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On mastodon remains from the Netherlands: an overview

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The purpose of this paper is to briefly describe two unknown molars of *Anancus arvernensis* (CROIZET ET JOBERT, 1828). One specimen was trawled from the Oosterschelde and the other was found in a clay pit near the village of Maalbeek, near Tegelen, The Netherlands. Also, an overview of the known molars of *A. arvernensis* and *Mammut borsoni* (HAYS, 1834) found in the Netherlands is given.

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INTRODUCTION

Anancus arvernensis (CROIZET ET JOBERT, 1828) had a wide Eurasian geographical range and existed from the Miocene until the Early Pleistocene. Its largest expanse was during the Pliocene. The oldest known fossils of *Anancus arvernensis* were found in Miocene deposits in Spain. A large amount of fossils of *Anancus* was found in Bulgaria in the region of Dorkovo in 1985, in a Pliocene deposit (Thomas *et al.* 1986). These dental fossils are characterised by a rather primitive morphology, which either indicates an Early Pliocene form or an intraspecific variation of the species. Other localities where *Anancus arvernensis* was found are in France (Chilhac), Italy (Valdarno) and the Netherlands (Maalbeek, Liessel, Schelde estuary). In France and in the Schelde estuary the remains of *Anancus arvernensis* were found in association with *Mammuthus meridionalis*. Late representatives of *Anancus* are characterised by molars with cementum in the valleys between the cusps. Both localities in France and the Netherlands show this identical late evolutionary stage of

Anancus teeth, which results in a comparable dating of the fossils to 1,9 million years old (Moraal 1998, Boeuf 1993). This means that the *Anancus* fossils found in the Oosterschelde belonged to the stratigraphically youngest representatives of the species. *Anancus* became extinct in the Early Pleistocene. *Anancus arvernensis* had a bunodont dentition and had two tusks pointing straight forward (Fig. 1). The shoulder height of the animal was about 2 m. The mandibles were short and the molars had nipple-shaped cusps arranged in transverse rows. These bunodont molars suggest a soft diet of leaves, fruit and twigs. The feet were made to walk on soft soil, which means that *Anancus* was an inhabitant of the moist woodlands. In the fossil record the molar crown became higher, the valleys between the cusps and rows were filled with cement and the transverse rows or lophids increased in number. The trend developed from soft forest food towards material like grasses, requiring grinding teeth (De Vos *et al.* 1998).

