USGS
science for a changing world

2006 Minerals Yearbook

NIOBIUM (COLUMBIUM) AND TANTALUM

U.S. Department of the Interior
U.S. Geological Survey

July 2008

Niobium (Columbium) and Tantalum

By John F. Papp

Domestic survey data and tables were prepared by Robin C. Kaiser, statistical assistant, and the world production table was prepared by Linder Roberts, international data coordinator.

In 2006, U.S. niobium apparent consumption [measured in contained niobium (columbium)] was 10,072 metric tons (t), an increase of 36% compared with that of 2005. U.S. tantalum apparent consumption (measured in contained tantalum) was 435 t, a decrease of 52% compared with that of 2005. The United States did not mine niobium (columbium) or tantalum ore; however, the United States exported $133 million and imported $334 million worth of niobium- and tantalum-containing materials.

The leading use of niobium is as an alloying element in steel. The leading use of tantalum is in electronic capacitors.

Because the United States has no niobium or tantalum ore reserves, domestic supply has been a concern during every national military emergency since World War I. The last significant mining of niobium and tantalum in the United States was during the Korean war (1950-53), when increased military demand resulted in niobium and tantalum ore shortages. World niobium and tantalum ore resources and mining capacity are geographically concentrated in Brazil (niobium and tantalum) in the Western Hemisphere and in Australia (tantalum) in the Eastern Hemisphere. Canada also produces niobium and tantalum. World niobium and tantalum ore reserves are adequate to meet anticipated world demand. Material for recycling is the only domestic supply source of tantalum.

Domestic Data Coverage

Domestic data for niobium and tantalum materials were developed by the U.S. Geological Survey (USGS) by means of the "Columbium (Niobium) and Tantalum," "Consolidated Consumers," and "Specialty Ferroalloys" surveys. Ferroniobium is the most consumed niobium-containing material. Steel producers are the leading consumers of niobium-containing materials.

Legislation and Government Programs

The Defense National Stockpile Center (DNSC) disposed of niobium and tantalum materials under its fiscal year 2006 (October 1, 2005, through September 30, 2006) Annual Materials Plan (AMP) and announced the fiscal year 2007 plan. The DNSC's fiscal year 2007 AMP set maximum disposal goals for niobium and tantalum materials (niobium materials measured in contained niobium and tantalum materials measured in contained tantalum) at 254,000 kilograms (kg) of niobium concentrates, 9,070 kg of niobium metal, 227,000 kg of tantalum minerals, 1,810 kg of tantalum carbide, 9,070 kg of tantalum oxide, and 4,540 kg of tantalum metal (Defense National Stockpile Center, 2006a).

The DNSC reported 2006 fiscal year sales (measured in contained tantalum) to be 253,844 kg of tantalum-containing materials comprising 233,473 kg of tantalum minerals for $19.7 million, 9,177 kg of tantalum ingots for $849,000, 9,275 kg of tantalum oxide for $663,000, and 1,919 kg of tantalum carbide powder for $161 million. The DNSC also sold (measured in contained niobium) 167,000 kg of niobium-containing materials comprising 157,000 kg of niobium concentrates and 8,980 kg of niobium ingot for $233,000 (Defense National Stockpile Center, 2006b, p. 10-11; Holder, 2006).

The DNSC's ferroniobium inventory was exhausted in fiscal year 2001, and its niobium carbide inventory was exhausted in fiscal year 2002. Tantalum metal ingot inventory was exhausted in 2005; tantalum metal powder and tantalum pentoxide inventory were exhausted in 2006.

Production

The major marketplace niobium materials are ferroniobium, niobium metal, niobium ore, and niobium oxide. The major marketplace tantalum materials are tantalum metal, tantalum ore, and tantalum powder. In 2006, neither niobium nor tantalum ore was mined domestically. The last significant mining of niobium and tantalum ore in the United States was during the Korean war, when increased military demand resulted in niobium and tantalum ore shortages.

Consumption

Niobium and tantalum were consumed in the United States by the electronics and metallurgical industries. Ferroniobium, niobium masteralloys, and niobium-nickel alloy, were consumed in steel and superalloys. Tantalum was consumed in capacitors and superalloys.

