Geology. — *Upper Triassic fossiliferous limestones in the island of Bangka.* By G. A. DE NEVE and W. P. DE ROEVER. (Communicated by Prof. H. A. BROUWER.)

(Communicated at the meeting of November 29, 1947.)

The fossiliferous limestones described in this paper have been collected by W. P. DE ROEVER during recent geological investigations in NE. Bangka; the determination of the fossils was done by G. A. DE NEVE, who identified the following fossils, indicating a Norian (Upper Triassic) age:

Entrochus spec.
Encrinus spec.
Montlivaultia molukkana J. WANNER
Peronidella moluccana O. WILCKENS

These are the first fossils of determinable age found in the bedrock ("kong") of the islands of Bangka and Billiton. They indicate a post-Norian age of the tin-granites, which are younger than the metamorphic sedimentary formations of these islands.

The fossiliferous limestones have been collected in the Loemoet tin-mine (nr. 7 Belinjoe), situated SE. of the Klabat Bay. This mine is already indicated as a fossil locality on the geological map of VERBEEK [1]), because of the occurrence of Quaternary or Pliocene plant-remains.

The limestone is grey in colour and may be strongly crushed; it occurs as a faulted layer or lens amidst an intricately folded formation of light-coloured, strongly altered sericite-phyllites and schistose, fine-crystalline quartzites. Near the limestone there is a small outcrop of very strongly altered effusive rocks, the relations of which have not yet been elucidated. The light-coloured phyllitic formation may show local intercalations of very strongly altered phyllitic arkoses or greywackes (blastopsammitic phyllites) and phyllitic conglomerates (blastopsephitic phyllites). The latter rock-type contains pebbles of effusive rocks. The southern wall of the mine shows outcrops of red and greyish green chert-like schistose quartzites, which are separated from the light-coloured phyllitic formation of the main part of the mine by an important fault-zone. This fault-zone is of considerable age, as indicated by the occurrence of phyllitic fault-breccias (blastomylonitic phyllites). In the fault-zone the chert-like quartzites are accompanied by dark-coloured sericite-phyllites and schistose quartzites, which may show veins of cassiterite and quartz.

As a consequence of solution of the limestone and accompanying subsidence of the neighbouring rocks a depression with a maximal depth of about 100 m has been formed in the surface of the bedrock. The

[1]) R. D. M. VERBEEK, Geologische beschrijving van Bangka en Billiton. Jaarb. Mijnw. Ned. Oost-Indië **26** (1897).

presence of this depression gave rise to the formation of one of the richest detrital cassiterite-deposits in the island of Bangka that are known.

The limestones were discovered in 1920 by Ir. J. VELDKAMP; just before the last war a collection of undeterminable crinoid-stems was made by Ir. E. DE WILDE on behalf of Dr. Ir. C. P. A. ZEYLMANS VAN EMMICHOVEN.

Elsewhere in the island of Bangka limestones have hitherto only been found as pebbles, at two localities.

The fossils embedded in the limestones of the Loemoet tin-mine have been seriously attacked by percolating waters, and the worn condition of the specimens together with their fragmentary nature have rendered the task of interpreting these remains one of great difficulty [2]).

The crinoids are represented only by portions of the stem, with which probably a few scattered brachials are occasionally associated. Apparently they belong to the family *Encrinidae*; the fragments of cylindrical stem, mostly from the root end, probably all belong to a single species of the genus *Entrochus*. Some stem-fragments show alternating dimensions of the columnals; they are usually assigned to *Encrinus* species. Neither to the stem-fragments of *Entrochus* nor to those of *Encrinus* it seems advisable to attach specific names either new or old. The crinoid-remains show much resemblance to those figured by BATHER, JAWORSKI, KRUMBECK, and WANNER, which were found in the Upper Triassic deposits of the islands of Timor, Buru, and Misol [3]).

The fossil coral was determined as *Montlivaultia molukkana* J. WANNER, a species occurring in the Upper Triassic *Pharetrones*-limestone of Seran (Moluccas) and described by WANNER and WILCKENS, while a probable find from Timor is mentioned by VINASSA DE REGNY [4]).

Finally some cylindrical fossils embedded in the limestone, with cavities extending to their bases, show characteristic identity with one of the *Calcispongiae* described by WILCKENS as *Peronidella moluccana* n.sp. The

[2]) The palaeontological description with the figures will be published in the periodical "Geologie en Mijnbouw".

[3]) F. A. BATHER, Triassic Echinoderms of Timor. Palaeontologie von Timor, XVI. Lieferung, Abschn. XXX, p. 215—251 (1929).

E. JAWORSKI, Die Fauna der obertriadischen Nucula-Mergel von Misol. Palaeontologie von Timor, II. Lieferung, Abschn. V, p. 1—174, Pl. 43—45 (1915).

L. KRUMBECK, Obere Trias von Buru und Misol. Palaeontographica, Supplement-Band IV, Abt. II, Abschn. I, p. 1—162, Pl. I—XI (1913).

J. WANNER, Beiträge zur Geologie der Insel Buru. Palaeontographica, Supplement-Band IV, Abt. III, Abschn. III, p. 59—112, Pl. IX, X (1919—1922).

[4]) J. WANNER, Triaspetrefakten der Molukken und des Timorarchipels. Neues Jahrb. f. Min. etc. Beil. Bd. **24**, p. 161—220, Pl. 7—12 (1907).

