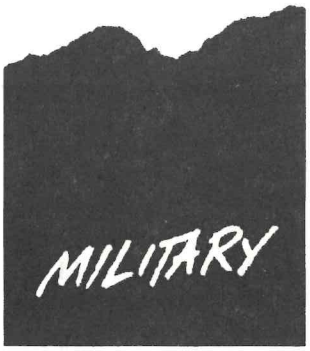


"Lockheed, for example, was using beryllium by the truckload to build Poseidon missiles ..."

Chart adopted from P Robbins, op cit.

Fat years for the beryllium monopoly

By the Raw Materials Group

Beryllium is one of the so called minor metals, ie small in value and volume in world trade compared to older major metals like iron and copper.
But rapid technological advances, especially in the electronics and space industries have made it increasingly important to the arms industry.
The Raw Materials Group has compiled some basic facts on this strategic metal.

"By and large the limited availability and high cost of utilization, as well as lack of knowledge about their properties, kept minor metals well out of the mainstream of economic and technological developments until World War II.

During the war years the environment for minor metals changed. Highly specialized requirements in modern aircraft, weaponry, and communications created a substantial market for minor metals. Indeed, they created the demand for properties that brought a number of minor metals into prominence. Older minor metals, such as bismuth and tungsten, were found useful in many new and quite different applications so that interest in them broadened. And a large number of metals, such as germanium and hafnium, that had been ignored or discarded in industrial wastes, were also found to possess properties with great advantages in modern applications. By the middle fifties minor metals were in the forefront of technologic development in the United States." [1]

Beryllium was initially discovered by the French chemist Vauquelin, who in 1798 managed to separate the oxide from aluminum. The German F. Wöhler and the Frenchman A. Bussy produced the first metallic beryllium as an impure powder in 1828. In France, Lebeau published information on production by electrolysis and on preparation of beryllium-copper alloys by direct reduction of beryllium oxide. In Germany, Osterheld published beryllium equilibrium diagrams with copper, aluminium, silver and iron in 1916. [2]

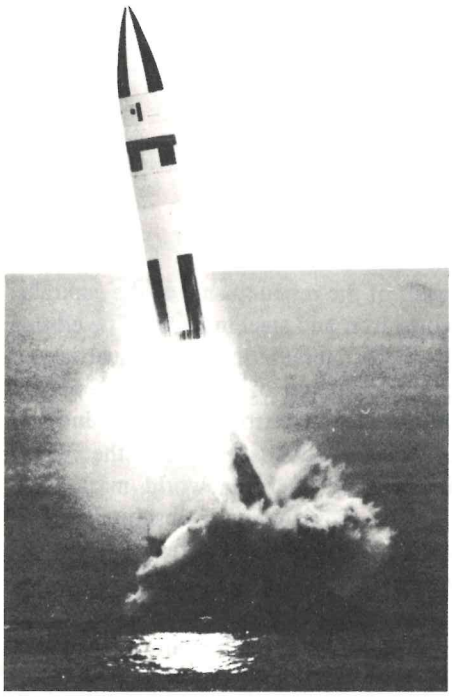
Monopoly control of production methods

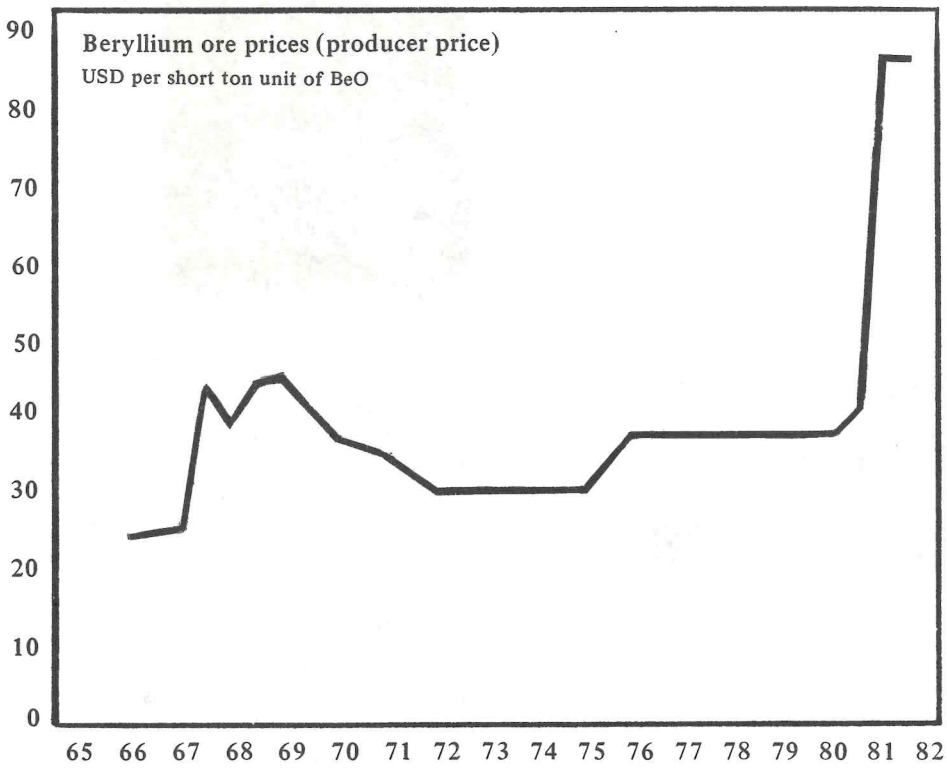
The technology for industrial production of beryllium in various metallic forms was originally developed in Germany. In the early 1920s a US company, Berylco, started production in the United States, on the basis of German patents. These patents were highly controlled, and a US Congressional Hearing in 1939 developed extensive evidence on the monopoly character of the beryllium industry. In the 1930s another US company, Brush Beryllium, was able to break into the field on the basis of a new and cheaper process, and it strengthened its position by developing products other than beryllium-copper. By the time that beryllium came to the attention of the Atomic Energy Commission (AEC) and the aerospace industry, the two established companies had the capacity to produce large amounts of alloy and the technical know-how to begin producing ductile beryllium metal. They had to expand, and they got ample government assistance for expansion, but it was clearly cheaper to graft this expansion onto Brush and Berylco than for the government to encourage the formation of new companies.[3]

