BISMUTH

Bill McCutcheon

The author is with the Minerals and Metals Sector, Natural Resources Canada.
Telephone: (613) 992-5480
E-mail: Bill.McCutcheon@cc2smtp.nrcan.gc.ca

Canadian Developments

Canadian bismuth production is estimated at 126 t in 1995, compared to 129 t in 1994 and 204 t in 1992. Cominco Limited is the largest producer of bismuth. It produces high-purity metal at its Trail smelter facility in British Columbia from its own sources and from external mines. Brunswick Mining and Smelting Corporation Limited (BMS) produces an intermediate bismuth-lead alloy (7.75% bismuth) that is sent elsewhere for further processing. Minor amounts of bismuth are derived from the processing of lead-zinc ores at Hudson Bay Mining & Smelting Co. Limited's Flin Flon complex in Manitoba. Bismuth is also recovered during the recycling of lead-acid batteries; Tonolli Canada Ltd. in Toronto and Nova Pb Inc. near Montréal are secondary lead smelters that process significant quantities of lead-acid batteries.

Canadian bismuth consumption in 1994 was reported to be 174 t, continuing the rapid growth rate seen since 1990 when consumption was reported at 12 t. Table 1 provides historical bismuth production and consumption data.

A new bismuth source in eastern Canada that shows promise is the Mount Pleasant property in New Brunswick. Mount Pleasant, a former tungsten producer, closed in 1985. Although now targeted as an indium source, the ore also contains 0.08% bismuth, as well as tin, tungsten, molybdenum and zinc. About 40 000 t of bismuth are contained in the deposit. At a 2000-t/d operating rate, about 400 t/y of bismuth would be produced. A production decision is expected in early 1996, depending largely on the indium market; operations could begin in 1997.

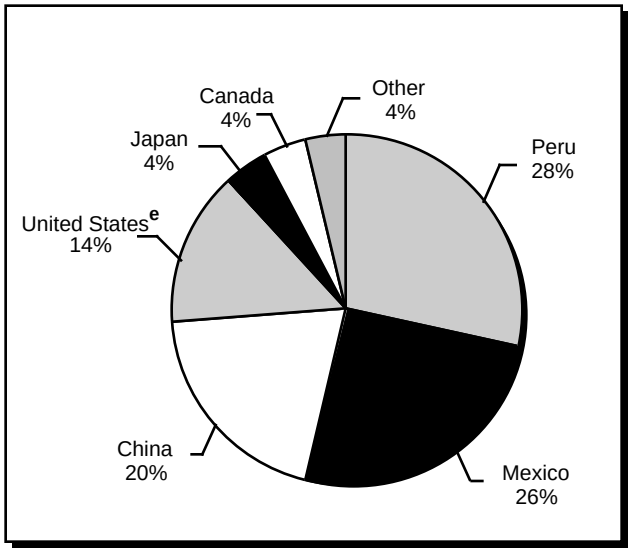
World Developments

In Bolivia, Corriente Resources Inc. of Vancouver owns the former primary bismuth mine at Tasna. Bolivia has not reported bismuth production since 1990. With the growing potential for increased bismuth consumption through new uses, the mine, which shut in 1984, has been reassessed. Sufficient reserves have been established for a mine life of about 11 years at an operating rate of 300 t/d. The grade was reported in early 1996 as 1.1% bismuth, 1.05% copper, 0.38% tungsten trioxide, 0.33 g/t gold, and 22.8 g/t silver. The tin reserves are not included in initial mining plans. Corriente plans to commence operations once it commits its entire output; as of January 1996, about half had been committed. The floor price for Corriente's material is reported to be US$5/lb. Approximately US$5 million will be required to rehabilitate the mine and mill, along with additional expenses to acquire an existing lance smelter in Bolivia to process the concentrates. In September it was reported that Corriente and Sidech of Belgium have a joint-venture agreement to refine the 900-1000 t/y of contained metal from the mine. Corriente has stated that it plans to sell to consumers who intend to use bismuth in new applications in order to minimize the impact of the additional production on existing markets and prices.

