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*Brown Bear (*Ursus arctos*) from Kainsbakke, East Jutland*

by JANE RICHTER

INTRODUCTION

Brown Bear bones from Kainsbakke demonstrate exploitation by Neolithic man. Various cut marks on the bones are definitely of human origin and illustrate utilization of bears for both food and raw material. This bone material represents the largest Danish settlement find of Brown Bear.

Brown Bear appears sporadically in the Danish subfossil record as single bog finds as well as from settlements. It appears that the bear was most common on inland sites from east Denmark in the Boreal and early Atlantic periods, after which there is a decline in the standing crop. The finds from late Atlantic and the Subboreal are mainly from coastal sites in Jylland. This seems to be caused by the development of the dense Atlantic forest combined with eustatic sea level rise caused by the Littorina transgression. This restricted the preferred habitats of Brown Bear (Noe-Nygaard, 1983). The species disappears from eastern Denmark during the Atlantic period (Degerbøl, 1933) but it survives in Jylland into the Subboreal (Spärck, 1928), probably due to immigration from the South.

The Kainsbakke settlement belongs to the Pitted Ware Culture and is located on the north-eastern part of Djursland (Rasmussen and Boas, 1982). The bear bones are retrieved from A47 (Rasmussen, 1984). The settlement is radiocarbon-dated to 2200 ± 70 b.c., uncalibrated (K-4463) (Rasmussen, in press).

NEOLITHIC FINDS

Brown Bear's first appearance is from the Allerød period (Jessen, 1924) and the youngest find is from the Germanic Iron Age. The latter is, however, represented by distal phalanges from funeral urns and therefore gives no indication of the presence of Brown Bear in Denmark as they might derive from imported skins (Winge, 1904; Møhl, 1977).

Six finds of Brown Bear have been recorded from the Danish Neolithic, Bundsø (Degerbøl, 1939), Lindø (Degerbøl, 1939), Spodsbjerg (Nyegaard, 1985), Holme Skanse (Andersen, 1983), Ørum Aa (Degerbøl, 1939) and Dræby Mark (Degerbøl, 1939). In Lindø, Spodsbjerg and Dræby Mark the finds consist of distal parts of the limb bones or canines which most likely derive

Fig. 1. Skull of Brown Bear, *Ursus arctos* (x2549). Note the injury at the back of the head. Size app. 1/3.

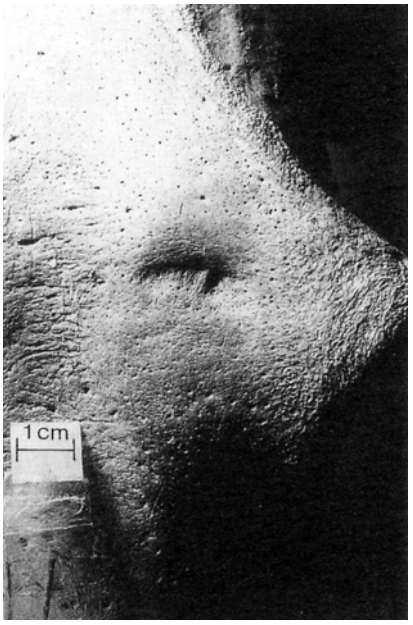

Fig. 2. Healed lesion in the forehead of skull x2549.

from imported skins and raw material. In Bundsø, Ørum Aa and Holme Skanse other parts of the skeleton are also represented and therefore establish the presence of the species in Denmark. Bundsø and Ørum Aa are however older than Kainsbakke. Holme Skanse is located in the South-eastern part of Mols. It has not been radiocarbon-dated but belongs to the Single Grave Culture and is contemporary with or perhaps slightly younger than Kainsbakke (S. Andersen, pers. comm. 1985). In Holme Skanse four fragments were retrieved. Two metacarpals, one phalanx and one fibula.

This means that Kainsbakke and Holme Skanse are the youngest records which confirm the presence of Brown Bear in Denmark. Incidentally these two localities are situated fairly close to each other.

MATERIAL

Thirty-two bones and teeth of Brown Bear were retrieved from Kainsbakke A47. They represent an estimated minimum number of individuals (EMNI) of four. The measurements taken are in accordance with von den Driesch (1976).

