

tage of red deer bones suggests connections of the hunters of Bunde with the post-Magdalenian Maglemosian industries further to the North (Koerhuisbeek and the Hengelo harbour in the province of Overijssel, Netherlands).

This suggested connection receives additional justification from the remarkable likeness which exists between the human skull cap from Bunde, pictured here in the photographs 9 (norma lateralis) and 10 (norma verticalis) and, especially, the comparable part of skull number C 1 from the Koerhuisbeek near Deventer described by Vallois (1943). The description of the Bunde skull cap will show that the specimen has reached an individual age of approximately 30 to 40 years, and, as in the case of the individual to which belonged skull C 1 from the Koerhuisbeek, probably was a male.

It should perhaps be stated here that two of the fossil human skulls found at Elst (roughly halfway between Bunde and Koerhuisbeek) and mentioned by van der Vlerk (1956) possess many morphological points of resemblance with the Koerhuisbeek skulls and with the Bunde skull cap. Elst may well be another point of occurrence of Maglemosian Man in our country.

### Summary.

An uppermost Pleistocene faunule is described from a construction site in a road at Bunde (province of Limburg, Netherlands). This faunule accompanies a part of a fossil human skull cap and provides interesting ecological data. Two new mammals and two birds are added to the list of fossil species of the Pleistocene in the Netherlands.

### Samenvatting.

Bij graafwerkzaamheden ten behoeve van de aanleg van een brug in een nieuwe weg nabij de Beatrixhaven in de gemeente Bunde, ten N. van Maastricht, werd een gedeelte van een fossiele menselijke schedelkap gevonden. Tegelijkertijd werd nog een aantal andere fossiele beenderen en fragmenten daarvan verzameld; het artikel geeft hiervan een kort overzicht en een beschrijving van enkele zeldzame vondsten, die er deel van bleken uit te maken. Een en ander verschaft inlichtingen omtrent klimaat en omge-

ving ten tijde van het vormen van de afzetting, vermoedelijk in het bovenste Pleistoceen en gelijktijdig met de afzetting der z.g. jonge löss. Twee zoogdieren en twee vogels, nieuw voor de lijst van uit het Pleistoceen in Nederland bekende dieren, worden beschreven: de Saiga (*S. tatarica* L.), een wild schaap dat affiniteiten vertoont met het Marco Polo schaap (*Ovis cf. ammon* L., subsp.), de bruine kiekendief (*Circus cf. aeruginosus* (L.)), en de roek (*Corvus frugilegus* L.). Een aanaal der beenderfragmenten vertoont duidelijke sporen van bewerking door de mens.

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### FORAMINIFERA FROM THE CRETACEOUS OF SOUTH-LIMBURG, NETHERLANDS. LXXV.

The Tuffeau de Ciply in the quarry Curfs, Houthem, the Canal Albert near Vroenhoven, Belgium, and the mine-shaft Maurits III, near Geleen.

by J. HOFKER

As already stated many times, above the hard ground with holes at the top of the Md, Maastricht Tuff Chalk, in drill-holes, mine shafts, in



the quarry Curfs, in the Ravensbos, and in the Canal Albert first is found a bed which contains more or less glauconite and many Foraminifera forming the transition between the the upper Maastricht Tuff Chalk and the lower Paleocene, called by me the Me. Then about 4—6 m of greyish white fine marls are found which contain a fauna very much comparable with that described by Brotzen from the Lower Seelandium of Sweden and Denmark with many of its markers, so that that bed has to be regarded as Lower Paleocene. In the quarry Curfs, the mine shaft Maurits and the Canal Albert, this bed is covered by a hard bank containing many Paleocene molluscs in casts only. Above this bank in all localities we find much coarser marls which lithologically do not differ in any character from the lower Tuffeau de Cibly above the Poudingue de la Malogne, in the type-locality near Mons, Belgium. Also the fauna is quite identical, with the following species found in a sample, K 3870, at km. 23,975 in the Canal Albert:

