Geology. — *"Geological data derived from the region of the "Bird's head" of New-Guinea"*. By Prof. L. RUTTEN.

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The great northwestern Peninsula of New-Guinea is one of the least known parts of the Indian Archipelago. In recent times some data concerning it have been published by R. D. M. VERBEEK in his "Molukken Verslag" [1]), and C. E. A. WICHMANN, when journeying from the east coast to Horna, discovered a folded coal-bearing formation [2]) which proved to be of tertiary age [3]).

In the last few years (between 1917 and 1921), however, explorations were made on a large scale in Northern New-Guinea and also in the "Birds head" for oil and coal, by the officers of the Mining Department in the Dutch East Indies. The results of these explorations have not been published as yet [4]), but some years ago I received from the Director of the Mining Department in the Dutch East-Indies a rather large collection of limestones and marls for examination. The study of this collection has been finished, but there would be little sense in expatiating on it here, a fortiori as a description will probably be published elsewhere. Il may be of interest though, to summarize the obtained results.

Although we are not quite sure that all the rocks we examined, are of tertiary age, this may yet be assumed for the great majority. Now, when observing on the subjoined sketch-map the localities of "Bird's head" from which the examined rocks are derived, we realize at once that *tertiary deposits have a wide distribution in the north-west part of New-Guinea*. However, *eocene rocks seem to be scarce* among the tertiary deposits, which is quite in keeping with what we know about the other parts of New-Guinea. They were found only in two regions: in the first place between the island of Rumberpon and Horna, where, in two localities, Nummulites-Alveolina limestone and Alveolina-Lacazina limestone have been

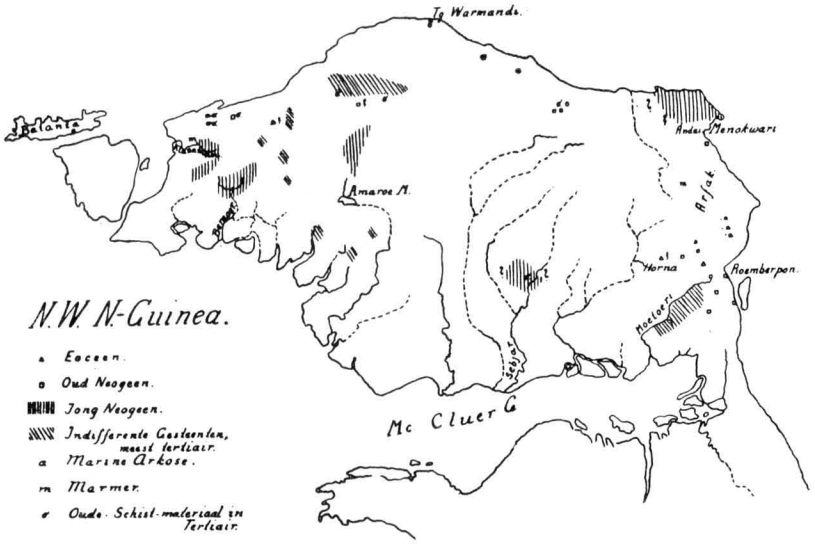
[1]) Jaarboek Mijnwezen Ned. Indië 1908. Wetensch. Gedeelte.

[2]) Nova Guinea. IV. 1917.

[3]) Nova Guinea. VI. 2. 1914.

[4]) I. C. O.-Commissie, The history and present state of scientific research in the Dutch East Indies. Geology. p. 28. 1923.

collected, as well as oligomiocene limestones; while Lacazina-limestones have been found near the Campong Horna; in the second



Eoceen	= Eocene.
Oud Neogeen	= Older Neogene.
Jong Neogeen	= Younger Neogene.
Indifferente Gesteenten, meest tertiair	= Indifferent Rocks, mostly tertiary.
Marine Arkose	= Marine Arcose.
Marmer	= Marble.
Oude Schist-materiaal in Tertiair	= Old Schist-material in Tertiary.

place in the northwestern part of the "Bird's head", where Lacazina-limestones have been collected, at one locality. From this it is evident that eocene is only sparingly distributed; moreover it should be observed that the rocks of the two localities, where Lacazina alone is found, cannot on that account be referred to the eocene with absolute certainty, however probable this may be. From the region between Rumberpon (Amberpon) and Horna rocks have been described by me formerly that pointed to the boundary strata between eogene and neogene [1]).