X 2249. An almost complete skull, broken in the median part of *os zygomaticus dextral*, the median part of *os parietale dextral* through the posterior part of *os frontale sinistral* and back to the *os occipetale sinistral*. M1 *dextral*, M2 *dextral* and P4 *sinistral in situ* (fig. 1). The three cusps of P4 show wear. M1 and M2 are moderately worn, no cusps can be recognized. Even the aboral part of M2 shows wear and folded enamel has disappeared.

The alveoli for the remaining teeth are preserved, showing that premolars P1, P3 and P4 have been present.

The sutures are obliterated except for the suture between the *os zygomaticus* and *os temporale*.

The buccal wall of the alveolus of the *sinistral* canine has been artificially broken.

The skull has a healed lesion in the *os frontale sinistral* (fig. 2).

X 2288. An almost complete skull. *Ossa zygomaticus*, anterior parts of *ossa temporalia*, *os nasale dextral* and the aboral part of *os maxilla dextral* are lacking (fig. 3). P4 *dextral* and M2 *sin. et dex. in situ*. Only the cusp of P4 show signs of wear. The meta- and paracones of the molars can be recognized. The teeth are moderately worn.

The alveoli of the remaining teeth are preserved, showing that premolars P1, P2, P3 and P4 have been present.

The following sutures are visible: *ossa premaxillare*, os *parietale – os frontale*, *os basioccipetale – os basisphenoideum*, *os squamosum – os alisphenoideum* and partly *ossa intermaxillaria*.

Distinct cutting-marks on the median part of *os frontale* (fig. 4), on *os pterygoideum dextral* and on the median part of *os basioccipetale*, just in front of *ossa exoccipetalia*.

X 2184. A skull fragment consisting of the anterior *dextral* part. *Os nasale*, *os maxillare*, *os zygomaticus* and the lateral part of *os frontale* are present together with parts of the nasal septum and nasal conchae (fig. 5).

P3, P4, M1 and M2 *in situ*. P3 shows no signs of wear. In P4 the enamel of the protocone is slightly damaged. But apparantly there is no signs of wear, while the trito- and tetracones show the very first signs of wear. In M1 the lingual part shows wear, while the para- and metacones only recently started to wear. The lingual and aboral parts of M2 are moderately worn, while meta- and paracones are slightly worn. Folded enamel is present.

The alveoli of C and P1 are preserved. M1 shows changes caused by caries in the oral part.

The following sutures are visible: *os nasale – os maxillare*, *os maxillare – os zygomaticus*, *os lacrymale – os frontale*. The sutures of the palate are difficult to interpret because of damage.

X 2552–15. A skull fragment consisting of part of *os frontale dextra* close to the orbita. – The fragment is artificially broken.

X2146–45. A skull fragment consisting of part of *pars squamosa of os temporale sinistra*. – The fragment is artificially broken.

X 2052–6. A skull fragment consisting of the aboral part of *maxilla*, *os zygomaticum* and the oral part of *os palatinum sinistra*. P4, M1 and M2 *in situ*. The fragment is artificially broken.

X 2052–127. A skull fragment covering the major part of *os frontale sinistra*. – Cutting-marks are present.

