# Malay Tin-Fields.

## Mining Position Broadly Reviewed.

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OF

H. E. SIR JOHN ANDERSON, K.C.M.G.,

Governor of the Straits Settlements

AND

High Commissioner of the Federated Malay States.

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1906.

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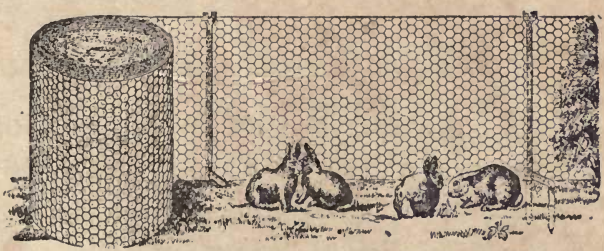

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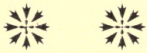

SURVEYS under the personal superintendence of Mr. Harold Carpmael, Fellow Surveyors Institution, London, and Licensed Surveyor, Straits Settlements.

# MALAY TIN-FIELDS.

## MINING POSITION BROADLY REVIEWED.

BY

RALPH STOKES,

*Late Mining Editor, "Rand Daily Mail," Transvaal.*

REPRINTED FROM THE "STRAITS TIMES,"

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# PREFACE.

IT was with a feeling of genuine gratification that this interesting and valuable Review of the Malay Tin-Fields, as set forth so clearly, shrewdly, and succinctly by Mr. Ralph Stokes, was received at the Offices of the *Straits Times*, and in due course published in the Daily and Weekly Editions of this paper. Seldom has the reader of a description and a criticism of Mines been treated to such an union of expert knowledge, sound judgment, and moderation in tone and feeling. But no eulogium is really necessary in a case like this, and Mr. Ralph Stokes's work may well be left, alone and unsupported, to prove its value in the opinion of the mining world and the general public.

It has been for centuries a superstition among Asiatics that Pearls breed Pearls and grow in number as well as size. If there be any truth in this, perhaps, there might be some ground for suggesting a somewhat similar idiosyncracy in regard to Tin. Now, anybody would be unwise

to stake his reputation by limiting the period during which the Malay Tin-Fields have been subjected to the pickings of man, unassisted by machinery and expert knowledge; and it seems safe to credit it with at least five centuries in length. Nevertheless, though the search for Tin may have been perfunctory, and the means inadequate, that search has been most persistent. Over and over again has man desisted at one spot and proceeded to another, yet his successor at the previous spot has discovered Tin, in sufficient quantity to reward his enterprise and labour. So, even at the present moment, Tin may still be growing in a spot which has been abandoned as absolutely Tin-less. Yet, whether Tin grows or does not grow in Malaya, it is the opinion of some that the Tin-fields here deserve further and fuller examination, not only deep down below the surface of the earth, but also above, where Tin when found is called alluvial. Among the experienced in such matters we may name Mr. J. M. Sinclair, Commercial Agent for the Government of the State of Victoria, Australia, who is at present with us in Singapore and, under date of the 9th of this October, writes as follows :—

" I recently made a tour through the Malay States, visiting Kuala Lumpur, Seramban,

Ipoh, and thence onward to Taiping. I spent some time at Ipoh, visiting several of the principal mines worked with modern appliances, and saw also the Chinese system with its primitive methods. Geology has been a favourite study with me all my life, and my travels in many countries have afforded me many an opportunity of giving effect to it. I have also a knowledge of mining on many of the Gold-Fields of Australia and America, and so viewed with particular interest this Tin-bearing country in the Malay States. What particularly impressed me was the extent of alluvial Tin-bearing country, which has been surface-worked in this primitive manner by Chinese, and its possibilities for reworking in a thorough and systematic manner, by means of centrifugal pump dredging plants, the same as those now in use in working old, abandoned, alluvial Gold-Fields in Victoria, Australia. The ground has to be very poor indeed, which does not pay for reworking with those labour-saving economical Victorian dredging plants. Working night and day, those plants, with six or eight men per shift, will do the work of 500 men as I saw them under Chinese system of working, and——what is specially important ——will do the work better, by saving more Tin, and taking practically everything out of

the material treated. These dredging plants, after working out an area, can be shifted to a new position and be at work again in three days. Owing to there being no cheap coolie labour in Victoria, for all the employed are Europeans at good wages, every economical labour-and-mineral-saving appliance possible has been brought into operation, so as to make these undertakings profitable. The cost of working has been reduced to a minimum, and at the same time there is in operation the most perfect method of saving almost every grain of the finest dust of the precious metal sought for. Compared with working the old abandoned leads on the Victorian Gold-Fields, with their close, compact detritus, often fairly cemented together with tough silurian clays, the dredging of these old Tin-Fields in Malaya would be nothing. I never saw such ideal dredging country, for working with centrifugal pump dredging plants. It is nearly all free, loose, sandy country, with plenty of water available, in the rivers and creeks, on the mountains and hills at either side of the wide extensive valleys. By means of these dredges, the costly system of overcasting, or removing by hand labour, all the overlying surface covering Tin-bearing strata would be avoided, as it could all pass through the dredge. The karong clay, con-

taining Tin at lower depths, could be taken out and worked by puddle machine, similar to those in use at Tronoh and Tambun, but the alluvial could be handled by these dredges. The puddle machines at work there recalled to me the sight of them in operation in Bendigo, in my boyhood days, where, I believe, they were first used of all places in the world on account of the prevalence of hard tough clays. The puddling tub with dolly was used first, then these circular puddle machines with harrows drawn round in the water, to disintegrate the clay, and reduce it to a mud or slime, from which the Gold could be washed. My own opinion is that there is a great future for the Tin-Fields of Malaya, provided these dredging plants are extensively introduced, and that this systematic and economical system of working would give profitable results to shareholders interested in their operations. This opinion I have found shared by several of the leading men connected with Tin-mining in Malaya, who have either personal knowledge, or know from other sources, of what is being accomplished, by means of these centrifugal pump dredges".