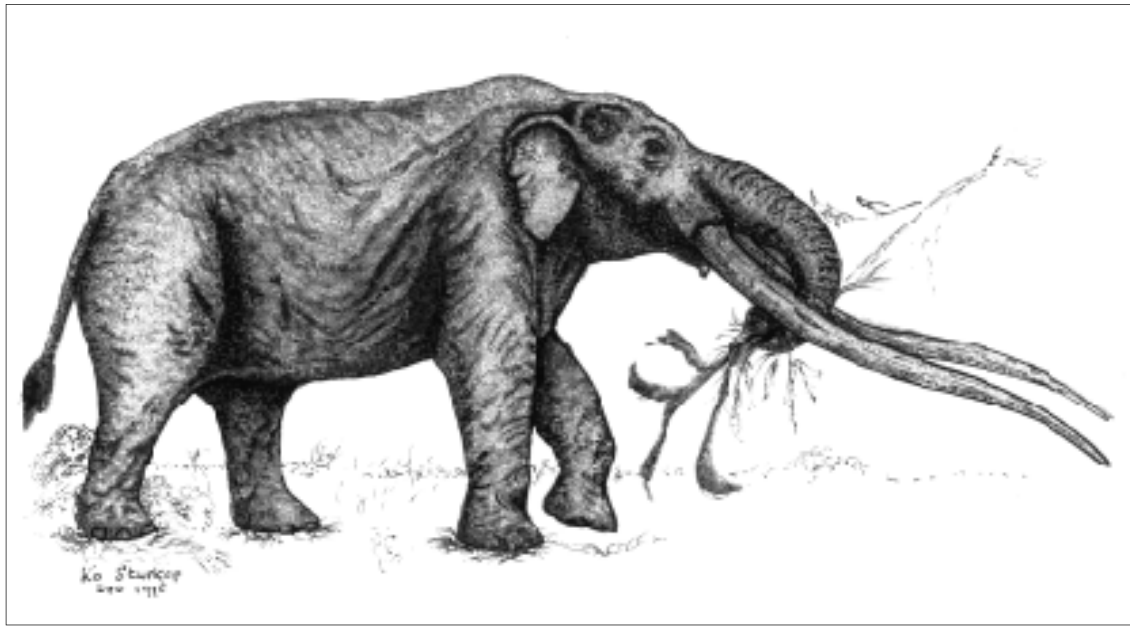


Figure 1 Reconstruction of *Anancus arvernensis* [illustration: Ko Sturkop]

RESULTS

New material of *Anancus arvernensis*

Anancus arvernensis is known from the province of Zeeland, in the south-western part of the Netherlands. Detailed descriptions and figures of dental remains of *Anancus arvernensis* are given by Schreuder (1944, 1945) and by Hooijer (1953, 1991). Van Essen & Mol (1996) and De Vos *et al.* (1998) gave an overview on the Early Pleistocene mammalian remains from the Oosterschelde in the Zeeland province. Most of the known remains of *Anancus arvernensis* are kept in Naturalis, the National Museum of Natural History in Leiden (see Appendix). One molar of *Anancus arvernensis* belongs to the Braber collection (Delft, The Netherlands) and bears the number B0100. This molar was unpublished so far. The exact locality where this *Anancus* molar was found is not known, but it was dredged from the bottom of the sea by a vessel from a fisherman from the island of Schouwen Duiveland. Bryozoa are clearly recognisable on the surface of the molar. Since there are other finds of *Anancus* known from the Oosterschelde which borders the

island, this is the most probable locality. The molar became part of the private collection of med.dr J.L. Braber in the sixties, when it was given to him as a token of appreciation for medical treatment.

The fossils from the Oosterschelde demonstrate a typical state of fossilisation: when tapped on with a hard object they produce a high-pitched sound. The molar in the Braber collection also has those characteristics and is very well preserved (Table 1, Fig. 2). Only at the right front side a cusp has been broken. The colour of the fossil is black for the enamel and dark brown for the cementum. Between the cusps there are relatively heavy cementum deposits. The molar is slightly worn at the conules of the protocone and at the conelets of the paracone, the protocone itself is missing (broken). The other cones, conelets and conules are unworn. The roots of the tooth are missing. The molar is an M3 dex. with 6 lophs of two cones, of which the 6th loph is much smaller than the other five. In the first loph both cones are accompanied by two conelets (buccal side of the sulcus) or

two conules (lingual side of the sulcus). In the 2nd, 3rd and 4th loph there is only one conelet or conule. In the two last lophs each cone has two conelets and two conules, except for the smallest cone, which has only one conelet. The cones and conules do not form a straight ridge, but do alternate each other in a way that the lingual cone is situated more to the front than the buccal cone of the same loph.

The *Anancus arvernensis* molar from Maalbeek

A famous site of Early Pleistocene faunal remains is Tegelen in the province of Limburg, The Netherlands. Several clay pits near Tegelen have yielded large quantities of fossils. Most of them originate from the same deposits (Kortenbout van der Sluijs & Zagwijn 1962). The main fauna of Tegelen is known from the stage Tiglian C 5, often written as TC5, and dated with an age of approximately 1.6 million years. From a site called the Van Cleef Pit or Maalbeek Pit near the village of Maalbeek in the neighbourhood of

Tegelen, much older mammals such as *Tapirus arvernensis* and *Anancus arvernensis* are known (Westerhoff *et al.* 1998). Only one set of *Tapirus* molars (Kortenbout van der Sluijs 1960) and one molar of *Anancus* (ST96438) were found. Often we come across both species mentioned in the faunal list of Tegelen. There has been a lot of discussion on the age of the Maalbeek Pit (Westerhoff *et al.* 1998). According to many researchers the clay of the Maalbeek Pit is placed in the Eburonian (e.g. Zagwijn 1963).

