THE MALAYAN TIN INDUSTRY TO 1914
with special reference to the states of Perak, Selangor, Negri Sembilan And Pahang.

by
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CHAPTER I.

THE MALAYAN TIN INDUSTRY TO 1874

1. The Tin Fields of Malaya

Malaya occupies the whole of the Malay Peninsula south of 6° 44′ north latitude. In its southward course down the Peninsula, the main mountain range of the country forms the natural boundary between the States of Perak and Kelantan, Perak and Pahang, and, finally, Selangor and Pahang, before it passes through Negri Sembilan to disappear in Malacca. Running almost parallel to the Main Range are lesser ranges of mountains. There is one range of mountains on the western border of Perlis. Another, the Bintang Range, runs along the eastern border of Kedah and continues into Perak. Between this and the Main Range is the Kledang Range, which stretches along the eastern side of the Perak River. East of the Main Range run the Benom Range, then the Tahan Range, and, finally, the last well-marked mountain range which forms the western border of Trengganu and extends into the Kuantan District of Pahang. These ranges give rise to numerous streams, which rush rapidly down the mountain sides to unite into rivers in the valley plains, where the rivers begin to wind slowly towards the sea. Owing to the dense vegetation which originally covered every part of the country, the rivers were, and in some places still are, the principal means of communication.

The mountain ranges are formed from granite, quartzite, or both. The principal ranges formed from granite are the Bintang Range, the Kledang Range, the Main Range, the Benom Range, and, lastly, the range nearest the east coast. The fact that these ranges are formed from granite is of especial importance, for Malaya's most valuable mineral asset, tin ore, owes its origin to the granite. The only tin ore of economic importance is cassiterite, or tin dioxide. It may occur as veins or lodes in the granite and, sometimes, in older rocks near the margin of the granite, or in the form of deposits either in alluvium or eluvium. Ores impregnated in the rocks are known as lode deposits, whereas those found in the alluvium or eluvium are called detrital deposits. The origin of these detrital deposits is easy to explain. The stanniferous rocks have been weathered, and the disintegrated tin lodes, along with the other weathering products are transported and redeposited by rivers in the valley plains. During
the course of their journey, the tin ores, on account of their high specific
gravity, settle from the bed load where the rivers lose gradient upon entering
the piedmont plains and thus undergo a natural concentration, usually not very
far from their original occurrence. In any sequence of sedimentation, the
heavy cassiterite grains are deposited first and are, therefore, found at the bot-
tom. Over them, lighter sediments accumulate to form the so-called unpro-
ductive overburden.

A simplified cross section of a Malayan tin field will show a bedrock in
many cases composed of limestone, topped by a layer of rich stanniferous
gravel or sand on which lies the overburden. The coarser grains of ore will lie
at the higher levels while the finer particles are to be found farther away in the
plains. The cross section will also show that the overburden is thicker in the
plains than near the hills, and that the ground water table will be nearer the
surface in the plains than in the higher areas. Often one or more layers of
payable stanniferous gravel occur higher up in the overburden, but the richest
layer always lies just above the bedrock. Payable tin-bearing earth is known
variously as pay-dirt, pay-gravel, tin-dirt or wash-dirt, but the richest stan-
niferous layer above the bedrock is designated karang by the Malays. The
surface of limestone bedrock is very irregular as a result of karst weather-
ing, the formation of lapiés and pinnacles. Usually the richest concentrations
of cassiterite are found in pockets in the limestone surface. This causes diffi-
culties in mining and in estimating by boring the richness of the pay-dirt.1

The alluvial tin deposits of Malaya occur mainly in a zone parallel to the
Main Range and on its western side. This zone begins in Kedah in the north
and stretches southward through the Taiping and Kinta Valleys, and then
across the Bidor fields in the centre of Perak, and farther south again through
Ulu Selangor, Kuala Lumpur, and western Negri Sembilan, terminating near
Port Dickson in Negri Sembilan and Kuala Linggi on the Malacca coast.
In these western tin fields some ores occur in lodes or veins, but the alluvial
deposits are still, as in the past, the most important sources of the mineral.
To the east of these tin areas, on the Main Range itself, and on its eastern and
western flanks, the ores begin to occur more and more in the form of lodes and
eluvial deposits. On the eastern side of the Main Range, the tin deposits spread
roughly from Kelantan in the north through western Pahang, particularly in
the vicinity of Bentong, and thence in a southeasterly direction to eastern
Negri Sembilan and Malacca. These deposits have been comparatively neg-
lected. Farther eastward from the Main Range, and closer to the sea, there
is the last range of granitic rocks which runs through Trengganu into Pahang.
It is among these rocks that valuable veins of tin ores are to be found, giving
rise in Pahang to the rich lode mines of Malaya.2

2. The Demand for Tin

Until tin became an important industrial raw material in the west, the tin trade of the Malay Archipelago was limited in scope. Nevertheless, it was a valuable trade. Attempts to monopolize the export trade were made, with varying success, first by the Portuguese after their capture of Malacca in 1511, and then by the Dutch who ousted the Portuguese from this port in 1641. Until the discovery of tin in Banka in 1711, Malaya was the main source of the metal in the Malay Archipelago. In the course of the 17th and 18th centuries, the Dutch tried to control by treaties with the local chiefs the exports of tin from Kedah, Junk Ceylon, Perak, Selangor, and Sungei Ujong. In 1755, the Dutch extended their control of the tin trade to Banka in order to retain their monopoly of the commodity.