*Textularia plummerae* Lallier  
*Textularia faujasi* Reuss  
*Textularia bundensis* Van Bellen  
 „*Marssonella*” *keyzeri* Van Bellen  
*Sigmomorphina brotzeni* Hofker  
*Pseudopolymorphinoides limburgensis* Van Bellen  
*Guttulina problema* d'Orbigny  
*Guttulina trigonula* (Reuss)  
*Globulina tuberculata* d'Orbigny  
*Robulus* cf. *rotulatus* Lamarck  
*Nodosaria fissicostata* Gümbel  
*Eponides toulmini* (very large specimens) Brotzen  
*Coleites reticulatus* Rzehak (typical Paleocene stage)  
*Rosalina ystadensis* Brotzen  
*Discorbis limburgensis* Van Bellen  
*Pararotalia globigeriniformis* (Van Bellen)  
*Rotorbinella corrugata* (Cushman and Bermudez)  
*Rotalia trochidiformis* Lamarck  
*Rotalia saxorum* d'Orbigny  
*Rotalia pseudodiscoideus* (Van Bellen)  
*Cibicides succedens* Brotzen  
*Karreria fallax* Rzehak (Paleocene evolution stage)  
*Cibicides geleenensis* Van Bellen  
*Cibicides bosqueti* Reuss  
*Globorotalia pseudomenardii* Bolli  
*Globorotalia* cf. *velascoensis* Cushman  
*Globorotalia pseudomenardii* Bolli  
*Gavelinella danica* Brotzen (Paleocene evolution stage)  
*Anomalina bundensis* Van Bellen  
*Dentalina nasuta* Cushman  
*Reussella europaea* (Cushman and Edwards)  
*Gyrogoninoides pontoni* Brotzen  
*Thalmanita madrugensis* (Cushman and Bermudez)  
*Nonion multisuturata* Van Bellen

*Boldia madrugensis* (Cushman and Bermudez)  
*Globigerina kozlowski* Brotzen and Pozaryska

I have already pointed out (Natuurhist. Maandblad, 1961, pp. 124—126) that this fauna is typical for the Montian of the type-locality near Mons; it is not even the fauna of the lowest part of it, the Poudingue de la Malogne, for it contains already the *Globorotalia* and „*Marsionella*” *keyzeri*, which are found for the first time about a meter above the Poudingue. It is the typical fauna as described from the drill-holes near Bunde by Van Bellen in 1946.

In the shaft Maurits III at 206 m the top of the Maastricht Tuff Chalk was encountered with a typical hard ground with holes, not differing in its fauna from that found in the quarry Curfs near Houthem or in the Canal Albert, Belgium. Above 206 m till 199 m, the typical Lower Paleocene was found with *Pseudopolymorphina paleocenica* Brotzen, *Sigmomorphina pseudoregularis* Cushman & Thomas, *Cibicides lellingensis* Brotzen, *Gavelinella umbilicata* Brotzen, *Citharina plumoides* (Plummer), *Loxostomum applinae* (Plummer), *Astacolus gryi* Brotzen, *Sigmomorphina geyeri* Brotzen, and many other forms as I described them in Natuurhist. Maandblad, 50, 1961, pp. 63—67; pp. 85—87; 51, 1962, pp. 8—11. All these species strongly indicate that the age of this limestone is that of the lower Seelandium Brotzen's, which is Lower Paleocene.

At 198,50 m in the mine-shaft Maurits III we find a hard fossiliferous bank with casts of Paleocene shells, forming the base of the next bed which lithologically and paleontologically is identical with the Tuffeau de Cibly at Mons, Belgium, and which at its top at 186 m also contains a hard fossiliferous bank and is then covered by typical Calcaire de Mons, just as has been found in drill-holes in the Basin of Mons, and also could be detected in the drill-holes near Bunde. This Tuffeau de Cibly of the Maurits III is characterised from its base on by *Globorotalia pseudomenardii* and *Rotorbinella corrugata* and the abundance of *Rotalia saxorum*.

So equally as is found in the quarry Curfs and in the Canal Albert, the Lower Paleocene has a thickness of about 6 m in the mine shaft Maurits, and is separated from the Tuffeau de Cibly by a fossiliferous hard bank. Quite the



same situation was found in several drill-holes to the East and the North of Maastricht.

In the Basin of Mons mostly the Lower Paleocene is missing, and only in some localities the Maastricht Tuff Chalk is found, called here Tuffeau de Saint-Symphorien (Hofker, Ann. Soc. géol. Belgique, 83, 1960, pp. 181—195). In many localities the Tuffeau de Ciply rests here on the Craie phosphatée which, according to its fauna, is of the age of our Cr 4, which at Maastricht is found below the base of the Maastricht Tuff Chalk (Hofker Ann. Soc. géol. Belgique, 83, 1960, pp. 165—180). But in the Carrière Liénard there is one locality in which there are two hard grounds separated by about 1 m of limestone. The lower one forms the top of the Craie phosphatée, and in its holes and in the one meter of chalk above, below the second hard ground with holes, we find the typical fauna of the Lower Paleocene found in the quarry Curfs, the Canal Albert and the mine Maurits III. So here are found the remains of that Lower Paleocene once again (see Hofker, Revue de Micropaléontologie, vol. 4, 1961, pp. 53, 57, fig. 1, Carr. Liénard).

