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ELISABETH IREGREN, BERTIL RINGBERG
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THE SKELETON, ITS AGE AND ENVIRONMENT

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ABSTRACT

Iregren, E., Ringberg, B. and Robertsson, A.-M., 1990: The brown bear (*Ursus arctos* L) find from Ugglarp, southernmost Sweden. The skeleton, its age and environment. Sveriges geologiska undersökning, Ser. C 824, 51 pp. Uppsala 1990. ISBN 91-7158-486-2.

In 1890–1893 a complete brown bear skeleton was found close to the village of Ugglarp in the province of Skåne in southernmost Sweden. The skeleton came to light in a ditch between two small fens in the hummocky moraine region south-east of Malmö. The skeleton has been reinvestigated for osteological assessment and dating by means of pollen analysis and radiocarbon determination.

The bear skeleton was radiocarbon dated by an accelerator to 9 355±130 B.P. A small piece of gyttja from a tooth alveolus of the bear proved to contain a pollen spectrum which can be placed in the Preboreal zone. Pollen analysis of the sediments where the skeleton was found indicated an open birch forest mixed with junipers, willows and herbs. A favourable climate is demonstrated by the presence of meadow-sweet *(Filipendula)* and the water plants myriad leaf *(Myriophyllum verticillatum)* and reed-mace *(Typha-Sparganium)*. The spread of hazel is reflected in the pollen flora.

The brown bear was an old male with some pathological changes such as scapula and pelvis fractures. Its size is compared with subfossil finds in Denmark and Skåne and with finds from the last millennium. For numerical reasons it cannot be said that there are any size changes from the Preboreal to the Subboreal period. Moreover, the subfossil finds are too few to be tested against younger bear samples. Thus, the question of postglacial dwarfing in the brown bear has not been solved. Until further finds are dated and evaluated the Ugglarp bear is thought to belong to the same subspecies as the recent Scandinavian bear *Ursus arctos arctos* L.

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INTRODUCTION

In autumn 1890 the skull and some other bones of a bear were found during ditch-digging close to the village of Ugglarp in the province of Skåne, southernmost Sweden. N. Mårtensson in Alstad collected the bones and initiated the investigation of the find. N.O. Holst and J. Jönsson from the Geological Survey of Sweden visited the locality in summer 1893 and succeeded in finding the remainder of a complete brown bear *(Ursus arctos)* skeleton. The skeleton was kept in the museum of the Geological Survey in Stockholm, partly on exhibition, but has since 1984 been on view in the museum at the local branch office in Lund. This paper is dedicated to the memory of N. Mårtensson, N.O. Holst and J. Jönsson 100 years after the find of the bear which is unique in a Swedish perspective. This is the oldest brown bear find in Sweden and consists of a complete skeleton. In the present work Elisabeth Iregren is responsible for the osteological investigations, Ann-Marie Robertsson for the pollenanalytical study and Bertil Ringberg for the field work and description of the geology at the site.

THE POSITION, TOPOGRAPHY AND GEOLOGY OF THE SITE

The site where the bear skeleton was found at Ugglarp, 22 km SE of Malmö, was described by Holst (1902). The place was also marked on the old geological map of Trelleborg (Westergård 1912) and was located in 1988 when a stratigraphical investigation was made (Fig.1).

