



# 2007 Minerals Yearbook

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## NIOBIUM (COLUMBIUM) AND TANTALUM

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# NIObIUM (COlUMBIUM) AND TANTALUM

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In 2007, U.S. niobium (Nb) apparent consumption (measured in contained niobium) was 9,020 metric tons (t), a decrease of 10% compared with that of 2006. U.S. tantalum (Ta) apparent consumption (measured in contained tantalum) was 644 t, an increase of 29% compared with that of 2006 (revised). No domestic mine production of niobium or tantalum ore was reported.

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. World niobium and tantalum ore resources and mining capacity are geographically concentrated in Brazil (niobium and tantalum) and Canada (niobium) in the Western Hemisphere and in Australia (tantalum) in the Eastern Hemisphere. 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.

## Legislation and Government Programs

The Defense National Stockpile Center (DNSC) planned to dispose of niobium and tantalum materials under its fiscal year (FY) 2007 (October 1, 2006, through September 30, 2007) Annual Materials Plan (AMP) and announced the FY 2008 plan. The DNSC sold no niobium or tantalum materials in fiscal year 2007. The DNSC’s fiscal year 2008 AMP set maximum disposal goals for niobium and tantalum materials (niobium materials measured in contained niobium and tantalum materials measured in contained tantalum) as follows: niobium metal, 9,072 kilograms (kg) and tantalum carbide, 3,629 kg (Defense National Stockpile Center, 2007).

The DNSC exhausted its ferroniobium and niobium carbide inventories in calendar year 2000; tantalum metal ingots, in 2005; tantalum metal powder, tantalum pentoxide, and niobium concentrates and tantalum concentrates, in 2006.

## Production

The major marketplace niobium materials are ferroniobium, nickel-niobium, and niobium metal, ore, and oxide. The major marketplace tantalum materials are tantalum metal, ore, and

powder. In 2007, neither niobium nor tantalum domestic mine production was reported. 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.

The Kougarak prospect, on Seward Peninsula in Alaska, hosts significant tantalum resources in a lithium-fluorine granite (Fetherston, 2004, p. 69).

## Consumption

Niobium and tantalum were consumed in the United States by the electronics and metallurgical industries. Niobium masteralloys—ferroniobium and niobium-nickel alloy—were consumed to produce steel and superalloys. Tantalum was consumed to produce capacitors and superalloys. About 75% of world niobium consumption is for the production of microalloyed steel (Companhia Brasileira de Metalurgia e Mineração, 2008b).

## 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 price and niobium and tantalum material unit values, respectively.

## Foreign Trade

Niobium and tantalum material exports from and imports to the United States include ferroniobium and niobium metal, ore, and oxide, and tantalum metal and ore. In 2007, the value of foreign trade of these niobium and tantalum materials was \$128 million for exports and \$391 million for imports.

## World Industry Structure

Brazil and Canada were the leading producers of niobium mineral concentrates; Australia and Brazil were the leading producers of tantalum mineral concentrates. Tantalum-bearing tin slags, which are byproducts from tin smelting, principally from Asia, Australia, and Brazil, are another source of tantalum.

## World Review

**Angola.**—Angola hosts the Longonjo carbonatite deposit in Huambo Province. CityView Corporation Ltd. planned to drill eight exploration holes up to 150 meters (m) each on the southern part of Chimbulundu Hill, a part of its 3,764-square-kilometer license (CityView Corporation Ltd., 2008, p. 10).

**Australia.**—Western Australia reported tantalite production of 435 t of contained Ta in shipments of tantalum concentrate in 2007, compared with 584 t of contained Ta in 2006 (Government of Western Australia, 2008, p. 17). Australia reported Joint Ore Reserves Committee (JORC)-compliant tantalum Proven and Probable Ore Reserves, as stated in company annual reports and reports to the Australian Stock Exchange for December 31, 2006, of 40,300 t of tantalum pentoxide ( $Ta_2O_5$ ) and for niobium of 21,000 t niobium pentoxide ( $Nb_2O_5$ ) (Geoscience Australia, 2007, p. 3).

Capital Mining Limited reported finding niobium, among other metals, at a concentration of 80 grams per ton at its Narraburra prospect about 12 kilometers (km) northeast of Temora, New South Wales (Capital Mining Limited, 2008).

Queensland Gold and Minerals Limited prospected for tantalum and niobium at Walwa (147° 45' E, 36° 00' S), Victoria State, and for tantalum at Grant's Gully—Buchanan's Creek (143° 25' E, 18° 35' S), Queensland State (Queensland Gold and Minerals Limited, 2006).

Galaxy Resources Limited prospected for tantalum at Mt. Cattlin, Western Australia, near the town of Ravensthorpe. Galaxy planned a bankable feasibility study of the 24.8 million metric tons (Mt) of mineral resource at Mt. Cattlin that was estimated to contain 3,000 t of  $Ta_2O_5$ , which contained 1,500 t of  $Ta_2O_5$  in the higher-grade part of the mineral resource (Galaxy Resources Limited, 2008).

Resource Capital Funds L.P. purchased Greenbushes and Wodgina Mines from Sons of Gwalia for \$170 million. Talison Minerals Pty. Ltd. reported that Wodgina Mine produced tantalum ore that was converted to a primary concentrate at Wodgina and then processed at Greenbushes to produce marketable tantalum concentrate. Greenbushes Mine was on care-and-maintenance status (Mining Journal, 2007).

