The mammal fauna from the interglacial deposits at Maastricht-Belvédère

T. van Kolfschoten

Institute of Prehistory, Leiden University, P.O. Box 9515, 2300 RA Leiden, The Netherlands

Abstract

A sequence of five superimposed mammalian faunal assemblages has been recorded from deposits exposed at Maastricht-Belvédère. The M-B 2, M-B 3 and M-B 4 assemblages document faunal changes during the transition from an early Saalian cold stage to a temperate phase, the so-called Belvédère Interglacial.
The faunal assemblages from the Belvédère Interglacial deposits are rather rich; larger as well as smaller mammals are represented. Recently recovered remains of mallard cf. Anas plathyrynchos, bear Ursus sp. and straight-tusked elephant cf. Elephas (P.) antiquus are described in this paper. The fauna indicates a partly wooded environment and full interglacial conditions. The mammalian faunas and the geological evidence indicate an intra-Saalian age for the Belvédère Interglacial deposits.

Introduction

The Maastricht-Belvédère locality, located on the Caberg terrace NNW of the city of Maastricht, has yielded mammal fossils since the beginning of the 20th century (Cremers, 1925; 1926). The amount of fossils has increased considerably since multidisciplinary (archaeological, geological and palaeontological) investigations in the pit started in 1980.

Larger and smaller mammal remains have been collected from the late Middle and Late Pleistocene deposits (Van Kolfschoten, 1985; 1990a). The amount of mammalian remains and the biostratigraphical significance of the palaeontological data make Maastricht-Belvédère one of the significant palaeontological localities of Northwestern Europe.

An extensive description of the mammal fossils has been published (Van Kolfschoten, 1985). Part of the material excavated and collected since 1985 has been described or listed in various papers (Van Kolfschoten, 1988; 1989a; 1989b; 1990a; 1990b; De Warrimont & Groenendijk, 1988; Roebroeks, 1988). This paper gives an up-to-date review of the various faunal assemblages. The assemblage M-B 4 is discussed in more detail because this fauna originates from the type deposits of the Belvédère Interglacial, an intra-Saalian warm phase with full interglacial conditions. Recently recovered remains of a bear (*Ursus* sp.) and the straight-tusked elephant (cf. *Elephas (Palaeoloxodon) antiquus*) extended our knowledge of this fauna and are therefore described in this paper.

A review of the faunas from Maastricht-Belvédère

Mammal fossils have been collected for many years, from various places and from a number of lithostratigraphical units in the Maastricht-Belvédère loess- and gravel pit. The faunal assemblages can be grouped according to their lithostratigraphical position. Several faunal assemblages have been recognized so far. The distribution of the mammal species in the Maastricht-Belvédère faunas 1.2, 2A, 3A, 3B, 3C, 3, 4 and 5 is presented in Figure 1.

Generally speaking, it can be stated that the faunal remains from the lithostratigraphic Units III and IV, except for the fossils assigned to Maastricht-Belvédère 1, date to the Early Saalian and the remains from Unit VI are of Weichselian age. Fossils of a straight-tusked elephant *Elephas (Palaeoloxodon) antiquus* (Maastricht-Belvédère 1), recovered from gravels at the base of the section (Cremers, 1926) date most probably from the late Cromerian s.l.

The assemblages M-B 2 and M-B 2A represent a cold stage fauna indicative of an open environment. The faunal assemblages M-B 3, 3A, 3B and 3C indicate in general a steppe-like environment and rather warm and dry cli-

matic conditions. These assemblages show similarities in composition with faunas from the Late Saalian deposits of the East Eifel volcanoes Tönchesberg and Plaidter-Hummerich (Van Kolfschoten & Roth, in prep.) and with Early Weichselian steppe faunas as known from e.g. Burgtonna (Heinrich & Jánossy, 1978). The faunal assemblages from the Maastricht-Belvédère section indicate a warm steppe phase between the early Saalian cold stage and the temperate interval (Belvédère Interglacial), reflected in the fauna M-B 4. This fauna will be discussed in detail in the next paragraph.

