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Geology. — “Contributions to the knowledge of the sedimentary boulders in the Netherlands. 1. The Hondsrug in the province of Groningen. 2. Upper Silurian boulders. Second communication: Boulders of the age of the Eastern Baltic zones H and I.” By Dr. H. G. JONKER. (Communicated by Prof. K. MARTIN).

H.

Besides the Borealis-limestone, described in my preceding communication (33) and on which I am going to touch later on, boulders with *Pentamerus*-remains near Groningen are rare. I can mention but three pieces here, in two of which the species is not to be made out, while in the third, found in the “Noorderbegraafplaats” in Groningen, *Pentamerus estonus* EICHW. occurs. Nor is this determination beyond doubt and especially the possibility of its being *Pentamerus oblongus* Sow. can in my opinion not be excluded, as indeed in outward appearance the latter corresponds almost perfectly with the former (12, p. 81 and 3, T. XVIII, f. 4^a). As however, the latter form in Gothland has no doubt to be looked upon partly as the real *P. estonus* EICHW. (27, p. 98), nothing can be said for certain about its origin, as the rock, a weathered, yellow limestone does not give sufficient indications for it. I mention this boulder however for completeness' sake.

With regard to the Borealis-limestone I wish to add, that after all I did find an almost complete specimen of *Pentamerus borealis* EICHW., in the Groningen museum, evidently from a Groningen boulder. The correspondence with the specimens from Weissenfeld, mentioned before, is however not very great, the top of the ventral valve in our specimen being much more curved and thus agreeing more with EICHWALD's description.

A close investigation removing the existing confusion with regard to the Upper Silurian *Pentamerus*-species is really most desirable.

31. Clathrodictyon-limestone.

White limestone, sometimes having a more or less light-yellowish-gray tinge. At the surface and in cavities the colour is rather yellow. It is always crystalline and the very irregular fractured surfaces show a peculiar fatty silk-gloss, which is most characteristic of them. If the colour becomes a little darker, as is sometimes the case, the

gloss remains preserved. The rock is a real *Stromatopora*-limestone, which may be distinctly perceived in some pieces, as they consist of slightly curved, concentric layers the surface of which is covered with small knobby mamelons (25, Pl. XVII, f. 14), which make it more than probable that we have to do here with

Clathrodictyon variolare ROSEN sp.

Its structure, however, is not easily traced on account of the crystalline character of the stone.

This species of boulder further contains real fossils only in the form of peculiar conical cavities, mostly slightly bent towards the point. On the inside they are invariably set with annular edges, which on an average are lying a little more than 1 mm. from each other in specimens of an average size. The cavity is often completely filled up with crystalline calcite bright as water. Its rather thick wall presents on the outside small irregularly running lines of growth. FRIEDRICH SCHMIDT, Akademiker in St. Petersburg, whom I sent a piece of this limestone, was kind enough to inform me that these cavities originate from *Cornulites* sp. (1, T. 26, f. 5—8), a fossil of the I-zone in Oesel, frequently occurring near St. Johannis.

These boulders are by no means rare near Groningen as appears from the following list:

"Noorderbegraafplaats",	Groningen	6
"Boteringesingel",	"	7
"Nieuwe Kijk in 't Jatstraat",	"	1
"Nieuwe Veelading",	"	3
"Schietbaan",	"	1
Behind the "Sterrebosch",	"	1
	"	1
Café "the Passage", Helpman		1
Villa "Edzes" near Haren		1
The "Huis de Wolf" near Haren		1
"Klein-Zwitserland" near Harendermolen		1

About the occurrence of the mentioned species of *Stromatopora* NICHOLSON records it from Borkholm and Worms in the Borkholm stratum in Esthonia, but he has especially found them frequently in the Estonus-zone there, chiefly near Kattentack. (25, p. 151). He does not record it from Gothland, though this fact is not sufficient altogether to exclude its occurrence there. Moreover LINDSTRÖM

mentions three other species of this genus (16, p. 22). Among my material for comparison is a specimen from Klein-Ruhde, to the west of Kattentack in the H-zone in Esthonia. This rock is somewhat darker, more grayish; but yet examples are to be found among our pieces which perfectly resemble it, so that the correspondence may really be called striking. The described *Cornulites* do not occur in it which it is true cannot surprise us in a piece of so small dimensions ($7 \times 6 \times 2$ c.M.).