The molar of *Anancus* was collected by the museum staff of the Leiden Geological Museum on February 23, 1960. G. Kortenbout van der Sluijs, under the leadership of professor I. M. van der Vlerk, at that time was doing a research project on the Tegelen fauna. Kortenbout van der Sluijs wrote on that day in his Tegelen diary (which is now in the collection of Dick Mol, Fig. 3):

‘Met Prof.v.d. Vlerk eerst naar Russel-Tiglia. We krijgen hier een aantal beenderen, o.a. een stuk gewei van *Eucladoceros* en een snijtand van een paard. Smeets is echter ziek, zodat een deel van de vondsten ontvindbaar is. Vervolgens naar Maalbeek. Hier krijgen we een aantal kleinere botjes, o.a. stukjes kies van *Cervus rhenanus* en een kies van *Anancus arvernensis*. Is de klei in deze groeve toch Onder-Tiglien?’

Translation:
‘With Professor van der Vlerk first to Russel-Tiglia. Here we obtain several bones, among which part of an antler of *Eucladoceros* and an incisor of a horse. Smeets, however, is ill, so a part of the finds is untraceable. After that to Maalbeek. Here we get some smaller bones, among which dental remains of *Cervus rhenanus* and a molar of *Anancus arvernensis*. Is the clay in this pit Lower Tiglian after all?’

Westerhoff *et al.* (1998) wrote in their extensive paper on the Maalbeek Pit that the molar was found *in situ* (1998: 61). This is not quite

Table 1. Measurements in cm of the *Anancus arvernensis* molar B0100 (coll. Braber). The enamel thickness, measured at the side where the protocone has been broken, varies between 0.53 cm and 0.81 cm.

loph	height of the crown	
	buccal	lingual
1st loph	4.35	
2nd loph	5.17	6.50
3rd loph	5.80	6.86
4th loph	5.93	6.87
5th loph	5.20	6.28
6th loph	3.92	4.93
length of the crown: +18.5		
width of the crown: 7.8		

