

## FEDERATED MALAY STATES.

### GEOLOGIST'S ANNUAL REPORT FOR THE YEAR 1913.

At the beginning of the year the Geologist was on leave. The Assistant Geologist, Mr. W. R. Jones, was acting as Geologist. The Geologist returned from leave and resumed his duties on 21st February.

2. During the year the Perak Chamber of Mines asked the Government to appoint a Chemist to the Geological Department in order that official assays might be obtainable. The appointment was sanctioned but had not been filled by the end of the year. The success of this appointment will depend mainly on the amount of support given by the mining community.

3. The Assistant Geologist continued mapping the Ulu Selangor and Kuala Selangor districts. Good progress was made with the work, and the map should be ready for publication in 1915. The Assistant Geologist failed to reach the flat land in the *ulu* of the Sungei Tinggi, concerning which the Chief Secretary made enquiries during the year. This land is difficult of access. By travelling from Tanjong Malim the Assistant Geologist reached only the extreme *ulu* of the Tinggi, in the Bukit Belata Forest Reserve, and later met with disaster when rafting down the Bernam river to approach the land in question from the north.

4. The Geologist began mapping in the Batang Padang district.

5. The Resident of Negri Sembilan suggested that a geological survey of that State in the near future would be desirable. In order to expedite this work provision was made in the 1914 Estimates for a Second Assistant Geologist.

6. It was proposed that, with the additional Assistant Geologist and the Chemist on the staff, the work of the department should be as follows:

Geologist: to direct the survey, specialize in field work in Perak, and do all petrological work for the department.

Chemist: to carry out all analytical work for the public and the department.

First Assistant Geologist: to specialize in field work in Selangor.

Second Assistant Geologist: to specialize in field work in Negri Sembilan and Southern and Eastern Pahang.

7. Buyong bin Haji Dris continued to do good work in the preparation of rock sections for the microscope.

8. Early in the year were published a geological sketch-map and descriptive memoir of the Kinta district, Perak.

9. A paper on the prospects of finding oil in payable quantities in the Federated Malay States was also published.

10. Some fossil corals, collected in the Kuantan district, Pahang, were sent to the British Museum of Natural History, and the Keeper of the Geological Department, Dr. A. Smith Woodward, has kindly promised a description of them.

#### CHINA-CLAY.

11. Enquiries were received again about the kaolin, or China-clay in the Federated Malay States. It was thought advisable to prepare a description of the resources of the country in this direction, and the Assistant Geologist was asked to undertake the work. In connection with this the Government sanctioned a visit to China in order to obtain information about materials used in porcelain works, but Mr. Jones was unable to start before the end of the year.

#### BORE FOR WATER ON THE LAPAN UTAN ESTATE, KUALA SELANGOR.

12. A bore put down by private enterprise on the Lapan Utan Estate, with the steam boring plant belonging to the Mines Department, was continued. The Assistant Geologist reports as follows:

"The bore at Lapan Utan Estate, Kuala Selangor, has now been abandoned after reaching a depth of about 220 feet. The bore passed through clay and interbedded sands, and the underlying rock was, unfortunately, not definitely proved. The little water which accumulated in the bore-hole was not potable, being rich in chlorides and organic matter.



"The presence of coarse angular tin-ore in two specimens sent from the Lapan Utan bore to the department should, I believe, be further investigated. It seems extraordinary that large angular fragments could possibly be found in a deposit containing smaller and rounded grains of quartz."

One reason why this bore was commenced was that it would check the opinion given by the Geologist in his "Memorandum on the Possibility of Obtaining Supplies of Artesian Water in the F.M.S." to the effect that the expense of boring at Kuala Selangor was hardly worth the risk of failure to obtain sufficient or indeed any potable water.

13. During the progress of this bore reports became current of mineral oil having been found. The evidence was followed up by the Geologist and found to be worthless.

#### SPECIAL REPORTS.

14. The Geologist furnished the following special reports :

- (1) On the Tin Mines at Intan, Upper Perak.
- (2) On the Raub Gold Mines.
- (3) On the Economic Geology of Perlis (prepared for the Perlis Government).
- (4) On the Tin Deposits of Gunong Bakau.

A short account of the tin deposits of Gunong Bakau is given at the end of this report.

15. The Assistant Geologist furnished a special report on an alleged discovery of coal in Johore. Careful enquiries made it almost certain that the coal was brought in a small steamer about 12 years ago to somewhere near the place where it was "discovered" in 1913. It is interesting to note that the discovery was reported by a European on a rubber estate in the following terms : "I am sending per this post a sample of coal, etc., found on our concession. These were struck in well sinking." When Mr. Jones arrived at the estate he found the coal, etc., had been lying on the floor of the estate office for over four years.

