

TANTALUM PRODUCERS INTERNATIONAL STUDY CENTER

QUARTERLY BULLETIN

DECEMBER 1975

FOURTH QUARTER

ACTIVITIES OF THE T.I.C.

1. Election of officers for 1976

During the Fourth General Assembly, the election of officers was held for the 1976 term. The officers will be:

President - Mr. Herman Becker-Fluegel
Mr. Paul Leynen
Mr. Enno Muller

Dr. Herkstroeter is relinquishing his direct responsibility for the Thailand Smelting and Refining Co. at the end of 1975 to move to the Billiton companies in The Hague. Mr. Muller will be the new delegate from Thaisarco to the T.I.C.

Mrs. J. E. Goodyear will continue as the Secretary of T.I.C.

2. By-law amendments

In an Extraordinary General Meeting of the members of T.I.C., the By-Laws were changed as follows:

1. The Article dealing with membership is changed to allow the membership of producers of columbite-tantalite raw materials, the processors which transform or otherwise treat raw materials of tantalite or columbite-tantalite, the companies which consume such transformed or treated products, and the international companies engaged in the trading of tantalite and columbite-tantalite raw material and who assist financially or technically in the production of such materials by miners who are not members of the T.I.C.

2. The Executive Committee, now comprising three members including the President, is expanded to allow up to five members.

3. Committees

The President appointed the following committees:

1. Standards - to establish standards for grades of tantalite and columbite to be used as a basis for trade and price quotation.

Members - Mr. Enno Muller
Mr. Nicholas Sinclair

2. Membership - to develop new members in accordance with the broader basis defined by the By-Law change.

Executive Committee

Mr. Herman Becker-Fluegel
Mr. Paul Leynen
Mr. Enno Muller

3. « Bulletin » - to collect information for the « T.I.C. Bulletin » and effect the publication.

Members - Mr. Paul Leynen
Mr. Graham Brown

4. Technical Advisor - to identify candidates for a technical advisor to the T.I.C.

Members - Mr. Paul Leynen
Mr. Michael Herzfeld
Mr. F. Vanden Herrewegen
Mr. Jean Courtois

4. Organization and functions of the T.I.C.

A study, prepared by Emory Ayers Associates of New York City for the T.I.C. provides a four-phase program to accomplish the T.I.C. objectives by promoting better understanding within the tantalum producing and consuming industries so that stability of raw material supply will be developed adequate to meet the growing needs of the end-product uses of tantalum. The program proposed the following in each phase:

Phase 1

Strengthen the T.I.C. to provide useful services to members and to develop credibility to outsiders by improving information services, expanding membership to include columbite producers and tantalum processors, sponsoring an International Conference on tantalum, and establishing a committee structure.

Phase 2

Formation of an industry-wide organization to further develop information and cooperation by exchanging forecasts and market indices, establishing permanent management, expanding membership to include traders and end-product manufacturers, and instituting a revised method of financing.

Phase 3

Achievement of supply stability.

T.I.C. FOURTH GENERAL ASSEMBLY

On September 18, 1975 the Fourth General Assembly of the T.I.C. convened in Brussels. All members were in attendance. Other invited attendees were Mr. Emory Ayers and Mr. Tom Barron of Emory Ayers Associates, Dr. C. Fincham and Mr. Paul Ziegler of the Tantalum Producers Association. A presentation was made by Emory Ayers Associates of the study made to develop a long-range program for T.I.C. Discussion with the T.P.A. representatives concerning closer cooperation of the two societies was followed by a business session covering current matters. The next General Assembly will be held in Brussels on Thursday, March 25, 1976.

Phase 4

Development of a permanent method of supporting tantalum and columbium promotion and research.

The members of the T.I.C. voted during the Fourth General Assembly to support and implement the program provided by the study. As the first step, a continuation of the study was authorized to develop information concerning the tantalum end-use market as to the overall planning strategy, and the outlook of the end-users affecting the future requirements for tantalum. The study will be continued by Emory Ayers Associates who will enlist the assistance of the Tantalum Producers Association, other processors, fabricators, and end-users. The study will assess the adequacy of the supply and reserves of tantalum-containing raw materials to meet the needs of the end-users. The study will be made available to all contributors. Prompt action was recommended, in view of the current well-advertised shortage of tantalum, to forestall the investigation of substitutes for tantalum by end-users.