**Brazil.**—The National Department of Mineral Production (DNPM) reported that Companhia Brasileira de Metalurgia e Mineração (CBMM), Anglo American Brazil, and Paranapanema Group produced niobium and tantalum. Fernandes and Andrade (2007) reported that Brazil produced 104,885 t of contained  $Nb_2O_5$  from reserves of 3,685,440 t of contained  $Nb_2O_5$  in 2006. Heidrich (2007) reported that Brazil produced 215 t of contained  $Ta_2O_5$  from reserves of 88,193 t of contained  $Ta_2O_5$  in 2006. CBMM mined niobium ore from the Barreiro Carbonatite Complex (19° 40' S, 46° 57' W) near Araxá, Minas Gerais, and beneficiated the ore at the mine site by selectively extracting the pyrochlore minerals from which niobium oxide was separated (Companhia Brasileira de Metalurgia e Mineração, 2008a). CBMM produced ferroniobium from a plant with an annual ferroniobium production capacity of 70,000 metric tons per year (t/yr), which was being planned to increase to 90,000 t/yr in 2008.

Mineração Catalão de Goiás Ltda. (Catalão), (a subsidiary of Anglo American plc) mines pyrochlore from a carbonatite deposit. Catalão Mine (47° 48' W, 18° 08' S) comprised three open pits and a processing facility near Catalão, Goiás. Catalão produced 4,700 t of niobium in 2007 from JORC-compliant proved reserves of 195,000 t of niobium and resources of 4,000 t of niobium (Guimarães and Weiss, 2001; Anglo American plc, 2008, p. 147, 160).

Mineração Taboca S.A. (a subsidiary of the Paranapanema Group) mined columbite at Pitinga Mine (0° 47' 01" N, 60° 04' 43" W), Presidente Figueiredo Municipality, Amazon. Columbite grade was 30%  $Nb_2O_5$  and 3%  $Ta_2O_5$ . Paranapanema reported ferroniobiumtantalum alloy production to have been 1,929 t in 2007, 1,414 t in 2006, 1,166 t in 2005, 1,513 t in 2004, and 1,207 t in 2003 (Bernstein, Eros, and Quintana-Velázquez, 2006; Paranapanema S.A., 2008a, b).

Angus & Ross plc prospected for tantalum at its Caiçara project in Rio Grande do Norte State (Angus & Ross plc, 2006, p. 3).

**Canada.**—Canada reported niobium mine production in 2007 of 4,313 t of contained  $Nb_2O_5$  and tantalum mine production of 55 t of contained  $Ta_2O_5$  compared with 4,177 t of contained  $Nb_2O_5$  and 68 t of contained  $Ta_2O_5$  in 2006. Niobium was produced in Quebec; tantalum in Manitoba (Natural Resources Canada, 2007; 2008).

More than 30 tantalum deposits and prospects have been explored in the Provinces of British Columbia, Manitoba, Nova Scotia, Ontario, and Saskatchewan, and in the Nunavut Territory and Northwest Territories (Fetherston, 2004, p. 63-69).

IAMGOLD Corporation mined niobium contained in pyrochlore mineral from the Saint-Honoré carbonatite deposit at its Niobec Mine 15 km northwest of Chicoutimi, Québec Province (about 48° 32' N, 71° 09' W). Niobec had a mill production capacity of 4,500 t/yr of niobium ore from which Niobec produces  $Nb_2O_5$  that was then converted to standard grade (66% Nb) ferroniobium by aluminothermic reduction (IAMGOLD Corporation, 2008, p. 79-82, 90).

Avalon Ventures Ltd. prospected for niobium and tantalum at its Thor Lake (about 62° 06' 20" N, 112° 36' W) property where it found  $Nb_2O_5$  at concentrations of 0.01% to 0.59% in indicated resources of rare-earth elements (Avalon Ventures Ltd., 2008).

Commerce Resources Corp. prospected for niobium and tantalum at the Blue River (east of Quesnel, British Columbia), Carbo (northeast of Prince George, British Columbia), and Eldor (south of Kuujuaq, Quebec) properties that host carbonatite deposits. Groham (2007, p. 39) estimated indicated resources of 1,810 t of contained  $Ta_2O_5$  and 11,870 t of contained  $Nb_2O_5$  at a  $Ta_2O_5$  cutoff grade of 150 grams per metric ton (g/t) and 4,000 t of contained  $Ta_2O_5$  and 26,430 t of contained  $Nb_2O_5$  at a  $Ta_2O_5$  cutoff grade of 100 g/t; and inferred resources of 1,140 t of contained  $Ta_2O_5$  and 7,394 t of contained  $Nb_2O_5$  at a  $Ta_2O_5$  cutoff grade of 150 g/t and 2,370 t of contained  $Ta_2O_5$  and 15,300 t of contained  $Nb_2O_5$  at a  $Ta_2O_5$  cutoff grade of 100 g/t.

Rocher Deboule Minerals Corp. (2007) acquired the Brent (north-central British Columbia) and Lonnie (southern boundary of the Brent claim) claims. The Brent and the Lonnie niobium showings contained significant niobium hosted in carbonatite and were situated approximately 4 km apart.