Finally I wish to state that in a boulder of stromatopora-limestone in Gothland, I found analogous *Cornulites*-cavities, which petrographically does not altogether agree with our pieces. The place where it is found is immediately to the north of Högklint, on the field (not in the beach). But this fossil is of little importance for the further determination of the age of the rock, as most likely various species will be implied in the name of *Cornulites serpularius* SCHLOTH. which is usually given.

Taking everything into consideration, it seems possible (perhaps even probable) to me that this Clathrodictyon-limestone comes from the H-zone in Esthonia or from its western continuation.

In connection with this must be said that among the very numerous stromatopora of the Hondsrug (of which specific determinations are hardly ever possible) two occur which from their characteristic astrorhizae may be called:

Stromatopora discoidea LONSD. sp. . . . 25, Pl. XXIV, f. 2.

Both pieces, found in the "Noorderbegraafplaats" and in the "Violenstraat" in Groningen, consist of fine-grained crystalline (stromatopora-) limestone; the former is all over white and therefore closely resembles Clathrodictyon-limestone, the latter is rather grayish and also partially weathered, which fact decreases the correspondence.

This species, very common in Wenlock limestone from England, also occurs in the neighbourhood of Wisby in Gothland. NICHOLSON calls those Gothland specimens however usually highly mineralised (25, p. 191), which with my material from Gothland corresponds but to this extent that this fossil occurs only as a not always very thick crystalline crust in marl or marly limestone. LINDSTRÖM records it only from *h* (16, p. 22), his youngest zone of the Upper Silurian of Gothland (*f*, DAMES). Contrary to this I allege to have found a specimen (it is true somewhat differing in a smaller number of astrorhizae) in the calcareous marl immediately to the north of Högklint, occurring there as firm rock; this fossil comes from a

stratum about 1 M. above the beach. This petrographical and stratigraphical occurrence is, it seems to me, hardly to be referred to the age *h*; the other specimen in the Groningen museum supports my observation only to the length of containing marly remains still distinctly to be seen. The place where it was found is, however, not further indicated.

Our Groningen fossils have upon the whole but little in common with these Gothland pieces; meanwhile this fossil also occurs in Esthonia near Klein-Ruhde in the Estonus-zone. That is why these two pieces have been mentioned here though no further data can be brought forward to prove their origin from these Eastern Baltic regions through want of material for comparison.

I.

Boulders which correspond in age with the Lower Oesel zone in the Eastern Balticum, are not rare near Groningen. BONNEMA already pointed it out some years ago (31); this short essay, however, has more of a palaeontological character, so that I wish to complement these communications and enter into further particulars.

32. Baltica-limestone.

In an unweathered state rather hard, tough, fine-grained-crystalline limestones of a bright-gray or light-brownish-gray colour. Some pieces are almost impalpable; some parts are coloured bluish-gray on the inside, so that the rock may originally have had that colour. Through weathering the bright-gray tinge passes into light-yellowish-gray; the uneven fractured surfaces then are very often covered with sallow-yellowish and brown spots. Crystalline calcite rarely occurs. The limestone is rather pure, but a little marly and hardly ever slightly dolomitic. Real dolomites are not among them. Stratification is imperceptible. The dimensions of the pieces found amount to 25 cm.

Fossils are not present in great numbers, chiefly Ostracoda, among which Leperditia-shells are the most important. Whilst bright-brown in the unweathered rock, the valves which sometimes occur frequently in a single piece, have become nearly white by weathering. As is often the case with the younger Leperditia-limestones, which are to be described later on, this limestone is not unfrequently connected with Stromatopora-limestone; the fossils to be mentioned below, however, never occur in it. Besides these large Ostracoda-remains, small Beyrichia- and Primitia-valves are also frequently found but

they become only distinctly visible through weathering. The fossil fauna consists of the following species.

- Leperditia baltica* HIS. sp.
Strophomena rhomboidalis WILCK. sp.
Strophomena sp.
Atrypa reticularis L.
Meristella sp.
Encrinurus punctatus WAHLB.
Zaphrentis conulus LINDSTR. 28, p. 32, T. VI, f. 65—68.
Orthoceras sp.
Murchisonia sp.
Tentaculites sp.
Primitia seminulum JONES. 14, p. 413, Pl. XIV, f. 14.
Primitia mundula JONES. 23 T. XXX, f. 5—7; 18, p. 375, Pl. XVI.
Beyrichia Jonesii BOLL. 17, p. 13, T. II, f. 10—11.
Beyrichia spinigera BOLL. 23, p. 501, T. XXXI, f. 19—20.