On the contrary *limestones of littoral facies from the older neogene* have been found in *a large* number of localities, characterized by the occurrence of Lepidocyclina, Miogypsina and Cycloclypeus. Similar limestones from the region between Rumberpon and Horna and from the Andai-river near Menokwari, have been previously described. They now appear to occur to the west of Rumberpon in a broad zone, running north-south, and to extend farther south

[1]) Nova Guinea. VI. 2. 1914.

than Andai, while they can be recognized in a zone running all along the north coast of "the Bird's head" as far as the island of Batanta. It will be seen at a glance that we have to do here with a comparativily narrow zone of older-neogene, which follows the east coast and the north coast of the "Bird's head". It may be that older-neogene still occurs also in the more western and southern region of "Bird's head", but it is remarkable that among the numerous rocks from those regions that were examined by me, there was not a single one that could positively be referred to the older neogene. We shall see lower down that this is partly due to the facies of the discovered rocks being indifferent, to our having to do either with non-fossiliferous rocks or with rocks that have been deposited in a deeper sea, in which the fossils, so characteristic of the littoral older neogene, cannot be expected to occur. But beyond these also rocks occur repeatedly in the southern part of the "Bird's head", that are of littoral facies, in which e. g. Lithothamnium, Operculina and Amphistegina, the companions of Lepidocyclina in the older neogene etc., occur, but in which the Foraminifera, which are characteristic of the older neogene, are lacking. In such cases we no doubt have to do with *younger neogene which indeed is often borne out by the habitus of the rocks.* As an instance we point to the basin of the Aer Beraur and of the Aer Klasaman, in which a series of rocks occur that are referable to the younger neogene. Another region of probably young-neogene rocks, partly with true littoral habitus, is situated North of lake Amaru. Between lake Amaru and the Aer Beraur a number of rocks have been found: globigerina marls, fine grained lime sandstones and the like, which are completely indifferent, so that nothing can be said about their age. The same applies to some rocks from the region south of lake Amaru. A long list of rock samples, collected in a west-east zone far north of lake Amaru, are undoubtedly referable to the neogene, but their fossils and their facies are not typical enough to say whether they belong to the older or to the younger neogene. In some rocks, however, doubtful Lepidocyclina were recognized; the others have been classed under the "indifferent rocks". Lastly among the rocks from the basin of the Aer Sebjar there are some littoral limestones, in which no "older" forms are to be found, so that here also we have probably to do with younger neogene. On the other hand, a number of very fine grained lime sandstones and globigerina limes, collected east of Muturi-river have to be classed under the "indifferent rocks". They may be of older-neogene age, because in the adjacent region towards the east (west of Rumberpon) a few transition rocks were

found among true littoral Lepidocyclina-limes and Globigerina-limes.

Lastly presumably young-neogene rocks are to be found to the North and West of Menokwari. Here Globigerina marls and loose limesands, occur, which indeed do not include typical fossils, but which on account of their quite young habitus are most likely to be reckoned to the younger neogene. This in fact agrees with the circumstance that some limestones in this region are of littoral facies but do not contain Lepidocyclina, Cycloclypeus or Miogypsina. Before this a description was published of limestones from the island of Manaswari, near Menakwari, that were considered to be younger-neogene [1]).

Between the localities of old-neogene limes south of Menokwari and those west of Rumberpon are situated the high Arfak Mountains, which according to VERBEEK [2]) and WICHMANN [3]) are composed of granular eruptive rocks, schists and slates. From the region of the Arfak mountains I received three rocks most likely tertiary and built up of *detritus from the Arfak Mountains*. They are coarse-grained arcoses of marine origin, which together with Corals also contain a very few Globigerina. The minerals represented here are much quartz, orthoclase, perthite and less plagioclase and biotite: apparently we have to do here with the detritus of acid granites.

Coarse-grained *detritus of old rocks* occurs also frequently in the *northern part of "the Bird's head"* in the rocks of tertiary age — notably in the old-neogene rocks. This goes to show that below, and perhaps also at the surface, *there must exist a mountain range of older rocks*. The localities marked on the map by an σ are those where in the limestones transported fragments of quartzite and phyllite occur. A rock from the basin of the Aer Sebjar contained grains of perthite and orthoclase, which remind us of the detritus rocks of the Arfak mountains.

The future reports of the Mining Department will undoubtedly contain interesting information on these "older rocks" in the" Bird's head".

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[1]) Nova Guinea. VI. 2. p. 29. 42.

[2]) Nova Guinea IV. p. 97.

[3]) Tijdschr. Kon. Ned. Aardr. Gen. (2). 21. 1904.