Mammal remains were also collected from the Weichselian deposits of Unit VI (Van Kolfschoten, 1985; 1990a). The largest fossil assemblage M-B 5 has been collected at the archaeological Site E (for the location of the site see: Roebroeks, 1988 and Roebroeks et al., 1993). The fauna is dominated by the arctic lemming *Dicrostonyx torquatus* which indicates cold climatic conditions and a tundra environment. However, the occurrence of *Cricetulus migratorius* is more in line with steppe environment. The M-B 5 fauna differs from the M-B 3, 3A, 3B and 3C assemblages in the occurrence of tundra inhabitants like the arctic lemming *Dicrostonyx torquatus* and the reindeer *Rangifer tarandus*. The heterogeneous fauna M-B 5 is typical of cold stage Pleistocene faunas, which reflect an environment no longer present today (Storch, 1969), and which may be the equivalent of the "Mammoth-Steppe" as described by Guthrie (1990).

The fauna from the Belvédère Interglacial deposits

The faunal assemblage M-B 4 is the largest one and is composed of several collections of material from lithostratigraphic Subunits IV B and IV C. These subunits are assigned to the Belvédère Interglacial and they also contain the main archaeological sites (Figure 2). A number of larger mammal remains has been recovered during the excavations of the archaeological Site G (cf. *Elephas (P.) antiquus*, *Dicerorhinus hemitoechus*, *Cervus elaphus*, *Capreolus capreolus* and *Bos* sp. or *Bison* sp.), Site N lower level (*Ursus* sp., *Dicerorhinus hemitoechus*, *Dicerorhinus* sp. and *Bos* sp. or *Bison* sp.) and Site N upper level (*Equus* sp., ?*Megaloceros* sp., *Cervus elaphus* and *Bos* sp. or *Bison* sp.).

Apart from the fossils recovered during the archaeological excavations, there are a number of isolated finds mainly collected by Mr. J. P. de Warrimont. Remains of the European pond tortoise *Emys orbicularis* have recently been collected from the transition of Subunit IV B to Subunit IV C, at the same level where a coracoid of a bird (cf. *Anas platyrhynchos*) has been found. This paper presents a detailed description of some of the newer finds: the coracoid, the metacarpal bone of a bear (*Ursus* sp.) from the lower level at Site N and a humerus and tibia of a straight-tusked elephant cf. (*Elephas (P.) anti-*

Figure 1

	Fauna assemblages								
	1	2	2a	3a	3b	3c	3	4	5
Erinaceus cf. davidi	.	.	.	.	.	.	.	+	.
Talpa europaes	.	.	.	.	.	.	+	+	+
Sorex araneus	.	.	.	.	.	.	+	+	.
Sorex minutus	.	.	.	.	.	.	.	+	.
Neomys fodiens	.	.	0	.	.	.	+	+	.
Crocidura sp.	.	.	.	.	.	.	.	+	.
Soricidas indet.	.	.	.	.	.	+	.	.	.
Ochotona pusilla	.	.	.	.	+	.	+	.	.
Eliomys quercinus	.	.	.	.	.	.	.	+	.
Spermophilus undulatus	.	.	0	0	0	.	0	.	0
Sicista subtilus	.	.	.	.	+	.	.	.	.
Cricetus cr. praeglacialis	.	.	.	.	0	.	+	.	.
Cricetulus migratorius	.	.	.	.	.	.	.	.	+
Lemmus lemmus	.	.	+	+	+	.	.	.	.
Dicrostonyx torquatus	.	.	.	.	.	.	.	.	+
Clethrionomys sp.	.	.	+	.	+	.	.	.	.
Clethrionomys glareolus	.	.	.	.	.	.	+	+	.
Arvicola sp.	.	.	+	.	.	.	.	.	.
Arvicola terrestris ssp. A	.	.	.	+	+	.	+	+	.
Arvicola terrestris ssp. B	.	.	.	.	.	.	.	.	+
Pitymys subterraneus	.	.	.	.	.	.	.	0	.
Microtus gregalis	.	.	.	+	+	.	+	.	+
Microtus oeconomus	.	.	.	.	+	.	.	+	+
Microtus agrestis	.	.	.	.	.	.	.	+	.
Microtus arvalis	.	.	+	+	+	.	.	.	.
Microtus arvalis and/or									
Microtus agrestis	.	.	.	.	.	.	+	+	.
Apodemus sylvaticus	.	.	.	.	.	.	+	+	.
Apodemus maastrichtiensis	.	.	.	.	.	.	+	+	.
Ursus sp.	.	.	.	.	.	.	.	+	.
Mustela nivalis	.	.	.	0	.	.	.	+	.
Elephas (P.) antiquus	+	.	.	.	.	.	.	+	.
Mammuthus primigenius	.	+	.	.	.	0	.	.	+
Eguus sp. (robust type)	.	+	.	.	.	.	.	+	+
Dicerorhinus hemitoechus	.	.	.	.	.	+	.	+	.
Coelodonta antiquitatis	.	+	0	.	.	.	.	.	+
Cervus elaphus	.	+	.	.	.	.	.	+	+
Megaloceros giganteus	.	.	.	.	.	.	.	+	.
Rangifer tarandus	.	.	.	.	.	.	.	.	+
Cervidas indet. (large deer)	.	.	.	.	.	.	.	.	+
Capreolus capreolus	.	.	.	.	.	.	.	+	.
Bos primigenius/									
Bison priscus	.	.	.	.	.	.	.	+	+