The first mentioned *Leperditia*-species is present in all pieces; all other fossils, however, occur either few and far between or in a single piece, excepting the small ostracoda. I have however not taken much pains to increase the number of species of them (for the greater part already mentioned by BONNEMA), because their stratigraphical value is still but trifling nowadays. Then to determine age and origin, we can restrict ourselves to the communication where and in which strata occurs the type-fossil of this group, *Leperditia baltica* HIS. sp. (after which in accordance with the names of Phaseolus-limestone and Grandis-limestone, generally in use, I have called these limestones).

First of all, however, the number of the pieces found here and the special places where they were found, be given here:

“Noorderbegraafplaats”,	Groningen	7
“Boteringesingel”,	„	4
“Noorderbinnensingel”,	„	5
“Violenstraat”,	„	1
“Nieuwe Boteringestraat”,	„	1
“Nieuwe Kijk-in 't Jatstraat”	„	2
“Nieuwe Veelading”,	„	1
	„	1
“Old Collection”		3
Helpman		2
“Hilghestede”, Helpman		1
Between Helpman and Haren		2
Harendermolen		1

So in all 31 pieces. The number found is presumably much larger, because I have only mentioned here the boulders which beyond any doubt belong to this group; among the numerous limestones with *Leperditia*-remains which cannot be specifically determined there will no doubt be a number of this age.

Leperditia baltica His. sp.

- Literature: 1869. KOLMODIN, 2, p. 13, f. 2—3.
 1873. SCHMIDT, 4, p. 15—17, f. 19—21.
 1876. ROEMER, 5, T. 19, f. 7.
 1878. MARTIN, 6, p. 45.
 1880. KOLMODIN, 8, p. 134.
 1883. SCHMIDT, 10, p. 11—13, T. I, f. 1—3.
 1884. KIESOW, 11, p. 275, T. IV, f. 4.
 1885. REMELÉ, 13, p. 26, no. 226.
 1888. LINDSTROM, 16, p. 5, no. 25.
 1890. KIESOW, 19, p. 89—91, T. XXIII, f. 14—16.
 1890. SCHMIDT, 20, p. 255.
 1890. DAMES, 21, p. 1125.
 1891. KRAUSE, 22, p. 5, 7.
 1891. KRAUSE, 23, p. 488, T. XXIX, f. 1—3.
 1891. SCHMIDT, 24, p. 123.
 1895. STOLLEY, 27, p. 109.
 1898. BONNEMA, 29, p. 452.
 1900. CHMIELEWSKI, 30, p. 17—20, 33; T. I, f. 17—20.
 1900. BONNEMA, 31, p. 138—140.

From the literature about this fossil, cited above, which as regards the later years is rather complete, it appears that for a long time a certain confusion and uncertainty about the limits of the species have existed, which have been removed but a few years ago. Besides the real *L. baltica* His., characterized by the comb-shaped striae on the inverted plate of the left valve (*L. pectinata* SCHMIDT) — which characteristic may be distinctly perceived in twenty of the boulders from here —, SCHMIDT had also described another species: *L. Eichwaldi* SCHM. BONNEMA has proved that both species have to be united (31); at nearly the same time this has also been observed by CHMIELEWSKI. The latter, however, distinguishes besides the typical form two other varieties:

L. baltica, var. *Eichwaldi* SCHMIDT
 „ „ „ *formosa* CHMIEL.

These two varieties are present among our boulders, var. *Eichwaldi*

not unfrequently, var. *formosa* less often. But the characteristics of these varieties are by no means conspicuous, so that there are specimens which partake of the nature both of these varieties and the real species, as CHMIELEWSKI himself too has perceived. In accordance with this is the fact that these varieties are practically of no stratigraphical importance; it is on these grounds I have thought it allowable to combine all these forms in one species under the name of *Leperditia baltica* HIS. sp.

It has been frequently found in boulders. KIESOW describes it from "weisslich-grauen Mergelkalk" of Langenau, from "ziemlich verwitterter und in Folge dessen gelblich gefarbter Kalk mit zahlreichen Schalen der *Leperditia baltica* HIS. (F. SCHMIDT); daneben finden sich *Encrinurus punctatus*, *Atrypa reticularis*, und einige schlecht erhaltene *Beyrichien*, u. s. w." from Zoppot-Olivaer Walde, also in West-Prussia. The first stone corresponds perfectly with limestone from Langers in the N.E. of Gothland, the second shows much correspondence with the occurrence of Oesterby near Slite. Therefore he refers these pieces to Gothland. (Of the co-occurrence of *L. baltica* HIS. sp. and *L. Hisingeri* SCHM., which question I treated of in my previous communication (33, p. 560), he is afterwards not quite sure — 19, p. 90). In his excellent, already frequently cited treatise CHMIELEWSKI briefly describes six boulders in which he has found *L. baltica* in Kurland, Kowno, East and West-Prussia. Most corresponding with our boulders seems to be his: "hellbräunlich-grauer, deutlich krystallinischer, wenig thoniger, fester, unebenbrüchiger Kalkstein mit *Encrinurus punctatus* (30, p. 33)," from Kowno. He does not give a decided opinion about the origin.

