24. BONAIRE

BY

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With geological map.

Before the visit of Prof. RUTTEN and his students in 1930, only once geological investigations were made on Bonaire. These took place in 1885, when Prof. MARTIN paid a short visit to the island. Though the stay of Prof. MARTIN on Bonaire lasted only four days, he nevertheless succeeded in composing a rough scheme of the geology of the island. I am very glad and I count it as an honour to have the opportunity of prosecuting the work of Prof. MARTIN. A visitor to Bonaire must, even before reaching the road of Kralendijk, observe the great topographical difference between the northern and the southern part of the island. One does not say too much when one asserts that Bonaire consists of two totally different parts. Of these, the northern part is higher and largely dissected, the southern part is a very low and level country. From a geological point of view the northern part is by far the most important: whereas the southern part is entirely composed of young quarternary limestones, the higher northern part contains all the older formations. That does not alter the fact, however, that quarternary limestones are very spread in the northern part too.

This higher northern part of Bonaire has a NW.—SE. direction, and one can say that it owes this direction to the oldest formation on Bonaire, of which the strata strike chiefly NW.—SE. This oldest formation which we, during our investigations on the island in the summer of 1930, under the leadership of Prof. RUTTEN, called the „Washikemba formation", after the Plantation Washikemba in E. Bonaire, is for the greater part built up of volcanic rocks. The formation begins with diabasic rocks, among which one can distinguish diabases, amygdaloidal diabases and diabasic tuffs. In the western part of the Washikemba formation the diabasic rocks pass upward into less basic rocks, chiefly being porphyrites, amygdaloidal porphyrites and porphyritic tuffs. At the top of the formation diabasic rocks appear here again. Higher up in the eastern part of the formation porphyritic rocks are intercalated rather irregularly between the diabasic rocks. Among the older diabase and, to a much greater extent, at the top of the formation cherts and radiolarites are intercalated between the

volcanic rocks, and here and there calcareous cherts and limestones are interstratified between the other rocks. Many of the tuffs contain a bigger or smaller quantity of radiolaria and small foraminifera.

Concerning the volcanic rocks, they have two petrographic characters in common:

1°. the small number of minerals of which they are built up;

2°. the richness in feldspar.

Most of the diabasic rocks contain, as essential constituants, only plagioclase and pyroxene, other constituants being insignificant or failing.

Among the porphyrites one can distinguish mica-bearing-porphyrites, quartz-porphyrites and pyroxene-porphyrites. Also most of the porphyrites are extremely rich in feldspar.

Throughout the Washikemba formation we find intrusions of porphyrites and, at the top of the formation, intrusions of diabase. These latter diabases differ from the other ones by their more or less pronounced gabbroid structure. Many of the intrusions appear in the form of sills.

The thickness of the formation must be at the least 5000 m.

This Washikemba formation shows petrographically much resemblance with the well-known „blue beach" of the northern Antilles. Just as the blue beach, it was probably deposited in cretaceous age.

In Upper-Cretaceous time the formation was folded and denuded. As has been mentioned before the strike is chiefly NW.—SE., the dip being almost monoclinal to the N., with an average amount of 35—40 degrees.

On the folded and denuded Washikemba formation were deposited in Upper-Cretaceous or, probably, in Lower-Tertiary time the limestones and conglomeratic limestones of what has been called the „Rincon formation", so called after the occurrence of those rocks in the vicinity of the village Rincon.

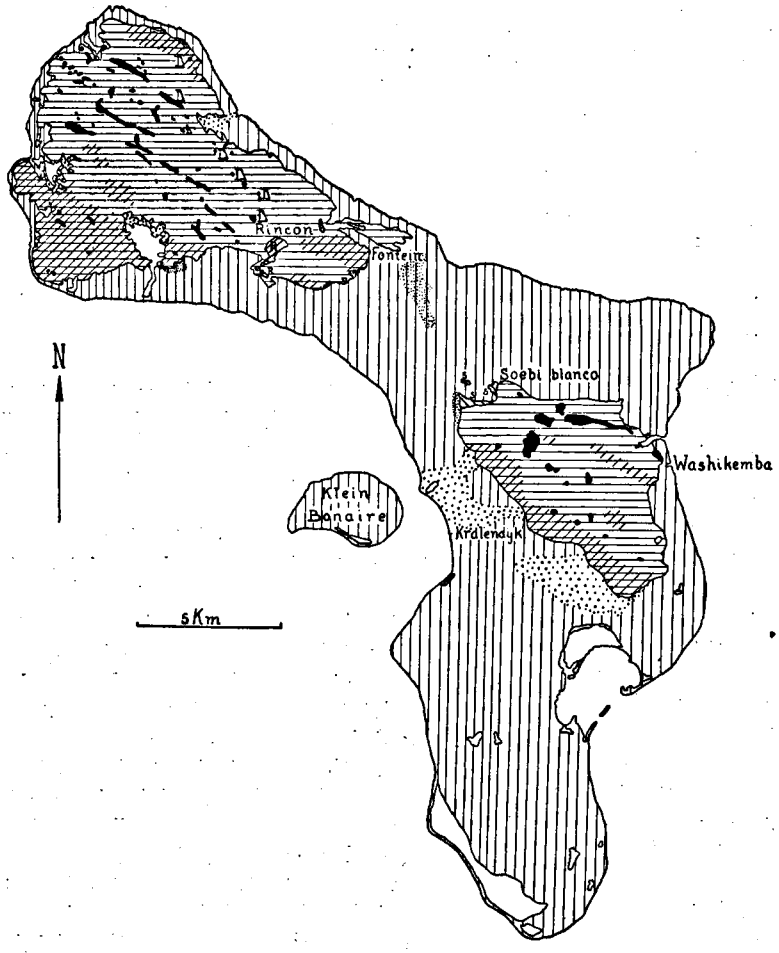
The strata of the Rincon formation have rather inconsequent strikes, with, generally, a low dip to the N., the dip being always less than in the Washikemba formation.

