



# Tin Mining in Malaysia- Is There any Revival?

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## INTRODUCTION

There were two main factors that had contributed to the rapid development of the Malayan tin industry in the mid-19th Century. One was the discovery of rich tin fields in Perak and Selangor. The other was a high demand for tin because of the development of tin canning. By the end of the 19th Century, Malaya was already the world's largest tin producer.

Today, Malaysia only produces less than 1.5% of total world production (refer to Table 1). Once the brightest star of the Malaysian economy, tin mining is now considered a sunset industry. What went wrong?

The main reason is because of the total collapse of the world tin industry in October 1985 when the price of tin fell by more than 50%. The other factor is there has been no new discovery of tin fields. Previously, most of the tin mining land was owned by the government. Furthermore,

Table 1: Tin production of Malaysia and tin price

Year	Production (tonnes)	Average Price (RMS/kg)
1970	73,795	10.99
1975	64,364	15.94
1980	61,404	35.72
1985	36,884	29.67
1986	29,134	15.39
1989	32,034	23.09
1990	28,468	16.45
1991	20,710	15.05
1994	6,458	14.14
2000	6,307	20.45
2001	4,972	16.80*
2002	4,215	15.44*
2003	3,358	18.58*
2004	2,746	32.20*

\*Tin prices from 2001 are quoted in US\$ per tonne. The figures are converted to RM (taking US\$1=RM3.80)  
(Sources: Malaysian Tin Bulletin and MSC Bhd)



Figure 1: A gravel pump tin mine in Chendriang, Perak in 1989

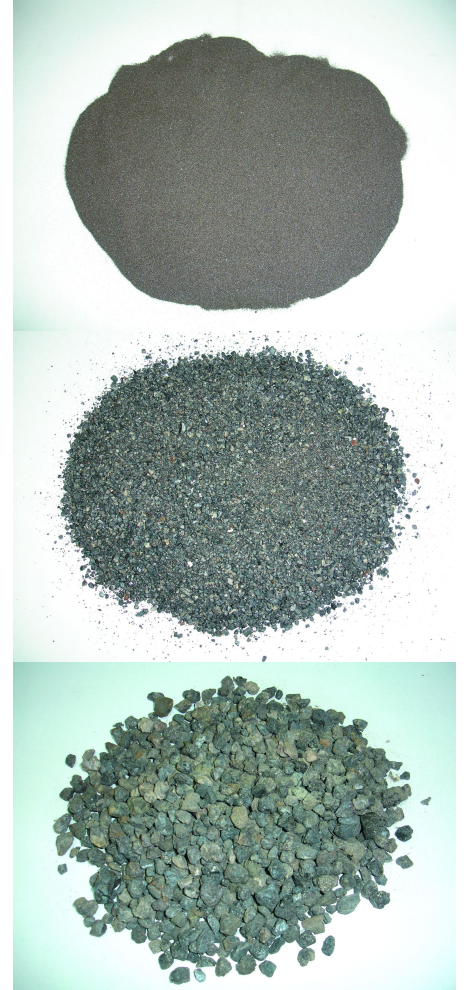
converting agriculture land for mining has become too expensive.

The high price of tin has caused great excitement in the tin mining industry. People are now talking about investing in the industry. The intention of this paper is to give a brief review of the industry from a former tin miner's perspective. The future of the tin industry depends on the price of tin, the value of the ringgit and, most importantly, the discovery of new tin fields. Is there tin at the end of the rainbow?

## HISTORY OF TIN MINING

Tin ore has been mined in Malaya for centuries. At that time, mining methods were primitive and tin ores were mined along the river banks. It was the discovery of large deposits of tin ore in Larut, Perak, in 1848 by Long Ja'afar that started the development of the tin mining industry in Malaya. Long Ja'afar employed Chinese miners to mine his land. Later, Chinese merchants from the Straits Settlements were encouraged to invest in the mines which led to the large influxes of Chinese immigrants. An even richer deposit of tin ore was discovered in the Kinta Valley in Perak, which later became the richest tin deposits in the world. Meanwhile, large deposits of tin were also discovered in Selangor.

