PERAK MUSEUM NOTES, NO. III.

THE TIN MINES

AND THE

MINING INDUSTRIES OF PERAK

AND OTHER PAPERS.

BY

L. WRAY, JUN.,

M.I.E.E., F.Z.S., CORR. MEM. P.S., ETC.,

CURATOR PERAK MUSEUM AND STATE GEOLOGIST.

ALSO A PAPER ON THE PADI INDUSTRY OF KRIAN BY H. W. C. LEECH, LL.D., AND AN ITINERARY OF A TRIP TO GUNONG BINTANG BY G. A. LEFROY, CHIEF SURVEYOR, PERAK.

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NOTICE.

From time to time, as material is available, it is proposed to publish, in pamphlet form, parts of a serial under the title of *Perak Museum Notes*. The papers in it will deal with and illustrate Museum and general scientific subjects connected with the State of Perak, its history, trade, industries, mines and products.

Communications and papers on the subjects indicated above are invited.

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SOME ACCOUNT OF THE TIN MINES AND THE MINING INDUSTRIES OF PERAK.

By L. Wray, Jun.

CHAPTER I.

HISTORICAL.

The mines, and the industries connected with them, are of such paramount importance and interest to all living in or having relations with the State of Perak, that it is hoped this attempt to give a detailed

NOTE.

The Plates in this book are numbered 4 to 10. Plates 1 to 3 have appeared in previous issues of this periodical.

that is to say, none in which anything but the doings of the chiefs and the records of the constant petty wars which ravaged the whole Peninsula are to be found. In Malaya, as in most other parts of the world, the things which have been thought worthy of recording in history are the very things that in subsequent times prove least interesting.

The metal tin has been known from the most remote ages—in fact, the first metallic instruments which were made to take the place of stone implements were fashioned out of bronze, except in America, where the vast amount of native copper would appear to have led to its use before the art of casting was discovered.

In early times tin must have had great value, for without it the copper could not be hardened so as to be of use for cutting anything but the softest of substances. The bronzes of antiquity—that is to say, of that age in the history of the world known as the Bronze Period, were composed of copper nine parts and tin one part; and it is a singular and significant fact that this proportion had a world-wide range. Later bronzes, manufactured by the Greeks, Egyptians, Etruscans and Romans, contained a certain amount of lead in addition to the tin and copper of the primitive alloy.

The duration of the Bronze Period is necessarily unknown, but it is conceded that it must have extended over a very considerable number of centuries. During it, man rose from a state of almost complete savagery to a comparatively high pitch of civilization. Writing was invented, and great advances made in many of the arts and manufactures; nearly all the animals we now keep were domesticated, and the cereals in cultivation, before the commencement of the Age of Iron.

During this time, judging from the abundance of bronze objects of all kinds that have been found, large quantities of tin must have been used. It is considered that the sources from which it was derived were Spain, Britain and Malaya. In the early Iron Period the great navigators of the world were the Phœnicians, and it was they who took tin from England and Spain and the Islands of India to the centres of civilization. There was, however, some other race of navigators who preceded the Phœnicians and exceeded them in the extent of their commercial voyages. Who these people were is uncertain, but the recent investigations into the antiquities of America make it certain that they crossed the Atlantic Ocean and carried on intercourse between the Old World and the New. A few of the discoveries that have been made may be mentioned here, to show the connection that exists between the old inhabitants of America and those of Europe and Asia. The stone and bronze implements are absolutely identical; the round towers, pyramids and coins are very similar; in both hemispheres embalming the dead, artificially deforming skulls, and the rite of circumcision were practised; and the most convincing of all is, perhaps, that carved representations of elephants have been found in Central America, and veritable tobacco pipes, associated with prehistoric remains of a period very many centuries before Columbus re-introduced the use of tobacco into Europe, have been found in Ireland. It is perhaps not improbable that these people, whose existence is recognised by both philologists and antiquarians, may have traded, like their successors the Phœnicians, with the lands of the East, as it is certain they did with those of the West.

So little is known of China and its antiquities that it cannot be stated with any degree of certainty where they obtained their tin. The discovery of the use of metals is placed by Chinese historians as prior to the reign of Te Yaou, of the dynasty of Hea, who lived in the year B.C. 2356. "The Emperor Kang-He," says Forbes, in *Five Years in China*, "himself records that bronze money first appeared in the time of the founder of the Chon dynasty, B.C. 1105, when Tae-Koung, the minister of Woo Wang, introduced round money with a square hole in the centre." The same author goes on—"Notwithstanding that the first round money is supposed to be [of] the time of Woo Wang, by the Emperor Kang-He, those who make Hwang-te, B.C. 2600, the originator of coined metal, state that it was in the form of a cutlass, and was called the Kin-taou-tseen, or money of the metal knife. . . . . . . Of the Kin-taou coins there are several kinds, varying in length from three to seven inches."

It is probable that these so-called "knife coins" were in the first instance actual metal implements which were used as money, though in later times they may have been real coins in the shape of implements.

The latest mention of these "knife coins" is in the time of Ouang-mang, A.D. 9.

The entering of foreign merchandise into China in the reign of Chaou-te, of the Han dynasty, B.C. 85, is recorded by Chinese historians, and of the Arabians trading at Canton in the reign of Hwan-te, A.D. 147. Logan, in the *Journal of the Indian Archipelago,* writes, "There is evidence of their (the Chinese) trading to Java in the ninth century, and if this trade was then established it is probable that they also visited Borneo in very remote times, and even before the Malay kingdom of Bruné was formed, for they were themselves engaged in the trade with India at least as early as the fourth century." When Marco Polo, the Venetian traveller, visited the Archipelago and China in about the year A.D. 1291, there was regular trade carried on by large junks with China. This is confirmed by the Arabian traveller, Ibn-Bathoutha, who visited India, Malaya and China in the year 1346. The trade between India, Arabia and China must have passed through the Straits of Malacca, and as tin was undoubtedly sent to the West, it was in all probability also sent to the East, then as at the present day.

There does not appear to be any evidence as to who the people were who worked the tin mines in Perak in very early days. They were certainly neither Sakais nor Semangs, nor any other of the wild tribes of the Peninsula, but they may have been Siamese or Malay settlers, the descendants of some prehistoric invaders of the Peninsula. The stone implements that are so abundant in Perak, Kelantan, Pahang, and other parts of the Peninsula, and also in Java, Sumatra and the other islands of Malaya, seem to prove that the Peninsula was invaded by the users of these weapons long anterior to the first invasion recorded in history.

A theory has been put forward by Mr. H. Clifford, in *Some Notes on the Sakai Dialects* ("Journal of the Straits Branch of the Royal Asiatic Society"), that because the *bliong*, the *parang* and the spear are known to the Sakais by Sakai names, that therefore they were the makers and users of the stone implements. As no stone implements have been found in Perak which even in the most distant manner resemble either spear-heads or parangs, the theory cannot be maintained, particularly when it is remembered that the Sakais make and use bamboo-headed spears, and that the earliest type of Malayan spear, the *apit dendang*, is undoubtedly derived from a weapon with a bamboo blade; and also that the parang, which is a chopping knife with the broadest and heaviest portion of the blade at the part farthest removed from the handle, has no prototype in the stone implements of any part of the world. The parang is a highly specialized implement, evidently developed from a sword-like weapon by the gradual broadening of the end of the blade, so as to distribute the weight and remove the centre of percussion—the effective part of the blade—from the handle end, to a point at or beyond its centre. The reason why the chopping knife was not developed in the stone age is, obviously, that stone is a material that has not sufficient tenacity to withstand the transverse strain which is produced in a blade when a blow is delivered with that portion of it which is known as the centre of percussion. One type of stone axe which is fairly common in

Perak, and which much resembles the modern Malay bliong, has also been found in Ireland, Denmark, Switzerland, Tennessee, Indiana, Java, and many other places, made both in stone and in copper and in bronze. Other types found in Perak also have a world-wide distribution, and it is quite inconceivable that the wild tribes of the Peninsula could have separately and independently invented these types of implements. It appears to be very much more reasonable to attribute them to some prehistoric inhabitants of the Peninsula, particularly as there are so many evidences that trade was carried on with Malaya long before the period of the historical settlement of the Sumatrans on the mainland.

Anderson, in his *Considerations Relative to the Malayan Peninsula*, says: "It is singular that the city of Canca Nagara, or Ma Lancapuri, is placed by Ptolemy [who died in A.D. 140] in the exact latitude of the River Dinding, in the Perak Territory (which is known as the Temala or Land of Tin of the same author), and which is no doubt the same city alluded to in the *Sejarah Malaya*, or Malayan Annals, written in the year of the Hejeirat 1021, or a little more than two centuries ago," reckoning from the year 1824.

"Confused and incongruous as is the history of the early settlements of the Malays on the Peninsula, which we find narrated in the *Sejarah Malaya*, or Malayan Annals, we are enabled to gather sufficient to show that prior to the emigration of the Malays from Sumatra in A.D. 1160 the more northerly part of the Malayan Peninsula was partially inhabited by Siamese. The Malays pretend to derive the descent of their sovereigns from Alexander the Great, and trace in a regular line of genealogy the successive dynasties and kings of Hindostan, till the time of Rajah Suran, grandson of Rajah Sulan, who reigned in Andam Nagara, and all the lands of the East and West were subject to him. The first place of importance he appears to have reached on the Peninsula, was a fort situated on the River Dinding, in the vicinity of Perak." From this account it would appear that there was a place of considerable importance on the Dinding river, in the Bruas district, in the year 1160. For a long time afterwards Bruas was the seat of government of the Rajas of Perak.

"It does not appear," Anderson goes on to say, "that Singapura, Malacca, Perak, Johor, Pahang, or Rhio, or indeed any of the Malay States which were founded by emigrants from Sumatra, ever were subject to Siam during the long interval from 1160, when Singapura was first settled, up to the period of the conquest of Malacca by the Portuguese in 1511."

After this date trading relations subsisted for many years between Perak and the Portuguese at Malacca. Some years ago an interesting discovery was made at Klian Kalong, in Kinta, of an earthenware jar, in which were a number of dollars of Ferdinand and Isabella. One of these dollars was secured by Sir Hugh Low, and is now in the Museum. It has been defaced in places and the date cannot be made out, but it must have been coined between 1469 and 1516, the dates of the accession and decease of Ferdinand. The jar was found buried 13 feet below the surface of the ground, and probably belonged to the men who were working the mine some 400 years ago. This find would appear to show that Portuguese coin passed current in Perak at that time.

In 1641 Malacca fell into the hands of the Dutch, and in the same year Valentyn, in his *Account of Malacca*, says: "Several necessaries, to the amount of 3801 rix dollars, had been forwarded per the said store-ship *Gragt* and per some other ships, whilst different sorts of calicos, to an amount of rupees 31,341, had been sent with the Factors Jan Dirkssoon Puyt and Joris Vermeeren for the tin trade at Perak, Kedah, Ujong Salang (Junk Ceylon), and Bangeri, besides 1000 rix dollars in specie; 31,341 guilders were also sent for the use of the above-named places, with orders that as much tin as could be got was to be sent to Batavia for the trade with Suratte and Persia."

About the year 1650 the Dutch established, by virtue of a treaty with Achin, a trading station on the Perak river, to control the tin trade. In the following year the Malays attacked it and killed all the Dutch. Captain Alexander Hamilton, who visited the Straits of Malacca in the end of the seventeenth century, quaintly writes:—"Perak is the next country to Quedah. It is properly a Part of the Kingdom of Johore, but the People are untractable and rebellious, and the Government anarchical. Their Religion is heterodox Mahometism. The Country produces more Tin than any in India, but the Inhabitants are so treacherous, faithless, and bloody, that no European Nation can keep Factories there with safety. The Dutch tried it once, and the first year had their Factory cut off. They then settled on Pullodingding, an Island at the Mouth of the River Perak, but about the year 1690 that Factory was also cut off, and I never heard that any Body else ever attempted to settle there since.

"There are several other Places along that Coast of Malaya that produce great Quantities of Tin, but Salangor and Parsalore are the most noted, tho' little frequented by Europeans, because they have too many of the Perak Qualities to be trusted with honest Mens Lives and Money. Their Religion is also a Sort of scoundrel Mahometism."

The factory on the Perak river was re-established and abandoned several times, and the Dutch were finally ejected by the English under Lieutenants Lord Camelford and MacAlister in the year 1795. Anderson says:—"Captain Glass, the commanding officer of the troops in Penang shortly after it was occupied by the English"—that is to say in 1787—"gives the annual export of tin from Perak as 5000 pikuls, which was sold to the Dutch at 32 Spanish Dollars per Bahar of 428 lbs.*

* * * * * *

"After the expulsion of the Dutch from Perak, there was equal to 2000 Bahars, or 6000 pikuls of tin annually imported into Prince of Wales Island from that country, and the whole produce about eighteen or twenty years ago, is not over-rated at 9000 pikuls." That is, in 1804 to 1806. Twelve years afterwards, in the year 1818, there were esti-

* This is interesting, as it appears to be one of the oldest mentions of the Perak standard of weight. The present bhara is taken to be 427·885 lbs. weight, or about one-tenth of a pound less. The difference per kati is only $2\frac{2}{3}$ grains, and the 24 dollars which constitute the kati would have weighed 416·108 grains each, instead of 416 grains as at present.

mated to be only 400 Chinese tin miners in the State. The bulk of the tin must therefore at that time have been raised by the Malays.

Perak was taken possession of by Kedah, acting under the orders of the King of Siam, in September, 1818, but the Siamese were driven out again by the Raja of Selangor in 1822, who put Tajudin on the throne. After the conquest of Kedah in 1822, the Siamese re-took Perak, and were again expelled in 1826, in consequence of the treaty made between England and Siam. Lieutenant-Colonel James Low took a party of sepoys up the Perak river in the *Antelope* and the *Zephyr* in October, 1826, to force the Siamese, who were encamped on the north bank of the river, to evacuate the country.

Colonel Low, who was about a month in the State, makes the following interesting observations on the tin mines of Perak.

"Tin, which is exchanged by the miners for goods at the rate of 30 dollars per bhar, and of which two thousand bhars might be afforded yearly. The goods most in request are blue cloth of cotton, Acheen dresses, opium, tobacco, salt, salt-fish, gambier and minor articles. The richest mines lie at the sources of the small streams which feed the main river, and these rise in the high range of mountains which stretch nearly north and south about from forty to fifty miles inland.

"They work the mines all the year; it is not until after the harvest has been housed that the agriculturists commence mining operations.

"The tin is gathered by both sexes, and persons of all ages. They work from 5 a.m. to 10 and from 3 p.m. till 6. Sometimes the concern is a general one, and is divided into shares of fifteen dollars each. But in this calculation of the produce of tin, reference has only been had to the quantity yielded in quiet times. Should much encouragement be given to Chinese and other settlers, no limit can be fixed to it.

* * * * * *

"The chief mines are as follows. At Budara, Bukkan, Sayong, Chekoos (where gold is also procured), Soongkie Beedok, where tin is dug on the plain. Kampa, Patoong Padang [Batang Padang], where some gold-dust is also obtained. The country is represented as flat. Chandariang, the ore is bartered, and is afterwards smelted by the Chinese. The next place is Riah, where fine ore is dug out of the plain. Kampa, Kantar, where the ore is dug at the foot of the hills, but on the plain.

* * * * * *

"With respect to the localities of the river, it may be stated that two streams branch off from the east bank, one called Kwalah Bidor, betwixt the anchorage for vessels and Bandar, and the other Kantoor, opposite to Rantau Panjang and above Bandar. Kwalah Bidor leads by a difficult canoe navigation of five or six days up to Bidor. Here a population of from three hundred to four hundred persons used to be employed in mining for tin-ore, which is heavy and rich.

"The Kantoor separates itself into four branches at a distance of a few miles above its conflux with the main river. These are Chandarang, Soongei Keah [S. Riah], Kampa and Kantar.

"After four or five days paddling, the canoes reach Chandariang tin mines. The country is favourable for rice.

"Krort is about the same distance above Rantau Panjang, with a population of four hundred souls; much tin is likewise obtained here on digging a small depth on the plain, and after the rains a large quantity of ore is found on the surface and in ravines. The miners exchange pieces of tin, from the weight of a quarter of a pound up to fifty, for cloth and other articles.

"Kampa is two days above Rantau Panjang, and had a population, in quiet times, of five or six hundred souls, but the inroads of the Siamese have so distressed the people that it would be no easy matter to ascertain the population of any given place. The Raja himself has not obtained a census.

"From Kampa to Kantoor is only a short journey. At the bottom of the hills near Kantoor, tin of the best quality the country produces is obtained. The inhabitants of both sexes and of all ages play at games of chance for pieces of ore or tin.

* * * * * *

"Bota. The Raja formerly resided here. It is a full day's tracking from Allahan, and in prosperous periods contained about five hundred inhabitants. Above Bota, and after having passed Pulo Pisang, is the village of Layang Layang, containing formerly from two to three hundred people. Several tribes of Sakai or aborigines in the neighbourhood. The traveller then reaches Budara, where there are tin pits, which are worked after the harvest. The ore is reckoned inferior to that of Kantar and Kampa. The village of Maroh is included in Budara, and they may, united, contain 200 persons. Passing Sadang the canoes reach Blanja on the third day, supposing that there is no great haste required. The cocoanut trees grow plentifully here, and the population, before the Siamese and Salangorians distracted the country, averaged 300 souls.

"On the fourth day, Bakau, where there are tin mines at the foot of hills, may be visited, as also Sirowan, Samut and Puel, and a halt made at Goar, which contained formerly about 300 souls.

"On the fifth day the river is found to grow narrow and very winding. Pass Paket, Sangan and Mundora, where much rice is cultivated, also Boaya and Bundong Kring, and halt at Sayong, where there are about 100 houses, and where ore tin is dug." *

From the foregoing extracts it is apparent that tin was mined in many parts of Perak at that time—in fact in all, or almost all, the fields that have been so extensively worked in later times.

Newbold, writing in 1839, gives the export of tin from Perak as 8,500 pikuls per annum—so that for a period of over forty years the output of tin appears to have been fairly constant, ranging only from 6,000 to 9,000 pikuls.

* *Observations on Perak*, Colonel Low.

Captain Speedy, the first Assistant Resident of Perak, gives the following account of the beginning of the mining industry in Larut. "But although the wealth of this kingdom [Perak] was thus early recognised, Larut appears to have been totally unexplored until 1848. During that year an enterprising Malay named Che Long Jaffar,* while bathing in a stream, had his attention arrested by some black sand, which, when assayed, was found to be tin. He immediately took steps for obtaining coolies, and with twenty Chinese from the Chin Seah district, opened a mine at a place called Galian Pao [Klian Pau, near where the Museum now stands], which proved to be extremely lucrative.

"As the report of this success reached China, a large number of other emigrants, comprising the men of many districts (generally, but erroneously, designated "tribes"), flocked to Larut, and the mineral resources of this country then first began to be in some measure developed.†

"In 1862 quarrels relating to the ownership of the mines arose between the Chin Seah and the men of another district—viz., the Fui Chin, which ended in the expulsion from the country of the latter.

"In consequence of the representations of some of the Fui Chins, who were naturalised British subjects, the then Resident Councillor of Penang, Colonel Mann, sent a man-of-war to demand compensation from the Raja of Larut for the serious losses which the complainants had sustained.

"The Raja, in his turn, demanded this of the Chin Seah, and the sum of $17,500 was accordingly obtained.

"During the ten succeeding years, affairs in Larut appear to have been tolerably peaceful, but early in 1872 disturbances again broke out among the miners, which soon assumed a most serious aspect.

"Two factions were formed, called respectively,—after the districts in China from which the men came—Sih Quan and Goh Quan—viz., Five Districts and Four Districts.‡

* Chi Lang Jaffar was a Malay trader who formerly collected the padi rents at Bagan Tiang, in the Krian district.

† Chi Lang Jaffar died about 1860, and was succeeded by his brother Chi Ngah Lamut, who was succeeded by his nephew, Chi Ngah Ibrahim, the son of Chi Lang Jaffar, as Mantri of Larut, in the year 1862.

‡ Mr. A. M. Skinner, in a Parliamentary Paper *Precis of Perak Affairs*, writes, "the miners consist of "Cantonese" (here called Macaos) and "Kehs" who are unfriendly, and speak different dialects. These two great race divisions, though at the bottom of all the disturbances, have become much confused, many siding with the kongsee to which they belong rather than with their own people. The present parties are best known by the names of See Kwans and Go Kwans, as follows:—

See Kwan (four districts).	Sin Neng Sin Whee Seow Keng Whee Chew	Mostly Gee Hins and Cantonese.
Go Kwan (five districts).	Cheng Sia Poon Say Soon Tek Lam Hye Tong Quan	Mostly Hye Sans and Kehs."

"The government of the country was at this time in the hands of the present Mantri, Nga Ibrahim (son of the above-mentioned Che Long Jaffar), and it was in great measure owing to the weakness and vaccillation shown by him in siding alternately with each faction, together with the inability of his police force to render effectual assistance to either, that he lost the confidence of both parties, at this time comprising nearly four-fifths of the entire population of Larut.

"So complete was the ruin brought about by this most disastrous warfare, that the country became almost depopulated—villages were demolished wholesale, thousands of people were massacred, the destruction to property was enormous, the land was laid waste, and not only did Larut itself thus suffer, but the returns of the value of imports at Penang during the years 1872 and 1873 showed a decrease of nearly 1,000,000 dollars, owing to the cessation of the importation of tin to that island from Larut.

"This distressing state of affairs continued to exist until the beginning of the year under review (1874), when it was most happily ended by the judicious policy of His Excellency [Colonel Sir Andrew Clarke, the then Governor of the Straits Settlements], whereby peace and prosperity were once more established."

This requires a little explanation. Captain T. C. S. Speedy, formerly of H.M. 18th Regiment, and during the Abyssinian Expedition of 1867 interpreter to our forces on Lord Napier's staff, and subsequently Commissioner of Police in Penang, resigned the latter appointment in July, 1873, and made an agreement with the Mantri of Larut to help him regain command of the district and stop the faction fighting amongst the Chinese, in return for a salary of $500 a month and a tenth of all the revenues of the country, for a period of ten years. In pursuance of this agreement, Captain Speedy proceeded to India in August, 1873, to engage men to form a police force, and brought back one hundred men in the end of September of the same year.

The state of affairs existing in Larut is so vividly portrayed in a petition made by some of the Chinese miners, in May of that year, to the Governor of the Straits Settlements, that it will perhaps be as well to give this document *in extenso*.

"THE HUMBLE PETITION OF AH YEU, UNG KENG SIN, SOH AH PANG, SU AH FOOED, AND OTHERS.

"That your Petitioners, the Headmen of a Kongsee named See Yip Long, engaged in tin-mining at Larut, and others connected with that Kongsee, beg to be permitted to lay before Your Excellency some matters relating to the country called Larut, and to ask for them Your Excellency's kind attention and consideration.

"1. That about seven years ago, namely, on the fifth moon of the fourth year Hong Chee, a mining Kongsee at Larut named Tan Siang had a quarrel and commenced fighting with another mining Kongsee at the same place, named Fee Chew, which was defeated.

"2. The Governor, or Mantri, of Larut did not attempt to arrange this quarrel, and instead of doing so, joined the victorious Kongsee, Tan Siang. This having been effected, they both attacked the beaten Kongsee, and after killing 700 of their number, drove that Kongsee from their houses and mines, and ultimately from the country.

"3. That about seven years afterwards, or in the first moon of the eleventh year Hong Chee, corresponding to the year 1866, the Headmen of the Tan Siang Kongsee entered into an agreement with their own people, 15,000 in number, to destroy your Petitioners' Kongsee, See Yip, which did not number more than 8000 men. They fought, and your Petitioners' Kongsee beat the other, who took refuge in the Mantri's fort, and captured this agreement.

"4. The Mantri ordered the Tan Siang, the beaten Kongsee, to continue the fight, but they were again unsuccessful, and, with the exception of eight of their headmen, who took refuge with and were protected by the Mantri, they all ran away.

"5. After the fight was over, your Petitioners, the headmen of the See Yip Kongsee, carried the agreement they had taken to the Mantri, but he refused to listen to them, and sent the eight Tan Siang Headmen off to a place called Teong.

"6. The See Yip Kongsee were the first to open mines at Larut, and unless set upon by others have always lived peaceably and quietly, while the Tan Siang people are robbers, and have become so in consequence of the counsel of, and their subsequent connection with, the Mantri.

"7. For nine months after the said first moon of the 11th year Hong Chee there was no fighting. After that the Mantri entered into an agreement with a Kongsee named Ong Tye You. On the 13th of the same moon and year he called the Headmen of the Kongsee See Yip to come to his house. They went, and as soon as they had entered, he ordered the Ong Tye You people to make a sudden attack on the See Yip, who, being unprepared and without their Headmen, suffered severely, and out of their 8000 men, had about 2000 killed in and about their houses and mines. As the remaining 6000, who were compelled to run for it, must necessarily go by the overland (Krean) route to Penang, the Mantri had ordered the Datus along that route to kill these poor men, and of these 6000 men, about, 3000 were killed, either by these Datus, by hunger, by fatigue, or by wild beasts. Their women, who accompanied them, were sold as slaves, and not more than 3000 succeeded in reaching Penang.

"8. Of these 3000 men, about 600 or 800, unable to obtain work or food at Penang, returned to Larut. On their arrival, the Ong Tye You Kongsee again attacked them, but the See Yip people, being on their guard, they, the Ong Tye You men, though 4000 in number, were driven back to the Mantri's house, and many of them killed.

"9. Fifteen days after this occurred, the Mantri brought from different places about 2500 Malays, whom he ordered to fight along with the Ong Tye You people, and destroy the See Yip men. They fought for ten days, with doubtful success, until at length the See Yip men beat and drove them into the fort.

"10. The Mantri being now in great fear and difficulty, left all and went to Penang, where he met His Highness the Raja Muda, and requested an order from him to settle the disputes at Larut, which he was ordered to do in two days.

"11. Instead of following this order, he hired four junks from China, which happened to be here at the time, also nine tongkongs and some small boats. He loaded the junks with men, ammunition and arms, and the tongkongs and boats with provisions, for the purpose of attacking your Petitioners' Kongsee. These vessels left this, and had got so far as the other side of Pulo Rimau, when they were met by, as they believed, a British war-steamer, and as the vessel sailed round about them, evidently for the purpose of counting their number, they made off with great speed for Penang; they were so frightened that they dispersed, and did not reach Larut.

"12. At present the Mantri lives in a boat in the Krean river, where, as is said, he has been enlisting men at Ulu Kurau, Krean and Patani, to the number of 4000, to carry on war at Larut; but whether these men have been sent or not, is unknown to your Petitioners.

"13. About fifteen days ago the Mantri agreed with us, before the Lieutenant-Governor, to settle this matter within five days, but up to this time nothing has been done.

"14. On the 26th day of the last month His Highness the Raja Muda left the Krean for Kurou, where he found two large tongkongs belonging to the Mantri, in which were found 150 muskets, 400 bags of rice, 40 bags of gunpowder, 8 large guns, and about 150 men.

"15. Having made this statement, which is true and correct, your Petitioners now beg to submit for the consideration of Your Excellency their own opinion, and, as they believe, that of the community here, that this Mantri has been the cause of nearly all the fighting that has taken place at Larut lately, and, therefore, indirectly, of the death and ruin of so many people at Larut, and of the ruin of many at this place. Your Petitioners believe, moreover, that, after what has happened, and judging from his conduct lately, and from his connection with some men here, there can be little hope of peace at that place, if he is allowed to be the Governor, or even to stay there, and your Petitioners respectfully pray, therefore, that your Excellency, in the consideration of this matter generally, will likewise be pleased to consider, whether or not it might be advisable to request His Highness the Rajah Muda to have him appointed to some situation at some place other than Larut, and as distant from it as possible.

"And your Petitioners will ever pray, etc.

"*Penang, 3rd May,* 1873."

Captain Speedy was not able to stop the faction fighting, and on the 20th January the Chinese headmen signed an agreement at Pangkor to submit their differences to the Governor of the Straits Settlements and to abide by his decision. In accordance with this agreement, Captain Dunlop, Mr. F. A. Swettenham, and Mr. Pickering, together with Capitan Ah Yam and Capitan Ah Kwi, were deputed to visit Perak, disarm the Chinese in Larut, destroy the stockades, and arrange terms between the See Kwans and Go Kwans. The Commissioners arrived on the 23rd January, carried out their instructions, and left again on February the 21st.