Niobium can substitute for about 43% of vanadium used in steelmaking at the rate of three units of niobium for two units of vanadium; however, higher melting temperatures and different rolling equipment are required and the resulting steel specifications change. As a result, disparate niobium and vanadium prices can result in substitution (Metal-Pages, 2006).

Prices

Niobium and tantalum materials are not openly traded. Purchase contracts are confidential information between buyer and seller; however, trade journals report composite prices of tantalite based on interviews with buyers and sellers, and traders declare the value of niobium and tantalum materials that they import or export. Thus, industry publications and U.S. trade

statistics are sources of tantalum ore prices and niobium and tantalum material values, respectively.

Foreign Trade

Niobium and tantalum material exports from and imports to the United States include ferroniobium, niobium chemicals, metal, ore, and oxide, and tantalum metal and ore. In 2006, the value of foreign trade of these niobium and tantalum materials was $133 million for exports and $334 million for imports.

World Review

Brazil and Canada were the major producers of niobium mineral concentrates, and Australia, Brazil, Canada, and Mozambique were the major producers of tantalum mineral concentrates. In addition to production reported in table 10, tantalum was available from tantalum-bearing tin slag, which is a byproduct of tin smelting, principally from Asia, Australia, and Brazil. However, tantalum recovery from tin slag is not a major source of tantalum.

Schwela (2006) reported that tantalum mine production from the first half of 2001 to the first half of 2006 declined. Throughout the 2001-06 time period, the leading source of tantalum production was tantalum ore and concentrate; however, tantalum production from tin slag and other sources contributed to primary production. In the next stage of processing, capacitor grade powder was the leading product; however, tantalum chemicals, carbide, ingot, mill products, and other products were also produced. Despite tantalum production response to high demand in 2000-01, perceived shortage resulted in substitution for tantalum in its leading end use, capacitors. Niobium mine production from the first half of 2001 through the first half of 2006 increased. Throughout the 2001-06 time period, the leading source of niobium was niobium ore and concentrates from columbite and pyrochlore ore. Some niobium was produced from tantalite. In the next stage of processing, high-strength low-alloy steel grade ferroniobium was the leading product; however, nickel niobium, niobium chemicals, metal, and alloys, and vacuum grade ferroniobium were also produced. After the September 11, 2001 events, the aerospace, automotive, and construction industries—all niobium consumers—experienced reduced activity.

Outlook

Niobium.—The principal use for niobium was an additive in steelmaking, mostly in the manufacture of microalloyed steels. The production of high-strength low-alloy steel was the leading use for niobium, and the trend for niobium consumption, domestically and globally, was expected to continue to closely follow that of steel production, as the steel industry is estimated to account for as much as 90% of niobium consumption. (Additional information about the the steel industry can be found in the Iron and Steel chapter of the USGS Minerals Yearbook, volume I, Metals and Minerals.) Demand for niobium, however, does not mirror trends in overall steel production, as only 10% of the steel products contain niobium. The leading nonsteel use of niobium was in superalloys for, among other applications, aircraft engines.

Tantalum.—The leading uses for tantalum were in alloys, capacitors, and oxides and carbides that are used in the electronics, chemical, and in the metallurgical industries. Performance in these industries was expected to respond to consumer demand driven by development in China.

References Cited

Defense National Stockpile Center, 2006a, Correction annual materials plan for FY 2007: Fort Belvoir, VA, Defense National Stockpile Center news release DNSC-06-2804a, 2 p.

Defense National Stockpile Center, 2006b, Strategic and critical materials operations report to Congress—Operations under the Strategic and Critical Materials Stock Piling Act during the period October 2005 through September 2006: Fort Belvoir, VA, 66 p. (Accessed August 24, 2007, at https://www.dnsc.dla.mil/Uploads/Materials/esolomon_6-22-2007_8-54-14_StrategicMaterialsRep2006.pdf.)

Holder, C.A., 2006, Chrome in the U.S. defense stockpile: Ryan's Notes Ferroalloys Conference 2006, Hollywood, FL, October 23-24, 2006, Presentation, [unpaginated].