#### SPECIMENS SUBMITTED FOR REPORT.

16. During the year 117 specimens were received for report. It is satisfactory that the public avails itself to such an extent of the facilities afforded by the Government. When the Chemist has taken up his duties it will be possible to deal with much more material than hitherto.

#### THE ASSISTANT GEOLOGIST'S WORK IN SELANGOR.

17. The Assistant Geologist reports :

"The most interesting and perhaps the most valuable work from an economic point of view has been the tracing of the junction of the granite of the main range with the schists with which it is in contact. This has now been done from near Tanjong Malim to a few miles south of Rawang, and has been plotted on the geological map.

#### LIMESTONE.

18. "Limestone is to be seen *in situ* in the Kanching Valley where, in addition to limestone cliffs, it forms the bed-rock on which lies most of the tin-ore ground of this valley.

19. "It is also exposed *in situ* at the tin-mine near Serendah Station, where it rises from the bottom of the mine as pinnacles. It is practically certain that limestone has at one time been exposed in Rawang Valley, and it would not be surprising to find that further work will prove its existence as bed-rock in parts of the Ulu Yam and neighbouring valleys.

20. "In the mine at Kalumpang, the mine nearest to Tanjong Malim, limestone was found but not definitely *in situ*. It formed what appeared to be the severed top of a limestone pinnacle, but further evidence is hoped for in the near future. Most of the bed-rock here, however, has been proved to be schists and phyllites.

#### SCHISTS, PHYLLITES AND QUARTZITES.

21. "These rocks cover very extensive areas in Ulu Selangor, and numerous exposures are to be seen along the road and railway cuttings from Tanjong Malim to Rawang. Some of the cuttings are at present fresh, notably those near Kuala Kubu, and the intensely disturbed character of the beds, mostly schists and phyllites, is illustrated in a striking manner. Towards the junction with the granite the rocks are undoubtedly schists, but as one proceeds westwards the schists grade into phyllites with bands of quartzite, whilst still further westwards quartzites are the predominant rocks.

22. "The schists, phyllites and quartzites have now been found to extend, near Tanjong Malim, for over 12 miles westwards from the granite junction, the series being found continuously *in situ* from Escot Estate to Tanjong Malim Estate, then to Bukit



Belata Forest Reserve and to the hills to the west of Bukit Tunggal, where the old coast-line forms a very distinct feature. The country to the east of this old coast-line is particularly hilly and is cut by innumerable deep and narrow valleys which will make it very difficult to develop. From the cleared part of Tanjong Malim Estate to Bukit Tunggal no fewer than a score of steep-sided and narrow valleys have to be crossed, and these are separated by hills rising generally from 300 to 400 feet above the valleys, but three of them reach twice that height.

23. "From the top of Bukit Tunggal the old coast-line can be very clearly seen extending from Rantau Panjang Forest Reserve to the Sungei Bernam. The isolated hills of Kuala Selangor are seen to rise above the level of the old sea-bed and even to-day appear as green islands standing in a green sea.

24. "It is interesting to point out that the tin-ore deposits of Ulu Selangor differ from those of the Kinta Valley in that the deposits in the former are more sandy and contain well-rounded pebbles. The stiff clays with angular boulders found at depth in parts of Kinta Valley are absent in Ulu Selangor. Where a stiff clay occurs, as at Serendah, it is found to overlie sandy beds with some pebbles and well-rounded grains of tin-ore, the whole having all the characters of an alluvial deposit.

25. "Too much importance cannot be attached to the fact that the ore of Ulu Selangor is derived from rocks now *in situ* in that district, and this fact should guide prospecting in that part of the Peninsula. Where the valleys are rich in tin-ore the hills should be very carefully prospected right up to the source of the streams running into the valleys. In the case of every valley in Ulu Selangor I have been able to find in this way, tin-ore *in situ* in the granite. Local enrichments with angular ore should be very carefully examined and the bed-rock itself tested for ore by crushing and washing.

26. "Of peculiar interest is the evidence obtained of faulting in undoubted alluvium at Towkay Loke Yew's mine at Serendah and in two mines at Kanching. The evidence in one of the Kanching mines, where rounded boulders had been cut right through by a fault with a throw of nearly two inches, was seen by the Geologist also. At the Serendah mine I made out the fault to have a throw of nearly three feet."

27. After visiting the alluvial mines in Ulu Selangor with the Assistant Geologist some of the best exposures of the Gondwana clays in Kinta were re-examined. As Mr. Jones remarks, the two deposits are distinct, but the Geologist thinks that the Gondwana clays may still be found in Ulu Selangor.