TIN SLAG PRODUCTION AT DATUK KERAMAT SMELTING IN PENANG

Historical Development

Tin concentrates from Malaysia and Thailand have been smelted at Penang since 1930. In the early days, the slag was disposed of by various means, the bulk of it used for earthfill in the low lying areas of the city. Then, early in the 1950 decade, Union Carbide Corporation purchased large quantities of Penang tin slags. The earthfill dumps were redug and the slag cleaned for shipment to the United States.

Realizing the value of the slag, Eastern Smelting (name changed to « Datuk Keramat Smelting » in 1975) then adopted selective smelting practice in order to enhance the tantalum content in some of the slag. Stockpiling of the classified slags followed. In 1967, the Thaisarco smelter at Phuket, Thailand began operation and all of the tin concentrates produced in Thailand have since that time been smelted there. Since Thai tin concentrates contain in general more tantalum than Malaysian concentrates, the slag produced at Datuk Keramat Smelting is no longer of the same quality as before.

Incidence of Tantalum in Malaysian Tin Concentrates

A geological survey was made of Malaysia in 1966. Only two areas were found containing deposits with content high enough to be of commercial value as tantalites or columbites. These deposits, however, are too small to be economically exploited. One deposit is in Northern Malaysia and the other in the extreme south of the peninsula.

In general, the cassiterite deposits in Malaysia contain some tantalum and niobium. Those with the better tantalum content are on the western side of the main Malaysian mountain range, but there is no uniformity of content. The distribution is erratic and often occurs only in patches within the same location.

The cassiterite associated tantalum-niobium is mainly intercrystalline with the tin. Various experiments and trials have confirmed the intercrystalline nature and the physical differences in the crystals are so small that separation by mineral dressing techniques fails to produce any tantalite-columbite of commercial value.

As a result, the concentrates going to the smelter range from 0.05 % to 0.50 % tantalum. The tantalum to niobium ratio runs about 1 to 1.2.

Tin Slag Production

All of the Malaysian cassiterite is sold to the two smelters at Penang : Datuk Keramat Smelting, Bhd and Straits Trading Co. Ltd. Although Straits Trading smelts the tin as it comes without regard to tantalum content, Datuk Keramat segregates ores in relation to their tantalum content. Whenever possible, ores from the mines known to contain tantalum are smelted together in batches of 40 to 50 tons.

The primary slag produced from the actual tin smelting step are analyzed for tantalum. They are graded on the basis of content into high, medium, and low groups and stocked by grade. When the primary slags are re-smelted to win the remaining tin, they are batch smelted by grade. The

resultant secondary, or final, slag is obtained in the three grades with the high grade averaging about 3.5 % Ta_2O_5 , the medium grade 2.75 %, and the low grade well under 2 %. The final slags are stockpiled and sold by grade.

The tin slag production of Datuk Keramat Smelting during the last ten years has been :

Year	Tons of Slag	Average % Ta_2O_5	Ta_2O_5 Content * (1000 lb.)
1965	3,829	2.68	226.2
1966	3,542	2.68	209.3
1967	3,779	2.82	234.9
1968	2,753	2.50	151.7
1969	3,725	2.72	223.4
1970	2,910	2.70	173.2
1971	3,554	2.58	202.1
1972	3,542	2.64	206.1
1973	5,221	2.70	310.8
1974	2,276	2.80	140.5

* By calculation

For at least the next three years difficulties are foreseen. There is an acute shortage in Malaysia of tin bearing land. Current production methods of reworking previously mined areas and the high cost of gravel pump mining in combination mitigate toward lower production of tin concentrates and the associated tantalum bearing slag. Datuk Keramat forecasts 1975 production at 1,800 tons of slag averaging about 2.60 % Ta_2O_5 (103,200 lb. Ta_2O_5). It is believed that the production might be down further to about 1,600 per year in 1976 and 1977.