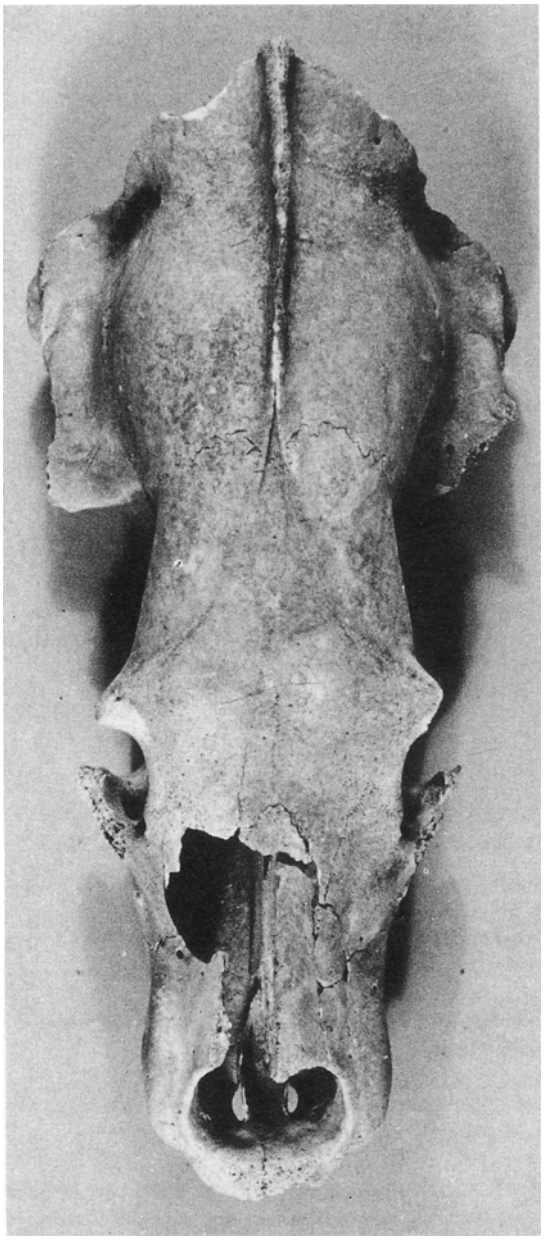

Fig. 3. Skull of Brown Bear, *Ursus arctos* (x2288). Note the injury on the forehead. Size app. 1/2.

Fig. 4. Cutting marks on the forehead of skull x2288.

Fig. 5. Skull fragment of Brown Bear, *Ursus arctos* (x2184). Size app. 1/3.

X 2269–27. A fragment of *os maxillare dextra* having P4 *in situ*.

X 2898. *Mandibula dextra*, having C, P4 and M2 *in situ* (fig. 6). The canine is moderately worn. The protoconids of P4 shows wear and all of M2 is moderately worn. No cusps can be recognized. The alveoli of the incissors, M1 and M3 are preserved. The aboral and lateral walls of the alveolus of the canine are missing.

Distinct cutting-marks on the median, basal part of the mandible, buccal side, below the position of M1 (fig. 7).

X 2765. *Mandibula sinistra*, having M1, M2 and M3 *in situ* (fig. 6). The alveoli for the incissors and the canine are slightly damaged, while P1's and P4's are preserved.

The para-, proto- and metaconids of M1 show a slight wear, while ento- and hypoconids have disappeared. In M2 meta- and entoconids can be seen. M3 is moderately worn.

The basal aboral part is missing.

X 2295. *Mandibula dextra*, having P4, M2 and M3 *in situ* (fig. 6). The

Fig. 6. Mandibles of Brown Bear, *Ursus arctos*. Above x2898 (left) and x2151 (right). Below x2595 (left) and x2765 (right). Size app. 1/3.

alveoli for the incissors and the canine are slightly damaged, while P1's and P3's are preserved.

The protoconids of P4 recently started to war. In M2 the metaconid is visible, the entoconids can be recognized, while the lingual part is moderately worn. Folded enamel is present.

The mandible was broken into three pieces, behind M3 and through the vertical ramus.

X 2151-a. *Mandibula sinistra* lacking the part oral to M1 and the most basal part of the vertical ramus (fig. 6). The molar row *in situ*. The teeth are moderately worn, only entoconids can be recognized.

Distinct cutting-marks on the oral side of the vertical ramus. *Proc. condylaris* have been cut off and the fragment show signs of burning.

X 2428–14. One isolated incissor *sup.*, *sinistra*.

X 1932–11. One isolated incissor *inf.*, *sinistra*.

X 1939–39. One isolated premolar not assignable to either side.

X. One isolated fourth premolar *sup.*, *dextra*. Moderately worn. Dimensions: length: 14 mm, breadth: 13 mm.

XX. One isolated first molar *inf.*, *dextra*. Moderately worn. Dimensions: length: 24 mm, breadth: 11,5 mm.

X 1915-a. One isolated first molar *sup.*, *sinistral*. Moderately worn. Dimensions: length: 22 mm, breadth: 17 mm.

