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The mines and minerals of the Malay Peninsula

By the Revd. J.E. Tenison-Woods, FGS, etc.

Abstract

At the invitation of Sir Frederick Weld, the Governor of the Straits Settlements from 1880 to 1887, and Sir Hugh Low, the British Resident of Perak from 1877 to 1889, Fr. Julian Edmund Tenison-Woods spent six or seven months in 1884 exploring through the state of Perak in the Malay Peninsula, then visiting Malacca and Selangor. While his exploring ranged across a number of sciences, he is remembered particularly for his geological work. During a visit to Hong Kong in 1885, he delivered an address on the "Mines and Minerals of the Malay Peninsula," which was recorded by the local *China Mail*. The journalist adds something of the flavour and humour of the afternoon, with local references to investors, and by providing the introductory remarks of the Governor of Hong Kong, Sir George Bowen. The text which follows is taken from that newspaper of 3rd February 1885.

An interesting lecture on the Mines and Minerals of the Malay Peninsula was delivered yesterday afternoon by the Rev. J. Tenison-Woods, in St. Andrews Hall. There was a large attendance: His Excellency the Governor presided, and among those present were His Excellency Vice-Admiral Dowell, K.C.B., Mr. Justice Russell, the Hon. W. Keswick, the Hon. A. Lister, and several ladies.

HIS EXCELLENCY, in opening the proceedings, said — Ladies and gentlemen, I have been requested to take the chair this afternoon on the very interesting occasion of the delivery of a lecture by the Rev. Julian Tenison-Woods on the "Mines and Minerals of the Malay Peninsula." As I am informed, this is a matter of practical and financial, as well as of scientific interest to some gentlemen in this colony — [laughter] — who have advanced funds for the exploration of the mineral resources of the Straits Settlements. If this be so, I earnestly trust that the patriotic efforts of those gentlemen to promote the cause of science will be rewarded by financial success; that they will be rewarded not only by advantage to their minds but also to their pockets. [Applause]. Of one thing I am quite sure, and that is, that they will get the most correct and useful advice from Mr. Tenison-Woods — [applause] — whom I have known for twenty-five years as an eminent geologist and mineralogist, and as the author of one of the best books on the exploration of Australia. My rev. friend has reminded me that he was my guest nearly a quarter of a century ago, when I was the first Governor of the great colony of Queensland, and I often heard of his reputation afterwards while I was Governor of New Zealand and Victoria — in fact during the whole twenty years that I passed in Australia as the Representative of the Queen successively in three of the greatest provinces of the Empire. [Applause]. I have therefore great pleasure in introducing Mr. Woods to this meeting. And here let me observe that the lecture of this day presents a very interesting subject of reflection. Here we have a practical proof that religion has no longer any fear of science. [Applause]. We see a Roman Catholic clergyman about to lecture on what was once considered the dangerous science of geology, and I am surprised that we have not the Bishop

ready to applaud him, but I am sure that it must be owing to some accident that my friend Bishop Raimondi is not here today. [Applause]. In the sixteenth century, as we all know, the great astronomer Galileo was persecuted because he contended that the earth goes round the sun, and until quite lately geology was considered a more irreligious science than astronomy. This feeling was not confined to the Church of Rome. At the end of the last century an eminent Bishop of the Church of England ridiculed the pretensions of geologists — and we know that ridicule is often a more dangerous weapon than hatred; as Horace says:

Ridiculum acri fortius ac melius magnas plerumque secat res.

— by saying that for a man crawling on the face of the earth to pretend that he knew what was going on in the interior of our planet was like a gnat on the shoulder of an elephant pretending that it knew what was going on in the bowels of the huge animal. [Laughter]. But behold what progress! Here we have Mr. Woods, at the end of the nineteenth century, about to tell us living in Hong Kong what is going on in the bowels of the Malay Peninsula, some three thousand miles away. [Applause]. Seriously, ladies and gentlemen, in the entire history of science there is nothing more remarkable than the progress of geology during the present century, or I will say during the last fifty years. So it is more or less with all the sciences, but I think the progress of geology is the most remarkable of all. But, like all other sciences, though it has achieved many victories, it has still many victories to achieve. That grand old philosopher, Sir Isaac Newton, on his deathbed, said that whatever might be thought by others of his great discoveries in natural science, he himself only felt that he had been like a child gathering shells on the shore of the eternal ocean of truth and knowledge. [Applause]. The field of science is like one of those vast Australian forests which Mr. Woods and I know and love so well, in which the more trees are felled the greater appears the expanse of wood around. Without further preface I now introduce to you the Rev. Mr. Tenison-Woods. [Applause].