Metal-Pages, 2006, Niobium takes share of vanadium market: Metal-Pages, January 3. (Accessed August 22, 2007, via http://www.metal-pages.com/.)

Schwela, Ulric, 2006, T.I.C. statistics and transport project: T.I.C. Bulletin, no. 128, December, 8 p.

GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

Columbium (Niobium). Ch. in Metal Prices in the United States Through 1998, 1999.

Columbium (Niobium). Ch. in Mineral Commodity Summaries, annual.

Columbium (Niobium). Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.

Columbium (Niobium) and Tantalum. Ch. in United States Mineral Resources, Professional Paper 820, 1973.

Columbium (Niobium) Recycling in the United States in 1998. Ch. in Flow Studies for Recycling Metal Commodities in the United States, Circular 1196–A–M, 2004.

Historical Statistics for Mineral and Material Commodities in the United States. Data Series 140.

Niobium (Columbium) and Tantalum. International Strategic Minerals Inventory Summary Report, Circular 930-M, 1993.

Recycling—Metals. Ch. in Minerals Yearbook, annual.

Tantalum. Ch. in Metal Prices in the United States Through 1998, 1999.

Tantalum. Ch. in Mineral Commodity Summaries, annual.

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

Tantalum Recycling in the United States in 1998. Ch. in Flow Studies for Recycling Metal Commodities in the United States, Circular 1196–A–M, 2004.

Other

Aerospace Industries Association.

American Metal Market, daily.

Company reports and news releases.

Defense National Stockpile Center reports and news releases.
Economics of Niobium, The (10th ed.). Roskill Information Services Ltd., 2005.
Economics of Tantalum, The (9th ed.). Roskill Information Services Ltd., 2005.
Federal Register, daily.
Mining & Metals Report. Interfax International Ltd., weekly.
International Symposium Proceedings, Tantalum-Niobium International Study Center, 2005.
Metal Bulletin, daily, weekly, and monthly.
Mining Journal, weekly.
Northern Miner, The.
Ores & Alloys for the Global Steel Industry. Metal Bulletin Books Ltd., 2000.
Platts Metals Week, weekly.
Roskill's Letter from Japan, monthly.
Ryan's Notes, weekly.
Tantalum-Niobium International Study Center.

TABLE 1
SALIENT NIOBIUM STATISTICS[1]

		2002	2003	2004	2005	2006
United States:						
Government stockpile releases, Nb content[2]	metric tons	9	223	90 r	152 r	156 p
Production of ferroniobium, Nb content	do.	NA	NA	NA	NA	NA
Exports, Nb content[3, 4]	do.	130	170	276	337	561
Imports for consumption:						
Mineral concentrates, Nb content[4]	do.	273 r	181 r	167 r	142 r	120
Niobium metal, gross weight[5]	do.	673	743	940	1,380	1,450
Niobium oxide, Nb content[e]	do.	654 r	585 r	633 r	661	760
Ferroniobium, Nb content[e]	do.	4,030	4,080 r	5,170	5,430	8,150
Tin slag, Nb content	do.	NA	NA	NA	NA	NA
Consumption, Nb content:						
Raw materials	do.	W	W	W	W	W
Ferroniobium and nickel niobium[e]	do.	2,740	3,240 r	3,760	4,170	4,670
Apparent	do.	5,510 r	5,640 r	6,730 r	7,430 r	10,100
Prices,[6] ferroniobium,[7] Nb content	dollars per kilogram	14.6	14.5	14.5	14.5	NA [9]
Value:[8]						
Niobium ore and concentrate (gross weight)	dollars per metric ton	8.79	9.75	6.96 r	9.70 r	13.71
Niobium oxide (gross weight)	do.	15.65	14.55	15.30	14.12 r	14.07
Ferroniobium (gross weight)	do.	8.52	8.74	8.72	8.66	9.13
World, production of niobium-tantalum concentrates, Nb content	metric tons	33,300 r	30,000 r	27,800 r	43,300 r	44,500

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available. W Withheld to avoid disclosing company proprietary data.

[1]Data are rounded to no more than three significant digits, except prices.

[2]Negative numbers indicate an increase in inventory. Release is the decrease of uncommitted inventory relative to the previous calendar year.

