

## *Bison bonasus* from the North Sea, the Netherlands

Marc Drees and Klaas Post

### Summary

*Bison bonasus* has been recognized in fossil material, dredged from the North Sea. It is postulated that this species appeared at the end of the Weichselian - beginning of the Holocene. Sexual dimorphism in *Bison bonasus* is clearly demonstrated in the metacarpal bone.

### Samenvatting

*Bison bonasus* is aangetoond in het fossiele materiaal, afkomstig uit de Noordzee. Het is aannemelijk te veronderstellen dat deze soort aan het einde van het Weichselien - begin van het Holoceen in dit gebied voorkwam. Tevens is aangetoond dat de metacarpus een duidelijke sexuele dimorfie toont.

### Introduction

Late Pleistocene material from the North Sea belongs to a faunal assemblage of Weichselian age (Van Kolfschoten, 2001), consisting of *Mammuthus primigenius*, *Coelodonta antiquitatis*, *Bison priscus*, *Ovibos moschatus*, *Equus* sp., *Equus hydruntinus*, *Rangifer tarandus*, *Megaloceros*

*giganteus*, *Crocuta crocuta*, *Panthera leo*, *Canis lupus*, *Ursus spelaeus*, *Ursus arctos*. In addition to the Weichselian fauna, a Holocene fauna consisting of *Bos primigenius*, *Sus scrofa*, *Capreolus capreolus*, *Alces alces*, *Castor fiber*, and *Lutra lutra* is present.

*Bison priscus* is abundantly present in the fossil material collected from the North Sea. Material attributed to *Bos primigenius* and *Bison menneri* is also present, but only in very limited numbers. Besides these species, fossil bones of unmistakable bovid morphology are also found, but in small numbers. The material clearly belongs to a *Bison* (Olsen, 1960), but is markedly smaller than *Bison priscus* (Fig. 1).



Fig 1 Metacarpi of *Bison priscus* (left) and the small *Bison* (right) from the North Sea.

Middenhandsbeentjes van *Bison priscus* (links) en de kleine *Bison* (rechts) van de Noordzee.

### Material and methods

A comparison has been made between *Bison priscus* and the smaller *Bison* using the metacarpal bone. A total of 14 complete, adult metacarpi of the small *Bison* were measured (see Fig. 2) and compared against 18 adult metacarpi of *Bison priscus* as well as data from literature regarding extant *Bison bonasus*, a relatively small woodland *Bison*.

The metacarpus was chosen because it is usually abundantly present. It also exhibits clear sexual dimorphism (Schertz, 1936; Brugal, 1994; Sher, 1997), making it relatively easy to discriminate between males and females of the same species. The measurements of the metacarpal bone are presented in the Appendix.

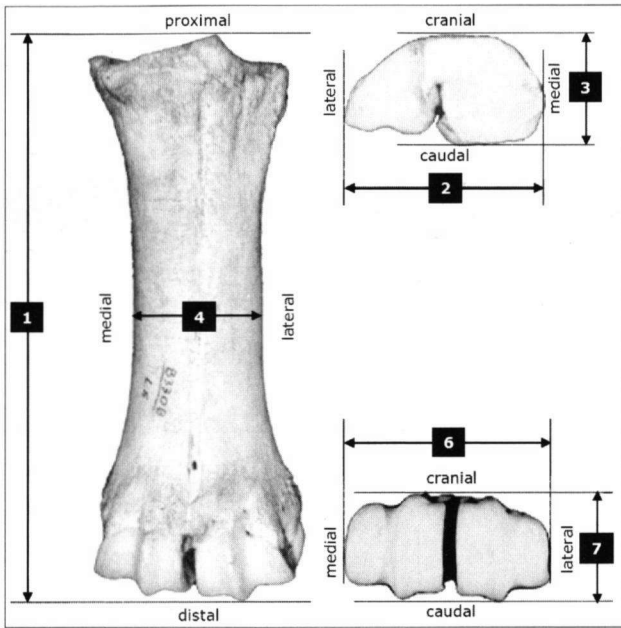


Fig 2 Measurements (see top, right) taken from the metacarpal bone. Measurement 5 is not represented

Maten (zie boven, rechts) die genomen zijn van het middenhandsbeen. Maat 5 is niet aangegeven.