XXX. One isolated first molar *inf.*, *sinistra*. Moderately worn. Dimensions: length: 24 mm, breadth: 12 mm.

X 1915-b. One isolated second molar *sup.*, *dextra*. Moderately worn. Dimensions: length: 21,5 mm, breadth: 16,5 mm.

X 2823–23. *Scapula dextra* consisting of the distal part including the majority of *cavitas glenoidales* and the distal part of *spina scapulae*. – *Cavitas glenoidales* has been artificially broken. Cutting-marks are present.

X 2823–14. *Scapula dextra*. A fragment of *spina scapulae*. Possibly from the same element as 2823–23. – Cutting-marks are present.

X 2552–6. *Humerus dextra* consisting of the major part of the diaphysis (fig. 8). – Cutting-marks are present. The only measurement, which could be taken is SD: 42 mm.

X 2146–5 + 2146–22. *Humerus sinistra*. A fragment of the cranial part of the diaphysis. – The fragment is artificially broken and shows cutting-marks in the proximal end.

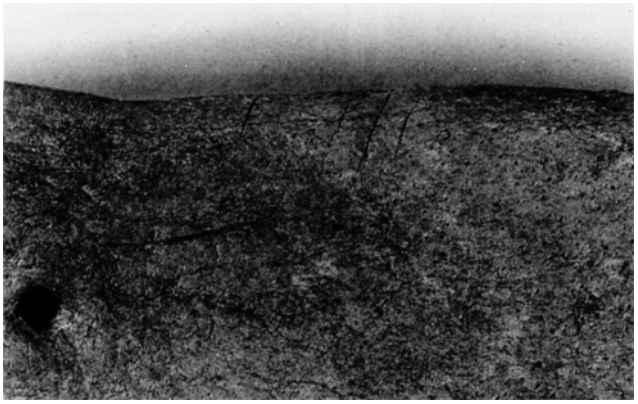

Fig. 7. Cutting marks on mandible x2898.

X 2314–5. *Humerus dextra.* A fragment of the cranial part of the diaphysis. – The fragment is artificially broken.

X 2361–33. *Humerus sinistra.* A fragment of the caudal part of the diaphysis. – The fragment is artificially broken.

X 1965–30. *Ulna dextra.* The distal part of the element. – The fragment is artificially broken.

X 3027–1. *Ilium dextra.*

X 2552–1. *Ilium sinistra.* A fragment of the acetabulum. – The fragment is artificially broken.

X 2823–34. *Os sacrum.* A fragment of the median part. – The fragment is artificially broken.

X 2552–2 *Femur dextra.* Proximal part of the diaphysis. – The fragment is artificially broken.

DISCUSSION

It is a well established fact that the Danish subfossil bone record of Brown Bear derives from individuals of a considerable size, the dimensions of which were much greater than the present population of Scandinavian Brown Bear (Degerbøl, 1933).

The dimensions of the Kainsbakke bones are compared to that of the entire Danish subfossil record of Brown Bear (Hundsø mose, Skalkendrup mose, Sværdborg, Jebjerg, Virksund, Almind mose, Mullerup, Fyns stiftsmuseum, Brabrand (Degerbøl, 1933) and Dyrhøjgaards mose (Nordmann, 1944) (table 1 and 2)).

The bones from Kainsbakke and Dyrhøjgaards mose together with a remeasurement of the dated bear skulls

Fig. 8. Humerus of Brown Bear, *Ursus arctos* (x2552–6). 1/2.

published by Degerbøl (1933) have been measured according to the definitions given by von den Driesch (1976).