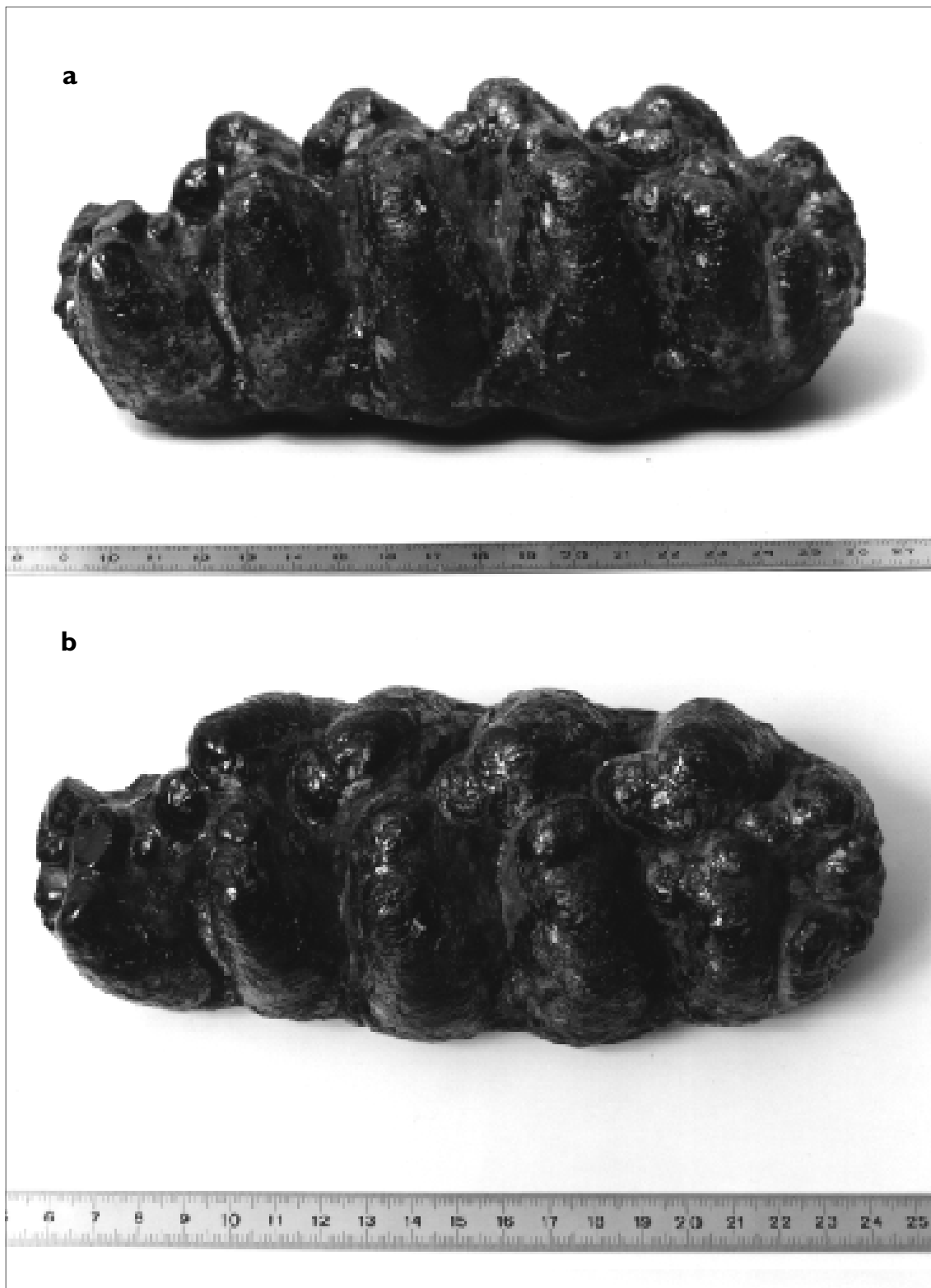


Figure 2 The upper M3 dex B0100 of *Anancus arvernensis*; **a** side view and **b** occlusal view (anterior to the left).
[photo: Esmee van Bokhoven]

consistent with the notes Kortenbout van der Sluijs wrote in his diary (see above) on his project on the Tegelen fauna. The workers in the pit donated the molar to him. Westerhoff *et al.* (1998) gave some interesting information (p. 62):

'The new exposures in 1993 and 1994, additional palynological research and a reappraisal of the primary data have

resulted in alternative ideas about the stratigraphical age of the fauna from Maalbeek. The clay with the mastodont molar is here referred to the Tiglian B pollen zone. The tapir remains might be slightly older and can probably be assigned to the Tiglian A pollen zone. The new results indicate that the mammal fauna