0 means determination cf. or aff.: + means determination certain.

quus) found at a distance of 2 metres from each other at the transition of Unit IV B to IV C.

Aves

cf. Anas platyrhynchos

(Mallard)

Material: Coracoid sin. (Figure 3)
Dimensions: length 53 mm.

A coracoid of a bird was found, together with some fish and rodent remains, at the transition of Unit IVB - IVC. The coracoid is almost complete; only the brachial tuberosity and the lateral and mesial edges of the posterior part are damaged. The coracoid is morphologically identical to an incomplete specimen recorded previously (Van Kolfschoten, 1985), but is more slender.

The specimen shows characters which are typical for the Anseriformes (ducks, geese and swans) according to Gilbert et al. (1981). The procoracoid (Figure 2b) is small but well developed, triangular in shape and only slightly folding over the medial side of the coracoid. A furcular facet and a pneumatic foramen are absent. The size and the morphology are very similar to the coracoid of the mallard (*Anas platyrhynchos*), the shaft is however more slender than the one figured by Gilbert et al. (1981; p. 43, Figure E).

Mammalia

Ursus sp.

(Bear)

Material: Costa (proximal end); Metacarpale II sin. (Figure 4)
Dimensions of the Metacarpale: Length: — ; minimal width of the diaphysis: 14.6 mm; anterior-posterior diameter of the diaphysis at the same position: 12.3 mm.

The caput of the costa is comparable in size and morphology to that of the living brown bear *Ursus arctos*. The metacarpal bone (Figure 4) is incomplete; the distal end is missing. The morphology is very characteristic and compares that of the metacarpale II of *Ursus arctos* in the shape of the articulation facets.

It is difficult to decide whether we are dealing with remains of *Ursus arctos* or a representative of the *U. deningeri-U. spelaeus* lineage. The metacarpals of *U. arctos* are generally longer and are more slender in comparison to those of the second group (Kurtén, 1968; Bishop, 1982). The Late Pleistocene *Ursus spelaeus* in particular has very broad metacarpal bones.

The width of the diaphysis of the specimen from Maastricht-Belvédère falls into the range of dimensions of the relative short metacarpals from Vértesszölös and from Westbury-sub-Mendip assigned to *Ursus deningeri* (Janossy, 1990; Bishop, 1982). It is, however, the length

LITHOSTRATIGRAPHIC UNITS			ARCHEOLOGICAL LEVELS AND SITES		FAUNA LEVELS	
VII						
VI	VI - E					
			—A*—		—F—	
	VI - D		A	E	F5	
	VI - C					
	VI - B				F	
	VI - A		A		F	
V	V - B		A*			
	V - A					
IV	IV - C	IV - Cß	A		F	
			A	N	F	
		IV - Cα	A		F	F4
					—F—	
	IV - B		A	N	F	
					F - 3C	
			—A*—		—F - 3B	F3
	IV - A				F - 3A	
III	III - B				F	
	III - A		A*		F2 + 2A	
					F1	

Figure 2
The stratigraphical relation between the lithostratigraphic (sub)units exposed in the Maastricht-Belvédère quarry (after Vandenberghe et al., 1993) and the stratigraphical position of the various archaeological and faunal levels.

of the bone which is discriminative and therefore it is impossible to assign our material to a particular species.

cf. Elephas (Palaeoloxodon) antiquus

(Straight tusked Elephant)

Material: Humerus sin. and Tibia dext.
Dimensions of the Humerus sin. (Figure 5): estimated length of the complete bone 100 cm; minimum width of the diaphysis 12,3 cm; anterior-posterior diameter of the diaphysis at the position of its minimal width 21,2 cm.

