



# 2015 Minerals Yearbook

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## TANTALUM [ADVANCE RELEASE]

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# TANTALUM

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**Domestic survey data and tables were prepared by Robin C. Kaiser, statistical assistant, and the world production table was developed by Glenn J. Wallace, the international data coordinator.**

In 2015, U.S. tantalum apparent consumption (measured in contained tantalum) was 560 metric tons (t), 10% more than that of 2014 (table 1). No domestic mine production of tantalum ore was reported. In 2015, the United States exported 657 t of tantalum contained in metal and tantalum-bearing alloys and tantalum ores and concentrates (9% less than that of 2014) and imported 1,220 t of tantalum contained in metal and tantalum-bearing alloys and tantalum mineral ores and concentrates (about the same as that of 2014) (table 1). The principal use of tantalum was in electronic capacitors. Tantalum content of world mine production was 1,210 t in 2015, a 16% decrease compared with that of the previous year (table 4).

Because the United States has no tantalum reserves, domestic supply has been a concern. World tantalum mine production is concentrated in Australia, Brazil, China, Congo (Kinshasa), Nigeria, and Rwanda. World tantalum reserves are adequate to meet anticipated world consumption. Materials for recycling and stocks are the only domestic supply sources of tantalum.

Traded tantalum materials included chemicals, metal, potassium hepta fluorotantalate (commercially known as K-salt), residue, scrap, slag, and tantalum ore and concentrate. K-salt and tantalum oxide do not have unique Harmonized Tariff Schedule of the United States (HTS) codes. As a result, a potentially significant part of tantalum material trade is undocumented. There is no unique 6-digit HTS code for tantalum ore and concentrate. As a result, world trade of tantalum ore and concentrate cannot reliably be documented. The absence of unique HTS codes for these tantalum materials eliminates international movement transparency for those materials and thereby may facilitate covert movement of illicit materials.

## Legislation and Government Programs

In response to Section 1502 of the Dodd-Frank Wall Street Reform and Consumer Protection Act, Kemet Corp. (one of the leading world tantalum consumers) assisted in the creation and operation of a conflict-free mine in Kisengo, Congo (Kinshasa). Kemet processed the ore in Matamoros (Mexico) and made metal powder in Carson City, NV (Loof, 2015).

The Defense Logistics Agency Strategic Materials (DLA Strategic Materials), U.S. Department of Defense, did not designate tantalum materials for disposal under its fiscal year 2016 Annual Materials Plan (Defense Logistics Agency Strategic Materials, 2015a); however, DLA Strategic Materials designated a ceiling quantity of 21 t of tantalum for acquisition (Defense Logistics Agency Strategic Materials, 2015b). The Under Secretary of Defense for Acquisitions, Technology, and Logistics requested tantalum for stockpiling because it is a conflict mineral and the United States is 100% import reliant

for tantalum (Under Secretary of Defense for Acquisitions, Technology and Logistics, 2015, p. 8, 6–81—6–82).

The U.S. Department of Labor identified coltan, a niobium- and tantalum-containing ore, from Congo (Kinshasa) as a good produced by child labor and forced labor (U.S. Department of Labor, 2014, p. 4).

## Production

The leading marketable tantalum materials are tantalum metal (unwrought and wrought alloys, metal, and powder), ore, and scrap. In 2015, no domestic tantalum mine production was reported.

## Consumption

Domestic consumption of tantalum materials was developed by the U.S. Geological Survey using the “Columbium (Niobium) and Tantalum,” “Consolidated Consumers,” and “Specialty Ferroalloys” surveys. For niobium and tantalum materials, one consumer responded to the “Columbium (Niobium), and Tantalum” canvass, about 70 responded to the “Consolidated Consumers” canvass, and one responded to the “Specialty Ferroalloys” canvass. In 2015, the steel industry accounted for about 80% of reported consumption.

ATI Wah Chang, Global Advanced Metals USA Inc. (GAM), H.C. Starck Inc., and Kemet Corp. consumed tantalum feed materials to produce intermediate tantalum materials used in industrial manufacturing processes and products.