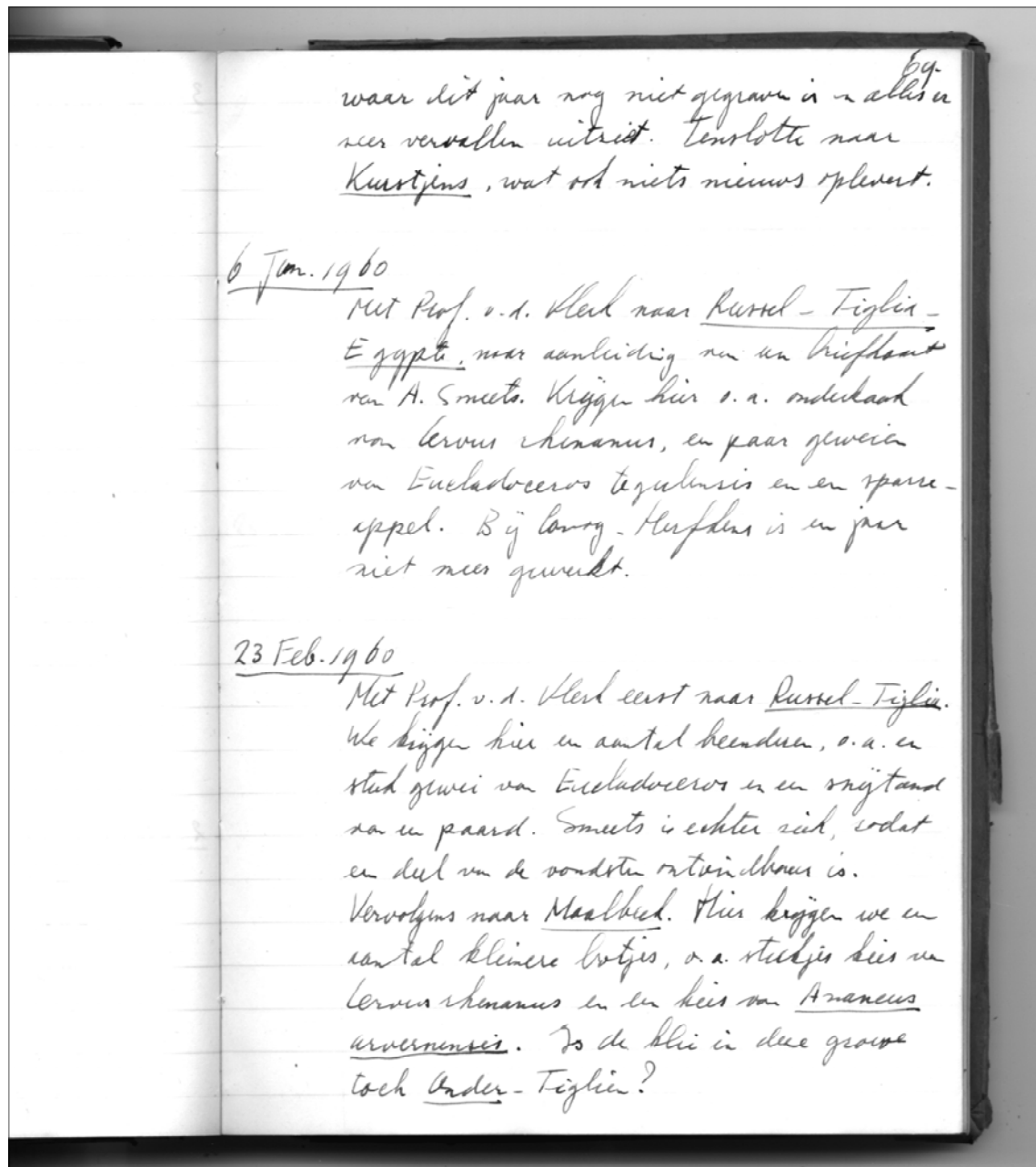


Figure 3 The section in the diary of G. Kortenbout van der Sluijs written on February 23, 1960 (Collection Dick Mol).

mentioned above is not younger but older than the fauna from the Tegelen pits.'

This means that Kortenbout van der Sluijs, when he wrote his notes in his Tegelen diary, was correct in his assumption about the dating of a Lower Tiglian age of the Maalbeek Pit. The molar (ST96438) now belongs to the collection of Naturalis in Leiden. It is the only *Anancus* fossil ever found in Maalbeek. This is the first time it is described, measured and depicted (Table 2, Fig. 4). ST96438 is an upper M1 dex., which is very worn down. On the lingual side of the molar all cusps are totally worn. On the buccal side five lophs can be distinguished, all worn.