The humerus is incomplete, both ends, proximal and distal are missing. The diaphysis is cracked but rather complete. The overall width of the humerus fragment suggests a large bone assigned to cf. Elephas (P.) antiquus because of its massive proportions. The humeri of Elephas (P.) antiquus are stouter in proportion to their length than those of Mammuthus primigenius (Andrews, 1928; Melentis, 1963).
The lateral side of the humerus shows at the height of the deltoid ridge a groove with a width of about 5 cm and a maximal depth of about 1 cm. The position of this groove and its width correspond with the very distinct and deep grooves in the humeri of Elephas (P.) antiquus from Crumstadt (Germany) described and depicted by Kroll (1991). This groove marks the Fossa musculus deltoidei, the area where the Musculus deltoideus inserts the humerus. Such a groove, although less deep, is also present in humeri of adult straight-tusk elephants from Gröbern I and Gröbern II (Kroll, 1991). Kroll suggested that the presence of a Fossa musculus deltoidei might be diagnostic for Elephas (P.) antiquus; as he did not observe this feature in any other humerus of living or fossil elephants.
However, three of the about 50 humeri, assigned to Mammuthus primigenius or Mammuthus sp., in the collection of the Nationaal Natuurhistorisch Museum at Leiden (The Netherlands), show the presence of the fossa. One large specimen has been collected from the bottom of the Westerschelde estuary, an area where molars of Elephas (P.) antiquus have also been found. This humerus might be from Elephas (P.) antiquus. The two other humeri (including the specimen with a very distinct groove) were dredged up along the river Maas at localities rich in remains of Mammuthus primigenius. The presence of Elephas (P.) antiquus in faunas from the latter localities has not been indicated so far; all the molars collected at these localities belong to Mammuthus primigenius. This might be an indication that the presence of a distinct Fossa musculus deltoidei, in the shape of a wide and rather deep groove, is common in Elephas (P.) antiquus but not restricted to this species. It can therefore, not be regarded as a diagnostic feature as suggested by Kroll (1991). The presence of the fossa and its proportions could also be dependent on the size of the individual. Investigation of a larger number of humeri of Mammuthus (Archidiskodon) meridionalis and M. (Mammuthus) trogontherii would be very useful in this aspect.

Figure 3
cf. Anas plathyrynchos:
a: coracoid sin.,
dorsal view;
b: schematic figure
to illustrate the
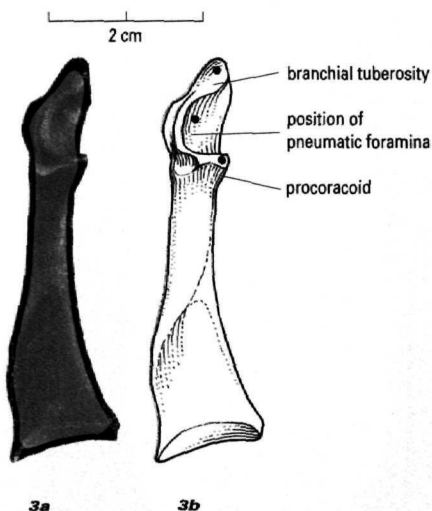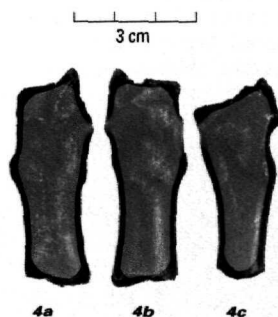terminology used
to describe the
morphology of
a coracoid.

Figure 4
Ursus sp.:
metacarpale II (sin);
a: anterior view;
b: posterior view;
c: lateral view.

2 cm

branchial tuberosity

position of
pneumatic foramina

procoracoid

3a   3b

3 cm

4a   4b   4c

Tibia dext. (Figure 6):
Dimensions: Figure 7

The tibia is rather complete although the distal parts, in particular, are heavily damaged. The proximal as well as the distal articulation facets for the fibula are missing. The diaphysis is, furthermore, partly covered with cemented gravels. The distal articulation facet which in *Elephas (P.) antiquus* shows discriminating features (Adams, 1874; Melentis, 1963) is missing.

Figure 5
cf. Elephas (P.) antiquus:
Humerus sin.;
a: anterior view;
b: posterior view;
c: lateral view;
d: medial view.

