

Laval University

From the Selected Works of Fathi Habashi

May, 2018

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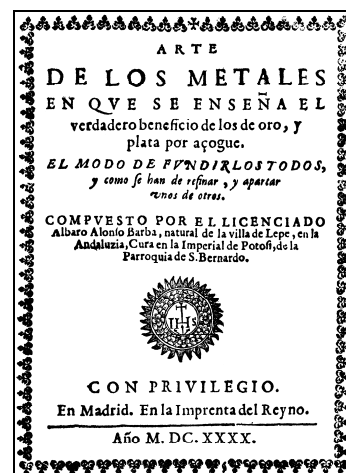
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Alvaro Alonso Barba (1569-1662) was born in Villa de Lepe, Province of Huelva, in Spain. In 1585, at the age of sixteen, he went to the Spanish Colony of Real Audiencia de Charcas, which comprised most of the present-day Bolivia. There he spent more than seventy years of his life as a priest. He visited different mines in the colonies and was particularly attracted by the Rich Hill of Potosí in Charcas known as Cerro Rico. The silver ore extracted from the mines in Potosi was refined by smelting in native furnaces. As the quality of the ore deteriorated, making smelting more difficult, it became necessary to introduce a different method.

The amalgamation of silver ores was mentioned by Vanoccio Biringuccio in his book, *De la Pirotechnia*, published in 1540. This process was applied by Bartholomeo de Medina in Pachuca in Mexico on a large scale in 1566. The ores were pulverised by grinding mills worked by horses or mules termed *arrastra*. The crushed ore in the form of mud is then transferred to the amalgamation yard, called *patio* where the amalgamation with mercury in vats were located. The material is then washed in large tubs filled with water to remove the fine ore particles, leaving behind the amalgam. Mercury was transported from Spain till the mercury mines in Huancavelica were discovered in Peru in 1564.

In 1572, the Viceroy Francisco de Toledo introduced this amalgamation in Bolivia but used hydraulic force to power the ore-crushing hammers as used in Saxony instead of the *arrastra*.

Barba later introduced the “Hot Amalgamation” process instead of the Patio process. In the new process the silver ore was slurried with water and heated with mercury in rotating barrels to accelerate the extraction of silver. He described his process in his book *Arte de los Metales* published in Madrid in 1640. The translation of the full title of the book would be “The Art of Metals in which is Taught the True Beneficiation of Gold and Silver with Mercury, the Mode of Smelting Them and How They are to be Refined and Separated One from Another”. The book is composed of five chapters devoted exclusively to ores, amalgamation, smelting, refining and parting of metals.



Book on amalgamation by Barba

The book attracted great attention at that time because silver in Europe was recovered mainly by smelting argentiferous lead and copper ores which was an expensive operation

requiring a large amount of fuel. Barba's process hot amalgamation seemed to be much cheaper because it consumed less fuel. Silver in Europe was an important commodity because it was used for coinage. This work was translated into English (1670, 1674, 1738, 1739, 1740), into German (1670, 1676) and into French (1730, 1751). A reprint of the latest English edition was published by John Wiley in New York in 1923. In 1657, Barba returned to Spain, where he died three years later at the age of 93.

Suggested Readings

F. Habashi, *Readings in Historical Metallurgy*, Volume 1. "Changing Technology in Extractive Metallurgy", Métallurgie Extractive Québec, Québec City, Canada 2006. Distributed by Laval University Bookstore "Zone", www.zone.ul.ca