[3]Includeds natural and synthetic niobium ore and concentrates; niobium oxide, niobium ferroalloy; and unwrought niobium metal and alloys.

[4]To estimate Nb content of mineral exports or imports, it was assumed that natural and synthetic tantalum ore and concentrates are 16% Nb_2O_5; niobium ore concentrates is 30% Nb_2O_5; and Nb_2O_5 is 69.9% Nb.

[5]Includes niobium and articles made of niobium.

[6]The published price for columbite ore was discontinued in 2001 at a range of $5.50 to $7.00 per pound of Nb_2O_5 content. The published price of Brazilian pyrocholore was discontinued in 1981; Canadian, 1989. Price is time-weighted average as reported in trade journals.

[7]Standard (steelmaking) grade. American Metal Market discontinued reporting the price of vacuum grade ferroniobium in 2002 and standard grade in 2005.

[8]Value is mass-weighted average value of trade (i.e., imported plus exported material).

[9]Correction posted May 6, 2008.

TABLE 2
SALIENT TANTALUM STATISTICS

		2002	2003	2004	2005	2006
United States:						
Government stockpile releases, Ta content[1]	metric tons	-2 r	336 r	127 r	273 r	226
Exports:						
Tantalum ores and concentrates, Ta content[2, 3]	do.	107 r	152 r	223 r	174 r	247 p
Tantalum metal, gross weight	do.	265	187	504	567	590
Tantalum and tantalum alloy powder, gross weight	do.	188	280	257	242	112
Imports for consumption:						
Mineral ore and concentrates, Ta content[3]	do.	732 r	483 r	451 r	382 r	322
Tantalum metal and tantalum-bearing alloys[4], gross weight	do.	551 r	474 r	1,090 r	1,240 r	835
Tin slag	do.	NA	NA	NA	NA	NA
Consumption, Ta content:						
Raw materials	do.	W	W	W	W	W
Apparent	do.	721 r	674 r	679 r	915 r	435
Prices, tantalite[5] (Ta_2O_5 content)	dollars per kilogram	74 r	66 r	66 r	77 r	72
Value,[6, 7] tantalum ore and concentrate, gross weight	dollars per metric ton	32 r	34 r	35 r	31 r	33
World, production of niobium-tantalum concentrates, Ta content	metric tons	1,340 r	1,280	1,480 r	1,400 r	1,390

pPreliminary. rRevised. NA Not available. W Withheld to avoid disclosing company proprietary data.

[1]Negative numbers indicate an increase in inventory. Release is the decrease in uncommitted inventory relative to the previous calendar year.

[2]Includes natural and synthetic tantalum ore and concentrates.

[3]To estimate tantalum content, it was assumed that natural tantalum ore and concentrate is 37% Ta_2O_5; niobium ore and concentrates and synthetic ore are 32% Ta_2O_5; and Ta_2O_5 is 81.9% tantalum.

[4]Includes waste and scrap.

[5]Time-weighted average price per Ta_2O_5 content as reported in trade journals. Includes Metal Bulletin, Platts Metals week, and Ryan's Notes and Ryan's Notes in 2006; Platts Metals Week and Ryan's Notes in 2002-2005.

[6]Mass-weighted average value of imported materials.

[7]Includes wrought, unwrought and waste and scrap tantalum metal.

TABLE 3
NIOBIUM AND TANTALUM MATERIALS IN NATIONAL DEFENSE STOCKPILE
INVENTORIES AS OF DECEMBER 31, 2006[1]

(Metric tons of niobium or tantalum content)

			Uncommitted			
Material[2]	Stockpile goal[3]*	Disposal authority	Stockpile-grade	Non-stockpile-grade	Total	Committed
Niobium:						
Concentrates	--	--	--	--	--	--
Carbide powder	--	--	--	--	--	--
Ferroniobium	--	--	--	--	--	--
Metal ingots	--	10.1 *	10.1 *	--	10.1 *	--
Total	--	10.1 *	10.1 *	--	10.1 *	--
Tantalum:						
Minerals	--	--	--	--	--	--
Carbide powder	--	1.73	--	--	1.73	--
Metal:						
Capacitor grade	--	--	--	--	--	--
Ingots	--	--	--	--	--	--
Oxide	--	--	--	--	--	--
Total	--	1.73	--	--	1.73	--

-- Zero.