Taseko Mines Limited acquired the Aley niobium property (northern British Columbia). The Aley deposit was discovered in 1980 by Cominco Ltd. From 1983-86, surface mineralization in the range of 20 to 30 Mt was outlined based on approximately 10,000 feet of diamond drilling among 20 holes. Assays for 18 of Cominco's 20 holes had intersections of greater than 8 m in length and averaged 0.75% Nb<sub>2</sub>O<sub>5</sub> (Taseko Mines Limited, 2008).

Niocan Inc. reported 7.30 Mt of measured resources at 0.66% Nb<sub>2</sub>O<sub>5</sub> and 1.32 Mt at 0.56% Nb<sub>2</sub>O<sub>5</sub> and indicated resources of 3.21 Mt at 0.66% Nb<sub>2</sub>O<sub>5</sub> and 2.22 Mt at 0.56% Nb<sub>2</sub>O<sub>5</sub> at its Oka niobium property (Niocan Inc., 2008, p. 2).

**China.**—TiChun Tantalum & Niobium Mine, about 26 km south of Jichun City, Jiangxi Province, produced tantalum and niobium concentrate (Yichun Tantalum Co., Ltd., 2008).

Western Mining Company Ltd., a member of the Western Mining Group, and Jiangxi Jinfeng Mining Co. planned to develop a tantalum and niobium mine near Geyuan Town, Hengfeng County, Jiangxi Province. The mine was to begin operation in 2009. Jiangxi Jinfeng reported resources of 30,000 t of contained Ta<sub>2</sub>O<sub>5</sub> and 50,000 t of contained Nb<sub>2</sub>O<sub>5</sub> (Metal Bulletin, 2006).

Ningxia Orient Tantalum Industry Co., Ltd. produced niobium and tantalum products (Ningxia Orient Tantalum Industry Co., Ltd., 2008). F&X Electro-Materials Limited, Xinhui, Jiangmen, Guangdong, produced niobium and tantalum products (F&X Electro-Materials Limited, 2008). Gui-Family Tantalum-Niobium Ltd., Jiangxi Province, produced niobium and tantalum products (Gui-Family Tantalum-Niobium Ltd., 2008).

**Congo, Democratic Republic of.**—Kivu, Maniema, Orientale, and Katanga Provinces in the eastern part of the Democratic Republic of Congo host columbite-tantalite deposits known locally as coltan (Fetherston, 2004, p. 71).

Kivu Resources prospected for tantalum through Central African Resources SPRL and processed tantalum ore purchased from small-scale miners through Mining and Processing Congo SPRL (Kivu Resources, 2008). Shamika Resources Inc. prospected for tantalum and niobium through Shamika Congo Kalehe SPRL (Shamika Resources, 2008). Rosspetplav (Russia) planned to raise money with which to restart niobium mining in the Congo through Midural Inc. (Luxembourg) (Shurmina, 2007).

**Egypt.**—The Eastern Desert region of Egypt hosted three tantalum deposits—Abu Dabab, El Nuweiba, and umm Naggat (Fetherston, 2004, p. 71).

Tantalum Egypt JSC, comprised of Gippsland Limited (Australia) and the Government of Egypt, planned to mine tantalum from the Abu Dabbab and Nuweibi deposits. At Abu Dabbab, Gippsland planned to mine 2 Mt/yr from the 40-Mt deposit containing resources (measured plus indicated plus inferred) of 39.9 Mt grading 0.025% Ta<sub>2</sub>O<sub>5</sub>; reserves (proven plus probable) were 14.6 Mt grading 0.026% Ta<sub>2</sub>O<sub>5</sub>. At Nuweibi, resources (indicated plus inferred) were 98 Mt at 0.014% Ta<sub>2</sub>O<sub>5</sub> with a resource cutoff grade of 0.01% Ta<sub>2</sub>O<sub>5</sub>. Gippsland estimated production of 295 t/yr of contained Ta<sub>2</sub>O<sub>5</sub>. H.C. Starck GmbH (Germany) agreed to buy 272 t/yr of contained Ta<sub>2</sub>O<sub>5</sub> for 10 years from Tantalum Egypt (Gippsland Limited, 2007, p. 6-9; H.C. Starck GmbH, 2007).

**Ethiopia.**—Ethiopia produced niobium and tantalum at the Kenticha Mine (Fetherston, 2004, p. 71, 73, 76). Ethiopian Mineral Resources Development Enterprise (state-owned) operated the surface mine, which had proven reserves of 2,400 t of contained Ta<sub>2</sub>O<sub>5</sub> and 2,300 t of contained Nb<sub>2</sub>O<sub>5</sub> at a cutoff grade of 0.015% Ta<sub>2</sub>O<sub>5</sub> and 0.005% Nb<sub>2</sub>O<sub>5</sub> from which it produced about 20 t/yr of columbotantalite concentrate (Geological Survey of Ethiopia, 2008).

**Greenland.**—Greenland hosted four niobium and/or tantalum deposits; Ilimaussaq, Motzfeldt Complex, Qaqaarsuk, and Saffartoq (Fetherston, 2004, p. 69, 71-72). Angus & Ross plc and St. Andrews University studied the geological complexities of the tantalum bearing ores in the Motzfeldt Complex (Angus & Ross plc, 2006, p. 3).

**Kazakhstan.**—Kazatomprom and Irtysh Chemical-Metallurgical Plant produced niobium and tantalum products.

**Korea, Republic of.**—Korea planned to add niobium to its national stockpile of metals to insulate the country from price surges or supply shortfall (Korea Culture and Information Service, 2007).