Brotzen and Pozaryska have given the situation as found in a drill-hole at Pamietowo in Poland. They found at 274,5 m the top of the Maastrichtian, comparable in its fauna with the top of our Cr 4, covered by one meter of Danian (?), with *Globigerina compressa* and *G. pseudobulloides*, very probably comparable with our Maastricht Tuff Chalk. From 273,5 to 266,8 they found lowest Paleocene with *Globigerina trilobuloides*, *Pulsiphonina elegans*, *Nonion graniferum*, *Alabamina solnäsensis* and *Loxostomum plummerae*, a fauna identical with that found in the Lower Paleocene above the Maastricht Tuff Chalk in the quarry Curfs, in the Canal Albert, and in the Maurits III. From about 240 m to 220,5 m they found a fauna with *Globigerina koxlowskii*, *Pararotalia* sp., *Boldia madrugensis*, "*Marssonella*" *keyzeri* Van Bellen, *Nonion multisuturatum* Van Bellen, *Protelphidium hofkeri* Haynes, *Discorbis bundensis* Van Bellen, *Rotorbinella corrugata* (Cushman and Bermudez), *Eponides toulmini* Brotzen, *Rotalia saxorum* d'Obigny, *Anomalina bundensis* Van Bellen, *Ruttenia geleenensis* Van Bellen, *Coleites reticulosus* (Plummer). They conclude, that this typical fauna is identical

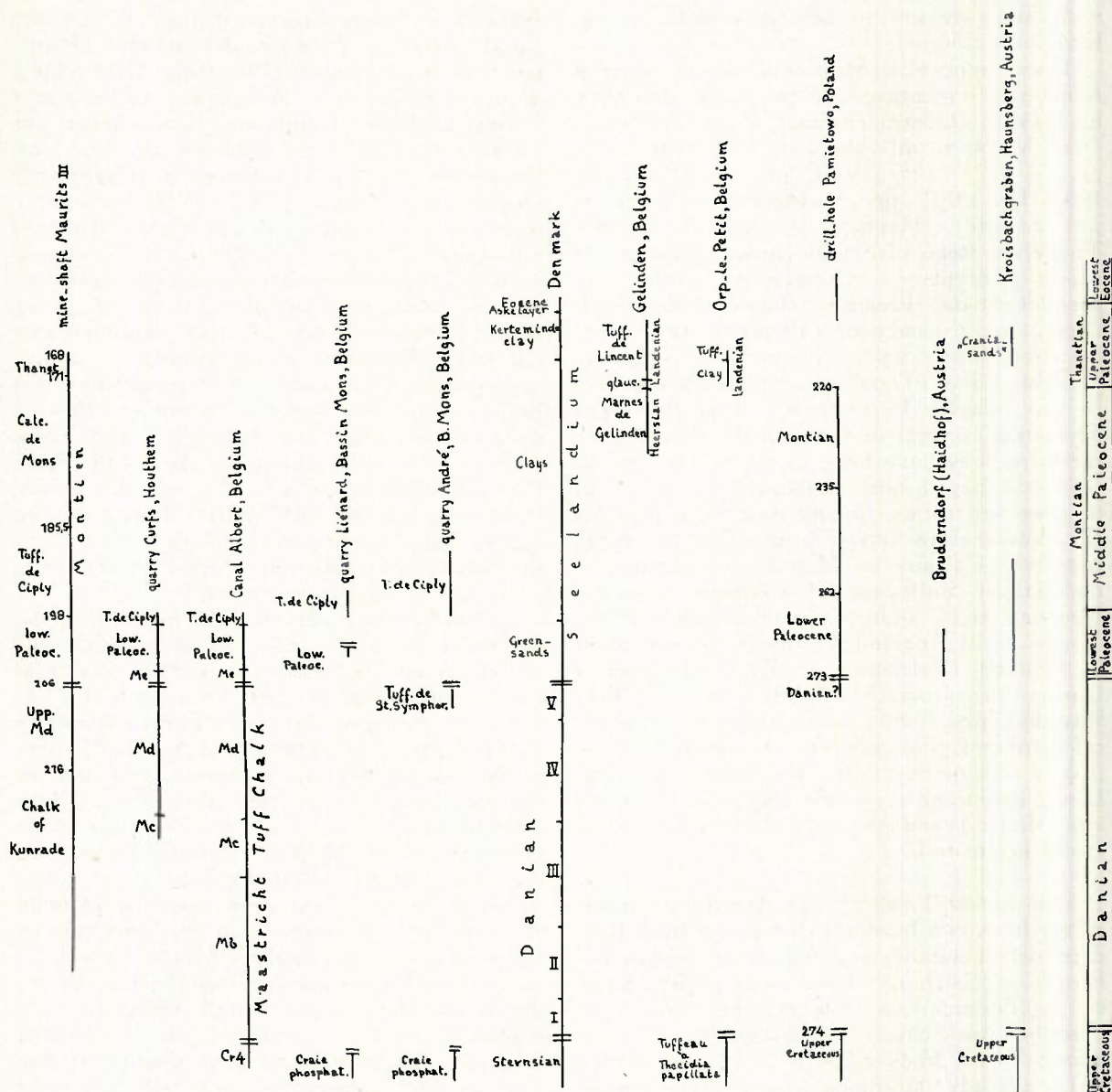
with that, found in the Bunde drill-holes, which is certain. This fauna, absolutely identical with the fauna of the Tuffeau de Ciply, clearly indicates that the Tuffeau de Ciply, and yet more the type-bed of the Montian, the Calcaire de Mons, which always covers the Tuffeau, are not the lowest Paleocene, but already Middle to Upper Paleocene. This is corroborated by the occurrence of the *Globorotalia* found in the Tuffeau de Ciply (the Calcaire de Mons is void of any planktonic Foraminifera in Belgium and Holland).