[1]Data may not add to totals shown because of independent rounding.

[2]National Defense Stockpile disposed of the remaining inventory of niobium-tantalum concentrates, tantalum oxide and capacitor grade tantalum metal in 2006*; tantalum metal ingots in 2005*.

[3]Goal effective as of December 28, 2001.

*Corrections posted on July 16, 2008.

Source: Defense National Stockpile Center.

TABLE 4
REPORTED CONSUMPTION, BY END USE, AND INDUSTRY STOCKS OF FERRONIOBIUM AND NICKEL NIOBIUM IN THE UNITED STATES[1]

(Metric tons of niobium content)

End use	2005	2006
Steel:		
Carbon	1,390	1,790
Stainless and heat-resisting	535 r	601
Full alloy	(2)	(2)
High-strength low-alloy	1,100 r	1,080
Electric	(2)	(2)
Tool	(2)	(2)
Total	3,020 r	3,470
Superalloys	1,570 r	1,580
Alloys (excluding steels and superalloys)	3 r	2
Miscellaneous and unspecified	-- r	--
Grand total	4,600 r	5,050
Stocks, December 31:		
Consumer	484	605
Producer[3]	W	W
Total	484	605

rRevised. W Withheld. -- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Included with "Steel, high-strength low alloy."
[3]Ferroniobium only.

TABLE 5

U.S. FOREIGN TRADE IN NIOBIUM AND TANTALUM METAL AND ALLOYS, BY CLASS[1]

HTS code	Class	2005 Gross mass (kilograms)	2005 Value (thousands)	2006 Gross mass (kilograms)	2006 Value (thousands)	Principal destinations and sources, 2006 (gross mass in kilograms and values in thousand dollars)
	Exports:[2]					
	Niobium					
2615.90.6030	Ores and concentrates	43,400	$398	68,600	$914	South Africa 28,500, $462; United Kingdom 17,400, $261; Germany 8,580, $63: Switzerland 6,570, $46; Italy 4,860, $34.
2825.90.1500	Oxide	--	--	--	--	
7202.93.0000	Ferroniobium	410,000	4,210	706,000	6,680	Canada 415,000, $4,320; Mexico 174,000, $1,583; France 79,900, $428; South Africa 15,300, $168; Netherlands 19,400, $139; Taiwan 1,820, $29.
8112.92.4000	Unwrought	--	--	--	--	
	Tantalum:					
2615.90.3000	Synthetic concentrates	66,500	156	213,000	$2,010	Germany 20,000, $1,670; Brazil 185,000, $287; Mexico 4,010, $11.
2615.90.6060	Ores and concentrates	479,000	9,140	571,000	11,400	NA.
8103.20.0030	Unwrought, powders	242,000	112,000	112,000	52,300	Israel 41,300, $27,100; El Salvador 11,000, $5,000; Germany 12,000, $4,420; Sweden 16,000, $2,550, Japan 4,850, $2,090.
8103.20.0090	Unwrought, alloys and metal	9,990	2,690	313,000	12,900	Belgium 291,000, $7,700; Japan 9,350, $3,480; France 2,480, $947; Netherlands 5,020, $704.
8103.30.0000	Waste and scrap	447,000	21,200	186,000	8,240	United Kingdom 62,300, $2,950; Kazakhstan 44,700, $1,960; Hong Kong 60,300, $1,520; Austria 10,200, $764; Canada 5,430, $508.
8103.90.0000	Wrought	110,000	49,000	90,800	39,100	Japan 29,400, $11,600; Israel 7,010, $4,980; Thailand 8,890, $3,010; Germany 21,200, $7,500; Kazakhstan 5,760, $2,950; France 7,160, $3,370.
	Total, exports	XX	199,000	XX	133,000	
	Imports for consumption:					
	Niobium:					
2615.90.6030	Ores and concentrates	9,770	118	5,170	98	Brazil 3,600, $56; China 1,090, $31; Singapore 250, $7.
2825.90.1500	Oxide	946,000	13,400	1,090,000	15,300	Brazil 515,000, $6,780; Germany 71,010, $2,710; China 217,000, $2,470.
	Ferroniobium:					
7202.93.4000	Silicon < 0.4%	1,100,000	12,800	1,090,000	14,800	Brazil 646, $9,390; Canada 326, $3,450; Germany 122, $1,960.
7202.93.8000	Other	7,260,000	58,900	11,400,000	99,500	Brazil 11,100, $96,100; Canada 654, $6,510; Germany 6, $378.
	Total, ferroniobium	8,350,000	71,700	12,500,000	114,000	
8112.92.4000	Unwrought, alloys, metal, powder	1,380,000	26,700	1,450,000	30,900	Brazil 1,190,000 $24,300; Estonia 148,000, $4,080, Germany 55,200, $1,560; China 46,500, $5,850.
	Tantalum:					
2615.90.3000	Synthetic concentrates	--	--	630	14	All from China.
2615.90.6060	Ores and concentrates	1,250,000	43,800	1,060,000	42,300	Australia 808,800, $35,300; Canada 226,000, $6,330; Nigeria 25,000, $633.
8103.20.0030	Unwrought powders	233,000	63,100	302,000	78,900	Thailand 95,000*, $22,900; Germany 89,400, $19,700; Japan 72,000, $27,600; China 43,000, $8,440.
8103.20.0090	Unwrought, alloys and metal	174,000	24,700	191,000	26,900	Kazakhstan 109,000, $15,000; Estonia 25,100, $3,620; China 21,700, $6,880; Germany 18,480, $1,880; Hong Kong 8,770, $1,870.