5a　　5b　　5c　　5d
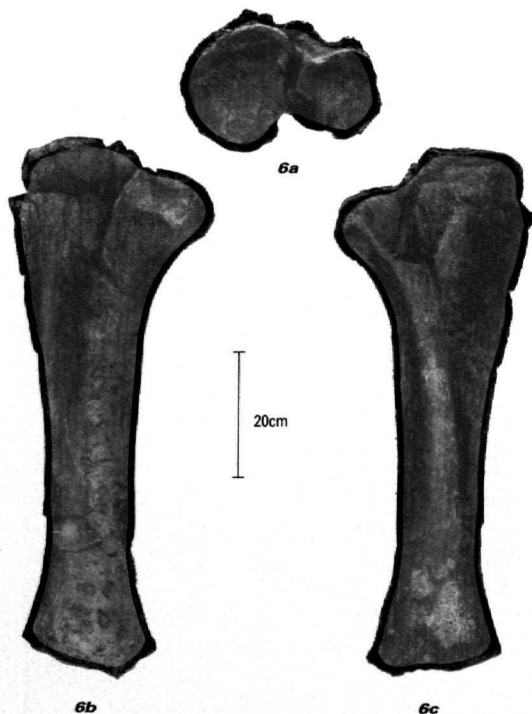
Figure 6
cf. Elephas (P.) antiquus:
Tibia dext.:
a: proximal view;
b: posterior view;
c: anterior view.

6a

6b　　　　6c

The proximal articulation surface (Figure 6a) is rather well preserved. The medial facet for the inner condyle of the femur is deeply concave, especially posteriorly. The lateral facet is concave and slopes towards the outer side, to a considerably lower level than the medial facet. The proximal epiphyse shows a clear, more or less triangular shaped, depression between the anterior parts of the medial and lateral articulation facets (Figure 6a). This feature is absent in all the tibiae assigned to *Mammuthus primigenius* or *Mammuthus* sp. in the extensive collection in the Natuurhistorisch Museum at Leiden (The Netherlands). The feature is present in the tibia of *Elephas mnaidriensis* from Mnaidra Gap (Malta) that is described and depicted by Adams (1874). The tibia from Malta also shows a depression between the posterior edges of the proximal articulation facets; this particular area is damaged in our specimen. Whether the presence of at least an anterior depression between the proximal articulation facets is characteristic for *Elephas (P.) antiquus* is questionable. Kroll (1991) who described the *Elephas (P.) antiquus* skeleton from Crumstadt (Germany) did not mention this feature, and its presence is not clearly visible in the figures.

The dimensions of the tibia exceed those of tibiae assigned to *Mammuthus primigenius* or *Mammuthus* sp. in the collection of the Natuurhistorisch Museum at Leiden (Marinelli pers. comm., 1991). These tibiae are from several localities and most of them are of Weichselian age.

The palaeoenvironmental conditions during the Belvédère Interglacial

The development of a soil (Huijzer & Mücher, 1993; Mücher, 1985) and the fossil mollusc and vertebrate fauna are indicative of the palaeoenvironmental condi-

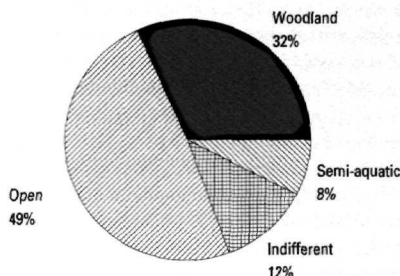tions. (there are no pollen in the Belvédère Interglacial deposits.)

Figure 8
Composition of the smaller mammal fauna from the Belvédère Interglacial deposits based on the minimum number of individuals.

The mollusc fauna, extensively described by Meijer (1985) and Duistermaat (1993), is indicative of the local environment. The smaller mammal fossils, which are for the greater part concentrated by birds of prey, give a more regional view, as do the larger mammals. The composition of the smaller mammal fauna (Figure 8) has, however, been heavily biased by raptor prey selection. The diet of the various species of birds of prey differs distinctly. Data from Britain show e.g. that the barn owl (*Tyto alba*) prefers the field vole (*Microtus agrestis*) and the common shrew (*Sorex araneus*) whereas the wood mouse (*Apodemus sylvaticus*) and the bank vole (*Clethrionomys glareolus*) are dominant in the pellets of the tawny owl (*Strix aluco*) (Andrews, 1990). The diet changes furthermore during the course of the year (Andrews, 1990). This implies that the composition of the fossil faunal assemblage alone cannot be used to give a detailed palaeoenvironmental reconstruction. The fauna

Figure 7
Measurements of the tibia of cf. Elephas (P) antiquus from Maastricht-Belvédère 4 compared with those of Elephas (P) antiquus from Upnor, England (Andrews, 1928) and Crumstadt, Germany (Kroll, 1991) and the dimensions of a large number of tibiae (n=52) of Mammuthus primigenius from different localities in the Netherlands (Marinelli, 1991; pers.comm.).