## Prices

Tantalum materials were not traded openly, rather purchase contracts were confidential between buyer and seller; however, trade journals reported composite prices of tantalite based on interviews with buyers and sellers, and traders declared the value of tantalum materials that they imported or exported (table 1). In 2015, the annual average price of tantalite ore per pound of contained tantalum oxide ( $Ta_2O_5$ ) was \$87.5, a 13% decrease compared with that of 2014. The average monthly Tantalite ore price in 2015 was \$87.5 per pound of contained  $Ta_2O_5$  in January, where it remained through December (CRU International Ltd., 2016).

Tantalum ore and concentrate price information has been described as opaque because there is no open market and the only source of price data is spot price in trade journals. Industrial tantalum ore and concentrate producers make long-term contracts that specify confidential prices with processors, so the spot price does not apply (Burt and Schwela, 2013, p. 6).

## Foreign Trade

Tantalum material exports from and imports to the United States included tantalum alloy powder, metal, and ores and concentrate. The value of U.S. exports of tantalum-containing materials decreased by 15% and imports of tantalum-containing materials reduced by 8% compared with those of 2014 (table 2).

## World Industry Structure

Congo (Kinshasa) and Rwanda were the leading producers of tantalum mineral concentrates (table 4). Tantalum-bearing tin slags, which are byproducts from tin smelting, principally from Asia and Brazil, were another source of tantalum. The leading tantalum ore and concentrate producers were artisanal mining operations in Congo (Kinshasa) and Rwanda and vertically integrated mining operations of AVX Corp. and Kemet Corp. in Congo (Kinshasa), which were expected to substantially increase their production (Zogbi, 2012, p. 91). See figure 1 for an outline of the material flow of tantalum materials from mining to end use.

The Tantalum-Niobium International Study Center reported annual niobium and tantalum primary production based on a survey of its members. Tantalum primary production from tantalum concentrates, tin slags, and other concentrates were estimated to have been about 870 t of contained tantalum in 2015 (Tantalum-Niobium International Study Center, 2016).

The electronics industry globally was the leading tantalum consumer, accounting for more than one-half of tantalum use, and electronic capacitors were the leading electronic use. Tantalum provides high dielectric constant and oxide layer stability to tantalum capacitors, resulting in high volumetric and thermally stable capacitance, which are desirable characteristics in some applications. Bioinertness makes tantalum useful in biomedical and surgical applications. Ductility and corrosion resistance make tantalum mill products useful in chemical processing. High-temperature strength and melting points of tantalum and tantalum alloys make tantalum suitable in superalloys. A wide variety of tantalum chemical uses takes advantage of specific properties. For instance, Ta<sub>2</sub>O<sub>5</sub> increases the refractive index of the glass used in camera lenses, tantalum carbide increases the toughness of cemented carbide cutting tools, and tantalum nitride contributes to the inertness of diffusion barriers in microelectronic circuits (Burt and Schwela, 2013, p. 11).

World consumption of tantalum by application in 2015 was capacitors, 33%; superalloys, 22%; sputtering targets, 17%; chemicals, 11%; mill products, 9%; carbides, 8%; and (Roskill Information Services Ltd., 2016, p. 1, 18–21, 108–110).

## World Review

**Australia.**—General Mining Corp. and Galaxy Resources Ltd. planned to restart production at the Mt. Cattlin spodumene and tantalum project near Ravensthorpe under a 3-year lease agreement. Galaxy put Mt. Cattlin on care-and-maintenance status in July 2012. The operation redesigned its mineral processing to achieve a throughput of 800,000 metric tons per year (t/yr) and to increase yield to 70% to 75% from 50% to 55%, which would yield 80 t/yr of contained Ta<sub>2</sub>O<sub>5</sub> (Galaxy Resources Ltd., 2016).

Pilbara Minerals Ltd. developed two tantalum properties: Tabba Tabba and Pilgangoora. Pilbara reported that Tabba Tabba had measured, indicated, and inferred resources of 318,100 t grading 0.095% tantalum. Pilbara planned to start production at Tabba Tabba in 2016 (Pilbara Minerals Ltd., 2015, p. 8; 2016, p. 1). Pilbara reported that Pilgangoora had indicated and inferred resources of 32.9 million metric tons (Mt) grading 0.022% tantalum. Pilbara planned to complete a Pilgangoora pre-feasibility study and a definitive feasibility study in 2016 (Pilbara Minerals Ltd., 2015).