An overview of the *Anancus arvernensis* molars found in the Netherlands

The Appendix provides an overview of all the molars and molar fragments known from the Netherlands. Until now there were found ten (almost) complete molars and 26 molar fragments of *Anancus arvernensis*. They all show comparatively heavy cementum deposits between the cusps and therefore belong to the late evolutionary stage. The localities were the *Anancus* and the *Mammut* molars were found in the Netherlands and in the North Sea are indicated on the map (Fig. 5).

An overview of the *Mammut borsoni* molars found in the Netherlands

Mammut borsoni (HAYS, 1834) is a zygodont mastodon known from the Pliocene of Europe and Northern Asia. The molars have sharp transversal ridges, derived from two fused cones, specialised for cutting the food like scissors. There are only two or three molars of *Mammut borsoni* found in the Netherlands. Two were found at the locality Liessel, a gravel pit in the province of North Brabant; Li 1001 is in the collection of the Museum Jan Vriens in Asten and the other one in the collection of mr. Nies in Deurne. They were found at about 100 meters distance from each other. The third molar (NMR 698), which is

Table 2. Measurements in cm of the *Anancus arvernensis* molar ST96438 from the Maalbeek Pit (Coll. Naturalis, National Museum of Natural History, Leiden). The enamel thickness, measured on the occlusal of the molar, varies between 0.29 cm and 0.65 cm.

height of the crown	
buccal	
1st loph	2.41
2nd loph	3.00
3rd loph	3.48
4th loph	3.58
5th loph	3.24
length of the crown: 11.39	
width of the crown: +6.82	

in the collection of the Natuurmuseum Rotterdam, is of unknown provenance. Molar Li 1001 was found in 1998 at a depth of 20 meter. It is a crown of a left m3 with five ridges, of which the first four are called lophs and the last the talonid. It is heavily worn, especially at the buccal side, which indicates that it belonged to an old animal. The second molar from Liessel was found in 1990 at a depth of 22 meters. It is the complete crown and a part of the root of a left m3 (Peters *et al.* 1991).

The stratigraphy of the Liessel site is very complicated, because the sediment was dredged from the pit. The fossils derived from the pit are diverse; remains of marine mammals dated into the Miocene and fossils of terrestrial mammals of Pliocene age. Also plant remains from the Pliocene were recovered. A Pliocene age for the molars of *Mammut borsoni* is most convenient, like the other terrestrial mammals and the plant seeds.