See footnotes at end of table.

TABLE 5—Continued

U.S. FOREIGN TRADE IN NIOBIUM AND TANTALUM METAL AND ALLOYS, BY CLASS[1]

HTS code	Class	2005 Gross mass (kilograms)	2005 Value (thousands)	2006 Gross mass (kilograms)	2006 Value (thousands)	Principal destinations and sources, 2006 (gross mass in kilograms and values in thousand dollars)
	Imports—Conitnued:[2]					
	Tantalum—Continued:					
8103.30.0000	Waste and scrap	758,000	17,500	304,000	14,100	Austria 30,900, $3,580; China 24,420, $2,410; Germany 35,640, $2,040; Japan 41,600, $14,100; United Kingdom 74,900, $1,950.
8103.90.0000	Wrought	78,500	17,100	37,800	11,200	China 21,700, $6,880; Kazakhstan 11,900, $2,990; Germany 1,030, $381; United Kingdom 236, $167.
	Total, imports	XX	278,000	XX	334,000	

NA Not available. XX Not applicable. -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]For niobium, data on exports of metal and alloys in unwrought and wrought form, including waste and scrap, are not available; included in nonspecific tariff classification.

*Correction posted March 31, 2008.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF NIOBIUM ORES AND CONCENTRATES, BY COUNTRY[1, 2]

	2005		2006	
Country	Gross weight (kilograms)	Value (thousands)	Gross weight (kilograms)	Value (thousands)
Brazil	--	--	3,600	$56
China	980	$41	1,090	31
Germany	--	--	230	2
India	613	7	--	--
Japan	39	4	--	--
Singapore	--	--	250	7
United Kingdom	8,140	67	--	--
Total	9,770	118 r	5,170	98

rRevised. -- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Harmonized Tariff Schedule of the United States code 2615.90.6030.

Sources: U.S. Census Bureau; data adjusted by the U.S. Geological Survey.

TABLE 7
U.S IMPORTS FOR CONSUMPTION OF TANTALUM ORES AND CONCENTRATES, BY COUNTRY[1, 2]

	2005		2006	
Country	Gross weight (kilograms)	Value (thousands)	Gross weight (kilograms)	Value (thousands)
Australia	983,000 r	$37,800	808,000	$35,300
Canada	268,000	5,930	226,000	6,330
China	17	4 r	79	18
Nigeria	--	--	25,000	633
United Kingdom	5	2	--	--
Total	1,250,000 r	43,800 r	1,060,000	42,300

rRevised. -- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Harmonized Tariff Schedule of the United States code 2615.90.6060.