Returning now to Captain Speedy's narrative, he proceeds:—"The Chiefs of Perak having been induced to sign a bond of peace and amity with each other, the heir-apparent to the throne (whose coronation had been during the previous two years deferred, owing to the dissensions of these very Chiefs) was by them acknowledged the rightful successor; and in compliance with the request of the Sultan, a British Resident was appointed for Perak.

"This took place at Pulo Pankor on the 20th January last year, and from that day the pacification of Larut may be dated.

"For the first two months traders hesitated to enter a country where so lately fire and sword had unsparingly been used, but enterprising Chinese merchants made advances of money and provisions to such men as were willing to commence re-working the disused mines, and Larut gradually assumed an aspect of industry and amendment.

"During the early part of the year, several petty outbreaks occurred, but this was entirely owing to the machinations of a few fighting chiefs of the Goh Quan faction, whose occupation, now that peace was proclaimed, was gone; nine of these men, however, were by my advice deported by the Mantri on the 23rd July, and since then everything has been as satisfactory as could be desired.

"Slowly but steadily the population began in some measure to regain its former status; and as early as March I found it necessary to select sites for towns in the centre of the mining districts.

"The Commissioners appointed by His Excellency to settle the claims regarding the disputed mines had done so during the previous month by drawing a line through the mining country and placing the Sih Quans in possession of the mines to the northward of the boundary, and the Goh Quans to the south.

"Two towns were accordingly planned—one for each district; that in the Goh Quan division, about two miles from Kotah Galian, I called Thaipeng, which being the Chinese for "everlasting peace," I regarded as a happy omen for the future. This town had at the close of the year 5000 inhabitants, one-tenth of whom are shopkeepers who supply the miners with goods.

"The town for the Sih Quan miners was named Kamunting, being the Malayan name of that district; and before the close of the year contained 4000 inhabitants and 300 shops.

"The population of the whole country had, during the disturbances of 1872 and 1873, been reduced to the number of 4000, who were merely the fighting men of both factions. Not a trader, Chinese or

Malay, had remained; but since the establishment of peace, at the end only of eleven months, the population has reached the number of 33,000, of which 26,000 are Chinese. So flourishing is the present condition of Larut that this bids fair to be trebled before the close of the year.

* * * *

"The land at present open for mining purposes is in extent four miles square. Several of the mines now in work have been opened for upwards of seven years.

"It is impossible to state accurately the amount of tin which previously to the year under review has been produced, but from native accounts the value of tin exported during the seven years above referred to appears to have been 6,000,000 dollars (upwards of £1,250,000 sterling.)

"This amount was the produce of only thirty mines. These mines were reopened after the pacification in March last, but up to the end of July did not export in any considerable quantity. This delay was occasioned by the complete state of disuse and ruin into which the mines had fallen during the previous two years of fighting. Sand and clay had been washed into some by the heavy rains, until they were nearly choked, and others were fathoms deep in water. Several months were consequently occupied in clearing away the *debris* and pumping the water out of the mines, and the machinery by which they were worked having been entirely broken and destroyed, much time was also lost before this could be replaced and operations commenced.

"Owing to these drawbacks, not more than 10,937½ pikuls were exported from the time that the mines might be said to be fairly in work to the end of the year, viz., from the 1st August to the 31st December. This gave an average of 70 pikuls for each mine per mensem, and the total value at the present low rate of 20 dollars per pikul was but 218,750 dollars.

"By the close of the year, however, besides the thirty mines above alluded to, ninety others had commenced work, and there is reason to believe that in a few months the greater number of these will be exporting tin. . . . . . .

"The tax now levied on tin is 19 dollars per bhara, viz., 3 pikuls, equal to about 400 lbs. avoirdupois.* Of this sum 13 dollars is charged as a royalty, which is taken as revenue for Larut, and six dollars as an export duty, which goes to Perak.

"This tax is extremely high, being at the rate of 31 per cent. on the value of the article, and there is no doubt that it cramps and fetters the trade of Larut. The average value of a bhara of tin is 60 dollars; the royalty of 13 dollars is at the rate of 21 dollars per cent., and the export duty at that of 10 per cent. A reduction of 25 per cent. will take place from the 15th instant, *i.e.*, the duty on the bhara will then be 15 dollars. The rates will be thus royalty $9, export $6, total $15. . . . .

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* The Perak bhara is 427·88 lbs. in weight.

"The total revenue on tin obtained during the year under review amounted to 70,227 dollars on the gross quantity exported, viz., 11,088 piculs."*

Mr. J. W. W. Birch, the first Resident of Perak, writing about the same time, that is in April, 1875, says, in reference to Perak proper:—"On the Kinta River, and its three or four branches, there are probably 2000 people. This is a rapid stream like the Bidor and Batang Padang, and very rich in mines of tin, while at Bidor a considerable amount of gold is mixed with the tin. The Chinese number about 2000 at Kinta, and 1000 at each of the other rivers; while perhaps 300 are situated at the foot of the hills at Qualla Kangsa, about 150 miles up the river, and where a road exists to Larut, passing through the first large range which you see from the sea, close to a remarkable hill called Gunong Pondok.

* * * * * *

"A royalty of 5 dollars on every bhar of tin was taken, respectively, by the Punghulu at the head of the Bidor and Batang Padang Rivers, amounting to about 500 dollars a month at each.

* * * * * *

"On all the tin in Perak the Sultan was supposed to get 11 dollars a bhar; but in reality he never got more than the six dollars levied at the Qualla. All the mines in the country which have been opened are supposed to have private owners, and they take 10 dollars a bhar. This makes the real duty taken 21 dollars, which is far more than the tin can pay; the equalization of this is in train, and I think can be easily arranged and reduced to a total charge of 15 dollars, of which 6 dollars, on the old mines, only would go to the Government, while on all new mines the Crown would receive the whole of 15 dollars a bhar."†

On the 2nd November, 1875, Mr. Birch was murdered at Pasir Salak, on the Perak River, and it was not until the beginning of 1877 that the country began to quiet down and the opening up of the mines proceeded in Perak proper. Since that time the State has had no further internal or external troubles, and the development of its mineral resources has steadily progressed.

By the Chinese method of working, to be fully explained later on, the water in the mines is all, or almost all, lifted by small overshot water-wheels and chain pumps; therefore the possibility of opening up land is determined by the proportion that the amount of water to be lifted bears to the water-power available to lift it; and the problem of how to increase the water-power so as to enlarge the area of the land that might be worked, early presented itself in Larut. Mr. P. Doyle, in *Tin Mining in Larut,* says the want of water-power "was at one time considered such a great difficulty in the working of the mines that the apprehensions of Government were carried into the form of a proposal for the construction of reservoirs, for a supply to meet certain contingencies, at a cost of £25,000. It was fortunate for the country that no funds were available for carrying the scheme into execution, and the

* Annual Report on Larut for the year 1874.

† Report from H.B.M. Resident of Perak, dated April 2nd, 1875.

project has now [1879] been consigned to the limbo of a good many official ideas of interest and importance, all alike more or less purporting to benefit the community and remunerate the State! The mining area has, since the idea was first entertained in 1874, increased largely and is still increasing."

In the year 1877, a memorable event in the annals of mining in Perak took place. The then British Resident, Mr. (now Sir Hugh) Low, purchased a steam engine and centrifugal pump for $4340 and had it put up at the Bun Hok Sing mine at Tupai, near Taiping. The success of this Government engine induced Capitan Ah Kui to erect a 10-horse-power engine, with a 6-inch Gwynne's centrifugal pump, on the Kong Lun mine at Kamunting, and shortly afterwards to put up a second engine with an 8-inch pump, on the same mine, which was then the largest in the country. Other miners quickly followed the example set them, and the whole water difficulty was terminated at a very small cost to the Government, for the first engine was rented for some time and was then sold to the Chinese.

It is rather a melancholy thing to have to say, but steam pumping is the only improvement that Europeans have been able to introduce into the Chinese system of mining. This is not because the Chinese will not adopt improvements, but simply because, taking all the circumstances into consideration, their system is as good as, if not better than, the European system.

The recent history of tin mining in this State is, perhaps, best given by quoting some of the official statistics. For a long time Larut was the principal tin field, but since 1889 Kinta has taken the lead, producing annually more tin than any other district in the State. The following table gives the monthly export of tin from the year 1874 to the present time for the district of Larut, together with the duty collected on it, and its estimated value. The latter item is not to be considered as more than an approximation—it has been derived from official papers, but it would appear that the full market value has not been put on to the metal, nor has any allowance been made for the difference in weight between the Perak and the Penang pikul, which alone would make the prices seven per cent too low. The major portion of the materials for this and the following table have been kindly furnished by Mr. Marples, the late State Treasurer, and Mr. Hewett, the present State Auditor.

The total export of tin from Larut for the past 19 years comes to 1,470,012 Perak pikuls, or 93,603 tons, of an approximate value of $43,903,700. As will be seen, in 1874 the export was only 11,035 pikuls; it then rose steadily to 126,999 pikuls in 1884; for five years it remained at about 100,000 pikuls, and then declined to 71,973 pikuls in 1892. The duty collected on this tin comes to $5,572,602. The figures for 1875-6-7 are not apparently recorded, but the sums put down are believed to be not much out. It will be observed that the monthly export fluctuates very considerably. This is caused by two things—firstly, the Chinese holidays, and secondly the rainfall.

The statistics for Perak proper are unfortunately not obtainable prior to the year 1876, and from then until 1880 the figures represent only the export from Lower Perak, and the separate districts from which the tin came are not given. There does not appear to be any record of the tin raised in Kuala Kangsar and Selama prior to the year 1880. The next table gives the yearly export of tin from the whole State, as far as the imperfect records will admit, from the year 1874 to 1892.

The total for these 19 years comes to 2,671,105 Perak pikuls, or 2,857,330 Chinese pikuls, and at an average price of $30 per pikul this would represent $85,719,919. Expressed in English weights, the export comes to 170,083 tons,* and, taking the average price of the metal at £80, this gives £13,606,640 sterling as the value of the tin raised during the 19 years that the State of Perak has been under British protection.

The revenue of the State for these years amounts to $24,166,037; and directly and indirectly certainly nearly nine-tenths of it has been derived from the tin mining industry. The trade returns give the value of produce exported in the year 1892 as $10,726,650, of which the single item, tin, amounts to $9,432,551, leaving only $1,294,898 as the value of all the other kinds of produce put together. The statistics of previous years tell the same tale, and show the utter insignificance, from a revenue point of view, of the other industries of the State.† It is doubtful whether the money derived from the tin mines can be rightly considered as revenue. It would perhaps be more correct to view it as the realisation of the property of the State, and place it to the capital account, as a commercial firm does when selling its real property.

A study of the records of alluvial mining in California, New Zealand, and the Australian Colonies is most instructive. The history of alluvial mining in every part of the world has been practically the same, and what has already happened in the districts of Larut, Kuala Kangsar and Selama, proves that this country is no exception to the general rule. The districts which are still rising are Kinta and Batang Padang. In Kinta the great rise in the last few years has been due to the shallowness of the ground, and to the speed with which it can be worked over, with little or no capital; but this necessarily implies its rapid exhaustion. When Kinta will attain its maximum output would be difficult to predict. It may be this present year, or the next, or the one after that; but it would not perhaps be rash to say that before five years are past the wane will have set in.

* It is somewhat difficult to realise what 170,083 tons of metal really represents. As a help, it may be mentioned that if the tin were cast into a solid cubical block, or ingot, it would measure 94 feet each way. If cast into pikul slabs, and the slabs were placed side by side, they would extend 270½ miles. If spread out into a plate one inch in thickness, it would cover an area of 230 acres. If drawn out into a rod of one inch in diameter, it would be 29,075 miles in length, or more than sufficient, by 4200 miles, to girdle the earth at the equator; and if employed for making tin plate (such as is used for biscuit boxes, tinned provisions, etc.), it would suffice for the manufacture of no less than 234,875 acres or 367 square miles of that material.

† The following are the export returns for the past five years, taken from the Annual Reports.

	Estimated value of tin.	All other produce.
1888	$9,055,686.38	$942,539.24
1889	8,204,482.62	842,576.38
1890	7,605,668.59	842,500.43
1891	8,028,741.57	1,107,534.87
1892	9,432,551.74	1,294,898.52

TABLE GIVI YEAR 1892, TOGETHER WITH THE

Year.	January.	February.	Ma	Total Annual Export. Pikuls.	Total Annual Export. In Tons.	Estimated Value.	Export Duty.	Year.
	Pkls. cts.	Pkls. cts.	Pkl	kls. cts.	Tons.	$ c.	$ c.	
1874	...	211 21½		11,035 42	702·6556	218,750 20	70,227 00	1874
1875	3,962 30¾	3,205 40½	1,1	29,601 10	1,884·8495	592,022 00	158,311 43*	1875
1876	5,807 27	1,833 57½	7	30,576 28	1,945·2771	575,656 75	152,881 40*	1876
1877	3,616 37	4,759 93½	7	39,853 09	2,537·6475	763,156 66	168,526 36*	1877
1878	4,744 02	1,315 08	1,9	46,172 79	2,940·0113	933,355 88	161,696 65	1878
1879	5,584 73	1,889 21	3,4	55,350 39	3,524·4216	1,118,739 87	186,381 77	1879
1880	6,812 43	4,254 30	2,5	69,928 03	4,452·6793	1,413,631 46	241,442 41	1880
1881	7,464 68	2,937 24	5,3	79,438 88	5,058·2300	1,604,221 03	320,060 84	1881
1882	8,692 98	7,512 41	5,0	95,437 80	6,076·9700	1,908,756 00	380,244 84	1882
1883	12,531 26	6,510 96	8,1	25,180 86	7,970·8619	2,503,617 20	500,723 44	1883
1884	13,971 57	6,587 37	8,9	26,999 43	8,086·6873	2,695,895 71	490,124 35	1884
1885	13,776 34	8,709 41	6,2	04,281 91	6,640·0491	3,153,878 00	347,689 43	1885
1886	10,247 87	4,837 97	7,3	93,972 48	5,983·6854	4,085,019 75	313,294 66	1886
1887	9,515 82	4,481 07	8,2	02,834 05	6,548·3576	4,730,366 30	342,839 50	1887
1888	9,912 11	7,836 10	6,0	02,289 39	6,513·3360	4,720,307 96	399,462 51	1888
1889	11,038 97	6,143 77	7,8	04,019 38	6,623·4930	3,881,555 36	415,836 80	1889
1890	8,315 91	5,594 68	7,3	95,336 18	6,070·5370	3,241,127 29	346,876 74	1890
1891	9,604 39	9,683 46	6,4	85,785 76	5,462·3775	2,940,712 89	287,575 09	1891
1892	7,167 61	5,000 19	6,9	71,973 83	4,582·8942	2,822,930 24	288,607 17	1892
				70,012 68	93,603·0209	43,903,700 55	5,572,602 39	

* No record of the export
monthly export and the rate of duty

TABLE AR 1874 TO THE YEAR 1892.

Year.	nd Li .	Total Export. In Pikuls.	Total Export. In Tons.	Year.
	Pkl cts.	Pkls. cts.	Tons.	
1874	11,	11,035 42	702·6556	1874
1875	29,	29,601 10	1,884·8495	1875
1876	30,	37,924 10	2,414·8077	1876
1877	39,	48,604 09	3,094·8692	1877
1878	46,	57,995 79	3,692·8942	1878
1879	55,	68,904 39	4,387·5010	1879
1880	69,	88,143 37	5,612·5412	1880
1881	79,	101,109 95	6,438·1988	1881
1882	95, 85	121,412 21	7,730·9335	1882
1883	125,	159,395 53	10,149·5070	1883
1884	126, 87	171,202 54	10,901·0752	1884
1885	104, 40	162,618 74	10,354·7333	1885
1886	93,	184,640 80	11,757·0537	1886
1887	102,	216,652 49	13,795·3570	1887
1888	102,	218,838 67	13,934·6161	1888
1889	104,	235,651 47	15,005·1206	1889
1890	95,	237,157 96	15,101·0800	1890
1891	85,	241,962 14	15,406·9781	1891
1892	71,	278,254 58	17,717·9408	1892
	1,470, 12	2,671,105 34	170,082·7125	

* The export fr y in the ratio of the output for the year 1880.

TABLE GIVING MONTHLY EXPORT OF TIN FROM LARUT FROM THE YEAR 1874 TO THE YEAR 1892, TOGETHER WITH THE ESTIMATED VALUE AND THE EXPORT DUTY COLLECTED.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total Annual Export. In Pikuls.	Total Annual Export. In Tons.	Estimated Value.	Export Duty.	Year.
	Pkls. cts.	Pkls. cts.	Pkls. cts.	Pkls. cts.	Pkls. cts.	Pkls. cts.	Pkls. cts.	Pkls. cts.	Pkls. cts.	Pkls. cts.	Pkls. cts.	Pkls. cts.	Pkls. cts.	Tons.	$ c.	$ c.	
1874	...	211 21½	93 96½	44 54¼	82 12	20 66	180 34	327 69	2,346 57½	2,450 98¾	2,626 44¼	2,650 88¾	11,035 42	702·6556	218,750 20	70,227 00	1874
1875	3,962 30	3,205 40½	1,162 31¼	235 16	1,625 41¼	2,193 37¾	2,225 87¼	3,417 71	2,985 52½	3,474 51½	2,602 06½	2,511 43½	29,601 10	1,884·8495	592,022 00	158,311 43*	1875
1876	5,807 27	1,833 57½	782 39½	1,732 25½	2,113 18½	2,274 91	3,192 83½	1,798 74½	1,499 96	3,060 10	2,960 02	3,521 11	30,576 28	1,945·2771	575,656 75	152,881 40*	1876
1877	3,616 37	4,759 93½	737 74	2,184 01	2,473 51½	2,052 42	2,638 99	4,242 44	4,915 92	2,621 39	3,351 02	6,259 34	39,853 09	2,537·6475	763,156 66	168,526 36*	1877
1878	4,744 02	1,315 08	1,914 70	3,544 72	4,240 39	3,978 93	4,644 90	3,745 85	3,589 87	3,586 08	5,250 63	5,617 62	46,172 79	2,940·0113	933,355 88	161,696 65	1878
1879	5,584 73	1,889 21	3,453 23	4,064 24	4,132 00	4,124 58	5,847 36	6,236 61	5,566 50	4,078 95	4,267 04	6,105 94	55,350 39	3,524·4216	1,118,739 87	186,381 77	1879
1880	6,812 43	4,254 30	2,512 44	3,056 78	4,551 91	7,993 14	7,542 35	5,693 46	5,606 15	7,021 32	7,465 44	7,418 31	69,928 03	4,452·6793	1,413,631 46	241,442 41	1880
1881	7,464 68	2,937 24	5,337 86	6,036 01	6,420 26	9,018 52	6,861 74	7,997 92	6,818 95	6,527 44	6,387 72	7,630 54	79,438 88	5,058·2300	1,604,221 03	320,060 84	1881
1882	8,692 98	7,512 41	5,043 70	5,419 01	7,644 76	8,776 32	10,183 15	7,937 17	8,268 90	8,561 57	7,423 10	9,974 73	95,437 80	6.076·9700	1,908,756 00	380,244 84	1882
1883	12,531 26	6,510 96	8,170 18	8,163 66	10,627 43	10,341 58	13,404 72	10,904 49	12,049 03	10,750 54	9,730 45	11,996 56	125,180 86	7,970·8619	2,503,617 20	500,723 44	1883
1884	13,971 57	6,587 37	8,962 71	10,476 30	9,590 81	9,746 78	11,466 11	11,419 23	11,080 58	10,865 66	11,254 77	11,577 54	126,999 43	8,086·6873	2,695,895 71	490,124 35	1884
1885	13,776 34	8,709 41	6,262 69	8,057 66	9,335 95	8,394 79	10,641 31	9,284 91	7,789 23	6,658 02	7,361 93	8,009 67	104,281 91	6,640·0491	3,153,878 00	347,689 43	1885
1886	10,247 87	4,837 97	7,344 45	7,029 60	7,711 74	8,573 41	8,908 76	8,117 33	7,270 22	6,888 82	8,352 38	8,688 93	93,972 48	5,983·6854	4,085,019 75	313,294 66	1886
1887	9,515 82	4,481 07	8,267 46	7,525 39	8,888 47	8,698 02	9,172 59	9,759 31	8,842 75	10,325 84	8,765 83	8,591 50	102,834 05	6,548·3576	4,730,366 30	342,839 50	1887
1888	9,912 11	7,836 10	6,075 23	7,232 38	4,089 70	8,569 60	11,453 72	11,276 31	10,026 60	8,440 97	7,839 41	9,537 26	102,289 39	6,513·3360	4,720,307 96	399,462 51	1888
1889	11,038 97	6,143 77	7,873 82	8,414 44	6,960 22	7,576 80	9,676 14	9,764 43	8,762 08	9,496 42	9,004 07	9,308 22	104,019 38	6,623·4930	3,881,555 36	415,836 80	1889
1890	8,315 91	5,594 68	7,332 68	6,485 93	8,671 90½	8,526 95	7,138 39	9,323 57	9,411 14	8,021 47	7,577 26	8,936 30	95,336 18	6,070·5370	3,241,127 29	346,876 74	1890
1891	9,604 39	9,683 46	6,450 39	7,599 08	7,697 73	7,655 45	7,288 68	7,768 19	6,764 70	6,229 97	5,479 51	6,564 21	85,785 76	5,462·3775	2,940,712 89	287,575 09	1891
1892	7,167 61	5,000 19	6,975 35	5,132 48	5,462 32	5,906 52	5,893 07	6.585 72	5,828 14	6,311 64	5,941 05	5,769 74	71,973 83	4,582·8942	2,822,930 24	288,607 17	1892
													1,470,012 68	93,603·0209	43,903,700 55	5,572,602 39	

* No record of the export duty collected during these three years could be found. The figures given above have been computed from the monthly export and the rate of duty levied at the time.

TABLE GIVING YEARLY EXPORT OF TIN FROM THE WHOLE STATE FROM THE YEAR 1874 TO THE YEAR 1892.

Year.	Larut.	Kuala Kangsar.	Batang Padang.	Kinta.	Lower Perak.	Selama.	Kurau.	Bruas and Sungei Tinggi.	Total Export. In Pikuls.	Total Export. In Tons.	Year.
	Pkls. cts.	Pkls. cts.	Pkls. cts.	Pkls. cts.	Pkls. cts.	Pkls. cts.	Pkls. cts.	Pkls. cts.	Pkls. cts.	Tons.	
1874	11,035 42	...	...	...	...	...	...	...	11,035 42	702·6556	1874
1875	29,601 10	...	...	...	...	...	...	...	29,601 10	1,884·8495	1875
1876	30,576 28	...	...	...	7,347 82 *	...	...	...	37,924 10	2,414·8077	1876
1877	39,853 09	...	...	...	8,751 00 *	...	...	...	48,604 09	3,094·8692	1877
1878	46,172 79	...	...	...	11,823 00 *	...	...	...	57,995 79	3,692·8942	1878
1879	55,350 39	...	...	...	13,554 00 *	...	...	...	68,904 39	4,387·5010	1879
1880	69,928 03	560 11	1,800 00	14,738 32	...	1,116 91	...	...	88,143 37	5,612·5412	1880
1881	79,438 88	667 75	1,929 15	17,382 43	...	1,691 74	...	...	101,109 95	6,438·1988	1881
1882	95,437 80	2,259 80	2,066 32	19,143 08	...	2,497 36	3 00	4 85	121,412 21	7,730·9335	1882
1883	125,180 86	5,062 52	2,362 87	24,853 89	...	1,935 39	...	...	159,395 53	10,149·5070	1883
1884	126,999 43	6,985 28	2,425 85	33,572 42	...	1,213 69	...	5 87	171,202 54	10,901·0752	1884
1885	104,281 91	8,354 19	2,258 93	46,925 47	...	795 84	...	2 40	162,618 74	10,354·7333	1885
1886	93,972 48	24,510 64	2,061 03	63,367 11	...	729 54	...	...	184,640 80	11,757·0537	1886
1887	102,834 05	23,327 18	3,238 15	86,498 44	...	754 67	...	...	216,652 49	13,795·3570	1887
1888	102,289 39	11,645 59	3,738 15	100,179 06	...	986 48	...	...	218,838 67	13,934·6161	1888
1889	104,019 38	7,505 22	4,349 37	118,983 90	...	793 60	...	...	235,651 47	15,005·1206	1889
1890	95,336 18	5,727 47	5,411 93	130,185 43	...	496 95	...	...	237,157 96	15,101·0800	1890
1891	85,785 76	5,595 07	4,922 98	145,328 16	...	384 54	...	...	241,962 14	15,406·9781	1891
1892	71,973 83	7,805 47	5,465 82	192,671 06	88 47	249 93	...	...	278,254 58	17,717·9408	1892
	1,470,012 68	110,006 29	42,030 55	993,828 77	41,564 29	13,646 64	3 00	13 12	2,671,105 34	170,082·7125	

* The export from Lower Perak for the years 1876 to 1879 should be credited to Kinta, Batang Padang and Kuala Kangsar, probably in the ratio of the output for the year 1880.

These views may possibly be considered pessimistic by those who look on the rapid advance that mining has made in the past as an evidence of the capacity of the State to continue to progress in the same ratio in the future. But, as the tin-ore in the alluvium is a definite quantity, which is decreasing in direct proportion to the amount of mining carried on, it is obvious that the more rapidly the ore is dug up, the sooner it will be exhausted.

The prolongation of the present prosperity of Perak undoubtedly depends, in a great measure, on the future management of the mines. The better these are controlled and worked, the greater will be the aggregate output of tin, and, conversely, the worse they are worked the less will be raised. It is considered by many that it is a matter of no great moment whether the land is worked over well or ill in the first instance, and this is in a measure correct when shallow land is in question, but it is quite a different thing when the land is deep. The difficulties and expenses of opening up small pieces of deep land, surrounded by ground that has been worked, are so great as to be absolutely prohibitive.

The two following diagrams show graphically the facts given in the preceding tables. In Plate 4, the line A, representing the district of Kuala Kangsar, attains its maximum in 1886. The Kinta line B has not yet reached its highest point. It crossed the Larut line C in 1889. The latter district touched its highest point in 1884, and is now steadily declining. The line D, representing the annual export of the whole State, rises until 1884, and then falls in the next year in sympathy with Larut, but recovers again in 1886, owing to the increased export of Kinta and Kuala Kangsar. From then to the end of 1892 the rise is maintained by the increasing export of Kinta, as the other districts show decreases. The thick line E represents the mean annual export for this period of nineteen years, which is, in figures, 140,583½ pikuls or 8,951¾ tons.

The diagram, Plate 5, represents the total output of tin on the left-hand side; next, the comparative output from Larut; then Kinta, and, on the right-hand side, that of all the other tin-producing districts massed together. Speaking roughly, Larut has produced nearly nine-sixteenths and Kinta six-sixteenths of the total, while all the other districts have produced the remainder—*i.e.*, a little over one-sixteenth.

