 800	12 400	11 100
France	8 300	7 600	9 200	9 000	8 000
Taiwan**e**	5 900	6 800	7 900	7 200	7 100
Malaysia	4 600	5 200	5 700	6 000	5 400
Italy	5 500	5 300	4 700	5 300	5 200
Thailand	3 700	4 900	5 100	5 600	6 000
Spain**e**	5 500	6 800	6 700	5 200	3 800
Brazil	6 500	4 100	3 600	5 000	6 100
Other	30 100	26 000	26 300	28 500	22 100
Total Western World	173 300	168 100	170 900	179 700	178 000
EASTERN COUNTRIES					
China, People's Republic of	12 900	21 100	32 100	36 300	27 200
Russia	15 000	12 800	7 000	6 200	3 600
Other	9 200	8 300	6 700	7 100	9 100
Total Eastern countries	37 100	42 200	45 800	49 600	39 900
Total world	210 400	210 300	216 700	229 300	217 900

Source: *World Nonferrous Metal Statistics*.
e Estimated; **p** Preliminary.
1 Tin refined from primary and secondary sources.

TABLE 5. WORLD PRODUCTION[1] OF TIN IN CONCENTRATES, 1992-96

	1992	1993	1994	1995	1996p
			(tonnes)		
WESTERN WORLD					
Indonesia	37 000	36 100	38 500	46 100	51 000
Peru	10 000	14 300	20 100	22 300	26 700
Brazil	28 500	23 300	19 700	19 400	20 300
Bolivia	16 500	18 600	16 000	14 400	14 800
Australia	6 600	8 100	7 400	8 600	8 800
Malaysia	14 300	10 400	6 500	6 400	5 200
Portugal	3 000	5 300	4 300	4 600	4 800
Thailand	8 400	5 100	3 100	1 800	1 300
Other	6 200	5 800	5 400	4 800	3 300
Total Western World	130 500	127 000	121 000	128 400	136 200
EASTERN COUNTRIES					
China, People's Republic of	43 800	49 100	54 100	51 900	57 000
Russia	15 200	13 100	10 500	9 000	7 500
Other	4 000	4 100	4 200	4 100	3 700
Total Eastern countries	63 000	66 300	68 800	65 000	68 200
Total world	193 500	193 300	189 800	193 400	204 400

Source: *World Nonferrous Metal Statistics*.
p Preliminary.
1 Recoverable tin content of ores and concentrates produced.

TABLE 6. WORLD PRODUCTION[1] OF TIN METAL, 1992-96

	1992	1993	1994	1995	1996p
			(tonnes)		
WESTERN WORLD					
Malaysia	45 600	40 000	38 100	39 500	38 100
Brazil	28 500	23 300	19 400	15 400	18 400
Indonesia	28 200	30 400	31 100	44 200	49 000
Bolivia	14 400	18 600	15 300	17 700	16 700
Thailand	10 900	8 600	7 600	8 200	11 000
Mexico	2 600	1 800	1 000	2 100	2 100
Other	7 500	6 000	2 500	2 600	3 100
Total Western World	137 700	128 700	115 000	129 700	138 400
EASTERN COUNTRIES					
China, People's Republic of	39 600	52 100	67 800	62 100	55 800
Russia	15 000	13 500	12 200	12 000	12 300
Other	2 400	2 300	2 300	2 300	2 300
Total Eastern countries	57 000	67 900	82 300	76 400	70 400
Total world	194 700	196 600	197 300	206 100	208 800

Source: *World Nonferrous Metal Statistics*.
p Preliminary.
1 Tin refined from primary and secondary sources.

TABLE 7. MONTHLY AVERAGE TIN PRICES, 1996 AND 1997

	N.Y. Dealer		London Metal Exchange	
	1996	1997	1996	1997
	(US$/lb)			
January	2.97	2.74	2.84	2.67
February	2.94	2.75	2.81	2.67
March	2.93	2.75	2.81	2.68
April	3.04	2.66	2.94	2.59
May	3.00	2.67	2.91	2.59
June	2.90	2.61	2.81	2.52
July	2.92	2.56	2.84	2.47
August	2.85	2.55	2.77	2.46
September	2.84	2.59	2.77	2.49
October	2.78	2.61	2.70	2.52
November	2.79	2.64	2.72	2.57
December	2.72	2.60	2.65	2.50
Yearly average	2.88	2.64	2.80	2.56

Source: *Metals Week*.