**Benin.**—The Government of Benin awarded Premier African Minerals Ltd. tantalum exploration rights to the Toumi mining area while suspending artisanal mining that has taken place in that region during the past 15 years (Whiterow, 2015). The highest grade Premier encountered was 0.0188% Ta<sub>2</sub>O<sub>5</sub> and 0.1631% niobium pentoxide (Nb<sub>2</sub>O<sub>5</sub>) in eluvial material south of the Toumi artisanal mining site (Premier African Minerals Ltd., 2015a).

**Brazil.**—AMG Advanced Metallurgical Group N.V. operated the multi mineral MIBRA mine where they extracted tantalite and other minerals. AMG further processed these materials at its Brazilian chemical plant to produce upgraded chemical products. AMG supplied tantalum materials to GAM (AMG Advanced Metallurgical Group N.V., 2015).

Grupo Minsur's Mineracao Taboca S.A. subsidiary temporarily halted production at its Pitinga Mine at the start of August owing to power supply problems and then resumed operations at a reduced rate. Water filtration issues at the dike of the hydroelectric plant that provides energy to Pitinga forced the hydroelectric plant to work at one-half of its capacity (CRU Group, 2015).

**Canada.**—Commerce Resources Corp. reported 53.8 Mt of indicated plus inferred resources containing 0.1964% Ta<sub>2</sub>O<sub>5</sub> and 0.01625% Nb<sub>2</sub>O<sub>5</sub> (Commerce Resources Corp., 2015, p. 1–1). Houston Lake Mining Inc. (HLM) updated their Pakeagama Lake pegmatite deposit resource estimate to 8.36 Mt of indicated plus inferred resources containing 0.01% Ta<sub>2</sub>O<sub>5</sub> (Houston Lake Mining Inc., 2015, p. 76).

**Congo (Kinshasa).**—Tantalex Resources Corp. (Canada) started to mine 600 to 800 kilograms per month of tantalum ore in the north Congo on a test basis (AZO MINING, 2015).

**Egypt.**—Arrowhead Resources Ltd. (formerly Gippsland Ltd.) reported that it had lost control of Abu Dabbab project, a tantalum resource it planned to develop (Arrowhead Resources Ltd., 2015, p. 5–6).

**Estonia.**—Molycorp Silmet AS, a metals producer that specialized in the production of tantalum and niobium, experienced a plastic pipe and construction waste fire. Silmet planned to make repairs to restore its lost production capacity (Gerden, 2015a).

**Malawi.**—Mkango Resources Ltd. (Canada) reported various anomalous niobium and tantalum values (0.78% Nb<sub>2</sub>O<sub>5</sub> and 0.0972% Ta<sub>2</sub>O<sub>5</sub> in rock chips) at its Thambani project (Mkango Resources Ltd., 2015).

**Mozambique.**—Pacific Wildcat Resources Corp. reported that its Muiane Mine site was attacked and destroyed by local rioters (Pacific Wildcat Resources Corp., 2015).

**Namibia.**—African Tantalum Pty. Ltd. (75% owned by Kennedy Ventures Plc) operated the Tantalite Valley Mine (TVM) near Warmbad, Karas District, Namibia. African Tantalum planned to increase throughput at TVM to 10,500 metric tons per month, which is equivalent to 2.3 metric tons of Ta<sub>2</sub>O<sub>5</sub> per month. TVM estimated resources of 843,000 t at 0.049% Ta<sub>2</sub>O<sub>5</sub> (Kennedy Ventures Plc, 2015, 2016).

**Russia.**—Technoinvest Alliance planned to build a tantalum-niobium mining complex in the Zashihinskoe rare-earth metals field located in the Nizhneudinsk area of the Irkutsk region, Siberia. The mine would produce a concentrate containing 4.4% tantalum and 44% niobium. The product was to go to Angarsk Electrolysis Chemical complex, which would produce 200 t/yr of Ta<sub>2</sub>O<sub>5</sub> and 2,000 t/yr of Nb<sub>2</sub>O<sub>5</sub>. Technoinvest planned to start construction in 2016 and start production in 2018 (Gerden, 2015b).

**Sierra Leone.**—Sula Iron and Gold Plc performed reconnaissance field work at its Ferensola license area and found the potential for alluvial, eluvial, and primary pegmatite columbite-tantalite mineralization (Sula Iron and Gold Plc, 2015).