The dimensions of Kainsbakke skull x 2549 are at the upper limits of the range of measurements of the earlier subfossil finds. The skull belonged to a very large individual. Kainsbakke skull x 2288 belonged to a small individual of a similar size as the Jebjerg skull. In Kainsbakke x 2184 only few measurements could be

Pollenzones	Zone IV	Zone V	Zone VI		Zone VII		Zone VIII		
	Hundsø mose	Skalkendrup mose	Sværdborg	Dyrhøjgårds mose	Jebjerg mose	Virksund	Kainsbakke X 2549	Kainsbakke X 2288	Kainsbakke X 2184
Total Length	400	390	-	395	337	-	-	343	-
Condylobasal Length	363	365	-	365	315	-	-	319	-
Basal Length	342	345	-	345	304	-	-	302	-
Basicranial Axis	96	93	-	101	78	-	-	84	-
Basifacial Axis	251	252	-	247	226	-	244	219	-
Upper Neurocranium Length	225	211	-	222	184	-	-	188	-
Facial Length	199	199	-	195	171	-	190	164	-
Snout Length	145	150	-	143	110	-	137	-	-
Median Palatal Length	196	189	-	187	174	-	182	170	-
Aboral Border of the Alveolus of M2 - Oral Border of C's Alveolus	134	142	-	133	102	-	138	123	(126)
Length of the Molar Row	63	63	-	55	56	-	60	-	56*
Length of P4	16	19	-	16	16	16	17	14	15
Breadth of P4	12	16	-	12	14	12	14	13	12
Length of M1	24	24	23	-	21	24	23	-	23
Breadth of M1	18	20	17	16	18	18	18	-	18
Length of M2	40	39	38	34	36	39	39	36	(34)
Breadth of M2	21	21	19	19	19	19	21	19	19
Greatest Breadth of the Occipetal Condyles	72	76	-	67	-	-	-	64	-
Greatest Breadth of the Bases of the Paraoccipetal Processes	175	(166)	-	(181)	-	-	-	152	-
Greatest Breadth of the Foramen Magnum	32	35	-	31	34	-	-	34	-
Height of the Foramen Magnum	26	27	-	25	29	-	-	28	-
Greatest Neurocranium Breadth	105	102	-	99	94	-	-	97	-
Least Breadth of the Skull	78	78	-	72	70	-	75	67	-
Frontal Breadth	123	139	-	123	107	-	132	96	-
Least Breadth between the Orbits	83	90	-	81	72	-	93	75	-
Greatest Palatal Breadth	94	107	-	90	89	-	101	88	-
Least Palatal Breadth	69	74	-	62	73	-	71	(68)	-
Breadth of the Canine Alveoli	(85)	(92)	-	81	(75)	-	-	76*	-
Greatest Inner Height of the Orbit	53	53	-	56	50	-	57	-	-
Skull Height	118	115	-	121	-	-	-	100	-
Height of the Occipetal Triangle	93	89	-	96	-	-	-	83	-

Table 1. Measurements of Danish subfossil skulls of Brown Bear. The measurements in the brackets are estimated, because the bones are slightly damaged. The measurements marked by an asterisk are measured along the alveolus. All measurements are in mm.

taken, but it seems to have been greater than x 2288.

Obviously the three skulls of the youngest Danish find at Kainsbakke are at the lower, the middle and the upper limits of the variation range of Danish subfossil bear.

The dimensions of the mandibles are in the middle of the range of measurements of the earlier subfossil finds and in some measurements near the upper limits. The Kainsbakke mandible x 2898 belonged to a very large individual.

In order to test whether a size gradient should exist between the oldest and the youngest Danish subfossil material of Brown Bear, teeth have been measured. The size of the teeth are independant of ontogenetic age (Degerbøl, 1933), therefore they can be directly compared. Fig. 9 shows diagrams of teeth arranged according to pollen zones. None of these diagrams show any convincing gradients, although they represent a time span of app. 6000 years. Therefore decrease in size in the Danish subfossil record cannot be verified from the present material.

Zachrisson and Iregren (1974) however find a decrease in size between modern Scandinavian Brown Bear compared with bears from 200 years old Lappish Bear Graves in Northern Sweden. They suggest that the small size of modern Brown Bear is caused by living in a suboptimal environment, to which they have been driven by intensive hunting.

