

Geology. — *On the age of Alkaline rocks from the island of Timor.* By
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(Communicated at the meeting of November 26, 1927).

Among the Permian sediments of the island of Timor which consist principally of tuffs, marls with tuffaceous material, marls, limestones and effusive rocks were also found locally conglomerates with pebbles of eruptive material. The pebbles from these sediments were not yet examined microscopically and their description is not included in my paper on the rocks of East-Netherlands-Timor ¹⁾. Permian conglomerates with pebbles of eruptive material have been described also from Djambi. TOBLER ²⁾ describes from there a thick series, consisting of porphyries and quartz-porphyrines, keratophyres and quartzkeratophyres with tuffaceous sandstones and thick beds of conglomerate in which the pebbles consist of the same volcanic rocks.

The Timor conglomerate, of which the pebbles have been studied, has been found in the neighbourhood of the path Soefa-Maubesi, where this path passes the grass-grown hills which can be followed from the mountain Somohole in a northerly to north-easterly direction. The locality is near and to the N. E. of the most northern of these hills, where the path turns round it. Tuffaceous material and lapilli are found in many of the highly fossiliferous Permian sediments of this region while several eruptive rocks have been already described ¹⁾. These latter rocks are often interstratified with the Permian, they are partly effusive rocks, partly perhaps intrusive sheets. The top of the mountain Somohole consists for instance of medium-grained augite-amphibole-diorite and farther to the north quartz-bearing augite-amphibole-diorite have been found. The latter rock has a peculiar chemical composition, as I already have shown (loc. cit. p. 23); it differs from the normal quartz-diorites by its high Na₂O content and its low Al₂O₃ content, characteristics which point to a transition to alkaline rocks.

Gabbros, diabases and porphyrites have also been described from this region.

Typical alkaline rocks are found in adjacent regions. Of the alkali-rhyolites, alkalitrachytes and keratophyres, which have been described in my previous papers ³⁾, an alkalirhyolite is found in the Fatu Forfaik to

¹⁾ H. A. BROUWER. *Gesteenten van Oost-Nederlandsch Timor.* Jaarboek v. h. Mijnwezen in Ned. Oost-Indië. Verhand. 1916. I.

²⁾ A. TOBLER. *Djambi Verslag.* Jaarboek v. h. Mijnwezen in Ned.-Indië. Verhand. 1919. III.

³⁾ H. A. BROUWER. *Neue Funde von Gesteinen der Alkalireihe auf Timor.* Centralbl. f. Min. Geol. und Pal. 1913, p. 570; 1914, p. 741.

the south-west of Sufa. Between the bivouac Sufa and the grass-grown hills to the north of the Somohole we found a brecciated alkalirhyolite with aegirine in the groundmass; alkalitrachytes and keratophyres have been found at different places in East-Netherlands-Timor. Many alkaline rocks are found in close connection with Permian sediments, we only mention the camptonites of the Noil Tonini, the alkalirhyolite of the Fatu Forfaik near Sufa, which rests upon Permian crinoidal limestone and the alkali-trachyte in the valley of the Noil Musa, which is found with Permian rocks.

Constituents of the Permian conglomerate.

Several pebbles of which some are up to several centimeters in diameter were studied under the microscope. Partly they are typical effusive rocks, partly they are medium-grained or porphyritic with a holocrystalline groundmass. Many of the pebbles are strongly weathered and their identification is difficult, because the dark minerals and sometimes also the feldspar are entirely decomposed. It is probable that more alkaline rocks are found among them but they cannot be identified with certainty without a chemical analysis, because the typical minerals cannot be determined.

Quartz (alkali) syenite porphyry.

This rock consists of phenocrysts of microperthitic feldspar and of acid plagioclase (principally albite) in a groundmass consisting of the same feldspars, rather much quartz, much ore (and ore-bearing substance), also some calcite. The original dark minerals of the rock is transformed in secondary minerals. The character of the feldspar shows however sufficiently the high alkali-content of the rock, so that it can be brought with great probability to the quartz-bearing alkali-syeniteporphyries.

(Alkali) Syenite.

It is a fine- to medium-grained rock, consisting mainly of microperthitic feldspar with decomposed dark minerals, numerous small crystals of ore and apatite. The original composition of the dark minerals cannot be identified, they are completely altered to calcite and a substance rich in iron. Their forms sometimes have a resemblance to those of pyroxene, which perhaps contained the aegirine-molecule in connection with the large quantity of ferruginous weathering-products.

(Alkali) Trachytes.

A great many of the pebbles, which were studied microscopically, are reddish to brownish rocks, which are rich in secondary minerals, principally calcite and also ferruginous weathering-products. The phenocrysts are sometimes abundant but they are always entirely altered, the feldspar generally into calcite, the original dark minerals into calcite with much of a ferruginous substance. In the groundmass, which is also rich in secondary products, numerous small feldspar-laths can often be recognized. Their extinction-angle is always small, orthoclase and acid plagioclase cannot be

distinguished. Typical trachytic structures are characteristic for several of the rocks. It is possible, that andesitic rocks occur among those, which are strongly altered.

Quartzalkalitrachytes.

These are the only pebbles of the Permian conglomerates, in which the dark minerals can still be determined. They are confined to the groundmass, but certainly belong to aegirine-augite or aegirine, so that there can be no doubt, that these pebbles belong to alkaline rocks.

The phenocrysts are orthoclase or anorthoclase, they are partially altered, calcite is the principal secondary mineral. The groundmass is rich in ferruginous weathering-products and consists of feldspar, rather much quartz, ore and small elongated crystals, which, when they are not decomposed, show a distinct greenish colour. They are optically negative, have a small extinction-angle and belong to aegirine-augite or aegirine.

Although these rocks are altered rather strongly, the unaltered character of a part of the aegirine in the groundmass makes their determination possible with certainty, while the unaltered parts of the other rocks allow a probable determination only.

The pebbles of alkaline rock in the Permian conglomerates prove, that these rocks are not younger than Permian. In connection with the abundance of effusive material in the Permian sediments of the adjacent regions, while pebbles of eruptive rocks are the only ones, which have been found, and in connection with the fact that similar alkaline rocks have been found closely connected with Permian sediments, the conclusion that the alkaline rocks are of Permian age seems to be warranted.