The tin production at Larut was very successful until the Larut War which



Figures 2,3,4: Tin ores occur in various forms from very fine to coarse. The coarser the ore, the more the impurities

broke out due to conflicts between the Malay chiefs and their respective Chinese partners. Similar wars also broke out in Selangor. The wars had disrupted the supply of tin which led to the British intervention in 1874.

Chinese miners were the main producer of Malayan tin ores before the British came. The British brought in dredges, which increased tin production tremendously and, subsequently, replaced the Chinese miners as the largest producer of tin in the country.





Figure 5: Lode tin ore



Figure 6: A large piece of lode tin ore



Figure 7: Karang or pay dirt is normally associated with gravel

## TIN ORE

Tin occurs in the form of cassiterite ( $\text{SnO}_2$ ) or tin ore which is associated with other heavy minerals, most commonly iron. Most of the tin ore is in sand-like form with the occasional large pieces. Figures 2 to 6 show various forms of tin ore. Lode tin is shown in Figures 5 and 6. The larger form needs to be crushed and grinded before being dressed. Most of the Malaysian tin deposits are alluvial and the bedrocks are normally limestones, decomposed granite or schist. Tin bearing layers or 'pay dirt' are locally known as 'karang' (Figure 7). The rough concentrates obtained from the 'palongs' and dredges are roughly 20%-30% tin. They have to be further rewashed to about

70%-75% tin before selling to the smelters. The residuals are known as 'amang' which contains tin ore and other heavy minerals. It is difficult for the layman to differentiate the 'amang' from tin ore.

## TIN SMELTING INDUSTRY

Initially, tin was sold in its unrefined state. However, being the world largest producer of tin, it was natural for the country to have its own smelting facilities. It was more economical to export tin in the form of blocks commonly known as ingots. An export tax on unsmelted tin ore was introduced as well. At the smelting factories, tin were made 99.9% pure and exported as ingots. Plants were set up in Singapore in 1887 and at Butterworth in 1902. Today, Malaysia still has some of the most efficient smelting plants in the world.

## METHODS OF MINING

### The Old Ways

The old Chinese method of mining was mainly carried out by hand. The ground was manually dug by 'changkol' (hoe) and the 'karang' was carried to hydraulic sluices. Tin ores were recovered by panning. Dewatering of the mine pit was also done by hand using buckets. Chinese miners used chain pumps which run on water wheels. Flooding of the mines was common and, often, deep mines had to be abandoned. The British introduced steam engines and centrifugal pumps which started the gravel pump method.

### Gravel Pump

Gravel pump (Figure 8) is the most common method of tin mining. The ore bearing ground is broken down by high pressure water jets known as 'monitors' (Figure 9) and the resultant slurry is washed to a sump in the pit floor. The ground is kept steep so that the slurry slides down to the sump by gravity. A gravel pump pumps all the material up to an elevated 'palong'. 'Palong' is a huge wooden sluice box (Figure 10) to trap and save tin ore. Tailings are dumped into retention ponds (Figure 11) or old mine holes. Water is recycled for use. The cost of setting up a gravel pump is much lower compared to that of a dredge.



Figure 8: The author with a huge gravel pump which was powered by a 620hp of Cummins engine. Note the size of the engine



Figure 9: High pressure water jet or monitor breaking up the ore bearing earth



Figure 10: Palong, a giant sluice to collect tin ore



Figure 11: Tailings dump – tailings are stored in impounded dams

### Dredging

The introduction of dredges marks a significant change in the Malayan tin mining industry (Figure 12). Dredges are highly efficient mining machines which can operate practically non-stop



Figure 12: The classic dredge, an efficient mining machine in flat alluvial ground

(24 hours with labourers working on shifts). Land of lower grade deposits can be profitable because of the high yardage of materials treated. The dredge is essentially a floating mine where mining and tin ore dressings are done on board. The ore bearing earth is dug by chain buckets and broken down by monitors; and jigs are used to wash the tin ore.

The main disadvantage of dredges is that it cannot recover tin ores lying between limestone pinnacles. Limestone cavity is often very rich in tin ore deposits. The gravel pump method is usually used to 'clean up' the cavities.

