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Geology. — "*On jurassic fossils as rounded pebbles in North-Brabant and Limburg*". By Dr. P. TESCH (communicated by Prof. G. A. F. MOLENGRAAFF).

(Communicated in the meeting of October 30, 1909).

It is now a year ago that I drew the attention to the fact that the so-called "Kieseloolithstufe" of the Lower Rhine basin, recognised as a separate formation in 1905 by German geologists, proves to be also represented in the territory of Northern-Limburg [1]). At that time especially the stratigraphical conditions of these fluviatile strata were discussed, this factor having proved to be of practical interest for the explorations of coal in these regions and the remarkable silicified fauna being found in these deposits was only mentioned in passing. After having finished this paper the collected material of fossils originating from the sands of this geological horizon has still greatly increased. This augmentation is owing, besides to the new borings executed since that time, to the discovery of a good finding-place in a clay-pit in the hills east of Reuver during this summer [2]), so that the collection now at my disposal is complete enough to enable us to draw some conclusions concerning the geological age of this silicified fauna and to compare these results with the opinions published by other authors about this subject.

So for the discussion of the stratigraphical and lithological composition of these strata referring to my former papers treating this subject and to the literature which is mentioned there, I have to study in the first place the results obtained by others when examining those fossils of neighbouring German places.

These silicified and rounded petrifactions are mentioned for the first time by Prof. Dr. J. POHLIG at Bonn in the "Verhandlungen des naturhistorischen Vereins der preuss. Rheinlande und Westfalen", 1883, second half, page 225. Here the following genera are enumerated, originating from the white coarse sands of *Duisdorf*, not far from Bonn:

Milioliden?	*Cardium*
Vioa	*Mytilus*
Astraea?	*Pholas*
Encrinus	*Purpura*

[1]) P. TESCH. Der niederländische Boden und die Ablagerungen des Rheines und der Maas aus der jüngeren Tertiär- und der älteren Diluvialzeit. Amsterdam, 1908.

[2]) P. TESCH. De klei van Tegelen, een onderdeel der "Kieseloolithstufe". Tijdschrift van het Kon. Ned. Aardrijksk. Gen. Deel XXVI (1909), p. 573

Pentacrinus
Cidaris
Serpula
Terebella
Membranipora
Monticulipora
Ostrea
Spondylus
Pecten.
Turritella
Turbo
Dentalium

The author believes those genera to prove an upper-senonian age for these organisms. The next year H. VON DECHEN already suggested some doubt as to the correctness of this conclusion in "Erläuterungen zur geologischen Karte der Rheinprovinz und der Provinz Westfalen", second volume, 1884, page 626. Meanwhile it was only in 1897 that the incorrectness of this opinion was demonstrated convincingly. In this year C. SCHLÜTER published in his paper: "Zur Heimatfrage jurassischer Geschiebe im Westgermanischen Tieflande" (Zeitschr. der deutschen geol. Gesellsch., Volume 49, 1897, page 486) the results of his examination of the petrifactions of *Duisdorf*, in consequence of which he expresses this opinion that this fauna originates from *upper-jurassic* strata. By this author the following fossils are mentioned, *all collected in the same gravel-pits of Duisdorf near Bonn*:

Thamnastraea (*Astraea*) *microconus Goldf.?*

Millericrinus horridus d'Orb. (*M. echinatus Schloth. sp.*) (many stems in different varieties).

Cidaris florigemma Phill. (spines).

Cidaris psammosa Mösch.? (fragment of spines).

Rhabdocidaris trispinata Quenst.? (fragment of spines).

Serpula (tubes).

Rhynchonella? (fragment).

Ostrea gregaria Sow.? (fragment).

Ostrea hastellata Schloth.? (fragment).

Ostrea pulligera-ascendens Quenst.? (fragment).

Exogyra reniformis Goldf.? (fragment).

Pecten vitreus Röm.? (printing).

Turritella jurassica Quenst.?

C. SCHLÜTER believes that those fossils more specially must belong to the middle part of the *Oxford*-horizon and must originate from the "*Terrain à chailles*" ("*Sequanien inféricur*") of French Lorraine, southern Baden, upper-Alsace, northern Switzerland and the Jura-mountains.

It was not before the geological exploration of the Rhine-province by the "geologische Landesanstalt" of Berlin was begun that the same strata as those of Duisdorf were found elsewhere too and that the silicified fossils were collected also on other places. In his description of these fluviatile deposits in the Lower Rhine basin Dr. G. FLIEGEL enumerates the following petrifactions: [1])

Millericrinus horridus d'Orb.
Cidaris-spines.
Serpula-tubes.
Alectryonia.
Nerinea.
Trigonia costata Park.
Belemnites
Quenstedticeras Mariae d'Orb.

Then this geologist publishes as his opinion that the greater part may be derived from *Malm*-deposits but also some species indicate an origin from younger *Dogger*-deposits.

After this compendium of what the German places have yielded now, I can pass to the discussion of the fossils collected in the same strata in *North-Brabant* and *Limburg*.

Some small pebbles in which round, lenticular and oval figures of the size of $^1/_2$ to 1 m.m., distinctly distinguished from the round anorganic oölites, are very numerous, may be considered as silicified *foraminifera-limestones*. With POHLIG those fossils can be classified with reserve under the *Miliolidae*.

Little fragments of *Spongiae* are present from different places, usually further totally irrecognisable. A fragment from the boring 1 near Vlodrop may belong to *Chemidiastrum stellatum Goldf. sp.*, another fragment from the same place to *Eusiphonella Bronni Mst. sp.* From the other fragments nothing is to be said with any probability.