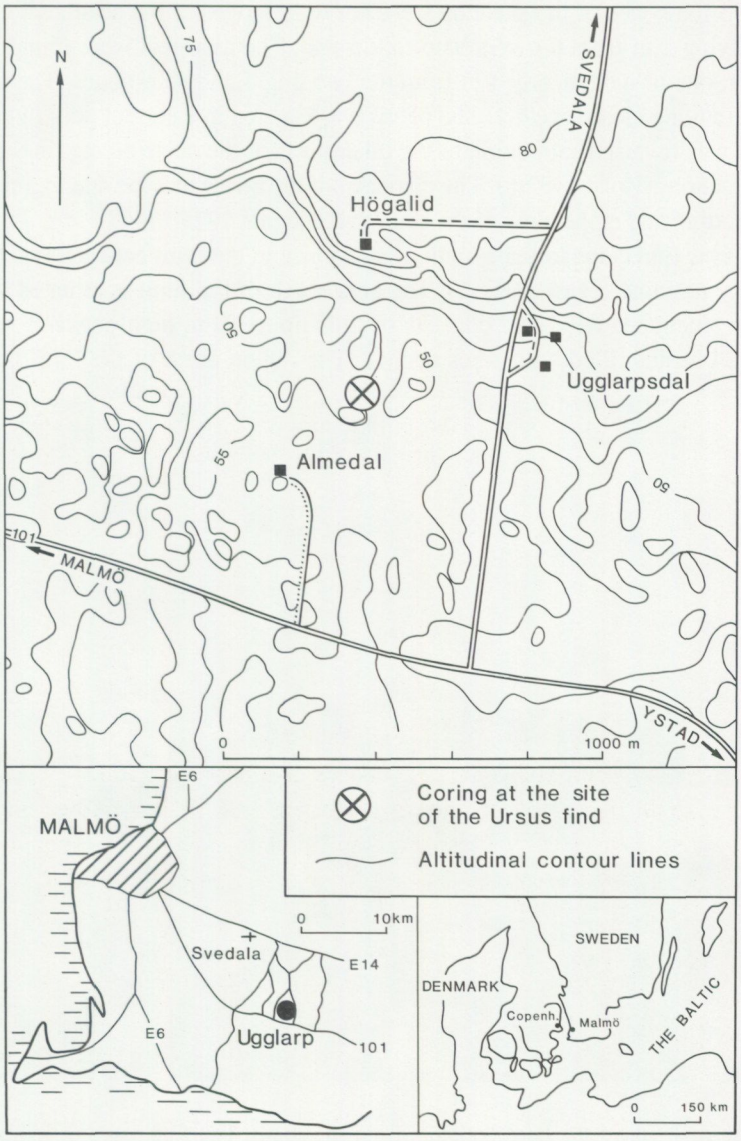

Fig. 1. Topography of the area around the find site of the bear skeleton in south-west Skåne. Drawing: Christin Andréasson.

The locality is situated 250 m NE of the farm at Almedal in a ditch between two small fens. The basins are now filled with water. The ditch is today filled in and there is no peat left between the two basins. Therefore the coring in 1988 was made where it was possible to find an undisturbed stratigraphy i.e. 7 m east of the shore of the southern small basin. The basin is today situated in a cultivated field and surrounded by shrubs (Fig. 2).

In 1893 the bones of the skeleton were not found together but scattered. One hind foot was lying 2 m from the vertebrae first found. The hind feet were found far from each other, one of them nearly 1 m from the two thigh- and shin-bones. The last mentioned were lying close together. The pelvis was situated in a correct dorso-ventral position but was reversed in relation to the other parts of the skeleton e.g. in the cranio-caudal direction (Holst 1902:6). The dispersal of the bones may be due to a process of floating, rotting and embedding of the carcase (Liljegren 1975:17–18).

The *Ursus* find came to light south of, and close to the limit between two different hummocky moraine regions (Fig.1). The area south of the limit is situated 40–55 m above the recent sea level and consists of hills up to 10 m high between which are many small basins filled with lakes or fens. The region north of the limit is situated

Fig. 2. The find site of the bear skeleton, from the south. The find came to light in a ditch between the two basins. A boring was made in 1988 close to, and east of the basin in the front of the photograph. Photo: Bertil Ringberg.

60-90 m above sea level and includes 25–50 m high moraine hills, in certain areas covered with glaciolacustrine clay, so-called plateau-clay (Westergård 1906). The upper till bed in both the described hummocky moraine regions is a clayey sandy till or clay till with a clay content of 5–25 %. The distribution of the different Quaternary deposits at the ground surface in the investigation area is shown in Fig. 3.