G.S.A. SALES OF TANTALITES AND COLUMBITES IN 1974

During 1974, the G.S.A. continued sales of tantalites and columbites to reduce the National Stockpile in accordance with the Office of Emergency Preparedness Stockpile Action 368 issued April 12, 1973. Sales during the year were as follows :

Date of Sale	Awarded to	Pounds Contained (Ta_2O_5)	Price Range (Per lb. Ta_2O_5)
Tantalites			
4 March	Philipp Bros.	122,101	\$ 10.878
24 April	Billiton Trading Philipp Bros. Assoc. Metals Wah Chang Fansteel	122,102	\$ 11.315 to \$ 12.355
17 June	Kennametal Samincorp. Philipp Bros. Norton Mallinckrodt	122,171	\$ 13.463 to \$ 14.513
22 Aug.	Samincorp Philipp Bros. Kawecki Berylco Hermann C. Starck	114,850	\$ 13.173 to \$ 15.407
Columbites			
17 Jan.	Samincorp Metallurg Norton Wah Chang	818,919	\$ 0.9678 to \$ 1.234
4 June	Kawecki Berylco Climax Moly. Kennametal Samincorp	1,087,306	\$ 1.4983 to \$ 5.56
5 July	Metallurg Fansteel Philipp Bros. Kawecki Berylco	989,552	\$ 1.5489 to \$ 2.00
23 Dec.	Metallurg Philipp Bros. Kawecki-Berylco	360,587	\$ 1.676

In November 1974 and January 1975, the G.S.A. solicited bids covering the remaining lots of tantalite and columbite available for disposal. On both occasions the prices were too low and no sale was made. The same lots were again offered for sale on August 11, 1975. Bids were accepted and sales resulted as follows:

Material	Awarded to	Pounds Contained	Price
Tantalite	Philipp Bros.	78,943 Ta ₂ O ₅	\$ 13.066
Columbite	Philipp Bros.	2,318 Ta ₂ O ₅	\$ 11.30 per lb. Ta ₂ O ₅

The tantalite was artificial concentrates produced from tin slags. Customarily such material sells at about \$ 1.00 per lb below current market price.

Remaining stated excess tantalites in the Strategic and Critical Material (SCM) Stockpile contain 2,733,346 lb. Ta₂O₅ and 2,503,771 lb. Cb₂O₅. There are no additional columbites. Re-evaluation of the excess and authorization by the U.S. Congress is required before the SCM tantalites can be sold.

MALLINCKRODT INC., A TANTALUM PROCESSOR

Mallinckrodt Inc. was founded in 1867 as G. Mallinckrodt & Co. In the mid-1950's the Company became interested in columbium and tantalum, developing a process for extraction from the complex euxenite ore from Idaho which contained uranium also. The tantalum/columbium oxides produced were sold under contract to the U.S. Government for the Strategic and Critical Material Stockpile beginning in 1956. The uranium concentrates were sold to the Atomic Energy Commission.

Upon conclusion of the government contracts in 1960, Mallinckrodt entered the commercial business of processing columbites and tantalites as the euxenite contained insufficient tantalum to be of commercial interest. Processing used the same technology developed for euxenite. The resultant products were potassium fluotantalate and refined columbium oxide. Shortly thereafter, the Company began processing tin slags, particularly those

from Nigeria, again using the euxenite process. Slag processing continued until 1973 at which time it was stopped.

Mallinckrodt, recognizing the needs of the market for increased quantities of tantalum which had to be obtained from the higher grade tantalites, developed its own solvent extraction technology. In 1964, the Company installed new equipment, i.e., mixer-settler boxes, ketone strippers, tanks, filters, etc. to run an efficient solvent extraction operation. A second extraction line was installed in 1966 along with greatly expanded calcining capacity for columbium oxide. Other capacity improvements have been installed in recent years as required.

Today, Mallinckrodt is a custom ore processor for Norton Co., Kennametal, Wah Chang, and other tantalum metal producing companies supplying potassium fluotantalate. Mallinckrodt also sells columbium oxide, tantalum oxide, and tantalum carbide to the trade.

TANTALITE INVENTORIES IN THE U.S.

The U.S. Bureau of Mines each year collects data and reports the year end inventories of tantalites, columbites and tin slags in the hands of dealers and processors in the United States. The data, in short tons, for the past three years follows:

Material	1972	1973	1974
Tantalite	1,120	745	1,079
Columbite	1,104	1,310	1,511
Tin Slag	33,775	34,691	33,695

The increase of tantalite inventory in 1974 was 334 short tons, about 225,000 lb. Ta₂O₅ at an assumed average content of 33 %. In view of sales during the year by G.S.A. of 480,000 lb. and the requirement that it must be processed in the U.S., it appears that imports during the year must have been 255,000 lb. less than the market demand.