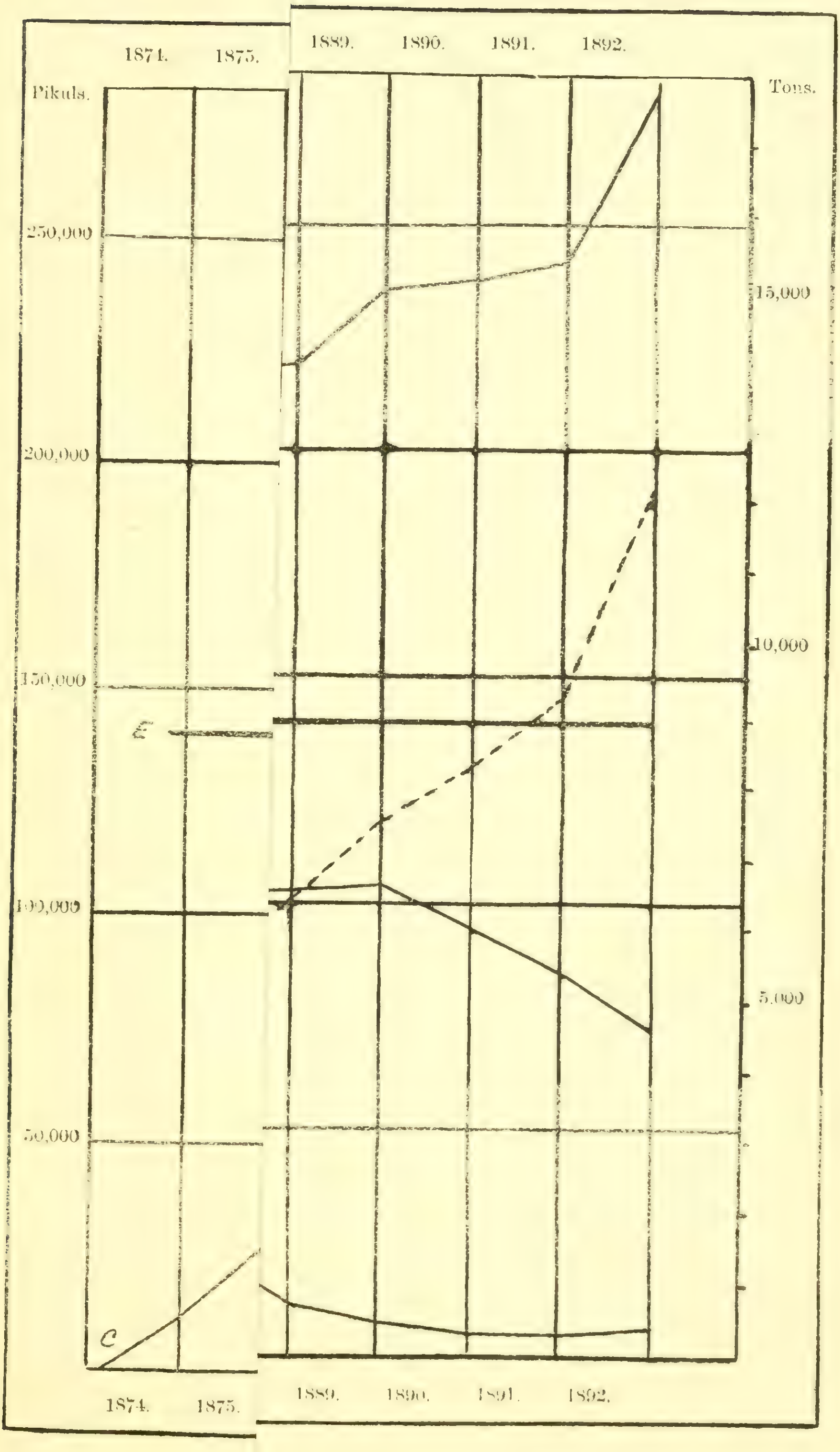
EXPLANATION OF PLATE 4.

Diagram showing the annual output of tin from the State of Perak from the year 1874 to the year 1892. A indicates the export from the Kuala Kangsar district. The dotted line B represents the output of the Kinta district. The line C, that of the Larut district, and the line D the export from the whole State. E represents the mean annual export.

EXPLANATION OF PLATE 5.

Diagram representing the total output of tin for the 19 years from 1874 to 1892 of the whole State of Perak, and the proportional output of Larut, Kinta, and the other mining districts, on a scale of one-fifth of a square inch to 10,000 pikuls.

Plate 4.



1874.
1875.
1889.
1890.
1891.
1892.
Pikuls.
Tons.
250,000
200,000
150,000
100,000
50,000
15,000
10,000
5,000
C

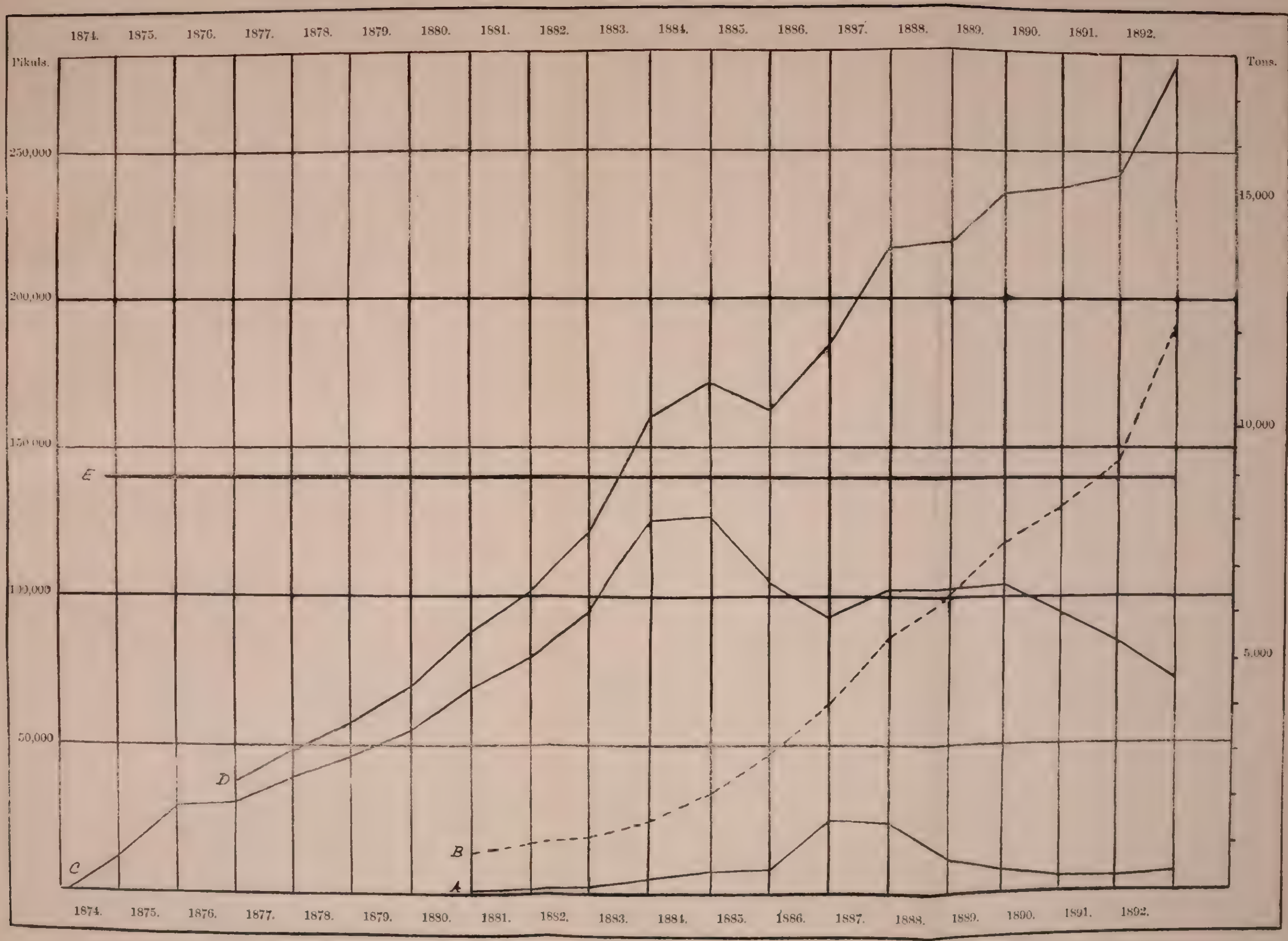


Diagram of the Annual Export of Tin from Perak.

Plate 5.

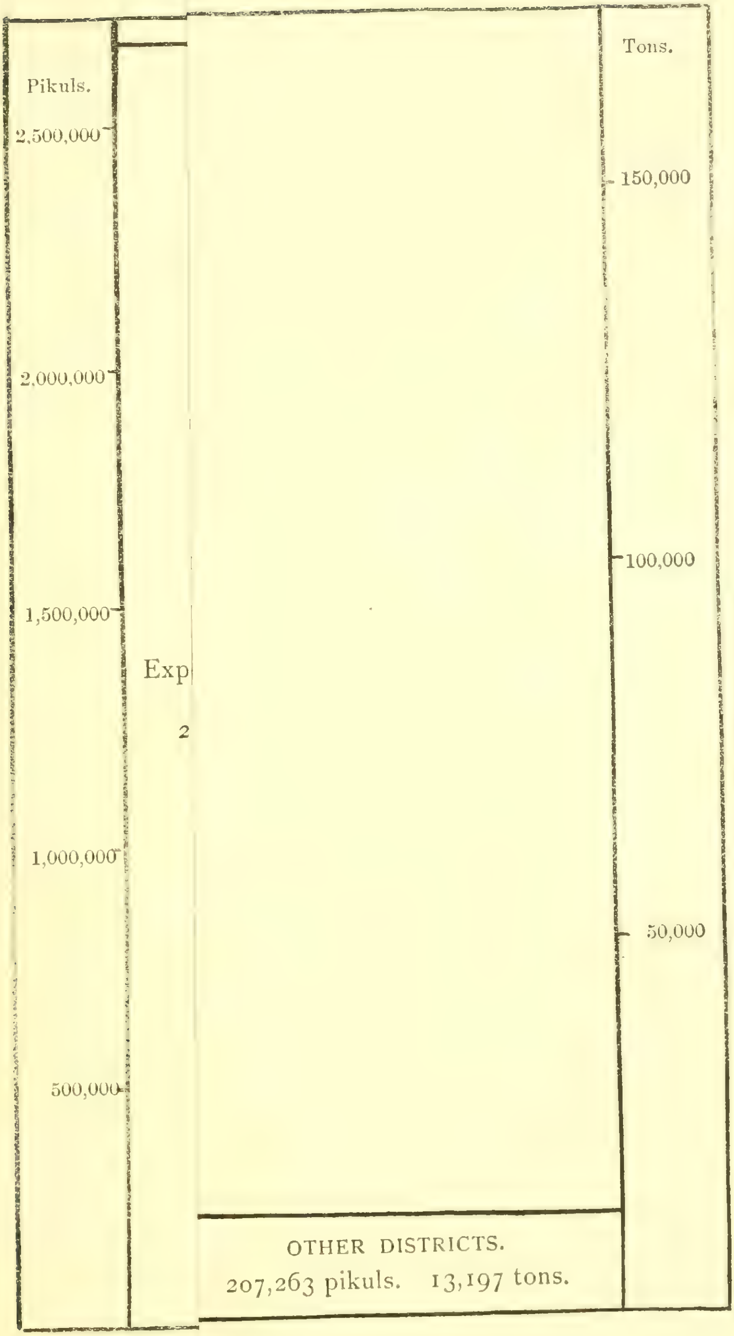

Pikuls.
2,500,000
2,000,000
1,500,000
1,000,000
500,000
Tons.
150,000
100,000
50,000
Exp
2
OTHER DISTRICTS.
207,263 pikuls. 13,197 tons.

Plate 5.

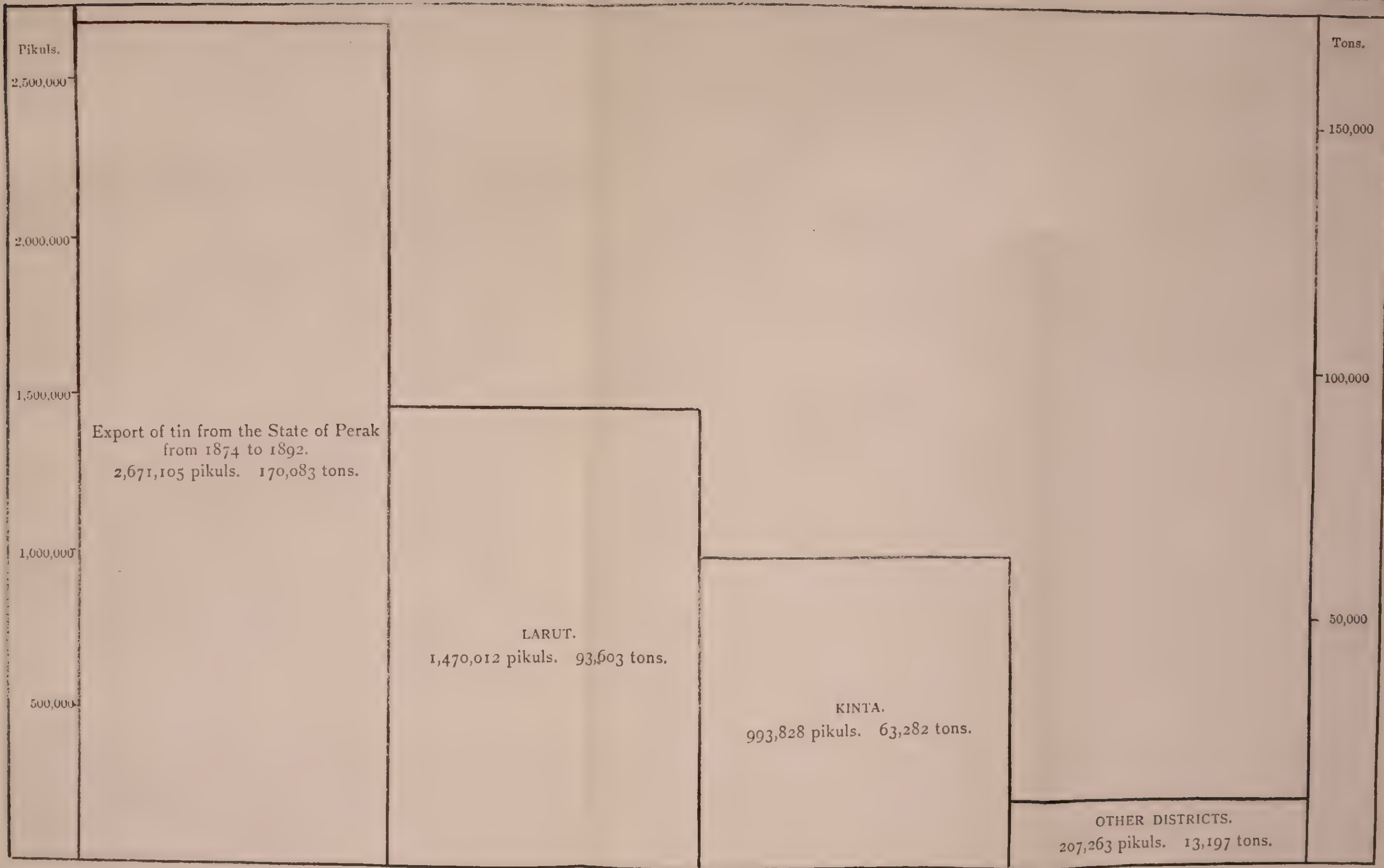


Diagram of the Export of Tin from Perak. Scale, one-fifth sq. in. to 10,000 pikuls.

CHAPTER II.

SKETCH OF THE GEOLOGY OF PERAK.

There are many interesting problems involved in the geology of the State which, unfortunately, at the present time there is insufficient data to solve; but leaving these debatable matters out of the question, the broad facts are very simple. There are in reality only four formations represented. These are—firstly, the granitic rocks; secondly, a large series of beds of gneiss, quartzite, schist, and sandstone, overlaid in many places by thick beds of crystalline limestone; thirdly, small sheets of trap-rock, and fourthly, river gravels and other quaternary deposits. The granites are of many varieties, and also, in all probability, of several different geological periods.*

The series of quartzites, schists and limestones are of great age, but as no fossils have ever been found in any of them, nothing definite can be stated as to their exact chronological position. Their lithological characteristics, and the total absence of all organic remains, point to the Archæan Period.† The failure to discover signs of life in them is, of course, merely negative evidence, and the finding of a single fossil would at once upset it. However, until this happens they may be conveniently classed as Laurentian. It is at present impossible to form anything approaching an accurate estimate of the thickness of this extensive series, but it is probable that it is somewhere between 4,000 and 5,000 feet. Unconformability has been noticed between the limestones and the beds beneath, but whether this is sufficient to separate them, or not, is a matter for future investigation.

In some places, on the top of the limestone, are small patches of heavy black trap, often vesicular in texture. It is evidently now only a remnant of what it once was, and is represented in many places by only a few scattered fragments; but the time which has elapsed since the deposition of the limestone is so great as to allow any amount of denudation to have taken place. It is a question whether the crystalline character of the limestones is not due to their having been flooded by a thick layer of incandescent trap.

The quaternary beds consist of old valley-gravels, newer clays, sands, peats and gravels, and, near the coast, fluviatile and marine deposits. They are composed of the detritus of the granitic and Laurentian formations, with, of course, a certain amount of organic matter, and, in Kinta, some slight admixture of decomposed trap-rock.

The interval of time represented by the position of the ancient archæan rocks and the modern alluvial beds lying on top of them is so immense that the question of what took place in Perak during all those countless ages naturally arises; but it can only be determined by a very much wider range of observations than have yet been made, extending

* The Rev. J. E. Tenison Woods expresses the opinion that the granite of the Bubu-Hijau-Inas range is a metamorphic sedimentary rock. (Vol. IX., Part 4, of the *Proceedings of the Linnæan Society of New South Wales.*)

† See the paper on "The Black Limestone at Kamuning," *Perak Museum Notes*, No. 1., pp. 28–29.

over the Peninsula and some of the adjacent islands. The interval is so great that many thousands of feet of rock may have been deposited and slowly washed away again. However this may be, it is sufficient here to state that no traces of any such beds have yet been discovered in Perak, and so, from the mining point of view, their previous existence or non-existence is a matter of no moment.

The period when the country assumed its present general configuration was, comparatively, quite recent. The eruption of the granite may very probably not have taken place at one time. There were most likely several successive eruptions, and between each the degradation of the granite itself and of the upturned edges of the beds of sedimentary rocks went on. All the present alluvial beds are of a date subsequent to the raising of the ranges of granitic hills, and if the suggestion already put forward, that the limestone was indurated by the molten trap-rock, is correct, then the eruption of the trap was anterior to the disturbance caused by the upheaval of the granitic. The peculiar forms of the edges of the limestone formation, the isolated position of small portions in places many miles from any other trace of it, and its fissured and shattered appearance, all seem to point to the conclusion that it was indurated prior to its being broken through by the granitic, and that the induration was uneven. According to this view the existing remains of the formation are those portions which in former times were subjected to the hardening action of the trap-rock, while all the unhardened parts have been washed away. Some of the outliers may have been indurated by direct contact with the granite: in the hill known as Gunong Pondok there are several granite dykes traversing the crystalline limestone of which the hill is composed, and at the end of the hill next to the granite range the two rocks are in contact. This action could only have taken place to a limited extent at the edges of the formation, as in other situations there are thick intervening beds of the non-calcareous members of the series, widely separating the limestone from the granite.

The taller hills are exclusively composed of granite, as are also some of the lower ones. The upturned Laurentian beds appear at the bases of the granitic ranges as spurs, or foot-hills, the limestone, in particular, forming most curious and picturesque hills, sometimes attaining a height of considerably over 2,000 feet.

A suitably chosen section across the Kinta valley would give, starting from the Meru range:—granite, gneissic and schistose beds, clay-slates and sandstones, limestone, remains of trap, alluvium, limestone, clay-slates and sandstones, schistose and gneissic beds, and lastly the granite of the central range of the Peninsula. Sections in other valleys would not be so perfect, as the limestone particularly is very fragmentary.

The ores of the following metals have been found in the different formations:—

Granite ...	Tin, lead, iron, arsenic, tungsten, titanium,
Laurentian ...	Tin, gold, lead, silver, iron, arsenic, copper, zinc, tungsten, manganese, bismuth.
Quaternary ...	Tin, gold, copper, tungsten, iron, titanium.

This is not to be considered a complete list, as small quantities of the ores of many other metals have also been found.

The metalliferous ores in the alluvial beds are naturally derived from the older formations, but are in many cases much more commercially important, because they are more accessible and easier to work. In the formation of these beds, Nature has done on a large scale what a miner does in a small way : she has crushed and ground to powder vast masses of rock, and by the action of water has sorted out and concentrated within restricted areas all the valuable constituents. The agencies employed were the same as we see now at work. Briefly, they are water, air and heat. The surface of the rock having been softened by the combined action of these three powerful destroyers, the rain detaches fragments and carries them in the streams down the hillside. In their descent, being thrown violently against the rocks of the bed of the stream, they chip off other fragments and themselves get gradually broken up, until on arrival at the level of the plains they are reduced to the state of sand and gravel. Here the heaviest particles deposit and the lighter gradually find their way far out on to the plain. This simple process continued for thousands of years wears away the hills and distributes their materials over the plains and at the bottom of the seas into which the waters ultimately flow.

The alluvial deposits themselves are also subjected to a somewhat analagous process. The floor of a valley formed of a thick deposit of alluvium will in time be lowered by the action of the stream flowing through it, and thus the first deposited matter will all be again shifted and sorted. Streams and rivers do not usually lower the level of the whole valley equally ; thus it comes that portions of the old alluvium are frequently left at the sides of the valleys, forming what are called river terraces. The excessive rainfall of Perak does not favour the formation of these river terraces, or, it would be more correct to say, it rapidly rounds them off, and the numerous tributaries which come in at such short distances from the hills on either side of the valleys cut them up and destroy their distinctive character ; but still, in many localities they may be recognised. They have taken in the past a curious and interesting part in filling the caves of some of the limestone hills with tin-bearing drift. Some of these caves are now over four hundred feet above the present level of the valley. They are worked for the tin contained in them ; and the remnants of some of the river terraces are also mined to a considerable extent.

From the foregoing it will be apparent that there are two distinct phases in the formation of alluvial valleys. Firstly, the filling in with the detritus of the hills, and secondly the sorting and partial carrying away of the deposit first formed. The two processes may be seen in operation sometimes in neighbouring valleys ; and to a certain extent, in the same valley, at different seasons of the year. Flooding is an essential of the filling-in process, and variations of rainfall therefore affect it ; but the alteration of the level of the lower part or outlet of a valley is the important determining factor between the two phases. The falling of a few trees, or the accumulation of some driftwood, will bank up a stream, and may cause it in a short time to deposit several feet of earth above the obstruction; while the breaking down of such a barrier, the cutting of a new channel by the stream, or other circumstances tending to lower it and prevent it flooding, may, on the other hand, cause a lowering of the surface of a valley to set in.

Some years back the filling-in process was going on to a considerable extent in some of the valleys at the foot of the hills between Papan and Lahat, in Kinta, where large stretches of standing dead forest were to be seen. This was caused by the silting up of the valleys and the raising of the level of the earth above what is called the crown of the trees. A layer of from one foot to eighteen inches of earth is sufficient to kill most jungle trees. The trees having been killed, rotted away and fell down branch by branch and trunk by trunk, further blocking up and impeding the flow of the streams and so increasing the amount of deposit. As soon as the deposition moderated, a fresh crop of trees would spring up, at a higher level than their predecessors, and in the course of years the same thing would happen again. It was in this way that the layers of peat and tree stumps were formed which are such characterstic features of all alluvial beds.

It is unnecessary to say more here on the subject of the occurrence of tin in these quaternary deposits, as it has already been sufficiently dealt with in *Alluvial Tin Prospecting,* (pages 1 to 3), the second number of this publication, while the minerals of the older rocks may be perhaps more conveniently treated in a subsequent chapter.

CHAPTER III.

OLD MINES AND NATIVE USES OF TIN.

In some of the old mines that have been discovered, implements have been found, but unfortunately they have not been preserved. At Lahat many old mines were opened out by the French Company, and most of them were said to be Siamese. In one an earthenware jar was found; this was, however, undoubtedly of Chinese manufacture. In a mine at Klian Bharu, in Batang Padang, a bronze figure of Buddha preaching was dug up, and is now in the Perak Museum. In the same district was also found a wooden shovel, said to be Siamese. It is 15 inches long, of which the handle is 6 inches. The shovel is nearly round, and has a raised rim round the upper part of it. There were trees of three feet diameter growing in this mine, so it is evidently a considerable time since it was worked, probably during the period from 1818 to 1826. At Kuala Kangsar, or rather Saiong, at a place called Gedong Siam, in Kinta, and other places, ingots of tin of the Siamese pattern have been found. . These are more or less boat-shaped, and many of them have a round hole running diagonally through them, which was formed by thrusting a taper stick into the yet fluid metal, after it had been poured out into the sand mould. On one of these ingots, which was found near Kuala Dipang, in Kinta, are some raised characters, which have been pronounced to be those used in Mergui in past times.

On the hill at Lahat there are a number of shafts from 20 to 30 feet deep and 7 or 8 feet in diameter. These pits are said by local tradition to be the work of the Siamese. It would appear that they were sunk down to the tin-bearing layer, which was then excavated as far as it could be with safety, without the use of timber. Having got out all the wash that could be raised without the sides of the shaft falling in, it was abandoned and another sunk near it, and the same process carried on. At the present time there is no trace of the enlargement at the base of the shafts, but the subsidence of the ground, which would take place in a few months after they were abandoned, would naturally have obliterated this.

Crawfurd, in his *History of the Indian Archipelago,* in describing the tin mines of Banka says: "The aboriginal natives follow still ruder processes. They mine in the form of a narrow cylindrical shaft, capable of admitting one person only, and, if the bed of ore be found productive, follow it, at the risk of their lives, under the alluvial strata, which often falls in upon them. They have no water-wheel, no aqueduct. To avoid the accumulation of water, they must always mine on the acclivities of elevated tracts, and for washing the mineral it must be conveyed, as it is extracted, to the nearest rivulet." This account, written seventy-three years ago, describes very accurately the method that must have been employed in Kinta at the time that these shafts were sunk on the Lahat hill.

Evidences of old Malay workings are everywhere to be found. The implements that have been brought to light in them are all like those now in use. The old Malayan ingots that have been dug up at different times are of many shapes, and a considerable amount of trouble has evidently been taken in forming some of the patterns from which they were cast, though some of the ingots have been simply formed by making a shallow depression in the casting-sand, into which the fluid metal has been poured. A common shape is a more or less conical cylinder, the upper part of which is six or eight sided, or decorated with a simple scallop pattern. Nearly cubical lumps of tin are also of frequent occurrence; they are slightly tapered to allow of the pattern being easily withdrawn from the casting-sand. Some very curious ingots were found in Lower Perak, and were presented to the Museum by Mr. N. Denison; some of these are of the same shape as the Pahang tin-money—that is, like the mortar used by the Malays for husking padi, only solid in the centre, and with four small projecting knobs on the bottom. Another form is an obtuse cone, broken up into eight sides by raised ridges running from the apex to the base. Some of these ingots were cast in piece-moulds, probably made of either baked clay or of a soft red stone which is now sometimes used for making the moulds in which are cast the tin chains that are attached to the circumference of cast-nets. Stone moulds have been found in Ireland, belonging to the Bronze Period, in which the bronze celts were cast, thus carrying back the use of this material far beyond historical times. Raised ridges are distinctly traceable on these ingots of tin, and mark the junctions of the separate portions of the piece-moulds in which they were cast. Piece-moulds are now never used in casting tin ingots—they are always cast in sand, from wooden patterns, both by the Malays and the Chinese.

These old ingots evidently passed as money, but it seems rather doubtful whether tin was ever coined in Perak as in Pahang, Kelantan, Leggai, and other of the Malay States on the eastern side of the Peninsula. Crawfurd, in the *History of the Indian Archipelago,* says, "In the countries which produce tin, this metal seems naturally enough to have been had recourse to as coin. A few coins of it are occasionally found in Java, and the *pichis*, a tin coin, still forms [1820] the small currency of several States, as Palenbang, Achin, Bantam, Cheribon and Queda. The pichis are small irregular lamina, with a hole in the middle for the convenience of being strung. Five thousand six hundred of these minute coin are considered equal to a Spanish dollar."

The use of tin as coin has had a wide range. In England in the time of James II. it was in circulation, while, according to Dêsirè Charnay, *(North American Review, 1880)* the ancient inhabitants of Mexico had coins of tin shaped like the letter T, besides round ones.

The purposes to which tin is applied by the Malays are very limited. They make, or rather used to make, oil lamps of it, and an old tin fire-syringe is in the Perak Museum collection. It is employed for cast-net chains and bullets, and occasionally for the mountings of walking-sticks. Grotesque representations of crocodiles, elephants, tortoises, and other animals are cast in tin. Bronze, the alloy of copper and tin, is used for the swivel and other guns, and for the Malayan gongs.

Mention has already been made of the use of bronze for the earliest forms of metal weapons and cutting instruments. This use of the alloy still survives in Malaya. Spear-heads, kris blades, *tumba ladas* and other weapons are even now sometimes to be met with.* It is rather an interesting survival, as in all, or nearly all, other parts of the world bronze has long ceased to be employed for this purpose, having been superseded by the more easily worked and cheaper iron and steel. Other equally interesting survivals from very remote times are to be met with in Malaya, of which the pottery of Perak and the neighbouring States, made without a potter's wheel, may be cited as a striking example.