**United Kingdom.**—Metalysis Ltd. produced nodular tantalum metal powder on a commercial scale from Ta<sub>2</sub>O<sub>5</sub> powder in a new one-step process that is more energy efficient than traditional processes (AZO Materials, 2015; Metalysis Ltd., 2015).

**Venezuela.**—The Government of Venezuela moved to clear illegal coltan miners from a national park in the Amazon area of Bolivar State, the home of 26 indigenous communities. Smugglers were moving the columbite-tantalite minerals out of the country via Colombia and Brazil (Giunta, 2015).

**Zimbabwe.**—Premier African Minerals Ltd. identified distinct high-grade zones in pit samples of eluvial materials. High Ta<sub>2</sub>O<sub>5</sub>, low thorium and uranium, and favorable ratios to niobium characterized the samples (Premier African Minerals Ltd., 2015b).

## Outlook

The amount of tantalum supplied from tin mining and recycling is expected to increase. The quantity of tantalum produced from tin mining depends on the demand for tin. Tantalum from recycling would rely on the price of tantalum concentrate. As the price of tantalum concentrate rises, more recycling of tantalum will become economic. World tantalum new supply (that is, from concentrates from mines, slags, and synthetic concentrates) is likely to increase. In 2015, artisanal mining accounted for about 57% of supply; conventional, 32%; and synthetic concentrates, 11%.

As microelectronic use increases, tantalum sputtering target use is expected to increase, assuming no significant technological changes. Tantalum alloys have high strength and high-temperature resistance, making them useful in jet and rocket engine applications. High corrosion resistance makes tantalum alloys and tantalum coatings useful in chemical process applications or other severe industrial applications. Thus, tantalum use in superalloys and tantalum alloys should follow trends in aircraft jet engines and chemical plant construction and renovation. Tantalum carbide is tough and temperature resistant and is used in cutting tools, machine tool bits, and teeth in construction, drilling, and mining equipment. As such, tantalum use would be expected to change in response

to changes in construction, drilling, metal manufacturing, and mining activities. In addition to being used as precursors to other chemicals, tantalum chemicals are utilized in a wide variety of applications including chemical vapor deposition, optical element coating, optoelectronics, piezoelectrics, and powder metallurgy. The large number of tantalum chemicals with a broad range of uses results in a highly fragmented market (Zogbi, 2012, p. 42–47, 51, 64, 66, 72).

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

		2011	2012	2013	2014	2015
United States:						
Exports:						
Gross quantity:						
Niobium ores and concentrates	metric tons	12	31	110	60	73
Synthetic concentrates	do.	20	209	61	200	138
Tantalum ores and concentrates	do.	186	202	204	225	98
Tantalum content: <sup>2</sup>						
Tantalum, unwrought	do.	198	136	161	247	235
Tantalum, waste and scrap	do.	303	235	521	285	280
Tantalum, wrought	do.	83	81	54	57	57
Imports for consumption:						
Gross quantity:						
Niobium ores and concentrates	metric tons	9	11	8	2	--
Synthetic concentrates	do.	11	--	--	--	--
Tantalum ores and concentrates	do.	179	261	655	897	730
Tantalum content:						
Tantalum-containing ores and concentrates <sup>3</sup>	do.	60	82	201	272 <sup>f</sup>	221
Tantalum, unwrought <sup>2</sup>	do.	101	138	113	114	150
Tantalum, waste and scrap <sup>2</sup>	do.	1,360	515	527	625	565
Tantalum, wrought <sup>2</sup>	do.	124	70	68	44	41
Apparent consumption, Ta content	do.	1,200	434	261	508 <sup>f</sup>	560
Price, tantalite, <sup>4</sup> Ta <sub>2</sub> O <sub>5</sub> content	dollars per kilogram	275	239	260	221	193
Value, <sup>5</sup> tantalum ores and concentrates, gross quantity	do.	46	45	68	69	65
World, production of tantalum concentrates, Ta content	metric tons	916 <sup>f</sup>	1,010 <sup>f</sup>	1,290 <sup>f</sup>	1,440 <sup>f</sup>	1,210 <sup>e</sup>

<sup>e</sup>Estimated. <sup>f</sup>Revised. do. Ditto. -- Zero.

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

<sup>2</sup>Tantalum content estimated at 100%.

