They must also have supplied Egypt with tin, because this old civilization possessed neither mining industry nor commerce. The metals which Egypt absorbed were, from the most remote times, furnished by Asiatic merchants, and it was only during the earlier centuries after the Christian era that the Egyptians began to navigate through the Red Sea—direct relations with the Indies. The early Christian centuries were contemporaneous with the prosperity of the Ethiopian Empire, and trade relations were therefore commenced and continued through the intermediation of this people. The Arabs interested themselves in the tin trade subsequently. The Abyssinians used the Hindu word *Arak*, whilst the Arabs used the Mediterranean term *Kestar*. After the conquest of Spain by the Romans, the Phœnicians lost the tin trade.

Concurrently with Spain, one of the principal producers of tin was England: Cæsar speaks of the "white-lead" that was imported from England and Diodorus recounts that the Britons found the ore in the stones. The smelted metal was transported in bars by way of Nectis (the Isle of Wight) across Gaul, on the backs of horses, to Rome. Marseilles became the Roman emporium and rapidly grew to the same importance that Cadiz enjoyed the Phœnicians. The metal was almost exclusively consumed in plating copper for the manufacture of vases, casks, etc., and occasionally for minting. The alloys of tin and copper were used to cast statues, to make weapons, mirrors and coins. There seems every reason to believe that anciently alloys were not obtained by the mixture of the metals them lves, but by the simultaneous metallurgical treatment of the two minerals. They probably smelted copper pyrites with stamped tin ore, just as they produced zinc bronze by smelting calamine with tin ore.

As a proof that the tin of Spain was, during the dawn of the Christian era, dominated by that of Cornwall, it may be recorded, that instead of the Latin term *plumbum album*, the gaelic word *Istean*, or *Stean* in Cornish, became prevalent. The names zinn, tin, etain, are of similar derivation.

Marseilles became a flourishing commercial town and even added a new branch of industry—that of casting bells. The ancient Hindu custom of using bells soon extended to Byzantium, and in the tenth century had already reached Italy, where it was applied to the services of the Christian religion. Later on, the use of bells increased more and more, until villages, as well as convents, took a pride in possessing the largest. (The first large church bell was founded in the Campagne hence the Latin word *campana*.)

The great increase of this industry favors the supposition that the production of, and commerce in tin, received a remarkable impulse during the middle ages. Gradually Marseilles was dispossessed of the tin trade by other commercial emporiums. Cologne had already business relations with England at the time of William the Conqueror, and during the twelfth and thirteenth centuries Bruges acquired the control of the eastern European markets, and consequently of the trade in tin.

At the beginning of the middle ages it would appear that Devonshire may have furnished the greatest amount of tin, from the rich stream-works existing there. About 1200 A.D. the production of the Cornish workings was still inferior to that of its sister county, but in the centuries immediately succeeding, the production of the mines of Cornwall surpassed that of the stream-works of Devonshire; the former county has preserved its supremacy to the present day, whilst the stream-works of the latter have become successively exhausted and now give to commerce but insignificant quantities.

Towards 1300 A.D. the miners and smelters of Cornwall ceded to the lord of the soil as royalty, about 40 % of the raw produce, in 1480 they yielded up 20 % to the lord and 20 % to the occupier of the land, in 1750 6⅔ to the lord and 11 % to the occupier whilst in 1830 the royalty diminished to 4½⅔ to the lord and 6 % to the surface proprietor.

During the latter part of the middle ages, the tin pigs were exported to Bruges, to which place the Italian and German dealers came to purchase them. The ordinary route by which the tin was exported, was by land towards Italy, but from the beginning of the fourteenth century, half the bulk was transported by sea in Italian bottoms, which then supplied the coasts of the Mediterranean and particularly the East (*Constantinople, Alexandria, etc.*)

It was about this time that tin, produced from the mines of Granpen in Bohemia, began to appear in the Continental markets, and it may be conceded that English tin was, to a very considerable extent, replaced throughout Germany by its youthful rival. The mines of Granpen have been known since the twelfth century, and during the thirteenth, Schonfield, another mining district in Bohemia, also produced much tin, and it is probable that Cologne—which at that epoch was possessed of the Boheman trade—threw a large aggregate of tin from these mines on the market. The mines of Granpen and Schonfield produced abundantly during the whole of the fourteenth century, and the tin not exported in bars to Germany was consumed in the country itself. At the Teinhof works in Prague they employed experienced smelters from Venice and Lombardy. The principal objects manufactured were table services, and untensils for religious ceremonies. Towards the conclusion of the middle ages, the production of tin must have considerably augmented, on account of the general practice of making bronze cannons, and because the use of tin for table services was common amongst the people of Italy and Germany.