The *Anthozoa* are also represented by some specimina. All fragments are however very incomplete. A specimen from the clay-pit near Reuver probably belongs to *Thamnastraea prolifera Becker*, a fragment from the boring 5 near Leemhorst probably belongs to the genus *Favia*; the rest however is too small and too much damaged to enable us to identify them.

By far the most numerous fossils are, with the serpula tubes, the remains of *Crinoidea*, so that this group forms the most characteristic part of this silicified fauna. Most of the stems certainly belong to

[1]) G. FLIEGEL. Pliocäne Quarzschotter in der Niederrheinischen Bucht. Jahrbuch der Königl. Preuss. Geol. Landesanstalt für 1907, p. 100.

species of *Apiocrinus* and *Millericrinus;* especially the sub-pentagonal and knobbed stems of *Millericrinus horridus d'Orb.* (= *M. echinatus Schloth.*) are rather well recognisable. Also thin and slender, smooth and round stems and free segments occur, which may be derived from allied species. The biggest stems measure 10 m.m. in diameter, the thinnest ones 3 or 4 m.m. and the greatest length amounts to 20 m.m. I could find these fossils in all places. Besides the stems I possess also a very fine *centrodorsalplate* of a calyx of *Millericrinus* originating from the clay-pit near Reuver, with the four sutures of fusion distinctly visible (the fused infrabasalia). Opposite to the round and roundish pentagonal, smooth or knobbed stems of the Apiocrines and Millericrines the remains of other *Crinoidea* are by far less numerous. From the boring 1 near Vlodrop I possess some free, starshaped segments of a species of *Pentacrinus.*

Of *Echinoidea* I have found only one spine in the clay-pit near Reuver. It is a typical spine of *Cidaris florigemma Phill.* of a length of 12 m.m. Some very thin and small plates of silex, covered with regularly arranged knobs, may also be derived from representatives of this group.

Very numerous again are all sorts of straight and curved small tubes of species of *Serpula* and *Terebella,* for which no further identification will be possible. Perhaps one spiral-rolled specimen from the boring 1 near Vlodrop can be considered as *Serpula convoluta Goldf.* while the rather common and faintly curved small tubes with a distinct parallel suture show much agreement with *Serpula limax Goldf.*

Of *Bryozoa* also some fragments are present: a nicely ramified little branch from the boring 1 and some other fragments consisting of small tubes placed radially from the Reuver and from a trialboring near Uden in North-Brabant. The silicification and the rounding however have rendered it impossible to identify those remains.

The *Brachiopoda* are represented by two specimina of a *Rhynchonella*: one very good specimen from the sandquarries of the Kollenberg near Sittard and a second incomplete specimen from a trial-boring at Reek near Grave. The Sittard specimen is closely allied to the *Rhynchonella 4-plicata Quenst.*, but shows on the ventral shell six radial ribs ending in the sinus of the frontal limb. It appeared impossible to me to identify this species with the literature I could dispose of [1]). The specimen of Reek does not allow any determination.

Little fragments of *Lamellibranchiata*-shells are not at all rare.

[1]) This specimen appeared later on to be identical with *Rhynchonella Thurmanni Voltz.* from the upper-Jurassic of French Lorraine.

The greater part belong to the *Ostreidae*; the smooth and flat fragments can be classed to the genus *Ostrea*, the severely folded and ribbed ones to *Alectryonia*. Among the latter *Alectryonia gregaria Sow.* may be represented. A fragment from Reuver suggests the delineation of *Trigonia costata Park.* Among the other fragments a radially ribbed printing reminds of *Cardium*, the rest however is totally irrecognisable.

Of *Gastropoda* I possess nothing else but the top of a real *Nerinea*-shell, from the clay-pit near Reuver, with distinct groove-line ("Schlitzband").

Finally of the *Cephalopoda* some fragments of *Belemnites* are at hand. The upper end of the rostrum of *Belemnites hastatus Blainv.* with alveole, found near Reuver, is rather well recognisable. The other fragments are very small and show no characteristic properties.

Summing up what is mentioned higher up we have the following list of fossils:

Miliolidae?
Spongiae: *Cnemidiastrum stellatum Goldf. sp.?*
Eusiphonella Bronni Mst. sp.?
Anthozoa: *Thamnastraea prolifera Becker.*
Faviа sp.?
Crinoidea: *Apiocrinus*
Millericrinus (f.i. M. horridus d'Orb.)
Pentacrinus sp.?
Echinoidea: *Cidaris florigemma Phill.*
Vermes: *Serpula limax Goldf.?*
Serpula convoluta Goldf.?

Bryozoa
Brachiopoda: *Rhynchonella Thurmanni Voltz.*
Lamellibranchiata: *Ostrea sp.?*
Alectryonia sp.?
Alectryonia gregaria Sow.?
Trigonia costata Park.?
Cardium?
Gastropoda: *Nerinea sp.?*
Cephalopoda: *Belemnites hastatus Blainv.*

This fauna points without any doubt to an origin from younger *jurassic* strata, though few species can be identified with certainty. The fixing of the geological age by SCHLÜTER and FLIEGEL of the fossils from the places in the Lower Rhine basin (Duisdorf near Bonn, Weilerswist, browncoalmines Liblar and Donatus near Brühl etc.) appears to be also correct for those from the places in Limburg and North-Brabant, situated further to the North-West.