Non-U.S. bismuth production in 1994 was estimated by the U.S. Bureau of Mines (USBM) at 3020 t. U.S. production data are withheld as ASARCO Incorporated's Omaha, Nebraska plant is the sole domestic primary producer. Some estimates put U.S. production at about 500 t with the majority coming from domestic sources. In the 1970s, ASARCO's bismuth production was estimated to be about 425 t/y. ASARCO would have to spend US$40 million to meet environmental standards in order to keep the Omaha facility operating past June 1, 1996. However, the plant has been losing money and ASARCO was not expected to spend the required amount.

According to the USBM, estimates for the major non-U.S. mines' production of bismuth in 1994 were: Peru, 1000 t; Mexico, 900 t; China, 700 t; Japan, 150 t; and Canada, 131 t.

Figure 1
World Bismuth Production, 1994



Sources: Natural Resources Canada; U.S. Bureau of Mines.
[e] Estimated.

The 1994 world non-U.S. bismuth production of 3020 t represents a decline from the 1990 level of 3440 t, but it is an increase from the 1992 level of 2740 t. Production dropped due to declining Chinese output from tungsten operations where bismuth is a co-product.

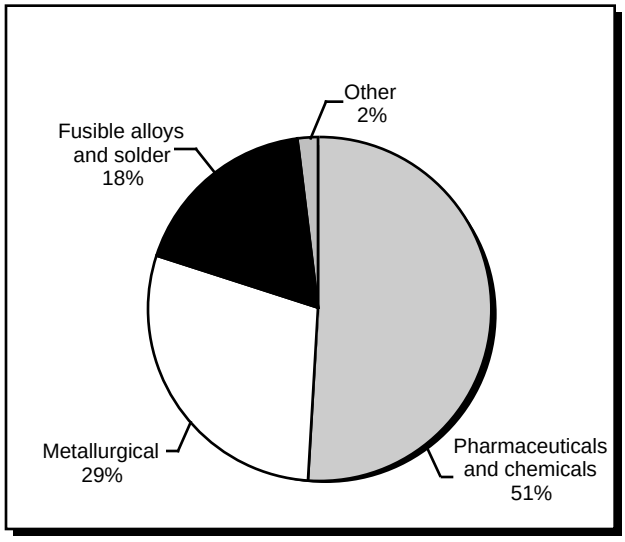
The USBM estimated that world refined metal production outside the United States declined from 4190 t in 1990 to 3670 t in 1992, and then climbed to 4100 t in 1994. The most significant non-U.S. producers in 1994 were: China (1000 t), Peru (900 t), Belgium (900 t), Mexico (650 t), and Japan (500 t). The implied recycling rate outside the United States, assuming the excess of refined production over mine production is due to recycling, shows an increase from 22% in 1990 to about 36% in 1994, or an increase from 750 t to about 1100 t of secondary bismuth.

Sales from U.S. stockpiles were 145 t in 1994 and 136 t in 1995. Sales of 136 t in fiscal year 1996 have been authorized. In early 1995, Russia announced that it would sell 550 t of bismuth from its strategic stockpile.

Consumption and Uses

Bismuth consumption in the United States by sector was estimated by the USBM as pharmaceuticals and chemicals, 51%; metallurgical, 29%; fusible alloys and solder, 18%; and other, 2%. Bismuth pharmaceuticals are used in the treatment of stomach ulcers and other intestinal problems, or for external uses because of their astringent and slight antiseptic properties. Bismuth chemicals are used in ceramic glazes, cosmetics, and pigmentation for paints.

Figure 2
Bismuth Markets in the United States



Source: U.S. Bureau of Mines.

Other applications for bismuth include use as fusible alloys or as metallurgical additives to steel, copper or aluminum to improve machinability.

