



# 2012 Minerals Yearbook

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## BISMUTH

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Bismuth consumption in the United States was estimated to be 647 metric tons (t), 7% less than that in 2011 (tables 1, 2). The estimated value of bismuth consumed domestically was \$14 million in 2012.

Bismuth was last produced domestically as a byproduct of lead refining at a Nebraska refinery that closed in 1997. The last stocks of bismuth in the National Defense Stockpile were sold that same year. In 2012, all primary bismuth consumed in the United States was imported. A small amount of bismuth was obtained by recycling old scrap. The leading producers of refined bismuth in 2012 were, in descending order by weight, China, Mexico, Belgium, Japan, and Kazakhstan. Belgium had no bismuth mine production, and its sole bismuth producer refined metal from imported anode slimes, concentrates, smelter residues, and flue dusts. The principal suppliers to the United States were, in descending order by weight, China, Belgium, the United Kingdom, the Republic of Korea, and Canada.

## Production

Although domestic production of primary refined bismuth ceased in 1997, some domestic firms continued to remelt bismuth alloy scrap. Secondary production was estimated to be less than 5% of domestic supply during 2012.

## Consumption

The U.S. Geological Survey surveyed domestic bismuth consumers on a quarterly and annual basis. The amount used by nonrespondents to the survey was estimated based on prior reports or on information from other sources.

Bismuth usage in pharmaceuticals included bismuth salicylate (the active ingredient in over-the-counter stomach remedies) and other bismuth medicinal compounds used to treat burns, intestinal disorders, and stomach ulcers in humans and animals. Bismuth nitrate is the initial chemical used for the production of most bismuth pharmaceutical compounds. Other applications of bismuth chemicals and compounds include uses in superconductors and pearlescent pigments for cosmetics and paints.

Bismuth metal is used primarily as a major constituent of various alloys and as a metallurgical additive (table 2). One class of alloys, fusible (low-melting-point, as low as 20 °C) alloys, are combinations of bismuth with other metals, such as antimony, cadmium, gallium, indium, lead, and tin. Applications for those alloys include fuel tank safety plugs, holders for optical lens and other articles for machining or grinding, solders, and fire sprinkler triggering mechanisms. Bismuth was also added in small amounts to aluminum and copper alloys

to improve machinability, and to malleable iron to prevent formation of graphite flakes.

In addition to lead-free glasses, pigments, shot for water fowl hunting, and solder, bismuth has been a substitute for lead added to certain steel products to provide greater machinability. Although bismuth has been used successfully to replace lead in various applications, it has been challenged as a lead substitute by tin and tungsten in some applications.

## Prices

In 2012, the average Platts Metals Week New York dealer price for bismuth decreased to \$10.10 per pound, a decrease of 12% from that in 2011. The weekly average bismuth price range began 2012 at \$11.50 to \$12.00 per pound and declined during the year to \$8.40 to \$8.90 per pound at yearend. Industry observers attributed the price decline to somewhat lower world demand.

## Foreign Trade

U.S. exports of bismuth alloys, metal, and waste and scrap were 764 t, an increase of 22% from that in 2011 (table 3). U.S. imports of bismuth metal were 1,700 t, a decrease of 3% compared with that in 2011. The leading import source was China, which supplied 63% of the United States imports (table 4).

## World Review

Bismuth was produced principally as a byproduct of the smelting of lead ores. In China, however, it was also a byproduct of fluorspar, tin, and tungsten ore processing. In Bolivia, the Tasna Mine, the only mine in the world known to produce bismuth from bismuth ore, has been on standby since the mid-1990s.

World refinery production of bismuth was 16,000 t (table 5), a decrease of 7% from that in 2011. China was the world's leading producer of refined bismuth accounting for 90% of the estimated world total, followed by Mexico with 5%.

**Canada.**—Adex Mining Inc. (Toronto, Ontario) planned to bring its Mount Pleasant, New Brunswick, tin-tungsten-molybdenum-bismuth mine back into production. The mine last operated from 1983 to 1985. Mount Pleasant is a polymetallic deposit with tungsten and molybdenum as the principal products. The company cited better-than-expected results from its 2011 drilling program at its North Zone and Saddle Zone. Adex started metallurgical feasibility testing during the first quarter of 2012, and in October, received an updated approval from the New Brunswick Department of Environment and Local Government to continue to maintain the Mount Pleasant Mine in its care-and-maintenance status (Adex Mining Inc., 2012a, b).