<sup>3</sup>Includes niobium and tantalum ores and concentrates and synthetic concentrates. Ta content of ore and concentrate is computed assuming 81.89% Ta in Ta<sub>2</sub>O<sub>5</sub>, 37% Ta<sub>2</sub>O<sub>5</sub> in tantalum ores and concentrates, and 32% Ta<sub>2</sub>O<sub>5</sub> in niobium ores and concentrates and synthetic concentrates.

<sup>4</sup>Average annual price per Ta<sub>2</sub>O<sub>5</sub> content as reported in Ryan's Notes.

<sup>5</sup>Weighted average value of imported plus exported materials.

TABLE 2  
U.S. FOREIGN TRADE IN TANTALUM-CONTAINING ORE AND CONCENTRATE AND TANTALUM METAL AND ALLOYS, BY CLASS<sup>1</sup>

HTS <sup>2</sup> code	Class	2014		2015		Principal destinations and sources in 2015 (gross quantity in kilograms and values in thousand dollars)
		Gross quantity (kilograms)	Value (thousands)	Gross quantity (kilograms)	Value (thousands)	
<b>Exports:</b>						
2615.90.3000	Synthetic concentrates	200,000 <sup>r</sup>	\$5,370 <sup>r</sup>	138,000	\$3,260	China 73,700, \$1,160; Germany 50,100, \$1,900; Hong Kong 12,100, \$201.
2615.90.6030	Niobium ores and concentrates	59,600	772	73,400	557	Germany 35,700, \$886; Estonia 30,900, \$120; United Kingdom 2,540, \$18.
2615.90.6060	Tantalum ores and concentrates	225,000	5,940	98,200	4,860	Hong Kong 54,000, \$3,130; China 26,200, \$1,610; Brazil 18,000, \$123.
8103.20.0030	Unwrought, powders	206,000 <sup>r</sup>	100,000 <sup>r</sup>	230,000	84,600	Mexico 155,000, \$61,300; El Salvador 34,000, \$8,740; Czech Republic 17,700, \$4,360; Israel 14,000, \$5,540; Sweden 6,200, \$2,280; Luxembourg 1,050, \$507; China 755, \$792.
8103.20.0090	Unwrought, other	40,200 <sup>r</sup>	9,740 <sup>r</sup>	5,300	2,140	Netherlands 1,370, \$575; Israel 1,160, \$783; Switzerland 921, \$111; Germany 767, \$260; Mexico 356, \$53; Republic of Korea 313, \$175; Canada 175, \$41.
8103.30.0000	Waste and scrap	285,000 <sup>r</sup>	46,300 <sup>r</sup>	280,000	42,700	Germany 60,400, \$9,840; Japan 42,900, \$8,190; Australia 35,500, \$3,390; Kazakhstan 32,000, \$7,570; Hong Kong 21,800, \$1,160; Mexico 17,600, \$1,710; United Kingdom 16,000, \$2,930; China 11,400, \$1,820; El Salvador 10,200, \$2,370.
8103.90.0000	Wrought	56,900 <sup>r</sup>	36,100 <sup>r</sup>	57,300	36,200	Germany 18,200, \$8,520; Republic of Korea 17,000, \$11,300; China 9,780, \$6,730; Japan 4,050, \$3,600; France 2,120, \$1,450; Czech Republic 942, \$843; United Kingdom 678, \$349; Mexico 528, \$359.
	Total exports	XX	204,000 <sup>r</sup>	XX	174,000	
<b>Imports for consumption:</b>						
2615.90.6030	Niobium ores and concentrates	2,000	148	--	--	--
2615.90.6060	Tantalum ores and concentrates	897,000 <sup>r</sup>	71,300 <sup>r</sup>	730,000	49,300	Rwanda, 302,000, \$16,600; Brazil 177,000, \$20,200; Australia 117,000, \$6,380; Congo (Kinshasa) 90,500, \$4,340; Tanzania 20,600, \$737; Congo (Brazzaville) 19,900, \$929.
8103.20.0030	Unwrought, powders	114,000 <sup>r</sup>	50,600 <sup>r</sup>	150,000	58,400	Germany 59,600, \$21,700; Thailand 44,200, \$18,900; China 27,200, \$12,800; Czech Republic 6,430, \$129; Kazakhstan 5,010, \$1,920; Japan 4,940, \$2,330.
8103.20.0090	Unwrought, other	178,000	68,900	237,000	81,000	China 141,000, \$49,200; Kazakhstan 66,600, \$23,700; Brazil 16,400, \$4,600; United Kingdom 3,970, \$1,440; Hong Kong 3,000, \$1,200; Singapore 2,990, \$110; Germany 1,570, \$444; Austria 800, \$264.
8103.30.0000	Waste and scrap	625,000 <sup>r</sup>	73,000 <sup>r</sup>	565,000	56,400	Austria 146,000, \$3,870; Mexico 111,000, \$6,370; Japan 48,300, \$5,840; Czech Republic 48,100, \$1,280; Germany 47,700, \$10,700; Republic of Korea 32,800, \$2,630; China 32,700, \$7,450; Estonia 29,100, \$7,950.
8103.90.0000	Wrought	43,900 <sup>r</sup>	25,900	41,300	21,500	China 26,900, \$12,800; Kazakhstan 6,160, \$3,420; Austria 4,170, \$2,650; France 1,940, \$961; Germany 889, \$552; Canada 293, \$333; Mexico 249, \$118; United Kingdom 171, \$81; Denmark 146, \$268.
	Total imports	XX	290,000 <sup>r</sup>	XX	267,000	