ESTIMATION OF AGE

All of the skulls and mandibles from Kainsbakke have their permanent dentition. According to Couturier (1954) this happens at app. 2 years of age. If degree of tooth-wear is applied, a relative estimate of age can be given. Erdbrink (1953) mentions that the tooth-wear in the cheek-tooth row begins in the third molar, followed

Pollenzones	Zone IV	Zone V		Zone VI			Zone VII	Zone VIII			
	Almind mose	Mullerup	Skalkendrup	Sværdborg	Dyrhøjgårds mose	Fyns stiftmuseum	Brabrand	Kainsbakke X 2898	Kainsbakke X 2295	Kainsbakke X 2765	Kainsbakke X 2151
Total length	–	–	268	–	254	220	–	253	244	–	–
The Condyle Process - Aboral Border of Canine Alveolus	–	–	231	–	221	195	–	210	208	–	–
Aboral Border of Alveolus of M3 – Aboral Border of Canine Alveolus	127	–	131	123	127	113	117	117	116	120	–
Length of Molar Row	78	–	77	–	67	64	70	72	66	67	67
Length of P4	–	–	15	–	12	11	13	14	13	14*	–
Breadth of P4	–	–	9	–	7	7	–	8	7	–	–
Length of M1	(24)	24	26	26	(23)	24	25	25*	21*	24	(20)
Breadth of M1	–	10	12	12	12	11	–	–	–	12	11
Length of M2	(28)	25	27	27	(24)	23	25	25	24	24	24
Breadth of M2	–	–	17	17	15	14	14	18	14	15	14
Length of M3	(25)	23	22	22	20	18	20	20*	21	21	22
Breadth of M3	–	–	18	18	16	15	–	–	15	16	16

Table 2. Measurements of Danish subfossil mandibulae of Brown Bear. The measurements in the brackets are estimated, because the bones are slightly damaged. The measurements marked by an asterisk are measured along the alveolus. All measurements are in mm.

by the superior second molar, inferior second molar, superior first molar, inferior first molar and superior fourth premolar. The lingual cusps of the superior molars and the buccal cusps of the inferior molars start to wear. In the superior fourth molar the tetracone starts to show signs of wear, while proto- and tritocone wear much later. In the inferior fourth premolar it is only possible to recognize wear in very old individuals (Couturier, 1954). If these informations are applied to the present material their order is as follows, from the youngest to the oldest: x 2295 – x 2765, x 2184, x 2288, x 2151, x 2249 – x 2898.

Kainsbakke x 2295 and 2765 are probably left and right mandibles from the same individual. The mandibular symphyses fit together and they show the same degree of tooth-wear.

Whether skull x 2249 or mandible x 2298 is the oldest cannot be decided on tooth-wear. No cusps can be recognized in any of the molars of these two elements.

Suture closure of the skull could elucidate the age determination. However, on account of its fragmentary condition x 2184 is difficult to interpret. In x 2288 the basioccipetale – basisphenoideum is not obliterated, while the intermaxillare suture is partly closed. According to Giles (in: Zachrisson and Iregren, 1974) the former coalesces in males at the end of the sixth year, while the latter closes between the age of six to eight years. So this individual is probably between six and eight years old. In x 2249 all of the sutures are closed, except for zygomaticum – temporale. Couturier (1954) states that most of the sutures are obliterated at the age of 18 to 20 years, except for zygomaticum – temporale, which never closes.

From the present material it can only be stated that it belonged to adult individuals of more than two years and that the oldest was more than eighteen years old.

INTERPRETATION

From the record of Danish subfossil Brown Bear it has not been possible to establish if the bears were utilized for consumption and raw material. It is suggested that phalanges found in funeral urns from the Germanic Iron Age come from hole skins, possibly imported (Møhl, 1977). The present material from Kainsbakke, however, has several traces of human origin which might give a clue as to the purpose.

Evidence of how the bears were killed is not obvious in the Kainsbakke material. In one skull (X 2288) there is a hole in the dextral maxilla and the dextral nasale is missing (fig. 3), an injury which could have been inflicted by a blunt instrument. This could not have been fatal, but perhaps left the bear unconscious, after which it would have been easy to stab it to death. However, it cannot be discounted that the injury reflects post-depositional damage.

From Swedish bear hunting a few hundred years ago there is evidence that the bears were killed during winter by awaking them in the winter dens, inflict a blow on the head of the bear and thereafter stab them to death or shoot them (Zachrisson and Iregren, 1974).