The first dredge was employed in 1912 at Batu Gajah, Perak. Within two decades, dredges overtook the gravel pump method as the main producer of tin. However, dredges are very expensive and were normally owned by large multinational companies.

### Dulang Washing

'Dulang' washing or panning (Figure 13) once played an important part in the mining industry and used to contribute a



Figure 13: Dulang washers played an important part of the tin mining industry

fair percentage of tin produced in the country. A 'dulang' is a wooden circular pan similar to the gold miner's pan. The 'dulang' is moved in a circular motion until the lighter materials are thrown off leaving tin ore. Most 'dulang' washers were Chinese women and they have to possess licences to mine and sell tin ore. The licence is known as a 'dulang' pass which is issued by the Mines Department. Favourite mining areas were abandoned mines and river banks. 'Dulang' washing is used to clean up the ore in areas where pumps and monitors could not reach.

### Open Cast Primary Tin

In areas where tin ore occurs in rocks and boulders, the ore bearing materials are dug by excavators and transported by dump trucks to a collection pit. Monitors are used to break up the materials. The ore bearing rocks are crushed and go through a separation process. An example of an open cast mine is the Rahman Hydraulics in Perak.

### Underground Mining

As the name implies, mining is carried out underground in tunnels and shafts. The most famous mine was the exhausted Sungei Lembing in Pahang.

### MINES DEPARTMENT AND MINING ENACTMENT

In the early years of mining, there were no laws or regulations. When the British took over the administration of the country, they set up the Land and Mines department to oversee the proper leasing of mining land. In around 1896, a mining enactment was implemented to control and regulate the tin mines.

All mines are required to obtain hydraulic licences before any mining activities can proceed. Licences are issued by the Mines Department and have to be renewed yearly. Application for the licence should include a proposed plan of the mining scheme with the following information:

1. Method of mining
2. Position and size of 'palong'
3. Intended or proposed location to be mined
4. Location, area and capacities of tailings and dry dumps

5. Size of the tailing bunds and place of discharge
6. Monthly average volume of yardage
7. Size of pumps and engines
8. Indication of the depth of the mine

The application has to be endorsed by a Professional Engineer (PE). Mine inspectors and their technicians from the Mines Department make regular inspection of the mines.

### TIN PRICE

Historically, tin has always been a fluctuating commodity. The price of tin dropped about 50% during the great depression years from 1929-1934. In 1931, the tin producing countries voluntarily enforced the International Tin Control scheme where each country was given an export quota.

The International Tin Council (ITC) was formed in 1956 to control the price of tin. Both the major producer and consumer countries were involved in the council. In 1983, the Association of Tin Producing Countries (APTC) was also formed for the same purpose. However, due to the poor state of the tin industry, the council was dissolved in 1990. Table 1 shows tin ore production and price since 1970; note the instability of the price and sliding output.

### MALAYSIA'S TIN RESERVE

It is a very difficult task to even guess the reserve of tin in Malaysia. Most of our tin had come from alluvial deposits and it is time to look for the mother lode. The Geological Survey of Malaysia has done extensive studies and results have shown that there may be large primary deposits (lode mining) along the main range. Mining the mother lode requires a very large investment and the cost of production is high.

Some of the large alluvial reserves are under developed towns and cities which are difficult to mine for obviously reasons. It has been reported that the town of Gopeng in Perak sits on a very rich reserve and there has been attempt to relocate the town for mining. The other possibility is in forest reserves like Belum in Perak.



It is interesting to note that the Mineral Commodity Summaries January 2006 by the United States Bureau of mines (Table 2) gives Malaysia an impressive figure of 1,200,000 tonnes of tin reserve, third only after China and Brazil. If the figure is even half true, the tin industry may have a chance.

**TIN MINING AND THE ENVIRONMENT**

Nowadays, protection of the environment is a hot topic. Tin mining has created some environmental problems such as the silting of rivers, waste lands and mining pools with slime. Figure 14 shows an ex-mining pool with slime.