Farther to the west this species is still recorded from Brandenburg by REMÉLÉ and KRAUSE, mostly together with fossils, which also occur in our boulders and from limestones which, so far as can be gathered from the short descriptions, correspond in some respects with ours. STOLLEY describes also various of those limestones from Sleswick-Holstein among which "ein gelber Kalk enthält neben *L. baltica* HIS., *Atrypa reticularis* L. und *Encrinurus punctatus* WAHLENBERG" is again conspicuous. From Groningen our species was already recorded in 1878 by MARTIN, from Kloosterholt afterwards also by BONNEMA (29, p. 452).

From these statements about the erratic occurrence of this species, it appears sufficiently, that it has spread from Kurland and Kowno to the Netherlands though nowhere, it is true, large numbers of such boulders have been met with. In the Scandinavian-baltic area it is found in different places in solid rock:

1st. In Malmö near Christiania which is not very important to us;

2nd. In Gothland, where SCHMIDT describes its occurrence as follows :

“Das grosse Centralmergelgebiet von Follingbo bis Slite und Fårö, das bald aus reinen Mergeln, bald aus Mergeln mit Kalken wechselnd besteht, wird neben andern Fossilien besonders durch die ursprüngliche *Leperditia baltica* HIS. mit kammförmiger Zeichnung auf dem Umschlag der linken Schale characterisirt, die einerseits auch bis zu den Mergeln von Westergarn vordringt und andererseits sich vielfach auch in den oberen Kalken der Wisby-Region findet, so bei Heideby und Martebo. Auf Fårö bei Lansa kommt sie zusammen mit *Zaphrentis conulus* LINDSTR., *Strophomena imbrex* VERN. u. a. im Kalk vor, wechselnd mit *Megalomus*-banken.” (20, p. 255). These places belong to SCHMIDT's middle zone; besides KOLMODIN records it from Oestergarn and Hammarudd near Kräklingbo (8, p. 134), where no doubt younger strata are found. In these two places I have been seeking for a long time, but failed to find it. According to LINDSTRÖM : b—c.

3^d. In Oesel this species is a type-fossil of the Lower Oesel-zone I. For a long time it was only known from dolomite from Kiddemetz (var. *Eichwaldi*) but has later also been found in limestones in the peninsula of Taggamois on the N. W. coast, thus verifying SCHMIDT's prediction. Only there this zone consists of crystalline limestone; everywhere else of dolomite or marl (9, p. 46—49).

With regard to the origin of these boulders whose age has now been determined, the following remarks may be stated. First of all the fact that Skåne cannot be thought of, as *Leperditia baltica* does not occur there. In general the marly character of the rock found in Gothland, argues against the possibility of its originating there; no doubt we have only to think of the north eastern part of the island. Though indeed our boulders do not make the least impression of originating in marly strata, it does not say so very much, because in Gothland the limestone with *L. baltica* cannot everywhere be decidedly looked upon as being limestone from marl. The question then about their origin is not to be solved without extensive material for comparison, which I do not possess; only a single piece of limestone from Slite does not correspond with our boulders. This limestone from Slite is differently coloured and also much more crystalline and betrays by marl-remains and a small concretion of little pyrite-crystals its origin from marl. Now as regards Oesel, from this region, too, I have but a single piece with *L. baltica* for comparison. It is from Kiro, immediately to the south of Taggamois, and corresponds

much more with our boulders. It is however but a badly preserved, weathered piece, so that it is not very important.

Taking all this into consideration the origin of our boulders is probably to be found between Oesel and Gothland, where there is every reason to assume that along the line Fårö—Taggamois limestones of the age of the I-zone have been developed.

More or less closely allied to this Baltica-limestone are different boulders which for their fossil contents may best be referred to the Lower Oesel zone:

a. Yellowish-gray limestones with:

- Proetus concinnus* DALM., var. *Osiliensis* SCHM. 26, T. IV, f. 1—9.
Calymmene tuberculata BRÜNN. 26, T. I, f. 1—7.
Cyphaspis elegantula LOV. sp. 7, T. XVII, f. 7.
Encrinurus punctatus WAHLB.
Strophomena rhomboidalis WILCK. sp.
Orthis sp.