The Rev. J. TENISON-WOODS said that it was due to his hearers, and in a certain sense due to himself, that he should explain as briefly as possible some of the qualifications he had for dealing with this subject, and why he had approached the subject at all in the lecture which he now proposed to give. He had lived for a long time, as His Excellency had informed them, in Australia, but His Excellency had not informed them, what he might now add, that during the time he had lived there he had been a witness to the great efforts His Excellency had made to forward anything which favoured the advance of science, whether geological or geographical, in those British colonies. In the course of his missionary duties he had explored a great deal of country which had never before been trodden by the foot of civilised man, and as he was always very much interested in geological subjects, and had visited most of the mineral-producing countries in Europe, he wrote down his impressions of what he then saw. He thought no more charming study could be imagined than a new country in which something is discovered which may largely influence the destiny of the colonies, and perhaps to some extent the history of the world.

And so, having seen a good deal that would interest the public, he published some of what he saw, at first on his own account and at his own cost. One or two of his first

works were geological, and these, in course of time, led him to be regarded as an authority on the subject, and the Government assisted him afterwards, and enabled him to publish accounts of many of his researches. In the course of time, he was invited to visit and report upon many mineral districts that had been discovered, so that the Government might have the opinion of an impartial and independent witness on the value of the deposits.

After many years had been spent in this way, during which he might say there were few mineral districts in the whole of Australia which he had not visited, he went on a visit to an old friend of his, Sir Frederick Weld, and while at Singapore he was invited by Sir Hugh Low to visit the mineral districts in the state of which he was Resident, and on the part of the Government His Excellency promised to see that he was taken about to every place he wished to see free of all expense, provided that he would give them a report. This he did. He spent six or seven months exploring through the native state of Perak, during which explorations he had the pleasure of becoming acquainted with some of the features of the country not previously made known. Subsequently he visited Malacca, and afterwards went through some of the mining districts of Selangor. Thus, he became intimately acquainted with all the mineral producing deposits of the Malay Peninsula. From there he went to Sumatra and Bintang, and the celebrated tin districts under the Dutch Government. Thus, he became not only acquainted with the tin deposits of Australia, which mineral ranked second as a production of that island only to gold, but he also became acquainted, and had means of comparing what he saw in Australia with what was to be seen in the Malay Peninsula. So much for his qualifications for dealing with the subject, and now as to his reasons for giving this lecture.

A great deal of misunderstanding existed with regard to the minerals of the Malay Peninsula. Very little was known about them, though he believed there were many in Hong Kong who thought they knew a great deal too much. [Hear, hear]. But for all that, he thought that if they had a little more explanation they would not take a despondent view they now seemed apt to take as to the future of the mining districts. What he proposed to do was to avoid as much as possible all technical matters, and give them as clear an idea as he could of the nature of the tin deposits of the Malay Peninsula. Though the object to which he should thus confine himself was a small one, he should have to choose very carefully among a multitude of subjects connected with it in order to fit it within the limits of a brief lecture.

From what he had seen and all he had read of the tin deposits of the Malay Peninsula, he concluded that they were, without exception, the richest in the world. He was aware that there was a prevailing impression here that this was not the case, but still it was perfectly true. There was no more widely distributed deposit of tin than in the Malay Peninsula, at least not of that particular kind of tin deposit which was termed "stream tin." They were very widely spread, and the deposits in themselves were practically inexhaustible. The lecturer proceeded to show by a map the peculiar formation of the peninsula remarking that its shape was singularly developed. There was an immense range of mountains, a few of which had been explored, and some of which he was the first to explore, while others, much higher, had been effectively explored by a French gentleman who had

since gone home. Some of the mountains reached a height of 10,000 feet, and there were, he believed, some even higher than that. These mountains, in about the centre of the peninsula, began to decline until they came to a part at which there was so little elevation that boats might be dragged from one river to another on the opposite side. It was there that the richest part of the tin deposit was to be found; there had been the greatest disturbance and there was the greatest mineral richness.

In a disputed country between the territory of Perak and Siam there were tin veins. He should speak briefly about those veins, and he might say that this was the only case he had met with where there were veins of tin in the peninsula; elsewhere, in the south, it was in alluvial deposits. This was a very important thing to bear in mind, because he had met in Hong Kong several persons who had asked him if there was not something peculiar about the tin deposits there. To these he would answer that there was nothing peculiar at all about them, they were exactly like stream deposits all over the world — no difference. He had been asked something about pockets; he knew pockets were a subject in connection with mines about which people were particularly tender — [laughter] — but there were no such things as pockets as they were generally understood which made them different from deposits in other parts of the world. The deposits of tin had been accumulating for ages from the wearing down of the granite rocks. He was also asked if there were no main sources from which the tin was derived, and he answered, "No, nothing of the kind was found in what was known as stream tin, as far as his experience went." It was most important to bear this in mind, that, wherever stream tin was discovered, veins were not found, and where veins were found, there was no stream tin. Had time allowed, he could have explained the reason of this, but he had now to confine his attention to what stream tin was.