With this by way of preface, the reader may now be left to peruse Mr. Stokes's review at leisure. It should be added here that

H. E. Sir John Anderson, K.C.M.G., Governor of the Straits Settlements and High Commissioner of the Federated Malay States, has been graciously pleased to intimate, through Mr. Oliver Marks, that he thinks Mr. Stokes's review "so excellent as to deserve publication in pamphlet form." In conformity with that esteemed expression of opinion, it has been deemed advisable to reproduce Mr. Stokes's review, which as a short serial has run through the *Straits Times* and *Straits Budget*; and this book is now issued.

R. W. Egerton Eastwick.

*Straits Times Office,*
*Singapore.*
*12th October, 1906.*

# Malay Tin-Fields.

## MINING POSITION BROADLY REVIEWED.

THE unprecedented rise and fluctuations in the price of Tin have drawn unusual attention to the question of the future supply of this ill-distributed metal; and, although keen public interest has been awakened in the matter, largely with the hope of drawing new lifeblood into the financial veins of certain languishing fields, it has always been allowed that Malaya must long hold the key of the position. In view of this country's 62½ per cent. contribution to the world's aggregate, such a recognition of its influence involves no extraordinary perception

nor generosity of mind. But the greater part of the commentaries on the Tin position published in the Home non-technical press has comprised but truisms and platitudes, followed by very questionable or extravagant generalizations as to the effect of the rise on various mining fields of less import. The influence of the advance in valuation of the metal has not been strikingly manifest in Malaya. For indeed, as it is scarcely necessary to reiterate, the standardization of the dollar has led to an augmentation of operating costs all round, not excluding those companies largely dependent on imported machinery and coal. It is of interest to regard the matter in this light, justifiably assuming that it costs as many dollars to do a given piece of work, whether the exchange is 1*s* 9*d* or 2*s* 4*d*. During 1902-4, the average price of tin was $80 a picul; today, it stands in the vicinity of $88—a rise of only 10 per cent. Yet, on the sterling basis, the rise is nearer 40 per cent. for the period.

## Excellent Suggestion.

Other dominant factors in the present position are the slow exhaustion of the richer surface deposits, worked by the Chinese, and the steady increase in the percentage of tin produced by the European-controlled venture.

It is to be regretted, having regard to the manifest ignorance prevailing in the outside world of Malay conditions and to the similarly manifest need for the introduction of more capital, that the Mines Department in conjunction with Mr. J. B. Scrivenor, Government Geologist, does not issue more readable annual reports, upon the course of events and the work of the principal mines. A systematically compiled review of this description, running to fifty or hundred pages and illustrated (I only suggest what is done as a matter of course in other Colonies), would without doubt be highly advantageous to the interests of the States. Apparently, however, the Department has its time too fully absorbed with legal questions and disputes as to water-rights, mining leases, and the disposal of ubiquitous tailings.

## Good Record.

In some respects, however, it may be said that the neglect of the Malay Tin-fields by financial men has been a blessing, for now that the time has surely come for the mining engineer with capital behind him to extend his control, the financial atmosphere is comparatively pure. Compared with other mining fields of like magnitude, Malaya may certainly

be said to have a good financial record. Honest failures can be nowhere entirely avoided. But in nearly all cases, it is to be seen that the basis of capitalization adopted has been reasonable. The fact that the capitals of thirteen leading producers in Perak, Selangor, and Negri Sembilan total £840,000, demonstrates this absence of excessive capitalization. Occasionally, the fault of providing insufficient working capital is committed. Perhaps, the Kledang Company, floated in Cornwall a few months ago with a capital of £100,000, has fallen into this error. For the initial expenditure must be heavy, and only £20,000 working capital, with 5,000 reserve £1 shares, has been allowed.

## Duty Question.

The Government are occasionally censured —and I think Mr. Warnford Lock, the well-known author and engineer, is amongst their most persistent and hard-fisted antagonists— for failing to encourage the capitalist, or, rather, for actually discouraging him by keeping the present undiscriminating schedule of taxation in force. Concessions should be allowed, it is claimed, to the company spending large sums on plant and development; the duty payable by such concerns should be less

than that for the surface working, equipped, may be, with only an endless chain pump, and a landshoot or two. The Government's position is clearly a difficult one. To suggest that they would wittingly act contrarily to the general interests of the mining industry and country is absurd. It must, moreover, be borne in mind that adequate allowance is already made to those ventures requiring to blast and crush their tin-bearing ground. The "lode" definition was recently cancelled for one simply of hardness, to be determined by the Senior Warden of Mines and the Government Geologist. Thus a body of calcite-cemented ore, as at the French Company's Lahat mine, receives the maximum 50 per cent. concession, whilst a true lode deposit, greatly decomposed, may receive much less. This is just enough, but does not, apparently, satisfy the demands of those who wish to see allowances made in respect of capital expenditure on plant. Were such made, it is to be feared that the Towkay mine-owners would consider their conservatism inequitably penalized and would protest vehemently, claiming that they are paying out twice or three times as much in wages per picul produced as their favoured neighbour with steam navvy and blondin conveyor. The whole question of taxation is one calling for

the most delicate handling, especially in fields where no system of profit assessment is practicable; and wherever the duty is high, as in Malaya, the Government policy must necessarily meet with disapprobation. Whether the finances of the States are not sufficiently sound to permit of a general reduction is another matter, worthy of independent discussion. If the present high rate is only prompted by fears of a speedy exhaustion of the tin, then certainly such a happy decrease would be advantageous and politic. But the official mind is oft inscrutable, though rarely as irrational as the uninformed critic would proclaim.