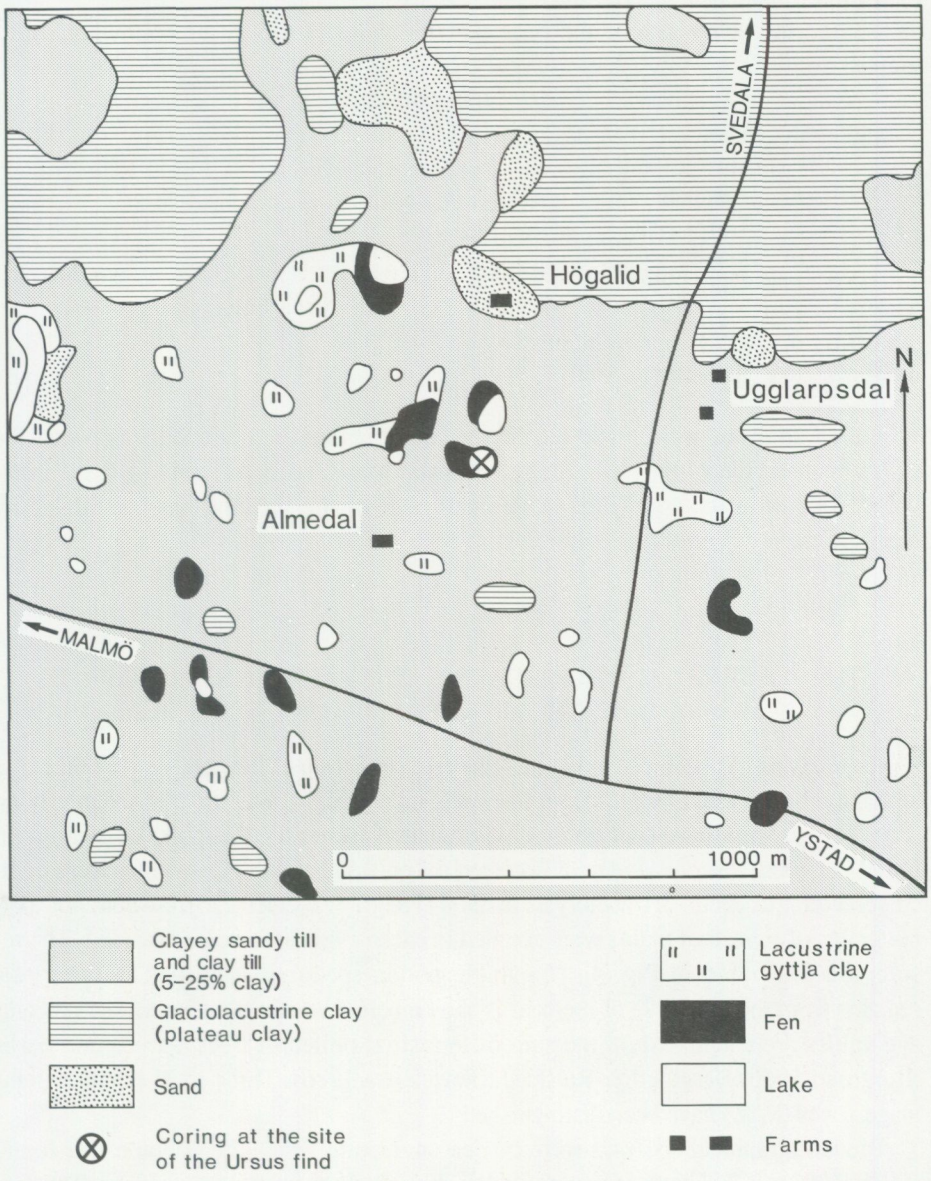

Fig. 3. The Quaternary deposits of the area around the find site of the bear skeleton (compiled after Daniel 1977 and Ringberg 1980). Drawing: Christin Andréasson.

The glacial Quaternary deposits were formed during the Late Weichselian (Daniel 1977; Ringberg 1980 and 1988). The final deglaciation of the hummocky moraine region south-east of Malmö took place during the Bölling chronozone (Robertsson 1973: 13) but dead-ice remained in the area until the Older Dryas (Robertsson *in* Ringberg 1980, Fig. 52) and the Alleröd chronozones (Nilsson 1935:430–432, 476–480; Lemdahl 1988; Liedberg Jönsson 1988).