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<sup>1</sup>Deceased.

**China.**—Hunan Jinwang Bismuth Industry Co., Ltd. (Chenzhou City, Hunan Province) opened a new multimetal production plant in Xianxi. The facility has an annual production capacity of 4,000 metric tons per year (t/yr) of high-grade bismuth, 260 t/yr of silver, 200 t/yr of tellurium, and 10 t/yr of gold. Jinwang, founded in 2001 in Chenzhou City, has been a leading bismuth producer. With the opening of the new plant, Jinwang claimed to be the world's leading bismuth producer (Chao, 2012).

Henan Jinhong Co. Ltd. (Henan Province) commissioned a production line for antimony trioxide and bismuth metal. The new facility had the capacity to produce 1,500 t/yr of antimony trioxide and 360 t/yr of bismuth metal (Metal-Pages, 2012).

## Outlook

Prior to the outset of the 2008 global recession, world bismuth consumption had been increasing by about 3% to 5% per year. However, the global economic slowdown led to substantial reductions in consumption. World consumption of bismuth in the steel sector has decreased, although the decrease was relatively minor compared with that in other use sectors.

Most of bismuth's end uses, especially its use as a metallurgical additive, are in the industrial sectors of the economy. An increase in demand will likely depend on economic growth in emerging nations.

Global lead mine production was expected to increase by 4% in 2013, although bismuth byproduct is produced from only a few of the world's lead mines (International Lead and Zinc Study Group, 2013). Bismuth from China could be expected to supply potential future increases in world demand.

## References Cited

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## GENERAL SOURCES OF INFORMATION

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Bismuth. Ch. in United States Mineral Resources, Professional Paper 820, 1973.

Bismuth. Mineral Industry Surveys, quarterly.

Historical Statistics for Mineral and Material Commodities in the United States, DataSeries 140.

### Other

Bismuth. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.

TABLE 1  
SALIENT BISMUTH STATISTICS

|                                  |                   | 2008                | 2009                | 2010                | 2011                | 2012   |
|----------------------------------|-------------------|---------------------|---------------------|---------------------|---------------------|--------|
| United States: <sup>1</sup>      |                   |                     |                     |                     |                     |        |
| Consumption <sup>c</sup>         | metric tons       | 1,210 <sup>r</sup>  | 812 <sup>r</sup>    | 636 <sup>r</sup>    | 696 <sup>r</sup>    | 647    |
| Exports <sup>2</sup>             | do.               | 375                 | 397                 | 1,040               | 628 <sup>r</sup>    | 764    |
| Imports for consumption          | do.               | 1,930               | 1,250               | 1,620               | 1,750               | 1,700  |
| Price, average, domestic dealer  | dollars per pound | 12.73               | 7.84                | 8.76                | 11.47               | 10.10  |
| Stocks, December 31, consumer    | metric tons       | 228                 | 134                 | 133                 | 138                 | 134    |
| World production: <sup>c,3</sup> |                   |                     |                     |                     |                     |        |
| Mine, metal content <sup>4</sup> | do.               | 7,500 <sup>r</sup>  | 7,500 <sup>r</sup>  | 7,700 <sup>r</sup>  | 8,100 <sup>r</sup>  | 7,000  |
| Refinery                         | do.               | 16,000 <sup>r</sup> | 14,000 <sup>r</sup> | 16,000 <sup>r</sup> | 17,000 <sup>r</sup> | 16,000 |

<sup>c</sup>Estimated. <sup>r</sup>Revised. do. Ditto.

<sup>1</sup>Data are rounded to no more than three significant digits; except prices.

<sup>2</sup>Comprises bismuth metal and the bismuth content of alloys and waste and scrap.

<sup>3</sup>Data are rounded to no more than two significant digits.

<sup>4</sup>Excludes the United States.

TABLE 2  
ESTIMATED BISMUTH METAL CONSUMED  
IN THE UNITED STATES, BY USE<sup>1</sup>

(Kilograms)

| Use                     | 2011                 | 2012    |
|-------------------------|----------------------|---------|
| Chemicals <sup>2</sup>  | 492,000              | 434,000 |
| Bismuth alloys          | 67,500 <sup>r</sup>  | 52,100  |
| Metallurgical additives | W                    | W       |
| Other                   | W                    | W       |
| Total                   | 696,000 <sup>r</sup> | 647,000 |

<sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data; included in "Total."

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Includes industrial and laboratory chemicals, cosmetics, and pharmaceuticals.