## Either Worked or Abandoned.

In one way, at least, it must be acknowledged that the Government have lately been working justly in the capitalist's favour, at the expense of the Chinese leaseholder. In Perak particularly—where the policy is of greatest importance—the Resident has been strictly enforcing the labour clause of agreements. Mr. Birch has declared himself anxious to see the ground either worked or abandoned. Thus, many leaseholders—who might have held out indefinitely for some exorbitant price—have been recently endeavouring to

dispose of their ground, perhaps low grade or deep level, to those with the capital and knowledge to turn it to account.

## Ultra-Prosperous Coolie.

There have been whisperings recently, now that survey plans and records have been brought into reasonable order, of the Land Department's throwing open the long-closed application books for Perak. It is very doubtful if any good purpose could be served by the alienation of further tracts of mining ground. Chinese immigration is now more or less at a standstill; and, as elsewhere in the Peninsula, labour is signally independent. With the gradual exhaustion of the surface deposits and the installation of labour-saving devices, there is some hope of the position righting itself, from the employer's point of view. But the opening of new ground would only tend to provide further demands for the services of the ultra-prosperous coolie, and new temptations to the deserter. Moreover, is it not to the very distinct advantage of the country that the old ground be thoroughly exhausted before its abandonment for "pastures new"?

## Natural Features.

It is only necessary here to give, for the

sake of completeness, the roughest outline of geological conditions. There are yet many problems associated with Malay geology calling for solution, but they are secondary rather than primary perplexities. The broad features of the Tin-fields are well-known—the great axial range of granite mountains, running north and south, with schists and gneisses along its marginal contact, and the upturned limestones, standing as precipitous jungle-covered hills to heights of one and two thousand feet. In the plains along the western edges of the granite, the best alluvial tin occurs. In many places—so many, in fact, as to suggest a principal source of origin—the tin has been traced to the low-lying hills of schist and pegmatite ranging along the margin of the granite. Meru, Bruseh, Jeher, Sipiau and Sudu Seremban may be cited in this context. Yet unmistakable tin-lodes, as the Government Geologist has proved beyond question, are also found in the lime-stone.

## Mr. Scrivenor.

It is unfortunate that the Government Service does not include a larger Geological Survey, for there is yet much information to be collected concerning the nature of Malay Tin deposits, of great industrial import. The

task is clearly beyond the capabilities of any one man, however skilful and energetic he may be. Nevertheless, Mr. Scrivenor has succeeded in performing a great deal of good work since his first engagement by Government, and a comprehensive report, to be prepared by him at the close of this year, will be a particularly valuable record of three years' labours. That Mr. Scrivenor's attention should have been principally concentrated upon less known Pahang was to be expected, but the more remarkable features of the western States have not been neglected, and the anticipated review should be satisfactorily far-reaching in its sphere. Yet the fact should not be lost sight of that the ultimate aim of every Geological Survey must be a Geological Map—a compilation of inestimable value to any country.

## Chinese Tin Preponderating.

It may be approximately estimated that from 85 to 90 per cent. of Malay tin is contributed by the Chinese. Despite their preponderating importance, the Chinese workings and methods will not be discussed in this article, purporting to deal exclusively with the present situation. And Chinese mining has been the same for decades past. There are

two famous Chinese mines, Tambun and Kamunting, typifying the advanced and conservatively backward classes, whose position may be pertinently noted.

## Tambun.

Tambun, once the world's greatest tin-producer, whose 1903 yield of 2,417 tons of metal was equivalent to half the production of all Australasia or Cornwall, is owned by Mr. Liong Fe, M.C. It may be recalled that an Englishman of high standing in the mining world was once part-owner of the ground (which was being held for coffee-planting) and sold his share for the proverbial song, all-unsuspecting the enormous wealth of the property. The karong or tin-bearing deposit occurs at a depth averaging 40-50 feet and has been in the past entirely worked on the Chinese shafting system, on particularly daring principles. An examination of the surface, to-day, and of the great subsidence over the old workings, marks how the gradual fall of the ground was profited by underground of the miners, who allowed their props to sink into the footwall whilst they kept pace with the subsidence. The value of the ground extracted cannot be exactly determined. During 1902-03, it averaged 26 katis per yard.

## Its Mining Plant.

Although the best days of the mine are surely past, there is still a considerable life ahead of the deposit. Shafting has now been stopped, and the proposition is being transformed into a large opencaste. While this is proceeding, outputs will be nominal. There will be a large quantity of low grade ground made available for profitable treatment under the altered conditions, and for this a new horizontal puddler and 300 feet of sluicing are being installed. For a Chinese mine, Tambun has always been remarkably well equipped; Mr. Liong Fe having discreetly placed his property in the hands of competent engineers. The plant comprises four 20-feet puddlers, from which the concentrates are run to a belt elevator, raising them above the trommels and jigs. Any rock fragments, too large for the first trommel, are passed to a jaw rock-breaker, huntingdon mill and wilfley table. Altogether, an undoubtedly good extraction is obtained.

## Kamunting.

Kamunting, the largest open-caste mine in the country and strangely situated in the languishing district of Taiping, presents a peculiar contrast to Tambun. It is held

privately by Mr. Ng. Boo Bee, whose ideas are conservative in the extreme. The output maintained is 1,500 piculs per month (black tin) and for this 4,000 coolies are employed, —an inadequate supply, according to the views of the merchant proprietor. People, who criticize the Chinese mine-proprietors for their lack of perception and their backwardness, are inclined to forget that machinery is apt to be trade-destroying as well as labour-saving. At Kamunting, Mr. Boo Bee courteously told the writer that monthly expenses total $40,000 of which $32,000 represent labour. How much of this does not return to the pockets of the employer ?