**Malawi.**—Globe Metals & Mining Limited prospected for niobium and tantalum at its Kanyika Resources project. Globe announced 56 Mt of JORC-compliant inferred resource, which it planned to develop by surface mining. The inferred resource graded 2,500 parts per million (ppm) Nb<sub>2</sub>O<sub>5</sub>. Globe planned to mine either 3,000 t/yr or 4,000 t/yr by extracting pyrochlore concentrate containing 25% Nb<sub>2</sub>O<sub>5</sub> and 1% Ta<sub>2</sub>O<sub>5</sub> by flotation after gravity separation of the crushed ore. Nb<sub>2</sub>O<sub>5</sub> and Ta<sub>2</sub>O<sub>5</sub> would be recovered by acid leaching, after which Nb<sub>2</sub>O<sub>5</sub> would be smelted by aluminothermic reduction to produce ferro niobium. Globe continued drilling to upgrade its resources, continued metallurgical work to validate the production process, and sought a strategic alliance (Globe Metals & Mining Limited, 2008).

**Malaysia.**—Metalysis Malaysia Sdn Bhd [a joint venture between Metalysis Ltd. (United Kingdom) and Rolls-Royce Motor Cars Ltd. (United Kingdom)] planned to produce tantalum metal (Metalysis Ltd., 2006; Rolls-Royce Motor Cars Ltd., 2006).

**Mozambique.**—Marropino, Morrua, and Muriane are tantalum deposits in the northwest region of Alto Ligonha in Zambezia Province (Fetherston, 2004, p. 74, 76-77).

Noventa Limited (Switzerland), formerly Highland African Mining, produced tantalum at Marropino mine and plant (Zambezia Province) and prospect for tantalum resources at Morrua, Mutala, and Ginama properties near Morropino. Noventa produced 100,000 t of contained Ta<sub>2</sub>O<sub>5</sub> in 2007 from the Alto Ligonha Pegmatite deposit and planned to increase production to 900,000 t in 2009. Noventa held reserves of 11.41 Mt grading 343 ppm Ta<sub>2</sub>O<sub>5</sub>, equivalent to 3,914 t of contained Ta<sub>2</sub>O<sub>5</sub> and indicated plus inferred resources of 29.10 Mt grading 296 ppm Ta<sub>2</sub>O<sub>5</sub>, equivalent to 8,614 t of contained Ta<sub>2</sub>O<sub>5</sub> (Noventa Limited, 2007a, p. 4, 11-20; 2007b, p. 129-130).

**Namibia.**—Three Aloes Mine in northern Namibia once produced tantalum. Southern Namibia hosts tantalum mineralization in Tantalite Valley in the Karas region. Magnum Mining and Exploration Limited (Australia) prospected for tantalum in Tantalite Valley (Fetherston, 2004, p. 74, 77; Magnum Mining and Exploration Limited, 2008, p. 2).

**Nigeria.**—Nasarawa, Gombe, and Kogi States and the Federal Capital Territory host tantalum deposits. Artisanal mining of coltan was practiced in Nasarawa (Fetherston, 2004, p. 75, 77).

**Rwanda.**—Artisanal mining of coltan was practiced around Kigali (Fetherston, 2004, p. 75, 77).

**Saudi Arabia.**—Tertiary Minerals plc explored for tantalum and niobium at the Ghurayyah deposit and prepared plans for mining; however, the Government of Saudi Arabia did not renew Tertiary Minerals exploration license. Tertiary Minerals put its prefeasibility study on hold until licensing issues could be resolved (Tertiary Minerals plc, 2008, p. 2).

**Zambia.**—Allied Energy Corporation inspected tantalite concessions near Choma. Allied considered purchasing the Starfield Mine from Starfield Minerals Ltd. Allied planned to mechanize the hand-labor open pit operation (Allied Energy Corp., 2007).

**Zimbabwe.**—Artisanal mining of tantalum has been practiced in the west around Kamativi and in the northeast around Rusambo and Shamva (Fetherston, 2004, p. 75, 77).

## Outlook

**Niobium.**—The principal use for niobium was as 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 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 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, carbides, and oxides that are used in the chemical, electronic, and metallurgical industries. Tantalum use was expected to change as its use in these industries changes.

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TABLE 1  
SALIENT NIOBIUM STATISTICS<sup>1</sup>

		2003	2004	2005	2006	2007 <sup>e</sup>
United States:						
Government stockpile releases, Nb content <sup>2</sup>	metric tons	223	90	152	156	--
Exports, Nb content <sup>3,4</sup>	do.	170	276	337	561	1,100
Imports for consumption:						
Mineral concentrates, Nb content <sup>4</sup>	do.	181	167	142	120	109
Niobium metal, gross weight <sup>5</sup>	do.	743	940	1,380	1,450	864
Niobium oxide, Nb content <sup>c</sup>	do.	585	633	661	760	744
Ferroniobium, Nb content <sup>e</sup>	do.	4,080	5,170	5,430	8,150	8,400
Reported consumption, Nb content:						
Raw materials	do.	W	W	W	W	W
Ferroniobium and nickel niobium <sup>f, e</sup>	do.	3,670	4,220	4,600	5,050	6,510
Apparent consumption, Nb content:	do.	5,640	6,730 <sup>r</sup>	7,430	10,100	9,020
Prices: <sup>6</sup>						
Ferroniobium <sup>7</sup> (Nb content)	dollars per kilogram	14.5	14.5	14.5	NA	NA
Value: <sup>8</sup>						
Niobium ore and concentrate (gross weight)	do.	9.75	6.96	9.70	13.71	22.55
Niobium oxide (gross weight)	do.	14.55	15.30	14.12	14.07	17.64
Ferroniobium (gross weight)	do.	8.74	8.72	8.66	9.13	13.88
World, production of niobium-tantalum concentrates, Nb content <sup>r</sup>	metric tons	40,800	41,900	60,300	51,200	60,400

<sup>e</sup>Estimated. <sup>r</sup>Revised. do. Ditto. NA Not available. W Withheld to avoid disclosing company proprietary data. -- Zero.