TABLE 3  
U.S. EXPORTS OF BISMUTH METAL, ALLOYS, AND WASTE AND SCRAP,  
BY COUNTRY<sup>1</sup>

| Country                           | 2011                                      |                      | 2012                                      |                      |
|-----------------------------------|---|----------------------|---|----------------------|
|                                   | Quantity<br>(kilograms,<br>metal content) | Value<br>(thousands) | Quantity<br>(kilograms,<br>metal content) | Value<br>(thousands) |
| Belgium                           | --  | --                   | 56,100                                    | \$1,110              |
| Brazil                            | 12,200                                    | \$111                | 2,350                                     | 32                   |
| Canada                            | 20,700                                    | 480                  | 72,000                                    | 712                  |
| China                             | 28,000                                    | 253                  | 36,200                                    | 337                  |
| Colombia                          | 1,240                                     | 11                   | 4,710                                     | 45                   |
| Costa Rica                        | 11,600                                    | 120                  | 7,960                                     | 90                   |
| Czech Republic                    | 3,410                                     | 31                   | --  | --                   |
| France                            | 44,100                                    | 400                  | 2,610                                     | 24                   |
| French Guiana                     | --  | --                   | 1,410                                     | 13                   |
| Germany                           | 9,320                                     | 85                   | 3,270                                     | 51                   |
| Hong Kong                         | 1,490                                     | 20                   | 32,100                                    | 292                  |
| India                             | 1,960                                     | 27                   | 2,270                                     | 21                   |
| Israel                            | 2,420                                     | 22                   | 1,470                                     | 13                   |
| Japan                             | 21,900                                    | 240                  | --  | --                   |
| Jamaica                           | --  | --                   | 1,280                                     | 12                   |
| Mexico                            | 219,000                                   | 2,410                | 159,000                                   | 1,680                |
| Netherlands                       | 3,750                                     | 34                   | 1,670                                     | 46                   |
| Singapore                         | 9,690                                     | 135                  | 4,500                                     | 80                   |
| Taiwan                            | 1,770                                     | 20                   | 36  | 8                    |
| Thailand                          | 10,900                                    | 200                  | 8,930                                     | 87                   |
| United Kingdom                    | 7,810                                     | 107                  | 13,300                                    | 210                  |
| Vietnam                           | 216,000 <sup>r</sup>                      | 1,970 <sup>r</sup>   | 351,000                                   | 3,190                |
| Other (13 Countries) <sup>2</sup> | 1,990 <sup>r</sup>                        | 10 <sup>r</sup>      | 2,620                                     | 63                   |
| Total                             | 628,000 <sup>r</sup>                      | 6,690 <sup>r</sup>   | 764,000                                   | 8,110                |

<sup>r</sup>Revised. -- Zero.

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Includes countries with a quantity less than 1,000 kilograms in 2011 and 2012.

Source: U.S. Census Bureau.

TABLE 4  
U.S. IMPORTS FOR CONSUMPTION OF METALLIC BISMUTH, BY COUNTRY<sup>1</sup>

| Country                         | 2011                    |                      | 2012                    |                      |
|---------------------------------|-------------------------|----------------------|-------------------------|----------------------|
|                                 | Quantity<br>(kilograms) | Value<br>(thousands) | Quantity<br>(kilograms) | Value<br>(thousands) |
| Belgium                         | 713,000                 | \$17,300             | 505,000                 | \$11,700             |
| Canada                          | 11,600                  | 285                  | 11,400                  | 330                  |
| China                           | 974,000                 | 22,100               | 1,070,000               | 23,600               |
| Germany                         | 824                     | 49                   | 200                     | 11                   |
| Korea, Republic of <sup>2</sup> | 26,700 <sup>r</sup>     | 627 <sup>r</sup>     | 45,000                  | 860                  |
| Mexico <sup>2</sup>             | 135 <sup>r</sup>        | 7 <sup>r</sup>       | --                      | --                   |
| Netherlands                     | 60 <sup>r</sup>         | 3 <sup>r</sup>       | 127                     | 27                   |
| Sweden                          | --                      | --                   | 128                     | 7                    |
| United Kingdom                  | 22,700                  | 666                  | 63,800                  | 1,550                |
| Vietnam                         | 5                       | 3 <sup>r</sup>       | --                      | --                   |
| Total                           | 1,750,000               | 41,100               | 1,700,000               | 38,100               |

<sup>r</sup>Revised. -- Zero.