(To be continued.)

* A bronze spear and tumba lada are in the Museum collection, and a bronze kris in that of the writer, all collected in the State.

SOME NOTES ON THE PADI INDUSTRY OF KRIAN, WITH A SHORT DESCRIPTION OF SOME OF THE PRINCIPAL VARIETIES GROWN THERE.*

By H. W. Chambré Leech, LL.D., C.E., B.L.

Padi and sugar growing are the principal, I may say the sole, industries of Krian, the northern district of Perak, a flat alluvial plain raised but a few feet above the sea.

There are many varieties of padi grown in Krian, and I have selected twenty of the most distinctive; but before proceeding to describe them, a short account of the method of cultivation, etc., may prove interesting.

When the wet season begins, generally early in September, the first thing done is to plant the nurseries. For this a small patch of ground a few yards square is carefully cleared and the grain scattered on it broadcast, so thickly as to nearly hide the earth. With the early rains this germinates in a few days, but in the meantime birds, rats and insects have levied a heavy tax on it. In about a month or six weeks the young plants are from a foot to eighteen inches high and ready for transplanting. While the nurseries are coming on, the land is prepared. As soon as the rains set in and flood the land, the weeds and grass, which have grown two or three feet high since the last harvest, are cut down with an instrument called a *tajak,* which may be described as a straight scythe with a heavy blade about fifteen inches long, with which the roots of the grass and weeds are chopped rather than cut. After being left to rot for some time on the land, these weeds are dragged with large rakes into heaps and are then formed into ridges or banks dividing the whole country into a number of little fields, varying in size from a few poles to an acre or more in extent. By the aid of these banks the planters are enabled to regulate the water, letting it flow from one field to another.

In some places—the centre and north of Province Wellesley and S'tiawan, for example—where the land is stiffer, it is necessary to plough it, but whenever I suggested ploughing to the padi planters in Krian I was told that it would increase the growth of the straw at the expense of the grain.

When the fields are prepared and the nursery plants sufficiently grown, the women begin planting out. Hitherto all the work has been done by the men, but the women alone do the transplanting. For this they use an instrument called a *kuku kambing* كوكو كمبيغ (goat's toe), which con-

* The following notes were originally prepared to accompany some exhibits for the Indian and Colonial Exhibition of 1886, and have been re-written for *Museum Notes.*

sists of an iron rod about two feet long with a crutch handle of wood at one end and a cleft at the other. The woman takes a padi plant from a bundle tied up in her apron and inserts it just above the roots into the cleft of the kuku kambing with one hand, and with the other thrusts it into the ground. The rapidity and regularity with which they set these plants, about eight inches apart, is simply marvellous. At a distance they appear to be simply sauntering up and down the field.

As I will mention when I come to describe the varieties of padi, some mature very quickly; others, again, are very slow growing. The slower the growth the heavier the grain, and therefore the more highly prized. Floods or drought, however, occasionally destroy the early nurseries, and then others of lighter grain have to be planted, which will mature before the wet season is over. I shall never forget on one occasion some years ago riding from Bagan Tiang to Kuala Kurau, about ten miles, and being particularly struck by the magnificent display of padi nurseries the whole way along the road. A fortnight after I rode over the same road and there was not a plant left: they had all been destroyed in the meantime by a flood. I made careful enquiries at the time to enable me to form an estimate of the value of the damage done, and over $10,000 was the amount arrived at.

The larger proportion of the padi planters are non-resident. They live on the island of Penang and along the coast of Province Wellesley, as far as the north of Kedah, and go to Krian to plant their padi, and when that is done return to their homes till the crop is ready to be cut, some members of the family occasionally visiting it to see that it is all right.

The enemies of padi are numerous, but the principal ones are rats and the padi-borer. In newly opened land near jungle, or if patches of uncultivated land are left to harbour rats, they are very destructive to the young crop, eating the shoot just above the ground. I have seen acres of padi that have been destroyed in this way in a single night. Traps, poison, and, best of all, the simultaneous clearing and planting of large areas are the best preventives against rats. Plaster-of-Paris is a favourite poison. Green grasshoppers, which are very plentiful, are caught and stuffed with the plaster-of-Paris and left about for the rats to eat, and the saying is, "one grasshopper one rat."

The padi-borer at one time practically ruined the entire crop of the district, but since then the Government has spent a good deal of money in drains and water-gates, by means of which the drainage is under better control and the land is not allowed to get into the sour, sodden condition that appears most favourable for the increase of this pest. Its attacks are apparent about the time the ear is forming. The moth lays its eggs on the stem, and when they hatch the maggot bores into the straw, which rapidly turns yellow and dies. To a casual observer the corn will appear ripe, but on examination it will be found that there is no grain in the ear.*

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* This insect is either *Chilo oryzaellus* or a nearly allied species. See "Report on the Padi-Borer," No. 19, *Journal of the Straits Branch of the Royal Asiatic Society*, 1887, and *Indian Museum Notes*, Vol. 2. p. 19, 1891. It was suggested in the first report that some

When the crop is ripe the district presents a very lively appearance, as harvesters flock in from all sides. It often happens that in a good padi season cholera is rife, the excess population arriving at a time when the weather is unusually hot, and water—obtained from surface wells—is scarce and bad, frequently brackish, and teeming with organic matter, naturally favours the development of cholera.

The grain alone is harvested, the straw being left to rot on the land. This, no doubt, to some extent explains how it is that the same land goes on apparently indefinitely yielding equally good crops of padi without a particle of manure. The reaping and threshing is of a most primitive nature. In the centre of the field a tub without top or bottom, about five feet in diameter and four feet high, made of the bark of a tree, is placed on a mat. The reaper, with a short hooked knife that answers to a sickle, cuts a handful of corn and takes it to the tub, where he beats it over the edge until all the grain falls in.

Every here and there along the roads in the padi districts Chinese shops are to be met with, from which the padi planters obtain their stores on credit and pay in grain when the crop is cut. In addition to this, the shop-keepers buy the padi in advance, and they sell it as rice. Before the harvest begins, the shop-keeper engages three or four Sin-kehs (contract coolies) who have to work for him for a year for their food. The year of servitude is spent husking padi. A hammer with a heavy wooden or stone head falls into a wooden mortar in which the padi is put; this hammer works on a pivot through what may be called the centre of the handle. The Sin-keh raises the head by stepping on the other end of the handle and when he releases it the head falls on the padi in the mortar. As the Sin-keh lives on the rice he pounds, and fish, which (so near the sea) is very cheap, the cost of husking the padi does not come to much. It would be well, therefore, for any one thinking of starting a steam rice mill in this district to bear this in mind.

For 100 gantangs (12½ bushels) delivered at the shop, $2.50 to $3 will be paid at the time of planting. At the harvest time padi used to be worth (in 1886) about $6 or $7 per kuncha (160 gantangs or 20 bushels); the dollar was then about 3*s.* 8*d.*—*i.e.*, padi was worth about 1*s.* 6*d.* per bushel. I am told that now, with the dollar at 2*s.* 6*d.*, it is worth $9.50 a kuncha,—*i.e.*, 23*s.* 9*d.* per 20 bushels, or 1*s.* 2*d.* a bushel, but these prices constantly change with the market in Penang.

It is not generally known that the different varieties of rice have distinctly different flavours, and that, at any rate in padi districts, it is the ambition of well-to-do people to have a large variety in stock, one to eat with sweets, another with curries, etc., and that it is, in their opinion,

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other plant might serve as food for this pest between one padi season and the next, and this surmise has been found to be correct. The plant—or at least one of them, for there may be others as yet undiscovered—is the Indian corn, and the part attacked is the flower stalk. As many as five caterpillars are sometimes found to be present in a single stalk. The effect on the plant is slight, the flower-head merely withers up before coming to maturity. The insect does not seem to attack the larger stalks, and so does not injure the crop materially, but nevertheless the subject is of importance, as without some food-plant or plants the padi-borer could not survive from one season to the next, and the removal of the food-plant or plants would consequently mean the extinction of the pest.—L.W.

only persons utterly devoid of palate who would eat, say, a pulut rice, suitable to be served with durian preserve, with curry.

The following description of the different sorts of padi was taken down *verbatim* from a number of headmen who procured for me samples of the padi described, but any one accustomed to take down statements from any peasantry knows how inaccurate they are when anything like exact data is sought for. For the exactness of the following particulars, therefore, I am not prepared to vouch; they may, however, be taken as the opinions of some of the more intelligent of the people engaged in padi growing and whose lives have been devoted to it. An almost limitless list might be prepared like the following, but it would be of little practical use, as many of the names are very local, and a few miles away the same padi may be grown under another name.

There are two species of padi grown by the Malays—the one, ordinary rice, Padi Jawei *(Oryza Sativa)* the other, Pulut *(Oryza Glutinosa)*; of these, I will describe ten each.

PADI JAWEI *(Oryza Sativa.)*

I. Padi Arong. فادي اروڠ

Sea padi. Is said to have come from China: hence, probably, the name, like the now almost forgotten name "sea-coal." It prefers a dry soil—that is, by comparison—as all the samples enumerated are grown in water, unlike the dry padi, which is grown on hilly or undulating ground.

The yield is about 400 or 500 gantangs to an orlong (37 to 47 bushels to the acre). Grows about five feet high, and takes some four months to mature, hence is often planted when the nurseries of some other heavier varieties have failed. This is rather a fancy padi, is the sort commonly chosen for presents, and fetches a comparatively high price.

II. Padi Duri Pandan. دوري فندان

From *duri*, a thorn, the end of the grain being pointed like a thorn, and *pandan* (a species of *mengkuang)*, the leaves of which are used as a flavouring in certain dishes. The taste and smell of this padi when cooked is not unlike that of the pandan.

Like the last, this is a fancy padi, in great requisition on festive occasions. The husk is yellow, the grain very white, long and thin, and soft when cooked. The straw grows about five feet long. Each stool will average from 30 to 35 stems. It is a slow grower, taking about seven months to mature. In a good year it will yield as much as 900 gantangs to an orlong (84½ bushels to an acre.)

III. Padi Mayang S'kupol. فادي مايڠ سکفول

Mayang is the blossom of the palms—coconut, areca-nut, etc.; *s'kupol (satu kupol)*, one handful. Two explanations are given for the name. The one, that a single ear will yield a handful; the other, that when first introduced into Krian from Siam a single handful was all that was brought. The flowers of the palms lie very close together, as do the grains in the ear of this padi. Being a very prolific padi, it is a favourite with the Chinese padi planters. The straw is white and thin; about 30 stems to a stool. The grain is rather long, thin, and pointed at both ends. The rice is rather sticky. It matures in less than six months, and under favourable circumstances will yield as much as 1,000 gantangs to the orlong (94 bushels to the acre.)

IV. Padi Radin. فادي رادين

Royal or Raja's padi, from *radin*, a Javanese word for raja. This is one of the most favourite of the padis. It is very heavy, and will bear the vicissitudes of the weather better than any other variety, hence is probably more extensively grown than any other. The husk is yellow and the rice white. There is nothing particularly remarkable about its flavour, but it is one of the very few varieties of rice which Malays consider fit to be eaten cold. It is a good ordinary rice for daily consumption. The grain is similar in appearance to the *padi mayang s'kupol*, but is longer and thinner; like it, it is very prolific, and has been known to yield in good seasons as much as 1,000 to 1,100 gantangs to the orlong (94 to 103 bushels to the acre.) It matures in about six months.

V. Padi Mĕlor Susun. فادي ملور سوسون

Flowers of the double *mĕlor* (jasmine). So called, it is said, from a supposed resemblance of the ear to the flower. The grains grow closer together on the stem than in any other variety. *(See III. Padi Mayang S'kupol).* The colour of the rice is white, and it has an agreeable taste and smell; but its shape is against it, being short and thick. It is usually eaten with santan, the juice expressed from the fruit of the coconut, or with rich luscious fruits, such as durian or jack. The plant is very large, having as many as 40 or 50 stems to a single stool. It does not grow tall—under four feet. The average yield in a good season is about 700 to 800 gantangs to the orlong (66 to 75 bushels to the acre). It matures in from five to six months.

VI. Padi Itam. فادي هيتم

So called from the dark-brown colour of the husk. The rice being hard is against it. The straw grows to over five feet long, and becomes white as it ripens. There are from 20 to 25 stems to a stool. Is rather prolific, yielding 800 gantangs, or, in exceptionally good years, as much as 1,000 gantangs, to the orlong (75 to 94 bushels to the acre). Being a slow grower (taking some seven months to mature) it is a very heavy, and is considered a very nutritious, grain.

VII. Padi Si Antah. فادي سي انته

Antah is the padi remaining in rice after pounding, the reason for the name being that this rice is very hard to husk and it is almost impossible to get the rice quite clean, some *antah* nearly always remaining in it.

This is one of the padis said to have been grown by the Sakais (the aboriginal inhabitants of the country), and is rather despised, the grain being short, hard and gritty. Its colour is also against it, being darkish or ash-coloured, and the proportion of chaff to grain is excessive. As a rule, a gantang of padi will produce half a gantang of rice, but in this variety only about 4½ gantangs of rice will be obtained from 10 gantangs of padi. Its recommendations are—being rather prolific, yielding 800 to 900 gantangs to an orlong (75 to 84½ bushels to an acre), and in being very hardy; it seldom fails. It is therefore often spoken of as the poor man's padi—a poor man in this case meaning a new settler who has not had time to lay in a stock of fancy rice. Taking about seven months to mature, it is rather a heavy padi.

VIII. Padi Sakai. فادي ساكي

So called after the Sakais, from whom it is said to have been obtained. The grain is large and short. The husk having a ruddy colour is considered to be a disadvantage. When cooked, however, it has a peculiar smell (mousy), which is much esteemed. This smell is more or less common to all newly harvested rice, but this variety has it in excess. It is a favourite rice for daily use. The yield is about 600 gantangs to the orlong (56 bushels to an acre). It takes about six months to mature. A remarkable point about it is the thickness of the straw, which the Malays say is as thick as one's thumb—a very small thumb. It averages about 15 stems to the stool.

IX. Padi Burong. فادي بوروغ

Bird padi. So called as it is considered the best padi to feed pigeons or doves on. Is said to have come from Siam. At one time it was a great favourite, but has gone out of fashion. The grain is small, nearly round, hard, and dry. It does not grow much over three feet high. Takes about five months to mature, and yields from 500 to 600 gantangs to the orlong (47 to 56 bushels to the acre.)

X. Padi Bunga Machang or Padi Kuda. فادي بوڠا ماچڠ اتو فادي كودا

Horse mango padi, so called by the Malays, as it is thought to go best with that fruit. By the Chinese generally spoken of as horse padi (*padi kuda*), being considered specially suitable for feeding horses. It is essentially a poor man's padi, and is not eaten when any other is procurable. The grain is short, thick, and hard. It is the most prolific of the padis, yielding as much as 1,200, and never less than 600 or 700, gantangs to the orlong (112, 56 or 66 bushels to the acre). The straw is very long—over seven feet. It takes longer to mature—nearly nine months; is the heaviest, and therefore probably the most nutritious, although it fetches the lowest price in the market.

PULUT. (*Oryza Glutinosa.*)

I will now describe some of the varieties of Pulut rice. This, Mr. Wray tells me, is a different species, and never finds its way into the European markets. After being husked, it will not keep more than a few days without getting maggots in it. As a rule it is more soft and gelatinous that the Jawei. By the local Malays it is said to be too heating for ordinary use, although the Javanese have no objection to using it constantly. Usually it is reserved for cakes, sweets etc., while the Jawei is used for ordinary consumption.

I. Pulut Serbok Mas. فولوة سربوق مس

Gold-dust pulut. So called from the colour of the grain. It is a great favourite, but is very delicate, as it will not do on dry ground and a very little too much water kills it, consequently it is but little cultivated. It is used for making cakes, and is eaten with milk, but is not suitable for curries. The yield is small, about 400 gantangs to an orlong (38 bushels to the acre). Matures in about four months.

II. Pulut Jarum Mas. فولوة جاروم مس

Gold-needle pulut. So called from the colour and shape of the grain, which is yellow and pointed. Like the last, it is much prized, and is also a very delicate crop. It is remarkable for the length of the ear. It is usually eaten with sweets or made into cakes, but will go with anything. The rice is very white—"like ants' eggs," I was told. The straw is thick, and grows to over five feet high. The average crop is about 500 gantangs, but as many as 800 have been got off an orlong (47 to 75 bushels per acre). Matures in from four to five months.

III. Pulut Itam. فولوة هيتم

Black pulut, the chaff being nearly black. When cooked, the rice is also dark coloured. All the puluts are glutinous, but this is more so than any other. It is supposed to have curative properties in pulmonary complaints. For this purpose it is made into pills with the yolk of an egg, or honey, having been first roasted until it is brown, and then ground into flour. Drinking the water in which it has been boiled is another way in which it is prescribed. The plant is small, has but few stems to the stool, and yields about 200 to 300 gantangs to the orlong (19 to 25½ bushels to the acre). In limited quantities it fetches a higher price than any other.

IV. Pulut Galah. فولوة ݢاله

Galah is the pole used in poling a boat. Three derivations are given, any or all of which may be correct. One, from the length of the grain; the other, because it is pointed at both ends; the third, from the length of the straw. The smell (mousy), which I have before alluded to, is stronger in this than in most of the other puluts. After being cooked, the grain has a peculiar glossy look, which is much admired: the colour, slightly reddish, is not good, but as it is usually eaten with santan, which is particularly white, this is not of much consequence. The plants are small—not more than 12 or 13 stems to a stool—but the straw is very long, often over six feet. Yield, about 300 to 400 gantangs to the orlong (25½ to 37½ bushels to the acre.) Takes about four months to mature. It is considered the best of the puluts.

V. Pulut Soh. فولوة سوق

One hasta pulut. *Soh* is an abbreviation for *satu hasta,* the length from the elbow to the tip of the middle finger. This pulut, which is so called from the extraordinary length of the ear, is supposed to have come from Siam. It is so soft that unless great care is taken in boiling it, it will become one mass. It is generally used with rich curries or preserves. The average crop is 400 to 500 gantangs to the orlong (27½ to 47 bushels to the acre). It takes about six months to mature.

VI. Pulut Kajang. ڤولوة كاجڠ

Kajang is a sort of mat used for temporary roofs, awnings, etc., made from the leaves of the nipah palm, and which in colour—a straw colour with a dark grey tinge through it—the ripe grain resembles.

Pulut Kajang is the heaviest of the puluts, and in this respect is more like Padi Jawei than any other. It is not a favourite, being too sticky. It is generally used for making *imping*, parched corn, used when travelling or where it is not convenient to cook—*e.g.*, on the pilgrimage to Mecca: query, was it the same as used by the Israelites in preparing their parched corn when the manna gave out? The following is the recipe. If dry, it is first soaked in water to soften it; if fresh, this is not necessary. Roast in a pan, a small quantity at a time, until it begins to jump, then beat in a mortar while still hot until the grains are flattened out to about the size of a 5-cent piece. After this, the chaff is winnowed off, and the imping is ready for use. It is usually eaten with milk, condensed being preferred. Imping is made from the other puluts, but pulut kajang is the best for it.

The yield is from 200 to 300 gantangs to the orlong, or in very good seasons as much as 500 (19 to $25\frac{1}{2}$ or 47 bushels to the acre). It takes nearly six months to mature.

VII. Pulut Telor. ڤولوة تلور

Egg pulut, the grain being short and stout, something like a miniature egg. It is not much thought of as rice, but from its extreme whiteness Chinese women fancy the flour made from it for making cakes of. Yield, about 600 gantangs to an orlong (56 bushels to an acre).

VIII. Pulut Minyak. ڤولوة مينيق

Oily pulut, the rice having on oily look when cooked. The husk is red, but the rice white. The straw is about four feet long, and there are about 25 stalks to a stool. The best way of cooking it is first to steep and then steam it. Usually eaten with sugar and santan, but may also be eaten with curry, etc., as an ordinary rice. Yields about 600 gantangs to the orlong (56 bushels to the acre). Takes about seven months to mature.

IX. Pulut Jangkar Ara. ڤولوة جڠكر ارا

Jangkar Ara, spread of the fig tree. It grows in a straggling way, as do the fig trees, and not as upright as ordinary padi does. Is supposed to have been one of the Sakai puluts. It is remarkable for its extreme softness and is grown for the sake of having a variety. Yields about 500 gantangs to the orlong (47 bushels to the acre), and takes about seven months to mature.

X. Pulut Tangki Mas. ڤولوة تڠكي مس

Golden stem. So called from the colour of the straw when ripe, which grows to as much as six feet long. For a pulut it is very prolific, yielding as much as 700 gantangs to the orlong (66 bushels to the acre). It takes some seven months to mature, and is used as na ordinary rice.

SOME OBSERVATIONS ON THE HEIGHT AND EYESIGHT OF THE WILD TRIBES OF PERAK.

BY L. WRAY, JUN.

The information here recorded was obtained at different times and in different places, and as no sort of selection was made of the subjects measured or tested, it is believed that the results may be taken as fairly representative of the height and powers of sight of these tribes.

HEIGHT.

Sakais.—These people are often called dwarfs and pigmies, but it is doubtful how far these names are appropriate to a race whose mean height is only about seven inches less than the average height of Englishmen and less than four inches shorter than an average Frenchman.*

In the following tables, the Sakais named as coming from Kuala Dipang belonged to the large tribe of which Toh Sang, of Batu Pipis, is the acknowledged chief. The Batang Padang men were from Cheroh, near Tapah, and from the Ulus of the Batang Padang and Woh. The ages given were estimated at the time, as they have no idea of their own ages.

Sakai of	Sex.	Age.	Height.		Span of arms.		Chest measure.
			ft.	in.	ft.	in.	in.
Batang Padang	Male	25	5	4½	5	6½	32
,, ...	,,	18	5	4	5	4½	31
,, ...	,,	30	5	3½	5	3½	32½
,, ...	,,	30	5	3½	5	6	—
,, ...	,,	35	5	2½	5	2	—
,, ...	,,	35	5	2¼	5	5½	—
,, ...	,,	30	5	2	5	5	—
Kuala Dipang	,,	22	5	2	5	5	—
Batang Padang	,,	18	5	1½	5	1	30½
,, ...	,,	30	5	1½	5	4	33
,, ...	,,	25	5	1½	5	2	33
,, ...	,,	20	5	1	5	1	—
,, ...	,,	40	5	1	5	4	—
,, ...	,,	40	5	0½	5	0¾	31
,, ...	,,	25	5	0½	5	1¼	34
,, ...	,,	35	5	0½	5	2½	30
,, ...	,,	25	5	0½	5	2	29

* General Faidherbe gives the average stature of French Carabineers as 1·65 metres or 5 feet 4¾ inches.

Sakai of	Sex.	Age.	Height.		Span of arms.		Chest measure.
			ft.	in.	ft.	in.	in.
Batang Padang	Male	16	5	0	5	2	29
,, ...	,,	35	5	0	5	3	31
Kuala Dipang	,,	25	5	0	5	3	—
,, ...	,,	22	5	0	5	1	—
,, ...	,,	20	4	11¾	5	0½	—
Batang Padang	,,	35	4	11½	4	11½	30
,, ...	,,	20	4	11½	5	0½	32
,, ...	,,	18	4	11	5	2	—
Kuala Dipang	,,	40	4	10¾	5	1¼	—
Batang Padang	,,	20	4	10	5	0	30
Kuala Dipang	Female	22	4	9½	5	0½	—
,, ...	,,	20	4	9¼	5	1	—
,, ...	Male	25	4	9¼	4	9	—
Batang Padang	,,	40	4	9	4	8¾	29¾
Kuala Dipang	,,	28	4	8½	4	11½	—
,, ...	Female	18	4	8½	4	9	—
,, ...	,,	50	4	7½	4	11	—
,, ...	,,	17	4	5	4	5	—

By these figures it will be seen that the average height of the thirty male Sakais is 5 feet 0·93 inches, or (say) 5 feet 1 inch; that the tallest is 5 feet 4½ inches, and the shortest 4 feet 8½ inches. The average chest measurement of 16 men is 31·04, the range being from 29 to 34 inches.

The average height of the five women is 4 feet 7·95 inches, or (say) 4 feet 8 inches, the tallest being 4 feet 9½ inches, and the shortest 4 feet 5 inches. There is therefore a difference of five inches in height between the sexes. This is nearly the same proportional difference as in England; that is, prior to the recent extraordinary increase in height of English girls of the better classes.

Wallace, in *The Malay Archipelago*, page 590, gives the average height of the Malays as 5 feet 2 inches to 5 feet 4 inches, while Professor A. H. Keane, in *A Geography of the Malay Peninsula, Indo-China, the Eastern Archipelago, the Philippines and New Guinea*, page 8, says the Malay " is described by competent observers as of low stature, averaging little over 5 feet." The average Malay is therefore, according to these authorities, little taller than the Sakai.

It will be noticed that the span of the arms, in both males and females, is rather greater than the height in the majority of cases. The mean span for the 30 men is 5 feet 2·08 inches, giving an excess of 1·15 inches above the mean height, or, in other words, an excess of one-fifty-third of the height. The five women show a greater length of arm. In their case the mean span is 4 feet 10·10 inches, which is greater by 2·15 inches than the average height; this gives one-twenty-sixth as the excess.

Semangs.—The following measurements were taken of dwellers in the Piah Valley, in Upper Perak.

Semang of	Sex.	Age.	Height.		Span of arms.		Chest measure.
			ft.	in.	ft.	in.	in.
Piah Valley...	Male	25	5	2½	5	4¼	36
"	"	40	5	2	5	3½	—
"	"	45	5	2	5	0¾	—
"	"	50	5	2	5	4½	—
"	"	20	5	2	5	2½	—
"	"	20	5	1½	5	4	—
"	"	30	5	1¼	5	4¼	33
"	"	25	5	1	5	2¼	—
"	Female	20	4	10¾	4	8½	—

These figures give an average for the eight men of 5 feet 1¾ inches, the tallest being 5 feet 2½ inches and the shortest 5 feet 1 inch, with a variation of 1½ inches only. The two chest measurements were 36 and 33 inches, and the corresponding hip measurements of these two men were 31½ and 31 inches respectively. These chest measurements are not to be taken as representative, as both men were exceptionally well-built.

Like the Sakais, the span of the outstretched arms is also greater than the height. The mean span is 5 feet 3·28 inches, being 1·43 inches more than the mean height, while the excess of the span over height is one-forty-third of the height.

Only one woman was measured, and she was rather taller than the tallest of the Sakai women.

The variation in the stature of the male Semangs is much less than amongst the Sakais. This uniformity of height is a thing that strikes any one at once. The same thing is recorded by Mr. Mann of the Andamese. The averages given by the above measurements seem to indicate that the Semangs are a slightly taller race than the Sakais, but more extended observations are necessary before this point can be established.

SIGHT.

These observations were taken with the test-spots used in the British Army. They are square black spots measuring one-fifth of an inch and are spaced at distances of one-fifth of an inch from one another. The black spots are most conveniently placed in the centre of 4-inch square pieces of white cardboard, each card having a different number or arrangement of spots on it, the numbers running from 2 up to 6. The spots occupy the central square-inch of each card, and there are in the pack that was used twenty-three cards in all. These cards are easy to make; all that is required is to cut the card up into 4-inch squares, then rule the central inch, in pencil, up into fifths of an inch, take some Indian ink and a paint brush and paint in, say, four of the squares, leaving a blank space between each; then take another and do the same, but arrange the four spots in a different pattern. It is an object to have as many arrangements of each number as possible, otherwise the pattern is recognised and the number of dots inferred though they cannot be individually counted. A few examples of these spots are given in this paper.