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

<sup>2</sup>Negative numbers indicate an increase in inventory. Release is the decrease of uncommitted inventory relative to the previous calendar year.

<sup>3</sup>Includes natural and synthetic niobium ore and concentrates; niobium oxide; niobium ferroalloy; and unwrought niobium metal and alloys.

<sup>4</sup>To estimate Nb content, it was assumed that natural tantalum and synthetic tantalum-niobium ores and concentrates are 16% Nb<sub>2</sub>O<sub>5</sub>; niobium ores and concentrates are 30% Nb<sub>2</sub>O<sub>5</sub>; and Nb<sub>2</sub>O<sub>5</sub> is 69.9% Nb.

<sup>5</sup>Includes niobium and articles made of niobium.

<sup>6</sup>The published price for columbite ore was discontinued in 2001 at a range of \$5.50 to \$7.00 per pound of Nb<sub>2</sub>O<sub>5</sub> content. The published prices of Brazilian and Canadian pyrochlore were discontinued in 1981 and 1989, respectively. Price is time-weighted average as reported in trade journals.

<sup>7</sup>Standard (steelmaking) grade. American Metal Market discontinued reporting the price of vacuum grade ferroniobium in 2002 and standard grade in 2005.

<sup>8</sup>Mass-weighted average value of imported plus exported materials.

TABLE 2  
SALIENT TANTALUM STATISTICS

		2003	2004	2005	2006	2007 <sup>e</sup>
United States:						
Government stockpile releases, Ta content <sup>1</sup>	metric tons	336	127	210 <sup>r</sup>	289 <sup>r</sup>	--
Exports:						
Tantalum ores and concentrates, Ta content <sup>2,3</sup>	do.	152	223	174	247	146
Tantalum metal, gross weight	do.	187	504	567	590	207
Tantalum and tantalum alloy powder, gross weight	do.	280	257	242	112	158
Imports for consumption:						
Mineral ore and concentrates, Ta content <sup>3</sup>	do.	483	451	382	322	294
Tantalum metal and tantalum-bearing alloys <sup>4</sup> , gross weight	do.	474	1,090	1,240	835	861
Tin slag	do.	NA	NA	NA	NA	NA
Reported consumption, Ta content:						
Raw materials	do.	W	W	W	W	W
Apparent consumption, Ta content:	do.	674	679	852 <sup>r</sup>	498 <sup>r</sup>	644
Prices, tantalite <sup>5</sup> (Ta <sub>2</sub> O <sub>5</sub> content)	dollars per kilogram	66	66	77	72	80
Value: <sup>6</sup> tantalum ore and concentrate, (gross weight)	do. *	34	35	31	33	43
World, production of niobium-tantalum concentrates, Ta content <sup>f</sup>	metric tons	1,390	1,520	1,470	964	815

<sup>e</sup>Estimated. <sup>r</sup>Revised. do. Ditto. NA Not available. W Withheld to avoid disclosing company proprietary data. --Zero.

<sup>1</sup>Negative numbers indicate an increase in inventory. Release is the decrease in uncommitted inventory relative to the previous calendar year.

<sup>2</sup>Includes natural and synthetic tantalum ore and concentrates.

<sup>3</sup>To estimate Ta content, it was assumed that natural niobium and synthetic niobium-tantalum ores and concentrates ore are 32% Ta<sub>2</sub>O<sub>5</sub>; tantalum ores and concentrates are 37% Ta<sub>2</sub>O<sub>5</sub>; and Ta<sub>2</sub>O<sub>5</sub> is 81.9% tantalum.

<sup>4</sup>Includes unwrought powders, unwrought alloys and metals, waste and scrap, and wrought alloys and metal.

<sup>5</sup>Time-weighted average price per Ta<sub>2</sub>O<sub>5</sub> content as reported in trade journals, including Metal Bulletin, Platts Metals Week, and Ryan's Notes.

<sup>6</sup>Mass-weighted average value of imported plus exported materials.

TABLE 3  
 NIOBIUM AND TANTALUM MATERIALS IN NATIONAL DEFENSE STOCKPILE  
 INVENTORIES AS OF DECEMBER 31, 2003–07

(Metric tons of niobium or tantalum content)

Material <sup>1</sup>	2007 Stockpile goal <sup>2</sup>	2007 Disposal authority	Uncommitted			2007 Committed
			Stockpile- grade	Non-stockpile- grade	Total	
<b>Niobium:</b>						
Concentrates	--	--	--	--	--	--
Carbide powder	--	--	--	--	--	--
Ferroniobium	--	--	--	--	--	--
Metal ingots	--	10.1	10.1	--	10.1	--
<b>Total</b>	<b>--</b>	<b>10.1</b>	<b>10.1</b>	<b>--</b>	<b>10.1</b>	<b>--</b>
<b>Tantalum:</b>						
Minerals	--	--	--	--	--	--
Carbide powder	--	1.73	--	--	1.73	--
<b>Metal:</b>						
Capacitor grade	--	--	--	--	--	--
Ingots	--	--	--	--	--	--
Oxide	--	--	--	--	--	--
<b>Total</b>	<b>--</b>	<b>1.73</b>	<b>--</b>	<b>--</b>	<b>1.73</b>	<b>--</b>

-- Zero.