The reported inventory of tin slag decreased by 996 tons in 1974 offsetting the 916 ton increase during 1973. Since there is no evidence of trade or use of low-grade Malaysian slags in the U.S., the indicated changes must have occurred in Thai slag and similar higher grade materials. If so, the 1974 reduction in inventory would have

been about 230,000 lb. Ta₂O₅. Thus the balance of trade in the U.S. during 1974, i.e., the shortfall of tantalite imports in relation to purchases, indicates a deficiency of supply as follows:

Inventory Changed	lb. Ta ₂ O ₅
Tantalite	225,000
G.S.A.	(480,000)
Tin slag	(230,000)
Total	(485,000)

PHILIPP BROTHERS A MERCHANT'S ROLE IN TANTALITE

At the very outset, a frequent misunderstanding in the Tantalite business should be corrected. Philipp Brothers are often referred to as "brokers". This is not correct. A broker's only function is to arrange a transaction between buyers and sellers for a "commission" - without taking responsibility for and without having ownership of the goods being sold. A

The tin slag inventory probably consists mostly of Malaysian slags imported prior to 1968 (the inventory level at the end of 1967 was 32,852 short tons) before the Thailand smelter began to provide the higher grade slags. Although there is some Thai slag in the reported inventories, the low grade portion probably contains at least 2,250,000 lb. Ta₂O₅ if the average content is assumed to be 3.5 %.

Columbite inventories increased during 1974 by 201 short tons. Since G.S.A. sales during the year were more than 10 times this amount and imports were small in comparison, the increase in inventory was probably all G.S.A. material. The sales were mostly high ratio material of the type used in ferro-alloy production. The inventory increase will not, as a result, contribute to the supply of tantalum.

The tantalite inventory of 1,079 short tons at the end of 1974 represents about a six month supply at the 1975 expected consumption rate. Since the traders and processors would hold at least a three month supply as a minimum working inventory, it might be assumed that an excess of 300,000 lb. to 350,000 lb. Ta₂O₅ is available for future needs.

NEW CAPACITOR POWDER

In September Fansteel Inc. announced the availability of a new tantalum capacitor powder, "Fanpress FDB 30". The new powder is produced from high-purity electron-beam melted material, ground to a specific size (in the micron range), and agglomerated to produce clusters of powder particles. The result is a high voltage, moderate capacitance, high reliability capacitor powder with a high crush strength at low density and with a capability of binderless pressing.

Capacitor manufacturers generally use Carbowax, Acrawax, Glyptol or other binders when pressing and sintering anodes. The FDB powder can be pressed without binder addition as the agglomerated particles tend to lock together. The resultant anode is porous, able to go to high working voltages with less leakage. Another advantage is that the powder can be recycled. High speed automatic pressing results in a proportion of powder not pressed into anodes because of intentional die overfill. Since the FDB powder does not lose its quality or characteristics, it can be fed a second or even third time. Fansteel reports that the FDB powder has received enthusiastic customer acceptance and expects it to be used in computers and military devices requiring 10,000 hour minimum operating life.

"merchant", however, is a principal; namely, the customer of the producer and the supplier of the consumer. The merchant takes responsibility, and will own or control the merchandise. Philipp Brothers are merchants.

Contrary to popular belief, a merchant does not speculate. While he does not

marry every purchase with every sale, he knows how much his customers will require and he buys accordingly, replacing inventory when sold with materials newly purchased. To do such, the tasks of the merchant in the Tantalite trade are several.

1. Foreign trade: The merchant arranges shipments from abroad in such a way that the foreign miner need only deliver the tantalite to the merchant at a point in the country of origin, inland or at port. The consumer need only take delivery of the tantalite at the port of entry or, at times, at his own plant. The arrangements for export, the ocean shipment and covering insurance, the arrangements for import, the exchange of currency from one country, to the other, etc. are all performed by the merchant. Thus services are provided for both the miner and the consumer which would not be convenient for either of them to provide for each tantalite transaction. The merchant, by generally handling a variety of commodities and consequent larger volume than either miners or consumers, can employ specialists to perform these service functions.

2. Market presence: A more important service rendered is the readiness of the merchant to purchase when the miner wants to sell and to sell when the consumer wants to buy. This continuous presence in the market often gives the merchant more information than the individual miner or consumer might have. It is evident that once a consumer is known to have purchased his needs for the year, few suppliers will be interested in talking to him then and there, while a miner who is known to be sold out will not hear from consumers for a while. The merchant who is always ready is likely to hear from both whenever there is interest in buying or selling.

