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Preliminary note on the geological structure of the sindang-barang district, on the South coast of Java

H. B. Guppy M.B.

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settlement. We have large tea-gardens, which, although they have not yet reached maturity, are expected to yield a net profit of about 20,000 rupees during the current year. Liberian coffee, cocoa, arrow-root, India-rubber, and other things, are being successfully cultivated; and when I tell you that each convict receives eight ounces of vegetables daily, you may imagine what extensive gardens we have to keep up. Between one and two hundred thousand coconut trees have been planted, and as each tree when it reaches maturity may be expected to yield a profit of one rupee, a large revenue will in time be derived from this source. The chief products grown by self-supporters are rice, Indian corn, and sugar-cane.

I have not time also to tell you of the manner in which the convicts are worked. The most important work on which they are employed is clearing forest land and reclaiming mangrove swamps in the fair weather, and road-making and repairing during the rains. There are now some eighty miles of roads in the settlement.

The gross cost of the settlement is about thirteen lakhs of rupees. The receipts amount to about four lakhs, so the net cost to Government is about nine lakhs—that is £90,000, if the rupee were at par. The above figures are exclusive of local productions, for which no cash expenditure is incurred, and which are used up in the settlement. These are valued at about four lakhs a year.

I must apologise for the meagreness of this sketch of the penal settlement. It is a subject which would afford ample material for a lecture by itself.

PRELIMINARY NOTE ON THE GEOLOGICAL STRUCTURE OF THE SINDANG-BARANG DISTRICT, ON THE SOUTH COAST OF JAVA.

By H. B. GUPPY, M.B.

[The following note is extracted from a letter addressed to Dr. John Murray, of the Challenger Expedition, and received by him from Dr. Guppy on 4th January 1889.]

I SHOULD commence by saying that this is only a preliminary note concerning the results of observations made during a traverse on foot from the railway station of Tjibeber to Sindang-barang, a distance of 32 geographical miles as the crow flies, but about 50 English miles by the road. I traversed this distance to the coast and back (about 100 miles) in six days, making extensive notes and collections. The most interesting portion of the district examined, the 12 or 13 miles between Tangoong and the Sindang-barang coast, was the part where I was most hampered in carrying out my purpose satisfactorily. This region is said to be much frequented by tigers, the result being that I found it difficult to get my men to leave the road for any distance, and in more than one locality I

had to go alone. Here we had to confine our walking to the heat of the day, and even then in some places I had to load my rifle before my men cared to follow. It is perhaps to the tiger-scare that I am indebted for this opportunity of striking upon ground new to the geologist. In a couple of days I am going to examine the coast further to the east of Sindang-barang.

The accompanying diagram, drawn from the base of the great volcanic cone of Pangerango to the sea-coast at Sindang-barang, will serve to illustrate my remarks. The railway at Tjibeber lies in a broad plain, extending northward to the base of Pangerango, and elevated 1400 to 1500 feet above the sea. Rising abruptly on the south side of this plain is a broad, mountainous plateau, about 10 miles across, reaching a height of nearly 4000 feet on its north side, but sloping away to its southern edge, where it is about 3000 feet above the sea. It is on this elevated plateau that the towns of Tjimpaka and Sukonagara are situated. South of it, there is a broad, deep valley, 10 miles in width, on the southern side of which lies the town of Tangoong, about 1000 feet above the sea-level. On the south side, overlooking Tangoong, rises an abrupt line of steep-sided hills, often displaying vertical faces, and stretching away like a line of escarpment to the eastward and westward as far as the eye can follow it. This is the northern edge of a second elevated plateau, which, being raised from 2000 to 2500 feet above the sea, where it overlooks Tangoong, slopes gradually through a distance of about 12 miles to the coast, where it terminates in cliffs 40 to 50 feet high. Such is the surface configuration of the district lying between the base of Mount Pangerango and Sindang-barang. As will be explained below, I should point out here that we should

Section from Tjibeber to Sindang-barang on the south coast of Java (a distance of 32 miles).

regard the valley of Tangoong, through which a large river runs, as a

valley of denudation, now separating into two parts what was once a *continuous plateau-land extending from the heights south of Tjibeber to the sea-coast*. Having viewed the neighbouring districts in profile from Palabuan on the shores of Wynkoops Bay to the westward, and from the railway line near Sukaboomi to the north-west, and from several other localities, I am satisfied that this is the general character of the sea-border of Java from Wynkoop Bay to the eastward of Sindang-barang, my acquaintance with the surface-configuration covering quite 60 miles of the sea-border and 30 miles inland. When I speak of this part of the sea-border of Java, as *having the character of a table-land sloping gradually to the sea from an elevation of 3000 to 4000 feet 30 miles inland*, I do not imply that this level district has not been carved out by the agencies of denudation into peaks and valleys. The reverse is the case: and it is only by obtaining distant views in profile of this region that the observer is able to form a comprehensive idea of the configuration of this part of the sea-border of Java. When this is understood, the geological structure is readily explained.