Let them suppose that they had in the mountains of the Malay Peninsula the representation of those forces which had upheaved their rugged summits, which had in the course of time, through the slowly acting forces of the weather, worn into peaks and gullies as they were now seen. The rev. gentleman said his hearers must excuse him if he appeared to enter into explanations of things that seemed self-evident; as he proceeded the reason would be apparent. This decomposing and wearing down of the granite by the action of the weather and owing to the iron contained in the feldspar being easily rusted, and thus the granite was disintegrated till nothing was left to represent it but heaps of fine sand. With this sand, there was washed down by the force of water grains of tin that had been contained in the granite. Whatever was contained in the granite was washed down into the valleys, and a great deal of alluvial granite was carried out to sea in the form of a fine mud which discoloured the water, but was finally deposited on the coast, and was the cause of those immense mangrove flats and mud islands that were to be found about the Malay Peninsula on the west coast. The lighter portions were carried away the furthest and the heavier portions remained at the foot of the hills, and it was with the latter that the tin was found. It was found at the bottom of the deposit, and it might be said that if it was thus deposited it must have been said that only the surface of the granite which was rich in tin, and it was washed down first, and subsequently covered with alluvial sand. But it would not

be right to argue in this way. The granite and tin had been mingled together so generally that probably a very minute examination of the granite would have been required to perceive the tin it contained, except in exceptional instances, where it was found in little streaks, and bosses, and lumps. As to the reason of the tin being gathered together in the lowest portion of the deposit, cassiteris was more than several times the weight of common quartz sand, and sank rapidly, but its weight alone would not account for the fact. The tin was found in some ancient stream bed — not the same breadth the stream now occupied, as in the course of ages the stream would have travelled over a wide valley. The sand it brought down obstructed its own course, and caused it to constantly change its channel, and it was carried backwards and forwards across the valley and the deposit was washed much in the way it was done by artificial means. Every time the stream changed its course it washed the sand from the alluvial deposits, and turned it over and over again, allowing the water to pass through the midst of it, so that the tin was gradually left, and the sand, or lighter portions were carried away. It was in this way that the tin came to occupy the lowest portion of the deposit. It was covered with a deposit of alluvium sometimes as much as 30 feet in thickness, in others as much as 50 feet, but usually much less, sometimes as little as ten feet. The thickness or richness of the tin deposit bore no reference to the thickness of the deposit above it. It was merely a matter of chance, only he thought it might be inferred that where there was a thick deposit of alluvium over the tin, and the tin was not very thick, the deposit could not be of a very rich character. The audience would now understand how stream tin occurred.

What occurred in Perak occurred also in Australia, and in all the mines he had visited where stream tin was worked. There seemed to be an impression that the stream deposits in Perak were poorer than those in other places, whereas the fact was that if anything they were richer. If people thought, too, there was a larger deposit of sand over the tin, that was a mistake. It would be found that in some cases there was more in Cornwall, and it was so also in Australia. Probably in Australia the tin deposits had not been fairly worked, for on account of labour being so very dear none but the richest mines were worked, and these were worked very differently from the mines in Perak. People asked him, again, how it was that the result of tin mining in the Malay Peninsula was so unsatisfactory if the mines were as rich or richer than those in other parts of the world. That depended upon economical considerations with which he could have nothing to do, but still he could form his ideas upon the subject, which might be right or might be wrong, for clergymen were not as a rule very good men of business, and when he told his hearers what he thought about the matter at the termination of his lecture, they might take his remarks for what they were worth.

Now they might consider what granite was. Its principal ingredients were mica, feldspar, and quartz, but granite was very rarely so simply composed as that, and in common use the name applied to a dozen different kinds of rocks having diverse chemical compositions. In his opinion, and in that he was following the ideas of most of the leading geologists at home, granite was formerly a stratified rock, having assumed its present form after having been subjected to great pressure. Pressure generated heat, and with steam that was confined — of course having

no means of escape under the pressure to which the granite was subjected — produced a force which no rock was able to withstand. Superheated steam was more corrosive than any acid; they had no knowledge of any acid which melted away quartz but one, and that only to a small degree. Rocks by this process, however, were reduced to a pasty condition. There was one fact about tin deposits in Perak to be noted, and that was that they were never found except at the junction of Palæozoic rocks and granite. The Palæozoic rocks were the most ancient stratified rocks with which they were acquainted. Now these Palæozoic rocks lay on the top of the granite, and if the junction between the two was followed, it would be found that there was a gradual passage from one form to the other. Stratified rocks bore marks of stratification like sand-stone or slate, and as they were followed down it would be noticed that these marks became less and less distinct, while crystalline structure became more and more distinct until gradually there was a passage between these Palæozoic rocks into granite, so that they appeared as if the one was derived from the other. That, however, was a matter of theory.