During the first half of the sixteenth century so much capital was engaged in the opening of numerous mines in Bohemia, that the production of tin was soon much increased. The Attenberg mines were working during the latter half of the sixteenth century, and during the first ten years its washings returned 500 to 750 tons of tin annually. The ancient mines of Granpen, Schonfield, Schlackenwald, Ehrenfriedersdorf, and Geyer, have been re-worked several times, and new washings installed at Eibenstock, Platten, Gottesgab, Abertam, Hengstererben, &c. Very soon afterwards, mines were also opened in various places in these districts. About 1546 A.D. twelve dressing floors were put up at Platten for the treatment of the tin ores, and at the same period the districts of Attenberg and Ehrenfriedersdorf in Saxony were conspicuous as tin producers.

The mineralized rock, or tinstone, was everywhere extracted in Bohemia and Saxony by the aid of wedges and by fire. Towards the termination of the fifteenth century the ores were still crushed in mortars and hand-mills, and the resulting pulp washed on frames. Stamps did not appear until the earliest years of the sixteenth century; the concentration was made on sleeping tables and in slime pits; the slimes were roasted and the impure tin was subjected to liquation.

In the sixteenth century the Italians invented new ways for the application of tin, viz:—tin leaf was employed to coat mirrors, and to glaze majolica and cooking utensils, and to enamel iron. Then, very soon, tin became indispensable to the dye-houses, on account of the discovery of the valuable properties of its salts as a mordant. Libavius first made tin chloride, but it was Dribble who first discovered, by accident, its value for fixing dyes, and the use of this important mordant speedily extended to Germany, England and France.

The early years of the seventeenth century are of great importance in the history of tin. In Bohemia and Saxony, the mining districts of Schlackenwald, Platen, and Altenberg, produced tin abundantly until the outbreak of the thirty years war, which caused the suspension of all the mines for at least fifty years. At the same epoch the miners in Cornwall worked only four hours a day, and broke all the ore by use of the wedge. In Bohemia and Saxony the science of mining was more advanced, and some German workmen who were invited to England, much improved the method of draining the mines, breaking the ores, and smelting them. Becher instructed the Cornish smelters how to reduce the tin ore in reverberatory furnaces with charcoal, and the improvements made had a sensible influence on the English production. During the thirty years war the English tin industry gained what that of Germany lost. The Indies and China continued to produce and to absorb immense quantities of tin. The Dutch, who in the seventeenth century repulsed the Spaniards and Portuguese from the East Indies, seized on a portion of the tin trade. Despite the great increase in the production of English tin, it must be admitted, that even early in the seventeenth century, the aggregate production of the civilized countries of Asia exceeded ten times that of Europe. During the eighteenth century the returns of tin from Bohemia and Saxony were much increased, and the trade continued in a flourishing condition, but modern times have seen the closing of nearly all the tin mines in the centre of Europe.

Towards the middle of the present century the system of contract (tutwork and tribute) was generally adopted.

The Newcomen steam engine replaced the horse engines and water wheels for the drainage of the mines, but between 1770 and 1780, these engines gave place to those of Watt. At the end of the eighteenth century, Cornwall sold more than 3000 tons of tin annually. In 1828 stamps were first used in that county. Near 1800 A.D. Siam and Malacca produced about 1500 tons yearly, and Junk, in Ceylon added 200 to 500 annually. From 1820 to 1860, Malacca sold about 2000 tons, but from 1860 to 1870 the production was much increased

The first man-engine was laid down in Cornwall in 1842, and in the same year round huddles came into use. In 1840 the tin ore was relieved of its impurities, and the produce raised, by treating it with hydrochloric acid.

Beginning from the end of the last century, the proportion of copper ore in the Cornish mines, increased with the depth, but from 1850, on the contrary, the percentage of tin ore has again increased. The production of tin since then has been about 8000 tons yearly. Between 1850 and 1860 trommels were introduced in the Schlackenwald district, for the classifying of the "roughs," and the slimes were roasted with salt. In England they followed the same method in certain mines. In 1858 tungstenic ores were first treated by Dr. Oxland (at Drakewalls mine) with soda, and the wolfram transformed into tungstate of soda, was sold as a by-product. This salt is employed in dyeing, and for the impregnation of substances to be made fireproof.

Banca produced, during the last century, more than 3000 tons of tin, but during the early decades of the present, this decreased by one-half. In 1850 it attained its maximum output—5000 tons yearly. After 1860 the production fell to 1000 tons, but this amount increased to about 4000 tons after 1870. Between 1850 and 1880, Peru, Chili, Bolivia and Java, have each exported from 50 to 200 tons of tin annually to England. In the United States, tin ore has been found in many localities, but up to now rarely in workable quantity. Since 1853 tin has been produced in Victoria and New South Wales, and in Tasmania since 1872. Important improvements in the preparation of the ores have been lately introduced in Australia. Long droughts compel the mines to establish numerous reservoirs, and to employ with the utmost economy the storage water. The European workmen have been pushed aside by the heathen Chinee to such an extent, that the government, to place a limit on the Chinese immigration, has established a heavy poll-tax The production in Australia, between 1874 and 1877, was from 10,000 to 15,000 tons annually.