On referring to the section, it will be observed that the level district around Tjibeber is largely formed of tufaceous rocks. The northern part of the elevated plateau south of Tjibeber is composed mostly of massive volcanic rocks (basic, andesite, etc.), which are exposed in the road-cuttings, and are often decomposed to a considerable depth. On the summit of the plateau, near the towns of Tjimpaka and Sukonagara, there occur tufaceous rocks often bedded and inclined at angles of 20° to 30° : they are often soapy to the feel, apparently serpentinised (specs. 67 to 71).¹ Tufaceous rocks, often partly serpentinised, bedded and similarly inclined, are exposed on the steep south slope of this plateau, together with decomposed volcanic rocks (specs. 64 to 66). Descending into the Tangoong valley at the base of this slope, we find tufaceous sandstones and clays often horizontally bedded, apparently non-foraminiferous and sometimes rather soapy to the touch (spec. 62). On the south side of the Tangoong valley commence the foraminiferous, fossiliferous muds and tufaceous sandstones, horizontally bedded or nearly so, and composing the gradually sloping plateau that stretches away for 12 or 13 miles to the coast (specs. 1 to 60). The horizontal bedding is well displayed in the vertical faces of the steeply escarped line of hills overlooking Tangoong. This is the northern border of the plateau, which here reaches a height of 2000 to 2500 feet. The rivers have cut steep-sided valleys with very small gradients into this table-land, and the horizontal bedding is frequently displayed in vertical faces high up the sides of the valleys. Reaching the coast we find that the plateau terminates in cliffs 40 to 50 feet high, and formed of the prevailing foraminiferous muds and tufaceous sandstones. No coral reefs occur at the coast, nor have any been upheaved in ages past.

It will be noticed in the section that I have given prominence to the underlying volcanic rocks. Only occasionally, as in the bed of a river, did I come upon them *in situ* in the plateau south of Tangoong. They are, however, very common as loose blocks in all the water-courses; and at heights greater than 1000 feet, and more than 7 or 8 miles inland,

¹ The specimens referred to by Dr. Guppy have not yet arrived.—ED.

they occur on the surface often as boulders of andesitic and basic rocks, which get more frequent the greater the distance from the coast.

The thickness of these tufaceous sandstones and foraminiferous muds is probably not less than 1000 feet. Occurring as alternating beds they are sometimes exposed to the extent of several hundred feet in a single section on the face of a hill. I obtained specimens of foraminiferous rocks from all elevations up to 2000 feet. To sum up briefly, I may say that the structure of the sea-border of this part of Java is as follows :—*A basis of massive volcanic rocks overlain by submarine tuffs and volcanic muds as far as 12 miles from the coast, and by older and altered tuffs further inland. The upheaval in post-tertiary times has been very great, and can only be measured by several thousands of feet. The examination of my collections will bring to light the depths at which these upheaved deposits were originally formed.*

An examination of the district of Palabuan, on the shores of Wynkoops Bay, shows that similar formations there prevail, but on a much less extensive scale. Starting from Sukaboomi, about 22 miles from Palabuan as the crow flies, and 1800 to 1900 feet above the sea, I descended for the first 8 or 9 miles along the continuation of the volcanic slope of Mount Pangerango. During the next 8 or 9 miles the country is much cut up by the rivers into deep valleys; and here the soft foraminiferous and fossiliferous deposits are exposed in the river-beds, and are overlain at the surface by tuff rocks, compact and friable, and sometimes containing sea-shells (specs. 76 to 77); in one river 5 miles from the sea I found large detached blocks of a hard white limestone, containing simple corals, molluscan shells, and foraminifera (specs. 83 to 86). Beyond lies the great valley leading down to Palabuan, and on the coasts around Wynkoops Bay are exposed old river-gravels and muds (specs. 95 to 96), and the old volcanic rocks of the district. In the region around Palabuan I did not find the soft foraminiferous deposits more than 8 or 9 miles inland, and at greater elevations than 300 feet above the sea. They are overlain by submarine tuffs up to 500 and 600 feet, and in their turn conceal the basic and andesitic rocks of the district. In all probability, however, if I had further explored the river-courses, I should have found these recent deposits at greater elevations. As at Sindang-barang, there would seem to be no coral reefs around Wynkoops Bay.

In conclusion, I would point out that I have only here given some of the general results of my observations on the south coast of Java. There are a great many interesting details I cannot refer to in a preliminary note.