The open-caste at Kamunting is some 2,400 feet long and about 100—150 feet across. The depth of the karong averages thirty to forty feet. This pit is being carried steadily across the property, the discarded overburden and wash dirt tailings being dumped at the exhausted side. The tin is extracted in the common landshoots (without preliminary puddling), of which there are seventeen double sets. Only a fair extraction is obtained. The majority of coolies are on day's pay, but the removal of ground is also undertaken on contract, at the rate of $9.50 per 50 yards for karong and $7.50 for overburden.

Kamunting appears to have a large stretch of virgin ground yet available.

## European Influence.

Turning from this essentially Chinese mine to the European influence, it is gratifying to record a substantial advance. In Perak, and especially in the richest section of it, Kinta, the European control is of particular strength. It may be calculated that nearly one fifth of the Perak tin-yield is derived from properties owned and managed by white men. Yet the number of mines falling under this category is small. I will now give a brief summary of the position and prospects of the principal producers of to-day, together with two or three properties approaching the producing stage, such as Redhills and Rambutan.

## Tronoh Tin Mines.

This leading producer, at the present day, was floated in 1902 with a capital of £160,000 which has now been almost returned to original shareholders. There are still some doubts as to the character of this wonderful deposit, which are being removed by a series of boreholes, but the general form of the ground is well-known. The run of the deposit is approximately north and south, and along the west

ranges a hill of shale, slate, altered sandstone, and detritus. On the other side is a bed of limestone, whose sub-outcrop is cut at 40 feet in the main vertical shaft. The width of the deposit is about 500 feet., its length over 2,000 feet, and the depth uncertain. A drill struck limestone in one spot at 147 feet and, at another, failed to bottom at 190 feet—the two bores having been 1,800 feet apart. The value of the karong, a sandy clay, may be estimated at 1½ per cent. Owing to an inconsistency of policy and uneconomical distribution of plant, working costs at Tronoh are deplorably high, and some sort of reform must surely be soon effected to bring them down to a reasonable figure. It is proposed to work the deposit by means of the main vertical and one other, outside the mine area to the west. Possibly, open-casting is the solution of the difficulty, though this would probably necessitate an enormous amount of nonproductive work. Open-working was largely undertaken by the former owner, Mr. Foo Choo Choon, but this cannot be continued, under present conditions, without causing slips from the hill. The evidence of the boreholes, however, must assist considerably in the formulation of the new working scheme.

There are two sets of treatment plant, each including four puddlers and four or five land-shoots. Some 20,000 trucks are treated per month for a yield averaging upwards of 3,000 piculs of black tin. The overburden is in many parts 50-60 feet thick.

Tests have lately been undertaken at the mines to determine the important question as to the relative economy of wood fuel and imported Bengal coal. As at Tambun, the latter is to be regarded with greater favour, and it seems probable that the use of coal will soon become far more general than it is at present.

## French Mining Company.

The Societé des Etains de Kinta, popularly known as the French Mining Company, was formed in Paris as far back as 1880 and must be placed amongst the greatest pioneers of scientific tin-mining in Malaya, although its methods have involved no exceptional engineering acumen. It is surprising that the prosperity of this venture, whose profits have totalled over 8½ million francs, and whose continued success is evinced by last year's record profit of about 1,300,000 francs, has not led to the introduction of more French capital into Perak, for no mining investors are gifted

with greater pluck and discernment than the Parisian.

The French Company holds several properties, but of paramount importance are those situated at Kampar and Lahat. The former comprises a large stretch of alluvial, on which there are three workings, two opencaste and the third shafted. The average grade of the ground, taking the full face of fifty feet, is estimated to run a picul to the 50 yards, but as a large percentage of barren overburden is removed, the grade of the ground passing through the puddlers may be raised to, perhaps, 20 katis per yard. From the three workings, 2,100 piculs per month are won. It is now proposed, however, to establish a central power station, operated electrically from a waterfall near the property, which would enable the Manager ( Mons. Legros ) to attack some lower layers of karong, proved to exist between 110 and 150 feet deep, requiring more powerful pumping plant. The fall for the turbine will have a head of 1,300 feet and register 60 gallons per second. According to the new scheme, 2,000 tons of ground per day should be puddled and sluiced.

## Lahat.

Of greater interest, mechanically and geologically, is the French Company's Lahat property. The origin of this ore-body in the limestone is yet uncertain, having baffled the Government Geologist and all other observers. The mass consists of a pipe or chimney of calcite-cemented crystals, neither waterworn nor symmetrical, about 25 feet in diameter and dipping almost vertically. At some depth, it makes into ramifications, but at 160 feet the body is still strong and rich. Round the edge, iron pyrites is to be noted, but no quartz or tourmaline, suggestive of lode origin, has been detected. In fact, this is most surely not the result of stanniferous solutions or impregnations, but has been mechanically formed in some inexplicable manner. The richness of the body, which runs up to 40 per cent. tin oxide (74 per cent. metal) militates against the simple hypothesis of a cemented pocket of alluvial. How has the the concentration occurred? The Government Geologist is praying for a recurrence of the phenomenon, which may throw further light on the question. But the majority of other tin deposits in the limestone have proved true lodes, associated with iron, copper, and arsenical pyrites.

The Lahat mine is also noteworthy for its efficient electrical equipment and gas producer plant. There are two Letombe gas engines of 35 h.p. each; and, with the use of charcoal fuel, the Manager is able to keep his power costs at a figure (3 cents. per h. p. per hour) about a third of the local average. Some 700 to 750 piculs per month are produced at this Lahat mine.

## Pusing Lama Co.

The Pusing Lama T, M. Co. floated in London with a capital of £98,000, has recently improved in outlook very considerably, owing to the success of systematic testing operations conducted over the property. It is a proposition of several parts. The mainstay of the Company appears to consist of the large gravelly low grade body, including stanniferous lumps of quartz, conglomerate, and other rock fragments, extentending from Redhills. Fifteen stamps, in conjunction with six puddlers, are employed in crushing the stones, but this mill is inadequate for the quantity derived from upwards of 1,000 trucks of ground per day, and considerable pebble accumulations are being reserved for subsequent treatment. The ordinary clay and gravel average 3 katis to the yard, whilst the hard lumps are estimated at  to 1 per cent.

