

Palaeontology. — “Some further remarks concerning tertiary fish-otoliths from the Netherlands.” By O. POSTHUMUS. (Communicated by Prof. J. F. VAN BEMMELEN.)

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Some time ago I received for study from the Netherlands Geological Survey ('s Rijks Geologische Dienst) a collection of otoliths, which had been found in some test-borings in the Southern and South-western part of the Netherlands. On this material the following remarks are based.

Concerning the determinations the same may be said as on a former occasion ¹⁾. It seems to me that a more thorough study of fossil fish-otoliths is only possible, when we have more data about those of recent fishes. Only then can we get a clearer idea as to the relative value of the different characteristics observed. It is to be hoped that the investigations which have been begun by G. ALLAN FROST ²⁾, may be continued on a sufficiently large scale to afford a solid basis for comparison in the future.

From Miocenic strata otoliths occur in the following borings ³⁾:

Boring Reek (handboring 48, Jaarverslag Rijksopsporing van Delfstoffen over 1909, p. 21). Here, at a depth of from 140 to 157 M., in strata of Mid Miocene age, the following forms occurred :

Otolithus (*Gadus*) *elegans* Koken (O. M. P.) ; this form is the most frequent ; some of them may be taken as belonging to the variety *sculpta*.

O. (*Merluccius*) *emarginatus* Koken (O. M.).

O. (*Merlangus*) *cognatus* Koken (O. M.).

O. (*Raniceps*) *latisulcatus* Koken (O.).

O. (*Ophidiidarum*) *diformis* Koken (O. M.) ; some of the specimens belong to the variety *acutangulus*.

O. (*Scopelus*) *austriacus* Schubert (M.).

O. (*Macrurus*) *Toulai* Schubert (M.).

O. (*Macrurus*) *pusillus* O. Posth. (M.).

As may be seen from the additional indications, O. (*Raniceps*) *latisulcatus* in other localities occurs in the Oligocene only ; O. (*Macrurus*) *Toulai* and O. (M.) *pusillus* in the Miocene only ; O. (*Scopelus*) *austriacus* occurs in the Pliocene of Sardinia too, but in a somewhat

¹⁾ O. POSTHUMUS, *Verhand. Geol. Mijnbouwk. Gen. voor Nederl.*, VII, 1923, p. 107 ; O. POSTHUMUS, *Otolithi piscium, Fossilium Catalogus, pars 24*, 1924, p. 3 ; in the latter further literature can be found.

²⁾ *Annals and Mag. Nat. Hist.*, vol. XVI, 1925, p. 433—446.

³⁾ After the names I have indicated the period in which the otoliths have been found in other localities : O = Oligocene, M = Miocene, P = Pliocene.

different form. The other species occur both in the Oligocene and the Miocene.

Boring Bakel (handboring 52, Hazenhut, Jaarverslag 1909, p. 23).

Here, at a depth of from 56 to 66 M., in Upper Miocenic strata the following forms were found :

O. (*Gadus*) *elegans* Koken (O. M. P.) ; this is also here the most frequent species ; some specimens belong to the variety *sculpta*.

O. (*Merluccius*) *emarginatus* Koken (O. M.).

O. (*Fierasfer*) *nuntius* Koken (O. M.).

O. (*Solea*) *subglaber* Schubert (M.).

O. (*Serranus*) *Noetlingi* Koken (O. M.).

O. (*Box*) *insignis* Prochazka (M.).

A number of *Macruridae* were also found, some of them closely resemble species previously described by me. It seems to me, however, that it is better to postpone a further discussion of these species until we have a better knowledge of the limit of variation in recent allied forms.

In this locality many of the forms are also known from Oligocene strata.

In Pliocenic strata the following species have been found :

In test-boring Beers (boring 58, Jaarverslag 1909, p. 24) in strata of Mid-Pliocenic age, at a depth of from 40 to 74.50 M. :

O. (*Gadus*) *merlangus* Newton (P.).

O. (*Gadus*) *luscus* Newton (P.).

O. (*Macrurus*) aff. *Toulai* Schub.

In test-boring Zeeland II (boring 66, Jaarverslag 1910, p. 22) from strata of Mid Pliocenic age, at a depth of from 22.50 to 60 M. :

O. (*Gadus*) *merlangus* Newton (P.).

In these borings the marine Upper Pliocene does not occur ; in the Maassluis test-boring at a depth of from 161.40 to 168.40 M., these strata were, however, found and

O. (*Gadus*) *merlangus* Newton (P.) occurred there.

In the test-boring Sommelsdijk some otoliths were found in strata from 67.80 to 68.50 M., which, according to the opinion of Dr. STEENHUIS, are younger than the above mentioned strata of Maassluis. The otoliths are practically identical with those of the cod and haddock ; this bears out the above mentioned supposition.

When studying this material, I was again struck by the fact, that the difference between the fishfauna of the Oligocene and Miocene in these regions is but slightly pronounced. Many forms, which were at first known from one period only, have afterwards been found in the other one as well. It seems, however, that in these countries the fauna of the Oligocene and Miocene on the one hand and that of the Eocene on the other hand, which is known to us from the researches of Priem, Schubert and Leriche from France, England and Belgium, differ far more widely.

Although in the Pliocene the otoliths are also sometimes rather numerous, they belong in these regions to a few species only, which closely resemble

living forms, such as *Gadus luscus* and *Gadus merlangus*. Only a few species from the Miocene occur, in slightly altered forms, in the Pliocene too.

It is not possible, to form an opinion as to what circumstances this is due to ; whether it is due to the extinction of the species or to their migration e.g. in connection with alterations of the climate or to other causes.

I wish to conclude by expressing my hearty thanks to Dr. STEENHUIS, Geologist to the Geological Survey, who kindly placed the material at my disposal and provided some data.