<sup>r</sup>Revised. 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>Harmonized Tariff Schedule of the United States.

TABLE 3  
U.S IMPORTS FOR CONSUMPTION OF TANTALUM ORES AND CONCENTRATES, BY COUNTRY<sup>1,2</sup>

Country	2014		2015	
	Gross quantity (kilograms)	Value (thousands)	Gross quantity (kilograms)	Value (thousands)
Aruba	456	\$10	--	--
Australia	74,300	4,230	117,000	\$6,380
Bolivia	--	--	1,280	5
Brazil	468,000	44,900	177,000	20,200
Canada	--	--	2	4
China	1,090	74	806	109
Colombia	100	6	--	--
Congo (Brazzaville)	--	--	19,900	929
Congo (Kinshasa)	30,300	1,460	90,500	4,340
Ethiopia	73,500	5,530	--	--
Germany	-- <sup>r</sup>	-- <sup>r</sup>	80	18
India	531	11	--	--
Madagascar	711	42	--	--
Mexico	1,330	3	329	8
Rwanda	236,000	14,600	302,000	16,600
Sierra Leone	11,100	409	--	--
Tanzania	--	--	20,600	737
Total	897,000 <sup>r</sup>	71,300 <sup>r</sup>	730,000	49,300

<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>Harmonized Tariff Schedule of the United States code 2615.90.6060.

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

TABLE 4  
TANTALUM: WORLD PRODUCTION OF MINERAL CONCENTRATES, BY COUNTRY<sup>1</sup>

(Kilograms, tantalum content)<sup>2</sup>

Country <sup>3</sup>	2011	2012	2013	2014	2015 <sup>c</sup>
Bolivia, Ta minerals	4,285 <sup>r</sup>	10,565 <sup>r</sup>	11,547 <sup>r</sup>	5,638 <sup>r</sup>	10,565 <sup>4</sup>
Brazil, Ta minerals <sup>5</sup>	111,000	96,600 <sup>r</sup>	152,000	96,600 <sup>r</sup>	98,000
Burundi <sup>c</sup>	31,000	51,000 <sup>r</sup>	14,000 <sup>r</sup>	21,000 <sup>r</sup>	12,000
Canada, Ta minerals <sup>6</sup>	--	-- <sup>r</sup>	30,000 <sup>r</sup>	-- <sup>r</sup>	--
China <sup>c</sup>	43,000 <sup>r</sup>	45,000 <sup>r</sup>	48,000 <sup>r</sup>	61,000 <sup>r</sup>	95,000
Congo (Kinshasa) <sup>c</sup>	260,000	250,000	270,000 <sup>r</sup>	450,000 <sup>r</sup>	350,000
Ethiopia, tantalite	94,500	91,000	9,800 <sup>r</sup>	50,000 <sup>r</sup>	63,000
Mozambique	39,000	83,000	43,000	23,000	20,000
Nigeria, columbite-tantalite	43,000 <sup>r</sup>	75,000 <sup>r</sup>	110,000 <sup>r</sup>	150,000 <sup>r</sup>	150,000
Rwanda <sup>c</sup>	290,000 <sup>r</sup>	310,000 <sup>r</sup>	600,000 <sup>r</sup>	580,000 <sup>r</sup>	410,000
Uganda <sup>c</sup>	1 <sup>r</sup>	--	--	--	4,800
Total	916,000 <sup>r</sup>	1,010,000 <sup>r</sup>	1,290,000 <sup>r</sup>	1,440,000 <sup>r</sup>	1,210,000

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

<sup>1</sup>World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown. Includes data available through May 12, 2017.