Measurement	Description
1	Maximum length
2	Transverse diameter proximal end
3	Anteroposterior diameter proximal end
4	Transverse diameter midshaft
5	Anteroposterior diameter midshaft
6	Transverse diameter distal end
7	Anteroposterior diameter distal end

### Results and discussion

A comparison of *Bison priscus* with the small *Bison* in a cluster analysis, using the 7 measurements simultaneously clearly shows that the small *Bison* differs significantly from *Bison priscus* (Fig. 3).

The two distinct clusters within the *Bison priscus* material represents intraspecific variation, attributed to sexual dimorphism (Drees, in press). The dissimilarity between *Bison priscus* and the small *Bison* is well beyond intraspecific

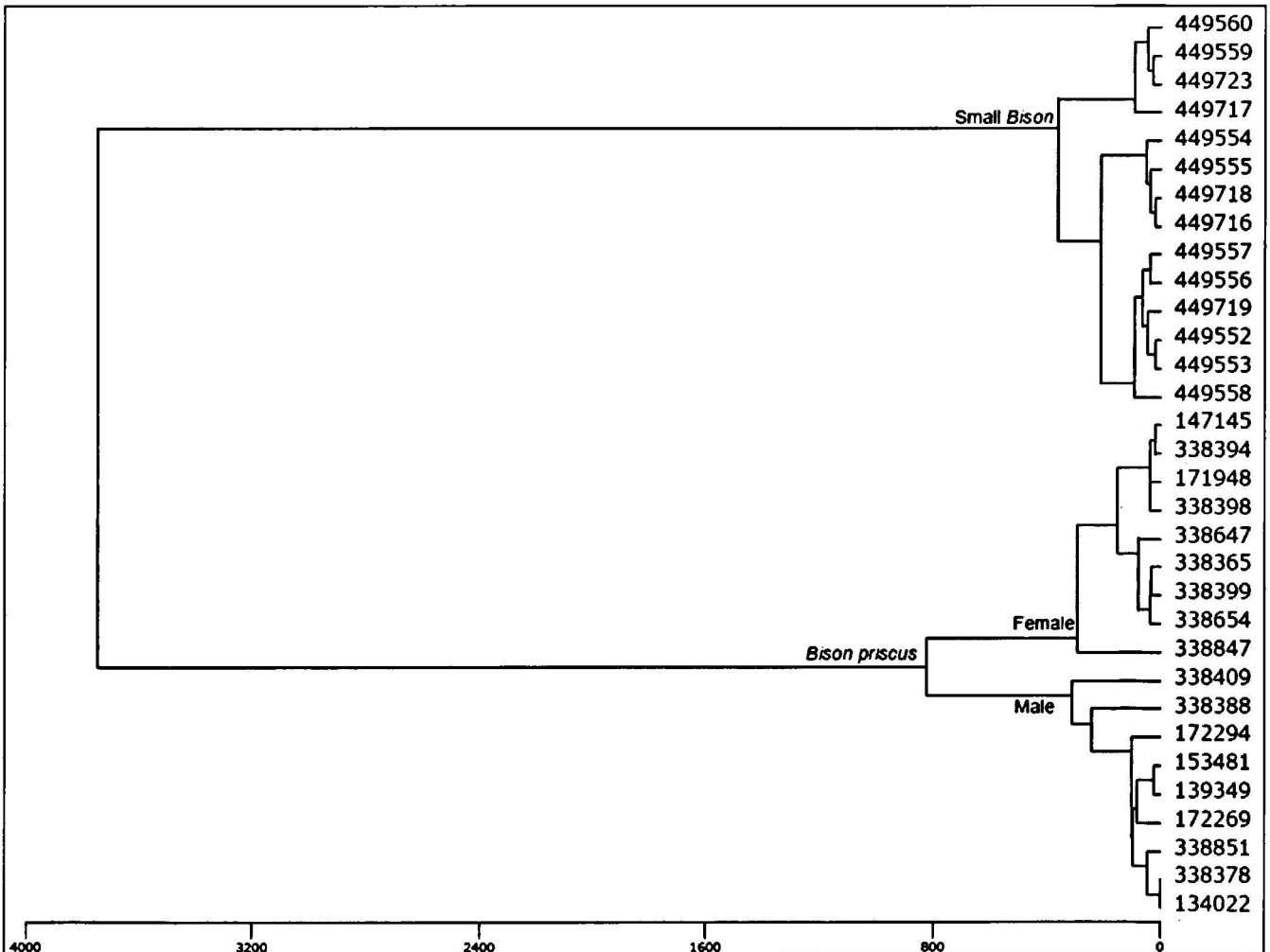


Fig 3 Cluster analysis of *Bison priscus* and the small *Bison*. / Cluster analyse van *Bison priscus* en de kleine *Bison*.