Potential significant growth areas for new uses centre on applications that substitute for lead. These include: free-machining brass for plumbing fixtures, lubricating greases, shot for hunting, sinkers for fishing, and crystal ware. In 1995, U.S. brass plumbing producers in California agreed to remove lead from plumbing products beginning in stages in 1996, thereby increasing the demand for bismuth to make free-machining brass. Water-fowl hunters in the United States received permission to use bismuth-tin shot for the 1995/96 hunting season. Estimates for future yearly demand for new bismuth uses are 300 t/y for water-fowl shot and 1000 t/y for plumbing. While the demand for bismuth as a lead substitute is promising, price will be an important factor in determining the extent to which bismuth consumption expands into such new uses because bismuth is not essential in these applications.

Prices and Stocks

Bismuth prices increased from an average monthly price[1] of between US$2.30 and $2.40/lb from January 1993 to June 1994 to rise rapidly to US$3.91/lb in August 1994. Between August 1994 and December 1995, prices declined slowly to US$3.27/lb in May and June 1995, and then recovered to end the year at US$4.10/lb. Figure 3 shows the trend of bismuth prices.

Outlook

The outlook for bismuth, as with most minor metals, is uncertain. Most bismuth production is as the by-product of lead, copper or tungsten ores and the price of bismuth is therefore rarely a critical factor that decides such a mine's fate. If tungsten prices were to recover, for example, then increased bismuth production from China could be expected, even if bismuth prices were low. Because bismuth prices and production decisions are not as directly linked as copper or aluminum prices and production are, bismuth and such other minor metals have more potential for greater price volatility (bismuth prices exceeded US$20/lb in 1974). Even so, the outlook for bismuth seems to be more optimistic than for many other minor metals, given the "green" applications that bismuth has the potential to fill.

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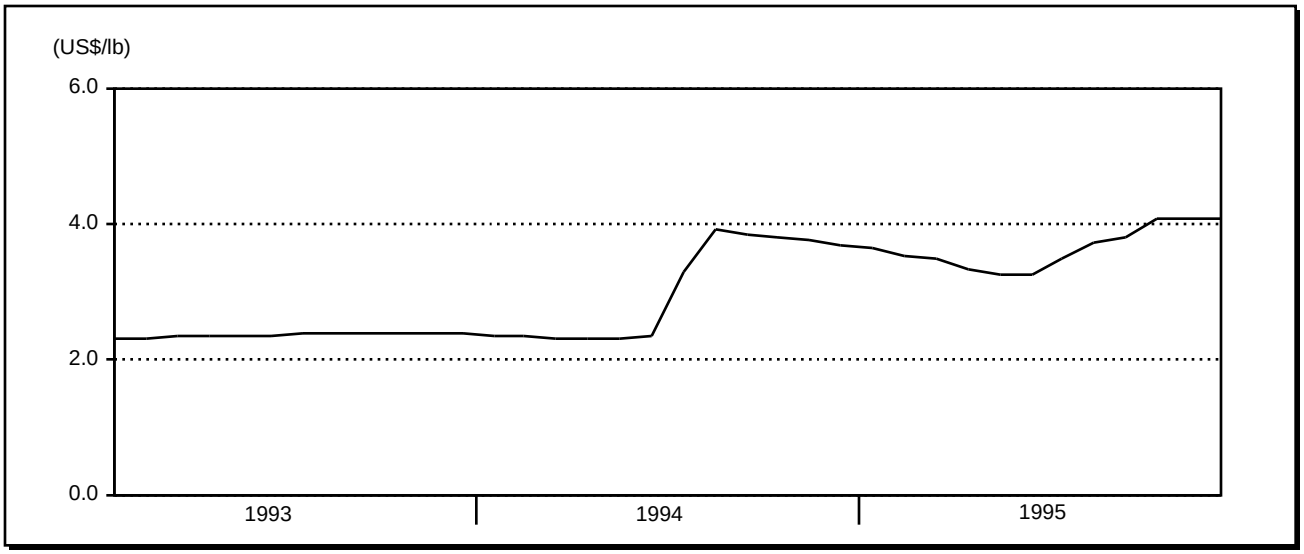
[1] The price cited is mean of the average low and average high prices reported by the *Metal Bulletin*.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 70. (2) Information in this review was current as of January 31, 1996.