<sup>1</sup>National Defense Stockpile disposed of the remaining inventory of niobium concentrates, tantalum minerals, oxide, and capacitor grade metal in 2006; tantalum metal ingots in 2005; ferroniobium and niobium carbide in 2001.

<sup>2</sup>Goal effective as of December 28, 2001.

Source: Defense National Stockpile Center.

TABLE 4  
 REPORTED CONSUMPTION, BY END USE, AND INDUSTRY STOCKS OF  
 FERRONIUM AND NICKEL NIOBIUM IN THE UNITED STATES<sup>1</sup>

(Metric tons of niobium content)

End use	2006	2007
<b>Steel:</b>		
Carbon	1,790	1,730
Stainless and heat-resisting	578 <sup>r</sup>	843
Full alloy	(2)	(2)
High-strength low-alloy	601 <sup>r</sup>	928
Electric	(2)	(2)
Tool	(2)	(2)
Unspecified	536	1,600
<b>Total</b>	<b>3,510<sup>r</sup></b>	<b>5,100</b>
Superalloys	1,540 <sup>r</sup>	1,400
Alloys (excluding steels and superalloys)	2 <sup>r</sup>	3
Miscellaneous and unspecified	--	--
<b>Grand total</b>	<b>5,050<sup>r</sup></b>	<b>6,510</b>
<b>Stocks, December 31:</b>		
Consumer	620	623
Producer <sup>3</sup>	W	W
<b>Total</b>	<b>620</b>	<b>623</b>

<sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data. -- Zero.

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

<sup>2</sup>Included with "Steel, unspecified."

<sup>3</sup>Ferroniobium only.



TABLE 5—Continued  
U.S. FOREIGN TRADE IN NIOBIUM AND TANTALUM METAL AND ALLOYS, BY CLASS<sup>1</sup>

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XX Not applicable. --Zero.

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

<sup>2</sup>Niobium waste and scrap is included in 8112.92.0600 along with other materials. Niobium other than unwrought; waste and scrap; and powders are included in 8112.99.9000 along with other materials.

<sup>3</sup>Includes revisions approved by the Department of Commerce.

Sources: U.S. Census Bureau and U.S. Geological Survey.

TABLE 6  
U.S. IMPORTS FOR CONSUMPTION OF NIOBIUM ORES AND CONCENTRATES,  
BY COUNTRY<sup>1</sup> (HTS CODE 2615.90.6030)

Country	2006		2007	
	Gross mass (kilograms)	Value (thousands)	Gross mass (kilograms)	Value (thousands)
Brazil	3,600	\$56	--	--
China	1,090	32 <sup>r</sup>	800	\$26
Germany	230	3 <sup>r</sup>	--	--
Singapore	250	7	--	--
Total	5,170	98	800	26

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

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

Sources: U.S. Census Bureau and U.S. Geological Survey.

TABLE 7  
U.S. IMPORTS FOR CONSUMPTION OF TANTALUM ORES AND CONCENTRATES,  
BY COUNTRY<sup>1</sup> (HTS CODE 2615.90.6060)

Country	2006		2007	
	Gross mass (kilograms)	Value (thousands)	Gross mass (kilograms)	Value (thousands)
Australia	808,000	\$35,300	708,000	\$42,000
Canada	226,000	6,330	209,000	6,350
China	79	18	1,450	94
Mozambique	--	--	48,084	1,291
Nigeria	25,000	633	--	--
Total	1,060,000	42,300	967,000	49,700

-- Zero.

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

Sources: U.S. Census Bureau and U.S. Geological Survey.

TABLE 8  
NIOBIUM AND TANTALUM MINING<sup>1</sup>

Country	Company	Internet address (http://www.)
Australia	Globe Metals & Mining	globeuranium.com.au
Do.	Gippsland Limited	gippslandltd.com
Do	Talison Minerals	talison.com.au
Brazil	Anglo American Brasil Ltda.	angloamerican.com.br
Do.	Companhia Brasileira de Metalurgiae Mineração (CBMM)	cbmm.com.br
Do.	Manmore Mineração e Metalurgia Ltda.	paranapanema.com.br
Do.	Mineração Catalao de Goias S.A. (Catalo)	NA
Canada	Camet Metallurgy Inc.	camet.de
Do.	Commerce Resources Corp.	commerceresources.com
Do.	Shamika Resources Inc.	shamikaresources.com
Ethiopia	Ethiopian Mineral Development Enterprise	NA
Malaysia	BEH Minerals Sdn Bhd	NA
Do.	Malaysia Smelting Corporation, BERHAD	msmelt.com
Tanzania	Rexwell Mining Company Limited	NA
Thailand	S.A. Minerals Ltd. Partnership	NA
Do.	H.C. Starck (Thailand) Co., Ltd.	hestarck.com
Do.	Thailand Smelting & Refining Co Ltd.	amcgroup.com/subsidiaries
South Africa	Noventa Ltd.	noventa.net
Do.	Tantalite Resources (Pty.)	NA
United Kingdom	Alfred H. Knight International Ltd.	ahkgroup.com
Do.	Angus and Ross plc	angusandross.com
Do.	Mekios (UK) Ltd.	NA
Do.	Alex Stewart Group	alexstewart.com
Do.	Teritary Minerals plc	teritaryminerals.com
United States	Wasser LLC	NA

Do. Ditto. NA Not available.