After the discovery of the Cape route to India, there was always the possibility that tin from the Malay Archipelago would be introduced into the European market, which was almost wholly supplied by the Cornish tin mines. As early as 1513, the Portuguese had imported into Europe some tin from the East. In the 18th century, the Dutch began to ship regularly to Holland small quantities of Banka tin as ballast rather than as commercial cargoes because the European tin market was limited in scope and was almost completely dominated by Cornish tin. During the thirty years from 1760 to 1789, the Dutch did not import more than 18% of the total production of the Banka mines for the whole period. The average annual imports were about 256 tons. In only one year, 1787, did the amount exceed 500 tons, and a large portion of it was dumped in the British market, depressing the price of Cornish tin to the extent of making the Cornish tin producers fear for a while competition from Banka tin. But for at least another half century, Cornish dominance in the European tin market remained secure because it was unprofitable to import Banka tin all the way from the East. The lucrative part of the Banka tin trade was in the East. There was indeed a possibility that Cornish tin might be sold in the East, if the price of the metal was sufficiently high. At least on five occasions before 1789, Cornish tin had been shipped to China, but on not a single occasion had the speculation been paying. In this year, the East India Company made the first successful shipment of Cornish tin to China, which, until then, had been the preserve of tin produced in the Malay Archipelago.

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7Unwin, G., Letters, Remarks, etc., with a View to Open Extensive Trade in the Article of Tin from the County of Cornwall to India, Persia and China, London, 1790, pp. 6, 27; Carne, op. cit., JRSS, II, 1839, pp. 262-3; Flower, A History of the Trade in Tin, pp. 20-1.
In the 1780's the shortage of tin in China had caused prices to become inflated, ranging from £84 10s per ton to £105 per ton. But at this time, the Cornish tin industry was suffering from depression. In 1789, George Unwin, a purser in the East India Company's service, pointed out that the export of Cornish tin to China might alleviate the depression and also help to adjust the adverse balance of British trade with that country. The outcome was that the Cornish miners entered into an agreement with the East India Company in 1789, whereby they supplied the Company with tin at low prices, making up their loss by the high prices of the metal at home, created by an artificial shortage of the commodity. This arrangement was so successful that in 1813, the artificially inflated prices in the British metal market made it worthwhile to repurchase Cornish tin in the East, and bring it back for sale in Britain. Consequently, in 1817 the arrangement with the East India Company was terminated. Cornish tin hardly appeared in the East again.

Despite fluctuations, the course of tin prices in Britain had shown an upward trend since 1790. In 1814 the average price of the metal stood at a peak of £176 per ton, a record value never to be exceeded again until 1906, when the price of English block tin in the London metal market averaged £181 4s. per ton. The reason for this was that the artificial shortage of tin created by withdrawing the metal from the British market for exportation to China was not accompanied by any substantial increase in the yield from the Cornish mines. In the first decade of the 19th century, the output of tin actually began to decline, with an average annual yield of 2,614 tons, or about 17% less than the average output for the decade 1790 to 1800. In 1810, the output dropped to 2,006 tons, the lowest recorded yield since 1750. The decline in output was caused partly by the exhaustion of the deposits in the more shallow stream and lode mines, and partly by the limitations of the existing mining machinery in coping with the increasing depth of the tin mines. But, in the meantime, the demand for tin had been growing. The quantity of tin consumed each year in the decade 1801 to 1810 averaged about one and a half times as much as the yearly consumption during the previous ten years. The increased demand for the metal was chiefly the result of the expansion of the British tin plate industry.

In the early part of the 19th century, the chief industrial use of tin was in the manufacture of alloys, of which pewter, plumber's solder, and bronze...
were the most important. The term “pewter” included several alloys of which tin formed a constituent part. The chief use of pewter was for the manufacture of a wide range of household utensils and wine measures. Bronze, an alloy of tin and copper, was for casting statues, bells, and pieces of artillery. Plumber’s solder was compounded of tin and lead, and the proportion of both metals varied with the purpose for which the solder was intended. Tin was alloyed with antimony to form a hard white alloy for the manufacture of the specula in telescopes and for the production of rolled plates on which music was engraved for ornamental purposes. Tin was also employed in the preparation of scarlet and purple dyes for colouring British textiles. Another important use of the metal was for the tinning of finished iron wares by a new but cheaper process of first fabricating them in cast iron and then dipping them in melted tin. Articles so tinned included pots, sauce pans, bridle bits, stirrups, and mails.\textsuperscript{14} However, the more important use of tin was in the tin plate industry, which, by 1805, was absorbing between one-third and one-half of the total annual consumption of tin in Britain.