3. Financing: Shipments from abroad must be financed since the miner certainly wants to be paid once his production leaves his shores. In many cases, however, the miner needs prepayment; in other words, advances against future production. Then the merchant must step in as consumers are not likely to be willing to finance production in advance.

4. Product Range: A consumer of tantalite is likely to want tantalum-bearing raw materials only and, in most instances, is not interested in the other products of the miner. As an example, a pegmatite miner might recover beryl, wolframite, or polucite in addition to tantalum. An ore merchant will purchase all of the materials produced by the miner. Thus the miner can achieve an integration of production and marketing, dealing with only one purchaser rather than a number and, on the other hand, the consumer need buy only the products he requires.

5. Collection: In several countries there are small producers who each mine only a few tons annually, quantities too small to be purchased directly but needed in aggregate by the consuming industry. The merchant collects these small lots by setting up stations which are usually no more than a small warehouse with one or two knowledgeable individuals who purchase from the small miners. On any given day, only a few pounds of a number of ores will be bought. These are accumulated and consolidated, possibly with

lots from other collection stations, into shipments of worthwhile quantity. Philipp Brothers has not only fixed warehouses but also has motorized collectors. For instance, it was generally known that the Phibro truck would stop at a specified corner in a certain Brazilian village on every Tuesday afternoon at three o'clock and at that time would buy whatever was offered. At other times, Phibro has opened stands in local markets and collected by buying small productions from miners so that they would have money to buy needed supplies.

Philipp Brothers is represented in 35 foreign countries throughout the free world. An office is also operated in Moscow, Phibros being one of only a few American companies permitted to have an office there. There are over 50 major offices plus the small collecting stations and one-man auxiliary units. Only a few of the many representatives are agents as practically all of the offices are affiliated with or owned directly by Phibro. With this broad coverage, it is evident that every tantalum raw material producing center is covered.

It is, of course, correct that what one man can do, another can do as well, and

certainly a consumer, if he wishes, can exercise all the functions of a merchant. If a consumer will perform all foreign trade tasks, including currency protection, purchasing whenever a miner wants to sell, financing abroad, buying (and reselling) unneeded commodities allied to tantalite, and, finally, establishing collecting stations, there is no need for the merchant. The consumer, however, who does all this successfully and achieves a continuous, smooth operation, will find that he has founded another Philipp Brothers.

GREENBUSHES TIN

Due to an error in transcribing information received, the production reported in the article "Greenbushes Mineral Field Australia" in the September 1975 issue of the "T.I.C. Bulletin" should be as follows:

Year	Production
1971	92,808 lb. Ta ₂ O ₃
1972	156,360 lb. Ta ₂ O ₃
1973	127,977 lb. Ta ₂ O ₃
1974	105,160 lb. Ta ₂ O ₃
1975	83,333 lb. Ta ₂ O ₃

T.I.C. MEMBERSHIP

The following list of T.I.C. member companies and their official delegates is republished to correct errors and changes in the list published in the Third Quarter:

DATUK KERAMAT SMELTING SENDIRIAN BERHAD

P. O. Box 280, Penang, Malaysia

Delegate: Nicholas Sinclair

Amalgamated Metal Corp. Ltd.

Leadenhall Avenue, London EC3V 1LD, England

MAKERI SMELTING COMPANY LIMITED

P. O. Box 653, Bukuru Road, JOS, Nigeria

Delegate: Nicholas Sinclair

Amalgamated Metal Corp. Ltd.

Leadenhall Avenue, London EC3V 1LD, England

SYMETAIN S.Z.A.R.L.

Kalima, Republique du Zaire

Delegate: Jean-Philippe Courtois

C/O Cometaux, 18, Square de Meeus, 1040 Bruxelles

TANTALUM MINING CORPORATION OF CANADA Ltd.

C/O National Resources Trading Inc.

576 Fifth Ave., New York, N. Y. 10036

Delegate: Herman Becker-Fluegel

THAILAND SMELTING AND REFINING Co., Ltd.

P. O. Box 2, Phuket, Thailand

Delegate: E. Muller, Director

C/O Billiton Handelsgesellschaft A.G.

P. O. Box 8, 6008 Lucerne, Switzerland