In the Mine Maurits, the Calcaire de Mons finds its top at 171 m; here suddenly the facies changes and clays are found. These clays, mingled with limonitic grains, also are found at the base of the Paleocene, described by Ten Dam in 1944 from drill-holes to the North in Holland (Meded. Geol. Stichting, C.V. no. 3). They contain *Nonion sublaeve* Ten Dam, *Proelphidium hofkeri* Haynes, *Elphidiella prima* (Ten Dam), *Gavelinopsis simplex* Brotzen, *Gavelinella aspera* (Brotzen), *Eponides toulmini* Brotzen, etc. This fauna is the fauna as described also by Haynes as that found in the Thanetian of England, and refound in the Landenian of Belgium and the Kerteminde Clay of Denmark.

So the so-called Bunde-fauna of Van Bellen, described by him as being Middle Eocene in 1946, in reality is not, as believed by Brotzen and Pozaryska, Upper Paleocene, but Middle Paleocene, since it is covered by the Upper Paleocene, as described by Ten Dam and Haynes.

The correlated sections as given in our figures will show an idea of the true stratigraphic position of the different localities mentioned.

In middle Belgium, at Gelinden and at Orpèpetit, outcrops are found which contain the "Heersian" and the "Landenian". A thorough study of the Foraminifera of both the Marnes de Gelinden (Heersian) and the lowermost Landenian (glauconitic clays and sands and the Tuffeau de Lincent) yielded rich foraminiferal faunas. These faunas do not contain any planktonic form; those of the Heersian are identical with those found in the upper parts of the Paleocene clays of Denmark below the Kerteminde clays; those of the typical Landenian are identical with the faunas found in the Kerteminde clays of Denmark as well as in the clays found



Stratigraphic correlations by means of Foraminifera of some beds in European localities.

in drill-holes in the North-eastern part of Holland, and described by Ten Dam, which also do not contain any planktonic species (but all are characterised by the marker *Rotorbinella parvula* (Ten Dam)). They must belong to the

uppermost parts of the Paleocene, since at Kerteminde in Denmark these clays gradually change into the so-called "aske-layers", containing no Foraminifera but many specimens of the diatom *Coscinodiscus*, and which are believed



with much reason to belong already to the lowermost Eocene.