Uses

Most beryllium is used in the form of beryllium-copper, a very important copper alloy used to make marine propellors, springs, aircraft engine components and electrical contacts. It is also used to make non-spark producing tools for use in coal mines and oil refineries, where there is a danger due to inflammable gases. There are minor applications for other beryllium alloys such as beryllium-nickel, and some pure beryllium is used, mainly in nuclear energy plants.[4]

Lighter than aluminum but stiffer than steel, beryllium is also a remarkable heat absorber that can withstand abrupt changes in temperature without warping or weakening. Small wonder that where fail-safe performance is required regardless of cost – as in rockets and military aircraft – industry has often turned to beryllium. Critical parts of the Columbia Space Shuttle, such as brake discs and windshield frames, are made of it.[5] (See also RMR Vol 1 No 1 on the MX missile)





Trade

Pure beryllium metal is rarely traded. Apart from being an extremely toxic metal, which makes handling very dangerous, it is only used commercially in the form of an alloy with other metals. It is therefore safer and easier to market beryllium in the form of a master alloy (an alloy with a high beryllium content compared with its content in the final form) which can then be diluted in the melt. The most common of these master alloys is beryllium-copper with a content of up to 5 per cent beryllium.[6,7] It's usually pressed into blocks the size of a large suitcase, but some users want it rolled into thin sheets as brittle as a china vase. All this processing takes huge amounts of energy and money.[8]

Market

Although beryllium ore is produced in many countries, the production of the metal in the capitalist world is effectively controlled by one US company, *Brush Wellman Inc*,[9] based in Cleveland, Ohio.

A well-known reference work on the metals markets describes the beryllium market in the following way:

> "The main producers have been successful in controlling prices and there is practically no free market outside this system."[10]

The chart on beryllium ore prices amply illustrates the market control of Brush Wellman.

The development of a monopoly

The strong military influence on the growth of Brush Wellman started, as we have seen, already in the 1930s when the US government intervened to develop an independent beryllium industry.

An article in *Fortune* has given illuminating facts of the developments since then:

> "In the late 1950s, when the US began responding to the Soviet challenge in space, beryllium generated the kind of excitement in Wall Street that genetic engineering does now. The stock of Brush Wellman (then known as Brush Beryllium) rose like a rocket to a price-earnings multiple of 70. But is subsequently plunged like a reentry vehicle as the big market for the metal failed to materialize. During the Vietnam war it shot up to a multiple of 30 before falling earthward again." "Lockheed, for example, was using pure beryllium by the truckload to build Poseidon missiles and parts for the C5A cargo plane.[11]

With the US defeat in Vietnam the military demand for metallic beryllium fell sharply. Brush Wellman met this challenge in two ways. Firstly by eliminating its only competitor in the production of metallic beryllium, Kawecki Berylco Inc; which stopped producing two years ago after it was aquired by Cabot Corp.

Secondly by developing new markets:

> "The biggest new market is in Silicon Valley. Because beryllium-copper alloy can withstand more heat than copper alone, it is increasingly used for the connectors that sprout from microelectronic chips. Since the chips themselves pack more and more functions and information for a given size, the connectors must hold up under a heavier stream of electrons that generate more heat."

These new products also have military applications and Fortune sums up: "With defence spending on the rise prospects have improved for Brush Wellman."

Notes:

1 Quoted from David B Brooks: *Supply and Competition in Minor Metals*, Resources for the Future, Washington 1965.

2 *Beryllium* in Mineral Facts and Problems, Washington 1975.

3 *Minor Metals*, p 80-81.

4 Peter Robbins: *Guide to Non-Ferrous Metals and their Markets*, Kogan Page, London 1982.

5 *Fortune* 1981-06-15.

6 P Robbins, p 58-59.

7 Mineral Facts and Problems.

8 *Fortune*, p 148.

9 *Industrial Minerals*, January 1982.

10 Robbins op cit.

11 *Fortune*, ibid. ■