But mill returns, equivalent to half the aggregate yield, have lately been augmented by the contributions from a new section of the property. In the course of his prospecting operations, Mr. Currie struck a rich body overlying a boss of modified granite, which certainly appears to be a highly decomposed contact lode. Of the value of the strike, it would yet be premature to speak with any suggestion of confidence, for its persistence is unproved. Rich stuff has been obtained in three trial shafts, whilst the deposit has been missed in others. An adit, being put in to cut the contact at a depth of 50 feet, should afford satisfactory evidence as to the significance of this new asset, which is at least of good promise.

As for the alluvial section, the lie of the country is unfortunately unsuitable to make hydraulicing economically possible, though a limited section capping the hill is to be run through sluice boxes by this method. The policy of Pusing Lama appears to be one of caution, and the necessary additions to plant are being made gradually, without the expenditure of large amounts. Recent installations include a wilfley table, a revolving concentrating table, and magnetic separator for the specular iron associated with the cassiterite.

The management of the property is in particularly able hands—a fact tending to minimize the natural speculativeness of the proposition. A yield of about 1,200 piculs of black tin per month is regularly declared.

## Bruseh.

Amongst the several prosperous hydraulicing ventures in Malaya, that at Bruseh near Bidor calls for prominent notice. For this property is not only the lowest-grade of any class operated in the Peninsula, but is probably the cheapest-worked and lowest-grade lode proposition in the world. When some of its costs are given, no attempt, of course, should be made to compare them with the expenditures of the average lode mine, where conditions are likely to be radically different. But Bruseh figures, besides being highly creditable to the management, are of principal interest in the mining world to emphasize the necessity for closely scrutinizing relative conditions, when endeavouring to establish instructive comparisons between the costs of two mines. In a Transvaal gold-mine, gold recovery costs 23/- per ton crushed ; at Bruseh, with a lode proposition, requiring to be blasted, tin is won at 12 cents per yard. These parallel statements, in one sense absurd in their juxtaposition, per-

tinently illustrate the limitation of such comparisons.

## Hill Land.

The Bruseh Company holds about 1,100 acres of hill land at the foot of the main granite range. Prior to the arrival in 1904 of Mr. O'Brien, the able Californian manager, work was principally done on the decomposed surface soil on the hill-sides. The formation consists of silicious schists (in contact with the granite), whose bedding planes head away from the contact, dipping 50 degrees south-east. The tin ore is found in a series of small impregnation veins, about half an inch thick, in a foulted zone near the contact. These veins strike slightly north of west and south of east, and dip 38 degrees approximately north. At present, work is proceeding on a large hill, 240 feet high, giving a cutting bank 220 feet high in three separate mines. The ground is first T-drifted, and broken with heavy charges of powder. Water through a 3-inch nozzle, at 130 lbs. pressure, is turned on to the fallen schists, which are beaten back against the bank with giants until thoroughly disintegrated. The ground is then allowed to pass through the sluice boxes, which are four feet wide, 20 ins. deep, graded at 1 in 24

riffled with inverted rails, 1½ inch apart, and are 300 to 400 feet in length. The greater part of the tin is won in the first three boxes or 36 feet length of sluice. A clean-up is made every third or fourth day and takes about 3½ hours. The water used in each box averages 750 cubic feet per minute. The ore as taken from the riffles contains 10 to 22 per cent of dirt. Seven miles of pipe-line serve the monitors.

The figures for one mine, for a recent six months, are instructive. In 181 days, 209,000 cubic yards were removed ( 1,155 per day ), of an average value of .391 kati per yard—say 23 cents—at a cost of 12 cents per yard. No other hydraulicing company in the F. M. S. can produce figures to compare with these.

## Jeher Hydraulic.

The Jeher Hydraulic T. M. Co., working on a smaller scale than the Bruseh, though on the same line of formation, was floated some 18 months ago. Its ground is considerably richer than that above described. The Tin occurs in narrow and rich quartz veins in decomposed schist, which needs blasting. A couple of monitors are engaged in clearing away the overburden, worth about one kati per yard, which is all put through the sluice-boxes. The strike

of the formation is east and west, and the dip south. An average yield of 500 piculs of black tin is maintained. There are several large low-grade bodies on the property, whose profitable treatment may be found possible. It cannot yet be said, how long the boss of tin-lode-containing schists will prove amenable to present cheap methods of treatment, before the quality of solidity is assumed below the decomposed zone. The water-race in use is 5 miles long, 7½ feet wide, and 3 feet deep, with a fall of 16 feet per mile. The main pipe-line is 2 miles long, 22 inches in diameter, and has a vertical head of 604 feet. Chinese miners had accomplished considerable work on the deposit, before the management was taken up by Mr. Proust, but a suitable scheme of exploitation had not been adopted.

## Old Hydraulicers.

The Gopeng Group, in the Gopeng district, are three large hydraulicing propositions under the control of Messrs. Osborne and Chappel, the engineering and mining pioneers of the Malay States, who were amongst the first to realize the possibilities of working lowgrade bodies on a large scale and have profited fittingly by their perception. The Gopeng Company itself, which worked with

two monitors in 1892, has been producing and paying dividends ever since. It was the second hydraulicing venture to start in the country, a failure near Chankat Pari having been the first. As many as ten monitors have been simultaneously employed. To-day, a yield of about 36 tons of black tin per month is registered, and last year's dividends of 25 per cent. will probably be exceeded by the payments for the present year, owing to the stronger tin market. A considerable revenue is derived from the sale of wolfram. The prospects of the venture are still good, though life estimates cannot be safely made.