	Elephas (P.) antiguus				M. primigenius		
	Maastricht Belvedere	Upnor	Crumstadt		Min.	Mean	Max.
length (max.)	750-800	1020	602	600	504	676	732
prox. width	260-270	281	208	198	122	204	243
length prox. med. art. fac.	155						
width prox. med. art. fac.	120						
length prox. lat. art. fac.	115						
width prox. lat. art. fac.	125						
prox. ant.-post diameter	183	163					161
min. width diaphysis	115				72	101	115
ant.-post. diam. diaphysis	113						
distal width	±200	161					160
max. width dist. art. fac.	230						
ant.-post. diam. dist. epiph.	±140	131					126

does not give exact indications of the extent of wooded areas and areas with an open vegetation.

The presence of species is therefore even more important than the relative number of fossil remains of a certain species. The composition of the smaller and that of the larger mammal associations (Figures 8 and 9) indicate comparable palaeoenvironmental conditions. The presence of species such as the garden dormouse *Eliomys quercinus*, the Bank vole *Clethrionomys glareolus*, the wood mouse *Apodemus sylvaticus/A. maastrichtiensis* and the roe deer *Capreolus capreolus* indicate the occurrence of woodland, whereas e.g. the common vole *Microtus arvalis* and the field vole *M. agrestis* represent species which inhabit an open environment. The occurrence of *Eliomys quercinus*, which is restricted to an entirely wooded environment with temperate climatic conditions, underlines the interglacial character of the fauna. The remains of the european pond tortoise *Emys orbicularis*, collected from two different levels (transition of Units IV B to IV C and transition Unit IV Cα to IV Cβ), confirm the interglacial conditions. Their occurrence indicates mean July temperatures which even exceed those of today.

The bio- and chronostratigraphical age of the Belvédère Interglacial fauna

The fauna from the Belvédère Interglacial deposits is rather modern in character, 60 % of the 25 species present occur in northwestern Europe today. Species characteristic of the early Middle Pleistocene "Biharian" faunas e.g. *Sorex (D.) savini*, *Talpa minor*, *Trogontherium cuvieri*, *Mimomys savini* and *Pliomys episcopalis* are absent. This implies that we are dealing with a "Toringian" fauna according to the biozonation proposed by Fejfar & Heinrich (1981). The Toringian "Stage" can be divided into two different biozones: the *Arvicola terrestris cantiana* Range-zone and the *Arvicola terrestris*

Partial-range-zone.

The Maastricht-Belvédère faunas M-B 2 to 5 are all referred to the latter biozone because of the occurrence of advanced evolutionary stages of the *Arvicola* molars (Van Kolfschoten, 1990a). The *A. terrestris* ssp. A molars are more advanced in the differentiation of their enamel thickness than the molars from e.g. Miesenheim I and Neede, which are referred to *A. terrestris cantiana*. The Belvédère specimen is less advanced than the molars from Rhenen (Vogelzang Pit), assigned to *A. terrestris* ssp B. For more detailed information on this point the reader is referred to Van Kolfschoten (1990a).

The fauna from Neede is correlated with the Holsteinian Interglacial, the smaller mammal fauna from Rhenen (Vogelenzang Pit) with the intra-Saalian Bantega Interstadial (Van Kolfschoten, 1990a). These correlations imply that the Belvédère Interglacial fauna should also represent an intra-Saalian warm temperate phase.

The full interglacial character of the Belvédère Interglacial suggests a correlation with the Hoogeveen Interstadial. This cannot be confirmed because of the absence of palynological data.

The Belvédère Interglacial mammal fauna is very similar to the smaller mammal fauna from Wageningen-Fransche Kamp (Van Kolfschoten, 1991) which might date to the same warm phase. The latter fauna has been collected from deposits which also produced a good pollen record. However, the correlation of the pollen record with the standard division of the Pleistocene appears to be problematic, and a correlation with the intra-Saalian Hoogeveen or Bantega Interstadial appears to be unlikely for the relevant deposits at Wageningen-Fransche Kamp (De Jong, 1991).