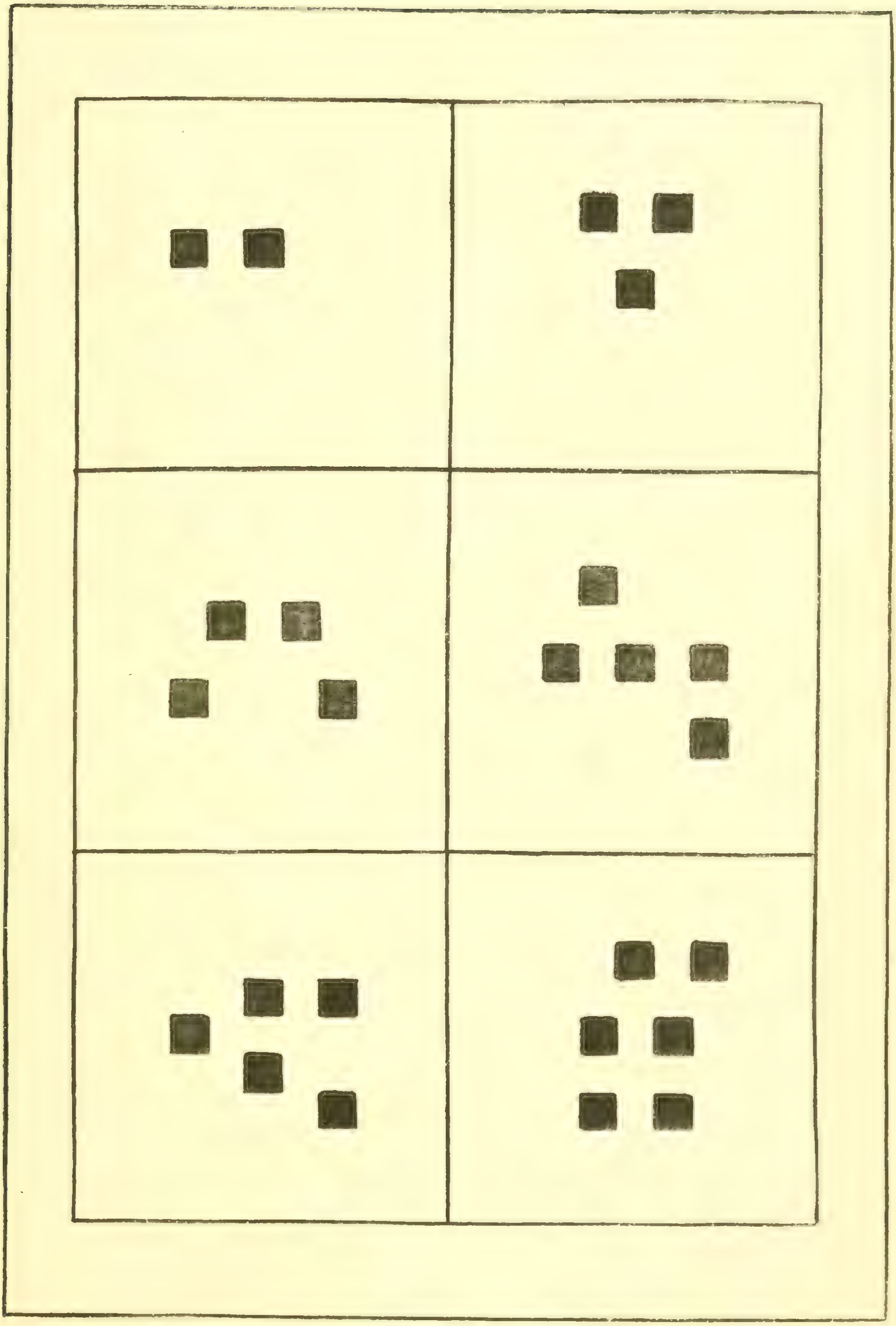
The way to use these cards is to take a measuring tape, a hundred-foot one if possible, and lay it out on the ground, put a peg into the ground at the one-foot end and place the person whose sight is to be tested at the peg, then go to (say) the 50-feet mark and hold up a card. If the man can count the spots correctly, go five or six feet further and try again, until a point is arrived at where he can no longer make them out; then try back again, going only six inches at a time, until the exact distance is determined. It will be found that a foot, or even half that distance, will make all the difference between being able to count them correctly and hopelessly failing.

These details are given here in the hope that others who have the opportunity may be able to take tests, not only of the wild tribes but of other races as well. These observations, if made with the standard test-spots, are always comparable with the large mass of statistics which have been accumulated by English observers in all parts of the world, and are always of interest.

Sakais.—Considerable difficulty was experienced with some of the Sakais, particularly the women, owing to their being unable to count above three or four. This was overcome by the use of matches, a bundle of which were given to the person under observation, who was requested to give one match for each spot on the card held up. This was quite successful, except in the instance of one old woman, who had to be given up as perfectly hopeless. With this one exception, every individual whose sight was tested has been recorded here.

Sakai of	Sex.	Age.	Distance at which test-spots were counted.
Batang Padang	Male	25	91 feet
,, ...	,,	18	88 ,,
,, ...	,,	30	88 ,,
,, ...	,,	15	88 ,,
,, ...	,,	14	83 ,,
,, ...	,,	30	72½ ,,
,, ...	,,	25	67 ,,
Kuala Dipang	Female	22	67 ,,
Batang Padang	Male	18	66 ,,
,, ...	,,	20	66 ,,
Kuala Dipang	Female	19	66 ,,
,, ...	,,	18	64 ,,

6.
Plate 7.



Samples of Army Test-spot Cards.

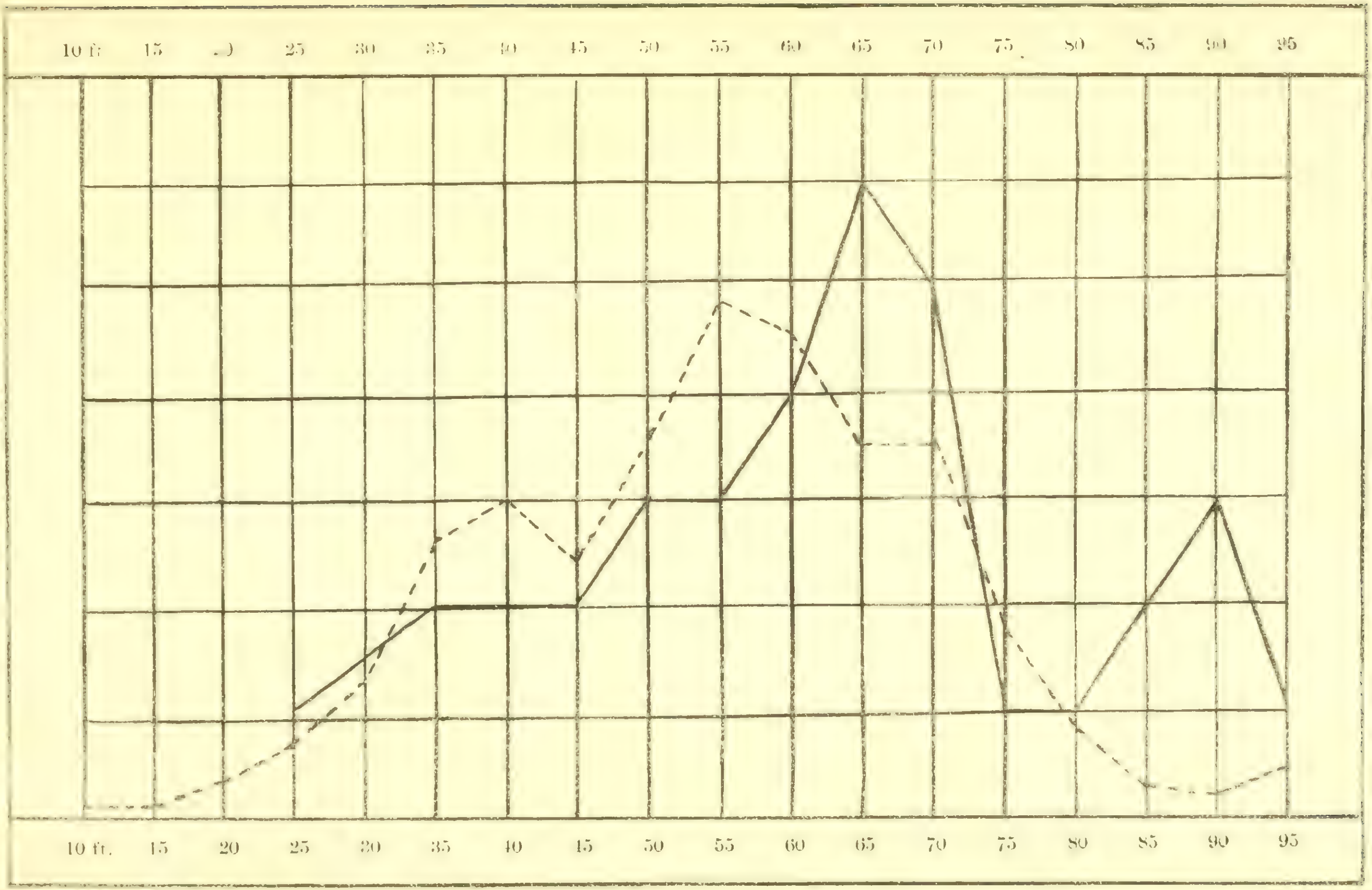


Diagram representing the Comparative Eyesight of the Sakais (by a solid line) and English Out-door Labourers (by a dotted line).

Sakai of	Sex.	Age.	Distance at which test-spots were counted.
Batang Padang	Male	35	64 feet
,, ...	,,	35	63 ,,
,, ...	,,	14	62 ,,
,, ...	,,	25	61 ,,
Kuala Dipang	Female	18	61 ,,
,, ...	Male	28	58 ,,
Batang Padang	,,	16	58 ,,
,, ...	,,	40	56 ,,
Kuala Dipang	,,	22	56 ,,
,, ...	Female	9	55 ,,
Batang Padang	Male	20	55 ,,
Kuala Dipang	,,	20	51 ,,
,, ...	,,	20	50 ,,
,, ...	,,	30	49 ,,
,, ...	,,	25	47 ,,
,, ...	,,	18	45 ,,
Batang Padang	,,	35	44 ,,
Kuala Dipang	,,	17	40 ,,
Batang Padang	,,	45	38 ,,
,, ...	,,	25	32 ,,
Kuala Dipang	,,	12	32 ,,
,, ...	,,	50	23 ,,

The range of sight, it will be seen, is from 23 to 91 feet. The distribution is fairly good throughout the range. The greatest frequency occurs between 60 and 70 feet, almost one-third of the total number. The mean for the 34 Sakais is 59·1 feet, for the 29 men 58·39 feet and for the five women 62·20 feet. The females occupy a central position in the table, the range of sight being only 12 feet, that is from 55 to 67 feet, and the mean is rather higher than that of the males. The number of observations is, however, too small to make sure that they are possessed of better vision than the men.

In the accompanying diagram are represented the frequency curves of the above observations on the 34 Sakais and of 385 English agricultural and out-door labourers between the ages of 16 and 45 years.* The Sakai curve is shown by a solid line and the English curve by a dotted line. The latter, being deduced from so many observations, is, as might be expected, more regular than that of the Sakais, but the two lines have nearly the same characteristics. The greatest frequency in the Sakai curve is at 65 feet, while the maximum in the other is at 55 feet. The sudden drop from 70 to 75 feet is very marked in both lines, while the comparative level between 35 and 45 feet is also well defined.

* Report of the Anthropometric Committee of the British Association for 1881.

Semangs.—Only three of these people have been tested as yet. The figures are as follows :—

Semang of	Sex.	Age.	Distance at which test-spots were counted.
Upper Perak	Male	14	92 feet
,, ...	Female	20	63 ,,
,, ...	Male	40	50 ,,

The range is here from 50 to 92 feet, and the mean 68·33 feet. The one woman is practically the same, as regards sight, as the mean of the Sakai women.

The theoretical limit of resolving power of the human eye has been placed at objects which subtend a visual angle of 25·8 seconds. Lord Rayleigh, writing under the heading *Civilisation and Eyesight,* says, "It is known to physicists that the resolving power of an optical instrument is limited by its *aperture.* With a given aperture no perfection of execution will carry the power to resolve double stars, or stripes alternately dark and bright beyond a certain point, calculable by the laws of optics from the wave-lengths of light." Mr. Sydney Lupton, writing on the same subject, says, "In the case of a small angle the aperture divided by the distance is approximately equal to the arc divided by the radius or to the circular measure of the angle. Hence in the present case we have $\frac{\cdot 1/40{,}000\text{th inch}}{1/5\text{th inch}} = \frac{1}{8{,}000}$ radian, or $\frac{206{,}265}{8{,}000} = 25{\cdot}8$ seconds nearly."

According to this, the utmost range at which the army test-spots, of one-fith inch diameter, could be resolved by the unaided human eye is 133 feet.

($\frac{206{,}264{\cdot}8 \div 25{\cdot}8}{120 \div 2} = 133{\cdot}24$ feet, the length of the radius of a circle, 25·8 seconds of which would measure one-fifth of an inch).

In the statistics above given the greatest distance at which the test-spots were read was 92 feet. This would equal an angle of 37·35 seconds.

$$\left(\frac{206{,}264{\cdot}8}{1/60 \text{ foot} \times 92 \text{ feet}} = 37{\cdot}356 \text{ seconds.}\right)$$

The mean of the 29 Sakai men, that is 58·39 feet, gives an angle of 58·87 seconds.

The common test for eyesight in England is the greatest distance at which "diamond" type can be read; and Mr. Brudenell Carter says "the commonly accepted standard of normal vision is satisfied by deciphering letters the parts of which subtend visual angles of one minute"—that is, about one and a quarter seconds more than that found for the Sakais.

According to the tables of the Anthropometric Committee of the British Association, given in their report for 1881, the average distance at which the army test-spots could be read by English agricultural and outdoor labourers between the ages of 16 and 45 years is 52·1 feet. This figure is obtained from 385 observations. The extremes were five individuals 90 feet and over, and one under 10 feet. Professor Longmore worked out from observations on British recruits an average of 57 feet.

It would appear from the above that the sight of the Sakais is slightly better than that of the average Englishman who leads an outdoor life, but it is insufficient to support the claim which has so often been made for the vastly superior eyesight enjoyed by savages. Mr. H. B. Guppy, who tested the eyesight of 22 Solomon Islanders (by means of the army spots) obtained an average of 57·5 feet, or almost the same as that for British recruits. His extremes were 35 feet and 70 feet.

ON THE MALAY METHOD OF COLOURING KRIS AND OTHER BLADES WITH ARSENIC.

By L. Wray, Jun. 1894.

It has often been stated that the Malayan kris blades, spears, and other weapons are poisoned; this, however, is a mistake, the application of arsenic being made solely for the purpose of differentially colouring the various qualities of steel of which the blades are composed, and showing the damask patterns more clearly. It is, however, more than probable that in times past the blades were actually poisoned with arsenic, otherwise it is hard to understand how the idea of applying it to them could have originated; for it seems very unlikely that the chemical reactions on which the process is based were known to such a singularly unscientific race as the Malays, and subsequently used to enhance the beauty of their weapons. As now employed, only a very thin firmly-adherent film is deposited on the parts of the blades intended to be dark, and from its close chemical and mechanical union with the metal and its insolubility in the presence of iron, it would be quite inoperative as a poison, even allowing for the well-known fact that much less arsenic when introduced into the circulation will produce a fatal result than when it is taken internally.

The blades of most krises are of what is known as damasked steel; that is, they are made by welding together a bundle of wires or strips of steel of different degrees of carbonization, so that when they are etched with acid or treated with a chemical compound which deposits a coloured film more readily on certain qualities of steel than on others, they assume a banded, mottled, or figured appearance, according to the disposition the strips of the original bundle of steel have been given during the forging. The patterns and designs imparted to the blades by the Malayan blacksmiths are sometimes of great beauty and intricacy, displaying a high degree of skill and a perfect knowledge of the qualities of the metals used and of the treatment necessary to produce the best effects.

In some of the blades, gold or copper is seemingly welded into and amongst the layers of steel. How this is accomplished is not clear, and it is believed that it would be correct to state that nothing similar is done by European artificers, but examples of blades containing each of these metals are occasionally to be met with.

Apparently no description of the manufacture of Malayan kris blades has been published, and therefore the technique of the art can only be guessed at. Some blades are manifestly produced in the way already indicated; in others, some of the strips of steel have been previously made of two or more strips welded and twisted together; while some seem to be formed from an ingot of damasked steel which is drawn out to nearly the shape of the blade, then slit along the edges and a piece of

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homogeneous steel welded in so as to form the cutting edge of the weapon; in other cases the ingot seems to have been cut in half longitudinally, a flat piece of steel placed between the two halves, and the whole welded together again. Some blades have evidently been formed in one of the ways already mentioned, and then have had hollows cut in them, into which different qualities of steel have been inserted, and the whole heated and welded together. In this way flowers, dragons, and various patterns are produced in the texture of the metal itself.

The temper of many of the blades is anything but good, some being so soft that they may be easily bent in the hands; on the other hand, some unite a keen edge with great elasticity, while some of the deeply fluted blades have singular rigidity with very small weight of metal.

In Perak the art is now extinct, and the great mystery which was always made over the forging of weapons makes it at present almost impossible to glean any reliable information as to the methods by which the old smiths produced their best work.

The method of colouring the blades, which is somewhat analogous to the browning of gun-barrels, is only known to a few Malays, and is kept by them as much a secret as possible, and has not, apparently, been hitherto fully explained.

Newbold, writing in 1839, thus describes the process. "Place on the blade a mixture of boiled rice, sulphur, and salt beat together, first taking the precaution to cover the edges of the weapon with a thin coat of virgin wax. After this has remained on seven days, the damask will have risen to the surface; take the composition off, and immerse the blade in the water of a young coconut, or the juice of a pine-apple, for seven days longer, and wash it well with the juice of a sour lemon. After the rust has been cleared away, rub it with *warangan* (arsenic) dissolved in lime juice; wash it well with spring water; dry, and anoint it with coconut oil."

Before proceeding to explain the process in detail, it may be as well to say a few words on the rationale of it. Acid solutions of arsenious oxide are decomposed by metallic iron, and if the solution is of the proper strength and the solvent a suitable one, the arsenium is deposited as a black amorphous film on the iron. If a thin sheet of iron is used, and is then rolled up and placed in a glass tube and heated over a spirit-lamp the arsenium will oxidise and the vapour condense on the cool part of the tube in the form of white arsenious oxide. This simple experiment is conclusive as to there being an actual film of arsenium formed on the surface of the iron.

The application of a weak current of electricity aids materially its deposition, and it will then be found to have been deposited only on that plate which is connected to the negative or zinc pole of the battery, the other plate remaining comparatively bright. As has been previously stated, kris blades are mostly compound ones, composed of steels of different degrees of carbonization, and when treated with a solution of arsenic, galvanic currents are set up and the arsenium is deposited on those portions of the blades which are negative to the other parts. Experiments show that steel is negative to wrought iron, and wrought iron to cast iron, in a solution of arsenic in citric acid. Six qualities of iron were tested, with the result that they were found to bear the following relation the one to the other, each metal being so placed that it is electro-positive to all beneath it and electro-negative to all above it:—

Cast iron	Small casting.
Wrought iron ...	Hoop iron. Best thin sheet iron.
Steel	Cast steel, from an American axe. Clock-spring steel. File steel.

From what has already been said, it will be evident that if a blade were forged of strips of, say, clock-spring steel and file steel, and were then placed in a solution of arsenic, those portions of it which were formed of the file steel would darken, while the remainder of it would remain white. There is evidently something besides the proportion of carbon in combination with the iron which governs the galvanic relationship of this group of metals, but it would require a large series of samples, of which the constituents were known, to enable the influence of the carbon and other substances to be exactly determined. However, for the purposes of this inquiry it is sufficient to know that the difference of electrical properties in various qualities of steel suffices to determine the deposition of the coloured film, and that a homogeneous blade, not giving rise to any electrical currents, with consequent differences of chemical action, colours uniformly.

A slight evolution of gas takes place during the process, and as a certain amount of it is arsenited hydrogen (an excessively virulent poison), every care should be taken in experimenting with this method of colouring damasked steel, to avoid inhaling the gas.

The blade of the weapon to be coloured is first cleaned from any oil that may be on it with a little wood-ash and water, then a lime is taken and the rind carefully cut off, to prevent the oil from the outer skin getting on to the blade and interfering with the subsequent operations. The peeled lime is cut open and the juice rubbed over the blade with the fingers. From time to time it is washed in water and fresh lime-juice put on. This is continued until the blade is clean and white all over. Spots of rust which resist the acid are cleaned off by friction with a piece of charcoal. Powdered charcoal mixed with the lime-juice hastens the cleaning very considerably, and for this purpose that prepared from the rind of the durian fruit is preferred.

The preliminary cleaning is also done by steeping the blade in either boiled rice and water, lime-juice, or chopped pine-apple leaves and water. About two days is required to free it from rust. The rice-water is said to be the quickest. The acid, of course, in this instance, is that formed by fermentation. A trough made of a joint of bamboo split longitudinally, or one formed with a piece of *upis*—*i.e.*, the spathe of the betel-nut palm, is used to steep the weapons in.

A new blade is generally steeped for some days in one of the above acid fluids to etch it and bring the damask into relief. Seven or more days may be required for this purpose. It is usual to coat the edges of the weapon with wax, put on after warming the blade, as a protection from the corroding action of the acid, which would otherwise eat into the thin edges and make them ragged.

The blade being clean, there are two distinct ways in which the solution of arsenic may be applied to it. These are known respectively as *masak* and *mantah*, or cooked and raw.

Warang masak must be done at night, and if there is any wind blowing, under a mosquito net. The arsenic is prepared in the following way for colouring two kris blades. Take 12 cloves, 15 peppercorns, six bird peppers, one nutmeg, and a piece of the root of a red-flowered climber called *aker cheraka (Plumbago rosea)* of the size of half a nutmeg. Grind up all these things on a *sankalan,* or Malayan curry-stuff grinder. Put into a cup and add the juice of one lime and a-half, and allow to stand. Strain through a piece of cloth, and to the fluid add about half a drachm of powdered arsenic. The reddish-coloured crude arsenic sold in the bazaar is preferred by some, and the white by others. The mixture is then put into a small cup, or what is considered better, the shell of the large bivalve that lives in the mangrove swamps. The *kulit krang* then has a temporary wooden handle, made of a split stick with a sliding ring of rattan, fixed to it, and is held over a fire and the contents allowed to boil until the mixture is reduced to about one-half, and becomes almost of the consistency of cream, when it is removed from the fire. The blade is then taken by the shank in the left hand, and the hot mixture of arsenic applied to it with the fingers of the right hand. It is worked and rubbed all over it, in the same way as the lime-juice was applied before to clean it, more of the mixture being added from time to time as required, and occasionally a little coconut milk. If all is well, the blade will be seen to slowly darken in places, and the damask come into view, *naik pamor*, as the Malays say. The rubbing is continued until portions of the blade are nearly black. This takes from about 30 to 40 minutes. The milk of a coconut whose shell is just beginning to darken is put into a basin and the fingers are dipped into it, and slowly the arsenic is washed off. After it is all removed, the blade is rubbed for some ten minutes with the coconut milk, and is then dried with a cloth, and afterwards gently rubbed with a tuft of the fine shavings of a piece of dry bamboo. This dries, and at the same time slightly polishes the parts of the blade that have not been darkened with the colouring mixture, particularly those thin bright lines of steel known as *pamor perak*.

A good blade will now show all the tints and gradations of colour, from a fine black to pure white. The final operation is giving the blade a slight coating of coconut oil. This is rubbed on sparingly all over it, and then wiped off again as far as possible. This makes the blade look brighter, and it also serves to protect it from rust.

The second method, known as *warang mantah,* is performed as follows. The blade having been cleaned in one of the ways already described, is dried and put out in the sun to warm. A lime is taken and carefully peeled, a piece is cut off with the blade, and some of the juice squeezed out on to it. With the fingers this is rubbed all over the blade, then the wetted finger is dipped into the dry powdered arsenic and rubbed on; more lime-juice and arsenic are taken as required, and the rubbing with the fingers is continued, and towards the end of the operation a little coconut milk is added. During all this time the blade is kept in the sun, as the warmer it is the sooner the deposit of arsenic takes place. When it is judged to be dark enough, more coconut milk is added and the arsenic is gradually all washed away. The darkening goes on for some time after the removal of all the arsenic. When quite finished, the blade is dried with a cloth, rubbed with bamboo shavings, and finally dressed with a little coconut oil.

The time taken to *warang* a kris by this method varies with the nature of the steel and the heat of the sun, from 20 to 40 or even 60 minutes. The result is, in appearance, the same as that obtained by the other method, but it is said not to protect the blade from rust so efficiently.

The edges of inferior blades, or those whose edges will not darken properly, are carefully rubbed over with the juice of a young betel-nut, or of the shoot of the coconut palm. Wherever these fluids touch the blade it will become quite black; veinings may also be traced on it with them. Again, parts that are intended to be white are sometimes coated with wax before the arsenic is applied, to protect them from its action. These are, however, hardly legitimate processes, and are only used to give inferior blades the appearance of better quality ones, like the sham colouring that is given to common gun-barrels in imitation of the real Damascus barrels.

Yet another way of colouring blades has been described to the writer, though not actually shown in operation like the two preceding methods. The blade is cleaned and is then rubbed with the following mixture. Coconut milk, black pepper, bird pepper and arsenic. This preparation is not boiled, and the colouring is performed in the day in full sunshine.

When it is wished to remove the arsenic from a blade, lime-juice and fresh crushed sirih leaves *(Chavica betle)* are rubbed over it. Lime juice by itself or other weak acids will not remove the coating of arsenic, and may therefore be used to clean and brighten up an old blade that has previously been coloured, the blade being afterwards washed in coconut milk and dried as already described.

It may perhaps be of interest to mention here that a very excellent preparation to preserve the blades of weapons is made by dissolving best white wax in white spirits of turpentine or benzole. The wax should be cut up into thin shavings, put into a bottle, and just covered with the solvent. The bottle may then be stood in hot water until the wax has dissolved. When cold, the mixture should be of the consistency of cream. When using benzole as the solvent, the greatest care must be taken not to bring a light anywhere near the bottle during the time it is being heated by immersion in hot water. The cream is to be lightly applied to the blades and well rubbed in with a piece of flannel. When dry the blade presents a dead surface; and the beauty of the damask is in no way interfered with. Vaseline and other oils make the blade look shiny, and they rapidly turn yellow and brown, and afford very little protection against rust. They also have the added disadvantage that they make greasy marks on anything they come in contact with.

ITINERARY OF A TRIP TO GUNONG BINTANG AND THE PERAK-KEDAH BOUNDARY, BY THE CHIEF SURVEYOR OF PERAK, DURING THE MONTHS OF OCTOBER AND NOVEMBER, 1892.

October 20th. Left Taiping by 2.16 p.m. train for Ulu Sapetang and Selama, but could not proceed beyond Briah Rest-house, owing to the bad state of the road, so slept there.

21st. Left Briah at 7 a.m., and arrived at Selama at 10.30 a.m. Baggage arrived in the course of the afternoon. Spent the day in collecting coolies and despatching part of baggage to Ulu Selama Rest-house.

22nd. At 6.30 a.m. despatched balance of baggage to Ulu Selama and prepared to follow, but it came on to rain heavily, so I did not leave Selama till the afternoon, and reached Ulu Selama after dark, only to find that all my clothes, instruments and baggage were soaked through with the rain, and that two of the Malay coolies had disappeared, taking with them some of my tinned provisions.

The Selama coolies refused to go on to Bintang, so I had to take measures to collect others at Kampong Ulu Selama. On application to Mat Dari, the late Penghulu, he promised to give me 40 in the morning, at 40 cents per diem each.

23rd. A fine morning, which I occupied till 9 a.m. in drying clothes and making up packs for coolies. At last, at about 9.30 a.m., left with 20 coolies and three elephants to dive into the jungle, Ulu Selama being the last settlement on the way. Our track was up the Selama river for about an hour and a half; we then turned to the northward and started up a ridge which divides the Selama and Krian rivers, up which we journeyed to a height of about 1,860 feet and descended 430 feet; finally at 5.20 p.m. made a camp (1,633 feet above sea level) at Sungei Ketam, a tributary of the Krian. By this time it was raining heavily, and everything was again wet before a tent could be rigged up, and it was past 9 p.m. when we were successful in getting a fire to burn and food cooked. It was pitch dark, and impossible to find anything to make a shelter, and those coolies who could not squeeze in under the tent, where we were lying two deep, were out in the wet all night; fortunately it was not very cold, but the leeches were in myriads all over the place, and it was simply impossible to evade their insidious attacks.

24th. The camp was astir at 7 a.m., and I finally got away at 8 a.m. with a couple of coolies, still continuing in a north-by-east direction across a ridge, attaining an elevation of 2,570 feet, and afterwards descended again and reached the Sungei Bintang at 10.30 a.m. and proceeded to build a camp at a point about 1,690 feet elevation. The balance of the coolies and the elephants began to arrive between 2 and 3 p.m., at which time it had commenced raining, and continued till 9 p.m.