The New Gopeng was floated in 1902, with a capital of £40,000, and holds 650 acres of ground. Last year's dividend was 20 per cent. An average output of 17 tons is recorded, every month, from the ground broken by five monitors.

The Kinta Tin Mines, under the same management and in the same area, was floated in 1898, with a capital of £60,000, all issued. It has since paid 17 dividends, the 1905 distributions totalling 20 per cent. The ground now under attack, running little more than 1/- per yard, is yielding an average of 17 tons per

month. An additional monthly income of $5,000 is derived from water-rights.

## Redhills.

The Redhills, Ltd., a non-producing company under Messrs. Osborne and Chappel's management, should be adding to Perak outputs in a month or so. This concern was recently floated with the reasonable capital of £40,000 and holds a large body of gravelly alluvial, adjoining Pusing Lama. It is being equipped on highly economical lines, with a view to the saving of labour and effecting a high extraction, well in advance of the Perak standards. For the shifting of the ground, which contains from 10 to 15 per cent of tin-bearing rockfragments requiring pulverization, a steam navvy and a blondin conveyor have been installed. By the agency of these, the dirt is dumped on an elevated place above the treatment plant, where it is further disintegrated by monitors before passing into longitudinal puddlers, below which are an inch and a half-inch trommels. The classified rock is delivered into the 25 (850 lbs) stamp battery, whose pulp is concentrated on wilfley and bus tables. For the trommel sludge there will be 200 feet of riffle boxes, 3 ft. 9 in. wide, and graded at 1 in 20. A magnetic separator

will be installed, as at Pusing Lama. It is estimated that 4 per cent. will be won from the crushed product, at a cost of 2 per cent. Taking the proposition generally, an average yield of $2.50 per yard should be recorded, or about 1,000 piculs per month. An extension of mill may be found advisable at later date, but this largely depends on the proportion of milling ore met with in actual working practice. Some consider that the 25 head battery will be unable to cope with the rock found, on the suggested basis of 1,000 tons of ground perdiem.

## Suction Dredging.

Rambutan, Ltd., a daring project embarked upon by the same firm, is to-day being as critically watched as any venture in the four States. For it involves the utilization of the first suction dredge yet worked, on the paddock principle, on Malay alluvial tin. Its success or failure will be considered of great significance, and will determine whether, as one may reasonably anticipate, the dredge is to form an important factor in the industrial operations of the future. There are certainly many stretches of alluvial, upon which such plants might be placed with fair prospects of success, but a pioneer has been needed to put the scheme to practical test. The gravelly alluvial to be

dealt with at Tanjong Rambutan is lowgrade and gravelly. So far as can be determined, there is nothing in it liable to disable the large centrifugal pump, even though there may be occasional calls for new liners. A recovery of not more than 1/- per yard is expected, while costs may be 4d. or 5d.; but no precision can be introduced into these hazardous estimates, at present. The pontoon, made of local hardwood, is 50 by 50 by 6 feet, and with its burden of machinery, now being put into place, should weigh some 350 tons. The dredge (Rambutan, Ltd.) is so designed as to draw from a depth of ten feet vertical (16 feet on incline) and to throw 45 to 50 feet. This means a working face of about 60 feet. A sixteen-inch intake pipe serves the centrifugal gravel pump, which weighs 18 tons and is capable of putting through nearly 2,000 yards of solid per day. This plant is of Australian manufacture and is being erected by an Australian, Mr Tobie ——a fact, not surprising when the experience of Australian and New Zealand engineers of dredging and dredging machinery is remembered. Rambutan, Ltd. is capitalized at only £27,000, which possibly means the fault of under-capitalization and a lack of reserve strength. However, this fault is always less harmful than excess of stock and, if found

disadvantageous in the case of an Osborne and Chappel concern, could doubtless soon be remedied.

## Some Other European Ventures.

Few other European ventures are of importance. The Chendai-Meru Hydraulic Mines, near Ipoh, held privately by Mr. Ogilvie, make good steady profits. The Kinta Association, whose chief holding is at Tanjong Rambutan, is making small profits, but is conserving its strength in the hope of obtaining some new property of value. This company, formed in Singapore in 1898, has paid dividends aggregating about 85 per cent. on its ordinary share issue of $120,000, but its holdings have not proved inexhaustible. Mr. Petherbridge, the manager, hopes to be able to start hydraulicing on another section of the Rambutan property shortly, if further prospecting gives satisfactory indications.

## Sungei Besi.

In Selangor and Negri Sembilan, where the European mining influence is comparatively inconsiderable, there are few properties of prominence. At Sungei Besi, an exceptionally large and deep opencaste is held by three Tronoh directors, by means of which a large

and rich body of alluvial is to be worked. Chinese miners, by shafting, have in the past extracted large quantities of ground but have by no means exhausted the mine, which the general manager, Mr. Grant Mackie, considers can be most economically and effectually dealt with on the lines adopted, A depth of about 80 feet has been attained, and the floor of the circular mine is now on high-grade karong. Great difficulty has been experienced on account of slips. An enormous body of waste fell into the mine after the rains early this year. Production has been slowly proceeding since January, 1904, since when 2,800 piculs have been turned out. It is estimated that at least 20 tons of black tin will be produced per month, working at the rate of 400 yards puddled daily, but rich patches are likely to throw out all regular estimates. Costs should be low, when operations are proceeding smoothly. The exploitation of this deep ground by opencaste was at first regarded as a daring experiment in the neighbourhood. A feature about the deposit is the purity of the tin-oxide, which is often of a light waxy appearance and is allowed a high metal percentage by the Straits Trading Company.