28. In December two excellent sections were seen, one on Tekka, Ltd., and the other on the French Company's land at Tekka, showing the junction of Gondwana clays with granite, and the alteration effected by the latter in the clays. Like sections seen in previous years, these granite junctions prove conclusively that the clays are older than the granite. It is proposed to publish in 1914 a description and photographs of the two sections named on account of their importance.

#### THE TIN DEPOSITS OF GUNONG BAKAU.

29. The following short account of the tin deposits of Gunong Bakau is given in this report because miners have expressed a wish to know the results of the Geologist's visits to the mountain in October and November. The Geologist wishes to record his indebtedness to these gentlemen for their assistance while he was there.

30. Gunong Bakau is a mountain 4,426 feet high on the Selangor-Pahang boundary and about 10 miles from Peretah, on the road between Kuala Kubu and the Gap. The mountain is composed of porphyritic granite, into which two tin-bearing rocks have been intruded at different times. The first to be intruded was one in which quartz and topaz are constant constituents, and which therefore is best described as the quartz-topaz rock. It occurs as veins, the largest of which are about 15 feet thick. Some of these veins appear at their outcrops on the side of the mountain to be regular in form and lying almost flat, thus resembling sills. Others, however, are irregular in their course and form. Some are only an inch or so in thickness.

31. The second rock to be intruded was topaz-aplite. This cuts both the porphyritic granite and the quartz-topaz veins. On the north side of the mountain it forms large masses and can hardly be regarded as a vein-rock. To the south it is not so abundant and one clear section shows distinct veins of it. The rock has been called aplite because that name conveys the best idea of its constitution, but it is in some parts rather coarse in grain for an aplite and nowhere coarse-grained enough to be called pegmatite.

32. Both the quartz-topaz rock and the topaz-aplite contain tin-ore as a disseminated rock-constituent. In the aplite, except in one spot, it has not been proved as yet to be present in sufficient quantity to be of value, but there is some reason to suppose that tin-bearing media connected with the aplite have been instrumental in forming very rich ore-bodies in pre-existing granite rocks. The veins known as "Hemy's lode" are some of these ore-bodies.



33. In the quartz-topaz rock the tin-ore varies in quantity from 9 per cent., or perhaps more, to nil. In Messrs. Bibby and Ruxton's quarry, where the most work has been done, it forms about 1.75 per cent. of the rock.

34. The quartz-topaz veins are found outcropping all round the mountain, and Messrs. Bibby and Ruxton have driven about 300 feet into the hill along one of them. But for this work and short prospecting drives, nothing is known of the extent of the veins in the interior of the mountain, and how prospecting can best be carried out is the most important problem at present regarding the deposits.

35. At first sight a suggestion that has been made—namely, prospecting by means of a drill, seems attractive, as the veins, many of which appear to be lying almost flat, are so disposed as to lend themselves to this form of prospecting were it not for the presence of the later intruded topaz-aplite and the difficulty of obtaining power on the mountain.

36. In considering the problem of prospecting the following points have to be considered :

- (1) The quartz-topaz veins in any part of the mountain may be found to be cut out completely by the topaz-aplite, which so far has not proved to be of value, except in one spot.
- (2) The tin-ore in the quartz-topaz rock occurs as small disseminated grains and crystals of cassiterite. It varies largely in quantity and there is no means of telling when percentages are going to drop or rise, nor would it be safe to estimate ore-values on the "blocking-out" principle, because neither "shoots" nor "runs" of ore, on a scale large enough to be a guide in mining operations, have been proved to exist. The percentage of cassiterite varies in much the same way as the percentage of one rock constituent may vary in any large mass of rock.
- (3) The quartz-topaz rock is very hard and drilling would be costly and slow.
- (4) Owing to the distribution of the cassiterite cores from a drill would not be a safe guide to the amount of tin-ore in the vicinity of the hole.
- (5) A very large number of drill-holes would have to be put down to prove to what extent the quartz-topaz veins are cut by the topaz-aplite.

37. Drilling would certainly give some information, but it is believed that this would be of so vague a nature that it would not be worth the cost.

38. The question is perhaps best answered thus : Messrs. Bibby and Ruxton have for some time been prospecting and working the stone by driving levels into the hill, which can be used for trucking ore as soon as they are made, and are made by hand. Even if one drilled to prospect the stone, levels would still have to be made to work it. With so poor a prospect of getting valuable information from drill-holes at a reasonable cost, it would seem to be the best course to prospect by means of drives, especially since figures supplied indicate that levels might very likely be cheaper per foot than drill-holes in the hard rock. There is no doubt that levels would give much more information.

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