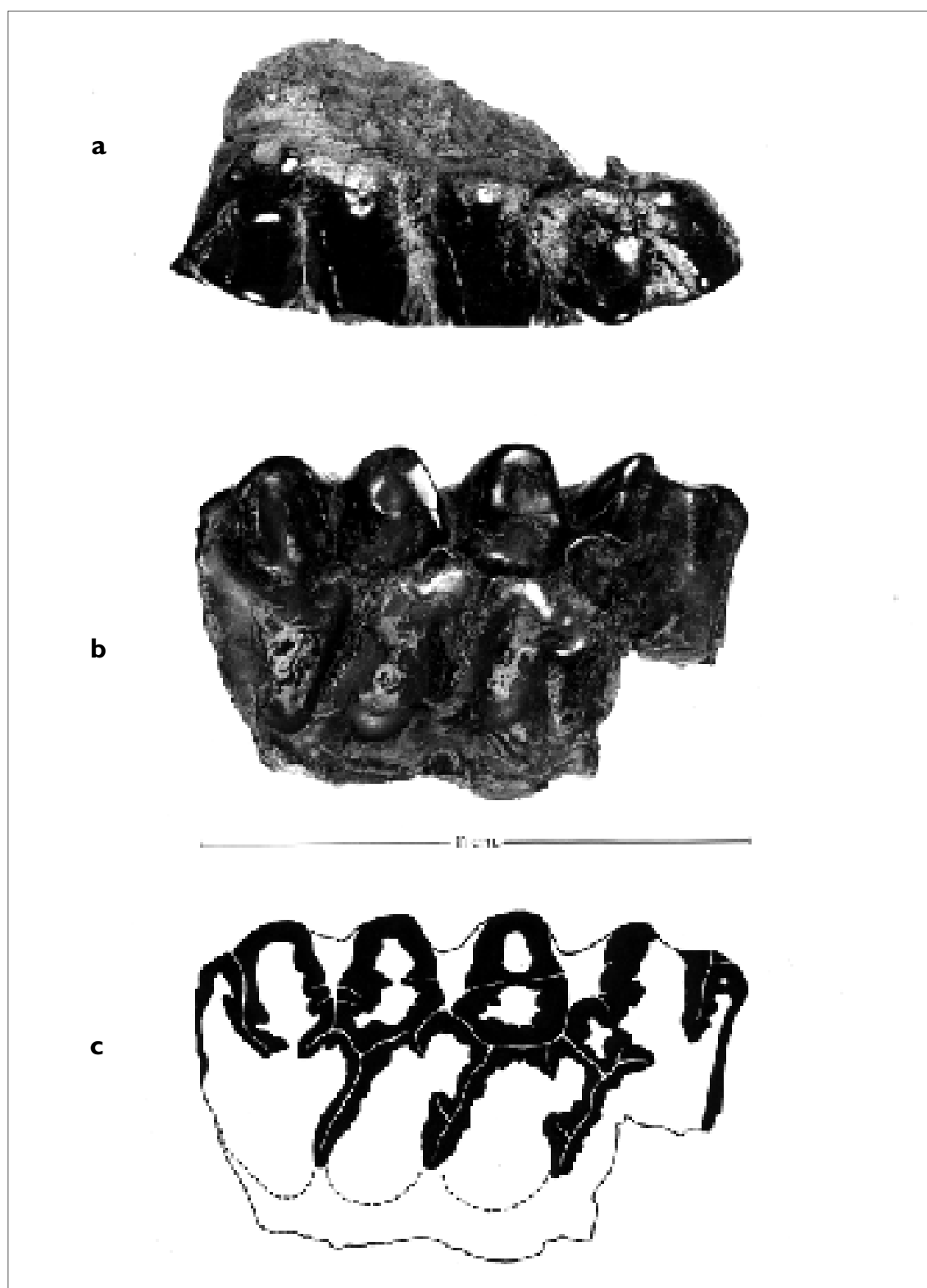


Figure 4 The upper M1 dex (ST96438) of *Anancus arvenensis* from Maalbeek (The Netherlands); **a** side view, **b** occlusal view and **c** a drawing of the surface of the undamaged enamel (anterior to the right).



Figure 5 Sites (underlined names) of all the known molars of *Anancus arvernensis* and *Mammut borsoni* in the Netherlands.
[illustration: Jaap van Leeuwen]

The third specimen (NMR 698) is only a part (two ridges) of a lower m3. There is no locality information available. Although Von Koenigswald (1950) interpreted it as a fossil found in the Oosterschelde, this is improbable. There are no traces of sea-life on the surface. The fossils found in the sea always have barnacles or bryozoans stuck to the surface. Another problem is that *Mammut borsoni* is known from the Pliocene and the finds of the Oosterschelde are younger, at least of Early Pleistocene age.

Mammut borsoni is often found associated with *Anancus arvernensis*. They must have had a different diet according to their dentition; *Mammut borsoni* cutting branches and twigs with its zygodont teeth, *Anancus arvernensis* with its bunodont teeth browsing on leaves, both in the moist woodlands at the river banks.