Figure 3
Bismuth Prices, 1993-95
Tonne Lots - Average Metal Bulletin Free Market Price



Source: *Metal Bulletin*.

TARIFFS

Item No.	Description	Canada			United States
		MFN	GPT	USA	Canada
2617.90.00.90	Bismuth ores and concentrates	Free	Free	Free	Free
8106.00.10	Unwrought bismuth, not alloyed; powders, not alloyed	Free	Free	Free	Free
8106.00.20	Unwrought bismuth, alloyed; waste and scrap; powders, alloyed; articles of bismuth	Free	Free	Free	Free

Sources: Customs Tariff, effective January 1996, Revenue Canada; Harmonized Tariff Schedule of the United States, 1996.

TABLE 1. CANADA, BISMUTH PRODUCTION AND TRADE, 1992-95

Item No.		1992		1993		1994		1995p	
		(kilograms)	($000)	(kilograms)	($000)	(kilograms)	($000)	(kilograms)	($000)
PRODUCTION (all forms)[1]									
	New Brunswick	203 604	1 359	116 947	782	116 000	1 072	110 000	1 263
	Manitoba	8	. . .	255	2	111	1	115	1
	British Columbia	177	1	11 668	78	13 260	123	16 198	186
	Total	203 789	1 360	128 870	861	129 371	1 196	126 313	1 451
EXPORTS									
8106.00	Bismuth and articles thereof, including waste and scrap								
	Germany	–	–	–	–	–	–	120 119	965
	United States	40 453	288	40 551	255	145 489	1 020	83 857	509
	Other countries	–	–	–	–	19 860	165	–	–
	Total	40 453	288	40 551	255	165 349	1 186	203 976	1 475
IMPORTS									
8106.00.10	Unwrought bismuth, not alloyed; powders, not alloyed								
	Mexico	–	–	–	–	–	–	18 031	197
	People's Republic of China	10 755	71	19 256	140	18 092	195	4 966	74
	United States	18 118	167	10 377	159	18 496	250	3 303	46
	Peru	–	–	–	–	2 345	31	–	–
	Other countries	–	–	–	–	–	–	777	8
	Total	28 873	239	29 633	300	38 933	477	27 077	328
8106.00.20.10	Unwrought bismuth, alloyed; powders, alloyed, articles of bismuth								
	United States	7 118	170	8 859	232	14 351	663	14 281	2 129
	People's Republic of China	–	–	–	–	31 025	217	–	–
	Netherlands	–	–	–	–	85	3	–	–
	Total	7 118	170	8 859	232	45 461	883	14 281	2 129
8106.00.20.20	Bismuth waste and scrap								
	United States	103	1	3 170	47	13 349	167	28 130	336
	People's Republic of China	–	–	2 287	34	–	–	–	–
	Total	103	1	5 457	81	13 349	167	28 130	336

Sources: Natural Resources Canada; Statistics Canada.
– Nil; . . . Amount too small to be expressed; p Preliminary.
1 Refined bismuth metal from Canadian ores, plus recoverable bismuth content of bullion and concentrates exported.
Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, BISMUTH PRODUCTION AND CONSUMPTION, 1975 AND 1980-95

	Production All Forms[1]	Consumption[2]
	(kilograms)	
1975	156 605	29 267
1980	149 366	10 271
1981	167 885	10 094
1982	189 000	10 074
1983	253 023	7 241
1984	166 000	9 398
1985	201 489	7 284
1986	152 930	6 617
1987	165 282	4 547
1988	180 907	6 709
1989	156 727	16 158[a]
1990	74 300	12 032
1991	59 526	32 036
1992	203 789	56 231
1993	128 870	96 337
1994	129 371	173 744
1995[p]	126 313	..

Source: Natural Resources Canada.
.. Not available; [p] Preliminary.
[a] Increase in number of companies being surveyed.
[1] Refined bismuth metal from Canadian ores, plus recoverable bismuth content of bullion and concentrates exported. [2] Refined bismuth metal reported by consumers.