A similar technique is possible at Kainsbakke, regarding the fact that the site (also) was used during the winter season (Richter, in prep.) and that even Danish Brown Bear must have been denning due to their feeding strategy, based partly on vegetable food.

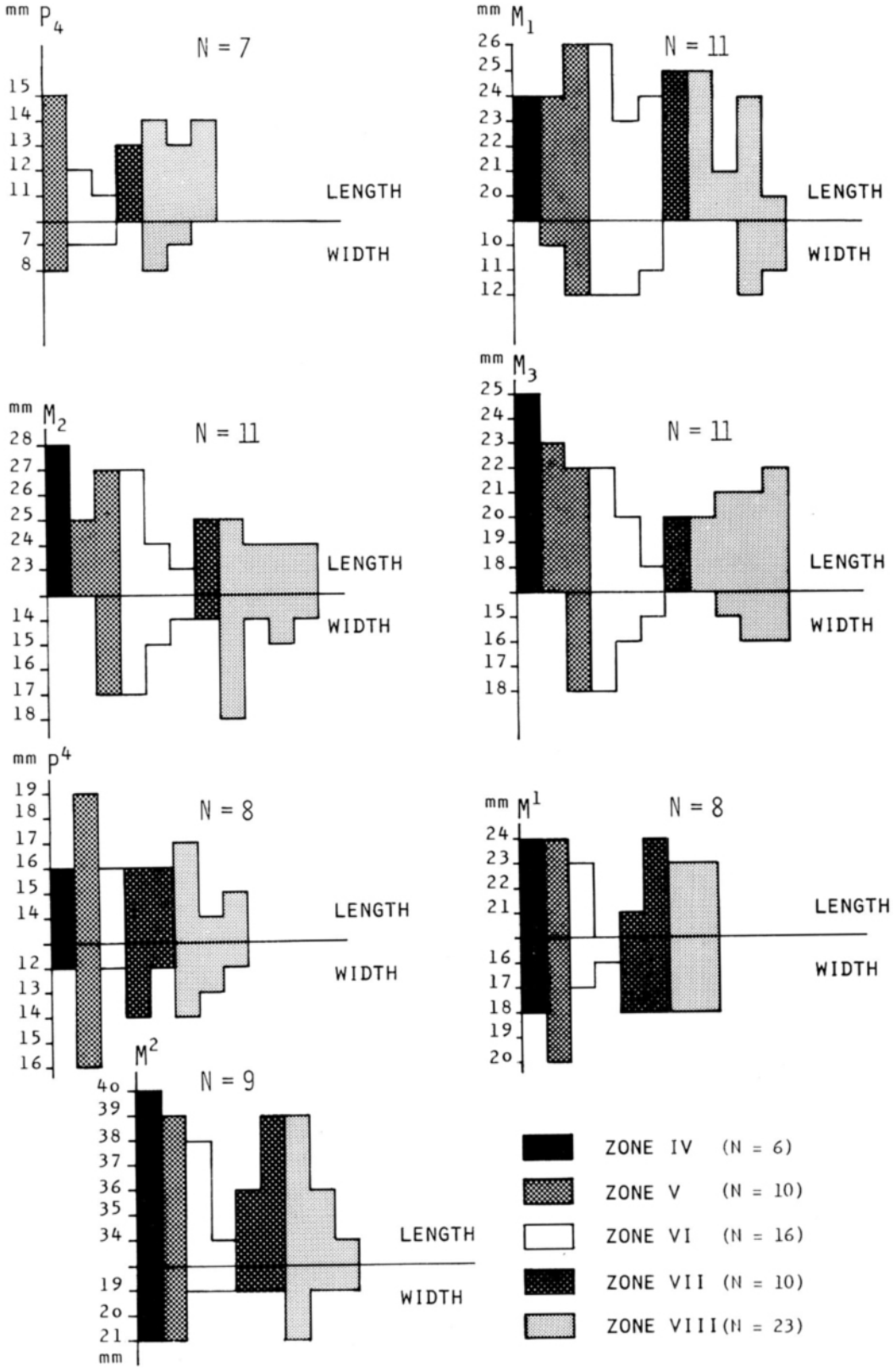

Fig. 9. Dimensions of teeth of Danish subfossil Brown Bear arranged according to pollen zones. The upper portion of the diagram shows the lengths of the teeth measured in mm, while the lower portion of the diagram shows the width of the teeth. The diagrams do not show any convincing gradients which could verify a decrease in size in the Danish subfossil record.