These discrepancies indicate that our knowledge of the Middle Pleistocene is still incomplete. Further investigations of the Middle Pleistocene fossil record are necessary to solve these problems.
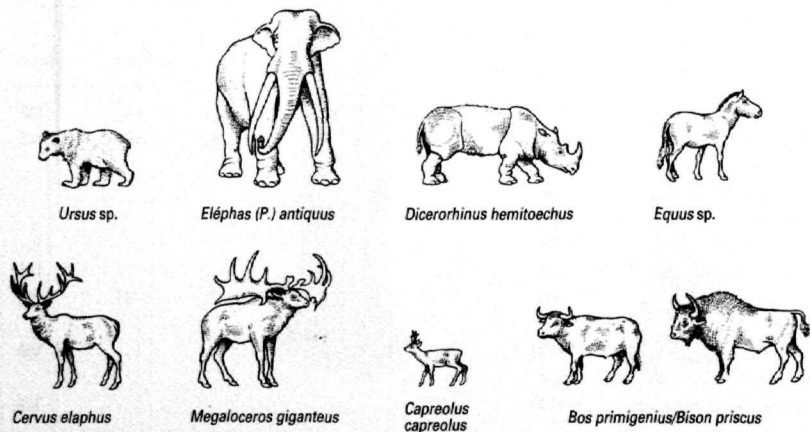

Figure 9
The larger mammals from the Belvédère Interglacial. The figures are from Thenius (1962).

Ursus sp.   *Eléphas (P.) antiquus*   *Dicerorhinus hemitoechus*   *Equus* sp.

Cervus elaphus   *Megaloceros giganteus*   *Capreolus capreolus*   *Bos primigenius/Bison priscus*

For a more extensive discussion on the stratigraphical age of the Belvédère Interglacial, the reader is referred to Van Kolfschoten et al. (1993).

Conclusions

The sections exposed at Maastricht-Belvédère are rich in vertebrate fossils. The mammal faunas from the lower sequence, deposited during the earlier part of the "Saalian Complex" and the Belvédère Interglacial give a unique example of the faunal change during the transition from the early Saalian cold stage to the warm phase defined as the Belvédère Interglacial. The fauna from the Belvédère Interglacial (M-B 4) is rich. It has been collected from the main archaeological findhorizon and is composed of smaller and larger mammals which indicate full interglacial conditions and a partly wooded environment. The fauna is of Intra-Saalian age. It is very similar to the mammal fauna from Wageningen-Fransche Kamp which might date to the same warm phase.

Acknowledgements

References

Adams, A.L., 1874: On the dentition and osteology of the Maltese fossil Elephants, being a description of remains discovered by the author in Malta between the years 1860 and 1866. - Trans Zool. Soc. London IX, 1, p. 1-124.

Andrews, C.W., 1928: On a specimen of Elephas antiquus from Upnor. - British Museum Natural History, London, 24 pp.

Andrews, P., 1990: Owls, caves and fossils. - British Museum Natural History, London, 231 pp.

Bishop, M.J., 1982: The mammal fauna of the early Middle Pleistocene cavern infill site of Westbury-sub-Mendip, Somerset. - Special Papers in Palaeontology, 28, p. 465-479.

Cremers, J., 1925: Belvédère (de meest interessante plek van Nederland). - Natuurhist. Maandbl., 14, p. 150-153.

Cremers, J., 1926: Verslag maandelijksche vergadering van woensdag 5 mei 1926. - Natuurhist. Maandbl., 15, p. 49-51.

De Jong, J., 1991: Pollen-analytical investigation on sediments of Pleistocene age at Wageningen (The Netherlands). - Meded. Rijks. Geol. Dienst, 46-1, p. 65-70.

De Warrimont, J.P. & Groenendijk, K., 1988: De vondst van een steppeneushoorn (Dicerorhinus hemitoechus) in de Belvédère groeve te Maastricht. - Cranium 5, 1, p. 16-21.

Duistermaat, L., 1993: The interglacial mollusc fauna from Maastricht-Belvédère Site G. - Meded. Rijks Geol. Dienst, 47, (this volume), p. 61-67.

Fejfar, O. & Heinrich, W.D., 1981: Zur biostratigraphischen Untergliederung des kontinentalen Quartärs in Europa anhand von Arvicoliden (Rodentia, mammalia). - Eclogae geol. Helv., 74/3, p. 997-1006.

Gilbert, B.M., Martin, L.D. & Savage, H.G., 1981: Avian osteology. - 709 Kearney, Laramie, Wyoming, 252 pp.

Guthrie, R.D., 1990: Frozen fauna of the Mammoth Steppe, The story of Blue Babe. - Univ. Chicago Press, Chicago, 323 pp.

Heinrich, W.D & Jánossy, D., 1978: Fossile Saugetierreste aus einer jungpleistozänen Deckschichtenfolge über dem interglazialen Travertin von Burgtonna in Thüringen. - Quartärpalaontologie 3, p. 231-254.