They closely resemble some pieces of Baltica-limestone and most likely neither differ very much from the latter in age. Without tracing their occurrence in particulars here the following list shows sufficiently why they are mentioned here:

	Gotland (16)	Oesel (26)
<i>P. concinnus</i> DALM., (var. <i>Osiliensis</i> SCHM.)	(c—e)	I
<i>C. tuberculata</i> BRÜNN.	c—f	I
<i>C. elegantula</i> LOV. sp.	c	I

Eight pieces of this limestone are from the following places:

“Boteringesingel”,	Groningen	2
“Noorderbinnensingel”,	„	2
“Nieuwe Veelading”,	„	1
„	„	1
“Hilghestede”,	Helpman	1
„	„	1

Again the tract between Gothland and Oesel must be looked upon as the place of origin by reason of perfectly similar considerations as mentioned in dealing with the Baltica-limestone.

b. Perhaps two limestone-rocks also belong to this with

Bumastes barriensis MURCH.

found in the “Nieuwe Veelading” and the “Schietbaan” in Groningen,

while HOLM records this fossil from the Eastern-balticum from *I* (15, p. 37), LINDSTRÖM from *b—h* in Gothland (16, p. 4, N°. 64).

c. Thirdly various limestones with

Encrinurus punctatus WAHLB.

may be mentioned here. These "Encrinurus-limestones" are not further to be determined in age on account of the want of other adequate fossils. Some corals, *Favosites* and *Halysites*, together with which they sometimes occur, can be of no use for that purpose.

d. Among the great number of corals from the Groningen Hondrug there are no doubt many of the age of the Lower Oesel zone e.g. *Thecia Swinderenana* GOLDF and others. However I do not intend to occupy myself with this question, but later on I shall deal with these together with the other corals, whose age is hardly ever to be determined between narrow limits, under the heading "Coral-limestone."

e. Finally I wish just to make mention of a single piece of dark-greenish-gray calcareous marl, which contains numerous pygidia and head-shields of a *Calymmene*-species. This boulder found in the "Boteringesingel" in Groningen suggests the marly stratum of St. Johannis of the *I*-zone in Oesel, but also corresponds fully with marls from different places in Gothland. About the origin, then, nothing can be said. Probably we have to do here with REMBLÉ's "Grünlichgrauer Calymmenekalk". (13, p. 27).

Here ends the enumeration of the boulders of the age *I*. Be it only added that this zone may possibly be well represented among the very manifold dolomites of Groningen. These, however, but seldom contain fossils and on account of this admit of no distinctly separated groups. At the end of the description of the Upper-Silurian boulders, I hope to be able to communicate some particulars about this.

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2. Bovensilurische zwerfsteenen.

Eerste mededeeling: Zwerfsteenen van den ouderdom der oostbaltische zone G''.

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Groningen, Min.-Geol. Institute, April 4, 1905.

Anatomy. — “*Note on the Ganglion vomeronasale.*” By E. DE VRIES.
(Communicated by Prof. T. PLACE.)

The description and drawings given in this note derive from a wellpreserved human embryo. This embryo was fixed in a ten percent solution of formaldehyde. After fixation the greatest diameter was 55 mm. Precise information as to the probable age of this embryo was not to be obtained, but the dimension of the embryo in connexion with the fact, that the corpus callosum was not yet formed, makes it probable that the age of the embryo may be estimated between 2½ and 3 months.

After the embryo being hardened in alcohol the head was cut off along the base of the crane and imbedded in paraffin; a complete series of frontal sections of 10 μ was made. A slight deviation from the frontal plane existed, so that the top of the right hemisphere first appeared in these sections. The greatest part was stained in haematoxylin and eosine in the usual manner, the rest of the sections with haematoxylin only, in slightly different ways.

A description is given of the right hemisphere, — which in the microscopical sections corresponds with the left one —, concerning only that part which has a closer relation to the rhinencephalon. This description is illustrated by four drawings of successive sections and by two semi-diagrammatic figures.

These figures (Fig. V, VI) are a projection of the olfactory lobe on a sagittal plane and constructed from the series of sections. Because the plane upon which the projection is performed is sagittal, only these curvatures of the olfactory lobe are seen, which have a component in that direction. The lines in these drawings denoted from I to IV indicate the place of the four sections marked with a corresponding roman number.

The olfactory lobe, as seen in this stage of development, forms