Sources: U.S. Census Bureau; data adjusted by the U.S. Geological Survey.

TABLE 8
PRINCIPAL WORLD NIOBIUM AND TANTALUM RAW MATERIAL PRODUCERS

Country	Company and/or mine	Material type
Mining of niobium- and tantalum-bearing ores:		
Australia	Sons of Gwalia Ltd. (Greenbushes)	Niobium-tantalum.
Do.	Sons of Gwalia Ltd. (Wodgina)	Tantalum.
Brazil	Cia. Brasileira de Metalurgia e Mineracao (Araxa)	Niobium.
Do.	Cia. de Estanho Minas Brasil[1]	Niobium-tantalum.
Do.	Paranapanema S.A. Mineracao Industria e Construcao (Pitinga)	Do.
Do.	Mineracao Catalao de Goias S.A. (Catalao)	Niobium.
Canada	Cambior Inc. and Mazarin Inc. (Niobec)	Do.
Do.	Tantalum Mining Corp. of Canada Ltd.[2]	Tantalum.
China	Government-owned	Niobium-tantalum.
Production of niobium- and tantalum-bearing tin slags:		
Australia	Sons of Gwalia Ltd. (Greenbushes)	Do.
Brazil	Cia. Industrial Fluminense[1]	Do.
Do.	Mamoré Mineracao e Metalurgia[3]	Do.
Thailand	Thailand Smelting and Refining Co. Ltd.	Do.
Production capacity for niobium- and tantalum-bearing synthetic concentrates, Germany, western states	H.C. Starck GmbH & Co. KG	Do.

[1]A wholly owned subsidiary of Metallurg Inc., New York, NY.
[2]A wholly owned subsidiary of Cabot Corp.
[3]A subsidiary of Paranapanema S.A. Mineracao Indústria e Construcao.

TABLE 9
PRINCIPAL WORLD PRODUCERS OF NIOBIUM AND TANTALUM PRODUCTS

Country	Company	Products[1]
Austria	Treibacher Industrie AG	Nb and Ta oxide/carbide, FeNb, and NiNb.
Brazil	Cia. Brasileira de Metalurgia e Mineracao (CBMM)	Nb oxide/metal, FeNb, and NiNb.
Do.	Cia. Industrial Fluminense[2]	Nb and Ta oxide.
Do.	Mineracao Catalao de Goias S.A. (Catalao)	FeNb.
Canada	Cambior Inc. and Mazarin Inc. (Niobec)	Do.
Estonia	Silmet	Nb oxide/metal.
Germany, western states	Gesellschaft fur Elektrometallurgie mbH (GFE)[2]	FeNb and NiNb.
Do.	H.C. Starck GmbH & Co. KG	Nb and Ta oxide/metal/carbide, K-salt, FeNb, NiNb, and Ta capacitor powder.
Japan	Mitsui Mining & Smelting Co.	Nb and Ta oxide/metal/carbide.
Do.	Cabot Supermetals[3]	Ta capacitor powder.
Do.	H.C. Starck-V Tech Ltd.[4]	Do.
Kazakhstan	Ulba Metallurgical	Ta oxide/metal.
Do.	Irtysh Chemical & Metallurgical Works	Nb oxide/metal.
Russia	Solikamsk Magnesium Works	Nb and Ta oxide.
Thailand	H.C. Starck (Thailand) Co. Ltd.[4]	K-salt and Ta metal.
United States	Cabot Supermetals[3]	Nb and Ta oxide/metal, K-salt, and Ta capacitor powder.
Do.	H.C. Starck Inc.[5]	Nb and Ta metal and Ta capacitor powder.
Do.	Kennametal Inc.	Nb and Ta carbide.
Do.	Reading Alloys Inc.	FeNb and NiNb.
Do.	Wah Chang[6]	Nb metal and FeNb.

[1]Nb, niobium; Ta, tantalum; FeNb, ferroniobium; NiNb, nickel niobium; K-salt, potassium fluotantalate; oxide, pentoxide.
[2]A wholly owned subsidiary of Metallurg Inc., New York, NY.
[3]A wholly owned subsidiary of Cabot Corp.
[4]A subsidiary of H.C. Starck GmbH & Co. KG.
[5]Jointly owned by Bayer Corp. and H.C. Starck GmbH & Co. KG.
[6]A subsidiary of Allegheny Technologies Inc.