The uses of tin have considerably multiplied and grown during the past 200 years. From 1700 A.D. tin has been widely applied in Bohemia and Saxony to the plating of iron Agricola was aware of the method of coating iron with tin, though, in his time, little use was made of the knowledge. Plating was introduced into England in 1670, and afterwards into France. But both before and after the invention of plating, numerous articles of commerce were manufactured exclusively from tin, and this branch of the trade was developed in an extraordinary manner during the eighteenth century in Germany, France and England. Salmon describes, in his splendid volume on tin smelting, the methods of working and the objects manufactured, and in his woodcuts, we find table services, knives and fork, jugs, candelabra, lamps, chemical and surgical instruments, boilers, etc., in the most varied forms. There existed in England in the last, and even in the present, century, a crowd of miserable little tin work shops, many of a very inferior class, which were occupied in the making of tin ware, and in the plating of copper and iron goods. It is only during the last three or four decades that the spirit of enterprise influenced capitalists to embark in this kind of industry. Between 1840 and 1850 A.D. Griffith perfected the manufacture of tinned utensils in one piece, and this branch of the trade was especially developed in France, between 1850 and 1860 A.D. Instead of compression by a blow, which caused much waste, a slow continuous pressure was applied Since then, pressed articles in plated iron have overcome all competition, as they unite the strength and cheapness of iron with the valuable properties of tin. The United States sustained the competition successfully by contriving in 1866, a method of manufacturing impermeable boxes from a single piece without soldering. England has, for a long time, produced large quantities of tin plates, and two-thirds of its colossal production have been exported, most of which between 1850 and 1860 found a market in the United States.

An interesting detail in the history of tin is the recovery of that metal from the waste. In the workshops using tin plates and notably in those making cans and buttons, six per cent. of loss occurs. Many attempts, more or less successful, have been made to recover this loss. Schmuck in 1848 patented various methods. In 1854, Higgins obtained a patent for the following way: solution in hydrochloric acid (with a little saltpetre) and precipitation by means of lime. Phillip's process for purifying the tin of Peru was employed later to extract tin from tin plate cuttings, viz:—the impure metal was granulated, and dissolved in hydrochloric acid, then, provided the tin was in excess, the wolfram, antimony, and arsenic, up to five or ten per cent. would not be attacked; the tin was deposited on zinc plates, and the zinc thus placed in solution was precipitated in the form of white zinc, by the addition of milk of lime. Jacobson used soda lye, and Parks concentrated sulphuric acid, to put the tin in solution, and the salt obtained was in each case employed in dyeing. Kunzel boiled the tin plate clippings in water acidulated by nitric acid; the tin was then thrown down by zinc, dissolved in hydrochloric acid, and the resulting salt was sold as a mordant; he treated in this manner, during 1869, over 400 tons of waste obtained from the manufacturers of canned preserves at Nantes and Paris. This method is somewhat varied by substituting for liquid hydrochloric acid the same acid in a gaseous state.

Tin is used for the preparation of phosphor bronze In the fusion of that alloy, the absorption of oxygen is very prejudical to its quality, the formation of oxidulated tin rendering the alloy brittle. Formerly they endeavored to hinder oxidation by stirring the mass with wood, or by adding a little zinc, but for the last dozen years this object has been much more efficaciously attained by the addition of a little phosphorus: this augments in a remarkable degree, the compactness, resistance and elasticity of the product, besides giving it a beautiful golden color. Cannons, statues, ornaments, bearings, etc., are cast in phosphor bronze with the greatest success, and the sale is day by day increasing.

If we combine the information relative to the production of tin, we obtain the following resume (1881):

Australia	10,000—15,000
England	10,000
Straits, Malacca, etc	10,000
Banaca and Billiton	7,000—9,000
Tasmania	3,000—5,000
China	5,000

or for the whole world, say, from 40,000 to 50,000 tons annually.

The largest consumers of tin are China, the East, United States, England and France. The most important use in Asia is for plating copper, whilst in Europe and America, tin is almost solely employed in the tin-plate trade; the manufacture of bronze and white metal, absorbing in comparison, only feeble quantities.

Testing Station for Explosives at the Produits Collieries, Flenu, Belgium.*

The object of this testing station—due to the manager and underground manager of the Produits Colliery, and to the managing director of the Clermont Powder Mills

*From *Explosifs de Surete*, by A. Macquet, director of the Hainault School of Mines.