<sup>1</sup>Mining related (such as, assaying, exploration, prospecting, development, or production) companies.

TABLE 9  
NIOBIUM AND TANTALUM MANUFACTURING<sup>1</sup>

Country	Company	Internet address (http://www.)
Austria	Plansee SE	plansee.com
Do.	Treibacher Industrie AG	treibacher.com
Brazil	Cia. Industrial Fluminense	metallurg.com
Do.	Mineração Catalao de Goias S.A. (Catalao)	NA
Belgium	Honeywell Belgium N.V.	honeywell.com
China	Conghua Tantalum & Niobium	NA
Do.	Duoluoshan Sapphire Rare Metal Co.	NA
Do.	F&X Electro-Materials Ltd.	fxelectro.com
Do.	Fogang Jiata Metals Co., Ltd.	NA
Do.	Gui-Family Tantalum-Niobium Ltd.	guifamily.com
Do.	Jiujiang Jinxin Non-ferrous Metals Co., Ltd.	jiujiangjx.com
Do.	Jiujiang Tanbre Smelter	NA
Do.	Ningxia Non-ferrous Metals Smeltery	nniec.com
Do.	Northwest Inst. Non-ferrous Metals Reaserch	NA
Do.	Taike Texhnology (Suzhou) Co. Ltd.	NA
Do.	Zhuzhou Cemented Carbide Works	chinacarbide.com
Denmark	Tantalum Technologies A/S	tantalum-coating.com
Estonia	AS Silmet	silmet.ee
France	Firadec	firadec.fr
Germany, western states	H.C. Starck GmbH	hstarck.com
Do.	W.C. Heraeus GmbH	heraeus.com
Japan	Cabot Supermetals KK	cabot-corp.com/
Do.	Hi & M Corporation	hiandm.co.jp
Do.	H.C. Starck Ltd.	hstarck.com
Do.	Hitachi AIC Inc.	hitachi-aic.com
Do.	Mitsui Mining & Smelting Co., Ltd.	mitsui-kinzoku.co.jp/en/
Do.	NEC Tokin	nec-tokin.com
Do.	Nichicon Corp	nichicon.co.jp
Kazakhstan	JSC Irtysh Chemical-Metallurgical Plant	ihmz.kz
Do.	NAC Kazatomprom	kazatomprom.kz/eng/
Russia	Rosredmet	NA
Do.	Solikamsk Magnesium Works	smw.ru
Do.	TVEL Corporation	tvel.ru/
Thailand	H.C. Starck (Thailand) Co. Ltd.	hstarck.com
United Kingdom	ABS Industrial Resources Ltd.	absgroup.co.uk
Do.	AVX Ltd.	avx.com
Do.	Advanced Alloy Services Ltd.	advancedalloys.co.uk
Do.	Elite Material Solutions	kemet.com
Do.	Metalysis Ltd.	metalyie.com
United States	ATI Wah Chang	wahchang.com
Do	Cabot Supermetals	cabot-corp.com
Do.	Exotech	exotech.usa.com
Do.	H.C. Starck Inc.	hstarck.com
Do.	Hi-Temp Speciality Metals, Inc.	hi-tempmetals.com
Do.	Kermet Electronics Corp.	kermet.com
Do.	Niotan, Inc.	NA
Do.	Reading Alloys Inc.	reading-alloys.com
Do.	Tosoh SMD, Inc.	tosoh.com
Do.	Zimmer-Trabecular Metal Techonlogy	zimmer.com

Do. Ditto. NA Not available.

<sup>1</sup>Companies that consumer Nb and/or Ta materials to produce other Nb and/or Ta materials.

TABLE 10  
 NIOBIUM AND TANTALUM: WORLD PRODUCTION OF MINERAL CONCENTRATES, BY COUNTRY<sup>1,2</sup>

(Metric tons)