TABLE 10
NIOBIUM AND TANTALUM: WORLD PRODUCTION OF MINERAL CONCENTRATES, BY COUNTRY[1, 2]

(Metric tons)

Country[5]	Gross weight[3]					Niobium content[4]					Tantalum content[4]				
	2002	2003	2004	2005	2006	2002	2003	2004	2005	2006	2002	2003	2004	2005	2006[e]
Australia, columbite-tantalite	3,100	2,500	2,000	2,000	2,000	290	230	200	200	200	807 [r]	765	835 [r]	852 [r]	850
Brazil:															
Pyrochlore	68,800	69,000	56,100	56,200	56,200 [p]	28,873 [r]	25,859 [r]	23,779 [r]	39,161 [r]	40,000	(6)	(6)	(6)	(6)	(6)
Tantalite	680	715	720	730	730 [p]	(6)	(6)	(6)	(6) [e]	(6) [e]	190	200	250	250	250
Burundi	72	24	23	43 [r]	43	NA	4	5 [r]	8 [r]	9	15	6	5 [r]	9 [r]	9 [7]
Canada:															
Pyrochlore	7,410	7,270	7,670 [r]	7,700 [r, p]	7,700 [e]	3,333	3,237 [r]	3,599 [r]	3,704 [r]	4,157	(6) [e]	(6) [e]	(6) [e]	(6) [e]	(6)
Tantalite[e]	232 [7]	220 [7]	276 [r, 7]	300 [r, 7]	300	12	11 [7]	10 [7]	10	10	71 [r]	67 [r]	69 [7]	77 [r]	68
Congo (Kinshasa):															
Columbite-tantalite	110 [r]	71 [r]	42 [r]	45 [r]	45 [e]	25 [r]	15 [r]	10 [r]	10 [r]	10 [e]	30	20 [r]	10 [r]	10 [r]	10
Pyrochlore	1,346	733	--	--	--	670	360	--	--	--	--	--	--	--	-- [7]
Ethiopia, tantalite	55	58	71	93 [r]	109	6	6	7	9 [r]	11	33	35	45	59 [r]	70 [7]
Mozambique	47	189	712	281	240 [e]	6	23	87	34	29	13	54	205	81	70 [7]
Namibia	9 [e]	23	10	-- [r]	--	(6) [e]	1	1	-- [r]	--	5	14	6	-- [r]	-- [7]
Nigeria, columbite-tantalite	156	383	100	99 [r]	100 [e]	65	160	40	35 [r]	35 [e]	8	21	5	10 [r]	10
Rwanda	96	128	200 [e]	250 [r]	250 [e]	30	40	63 [e]	80 [r]	80 [e]	20	26	40	50 [r]	50
Uganda	6	16	(6)	(6) [e]	(6) [e]	3	8	(6)	(6) [e]	(6) [e]	2	4	(6)	(6) [e]	(6)
Zimbabwe	481	231	14	-- [r]	--	NA	NA	NA	NA	NA	144	69	4	-- [r]	--
Total	82,600 [r]	81,600 [r]	67,900 [r]	67,700 [r]	67,700	33,300 [r]	30,000 [r]	27,800 [r]	43,300 [r]	44,500	1,340 [r]	1,280	1,470 [r]	1,400 [r]	1,390

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Excludes production of niobium and tantalum contained in tin ores and slags. Table includes data available through July 3, 2007.

[3]Data on gross weight generally have been presented as reported in official sources of the respective countries, divided into concentrates of columbite, tantalite, and pyrochlore where information is available to do so, and reported in groups, such as columbite and tantalite, where it is not.

[4]Unless otherwise specified, data presented for metal content are estimates based on, in most part, reported gross weight and/or pentoxide content.

[5]In addition to the countries listed, Bolivia, China, French Guiana, Kazakhstan, and Russia also produce or are thought to produce niobium and tantalum mineral concentrates, but available information is inadequate to make reliable estimates of output levels.

[6]Less than ½ unit.

[7]Reported figure.