Table 1. Comparison of *Bison bonasus* with the small *Bison* from the North Sea.

Tabel 1. Vergelijking van *Bison bonasus* met de kleine *Bison* van de Noordzee.

Measurement	Female	Male	%diff	Species
<b>Greatest length</b>				
Empel & Roskosz (1963)	209,5	217,5	3,7	<i>Bison bonasus</i>
Schertz (1936b)	207,1	213,1	2,8	<i>Bison bonasus</i>
North Sea	191,5	195,4	2,0	Small <i>Bison</i>
<b>Proximal transverse diameter</b>				
Empel & Roskosz (1963)	68,7	79,8	13,9	<i>Bison bonasus</i>
Schertz (1936b)	65,3	74,8	12,7	<i>Bison bonasus</i>
North Sea	65,1	72,8	10,6	Small <i>Bison</i>
<b>Transverse diameter, mid-shaft</b>				
Empel & Roskosz (1963)	38,2	48,8	21,7	<i>Bison bonasus</i>
Schertz (1936b)	35,4	43,4	18,4	<i>Bison bonasus</i>
North Sea	39,7	46,6	14,7	Small <i>Bison</i>
<b>No. of metacarpal bones</b>				
Empel & Roskosz (1963)	13	16		<i>Bison bonasus</i>
Schertz (1936b)	4	7		<i>Bison bonasus</i>
North Sea	4	10		Small <i>Bison</i>

variation, clearly indicating that the small *Bison* is indeed a different species. The variation within the small *Bison* material also suggests the presence of sexual dimorphism.

In an attempt to determine the species of the small *Bison*, the material from the North Sea was compared with extant *Bison bonasus*, using the data of Schertz (1936) and Empel & Roskosz (1963).

Schertz (1936b) used the following formula to calculate the amount of difference between the two sexes for a particular measurement:

$$(X_1 - X_2) / (X_1 * 100) = \text{percentage difference}$$

, in which  $X_1$  = average male value and  $X_2$  = average female value.

The metacarpals of the small *Bison* from the North Sea have a smaller overall length in comparison with extant *Bison bonasus*. Other measurements are more in agreement with *Bison bonasus*. It is therefore postulated that the small *Bison* of the North Sea is *Bison bonasus*, although of rela-

tively small posture. The two groups recognized in the cluster analysis are indeed the two sexes of the small *Bison*, based on the overall agreement of the differences in comparison to those of *Bison bonasus*.

The relative paucity of the material, when compared to the abundance of *Bison priscus* fossils, suggests a markedly shorter timeframe of occupation by *Bison bonasus*; assuming that chances of preservation were not markedly different for either species. This seems in accordance with the preferred habitat of *Bison bonasus*, an open woodland environment. This type of environment developed at the transition of the Weichselian into the Holocene. While fossils of Holocene age are known from the North Sea, they are all represented in limited numbers. This observation seems to support a position during the Weichselian - Holocene transition.

## Conclusions

*Bison bonasus* has been recognized from the North Sea with a high degree of confidence, based on a comparison with metacarpalia of extinct *Bison priscus* and extant *Bison bonasus*. Variation within the *Bison bonasus* material is attributed to sexual dimorphism.

## References

- Brugal, J. P., 1994. Le bison (Bovidae, Artiodactyla) du Pleistocene moyen ancien de Durfort (Gard, France). Bull. Mus. nat. Hist. nat. 16, section C (2-4): 349-381.
- Drees, M., in press. Sexual dimorphism in Pleistocene *Bison priscus* (Mammalia, Bovidae) with a discussion on the position of *Bison schoetensacki* (Mammalia, Bovidae).
- Empel, W. & T. Roskosz, 1963. Das Skelett der Gliedmassen des Wisents, *Bison bonasus* Linnaeus 1758. Acta Theriologica 7 (13): 259-300.
- Olsen, S.J., 1960. Post-cranial characters of *Bison* and *Bos*. Papers of the Peabody Museum of Archaeology and Ethnology, Harvard University 25 (4), 61 pp.
- Schertz, E., 1936. Der Geschlechtsunterschied an Metapodien von *Bison*. Senckenbergiana 18 (11-6): 357-38.
- Sher, A. V., 1997. An Early Quaternary *Bison* population from Untermassfeld: *Bison menneri* sp. nov.. In: Kahlke, R.D. (1997). Das Pleistozän von Untermassfeld bei Meiningen (Thüringen): 101-180.
- Van Kolfschoten, Th., 2001. Pleistocene mammals from the Netherlands. Bolletino della Società Paleontologica Italiana 40 (2): 209-215.