## Rich Bunch.

At Salak, there is a very remarkable arsenical deposit, also being opencaste to considerable depth. This is privately held by Mr. Cummings and a few others. Before abandonment as unpayable. a borehole was put down to test greater depths and gave a good show of tin oxide and arsenical pyrites. Upon further mining, the body indicated was opened up and with the aid of a horizontal puddler, capable of treating up to 400 loads daily, Tin at the rate of 25 tons per month was produced. At the time of the writer's visit, alluvial ground was being extracted by the basket (at a depth of 700 feet), that certainly ran 80-85 per cent. tin oxide or, say, 55 per cent. metal. How extensive such a wonderful enrichment can be, cannot be surmised, especially in view of the geological problems associated with the deposit. With the ore, though not intermixed, a large quantity of mispickel is found, as in many of the deep deposits.

Apropos the mixture of arsenical pyrites with the tin, customarily removed in calcining furnaces, it must be noted that Government regulations, prompted by the ill-effects of the fumes upon vegetation and perhaps livestock, in various parts of the country, are to be made

so stringent as to drive producers direct to the Straits Trading Company with their ore. This company, I hear, is now experimenting with mechanical separators which should remove the arsenical fume evil, whose seriousness in some districts has been very conspicuous.

## Sipiau Tin Company.

In Negri Sembilan, the principal producers to-day, under European control, are hydraulicing in the neighbourhood of the capital, Seremban. The Sipiau Tin Co., formed in 1899, with a capital of $230,000, is now working with two monitors on a body of decomposed pegmatite (micaless granite), through which several veins of tin stone run. One of these lodes has lately been traced for 500 feet and tapped at several points about thirty feet below the level of natural disintegration. It has not been possible to restrict the monitor cutting-face to the immediate region of these tin-carriers, and large bodies of practically barren ground have passed the riffle-boxes. An average of 20,000 yards is treated per month for 9 tons of tin-oxide, of which four tons almost cover costs. The property is managed by Mr. Tedlie, who has done much hard and beneficial work for local mining during recent years.

## Seremban Tin Co.

Not far distant, the Seremban Tin Co. is controlled by Messrs. Osborne and Chappel and is perhaps the least noteworthy of the concerns managed by this firm. It was floated in Redruth, Cornwall, in 1898, with a capital of £20,000. An average yield of 8 tons of 70 per cent. black tin is recorded from a large lowgrade deposit, with a 40 ft. face.

## Held in Germany.

Sudu Seremban is held privately in Germany, and the old property is now almost exhausted. Five 2½ inch monitors have been employed. Some months ago, an average of 15 tons per month was won from 60,000 cubic yards. The deposit lay on decomposed pegmatite, also containing quartz stringers. A nine-mile pipe-line is an asset of the holders, which may be shortly turned to account on a new property whose acquisition is contemplated.

Pahang is a province which must necessarily be accorded delicate handling, for fear of irritating the tender susceptibilities of those whose faith in its "marvellous," though ill-defined and unsubstantial, mineral wealth has been unshaken by the revelations of recent

years. Perhaps it may be diffidently suggested, however, that the reputation of this "Cinderella" of the Federation has been largely based on the shadowy foundation of sentiment and conjecture, and that, although it can be justly claimed that Pahang is comparatively undeveloped and suffers sadly from lack of transport facilities, the country has not improved npon acquaintance. It seems that the Tin has been ill-distributed on either side of the great granite dividing range, and that, although a gold field was thrown-in by way of make-weight on the east, the west has infinitely the better of the measure.

## The Eastern State.

The field under exploitation by the Pahang Corporation in the Kuantan district falls under a different category and, despite the peculiar transport, fuel, and labour difficulties encountered by this plucky concern in the past, is likely to retrieve its former prosperity. So ample and straightforward are the circulars and annual reports published by the Company, that only brief reference to its position need here be made. After years of variable results (illustrated by its profits for the last six years, viz:—£27,321, £5,193, £22,240, £11,548, £3,076, and £2,302), the entire proposi-

tion, underground and on surface, is now undergoing complete transformation, which must in large measure check the troubles complained of so long. By the installation of the electric power scheme and of new mills with heavier stamps and new dressing floors, the Company will overcome the evergrowing fuel difficulty, make themselves less dependent on a peculiarly poor labour-supply, and effect a higher extraction from the unoxidized ore of the lower levels. Five-hundred coolies will be released from wood-cutting.

## A Masticator.

The old battery was insufficiently powerful —was unable to properly "masticate its food." The Pahang Corporation is a concern of many lodes, which run as fissures through the granites and metamorphosed and sedimentary rocks, associated with copper, tourmaline, chlorite, and mica. It has been pointed out that the decreased profits of the past year or so have been due to increased working costs and a falling-off in grade, which was 2.9 per cent. in 1903 and 1.9 in 1905. Under the new conditions, the greater scale of working and the introduction of additional labour-saving appliances should satisfactorily influence costs; and the advance in the price of Tin, especially

appreciated by so mechanical a venture, has been equivalent to a large increase in the value of ore reserves. The prospects of the Company have, indeed, been happily improved, although it must ever bear the burden of a heavy capital.

In the course of a journey from north to south of the Peninsula, the writer collected the opinions of many leading members of the Malay Mining world as to the present outlook. The views expressed bear so marked a resemblance that only a few selected opinions will here be given—the opinions of men who should need no introduction to the majority of the readers of this review.

## Steadily Increasing Yields.

Mr. Chappel, of Messrs. Osborne and Chappel, thus sums up his views:—"I do not think there is any reasonable possibility of the aggregate yield of tin from the F. M. S. rapidly increasing. Although a few large plants are now being installed, such as at Redhills and Rambutan. and will, if as successful as we have cause to anticipate, doubtless lead to the rise of similar enterprises calling for capital and mechanical skill, the steadily increasing yields from these concerns will be more than neutralized by the falling-off in returns from

the shallow deposits worked on the Chinese system."