The coring at the site of the bear skeleton (Fig. 1) shows the following stratigraphy:

0–0.50 m	Top soil, reworked from the surrounding hills
0.50–2.05 m	Fen peat
2.05–2.70 m	*Carex* peat
2.70–3.00 m	Gyttja
3.00–3.42 m	Clay gyttja
3.42–3.54 m	Gyttja clay
3.54–3.63 m	Clay, rich in humus
3.63–3.73 m+	Till, clayey sandy

Pollen analyses were made on samples taken around the boundary between the *Carex* peat and the gyttja where the skeleton was found, i.e. corresponding to the interval 2.6–3.0 m in the core (Fig. 4). A small bone of the skeleton has been dated by means of the accelerator (see below).

THE POLLENANALYTICAL DATING, THE PALAEOENVIRONMENT AND THE PREBOREAL FAUNA

Pollen analysis has been carried out for the reconstruction of the palaeoenvironment in which the bear lived. Samples from the gyttja layer and the lower part of the overlying sedge *(Carex)* peat have been analysed. Fortunately, some small remains of gyttja were found in a tooth alveolus and could be used for pollen analysis. All samples were treated according to Erdtman's acetolysis method (Faegri & Iversen 1975). About 400 pollen grains of terrestrial plants were counted in each of the 10 samples analysed. The results are illustrated in Fig. 4. The single pollen spectrum identified in the gyttja remains from the mandible of the bear is shown below the main diagram. The percentage values are calculated on the sum of terrestrial pollen of trees, shrubs and herbs (Berglund 1966; Berglund & Ralska-Jasiewiczowa 1986). Three local pollen assemblage zones (PAZ) have been distinguished.

Biostratigraphical analyses were carried out already when the skeleton was found (Holst 1902). P.T. Cleve investigated the diatom flora in the gyttja layer. The frequency was low, but nearly all the diatoms identified are so-called clear-water