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Data for the Republic of Korea were erroneously reported as Kazakhstan, Mexico reported as Republic of Korea, and Netherlands reported as Mexico in 2011.

Source: U.S. Census Bureau.

TABLE 5  
BISMUTH: ESTIMATED WORLD MINE AND REFINERY PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Metric tons)

| Country <sup>3</sup>    | Mine               |                 |                 |                    |                    | Refinery            |                     |                     |                     |        |
|-------------------------|--------------------|-----------------|-----------------|--------------------|--------------------|---------------------|---------------------|---------------------|---------------------|--------|
|                         | 2008               | 2009            | 2010            | 2011               | 2012               | 2008                | 2009                | 2010                | 2011                | 2012   |
| Belgium                 | --                 | --              | --              | --                 | --                 | NA <sup>r</sup>     | NA <sup>r</sup>     | NA <sup>r</sup>     | NA <sup>r</sup>     | NA     |
| Bolivia <sup>4</sup>    | 28                 | 54              | 87              | 41 <sup>r</sup>    | 10                 | 92                  | 73                  | --                  | 31 <sup>r</sup>     | --     |
| Bulgaria <sup>5,6</sup> | 6                  | --              | 3               | -- <sup>r</sup>    | 1                  | 6                   | --                  | 3                   | -- <sup>r</sup>     | 1      |
| Canada <sup>7</sup>     | 71 <sup>4</sup>    | 86 <sup>4</sup> | 91 <sup>4</sup> | 92 <sup>4</sup>    | 121 <sup>p,4</sup> | 150                 | 150                 | 150                 | 150                 | 145    |
| China                   | 5,000              | 6,000           | 6,500           | 7,000              | 6,000              | 13,100              | 12,300              | 14,000 <sup>r</sup> | 15,000 <sup>r</sup> | 14,000 |
| Italy                   | --                 | --              | --              | --                 | --                 | 5                   | 5                   | 5                   | 5                   | 5      |
| Japan <sup>8</sup>      | -- <sup>r</sup>    | -- <sup>r</sup> | -- <sup>r</sup> | --                 | --                 | 480 <sup>4</sup>    | 423 <sup>4</sup>    | 454 <sup>4</sup>    | 460                 | 470    |
| Kazakhstan              | 150                | --              | --              | --                 | --                 | --                  | 90                  | 150                 | 150                 | 150    |
| Mexico <sup>4,5</sup>   | 1,132              | 854             | 952             | 935                | 800                | 1,132               | 854                 | 952                 | 935                 | 800    |
| Peru <sup>4,5</sup>     | 1,061 <sup>r</sup> | 423             | --              | --                 | --                 | 1,061 <sup>r</sup>  | 423                 | --                  | --                  | --     |
| Romania                 | --                 | --              | --              | --                 | --                 | NA <sup>r</sup>     | NA <sup>r</sup>     | NA <sup>r</sup>     | NA <sup>r</sup>     | NA     |
| Russia                  | 70                 | 65              | 50              | 50 <sup>r</sup>    | 40                 | 13                  | 12                  | 10                  | 10 <sup>r</sup>     | 8      |
| Total <sup>9</sup>      | 7,500              | 7,500           | 7,700           | 8,100 <sup>r</sup> | 7,000              | 16,000 <sup>r</sup> | 14,000 <sup>r</sup> | 16,000 <sup>r</sup> | 17,000 <sup>r</sup> | 16,000 |

<sup>p</sup>Preliminary. <sup>r</sup>Revised. NA Not available. -- Zero.

<sup>1</sup>Estimated data are rounded to no more than three significant digits.

<sup>2</sup>Includes data available through August 8, 2014. Bismuth is produced as a byproduct of mining and processing other metals, mainly lead and tungsten. Not all mines that produce ores containing recoverable bismuth report their production. Therefore, some bismuth production may only be accounted for at the refinery level.

<sup>3</sup>Belgium and Romania produced refined bismuth; available information is inadequate to make reliable estimates of output levels.

<sup>4</sup>Reported figure.

<sup>5</sup>Mine production was not reported and is assumed to be equal to reported refinery production.

<sup>6</sup>Refinery production is estimated from reported net exports. Bismuth was produced as a byproduct of lead production.

<sup>7</sup>Figures listed under mine output are the metal content of concentrates produced.

<sup>8</sup>Refined bismuth was produced as a byproduct of zinc production.

<sup>9</sup>World totals are rounded to no more than two significant digits.