The limestones contain a great many ill-preserved fossils: *corals, gastropoda, lamellibranchiata, foraminifera* and *lithothamnia*. The palaeontological examination of the fossils having not yet taken place, nothing can be said hitherto about the exact stratigraphical position.

The pebbles of the conglomeratic limestones consist for the greater part of Washikemba material, besides, however, they consist for a small part of granodiorites, the latter rocks being foreign for Bonaire, as we do not know a single primary occurrence of granodiorites on the island.

We are able to state the fact that during the sedimentation of a conglomerate which is younger than the Rincon formation, but only slightly differing in age, the supply of foreign rocks increases in different ways.

In the first place the percentage of foreign pebbles in this conglomerate is much greater than it is in the Rincon formation; secondly the pebbles are larger; and thirdly we can state a qualitative increase of



Explanation to the Geological Sketch-Map of Bonaire.

Alluvium.

Quarternary limestone.

Tertiary limestone.

Soebi Blanco conglomerate.

Rincon formation.

Principal porphyrite-intrusions in the Washikemba formation.

Diabase-intrusions in the Washikemba formation.

Washikemba formation.

Principal diabase regions in the Washikemba formation.

the foreign pebbles, as we find, beside granodiorites, also other foreign rocks represented among the pebbles, f. i.: several gneisses, quartzites, a plagiaplite, a zoisite-quartz-feldspar-schist.

After its occurence near to the Soebi Blanco, the conglomerate was called „Soebi Blanco conglomerate". Just as the Rincon formation, the Soebi Blanco conglomerate is only feebly folded, with chiefly W.—E. strike of the strata and low-dip to the N.

Fossils were not found in the Soebi Blanco conglomerate.

Both Rincon formation and Soebi Blanco conglomerate contain tuffaceous material, which fact proves that the volcanic activity continued until the deposition of the Soebi Blanco conglomerate.

Outcrops of the Soebi Blanco conglomerate occur only in a small area, but there are two indications that the extension of the Soebi Blanco conglomerate is, or was, very much greater.

The primary position of the foreign pebbles in the Soebi Blanco conglomerate must probably be searched SW. of Bonaire. The only district in the vicinity where we come across comparable rocks is N. Venezuela. Thus it is not improbable that the foreign pebbles have originated from Venezuela, or from somewhere S. or SW. of Bonaire, between this island and Venezuela. In the first case we must assume a connection between Bonaire and Venezuela in Upper-Cretaceous or Lower-Tertiary time, in the second case there must have been at least a considerable landmass S. of Bonaire in that time.

As it is, there must have been complicated tectonical movements during the sedimentation of Rincon formation and Soebi Blanco conglomerate, whereas the tectonical movements in Washikemba time were rather simple. The Washikemba rocks were deposited under true geosynclinal conditions and during their sedimentation only slight vertical movements took place, revealing themselves by the alternation of cherts, calcareous cherts and limestones.

In post-Washikemba time the geosynclinal conditions ceased to exist. Rincon formation as well as Soebi Blanco conglomerate may have a thickness of about 200 m.; there is no question of geosynclinal development, and the same can be said of the younger formations, as we shall see further on.

We have seen that of the foreign rocks only granodiorites occur in the Rincon formation. At the time that the Rincon rocks were deposited, the configuration of the land S. of Bonaire has evidently been in such a manner that only granodiorites could get into the Rincon formation. Thereupon the Soebi Blanco conglomerate transgrediated over the Washikemba formation. The supply of foreign rocks increased in a high degree, and at the same time the Rincon formation emerged from the sea, for we find Rincon rocks in the Soebi Blanco conglomerate.

Finally, in Tertiary and Quarternary time Washikemba formation, Rincon formation and Soebi Blanco conglomerate were covered by various limestones. The Tertiary limestones are probably of Upper-Eocene age; they contain a. o. *foraminifera* and *echini*. Of these limestones too, the palaeontological examination must still fix the exact stratigraphical position. Out of the preceding it is evident that the Tertiary limestones

occur only in the higher northern part of Bonaire, where they have outcrops on many different spots.

As has been mentioned before, the Quarternary limestones occupy a great part of N. Bonaire and built up the lower southern part of the island. The islet Klein-Bonaire too is entirely composed of young Quarternary limestones

The Quarternary limestones show several elevated terraces of abrasion. These elevated terraces have no constant height and some of them even merge. A very prominent terrace in NE. Bonaire runs f. i. from 22.8 to 12.9 m. From this we can conclude that these terraces are not merely the result of rise and fall of the sea-level, but are to some extent due to tectonical movements of the island itself. In consequence these movements went on until the present time.