Table 2: World mine production and reserve base

	Mine production		Reserve base (estimates)
	2004	(estimates) 2005	
United States	-	-	40,000
Australia	800	800	300,000
Bolivia	16,800	17,000	900,000
Brazil	12,200	12,300	2,500,000
China	110,000	115,000	3,500,000
Congo (Kinshasa)	2,000	2,000	NA
Indonesia	66,000	80,000	900,000
Malaysia	3,000	2,000	1,200,000
Peru	42,000	42,000	1,000,000
Portugal	500	500	80,000
Russia	2,500	3,000	350,000
Thailand	600	650	200,000
Vietnam	4,000	4,000	NA
Other countries	4,000	1,200	200,000
World total (rounded)	264,000	280,000	11,000,000

Note: NA =Not available

(Source: Mineral Commodity Summaries, January 2006, U.S. Geological Survey-US Bureau of Mines)

It has been proven that mining and conservation of the environment could co-exist as the rehabilitation of mines has shown great results. Oil palms have been successfully planted in ex-mining grounds. Constructions in ex-mining grounds have been carried out successfully. In fact, many housing estates in Selangor, Kuala Lumpur and Perak are built on ex-mining land. Ex-mining pools are used for recreation purposes such as the Clearwater Sanctuary.

Tin mines have, for many years, provided sand to the construction industry. Malaysia is fortunate to have some large mining pools which were converted into landfills. Ex-mining pools can be also used for flood control (the SMART project).

**SOME INTERESTING FACTS**

- 1. Most productive tin mine in the world**  
The Ayer Hitam No 2 Dredge at Puchong, Selangor, was declared the most productive tin dredging ever. In the month of November, 1976, in just 30 days, its output was recorded at 801.26 tonnes. [5]
- 2. Collapse of tin**  
The tin buffer stock system collapsed in October 1985. The controlled price of tin fell from RM29 to around RM15.
- 3. Malaysia is a net importer of tin ore**  
From being the largest producer in the



Figure 14: An ex-mining pool - a challenge for geotechnical engineers



Figure 15: Drilling for primary deposits

world, Malaysia is now a net importer of tin ore. The ores are for the smelting plants in the country and it is still one of the largest exporters of refined tin.

#### 4. US stockpile

The US government has a stockpile (GSA sales) to control the price of tin.

#### 5. Tin ore mined at the Federal Highway

A rich deposit of tin ore was discovered during the construction of the highway. A 'palong' was constructed to mine the area and, rightly so, as otherwise, the tin ore would have been lost forever.

#### 6. Monitors run by waterfall

A Chinese tin miner in Perak converted a waterfall to power his monitors.

#### 7. Old Chinese miners' beliefs

It is said that tin ore can be separated by a sheet of paper. All the soil testing and investigation will come to naught if you do not have luck.

### FUTURE PROSPECT

The revival of the tin mining industry depends on the discovery of new tin fields and the stability of the price of tin. New land has to be opened by the government for prospecting by the miners. Presently, any land, agriculture or otherwise, that is converted for mining has to be surrendered to the government after mining activities has ceased. The future is probably in the exploration and discovery of primary tin deposits (Figure 15).

### CONCLUSION

Tin mining is indeed a sunset industry in Malaysia. It would take a miracle for it to return to its past glory. The main obstacle is that there is no land with rich tin deposits. For the last two decades, tin ores had been mined from dredged out areas, old mines and reworking of the tailings. Most of the known tin ore areas are of low grades.

The government should study the conversion of agriculture land for mining. The law should be amended so that the land would be returned to the land owner after mining activities have ceased. The tin should be extracted before any development comes in as, otherwise, the tin ores would be lost forever.

The viability of a tin mine depends not only on its reserves and effective mining methods but also on the demand for tin and the value of the ringgit. The recent increase in the price of diesel adds to the plight of the tin mining industry, as fuel constitutes a high percentage of the operational cost.

The price of tin has always been unstable and miners are sceptical on the sustainability of its prices. The present high price is due to the demand from China and the 'metal boom'. The price of most metal are on record high and financial analysts are talking about the expected bubble burst, similar to the dot.com experience a few years ago.

The future of tin is probably in mining primary deposits. However, even exploration works for primary tin involves high capital investment and high risk. ■

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