25th. At 7.50 a.m. I again started ahead of the main body with two coolies, to make a shelter at the next camping-ground. As on the previous days, our journey consisted of going up one side of a spur and down the other into the valley of the stream. In this way I arrived at Klian Bharu, the next camp, at 10.9 a.m. Here, fortunately, were the remains of a former Malay encampment employed in lampaning the stream for tin. It looks a very likely place, and a few pikuls were, I believe, obtained, but the adventurer, Kulop Mat Dari, of Selama, was not satisfied with the results, and gave it up. The main body of the coolies and the elephants were again late, arriving at 2 p.m.

The soil in this neighbourhood is particularly promising in appearance, and there is a marked absence of boulders; bamboos and long grass grow very freely, and it evidently is a neighbourhood teeming with large game, elephants, rhinoceros, etc.

26th. We left camp at 7.55 a.m., and immediately began the ascent of a spur which we topped at 8.30 a.m. From this point (2,400 feet) both Bintang and False Bintang are visible, and a great many of the valleys which form the horseshoe, with Gunong Inas as the apex, were laid out before us. The view thus obtained showed that the spurs are not very steep, but have long slopes towards the north and north-west. The track then continued along the ridge for about two miles, maintaining an elevation of 2,400 to 2,500 feet, the whole country being remarkably free from boulders or any form of rock, with deep rich soil, the jungle containing many wild citrons and limes. At 9.20 a.m. we reached the point where the ridge began to descend, and, at 10.7 a.m., we struck the Krian River, at an elevation of 1,440 feet, the bed being very rough and full of boulders of considerable size. A few yards brought us to a hot spring, which issues from what appears to be a bed of schistose rock, dipping about 15° to the south-east, overlaid by the rocky bed of a small rivulet, the granite boulders in which are of very considerable size.

The temperature of the water issuing was 93° Fah., that of the air at the same instant being 79° Fah.; it smelt very strongly of sulphuretted hydrogen, and a new 5-cent piece immersed in it was rapidly blackened by the formation of sulphide of silver. There was a slight indescribable taste, not unpleasent to the palate, and a subsequent evaporation of some of the water I brought back to Taiping showed the presence of soda and silica. I fixed upon a camping-ground about five minutes' walk beyond the spring, and before the camp was completed it came on to rain in torrents, soaking everything and continuing till midnight, when there was a lull. This camp was at an elevation of about 1,475 feet. The bed of the river was very rocky, and the track beyond impassable for elephants, so I had to send them back to Selama.

27th. Got away from the camp at 8.35 a.m., and steered north-east along the top of a spur attaining an elevation of 2,500 feet, but had to descend again into the river, which we struck at an elevation of 2,150 feet, and then followed it up to camp No. 5 at the foot of the Bintang range, and at an elevation of about 2,600 feet, which was reached at 2.12 p.m. During this day's journey I found several wild pomelo trees in fruit, the ground being strewn with them. From this camp the pass to the north of False Bintang, which leads into Ulu Sungei Kendrong, is about two hours' walk, and its elevation is about 3,200 feet. The temperature in the hut at 3.30 p.m. was 69° Fahr.

28th. The temperature at 6 a.m. was 65°. At 8.5 a.m. we left in a north-westerly direction, climbing up the ridge to Bintang; at 9.58 a.m. I crossed the Ulu of the Sungei Kendrong, and at 10.13 a.m. arrived at the top of the ridge at an elevation of 5,118 feet, a point on the watershed of the Krian River since fixed as a minor trigonometrical station. From here to the top of the highest point of the Bintang range the track lies along a ridge, rising and falling to the extent of a couple of hundred feet occasionally, and is fairly easy walking, no special assistance or laddering being required, as is the case at Kerbau. I arrived at Bintang trig. station (6,109 feet) at 1.30 p.m., and found Mr. Jayesuria and his few coolies still remaining on the hill, looking fairly healthy after nearly three months in the jungle of these ranges. At about 2 p.m. it came on to rain in such torrents that it went through huts, tents and everything, and my prospects were anything but encouraging, as none of my coolies with food and baggage had turned up. After dark four men struggled into camp with my bedding and some instruments, and reported that the balance of the coolies, about 12 men, were remaining in the jungle, being unable to proceed any further, several of them being attacked with fever. Later on, 7 p.m., three men turned up and reported having left their packs in the jungle. These men had had to climb 5,195 feet since morning, extremely trying work in the jungle where the only paths are game tracks. At 6 p.m. the thermometer registered 60°.

29th. Rained all last night, and my tent let water through like a sieve; this defect I was only able to remedy subsequently by stretching my waterproof, as a fly-sheet, over the portions of the tent occupied by my bed. At 6.30 a.m. the thermometer registered 60·5°, a high temperature considering the elevation (6,109 feet). More or less rain fell all day, and one could do nothing but keep under cover. The last coolies arrived at 4 p.m., quite done up. At 3.30 p.m. the thermometer fell to 59°, owing to the prevalence of a high wind, which died away about 7.30 p.m., and the thermometer immediately rose to 61·5°.

30th. At 6 a.m. thermometer in the tent read 61°. A very cloudy morning followed, which prevented any observations being recorded, and at noon rain again fell and continued till past midnight.

31st. The morning opened clear, and at 8 a.m. the thermometer stood at 59°. I was able to get a few observations before mid-day, when the neighbourhood was again enveloped in mist, and from 3 p.m. it rained till sunset.

November 1st. It was so cold all night that it was impossible to sleep, and the thermometer in tent registered 57·5°. The morning was fine, but with a cloudy sky which developed into a mist about mid-day, and, as a consequence, I could practically do nothing. In the afternoon the temperature rose rapidly, as the mist deepened, and at 9 p.m. the thermometer was as high as 66·5°.

2nd. In the early morning the thermometer again fell rapidly to 55·5° in the tent. The sky was cloudy all day, and no trigonometrical points that were required could be seen. In the afternoon I descended into a ravine running about WSW from the side of the trig. station. In a very short time I descended 450 feet below the top of Bintang, and found myself in a great chasm about ten chains long, a few feet wide, and from 100 to 150 feet deep. The bottom of this ravine is the bed of a considerable stream, which appears to occupy the site of a lode which has been eroded away, the hanging wall of which remains intact and consists of a decomposed granite which is so soft that it can easily be dug into with a stick. The footwall has disappeared, as will be seen from the accompanying sketch. The stream, I believe, flows into the Sungei Mahang, and I should not be surprised if, at a lower level, it were found to be rich in alluvial tin.

3rd. A cloudy morning again, and I could do nothing all day. In the afternoon the usual rain came down. The thermometer at 6 a.m. registered 58°, and at 8 p.m. 62°.

4th. Cloudy as the previous day, and one could do nothing but mope about and try to keep warm. The thermometer stood at 58° all day, and there was a great deal of mist. At about 8 p.m. there was an eclipse of the moon, of which nothing could be seen, and it became much colder.

5th. It was intensely cold all last night, the thermometer in my tent falling to 53°, and sleep was impossible. The morning opened fine, and I was able to get about five hours' observing before it clouded up again. I saw a mountain new to me on the eastern boundary of the State, which I made out to be about 7,500 feet in elevation; I think this must be the bluff fixed by Deane to the north of the Ulu Plus.

6th. The night was a little warmer with a fine moon, and the thermometer only fell to 58°. The morning, however, opened wet and misty, which continued all day and made it impossible to do any observing, so I spent the day in exploring the immediate neighbourhood. At 8 p.m. the thermometer had risen to 60·8°.

7th. Warm night, thermometer 59°, but cloudy and misty and damp all day.

8th. Roused at daylight by a coolie, who reported that Mr. Jayesuria had been very ill with fever all the night. Went to see him and found the report to be true. This was very serious, because all our coolies but two had some days before been sent to Ulu Selama to procure fresh supplies, as our commissariat was almost exhausted. There were no medical comforts in the camp beyond a dose of liver pills, a little castor oil, half a tin of condensed milk, and two chickens which had become wild in the jungle, and, being eleven days from our base of supply, I was a little anxious. Fortunately, some quinine had been left at a camp in our rear, which I got the next day. I gave him the liver pills, and followed them up with a couple of strong doses of castor oil, to prepare the way for the quinine. Then followed a spirited hunt after the wily fowls with a revolver, and at last I succeeded in bagging one, which was promptly converted into broth. A mist hung round all day so thick that nothing was visible at a distance of a few yards, and everything and everybody were wet. Thermometer read 60° in the evening.

Ravine on Bintang.

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9th. At 6 a.m. the thermometer read 58·5°, and the morning opened a little brighter than yesterday. Mr. Jayesuria's fever, however, was no better, and there only remained medicine enough for the day and no food suitable for an invalid, except the tinned milk, which was not a success. In the evening the fever became more violent than heretofore, and the weather continued very unfavourable, so I determined to start him down the next day, with the remaining coolies, for Selama. Four coolies turned up with rice, but no medical comforts, so we were much in the same po sition as before.

10th. A warm night, the temperature being 63°, and a favourable morning followed. Mr. Jayesuria was a little better, so I packed him off, with three coolies, in the hope that he would meet supplies on the road. The hill was enveloped in clouds all day after 8 a.m. I had for some days intended to visit the northern point, so I now sent three men to Nortn Bintang to erect a tent and await my arrival there.

11th. The temperature was 58°, the morning dull and still, but in the afternoon a high wind, accompanied by heavy rain, sprang up and continued all night. Four more coolies arrived from below.

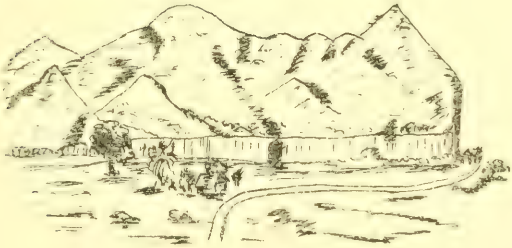
12th. Rain and storm continued all night, with a temperature of 57° in my tent. A wet forenoon. At mid-day I left to walk to North Bintang, which is the extreme north of the Titi Wangsu range; it rained the whole way, more or less. I arrived at the camp at 5.30 p.m., the elevation of which was 6,038 feet. My clothes, bedding, tent and everything were wet. To add to our miseries, there was no firewood to be got, as it was too pitch dark to find it. I had to allow the coolies to share my tent, through which a stream of water (in which they had to lie) was running most of the night. As the night was intensely cold and they had only one blanket between them, their groans and sufferings can be better imagined than described.

14th. It rained all night till 6 a.m., and had now been raining straight on end for over 40 hours. When it cleared up a bit, I was able to collect a little information for mapping Ulu Rhui and the Muda River country during the forenoon, after which a drizzle again set in and continued all the evening.

15th. A fine morning. I procured an excellent view of the country to the north and west, and was able to obtain some bearings to fix the Kedah hills north of Selama. I afterwards walked along the ridge to the north end and climbed a tree giving a view to the north and north-east. The watershed between the north and north-east appears to fall into the Muda River, and to be in Kedah territory, while that on the north-west, I am inclined to think, falls into the Mahang and Krian Rivers, though the late Mr. D. D. Daly's map, based on an exploration of the Muda River, accompanying his papers, "Surveys and Explorations of the Native States of the Malay Peninsula, 1875-1882," read before the Royal Geographical Society of London (*vide Proceedings Royal Geographical Society,* July, 1882), would make it appear to belong to the Sungei Sedin, a tributary of the Muda. If I am correct in my surmise, the main stream of the Krian, and the boundary of Perak, runs to the north of the Bintang range (*vide* sketch map), but this question can only be decided by further exploration.

The stream already mentioned as running north is evidently the Ulu Sungei Kopong, which Mr. Daly partially explored. About 12 miles north-by-east of North Bintang is a very curious-shaped limestone hill, standing up in the centre of the valley of the Sungei Kopong and surrounded by padi-fields; it has, roughly, the appearance shown in the sketch, and is a very remarkable feature in the landscape. I am sorry I could not find a means of fixing its position somewhat accurately, as it is an excellent landmark for explorers in this part of the Peninsula to tie on to. The whole valley of the Kopong, as far as it could be traced, appears to be studded with large padi bendangs and to have a fairly large population. The accepted geography of this region requires much revision. All our previous records show the Perak boundary running along a mountain chain in a line almost due north of Gunong Bintang. It is not so; that line of country is occupied by the valley of the Kopong, whose eastern watershed runs in a north-by-east to NNE direction, and does not contain any point which can be over 3,000 feet high. This line of country is also the watershed of the Rhui, which again is shown in our present map too much to the westward, and, as there represented, requires to be moved over several miles to the eastward to bring it into its proper position.

Gunong Kendrong and Gunong Kernei are also shown too much to the north and west, and are about ten miles out of position. Mr. Daly showed these two remarkable hills to be 2,653 and 2,128 feet respectively. But observations taken by me from Bintang, and by Mr. Morris from Gunong Basak, make them to be about 4,063 and 3,176 feet. The eastern side of the valley of the Rhui contains many limestone hills and long spurs, with moderate slopes to the SW. Many indications of large ladang cultivations could be distinctly seen, and the country presented a very favourable appearance. A high range of mountains divides the valley of the Rhui from the Perak, and on the side of the latter it is probably very precipitous. The mouths of the Tumungoh and Sengoh could be distinctly seen, and from bearings taken, appear to be placed too far south on our present charts, the former being about five miles and the latter two miles further north than shown. The mountains on the north-eastern boundary of Perak, I think, appear too much to the westward on our present map also. If this be the case there are several points on our eastern frontier which must be between 7,000 and 8,000 feet in height. At 10 a.m. I left for Bintang, and arrived at my camp there at 2 p.m. The country between Bintang and North Bintang is a long saddle, with only one considerable depression of about 500 feet. It is composed solely of decomposed granite, and in some places there are quite small forests of pines, which grow to considerable dimensions. A very curious feature is the existence of several large holes in the depressions between the tops of the ridges, which are truncated cones. These holes are of considerable diameter, 50 feet or so, and funnel-shaped; the water from the contiguous ridges drains into them and disappears. Although I saw them in very heavy rain, with streams discharging several thousands of gallons of water into them, it appeared to filter away almost as rapidly as it came in. On my return journey, when it had been dry for 24 hours, I examined one cursorily (owing to the thick growth of ferns, etc.), but did not find any exit for the water, so



Limestone Hill.

[*Page 56.*

it must filter away. From observations made on other parts of the range, I believe the upper crust, to the extent of 1,500 to 2,000 feet, is decomposed granite, so soft that it can be cut with a knife or changkol as easily as an earth bank. These holes may therefore serve as reservoirs for collecting the water which feeds the hot springs at a lower elevation, their heat and mineral salts being obtained from the decomposing granite. In many cases they are no doubt the cause of large landslips, which appear to occur periodically in these ranges.

16th. Thermometer fell to 56.2° during the night. For the first time I was able to successfully observe Western Hill, Penang, till 2 p.m., the main reason I had for visiting Gunong Bintang. There was now nothing further to detain me, so I prepared for striking camp on the morrow. It may perhaps be worth recording here that on the tops of Perak hills over 4,000 feet in elevation materials suitable for hut building are seldom, if ever, found, and it is generally necessary to carry materials a considerable distance. On Bintang, which is more favourably situated than most of the higher mountains in Perak, the coolies had to walk 2½ miles and descend over 2,000 feet to find ataps. The materials for the hut I occupied (7 feet long, 5 feet high, and 4 feet 6 inches wide) required four men for four days to collect and deliver on the top of the mountain. It will thus be seen that the proper housing of a large body of coolies, on a mountain over 4,000 feet in elevation, is a most difficult matter, which, if neglected, leads to the coolies contracting fever and not infrequently dying from exposure. I am glad to say that on this occasion, although they suffered much from fever and bronchitis, from which about half the labour employed suffered more or less, none died in the jungle, nor have I since heard of any deaths which could be attributed to this trip.

17th. The previous night was warm, and the thermometer did not fall below 56°. The morning was fine, and I started on my return journey for Selama at 8 a.m. On the way down I fixed the most prominent points of the watershed, which is here the Perak boundary, and at noon arrived at South Bintang, where we remained for the night, at an elevation of about 5,118 feet.

18th. Having completed the observations required at South Bintang, I determined the height of the pass into Ulu Perak, which is situated between this point and False Bintang, as it appeared to me to be the best way of getting into the Ulu Rhui and Klian Indah tin mines from North Larut. Having directed the main body of the coolies to travel to the hot spring on the Krian River and there to wait for me; I left at 8.35 a.m. with two coolies, and travelled about ENE till 11.30 a.m., when, at an elevation of 2,500 feet, I struck into the valley of a subterranean river, probably the Ulu Kendrong, running a little north of east. The bed was full of enormous boulders, under which the water could be heard dashing along, though nowhere could it be seen. We had descended too far and missed the pass, so we turned up to the westward, and after a short climb, found ourselves on a well-beaten elephant track which led to the pass. It took us past an old camping-ground, of probably eight years or more ago, and then into a defile through high granite boulders. Here we suddenly became aware of the presence of elephants, from the dirty water which came flowing down towards us; we therefore climbed a a high boulder, and at a distance of about 50 yards saw the elephants, three in number, one of which was an enormous brute, though I could not see if he were a tusker, because his head was not distinctly visible. The two Malays with me most incontinently fled, and I had to follow. After a climb of more than 300 feet, I managed to stop them, but could not get them to go down into that pass again under any inducements. They said they did not approve of catching elephants with a ·450 revolver and a barometer, which was my armament, and would prefer coming another day when arms were more plentiful. As a consequence, I had to go through a higher gap to the north, which I have determined as being 3,290 feet above sea level. We passed through the gap at 1.25 p.m., and started down the Krian Kanan, which here was about six inches wide, reaching my old camp at the foot of South Bintang at 2.22 p.m. After a short rest, we continued down the river to the Kuala Serau, where we arrived at 6 p.m. The last three hours we were in the bed of the river, and I arrived at camp wet through from repeatedly falling into the stream. Several of the pack coolies did not turn up till after dark, and even then had left their loads in the jungle. Rained during the night.

19th. I had to send several men back for packs left in the jungle; nothing but wet clothes to put on, and bedding in the same state. I left the camp at 8.20 a.m., and at 8.30 took the temperature of the hot spring and found it to be 93°Fah., the temperature of air being 75° at the same time. Afterwards continued march and arrived at the camping-ground at Sungei Bintang at 12.55 p.m. The coolies were all behind with baggage and food, and my clothes were soaked through from constantly wading through rivers, and I had to remain in them till my blanket arrived about 4 p.m., the consequence being a severe cold.

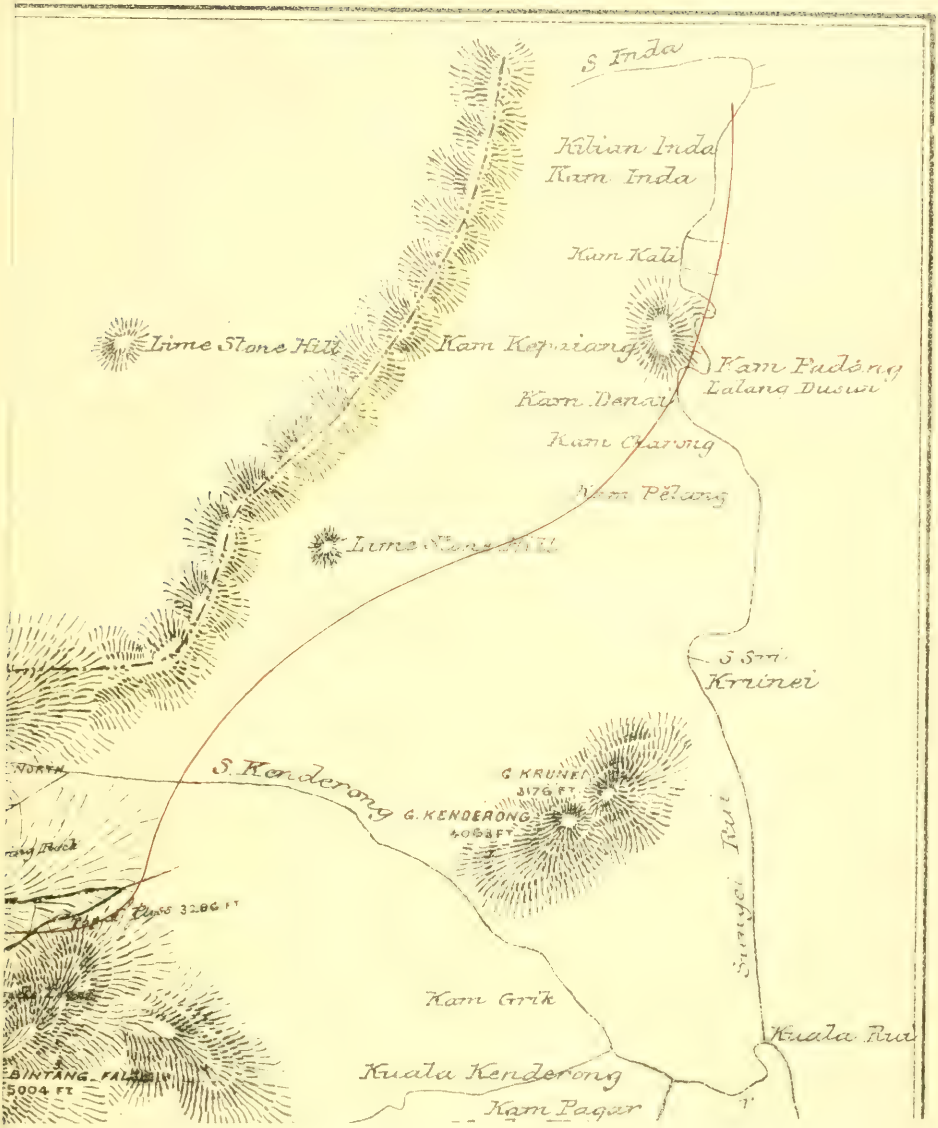
20th. Left camp at 8.10 a.m., and arrived at Sungei Ketam at 9.50 a.m. (on my way up to Bintang, this stage was a one day's journey) and waited till 10.30 for the baggage to come up, then marched on till the Selama River was struck at 12.15 p.m. We waited here for half an hour before a boat could be procured to take us across the river. It rained the whole way down the river, and we arrived at Ulu Selama Rest-house at 2 p.m.

I may say that since leaving South Bintang on the morning of the 18th not a single member of the party had dry clothes on at any time for two consecutive half-hours. It was not surprising, therefore, that every one was done up on arrival at Selama.

21st. I fixed position of the Ulu Selama Rest-house, and then left for Selama, arriving at 12.45 p.m., finding Mr. Jayesuria at the rest-house, quite restored to health.

22nd. Occupied the day in settling up with coolies and local shopmen.

23rd. Left Selama village at 10.30 a.m. in a boat for Parit Buntar, which we did not reach till 11 p.m. I expected to find the Survey launch *Constance*, but she had not turned up.


S. Inda
Kibian Inda
Kam Inda
Kam Kali
Lime Stone Hill
Kam Kepriang
Kam Padang
Lalang Dusun
Kam Denai
Kam Charong
Kam Pĕlang
S. Sri
Krinei
S. Kenderong
G. KRUNEI
3176 FT.
G. KENDERONG
4063 FT.
Pass 3286 FT
Sungei Rui
Kam Grik
Kuala Rui
Kuala Kenderong
Kam Pagar
5004 FT

Route Map
of
Journey by G.A. Lefroy,
Chief Surveyor, Perak.
November 1892
Scale 4 Miles to an Inch
KEY
Shews line for Bridle Roads etc. to open up the Ulu Rui Tin Mines from the Krian District, proposed by the Chief Surveyor
Shews Chief Surveyor's track
" " Camps
PROVINCE WELLESLEY
KEDAH
PERAK
Sungei Sidin
K. Baksi
Sidin
Kam Sinong
Kam Paya
Lime Stone Hill
Kam Kelapang
Kam Pelong
Lime Stone Hill
KANGAR 4860 FT
G. BINTANG 6038 FT
G. BINTANG 5109 FT
S. Kenderong
G. KRUNEI 3176 FT
G. KENDERONG 4063 FT
Kam Kuak
Kam Grik
Kuala Rui
Kuala Kenderong
Kam Pagar
Kuala Plang
S. Mahang
X Ulu Krian
S. Krian
BINTANG FALL 3004 FT
K. Kantau Panjang
S. Kluang
S. Naga
Kam K. Selama
SELAMA
Ulu Selama R.Ho
Selama Village
Sungei Krian
PARIT BUNTAR
PANCHOR 1389 FT
Point to which Launches & Tongkangs can safely navigate up the Krian River
Road to Taiping
Sungei Ijok
Bria R. House
G. INAS 5861 FT
G. ULU TRASS 5109 FT
G. ULU JENNEH 5170 FT
Pass to Upper Perak 1700 FT
G. RAMBONG 3924 FT
Kinering Village
Jeram Panjang
JANING
Kuala Kinering
Rest House
Kam Sawah
S. Krian
J. Jamak
Trig. Survey Office
Taiping

24th. Heard the *Constance* was at Bagan Serai, so went down there and left in her at 8.30 p.m. We stuck on the bar for some hours going out, and finally reached Port Weld at 6 a.m. on the 25th, having been absent from Taiping 35 days.

As a result of my journey, I may say that the whole of the country through which I passed from Ulu Selama to North Bintang is equal, as agricultural and planting land, to any I have seen in the State. In many places there is great depth of soil, derived from the decomposition of granite, and the slopes are seldom what one in Perak would call steep. At present this fertile country is totally uninhabited, even the nomadic Semang being conspicuous by his absence.

It is the most practicable outlet in Perak territory for the produce of the Klian Indah and Intan tin mines of the Ulu Rhui District (which at present finds its way to Baling in Kedah) through the pass below False Bintang, which I visited, and from my observations it may be taken as being under 3,290 feet above sea level.

Although this height is very considerable, there would be very little difficulty in grading a road at 1 in 20 to 1 in 25 through it, because the valley of the Krian Kanan runs back so far that there is ample room to get the rise without the introduction of dangerous zigzags.

Taking advantage of the False Bintang pass, the Klians Intan and Indah could be connected with a port on the Krian River by well-graded cart-roads and bridle-tracks of a total length, after making all allowances for grading, of 68 miles.

Of that distance, four miles is already a metalled road and three miles an earth bank, which leaves about 61 miles of road and bridle-track to complete the connection. Four of the former and 57 of the latter would ensure cart traffic to Selama, beyond which a bridle-road would take its place.

The general line that such a track should follow I have roughly indicated by the dotted curved line shown on my map (accompanying this paper), from a point on the Krian River, about south-east from Bukit Panchor, to which large tongkangs and steam launches can safely navigate that river at any state of the tide.

In addition to opening up the valley of the Ulu Rhui, such a bridle-road would bring several thousand acres of fine planting land within easy reach of Penang and Province Wellesley.

G. A. LEFROY, A.M.I.C.E.

THE LONG-JOINTED BAMBOO, CALLED "BULOH BER-SUMPITAN," USED BY THE SEMANGS FOR MAKING BLOW-PIPES.

By L. Wray, Jun.

The Semangs of Upper Perak and Ulu Selama, and the Sakais of the Plus Valley, make the outer cases of their blow-pipes from single joints of a very long-jointed bamboo. The pipes are about seven feet in length, and the joints from which they are made are from four to six inches longer than this.

To make a blow-pipe, two lengths of the small-sized canes, aggregating the length of the intended blow-pipe, and of an outside diameter of about five-eighths of an inch, are taken. They are straightened over the fire and dried in the smoke of the cooking-place. They are then carefully trimmed and joined together by means of a short length of bamboo of a size which will just slip tightly over them. On to one end of the long tube so formed is fixed a short length of stouter and larger bamboo, about four inches in length, and this end is then terminated by either a wooden or a gutta-percha mouth-piece. A larger piece of bamboo is taken to form the case. This is of such a diameter that the junction of the small tube will just pass inside it. The top, that is the end next the mouth-piece, is cut some distance from a joint, while the other end is cut near a joint. The top is always that end of the cane which was downward when growing. The inner tube is now passed into the case, and it is trimmed so that when in position the bottom end of it fits tightly into the end of the case. When in position, the inner tube touches the outer only at three points—that is, near the mouth-piece, in the centre where the junction is, and at the bottom end. Both ends of the case are generally bound with rattan to prevent splitting, as also the short length at the mouth-piece. The inside of the tube is polished by pulling a piece of a very hard rough root through it. The complete blow-pipe, therefore, consists of the following parts. Two lengths of small bamboo, one short junction-piece, one short length next to the mouth-piece, the mouth-piece, and one long length of bamboo to form the outside case. This latter is about 6 feet 6 inches to 6 feet 8 inches in length, and from seven-eighths to one inch outside diameter. The bore of the inner tube is from three-eighths to half an inch. The mouth-piece is generally a nearly globular mass of gutta-percha, about $1\frac{1}{2}$ inches in diameter, moulded on to the end of the inner tube. One of the inferior sorts of gutta is used as a cement to fasten the parts of the inner tube together, but the outer case is not fastened, and it may be removed at any time to allow of the inner tube being repaired should it get damaged.