The fact they found was that where they found minerals was always at the junction of granite or intrusive rock with a stratified rock. There was no exception to this rule throughout mining in the Malay Peninsula; he had never seen any tin deposits except such as were derived from the wearing down of the rock which were at the junction of the slates with the granite. If he were asked why that was so, he could give them a reply which was satisfactory to himself as the most reasonable way of accounting for it. All rocks were derived from marine action, and water, no matter how pure it might be, contained in solution some proportion of all the metals. Sea water, for instance, contained an appreciable amount of gold as well as silver. Supposing these rocks had been thrown down or sunk beneath the earth's surface, and subjected to the influence of heat generated from the rocks being piled above them, the metals would run together in consequence of the rocks being reduced to the pasty description which he had described, even when the particles were so finely divided as would be the case of gold in sea water. The quantity, they might say, was infinitesimally small, but the amount of gold taken out of the earth as compared to the amount of rock which was crushed and beaten for gold was infinitesimally small — much less than the quantity in the sea water at the present time. In the first state these rocks contained a certain amount of tin, and in the course of time the rocks became transmuted by the action of the steam he had described, and the result was that the tin became aggregated into fine grains and was more or less unequally distributed throughout the granite. But why was tin found at the junction of the Palæozoic rocks and the granite? Possibly it was by being brought into a state something like sublimation, that was converting the metal into vapour, from which state it would be condensed on the cooler or untransmuted portions of the stratified rock. In giving that explanation, he was aware that the term sublimation was not strictly correct, but he used that because it would convey to his hearers the nearest idea of what he wished to explain to them. Certainly, they found that the tin existed most in the uninterrupted parts of the Palæozoic rocks. That was a fact which he was glad to say was being more recognised than previously.

Over and over again he had pointed out to those searching for minerals in Perak that there were two things they must look for, first, a place where there had been a watercourse, and, second, a place where the rock had been composed of a junction of the Palæozoic rock with the granite. There was no rule of thumb for finding tin. He knew that there were some who would say, "That looks like a likely place, put down the rod and you will find metal." Sometimes they were right, but more often they were wrong and it was a mere chance if they were ever right. This was mere charlatanism which practical business men should put aside as much as possible. He thought there had been a little of that in the Malay Peninsula. In those cases the simple rule was lost sight of that alluvial tin could only be expected where there had been a watercourse, and, secondly, that not only must they look for it at a watercourse but also in those places where the rocks had been composed of the junction of the Palæozoic rocks and the granite. Now how was that to be told? Generally, they could tell it by the colour of the soil, but not always. The soil ought to be a reddish or yellowish colour, because the peroxide of iron in the Palæozoic rocks generally gave rise to a fiery red soil. If these rules were adopted, it was easy to tell whether any place was a likely place to find alluvial tin in, but they must not go so far as to say that as a matter of course tin was to be found there, though nearly always such was the case.

Then another thing was to be said about the deposits of tin. They were not to be worked on ordinary mining principles, because the alluvial soil was at most only some fifty feet thick, rarely so much, and more often only fifteen or sixteen feet. Under these conditions, they could not go tunnelling and burrowing and putting in operation all those mining apparatus found so useful where great depths below the surface had to be reached. Practically they could do nothing but strip off the alluvial soil, and on coming to the tin extract from it the deposit by means of washing. That was the simple process of mining in the Malay Peninsula. He did not know of any other place where similar deposits could be worked otherwise unless they were very deep, and then they could not be worked profitably unless they were unusually rich. He did not think that had been recognised by the Europeans concerned in the Malay Peninsula. It had been assumed they could sink shafts and run galleries and tunnels. That was sure to lead to failure. Even if they could do so they were sure to meet with large granite boulders, and, as they could not use dynamite where the working was so shallow, they would have to work round the rocks and leave a good deal of valuable tin in doing so. No doubt it was very gratifying to our national vanity to be able to show the Chinese what could be done with machine appliances, and if it were merely a benevolent undertaking that would be very interesting, but in practical work it led to a great deal of unnecessary expenditure and could not result in any great gain to those interested. His impression was that the mistake had been in not mining as the Chinese do. They strip off the soil in the most economical manner, they wash their tin deposits without any great appliances, and in that way they make their money. Probably it would be said the Chinese have advantages which we do not possess. This was perfectly true, and it seemed to him, if he might offer a suggestion — and this was where he meant his ability was not sufficiently trustworthy — he would suggest that the mines should

be carried on by Europeans on the tribute system rather than by the use of appliances which from the nature of the case could not be expected to pay.