<sup>2</sup>Content is quantity of tantalum contained in marketable tantalum minerals produced. Ta<sub>2</sub>O<sub>5</sub> is 81.89% tantalum.

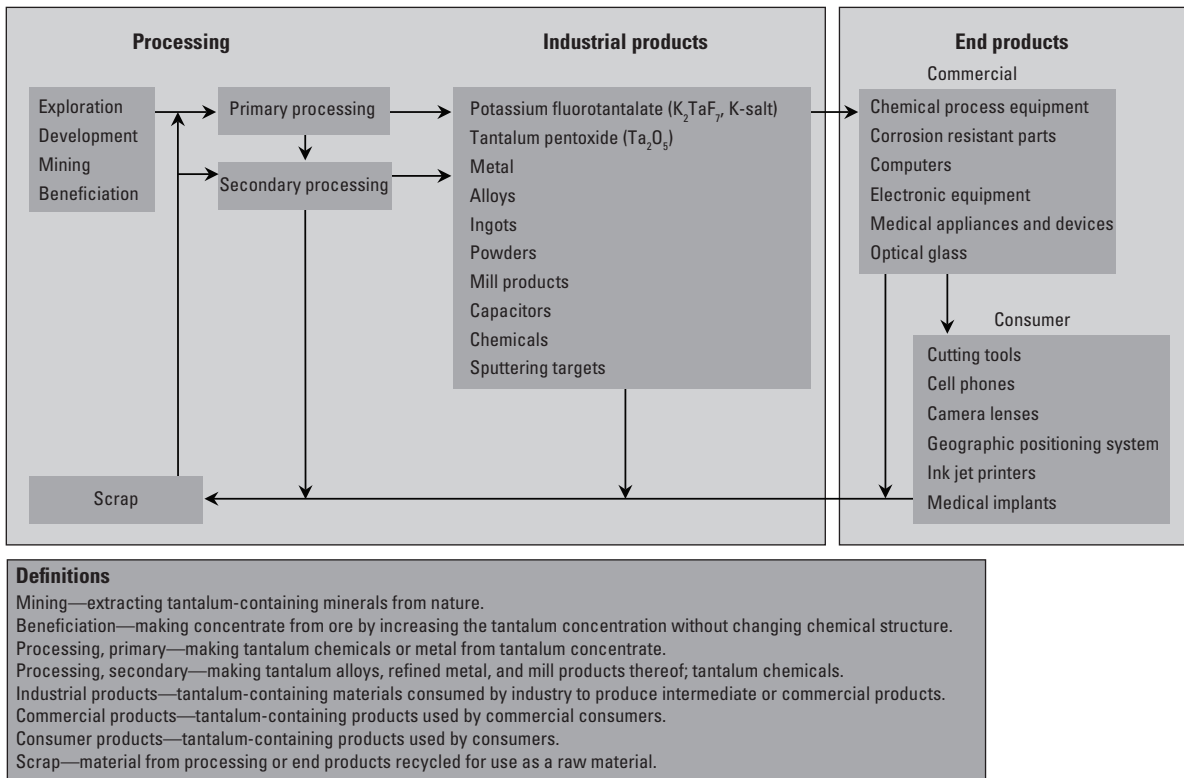
<sup>3</sup>In addition to the countries listed, Australia, French Guiana, Kazakhstan, and Russia also produce or are thought to produce tantalum mineral concentrates, but available information is inadequate to make reliable estimates of output quantity.

<sup>4</sup>Reported figure.

<sup>5</sup>Includes djalmite and tantalite.

<sup>6</sup>Reported in Ta<sub>2</sub>O<sub>5</sub> content by Statistics Canada in Mineral Production of Canada, by Province, various years.





**Figure 1.** Flow chart depicting the world tantalum industry from exploration through consumer products.