When completed the weapon is fairly rigid, and if held out horizontally by the mouth-piece end, shows little or no flexion. It is usually ornamented with a few incised patterns at either end, but often this is confined to the short length of bamboo at the mouth-piece.

An attempt was made in 1891, at the suggestion of Sir Hugh Low, G.C.M.G., to send live plants of this bamboo to Kew Gardens. In the following year another attempt was made, but again without success. Botanical specimens were, however, collected and sent to Kew, and the following description of the plant is taken from the *Kew Bulletin*, No. 73, January, 1893 (pp. 14-17).

"40. BAMBUSA WRAYI, *Stapf.*—(Gramineæ); alte scandens, culmo superne tenuissimo nutante sæpe usque ad solum flexo inermi, internodiis flavidis glabris teretibus nitidis, foliis lineari-lanceolatis longe et augustissime accuminatis basi rotundatis lævibus glabris, nervis secundariis utringue 7-8, vaginis striatis pallidis glabris, ligula truncata breᴀi pilis 3-6 lin. longis deciduis ciliata panicula nuda vel apicem versus foliosa a basi ramosissima ramis aut abbreviatis arcte congestis verticillatis aut semi-verticillatis vel elongatis, spiculis laxius dissitis vel sæpius fasciculatim congestis, fertilibus paucis, glumis gradatim increscentibus infimis 2 vacuis ovatis sequentibus 2-3 plerumque gemmiparis lanceolatis acuminatis tenuiter coriaceis opacis marginibus ciliatis, florifera rachillam tenuem elongatam gemmulam rudimentarium gerentem æguante vel subæquante, palea submembranacea gluma sua paulo breviore superne bicarinata in carinis asperula vel ciliata in sulco dorsali rachillam productam et rudimentum recipiente, lodiculis obovatis ciliatis subæqualibus, antheris 6 glabris basi sagittatis muticis, ovario oblongo sensim in stylum brevem attenuato, stigmatibus tribus tenuis plumosis, caryopside (immatura) e basi oblonga in rostrum brevem cylindricum attenuata.

"Habitat.—Mt. Gunong Inas, at the source of the Selama River, and at the source of the Plus River, 4,500-5,500 feet., L. Wray Jr. (Perak Museum Herb., Fl. Malay Pen., No. 4166).

"*Culmus* 40-60 ped. altus, basi circa 1 poll. crassus, internodio tertio vel quarto interdum ad 7 ped. longo. *Folia* 8-10 poll. longa, 10-13 lin. lata. *Panicula* a 5-8 poll. ad 3 ped. longa. *Spiculæ* 6-9 lin. longæ. *Glumæ* infimæ ad 4½ lin. longæ. Ovarium vix 1 lin. longum, stigmatibus 1½-2 lin. longis.

"This species, like *B. Griffithiana,* Munro, is closely allied to *Nastus,* so far as the composition of the spicula is concerned. The fertile spicula begins with an empty bicarinate glume which is pressed against the relative primary axis. Then follow 1-2, empty, and 2-3, mostly bud-bearing glumes, which increase in size and are, except the lowermost, but indistinctly unicarinate; above these is the single fertile glume and a rudimentary bud borne by a long pedicel, a prolonged internode of the axis of the spicula. Sometimes the buds (gemmæ) grow into sterile spiculæ almost the length of the primary one. They also begin with a bicarinate glume, which is followed by closely set ecarinate glumes, increasing insize up to a certain point, thence decreasing. These, like all sterile spiculæ, bear in the axils of most of their glumes more or less reduced branchlets in the shape of small buds, and there is no prolonged internode in their rachilla. As all ramifications within the inflorescence begin with a bicarinate bract ("adossirtes vorblatt," Eichler), and those bracts are all of the same shape and, as also the bracts of the other series to which the gemmiparous and the fertile glumes belong, are like each other, and only differ in size, it is often nearly impossible to distinguish the single spiculæ.

"So far the composition of the spiculæ is almost the same as in *B. Griffithii*, and it approaches very much that of *Nastus*. The only deviation from the structure in the latter genus is the presence of gemmæ. The anthers, styles, and ovary are as in *B. Griffithii*. But whilst the lodiculæ in *B. Griffithii* are, according to Munro, unequal, as in *Nastus*, I find them equal, or almost so, in *B. Wrayi*. On the other hand, both *B. Griffithii* and *B. Wrayi* differ from *Nastus* in the shape of the ovary, which is oblong, gradually tapering into the short style, which persists in the fruit as a cylindric beak, instead of being widened above. The glumes are coriaceous, but not so prominently nerved as in *Nastus*, and more like those of most *Bambusæ*. In habit and leaves *B. Wrayi* differs very much from *B. Griffithii*, approaching more nearly *B. Arundinacea*, at least so far as herbarium specimens are concerned. If we imagine the "gemmæ" of the fertile spiculæ as being all entirely suppressed, we should have exactly the same structure as we have in *Nastus*. The step to this is hardly greater than from the many-flowered spiculæ of the majority of *Bambusæ* to the one-flowered spiculæ of *B. Griffithii*, and if we retain this in *Bambusa* we ought, I think, to reduce *Nastus* also to *Bambusa*, where it might stand as a section or as a sub-genus, distinguished by the more distinct reduction of the structure of the spiculæ, but linked very closely to the true *Bambusæ* by *B. Wrayi* and *B. Griffithii*. From a geographical point of view, it is very interesting to note that the centre of *Nastus* lies quite at the periphery of the common area of the other *Bambusæ*, in Madagascar and in the island of Bourbon, and that it just reaches Western Sumatra (Angkola, Junghuhn, according to Munro). Here in the most western part of the Malayan flora it is joined by its nearest ally, *B. Wrayi*, whilst *B. Griffithii* was found in the extreme north of Burma and in Manipur by Mr. C. B. Clarke.

"Mr. L. Wray, Jr., states that this Bamboo was only found in the two localities mentioned above. According to him it dies off after having fruited. The Semangs call it *Buloh bersumpitan*, and they 'use the large canes for the outer case of their arrow blow-pipes; the small ones for the inner tube. They straighten them over a fire when green, and hang them up in the smoke of their cooking-places to dry.' In numerous sterile spiculæ the 4th or 5th glume was deformed by insect action. The basal portion was much enlarged and adnate to the likewise enlarged next internode of the rachilla. This portion, a kind of oblong gall, contained the larva of the insect in the cavity.

"In regard to the plant described above (*Bambusa Wrayi*), the following interesting particulars respecting it are contained in a letter received at Kew from Mr. Wray, dated Perak, June 14th, 1892:—

"PERAK GOVERNMENT MUSEUM, LARUT,
June 14th, 1892.

"DEAR SIR,

"I recently went up a mountain called Gunong Inas, in the north of this State, and procured live plants of the bamboo of which the Semangs make their blow-pipes, known by the Malay name of *buloh bersumpitan*.

"If these plants grow, I will send them to you before the cold weather sets in. I have sent them up the hills here, where they will be at nearly the same elevation as their natural habitat.

"I was also fortunate enough to find a clump of these bamboos in flower, and I send you the specimens. As I expect this is a new species, and that you will describe it, I have sent you all the specimens, as it is better to have the whole material available to describe from. I would ask you, after having kept what you require for your herbarium, to kindly send the duplicates to Dr. King, of Calcutta.

"The plant grows at from 4,500 feet to nearly 6,000 feet elevation, generally on the ridges of the hills. The canes are about one inch in diameter near the ground, and taper away to one-sixteenth of an inch. These long thin ends drop down till they touch the ground. The canes are from 40 to 60 feet long. They are furnished with whorls of leaves at all the upper joints, and, as can be imagined, the bamboo is about the most elegant of its kind. From what I saw, I arrived at the conclusion that this plant having arrived at maturity, fruits, and then dies. I cannot form any idea at what age this happens, but I saw a cane which had been partly cut through by a knife, and it was still in vigorous growth, and as this hill has not been visited since 1886 this particular cane must be at least six years old, and as there would be many successions of canes before a plant reaches maturity the age of these bamboos must be very considerable. When they fruit, the barren canes die and are replaced by canes on which flowers appear at all the upper joints. I saw two dead clumps which had fruited.

"The joints are often over seven feet in length. The longest joint of a cane is generally the third or fourth from the ground. The Semangs use the large-size canes for the outer case of their blow-pipes, and the small ones for the inner tube. They straighten them over a fire when green, and hang them up in the smoke of their cooking-places to dry.

"They appear to grow in two places only in Perak. That is, on the mountains at the source of the Plus River, and on the mountains at the source of the Selama River, from the latter of which localities the specimens now sent were obtained.

"The parcel goes by this mail, and I hope will reach you in safety.

"I am, etc.,

"L. WRAY, JUN.

"W. T. THISELTON DYER, ESQ., C.M.G., ETC.,
ROYAL GARDENS, KEW."

This bamboo is figured in Hooker's *Icones Plantarum*, Vol. III. of the fourth series, Part III., May, 1893, plate 2253. In general appearance it is very similar to *Buloh aker*, only it is a much smaller plant.

The bamboo used by the Sakais of the south of Kinta, Batang Padang and Slim, although known by the same native name, is quite a different species. It does not appear to have been as yet identified, though it has probably long since been described. The longest joints are about four feet, and two of them are required to form one blow-pipe. The joint which occurs in the centre is pierced by a stick made out of the leaf-stalk of a rattan. This is extremely hard, and the joint can be quite cut out by it. The inside is then smoothed by pulling pieces of the hard root already mentioned through it. The inner tube is made of either two or three lengths of small diameter bamboo, joined together in the manner already described. The blow-pipes are generally extensively ornamented, sometimes throughout their whole length. Occasionally it will be found, on taking them to pieces, that even the inner tube has had patterns cut on it. This shows an amount of thoroughness that would scarcely be expected in the work of mere savages.

SOME NOTES ON THE MALAYAN FOLK-LORE OF NATURAL HISTORY.

By L. Wray, Jun.

A strange superstition is attached to a small snail which frequents the neighbourhood of the limestone hills in Perak. It belongs to the *Cyclophoridæ*, and is probably an *Alycæus*. Among the grass in the shadow of a grazing animal these creatures are to be discovered, and if one of them is crushed it will be found to be full of blood, which has been drawn in a mysterious way from the veins of the animal through its shadow. Where these noxious snails abound the cattle become emaciated and sometimes even die from the constant loss of blood. In the folk-lore of other countries many parallels to this occur, but they differ in either the birds, bats or vampires, who are supposed to prey on the life-blood of their fellows, going direct to the animals to suck the blood instead of doing so through the medium of their shadows.

A horned toad, known as *katak bertandok*, but not the common one of that name (*Megalophrys nasuta,* Gunther), has a very bad reputation with the Malays. It is said to live in the jungle on the hills, and whenever it takes up its abode all the trees and plants around wither and die. So poisonous is it, that it is dangerous even to approach it, and to touch or be bitten by it is certain death.

The bite of the common toad (*Bufo melanostictus*, Cantor) is also said to prove fatal. That toads have no teeth is an anatomical detail that does not seem to be thought worthy of being taken into account.

The supposed venomous properties of this useful and harmless tribe have a world-wide range. In Shakspeare many allusions to it are made; one of them, which mentions the habit of hibernation possessed by those species which inhabit the colder parts of the earth, says—

> "In the poison'd entrails throw,
> Toad, that under coldest stone
> Days and nights hast thirty-one,
> Swelter'd venom sleeping got,
> Boil thou first i' the charmed pot."
> *Macbeth*, Act. iv.

In another, reference is made to the toad-stone, which seems to be represented in Malayan tradition by the pearl carried in the bodies of the hamadryad, the cobra and the bungarus, the three most deadly snakes of the Peninsula.*

> "Sweet are the uses of adversity
> Which, like the toad, ugly and venomous,
> Wears yet a precious jewel in its head."

* These stones are called *batu gligar*, and are highly valued. They are calcareous, and look like the rounded and waterworn operculum of some marine mollusc, but their true origin is uncertain.

Boccaccio makes one of his stories turn on the poisonous properties of a toad, the two principal characters, Pasquino and Simona, being killed by putting into their mouths the leaves of a sage plant which grew over the hole of a large toad. "King John of England is supposed to have been poisoned by a drink in which matter from a living toad had been infused."—*Medical Jurisprudence,* by Beck.

There is some foundation of fact for the popular belief, as toads secrete an acrid fluid from the skin, which appears to defend them from the attacks of carnivorous animals.*

A species of fish-like tadpole, found at certain seasons of the year in the streams and pools, is supposed to divide when it reaches maturity, the front portion forming a frog and the after part or tail becoming the fish known as *ikan kli,* one of the cat-fishes or siluridæ. In consequence of this strange idea many Malays will not eat the fish, deeming it but little better than the animal from which it is supposed to have been cast.

The *ikan kli* is armed with two sharp barbed spines attached to the fore part of the pectoral fins, and can and does inflict very nasty wounds with them, when incautiously handled. The spines are reputed to be poisonous, but it is believed that if the brain of the offending fish is applied to the wound it will act as a complete antidote to the poisonous principle, and the wound will heal without trouble. The English cure for hydrophobia—that is, "the hair of the dog that bit you," will occur to all as a modification of the same idea.

When the eggs of a crocodile are hatching out, the mother watches; the little ones that take to their native element she does not molest, but she eats up all those which run away from the water, but should any escape her and get away on to the land they will change into tigers. Some of these reptiles are said to have tongues, and when possessed of that organ they are very much more vicious and dangerous than the ordinarily formed ones. When a crocodile enters a river, it swallows a pebble, so that on opening the stomach of one it is only necessary to count the stones contained in it to tell how many rivers it has been into during its life. The Malays call these stones *kira-kira dia,* on its account. The Indians on the banks of the Oronoko, on the other hand, assert that the alligator swallows stones to add weight to its body to aid it in diving and dragging its prey under water. Crocodiles inhabiting a river are said to resent the intrusion of strangers from other

* "The toad secretes a venom of a tolerably powerful character; and instead of this secretion taking place, as in the case of snakes, entirely through the salivary glands, it is actually secreted by the skin, so that the word "sweated" is most accurately descriptive. Dr. Leonard Guthrie mentions that the secretion also occurs in the toad through the parotid glands, and the venom is a thick milky fluid like the juice of dandelion stalks in taste and appearance. When inoculated subcutaneously it kills small birds in six minutes, and dogs and guinea-pigs in half an hour to an hour and a half; the symptoms in birds being loss of co-ordination, followed by death, in guinea-pigs, convulsions, and in the dog, depression, vomiting, and intoxication. Dr. Guthrie describes two very interesting observations of his own on the effect of toad's venom. He kept a small toad in a cage with some common lizards, and one day a lizard, having bitten the toad, immediately afterwards rushed wildly round the cage, burrowing its head in the sand, became convulsed, and died in less than two minutes. His dog having seized a toad, was attacked by instantaneous and profuse salivation, violent vomiting, and collapse. He also noticed that the venom has a most powerful local action on the skin, so that after carrying a toad in his hand he got numbness and tingling in it, with slight swelling and dryness of the skin, lasting for several hours."

waters, and fights often take place in consequence. According to the Malays they are gifted with two pairs of eyes. The upper ones they use when above water and the under pair when beneath the surface. This latter pair is situated half way between the muzzle and the angle of the mouth, on the under surface of the lower jaw. These are in reality not eyes but inward folds of skin connected by a duct with a scent gland, which secretes an unctuous substance of a dark grey colour, with a strong musky odour. Medicinal properties are attributed to the flesh of the males, which are believed to be of very rare occurrence, and to be quite unable to leave the water by reason of their peculiar conformation. The fact is that the sexes are almost undistinguishable, except on dissection, and therefore the natives class all that are caught as females. While on this subject it may be worth mentioning that at Port Weld there used to be a tame crocodile which would come when called. The Malays fed it regularly, and said it was not vicious and would not do any harm. It was repeatedly seen by the early visitants to Port Weld, or Sapetang as the place was then called, and was a fine big animal, with a bunch of seaweed growing on its head. Some one had it called, and then fired at the poor thing; whether it was wounded, or only frightened, is uncertain, but it never came again.

The gall-bladder of the python, *uler sawah*, is in great request among native medical practitioners.* This serpent is supposed to have two of these organs, one of which is called *lampedu idup*, or the live gall-bladder. It is believed that if a python is killed and this organ is cut out and kept it will develope into a serpent of just twice the size of that from which it was taken. The natives positively assert that the python attains a length of 60 to 70 feet, and that it has been known to have killed and eaten a rhinoceros.

One of the pit vipers is exceedingly sluggish in its movements, and will remain in the same place for days together. One individual that was watched, lay coiled up on the branch of a tree for five days, and probably would have remained much longer, but at the end of that time it was caught and preserved. The Malays call it *uler kapak daun*, and they say that it is fed three times a day by birds, who bring it insects to eat. One man went so far as to say that he had actually once seen some birds engaged in feeding one of these beautiful bright green snakes.

The weaver-bird, which makes the long hanging bottle-shaped nests occasionally seen hanging from the branches of a low tree, is said to use a golden needle in the work; and it is affirmed that if the nest is carefully

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* "Those who take them proceed to extract the gall from the inside, and this sells at a great price; for you must know it furnishes the material for a most precious medicine. Thus if a person is bitten by a mad dog, and they give him but a small pennyweight of this medicine to drink, he is cured in a moment.

* * * * * * * * *

"Yet, again, if one has any disease like the itch, or it may be worse, and applies a small quantity of this gall he shall speedily be cured. So you see why it sells at such a high price.

"They also sell the flesh of this serpent, for it is excellent eating, and the people are very fond of it. And when these serpents are very hungry, sometimes they will seek out the lairs of lions or bears or other large wild beasts, and devour their cubs, without the sire and dam being able to prevent it. Indeed, if they catch the big ones themselves they devour them too; they can make no resistance."—*The Book of Ser Marco Polo the Venetian.* (A.D. 1273.)

picked to pieces without breaking any of it, the needle will be found, but if it is pulled ruthlessly apart, or if even a single piece of the grass of which it is made is broken in unravelling it, the golden needle will disappear. The makers of these curious and beautiful nests are said to always choose trees that are infested with red ants or wasps, or which grow in impassable swamps.

The king crow is called by the Malays the slave of the monkeys, *burong hamba kra*. It is a pretty, active, noisy little bird, incessantly flying about with its two long racket-shaped tail feathers fluttering after it. They say that when it has both of these feathers it has paid off its debt and is free, but when it is either destitute of these appendages or has only one of them it is still in bondage. The grey sea eagle is called *burong hamba siput*, and its office is to give warning by screaming to the shell-fish of the changes of the tide, so that they may regulate their movements, and those species which crawl about on the mud at low water may know when to take refuge in the trees and escape the rising tide, or when the tide is falling, that they may know when to descend to look for food.

Burong demam, or the fever bird, is so called from its loud tremulous note, and the Malays say that the female bird calls in its fever-stricken voice to its mate to go and find food because it has fever so bad that it cannot go itself. This bird is probably one of the large green barbets. The note is often heard, and doubtless the bird has been collected, but it is one thing shooting a bird and another identifying it as the producer of a certain note.

Another bird, the white-breasted water-hen, a frequenter of the edges of reedy pools and the marshy banks of streams, is reputed to build a nest on the ground which has the property of rendering any one invisible who puts it on his head. The prevailing idea among the Malays is that the proper and legitimate use to put it to is to steal money and other species of property.

Elephants are said to be very frightened if they see a tree-stump that has been felled at a great height from the ground, as some trees which have high spreading buttresses are cut, because they think that giants must have felled it, and as ordinary-sized men are more than a match for them they are in great dread of being caught by creatures many times more powerful than their masters. Some of the larger insects of the grasshopper kind are supposed to be objects of terror to elephants, while the particularly harmless little pangolin (*manis pentadactyla*) is thought to be able to kill one of these huge beasts by biting its foot. The pangolin, by the bye, is quite toothless. Another method in which the pangolin attacks and kills elephants is by coiling itself tightly around the end of the elephant's trunk and so suffocating it. This idea is also believed in by the Singhalese, according to Mr. W. T. Hornaday's *Two Years in the Jungle*. Passing from fiction to fact, a thing that does not seem to be generally known, or at least that has not found its way into natural history books, may be mentioned here. It is that elephants are very fond of eating earth. They methodically dig it out with their fore feet, put it into their mouths with their trunks and munch it up with evidently great relish. Probably it is a means of keeping their teeth sharp, but they undoubtedly swallow it.

A Malacca cane with a joint as long as the height of the owner will protect him from harm by snakes and animals and will give him luck in all things. What is called a *samambu bangku*, or *baku*, possesses the power of killing any one, even when the person is only slightly hurt by a blow dealt with it. These are canes that have died down and have begun to shoot again from near the root. They are very rare, one of 18 inches in length is valued at six or seven dollars, and one long enough to make a walking-stick of, at 30 to 50 dollars. At night the *rotan samambu* plant is said to make a loud noise, and, according to the Malays, it says—" Bulam sampei, bulam sampei," meaning that it has not yet reached its full growth. They are often to be heard in the jungle at night, but the most diligent search will not reveal their whereabouts. The *rotan manoh* is also said to give out sounds at night. The sounds are loud and musical; but the alleged will-of-the-wisp character of the rattans which are supposed to produce them seems to point to some night-bird, tree-frog, or lizard as being the real cause of the weird notes, though it is just possible that the wind might make the rattan leaves vibrate in such a way as to cause the sounds.

One of the largest and stateliest of the forest trees in Perak is that known as Toallong or Toh Allong. It has a very poisonous sap, which produces great irritation when it comes in contact with the skin. Two Chinamen who had felled one of these trees in ignorance, had their faces so swelled and inflamed that they could not see out of their eyes and had to be led about for some days before they recovered from the effects of the poison. Their arms, breasts and faces were affected, and they presented the appearence of having a very bad attack of erysipelas. These trees are supposed to be the abiding places of *hantu*, or spirits, when they have large hollow projections from the trunk, called *rumah hantu* or spirit houses. These projections are formed when a branch gets broken off near the trunk, and are quite characteristic of the tree. There are sometimes three or four of them on a large tree, and the Malays have a great objection to cutting down any that are so disfigured, the belief being that if a man fell one he will die within the year. As a rule these trees are left standing when clearings are made, and they are a source of trouble and expense to planters and others, who object to their being left uncut.

The following series of events actually happened. A Malay named Panda Tambong undertook, against the advice of his friends, to fell one of these Toh Allong trees, and he almost immediately afterwards was taken ill with fever, and died in a few weeks' time. Shortly after this some men were sitting plaiting ataps under the shade of another of these ill-omened trees, when, without any warning, a large branch fell down, breaking the arm of one man and more or less injuring two others. There was not a breath of wind at the time, or anything else likely to determine the fall of the branch. After this it was decided to have the tree felled, as there were coolie houses nearly under it. There was great difficulty in getting any one to fell it. Eventually a Penang Malay undertook the job, but stipulated that a *pawang*, or sorcerer, should be employed to drive away the demons first. The pawang hung pieces of white and red cloth on sticks round the tree, burned incense in the little contrivances made of the split leaf-stalks of the bertam palm used by the Malays for that purpose, cut off the heads of two white fowls, sprinkled the blood over the trunk, and in the midst of many incantations the tree was felled without any mishap ; but, strange to say, the pawang, who was a haji and a slave-debtor of the Toh Puan Halimah, died about nine months afterwards.

ON THE APPLICATION OF HYDROCYANIC ACID TO THE INSECT PESTS INFESTING MUSEUM SPECIMENS.

By L. Wray, Jun.

It may perhaps be thought that insect pests should be unknown in a museum; but in this, as in so many other cases, what should be and what is are quite different things. The poisons which are so freely applied to the specimens do not appear to afford much protection; it matters not whether it is arsenic or corrosive sublimate that is used, insects abound, and spring-tails, moths, beetles and mites devour the specimens and appear to thrive on the poisons. Whether it is that, like the human opium and arsenic-eaters, a long course of poison-taking has enabled these pests to tolerate it, or what other explanation there may be, the fact remains that they can eat highly-poisoned things with perfect impunity. Mr. Montagu Browne, the Curator of the Leicester Museum, says, in speaking of arsenic: "It is also perfectly useless as a scarecrow or poison to those *bêtes noirs* of the taxidermist, the larvæ of the various clothes and fur-eating moths of the genus *Tinea*, or the larvæ of *Dermestes lardarius, D. Murinus,* and other museum beetles. They simply laugh arsenic to scorn; indeed, I believe, like the Styrian arsenic-eaters, they fatten on it. I could give many instances. Of course, when you point out to a brother taxidermist—rival, I mean: there are no brothers in art—the fact that somehow this arsenical paste does not work the wonders claimed for it, he replies, 'Oh! Ah! Yes! that specimen, I now recollect, was done by a very careless man I employed; he never half painted the skin.' All nonsense! men, as well as masters, lay the 'preservative' on as thickly as they can."

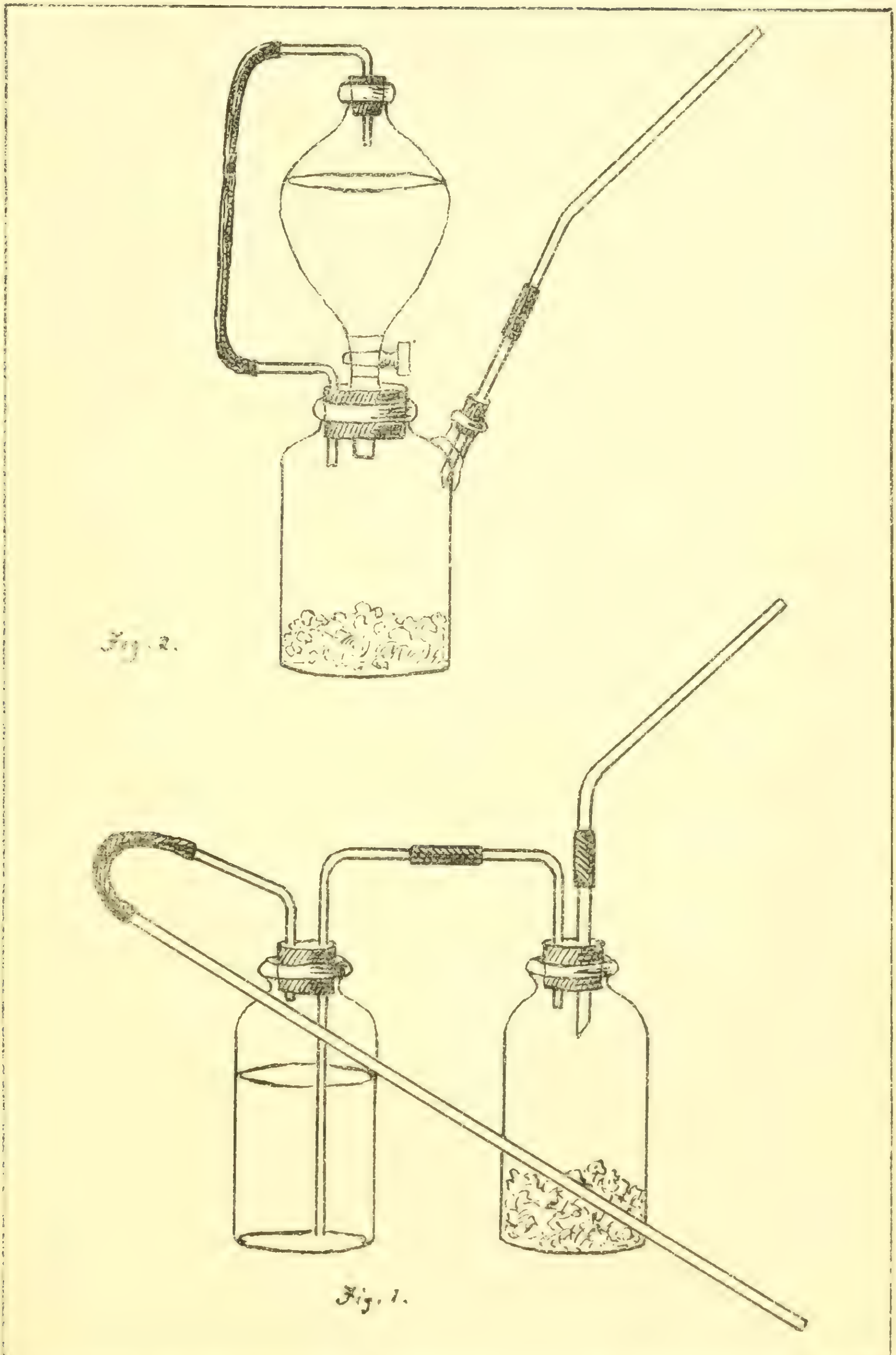
The atmospheric poisons, such as camphor, napthaline, creosote, *kayu puteh* oil, turpentine, carbolic acid, etc., have little effect on some of the worst pests. The vapour of almost any of them will, however, kill ants, and although not fatal to museum beetles, undoubtedly has a slight deterrent effect on them. It would seem that there is no way at present known of preventing the appearance of insects amongst zoological collections, so that a method of stopping their ravages when they do appear, without doing injury to the specimens, is a matter of considerable importance to all those to whose care natural history collections are entrusted.