Huijzer, A.S. & Mücher, H.J., 1993: Micromorphology of the intra-Saalian interglacial pedocomplex and Eemian Rocourt soil in the Belvédère pit (Maastricht, The Netherlands). - Meded. Rijks Geol. Dienst, 47, (this volume), p. 31-40.

Jánossy D., 1990: Vertebrate fauna of site II. In: Kretzoi, M. & Dobosi, V.T. (eds): Vértesszölös; site, man and culture., - Akadémiai Kiadó Budapest, p. 187-229.

Kroll, W., 1991: Der Waldelefant von Crumstadt. Ein Beitrag zur Osteologie des Waldelefanten, Elephas (Palaeoloxodon) antiquus. - Dissertation, Universität München, 31 pp.

Kurtén, B., 1968: Pleistocene mammals of Europe. - Weidenfeld & Nicolson, London, 316 pp.

Melentis, J.K., 1963: Studien über fossile vertebraten Griechenlands. - Ann. Géol. d. Pays Helléniques, 14, 107 pp.

Meijer, T., 1985: The pre-Weichselian non-marine molluscan fauna from Maastricht-Belvédère (Southern Limburg, the Netherlands). - Meded. Rijks Geol. Dienst, 39-1, p. 75-104.

Mücher, H.J., 1985: Micromorphological study of the terrace sands (Unit 4) and "loams" (Unit 5) and their paleosols in the Belvédère pit near Maastricht, Southern Limburg, the Netherlands. - Meded. Rijks Geol. Dienst, 39-1, p. 19-29.

Roebroeks, W., 1988: From find scatters to early hominid behaviour: a study of middle palaeolithic riverside settlements at Maastricht-Belvédère (The Netherlands).-Analecta Praehistorica Leidensia, 21, 196 pp.

Roebroeks, W., Van Kolfschoten, T. & Vandenberghe, J., 1993: The Belvédère Project: Introduction. - Meded.

Rijks Geol. Dienst, 47, (this volume), p. 5-6.

Storch, G., 1969: Über Kleinsäuger der Tundra und Steppe in jungeiszeitlichen Eulengewöllen aus dem nordhessischen Löß. - Natur und Museum, 99, 12, p. 541-551.

Thenius, E., 1962: Die Großsäugetiere des Pleistozäns von Mitteleuropa. - Zeitschr. für Säugetierkunde 27, 2, p. 65-83.

Vandenberghe, J., Mommersteeg, H. & Edelman, D., 1993: Lithogenesis and geomorphological processes of the Pleistocene deposits at Maastricht-Belvédère. - Meded. Rijks Geol. Dienst, 47, (this volume), p. 7-18.

Van Kolfschoten, T., 1985: The Middle Pleistocene (Saalian) and Late Pleistocene (Weichselian) mammal faunas from Maastricht-Belvédère, Southern Limburg, (The Netherlands). - Meded. Rijks Geol. Dienst, 39-1, p. 45-74.

Van Kolfschoten, T., 1988: De steppeneushoorn uit Maastricht-Belvédère. - Cranium, 5, 1, p. 22-26.

Van Kolfschoten, T., 1989a: De Pleistocene neushoorns van Nederland. - Cranium, 6, 2, p. 19-32.

Van Kolfschoten, T., 1989b: Neushoornvondsten uit de groeve Maastricht-Belvédère. - Cranium, 6, 2, p. 33-43.

Van Kolfschoten, T., 1990a: The evolution of the mammal fauna in the Netherlands and the middle Rhine Area (Western Germany) during the late Middle Pleistocene. - Med. Rijks Geol. Dienst, 43-3, p. 1-69.

Van Kolfschoten, T., 1990b: Review of the Pleistocene Arvicolid Faunas from The Netherlands. - In: Fefjar, O. & Heinrich, W.D. (eds.): International Symposium. Evolution, phylogeny and biostratigraphy of Arvicolids (Rodentia, Mammalia). Rohanov, Czechoslovakia, May 1987. - Geol. Survey Prague. p. 255-274.

Van Kolfschoten, T., 1991: The Saalian mammal fossils from Wageningen-Fransche Kamp. - Meded. Rijks Geol. Dienst, 46-1, p. p. 37-53.

Van Kolfschoten, T., Roebroeks, W. & Vandenberghe, J., 1993: The Middle and Late Pleistocene sequence at Maastricht-Belvédère: the type locality of the Belvédère-Interglacial. - Meded. Rijks Geol. Dienst, 47, (this volume), p. 81-91.