These uppermost Paleocene layers show a fauna nearly identical with the faunas described by Haynes (Contr. Cushman Found. for Res., 1954, V, pt. 4, pp. 185—191; 1956, VII, pt. 3, pp. 79—101; 1957, VIII, pt. 2, pp. 45—53; 1958, IX, pt. 1, pp. 4—16; 1958, IX, pt. 4, pp. 83—92). Haynes describes from this Thanetian some planktonic forms, *Globigerina aspera* (Ehrenberg) (Cretaceous), *Globigerina pseudobulloides* Plummer (Lower Paleocene), *Globigerina triloculinoides* Plummer (Lower Paleocene), *Globorotalia velascoensis* (Cushman) aff. var. *acuta* (Toulmin) (middle Paleocene). In the samples I examined from the type-Thanetian, several of these forms occurred, as rarely as they have been found by Haynes; in castor-oil they all turn out to have the characters of reworked forms. So, till now no planktonic Foraminifera are known from either the type-Montian (Calcaire de Mons), nor the middle and Upper Paleocene of Denmark, nor the Heersian and Landenian of Belgium, nor the Thanetian of England, nor from its equivalent in Holland (Paleocene as described by Ten Dam). Only from the Middle Paleocene Tuffeau de Ciply, Bunde-fauna from Poland, several planktonic Foraminifera are known, indicating a distinctly higher Paleocene than the Lower Paleocene above the Danian in Denmark and Holland and than the Lower Paleocene found in Austria.

This Lower Paleocene of Austria is known to me from two localities, the fauna from Bruderndorf (Haidhof) and that from the Haunsberg near Salzburg (Kroisbachgraben). Some of the Foraminifera from Haidhof have been described by Schmid (1962, Sitzber. Oesterr. Akad. Wiss., M-N Kl., Abt I, 171, pp. 315—361); already this fauna described by Schmid shows, that we deal not with the fauna as found in the type-Danian, and that the supposition that the age is Danian must be a wrong one; the planktonic as well as the benthonic fauna, which at least covers 120 species, shows many well-known species from the Lower Paleocene, such as *Entosolenia crumenata* Cushman, *Nonionella ovata* Brotzen, *Robulus midwayensis* Plummer, *Robulus alabamensis* Cushman, "*Glo-*

*borotalites*" *lobata* Brotzen, *Gavelinella umbilicata* Brotzen, *Neoflabellina delicatissima* (Plummer), *Palmula oldhami* (Plummer), *Osangularia plummerae* Brotzen, *Anomalina midwayensis* Plummer, *Bulimina midwayensis* Cushman and Parker, *Globigerina kozlowskii* Brotzen and Pozaryska, *Reussella naheolensis* (Cushman), *Dorothia monmouthensis* Olsson, *Bolivina midwayensis* Cushman, *Robulus discus* Brotzen, *Globigerina varianta* Subbotina, *Globigerina pseudobulloides* with extreme honeycomb-structure, *Bolivinoidea oedumi* Brotzen, *Angulogerina cuneata* Brotzen, *Clavulinoides midwayensis* Cushman, *Stensiöina whitei* Morozowa, *Bolivinoidea curta* Reiss, *Globorotalia pseudomenardii* Bolli, *Globorotalia immitata* Subbotina, *Buliminella grata* Parker and Bermudez, and many other species, all pointing to the Wills Point Formation of Texas and thus to the Lower Paleocene, not to the Danian. Many of the species also occurring in the Danian, here show the advanced forms only found in the beds above the Danian in Denmark.

Quite the same can be said from the beds, described by Gohrbandt (Mitt. geol. Gesellschaft, Wien, vol. 56, 1963, pp. 1—116) from the Haunsberg as Danian, Montian and Thanetian according to planktonic Foraminifera. As well the planktonic forms found abundantly here as the benthonic fauna distinctly show that in the Kroisbach Graben itself we deal only with a fauna, very much resembling that of the Wills Point; no typical Montian or Thanetian species are found, and the planktonic forms also distinctly point to an age later than the Danian, even in the bed pointed out by Gohrland as "Danian", and older than the Middle Paleocene. In the so-called Craniensandstein in this region, the foraminiferal fauna mainly seems to be a reworked one from Cretaceous and Paleocene, with some markers pointing to, possibly, lower Eocene. The stratigraphic figure will once more give my view on these European localities.

So it is obvious, as I pointed out already earlier, that the Danian is very rare in Europe and that we have to separate the Danian from the Lower Paleocene which is much commoner. Moreover it is certain, that "Landenian" or "Thanetian" cannot be established with planktonic Foraminifera only, since they do not occur in the type-localities.