CONCLUSIONS

The only *Anancus* molar which is known from Maalbeek is an upper M1 dex. Its geological age is Tiglian B. Kortenbout van der Sluijs (1960) was the first author to recognise that the Maalbeek fauna was older than the main fauna of the famous Tegelen clay pit. All the published molars and molar fragments of *Anancus arvernensis* known from the Netherlands are listed in this paper and all the molars show the heavy cementum deposits between the valleys of the cusps. This indicates that they all had the same evolutionary stage and therefore we can conclude that *Anancus arvernensis* became extinct in the Early Pleistocene in North-western Europe, probably during the Tiglian B. *Mammuth borsoni* is often found associated with *Anancus arvernensis*, but only restricted to the Pliocene, while *Anancus* is also known from the Early Pleistocene (Mol & Van Essen 1996). In Dorkovo (Thomas *et al.* 1986) the two proboscideans were also found associated, they are of Pliocene age and the large molars of *Anancus arvernensis* represent the more primitive stage. In Liessel, where the stratigraphy is rather complicated and sediments could be mixed, *Mammuth* and *Anancus* are both present, but it is not clear that they derive from the same deposit. Because *Anancus* represents the late evolutionary stage in dentition, characteristic for the Early Pleistocene age, and the age of *Mammuth* fossils is restricted to the Pliocene in Europe, it is assumed that the layers of Late Pliocene and Early Pleistocene age in Liessel are mixed up and that the remains of the two Proboscideans derived from different layers.

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APPENDIX An overview of the *Anancus arvernensis* molars and molar fragments found in the Netherlands.

MOLARS	NR.	LOCATION	COLLECTION
(almost) complete molars:			
M2 dex	ST104763	Westerschelde	NNM
M3 sin	ST152509	Oosterschelde	NNM
M3 dex	ST50478	Oosterschelde	NNM
M3 dex	ST145536	Oosterschelde	NNM
M3 dex	GV1562	Oosterschelde	KZGW
M3 dex	B0100	Oosterschelde	FBD
d4 dex	ST118680	Oosterschelde	NNM
m1 dex	2263 B	Oosterschelde	MM
m3 sin	ST118986	Oosterschelde	NNM
m3 dex	GV1983.25	Oosterschelde	KZGW
fragments:			
d/D3 and d/D4; 2 frags.	ST152506	Oosterschelde	NNM
D4 sin fragm. ant.	ST118935	Oosterschelde	NNM
D4 dex fragm. ant.	ST145876	Oosterschelde	NNM
D4 dex fragm.	ST118934	Oosterschelde	NNM
M1 sin fragm. post.	ST401326	Oosterschelde	NNM
M1 dex fragm.	ST401323	Oosterschelde	NNM
M1 dex fragm.	ST96438	Maalbeek Pit	NNM
M2/3 sin fragm. ant.	2263D H-p12	Oosterschelde	MM
M3 fragm.	L1612	Lissel	MVA
M3 dex fragm. post.	2263A H-p11	Oosterschelde	MM
m/M fragm.	ST401324	Oosterschelde	NNM
m fragm.	ST119071	Oosterschelde	NNM
m1 dex fragm. ant.	2978A	Oosterschelde	MM
m1/2 fragm. post.	ST145413	Oosterschelde	NNM
m1/2 sin fragm. ant.	ST145928	Oosterschelde	NNM
m1/2 sin fragm. ant.	ST152507	Oosterschelde	NNM
m2 sin fragm.	1752	Thornton Bank	DMH
m2/3 sin fragm.	ST152508	Oosterschelde	NNM
m2/3 dex fragm. ant.	2262E	Oosterschelde	MM
m3 dex fragm. post.	ST401325	Oosterschelde	NNM
m3 dex fragm.	ST145273	Oosterschelde	NNM
m3 sin fragm. ant.	ST145343	Oosterschelde	NNM
m3 dex fragm.	3203	Oosterschelde	MM
m3 dex fragm. post.	ST119590	Oosterschelde	NNM
m3 dex fragm.	ST118226	Oosterschelde	NNM
m3 dex fragm. post.	2263C H-p12	Oosterschelde	MM

Abbreviations: NNM = Natuurlijc, National Museum of Natural History, Leiden; KZGW = Koninklijk Zeeuwisch Genootschap der Wetenschappen at the Zeeuw Museum in Middelburg; MM = Maritiem Museum of Zierikzee, Gemeente Schouwen Duiveland, Zierikzee; MVA = Museum Vlaards, Assen; FBD = collection F. Braber, Delft; DMH = collection D. Mol, Hoofddorp. All in The Netherlands.

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