O. WILCKENS, Korallen und Kalkschwämme aus dem obertriadischen Pharetronenkalk von Seran (Molukken). Neues Jahrb. f. Min. etc. Beil.-Bd. **77** B, p. 171—208, Pl. 6—13 (1937).

P. VINASSA DE REGNY, Triadische Algen, Spongien, Anthozoen und Bryozoen aus Timor. Palaeontologie von Timor, IV. Lieferung, Abschn. VIII, p. 75—118, Pl. 63—72 (1915).

almost equal dimensions together with the same microscopic texture in oblique sections as given in WILCKENS' figure have led to this conclusion [5]).

It is to be hoped that future investigations will provide more and better preserved fossil remains, especially of the crinoids.

In his synopsis on the pretertiary history of the Malay Archipelago UMBGROVE has given a review of the deposits of Triassic age found in many islands and occurring in a number of different facies, while he also mentions the probable occurrence of Triassic sediments in the islands of Bangka and Billiton [6]).

In Northern Sumatra, in the highlands of Padang, North of Lake Singkarah, an important section with Upper Triassic fossiliferous deposits was found by MUSPER [7]). But also in other parts of Sumatra clay-shales and sandstones with *Halobia* and *Monotis salinaria* have been found, indicating Carnian and Norian ages.

SCRIVENOR [8]) mentions the occurrence of Upper Triassic fossiliferous shales, quartzites, and sandstones in Malacca. In the neighbouring Riau-Archipelago *Halobia*-bearing shales were found by BOTHÉ [9]), whilst MARTIN determined *Daonella* in brown-grey shales from the shore between Laboean Dadong and Sei. Keloemoe, Island of Lingga [10]), and ROGGEVEEN described *Protocupressinoxylon malayense*, a probably Triassic conifer, from the island of Soegi [11]).

Bandoeng, Dienst van de Mijnbouw.

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[5]) O. WILCKENS, see footnote 4.

[6]) J. H. F. UMBGROVE, De pretertiaire historie van den Indischen Archipel. Leidsche Geol. Med. 7, 125, 128—134 (1935).

[7]) K. A. F. R. MUSPER, Beknopt verslag over de uitkomsten van nieuwe geologische onderzoekingen in de Padangsche Bovenlanden. Jaarb. Mijnw. Ned. Oost-Indië, Verh., 58, 265—329 (1929).

[8]) J. B. SCRIVENOR, The geology of Malaya (1931).

[9]) A. CHR. D. BOTHÉ, Het voorkomen van tinerts in den Riau-Archipel en op de eilandengroep van Poelau Toedjoe (Anambas- en Natoena-eilanden). Verslagen en Mededeelingen betreffende Indische delfstoffen en hare toepassingen, 18, 5 (1925).

[10]) A. CHR. D. BOTHÉ, Geologische verkenningen in den Riouw-Lingga Archipel en de eilandengroep der Poelau Toedjoeh (Anambas- en Natoena-eilanden). Jaarb. Mijnw. Ned. Oost-Indië 54, Verh. II, 98, 143 (1925).

[11]) P. M. ROGGEVEEN, Mesozoisches Koniferenholz (Protocupressinoxylon malayense n.s.) von der Insel Soegi im Riouw-Archipel, Niederländisch Ost Indien. Proc. Kon. Akad. v. Wetensch., Amsterdam, 35, 580—584 (1932).

Petrology. — *Anorthoclase-bearing granogabbroid to granonoritic rocks from Boeloengan (Eastern Borneo).* By W. P. DE ROEVER and A. KRAËFF. (Communicated by Prof. H. A. BROUWER.)

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In the years 1924 and 1931 several rock-samples of granogabbroid affinities have been collected by Ir. A. HARTING and Ir. J. G. H. UBAGHS in the vicinity of the confluence of the S. Kajan and the S. Bahau. Some of these rocks have been found as veins in a dynamometamorphic formation of slates, phyllitic slates, arkoses, and sandstones, which will be described in a later paper. Most of the samples, however, have been taken from boulders, some of which are idolized by the natives.

Two of the samples, H 120 and H 123 — both found as boulders in the S. Kajan, at a distance of ± 9 and ± 16 km, respectively, above the confluence with the S. Bahau — are fresher and less fine-crystalline than the others, and are adapted for a more detailed microscopic study of this comparatively rare rock-type.

The sample H 120 is medium-grained and of a brown-grey colour; the largest crystals of pyroxene are 5 mm in length. The other sample (H 123) shows a porphyritic development owing to the presence of many larger crystals of pyroxene — with sizes of up to 1 cm — amidst a finer crystalline mesostasis.

Under the microscope the main constituents of these rocks appear to be plagioclase, augite, hypersthene, quartz, and anorthoclase, with subordinate or accessory biotite, amphibole, ilmenite, and apatite. Volumetric analyses of one ordinary size thin section of each of these rocks gave the following results:

	H 120	H 123
Plagioclase	43 %	49 %
Augite	19 %	9 %
Hypersthene	15 %	10 %
Quartz	10 %	16 %
Anorthoclase	10 %	14 %
Other constituents	3 %	2 %

Under the microscope both rocks appear to show a rather feebly developed porphyritic structure owing to the presence of larger crystals of pyroxene, especially of augite. The crystals of plagioclase may reach sizes of 2 mm. The anorthoclase and quartz are often in granophyric intergrowth; these minerals are found in the interstices between the crystals of the other