## Contact information

Marc Drees  
marcdrees@planet.nl

Klaas Post  
klaas@fiskano.nl

Appendix

Coll. Nr	Species	1	2	3	4	5	6	7
449558	<i>Bison</i> sp.	185,18	73,30	41,50	47,40	28,70	74,00	37,16
449717	<i>Bison</i> sp.	187,03	61,99	36,83	38,14	26,57	63,36	33,31
449557	<i>Bison</i> sp.	189,81	70,71	39,35	44,50	26,93	70,86	35,56
449560	<i>Bison</i> sp.	190,54	65,03	39,14	42,19	28,66	67,93	35,83
449552	<i>Bison</i> sp.	190,67	72,08	43,87	48,79	29,16	73,13	37,03
449553	<i>Bison</i> sp.	191,30	72,98	45,59	45,65	29,65	71,83	35,44
449559	<i>Bison</i> sp.	194,03	64,80	38,50	39,73	28,90	63,65	34,24
449723	<i>Bison</i> sp.	194,23	68,66	40,33	38,81	29,49	65,56	36,06
449556	<i>Bison</i> sp.	194,73	70,05	38,67	46,99	27,94	70,78	34,35
449719	<i>Bison</i> sp.	195,64	74,39	41,90	45,47	30,31	72,72	34,62
449555	<i>Bison</i> sp.	199,34	73,33	44,97	47,88	33,28	72,40	36,89
449554	<i>Bison</i> sp.	200,99	71,15	43,39	47,08	30,54	77,23	39,09
449716	<i>Bison</i> sp.	202,88	75,00	42,20	46,57	29,09	73,25	36,76
449718	<i>Bison</i> sp.	203,34	75,19	44,23	45,55	31,40	72,09	39,05

Coll nr.	Species	1	2	3	4	5	6	7
171948	<i>Bison priscus</i>	238,0	78,0	45,0	45,0	35,0	78,0	42,0
338394	<i>Bison priscus</i>	238,0	78,0	45,0	50,0	33,0	78,0	43,0
338398	<i>Bison priscus</i>	238,0	77,0	46,0	46,0	30,0	80,0	42,0
338399	<i>Bison priscus</i>	232,0	78,0	45,0	43,0	32,0	73,0	44,0
338654	<i>Bison priscus</i>	230,0	77,0	45,0	47,0	31,0	73,0	40,0
147145	<i>Bison priscus</i>	235,0	77,0	43,0	49,0	32,0	78,0	44,0
338365	<i>Bison priscus</i>	233,0	75,0	47,0	44,0	31,0	75,0	41,0
338847	<i>Bison priscus</i>	247,0	78,0	47,0	41,0	33,0	75,0	45,0
338647	<i>Bison priscus</i>	226,0	72,0	48,0	45,0	34,0	75,0	40,0
338378	<i>Bison priscus</i>	239,0	91,0	50,0	55,0	34,0	85,0	45,0
134022	<i>Bison priscus</i>	239,0	91,0	50,0	55,0	34,0	85,0	45,0
139349	<i>Bison priscus</i>	247,0	87,0	52,0	55,0	38,0	85,0	45,0
172269	<i>Bison priscus</i>	244,0	90,0	52,0	59,0	33,0	89,0	47,0
172294	<i>Bison priscus</i>	245,0	82,0	50,0	58,0	32,0	84,0	46,0
338388	<i>Bison priscus</i>	241,0	96,0	55,0	56,0	38,0	91,0	48,0
338409	<i>Bison priscus</i>	257,0	86,0	53,0	58,0	38,0	89,0	46,0
338851	<i>Bison priscus</i>	242,0	87,0	51,0	55,0	35,0	81,0	44,0
153481	<i>Bison priscus</i>	248,0	87,0	50,0	58,0	40,0	87,0	46,0