He would give an illustration of this. In the early days of gold mining in Port Philip some of the mines gave very large dividends. One of the most prosperous for a time was the "Clunes" mine,[1] but as they went deeper and deeper the quartz got poorer and poorer until at last it was found that the mine did not pay. The shareholders got alarmed, and some of them were for selling off and realising their property as soon as possible. However, better counsels prevailed. Those who understood the matter said — "Look here, these miners are bringing up all sorts of stuff for you to crush in your mills. They do it because they are paid so much a ton, and they will go on digging without reference to anything but bringing so many tons to grass." The miners were then told they could take so many cubic yards, they could take all the gold and the company would pump and wind for them. The consequence was that the Clunes mine, instead of becoming a loss, was soon returning nearly as large dividends as it did previously. He thought the only way to mine successfully in Perak would be on a somewhat similar principle. Let the tributaries be the Chinese, who knew how to work the mines, and let as few Europeans as possible have anything to do with it. The climate was bad, the privations great, and the Europeans employed deserved to be paid good salaries; but let there be as few such as possible.

He would not detain them further. He could say more, but what he had said he hoped was sufficient to make clear to them that mines in Perak are no exception to mines elsewhere. They are rich; they offer favourable fields for the employment of British capital; but they require care in the working. In the end, they cannot fail to yield satisfactory results. [Applause]. He begged to thank the audience for the attention with which they had listened to him, and His Excellency for presiding. — The lecturer on resuming his seat was loudly applauded.

Mr. E. J. ACKROYD — Ladies and gentlemen, I am sure I do but express the sentiments of you all when I rise to move a vote of thanks to the Rev. Mr. Tenison-Woods for the very clear and lucid lecture he has given me to-day on the tin deposits and tin mines of Perak. [Applause.] His great knowledge of the subject and his experience have enabled him to treat it in such a simple and clear way that he has made it intelligible to many who were not acquainted with geological terms. To those who have no interest in these mines but came for the love of science I am sure he has afforded great pleasure, while to those who are interested he has given valuable information which may lead to practical measures being taken for the proper working of the mines. I beg to tender Mr. Tenison-Woods our best thanks for the very pleasant afternoon he has afforded us. [Loud applause.]

[1] Henry Alderson Thompson, Description of the Clunes Gold Mine, Victoria, *The Sydney Magazine of Science and Art* 2: 79–80, 1859. (Paper presented at the Philosophical Society of N.S.W. on Aug. 11, 1858.) https://archive.org/stream/sydneymagazines01socigoog#page/n95/mode/1up

THE GOVERNOR — I offer you, Mr. Tenison-Woods, the thanks of the meeting tendered by acclamation.

Rev. TENISON-WOODS acknowledged the compliment and moved a vote of thanks to His Excellency for so kindly presiding. Carried by acclamation.

THE GOVERNOR, in acknowledging the compliment, said that, as Mr. Tenison-Woods had said, when he was in Australia he was always ready to promote geographical or geological explorations. He assured them he should always be the same so long as he remained in Hong Kong.

Cover Note by Governor George Bowen

On the day following the lecture, Governor Bowen sent a copy of the newspaper report to the Colonial Office in London:

> Government House,
> Hong Kong, 4th February, 1885
> The Right Honourable The Earl of Derby KG
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> My Lord,
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> I have the honour to report that I was yesterday requested to take the chair at a lecture delivered by the Reverend Julian Tenison-Woods on "The Mines and Minerals of the Malay Peninsula." As I said in the speech with which I opened the proceedings, I had known Mr. Tenison-Woods for twenty years while I was Governor successively of Queensland, New Zealand, and Victoria, as an eminent geologist and Mineralogist, and as the author of one of the best books on the exploration of Australia. He has lately explored the mining districts of the Malay Peninsula, under the auspices of the Governor, Sir Frederick Weld. His lecture (of which a report is enclosed) was very well received and (as I observed) was of practical and financial as well as scientific interest to many person in this community who have advanced funds for the working of the Mines in the Malay Peninsula.
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> I have the honour to be, My Lord, Your Lordship's Most Obedient, Humble Servant, G. F. Bowen