Professor E. M. Shelton, in Bulletin No. 16 of the Department of Agriculture of Queensland, quoting from Bulletin No. 23 of the Entomological Division of the United States Department of Agriculture, gives an account of the hydrocyanic acid gas treatment as applied to insect pests infesting orange, lemon and other fruit trees. This account suggested the application of the gas to the insect pests which attack natural history specimens in museums, and as the experiment has proved completely successful some account of it may be of interest.

As applied to trees, a tent of waterproof material is erected over them and the gas is generated in an open vessel placed on the ground beneath the tent. Half an hour is said to be sufficient to kill all the scale insects on a tree, but the gas so applied has not a fatal effect on mites and beetles. As beetles of several kinds are the worst enemies of museum specimens, it was necessary to modify the process, by using an air-tight box in which to place the specimens and subject them to the gaseous poison, and also to increase the amount of the gas in proportion to the volume of the enclosed air.

The death chamber may be made in almost any way, so long as the requirements of the case are fulfilled. These are that it should be large enough to accommodate any specimen in the collection, that it can be closed air-tight, that it can be opened without danger to the person using it, and that it is fitted with moveable shelves so as to take numerous small specimens at one time. The best material to build it of would be brick, with an inside rendering of cement. The death chamber recently built at the Perak Museum is a large wooden box, measuring 8 feet long by 6 feet high by 2½ feet wide. It is rendered air-tight by pasting strips of paper over all the seams and then serving the whole interior with several coats of white paint. One entire side is moveable. This is hung from the top edge by jointed hinges and can be raised by a cord attached to its lower edge and passed over a pulley in the roof of the building. The cover is held in place by eight wedges, which are driven in between it and four vertical moveable wooden bars which fit into holes in eight pieces of wood which project from the top and bottom of the chamber. The edges of the case are covered with list, so that a tight joint can be made. At the two ends of the chamber are three horizontal pieces of wood which serve to support three moveable shelves, each of which is composed of four wooden bars. This chamber contains 120 cubic feet, and will hold a large number of specimens at one time. It is placed in a shed where there is free ventilation, a matter of importance, as otherwise there might be danger of inhaling the gas when the chamber was opened, with unpleasant or even serious results.

The hydrocyanic, or as it is more commonly called, prussic acid gas, is produced by decomposing cyanide of potassium with sulphuric acid. The common form of sulphuretted hydrogen gas bottle is a satisfactory apparatus to use. The long glass funnel in the large bottle is to be replaced by a wide glass tube, this should not descend far into the bottle; it is to be bent at right angles and serves to carry the gas into the death chamber. To use the apparatus, put into the larger bottle the coarsely pounded cyanide and into the smaller the dilute sulphuric acid, replace the corks and tubes, then blow into the smaller bottle by the free tube and force some of the acid through the connecting pipe into the larger bottle containing the cyanide. The evolution of the gas will at once begin, and, as required more acid is forced over until the whole of the cyanide is decomposed. There should always be more acid in the small bottle than is required, so that what is left in it will prevent the gas from



Apparatus for generating Hydrocyanic Acid Gas.

escaping. It is advisable to use as a mouth-piece a long tube connected by a length of india rubber tubing, so that it is not necessary to put the head near the generating bottle. The whole apparatus can easily be constructed out of a couple of pickle bottles and a few glass tubes, as shown in the sketch at Plate 10, Fig. 1.

If preferred, the acid may be put into a pipette and allowed to flow into the generator by opening a stop-cock or pinch-cock, as the case may be. In this case the top of the pipette should be connected with the generator by a bent tube, so as to prevent the acid being blown out of the top of the pipette. The object to be kept in view is that the acid may be supplied gradually, while any leakage of the gas is prevented. An apparatus of this character is shown in Fig. 2. The generator is conveniently placed on a shelf fitted to the outside of the back of the chamber.

It has been found by experiments on the various insects infesting museum specimens that three ounces of fused cyanide of potassium and nine fluid ounces of dilute sulphuric acid, of a strength of two measures of water to one of acid, is sufficient to charge this chamber. That is, that one quarter of an ounce of cyanide is required for each 10 cubic feet of air space.

The dilute acid should be mixed and cooled before use, otherwise it might lead to the breakage of one or both of the bottles. Should this or any other accident happen during the evolution of the gas, the safest course would be to leave everything for half an hour or so until the gas has passed off. Mixing the acid is best done in a bottle or earthenware jar stood in a bucket of cold water. It is perhaps best to add the water to the acid.

From two to three hours is sufficient to kill every living thing in the chamber, though perhaps it is as well to allow rather more time to elapse, particularly when large stuffed animals are being treated, as the gas must naturally take some time to find its way into the stuffing. When it is wished to open the chamber the cover may be released, and by pulling the cord it may be raised without going near it. Half an hour should be allowed to pass, for the escape of the gas, before it is emptied of its contents. With care there should be no danger in using this apparatus, if, as has been said before, it is placed in an open or nearly open shed, if the cover is raised by a cord or other means so that it is not necessary to approach it closely, and if a sufficient time is suffered to elapse before the contents are removed.

Of its efficacy there can be no question, for moths, spring-tails, beetles and their larva are all destroyed, though eggs, and possibly crysalids, may escape. It is doubtful if anything else would be at once so simple of application and so cheap.

Chloroform, bisulphide of carbon, carbonic acid or carbonic oxide would probably be equally effective, but the cost and trouble of applying would, however, be greater, and the vapours of the two former are dangerously explosive when mixed with air, and they are both very difficult to keep, even in the best of bottles, in the tropics.

ON A WILD CUBEB FROM PERAK, "PIPER RIBESIOIDES."

BY L. WRAY, JUN.

The true cubeb is the fruit of a pepper called *Piper cubeba*, and is known locally as *lada berekor*, or tailed pepper, from each berry having a prolongation like a stalk. It is a valuable drug, possessing stimulant and diuretic properties.* It yields cubeb oil and the alkaloid cubebine. It commands a high price, which leads to its adulteration with the fruits of other nearly-allied peppers. One of these adulterants which has found its way into the English market has been found to cause nausea and diarrhœa, with other symptoms of poisonous action, when taken internally. In an attempt to trace this spurious cubeb to its source, I heard that a wild pepper was collected in Selama by the Malays, and on going there found it to be a cubeb. Mr. Bede Cox kindly procured for me a quantity of the fruit, which, together with botanical specimens of the plant, were sent to Mr. E. M. Holmes, the Curator of the Museum of the Pharmaceutical Society. On comparison with specimens in the herbarium of the Natural History Museum at South Kensington, and at Kew, he identified it as *Piper ribesioides*, Wall. It was not the poisonous variety; that has since been found to come from Java.

It is thus described in the *Flora of British India:*—

"Section II. CUBEBA. *Spikes* solitary; flowers diæcious; bracts of female spikes peltate. *Fruit* contracted at the base into a pedicel.

"6. PIPER RIBESIOIDES, *Wallich. Pl. As. Kar.* I. 79. t. 9, and *Cat.* 6637; quite glabrous, very robust, leaves 8—12 inches, very coriaceous linear—or ovate oblong acuminate base deeply cordate 5—9-nerved at the very base 3-nerved higher up, petiole 1—2 inches, fruiting spike short, stout, pedicel glabrous as long as the globose apiculate fruit. *Cas. DC. in Prodc.* 342. Cubeba Wallichii, *Miq. Syst. Pip.* 289, and *Ill. Pip.* 47, t. 46, 47. (Habitat) Tenasserim, Penang, Singapore and Burma.

"A very stout climber; branches pale, as thick as a goosequill, deeply furrowed when dry. *Leaves* variable, sometimes 5 inches, broad, basal sinus 1-1½ inches deep, lobes rounded equal or not; lanceolate, subsagittately cordate. *Spikes* 1-3 inches; bracts short coriaceous, rachis of spike stout, rigid; bracteoles together semilunar. *Fruit* ½ inch, diam."

This wild cubeb is fairly common in some localities in Perak. It grows on the plains and low hills, is a climber, and in habit and general appearance resembles sirih (*Chavica betle*). I have collected it in flower in April and in fruit in July. Most probably it fruits twice a year, like so many other plants in the Straits, in which case the times would be July and about the end of December.

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* Cubebs have been in use for many years: they are mentioned by Marco Polo as exported from Java at the time of his visit to that island, in about the year A.D. 1290.

Thinking that it was possible the wild cubeb from Selama might possess properties which would render it of service as a drug, I suggested to Mr. Holmes that it might be examined physiologically. This has not yet been done, but it has been examined chemically, and the following interesting paper was read before a meeting of the School of Pharmacy Students' Association, February 23rd, and published in the *Pharmaceutical Journal*, Vol. XXIII., Third Series, March 4th, 1893, p. 734.

"AN EXAMINATION OF "PIPER RIBESIOIDES" BY EDWARD BROOKE, F.C.S.

" A specimen of the spurious cubebs received from Mr. L. Wray. Jr., Corresponding Member of the Pharmaceutical Society, and described in the *Pharmaceutical Journal,* (3) XXIII., 121, was handed to me for examination by Mr. Holmes, who had ascertained that it did not give the characteristic crimson colour with sulphuric acid, and suggested an examination with the view of determining its chemical constituents.

" A. *Extraction by Petroleum Spirit.*—By percolation with light petroleum spirit a residue was obtained on evaporation equal to 19·85 per cent. It consisted of a semi-solid mass, of a deep brown colour, having a peculiar aromatic odour and a rather bitter taste. Exposed to the heat of a water bath for several hours, it gradually lost weight to the extent of 6·23 per cent, which figure was taken as representing the amount of volatile oil present.

" The remaining 13·57 per cent was then dissolved in absolute alcohol, a weighed portion taken and titrated with a solution of potash, phenolphthalein being used as an indicator. The presence of free fatty acids in considerable quantity was indicated, in addition to some neutral fat.

" On distillation of the powdered drug in a current of steam, scarcely one per cent of oil was obtained, owing to the difficulty with which it distilled. This was of a pale straw colour, with a pungent and rather disagreeable odour, somewhat like dried hops. It is soluble in alcohol, chloroform, and ether.

" The following comparative tests were applied to the volatile oil. (*Vide* Braithwaite on Oil of Daphnidium Cubeba, *Pharmaceutical Journal* (3), XVII.)

Reagent employed.	Vol. Oil, P. Ribesioides.	Vol. Oil, P. Cubeba.
Sol. Bromine in Chloroform 1 in 20...	Yellow	Yellow to Violet
Sulphuric Acid in Chloroform	Brown-red, turning to Violet	Same
The same with excess of water	At first colourless, then Violet	Same
Hydrochloric Acid	Slight Violet	Same
Nitric Acid	Brown with Violet edges ...	Same

" B. *Extraction with Ether.*—After extraction with petroleum ether the powder was dried and exhausted by percolation with ether. By this means 3·08 per cent of extract was obtained, of a black-brown colour, having an aromatic, rather bitter taste, and a slight odour.

"The extract was treated with absolute alcohol, which dissolved 2·06 per cent of the total residue, the remaining 1·02 per cent being insoluble and of a black colour. This insoluble black substance was found to be freely soluble in alcoholic potash, which when diluted with water gave a copious precipitate on the addition of an acid, thus clearly indicating an acid resin. The portion soluble in alcohol presented the characters of a neutral resin.

"C. *The Alcoholic Extract.*—The marc was next exhausted with alcohol, which yielded on evaporation 1·48 per cent of solid, which was of a dark brown colour, with a bitter taste.

"Neither alkaloids, glucosides, or sugar in any form could be demonstrated in this extract.

"D. *The Aqueous Extract.*—Further treatment with water yielded 7·64 per cent of a dark brown solid, containing neither gums nor sugar, but a small quantity of starch was present. On dissolving the extract in water, adding lead acetate, decomposing the precipitate formed by sulphuretted hydrogen, and concentrating the filtrate, malic acid was faintly indicated. Ferric chloride indicated a slight quantity of tannin. A little phosphate was also detected. Nitrate of silver gave no precipitate. Glucose and cane sugar were absent in the portion not precipitated by lead acetate. The residue from the original powder, after exhaustion with the various solvents, was equal to 67·26 per cent.

"E. *The Ash.*—After several determinations, the ash in a sample of genuine cubebs, kindly supplied by Mr. Holmes, was found to be 8·31 per cent. It contained a trace of lithium and a considerable amount of potassium, with some calcium. Iron was present to the extent of 0·81 per cent in the ash, representing 0·007 per cent of the whole drug. A green colouration of the ash pointed to the presence of manganese or copper, but only the former was found. A typical trade sample of cubebs yielded 8·43 per cent of ash, the stalks present yielding 8·26 per cent, and the berries, independent of the stalks, 8·1 per cent.

"The ash in each case contained iron, together with manganese, potassium, and some calcium.

"In the case of *Piper ribesioides* the ash amounted to 4·87 per cent. It was of a brown colour and was shown to contain 3·58 per cent of iron in the ash, equivalent to ·174 per cent on the original drug. There was also found a large quantity of potassium, some calcium, manganese, and silica.

"As the ash of ordinary cubebs and *Piper ribesioides* differed so greatly in the proportion of iron, it occurred to me that the aqueous solutions of the raw drugs might differ in the same way.

"It was found that on digesting the *Piper ribesioides* in acidulated water for about an hour, a copious precipitate was given with ferrocyanide of potassium, thus differing entirely from the samples of ordinary cubebs when similarly treated. Again, on a cold decoction being treated with iodine, *Piper cubeba* gave only a slight reaction for starch, whereas *Piper ribesioides* gave quite a dense blue.

"The following tables are a summary of the results obtained:—

PIPER CUBEBA.	PIPER RIBESIOIDES.
RAW DRUG.	
No reaction for iron in aqueous solution or acid solution.	Copious reaction for iron in dilute acid after an hour.
A decoction gives only a slight reaction with iodine.	Iodine in cooled decoction indicated a considerable quantity of starch.
ASH.	
8·01 per cent, which contained ·081 per cent of Fe_2O_3	4·87 per cent, which continued 3·58 per cent of Fe_2O_3

OBTAINED FROM FIFTEEN GRAMMES.

	per cent.	
Petroleum extract	19·85 ...	Vol. oil 6·28 per cent., non vol. fats and fixed oil 13·57 per cent.
Ether extract	3·08 ...	Two resins; one neutral, soluble in alcohol, 2·06 per cent; one acid, insoluble in alcohol, 1·02 per cent.
Alcoholic extract	1·48 ...	Chiefly extractive.
Aqueous extract	7·64 ...	Colouring matter and extractive. No glucosidal matter and free from sugar.

	Grammes.
Total ...	32·05
Residue ...	67·26
Waste ...	·69
	100·00

The moisture at 100° C. was 1·75 per cent."

THE BATS' GUANO FROM GUNONG PONDOK.

BY L. WRAY, JUN.

The following analysis of the bats' guano from the caves in the limestone hill called Gunong Pondok, at Gapis, has been communicated by Mr. Arthur Lutyens, of Waterloo Estate:—

1	Water (lost at 212° F.)	22·21
2	Organic Matter and Ammonia Salts*	17·11
3	Phosphoric Acid†	15·05
4	Lime	25·95
5	Sulphuric Acid	11·55
6	Potash	·68
7	Soda	·06
8	Carbonic Acid, Magnesia, Chlorine	4·06
9	Sand	3·33
		100·00

Nitrogen as organic matter and Ammonia Salts	1·01
Do. as Nitrates	1·60
Total Nitrogen	2·61

* Equal to Ammonia... 3·16
† Do. Phosphate of Lime ... 32·85

(Sd.) JOHN HUGHES,
F. Inst. Chem., M. S. Pub. Anal.,
Consulting Chemist, Ceylon Planters' Association.

Analytical Laboratory,
79, Mark Lane, London.

The two constituents of guano which make it of special value as a manure are the ammonia and the phosphate of lime. In the above analysis these are given as—ammonia, 3·16 per cent, and phosphate of lime, 32·85 per cent.

The following averages, deduced from a number of analyses of different guanos, taken from Ure's *Dictionary of Arts, Manufactures and Mines,* show the comparative value of this bats' guano.

	Ammonia, per cent.	Phospate of Lime, per cent.
Peruvian Guano	17.00	25·12
Angamos ,,	20.00	20·25
Ichaboe ,,	7.00	31·50
Patagonian ,,	2·50	47·40
Saldanha Bay Guano	1·50	55·84
Kooria Mooria ,,	0·25	15·66

In this list it would take a central position, coming after Ichaboe guano. The amount of potash is very small—only ·68 per cent, equal to 1·44 per cent of dry nitrate of potash—which is rather curious, for Mr. W. E. Maxwell (in *Notes and Queries*, page 103, of the Straits Branch, Royal Asiatic Society,) says that Mr. Howison, who owned a warehouse in Beach Street, Penang, in partnership with a Mr. Lamb, "started the manufacture of saltpetre out of the bats' guano in the caves in Gunong Pondok, and built a large shed with 40 or 50 pans. The saltpetre which he produced was very white. He lost money in this enterprise." This is the Mr. Howison who cleared the hill at Sungei Limau, which is now known as Changkat Orang Puteh. He is said to have lived there about three years.*

Mr. W. Barrington D'Almeida, in a paper entitled *Geography of Perak and Salangore, and a Brief Sketch of some of the Adjacent Malay States*, read before the Royal Geographical Society in 1876, says, in reference to the same place, "saltpetre has been found in large quantities in Perak, and is obtained from a nitrous mud, which has been forming for ages in certain caverns and clefts of the rocks in the interior."

Recently a Chinaman named Li Peng Neo has found some very good nitrate of potash in a cave in a limestone hill near Tambun, in Kinta, which he has asked permission to work. Judging from the specimens which have been forwarded by the District Magistrate of Kinta to the Museum, the salt occurs in bats' guano like that which was formerly worked in Gunong Pondok.

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* The Malays of Gapis have a curious legend about this man. They say that he once took a rifle and fired a shot at the rocky face of Gunong Pondok, and that his arm and head became fixed in the position he took when firing, and that he could never put down his arm or put up his head again. This is interesting as showing how short a time is sufficient for a tradition of this kind to grow in. Gunong Pondok is supposed to be the house of a giant who lived there and whose fish-trap (*bubu*), turned into stone, now forms the conical summit of Gunong Bubu. In the cave where the guano is, there used to be a sort of altar made of wood, with the heads of buffaloes and other offerings on it.

MALAYAN ÆOLIAN PIPES.

By L. Wray, Jun.

Bamboos, so cut that they emit musical notes when the wind blows, are called by the Malays *buloh perrindu*, from *buloh* the bamboo, and *rindu*, plaintive or melancholy.

The way in which they are made is as follows. A long bamboo is taken, which may be of any size from an inch in diameter upwards; and in each of the upper joints a hole is cut somewhere near the centre. These holes are of many different shapes and are placed alternately on either side of the bamboo, so that whichever way the wind blows the pipe will sound. They are also spaced at different parts of the joints to give different notes, and the shapes of the holes are varied with the intention of altering the timbre of the notes, in the same way as is done with organ pipes. The holes are square, round, triangular, elliptical, rhombic, rectangular, besides segments and sectors of circles and many irregular shapes.

The *buloh perrindu* being prepared is stuck upright into the ground, large end downwards, or tied on to a tree-top near a house, so that its music can be heard. Living bamboos are also sometimes cut and made æolian, and they will remain alive for some long time afterwards. A clump so treated will produce musical notes whenever the wind rustles through it.

The sounds emitted by these æolian bamboos are, as the Malay name indicates, weird and plaintive, rising and falling as the wind rises and falls:

> "Low at times and loud at times,
> And changing like a poet's rhymes."

A Malay writer, quoted by Marsden, uses the tones produced by these bamboos as something particularly melodious with which to compare the musical voice of a woman. "Sweet was the sound of her voice as that of the tuneful reed—*Mardu-lah bunyi swara-nia seperti buloh perrindu.*"

The name *buloh perrindu* is also applied to a small species of bamboo that grows on the tops of some of the taller hills in Perak, at from 5,000 to over 6,000 feet elevation. Flowering specimens of this pretty little bamboo were collected on the summit of Gunong Berumbun in 1888, but have not yet been identified. The word *rindu* also means to desire earnestly, long for, and pine after, and apparently this is the meaning that the name bears as applied to this species, for the Malays say that it has mystic properties and that if a man can get his lady-love to accept a piece of it, that it will act like a philter or the elixir of love. The lady need not knowingly take it. It is sufficient if she is possessed of a small piece, even though she is not aware of it. It is reputed to be a very powerful charm, subjugating the coldest and most indifferent, and even turning hate to love. On the occasion when botanical specimens of it were collected, the Malays of the party cut and brought down bundles of the canes for use as love charms.

REPORT ON A SAMPLE OF WOLFRAM FROM CHUMOR, BATANG PADANG.

DOWNING STREET, LONDON,
11*th August*, 1893.

Straits Settlements (Perak.)

SIR,—I have the honour to enclose, for the information of His Excellency the Governor, copies of two reports, with enclosure, which have been furnished to us by Mr. Kellner, Chemist to the War Department, Royal Arsenal, Woolwich, relative to the samples of wolfram sent from Perak in June, 1892.

I have to express our regret at the length of time which has elapsed in dealing with this matter, but as you will see from Mr. Kellner's letter to us of 10th instant, great difficulties have arisen in obtaining anything like reliable information as to the commercial value of this material.

I have, etc.,

(Signed) M. F. OMMANNEY.

THE HON. COLONIAL SECRETARY,
STRAITS SETTLEMENTS.

CHEMICAL DEPARTMENT,
ROYAL ARSENAL,
WOOLWICH,
12*th January*, 1893.

SIR,—In accordance with the request contained in your letter of August 30th last, an examination of the samples of wolfram has been made, and I enclose herewith the details of the analysis and results obtained.

I am, etc.,

(Signed) W. KELLNER,
Chemist.

THE CROWN AGENTS FOR THE COLONIES,
DOWNING STREET.

Analysis of Samples of Wolfram from Perak, Straits Settlements.

The samples were contained in two bags, each bag weighing about 40 lbs. There was no distinguishing mark on the bags. The contents of each bag were treated as one sample, and are referred to as sample No. 1, sample No. 2.

For the purpose of analysis an average sample was prepared from each of the two lots.

A few qualitative tests indicated that the mineral consisted chiefly of tungstate of iron and manganese, and that it was therefore wolfram or wolframite.

The quantitative analyses were made in duplicate, two different methods being employed for the estimation of the constituents in each of the two lots.

The results obtained by the two methods agreed closely, giving as the average composition of the mineral the following numbers :—

	Sample No. 1.	Sample No. 2.
Tungsten Trioxide, WO_3 ...	73·36 % = (58·17) (Tungsten)	73·73 % = (58·47) (Tungsten)
Ferrous Oxide, Fe O ...	12·26 %	11.84 %
Manganous Oxide, Mn O	12·54 %	12·88 %
Stannic Oxide, $Sn O_2$ ...	1·00 %	0·95 %
Silica, etc., $Si O_2$ ...	0·84 %	0·60 %
	100·00	100·00

(Signed) W. KELLNER.

Chemical Department,
12th January, 1893.

Chemical Department,
Royal Arsenal,
Woolwich,
10th August, 1893.

Sir,—I regret that a reply to the question dated 17th January, and reminder of the 26th ultimo, as to the commercial value of wolfram, has been so long delayed. There has been considerable difficulty in obtaining reliable information on this point, and only quite recently have I been furnished with statements of any practical value. The following are quotations for wolfram :—

A lot of 10 tons, 49 per cent tungstic acid :

8*s.* 6*d.* per unit per cent of tungstic acid, or £20 16*s.* 6*d.* per ton, free on rail at the mine.

A lot, about 60 per cent tungstic acid :

10*s*. 9*d*. per unit per cent of tungstic acid, or about £32 per ton, at the mine.

A lot of 3 tons, about 50 per cent tungstic acid :

8*s*. per unit per cent of tungstic acid, or £20 per ton, at the mine.

These particulars, I trust, will be of service to the Colonial Government in coming to a decision as to the practicability or otherwise of working the deposit at the Straits Settlements.

It appears to me, seeing that the ore at Perak is considerably richer in tungstic acid than any quoted above, it would be well worth while to work the mine.

I am, etc.,

(Signed) W. KELLNER,
Chemist.

THE CROWN AGENTS FOR THE COLONIES,
DOWNING STREET, S.W.

The samples reported on above were collected at Chumor, near Tapah, where wolfram occurs in considerable quantity mixed with the alluvial tin. The Chinese miners pick it out by hand from the tin-sand and throw it away, but an appreciable amount remains, and must lead to a not insignificant loss of tin in the smelting.

Recently the ore has been collected and sent to Europe. The following return gives the export from Batang Padang up to July, 1894:—

	Pkls. ctts.
March, 1894	537 44
April ,, ...	235 92
May ,, ...	56 66
June ,, ...	17 28
July ,, ...	29 63
TOTAL ...	876 93 = $52\frac{1}{5}$ tons.

Veins of quartz containing wolfram have been noticed at Chumor traversing the greiss-stone—a variety of granite composed of quartz and mica—which is rather extensively represented there.

Wolfram has also been found in granite at Jenah, near Taiping, and near Tambun in Kinta, in the limestone formation.

Scheelite, another ore of tungsten, has been found, associated with alluvial tin, at Plang, in the district of Kuala Kangsar, and at Lahat in Kinta. This mineral is a tungstate of lime, and contains from 76 to 80 per cent of tungstic acid, from 18 to 19 per cent of lime, and sometimes one or two per cent of silica and peroxide of iron. A sample from Plang gave, on assay,—tungstic acid, 76·50 per cent. This would equal 61·20 per cent of metallic tungsten. At 11*s*. per unit of tungstic acid this scheelite would be worth £42 1*s*. 6*d*. per ton, or about $21 per pikul.

The following extract from the *English Mechanic* gives some interesting details respecting the metal and its uses.

"Tungsten belongs to a group of rare metals, and until a comparatively recent time was known only to the chemist, and its value was known only in the laboratory.

"With the invention of 100-ton guns the demand for tungsten soon made the previously obscure metal well known throughout the mining world. It was soon found that the steel tube lining the bore of these enormous guns could not resist the shock entailed by discharging many shots without becoming fractured. Experiment proved that the addition of a small quantity of tungsten to the fine steel employed in gun-making rendered the latter metal wonderfully elastic, so that the steel tube will expand under the tension of firing and contract again to its normal size a great many times before the quality of the metal is in any way impaired. The German gun factories absorb most of the tungsten found in the world, and from being a mere curiosity seen only in the laboratory of the chemist, this rare metal has acquired considerable value. Wolfram generally occurs in combination with iron in Europe, but it is also found in scheelite, or tungstate of lime. It is in the latter form that it occurs in Otago (New Zealand). The metal itself is of a white colour, extremely brittle and heavy, the specific gravity being 19·1, that of gold being 19.3. It will thus be seen that tungsten is a very heavy metal, being only very slightly lighter than gold."

PERAK
GOVERNMENT PRINTING OFFICE,
TAIPING.