A tin plate is nothing more than a sheet of steel or iron coated with tin so as to prevent the steel or iron from rusting. From very early times, iron and copper wares were given a coating of tin for a similar purpose. These articles were first finished and then immersed in a bath of molten tin to receive the protective covering. In the case of tin-plate wares, the articles were fashioned from raw material which had already been tinned.

The manufacture of tin plates was not feasible until the technical difficulties of making thin iron sheets economically had been solved. This discovery was probably first made in the fourteenth century at Wunsiedel in Bavaria, where the use of the tilt hammer led to the growth of a tin-plate industry. From there the technique of manufacture spread slowly, first to Nürnberg and the Amberg region of the Upper Palatinate, where tin plates were already being manufactured by the end of the fifteenth century, and then to Saxony during the early sixteenth century. In the course of this century, a rival industry was set up in Bohemia, but Saxony and the Upper Palatinate retained an effective monopoly of the manufacture of tin plates until the early seventeenth century.

But the loss of their supplies as the result of the Thirty Years’ War provided the impetus for Britain, then France, and, finally, the Spanish Netherlands and Sweden to establish their own tin-plate manufactories. Apart from the British efforts, all the other attempts were failures. By 1750, the British industry had driven out its continental rivals in the home market, and by 1784 it was a formidable competitor in the international market. Thereafter, it began to overshadow its German rivals.\textsuperscript{15} In 1800, there were nine tin-plate

\textsuperscript{13}See Minchinton, W. E., The British Tinplate Industry, Oxford, 1957, for the latest history of the growth of the British tinplate industry.

\textsuperscript{14}Parkes, Samuel, A Descriptive Account of the Several Processes which are usually Pursued in the Manufacture of the Article Known in Commerce by the Name of Tin-plate, (Manchester?), 1818, pp. 3-6; Encyclopaedia Britannica, 6th Edition, Edinburgh, 1823, XVI, p. 244; Encyclopaedia Britannica, 9th Edition, Edinburgh, 1875-89, XXIII, p. 401.
works in Britain, only five more than in 1750. But in the course of the nineteenth century, the tin-plate industry began to expand more rapidly, the rate of expansion being particularly marked after 1860, as may be inferred from Table I below.16

1 Number of Tin Plate Works and Output of Tin Plates in Great Britain, 1825-1875

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of works</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1825</td>
<td>16</td>
<td>Not available</td>
</tr>
<tr>
<td>1850</td>
<td>34</td>
<td>748,000 boxes</td>
</tr>
<tr>
<td>1860</td>
<td>40</td>
<td>1,550,000 boxes</td>
</tr>
<tr>
<td>1865</td>
<td>47</td>
<td>1,755,000 boxes</td>
</tr>
<tr>
<td>1870</td>
<td>59</td>
<td>2,700,000 boxes</td>
</tr>
<tr>
<td>1875</td>
<td>75</td>
<td>3,500,000 boxes</td>
</tr>
</tbody>
</table>

By 1875, the British tin-plate industry had become the largest in the world, supplying practically all its requirements. British supremacy rested ultimately on two factors: one was the continual improvements in technology, especially the replacement of the tilt hammer by the rolling mill, which resulted in significant economies in production costs; the other was the tariff protection given to the industry since 1664. In 1875, the commercial production of tin plates with Siemen's open-hearth steel in place of plates made from charcoal iron brought about great improvements in the quality of the finished products, as well as further significant reduction in the cost of manufacture. Tin plates could now be sold cheaper in the markets, and in consequence stimulated the discovery of new uses for them.17 The most important uses for tin plates were for the production of cans for preserving food, and barrels for storing and transporting oil. About the second decade of the 19th century, the needs of feeding the army and navy in protracted wars at distant fronts stimulated the development of the technique of preserving food in tin cans in Britain and France. Before the end of the Napoleonic Wars, the British army and navy were already using tinned food, giving rise to a new market for tin plates. But it was not until about 1860 that the canning industry became the dominant factor in stimulating the expansion of the tin-plate industry, partly because the public was for a long time prejudiced against tinned food, and partly because the surplus in food production, so necessary for the establishment of large scale canning, did not exist. By the middle of the 19th century, the economic development of several countries had led to the existence of food surpluses, which encouraged the growth of large scale canning industries in these places.

16The figures for the number of tinplate works are from Flower, A History of the Trade in Tin, p. 209; the figures for the output of tinplates are from Brooke, E. C., Chronology of the Tinplate Works of Great Britain, Cardiff, 1944, pp. 1-2.