Fig. 10. Canine alveolus of skull x2249. The alveolus has been deliberately broken in order to remove the tooth.

The injury at the back of the head of skull x 2549 (fig. 1) seems to have been inflicted by a series of blows. This does not seem to be the cause of death. The systematic nature of the blows indicate that the damage is more likely to be post-mortem in order to get access to the brain. Further, this skull has a healed lesion in the forehead. Whether it was caused by an earlier hunting injury, intraspecific strifes or by accident is not obvious. Radiographs of the lesion did not give any further clues as to the cause of the lesion.

Cutting-marks in connection with skinning are seen on skull x 2288 (fig. 4) and mandibles x 2898 (fig. 7) and 2151. These individuals have undoubtedly been skinned. No phalanges are found at the site. This could be a further indication for skinning as these elements usually are left in the skin.

Canines seem to have been used as raw material or pendants. In skull x 2549 the alveolus has been deliberately broken in order to remove the canine tooth (fig. 10). Whether other teeth have been used is not obvious in the present material. No incissors are *in situ*, but they are usually lost during burial and /or diagenesis. However, premolars and molars *in situ* are so numerous together with one canine that they cannot have been regarded as valuable.

Only few bones of the post-cranial skeleton are represented (fig. 11). The limb bones are marrow fractured and the fracture of one of the humeri (upper arm) (x 2552–6) having very sharp edges, indicates that the bone was divided before removal of the meat (Noe-Nygaard, pers. comm. 1983). Post-depositional fragmentation can be excluded in this case. Due to the meticulous excavation, fragments caused by post-depositional fragmentation are retrieved within the same square and can be reassembled. Cutting-marks are scattered on several of the fragments e.g. the scapula (shoulder blade), suggesting that the meat was scraped off. The nature of the fragments definitely indicates that they are meal remnants.

The evidence from Kainsbakke would suggest that the bears have been treated in a similar manner as other game animals. The bear bones have even been deposited in the dump together with the rest of the refuse from the settlement. Throughout the circumpolar region rites associated with bears have been found e.g. a special grave for the bear, often with the bones placed in their anatomically correct position (Zachrisson and Iregren, 1974). However, the treatment of the bone material from Kainsbakke has no similarities with the bones from these rites and the bones show no signs of having been used in any form of ritual.

CONCLUSIONS

The bone material of Brown Bear from Kainsbakke represents the largest Danish settlement find of the species. Together with Holme Skanse it is the youngest find, which establishes the presence of the species in Denmark up to 2500 B.C. (calendar years).

It is suggested that the bears were hunted during the winter season, in connection with denning. Human-

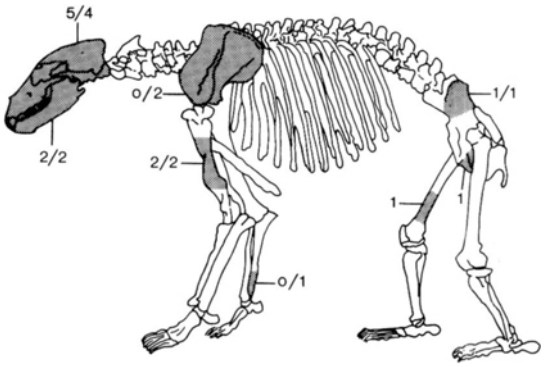

Fig. 11. Skeleton of Brown Bear showing the type (dots) and number of bones found at the Kainsbakke site. White areas indicate bones or fragments which have not been found at the site. The figures to the left of the dividing line indicate number of fragments found from the left side and the figures to the right indicate fragments found from the right side of the animal. Redrawn from Kurtén (1976).

made marks on the bones show that the animals were extensively utilized for skin, teeth and food. The bones show no indication of bear rituals.

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