Country <sup>5</sup>	Gross mass <sup>3</sup>					Niobium content <sup>4</sup>					Tantalum content <sup>4</sup>				
	2003	2004	2005	2006	2007 <sup>e</sup>	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007 <sup>e</sup>
Australia, columbite-tantalite <sup>6</sup>	3,560 <sup>r,e</sup>	3,610 <sup>r,e</sup>	3,821 <sup>r</sup>	2,140 <sup>r,e</sup>	1,590	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	--	973 <sup>r</sup>	985 <sup>r</sup>	1,043 <sup>r</sup>	584 <sup>r</sup>	435 <sup>7</sup>
Brazil:															
Nb minerals <sup>8,9</sup>	163,000 <sup>r,e</sup>	168,000 <sup>r,e</sup>	247,000 <sup>r,e</sup>	207,000 <sup>r,e</sup>	245,766 <sup>7</sup>	37,920 <sup>r</sup>	39,148 <sup>r</sup>	57,560 <sup>r</sup>	48,129 <sup>r</sup>	57,267	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	--
Ta minerals <sup>10,11</sup>	747 <sup>r,e</sup>	780 <sup>r,e</sup>	792 <sup>r,e</sup>	645 <sup>r,e</sup>	650	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	--	156 <sup>r</sup>	148 <sup>r</sup>	148 <sup>r</sup>	176 <sup>r</sup>	180
Burundi	24	23	43	16	16	4	5	8	3 <sup>e</sup>	3 <sup>e</sup>	6	5	9	3 <sup>r</sup>	3
Canada:															
Nb minerals <sup>8,9</sup>	9,710 <sup>r,e</sup>	10,800 <sup>r,e</sup>	11,100 <sup>r,e</sup>	12,500 <sup>r,e</sup>	12,900	2,263 <sup>r</sup>	2,516 <sup>r</sup>	2,589 <sup>r</sup>	2,906 <sup>r</sup>	3,015	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	--
Ta minerals <sup>10,11</sup>	245 <sup>r,e</sup>	253 <sup>r,e</sup>	282 <sup>r,e</sup>	249 <sup>r,e</sup>	201	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	-- <sup>r</sup>	--	55 <sup>r</sup>	57 <sup>r</sup>	63 <sup>r</sup>	56 <sup>r</sup>	45 <sup>7</sup>
Congo, (Kinshasa), columbite-tantalite <sup>12</sup>	113 <sup>r</sup>	74 <sup>r</sup>	124 <sup>r</sup>	52 <sup>r</sup>	120	26 <sup>r</sup>	17 <sup>r</sup>	28 <sup>r</sup>	12 <sup>r</sup>	28	30 <sup>r</sup>	20 <sup>r</sup>	33 <sup>r</sup>	14 <sup>r</sup>	32
Pyrochlore	733 <sup>r</sup>	--	--	--	--	360 <sup>r</sup>	--	--	--	--	--	--	--	--	--
Ethiopia, tantalite	58	71	93	109	120	6	7	9	11	12 <sup>e</sup>	35	45	59	70	77
Mozambique	189	712	281	80	80	23	87	34	10 <sup>r</sup>	10 <sup>e</sup>	54	205	81	23 <sup>r</sup>	23
Namibia <sup>e</sup>	100 <sup>r</sup>	30 <sup>r</sup>	--	--	--	1	(13) <sup>r</sup>	--	--	--	36 <sup>r</sup>	11 <sup>r</sup>	--	--	--
Nigeria, columbite-tantalite	383	100	99	100 <sup>r</sup>	100	160	40	35	35	35 <sup>e</sup>	21	5	10	10 <sup>e</sup>	10
Rwanda	187 <sup>r</sup>	220 <sup>r</sup>	276 <sup>r</sup>	188 <sup>r</sup>	190	59 <sup>r</sup>	69 <sup>r</sup>	86 <sup>r</sup>	58 <sup>r</sup>	59 <sup>e</sup>	41 <sup>r</sup>	49 <sup>r</sup>	61 <sup>r</sup>	42 <sup>r</sup>	42
Uganda <sup>e</sup>	16 <sup>7</sup>	(13) <sup>7</sup>	(13)	(13) <sup>e</sup>	(13)	8 <sup>7</sup>	(13) <sup>7</sup>	(13)	(13)	(13)	4 <sup>7</sup>	(13) <sup>7</sup>	(13)	(13)	(13)
Zimbabwe <sup>e</sup>	13 <sup>r</sup>	50 <sup>r</sup>	--	NA <sup>r</sup>	NA	NA	NA	-- <sup>r</sup>	NA	NA	4 <sup>r</sup>	14 <sup>r</sup>	--	NA <sup>r</sup>	NA
Total	178,000 <sup>r</sup>	185,000 <sup>r</sup>	264,000 <sup>r</sup>	223,000 <sup>r</sup>	262,000	40,400 <sup>r</sup>	41,900 <sup>r</sup>	60,300 <sup>r</sup>	51,200 <sup>r</sup>	60,400	1,390 <sup>r</sup>	1,520 <sup>r</sup>	1,470 <sup>r</sup>	964 <sup>r</sup>	815

<sup>e</sup>Estimated. <sup>r</sup>Revised. NA Not available. -- Zero.

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

<sup>2</sup>Excludes production of niobium and tantalum contained in tin ores and slags. Table includes data available through July 9, 2008.

<sup>3</sup>Gross mass is mass of concentrate before metal is extracted.

<sup>4</sup>Content is mass of metal produced. Nb<sub>2</sub>O<sub>5</sub> is 69.904% niobium; Ta<sub>2</sub>O<sub>5</sub> is 81.897% tantalum.

<sup>5</sup>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.

<sup>6</sup>Tantalum production reported in tantalum content. Gross mass is concentrate assumed to be one-third Ta<sub>2</sub>O<sub>5</sub>.

<sup>7</sup>Reported figure.

<sup>8</sup>Niobium concentrate production reported in Nb<sub>2</sub>O<sub>5</sub> content converted to niobium content. Gross mass is concentrate assumed to be one-third Nb<sub>2</sub>O<sub>5</sub>.

<sup>9</sup>Includes columbite and pyrochlore.

<sup>10</sup>Tantalum production reported in Ta<sub>2</sub>O<sub>5</sub> content converted to tantalum content. Gross mass is concentrate assumed to be one-third Ta<sub>2</sub>O<sub>5</sub>.

<sup>11</sup>Includes djalmaitite and tantalite.

<sup>12</sup>Reported data includes the North and South Kivu provinces.

<sup>13</sup>Less than 1/2 unit.