## Deeper Deposits.

Confirmatory of this, the opinion of Mr. Liong Fe (owner of Tambun and Member of the Perak State Council) may be given: "Relying upon the small workers, the yield must dwindle, for the easily treated deposits are nearing exhaustion. Whether the industry in Perak expands or not, depends largely upon outside capitalists and investors, to whom we look for the money to bring the deeper deposits to a producing stage with suitable mechanical appliances."

Mr O·Brien, the Californian manager of Bruseh, notes, in reply to a query,—"The most striking feature of mining affairs at present is the losing of ground by the wasteful Chinese miner, who has practically picked the eyes out of the country, and the advance of the White miner, who is making excellent profits out of ground the Chinese could not touch."

Mr. Foo Choo Choon, vendor or owner of the Tronoh, Kledang, Chankat Pari, Sungei Besi, and other mines, accentuated, through his interpreter, the necessity of adopting

machinery to displace labour. The price of Tin he considers more or less self-regulative; if the price increases, a bigger output will be recorded, bringing it down again. "If the price remains where it is now (about £200 per ton at time of conversation), the yield will certainly advance in magnitude."

## Well-nigh Inexhaustible.

In striking contrast to the average, appears the opinion of Mr. Ng Boo Bee, owner of Kamunting and employer of 4,000 coolies:— "The Tin is well-nigh inexhaustible, but cannot be won owing to labour shortage. Immigration from China is at a standstill owing to the increased prosperity of that country and its rail-road-making activity. This circumstance checks the yield and will result in the high price of Tin being maintained." Like many other mine-owners, Mr. Boo Bee also had a word of censure for the Government's system of taxation, or more particularly, for the heaviness of the duty.

## Pahang Prospects.

Mr. H. E. Nicholls, Superintendent of the Pahang Corporation, refers to the prospects of the Eastern State thus:—

"A considerable experience of the old

deposits, both alluvial and lode, convinces me that no satisfactory results will be obtained therefrom; the deposits are far too uncertain and irregular to be worth opening. Occasional rich pockets are met with, but these are few and far between. Encouraging results have certainly been obtained from alluvial, though, so far, nothing to compare with the deposits on the Western side of the Peninsula have been met with. Whether the opening-up of the country will develop richer fields, is an open question. The lode deposits of the Kuantan district certainly have a big future before them."

## General Output.

Mons. Legros, manager of the French Mining Company, is strongly of opinion that the output of the Malay States will continue to decrease, owing to the death of the surface deposits, and that the opportunities of the European investor and engineer will proportionately increase. He doubts whether the opening of the application books would greatly affect the position. Kinta is likely to maintain its pre-eminence for years to come.

## Coolie Troubles.

Mr. Chung Thye Phin, M.C. (owner of mines

in Gopeng, Taiping, and Tronoh districts):—"I do not look for any general expansion of the industry. We are now greatly troubled with our coolies, who are independent and desert freely. In view of these labour troubles, I have installed tramming services where possible, and lengthened the working day."

## Officials Silent.

Government Officials are unable, naturally, to express opinions for publication, save anonymously. One member of the Mines Department declared that he considered the scarcity of first class mining engineers a check upon the scientific development of the industry, but allowed that there was a marked tendency to improve the class of machinery introduced.

## A Grateful Visitor.

In conclusion, the writer would refer with gratitude to the exceptional kindness and hospitality extended to him throughout his tour of inspection, by Government Officials and by Mine Managers and Mine-Owners, European and Chinese. In no single instance did an application to view a property meet with refusal. In no single instance was a visit not marked by every effort on the part of the Management to satisfy all reasonable requests

for data. The Mining Engineer or Mine-Owner of Malaya has, indeed, no wish to enshroud his work with the cloak of mystery, to conceal his simple methods, or misrepresent his results.

Honourably controlled, possessed of wonderful wealth, well-adapted to economic mining, favoured geographically and in climatic conditions—how can the Federated Malay States but continue to enjoy the golden recompense of their prosperous industry !

**Ralph Stokes,**
*Late Mining Editor,*
*"Rand Daily Mail,"*
*Transvaal.*

| Company. | Date of Formation. | Capital. | Subscribed. | Number of Shares. | Issue Value. | Paid up to | Reserve |
|---|---|---|---|---|---|---|---|
| Belat Tin Mining Co., Ltd. ... ... | 1903 | $300,000 | $300,000 | 30,000 | $10 | $10 | ... |
| Bruseh Hydraulic Tin M. Co., Ltd. | 1901 | $600,000 | $600,000 | 60,000 | $10 | $10 | ... |
| Jeher Hydraulic Tin Mine Ltd. ... | 1905 | £30,000 | £30,000 | 30,000 | £1 | £1 | ... |
| Karangan Hydraulic Tin M. Co., Ltd. | 1901 | $120,000 | $120,000 | 12,000 | $10 | $10 | 5,000 |
| Kinta Tin Mines, Ltd. ... ... ... | 1898 | £60,000 | £60,000 | 60,000 | £1 | £1 | ... |
| Kuantan Tin Mining Co., Ltd. ... | 1905 | $150,000 | $99,000 | 15,000 | $10 | $10 | 6,000 |
| Pusing Lama Tin Mines, Ltd. ... ... | 1904 | £120,000 | £98,000 | 98,000 | £1 | £1 | ... |
| Royal Johore Tin Mining Co., Ltd. ... | 1900 | $110,000 | $110,000 | 22,000 | $5 | $5 | ... |
| Sipiau Tin Mining Co., Ltd. ... ... | 1899 | $230,000 | $230,000 | 23,000 | $10 | $10 | ... |
| Tronoh Mines, Ltd. ... ... ... ... | 1902 | £160,000 | £160,000 | 160,000 | £1 | £0 | ... |
| Singapore T. M. Synd., Ltd. ... ... | | | | 320 | $100 | $100 | ... |
| ,, ,, ,, 10% Pref. | | | | 65 | $100 | $100 | ... |

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