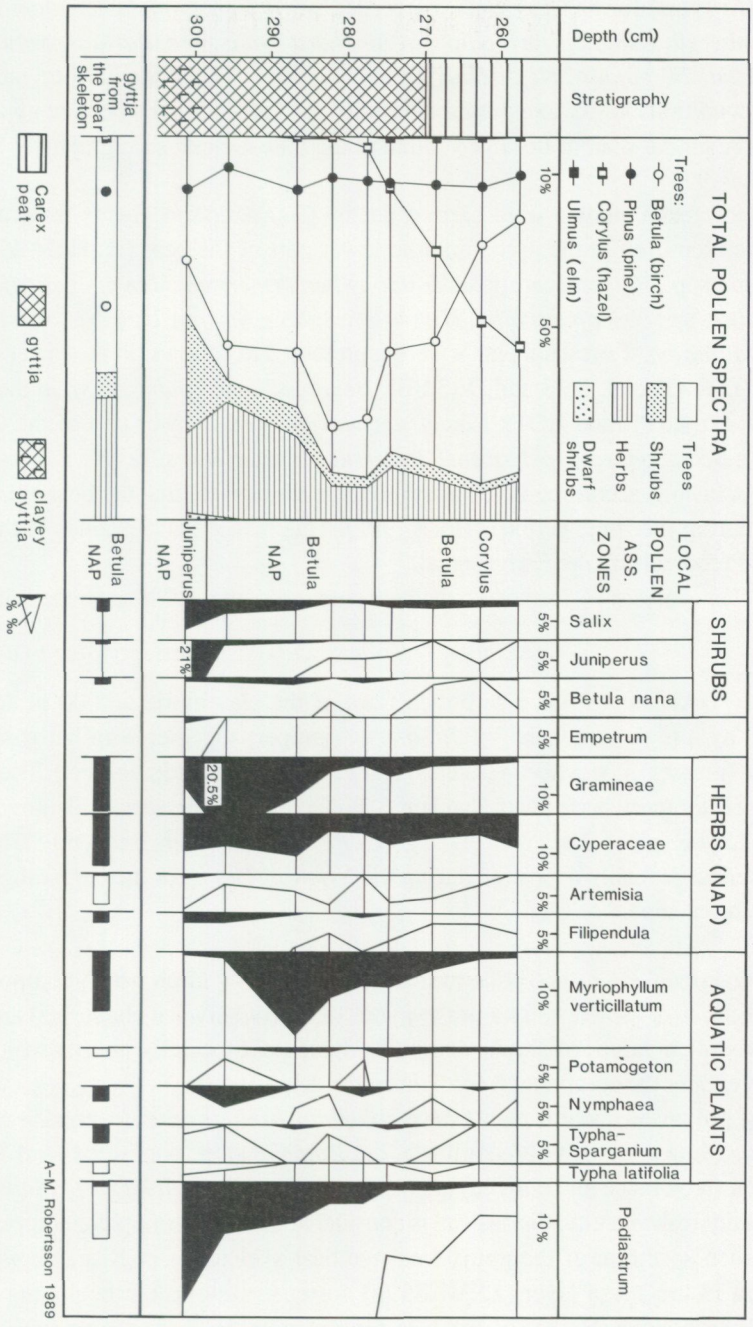

Fig. 4. Pollen diagram from the coring at the site of the bear skeleton. The main components of the pollen flora are included. Drawing: Christin Andréasson.

(Arenaria/Ancylus) forms. The species recorded were: *Gyrosigma attenuatum, Cymbella ehrenbergii, Cymatopleura elliptica, Amphora ovalis, Fragilaria pinnata, Navicula gastrum, N. pupula, N. tuscula and N. vulpina.* The diatom flora indicates eutrophic conditions in the lake during the end of the Late-Glacial when the gyttja was deposited. A similar diatom flora was found in the Late-Glacial stratigraphy at Skurup (Robertsson 1973).

The macrofossil studies were carried out by G. Andersson. Seeds from aquatic plants were identified in the gyttja and the lower part of the peat (cf. Holst 1902:8): *Potamogeton* spp., *Batrachium* spp., *Ceratophyllum demersum, Menyanthes trifoliata, Myriophyllum* sp., *Nymphaea alba, Hippuris vulgaris, Scirpus lacustris, Carex* spp. and *Sium latifolium.* Terrestrial plants were represented as follows: in the lower part of the gyttja (Late-Glacial, DR3 and DR3/PB): *Betula odorata (pubescens),* in the upper part of the gyttja (PB and BO1): *Empetrum nigrum,* in the lower part of the *Carex* peat (BO1): *Betula odorata (pubescens), B. verrucosa* and *Pinus silvestris.*

The conclusions according to the macrofossil remains were that the bear at Ugglarp had lived during the "pine period" (Holst 1902). This biozone corresponds to the later part of the Preboreal and the Early Boreal.

The pollen analyses performed on the new core sampled in 1988 gave the following results:

Juniperus – NAP local PAZ. The pollen flora of the clay gyttja at 3.00 m depth is dominated by a high percentage of *Juniperus* (juniper) together with herbs such as *Gramineae* (grasses), *Cyperaceae* (sedges) and *Filipendula* (meadow-sweet). The dwarf shrub *Empetrum* (crowberry) was also noted. Pollen of trees are represented by *Betula* (birch) and *Pinus* (pine). The green algae genus *Pediastrum* occurs frequently. The clay gyttja was most probably deposited during the Younger Dryas, or the beginning of the Preboreal chronozone.

Betula – NAP local PAZ. The pollen flora is dominated by birch which composes up to 75 % of the total pollen spectra in the gyttja sediment between about 3.00 and 2.75 m (Fig. 4). Pollen values of shrubs and herbs decrease, especially juniper which was not able to endure the competition for light in the dense forests.

Among pollen of aquatic plants *Myriophyllum verticillatum* (myriad leaf) and *Nymphaea* (white water-lily) predominate, but *Potamogeton* (pondweed) and *Typha-Sparganium* (reed-mace and burreed) are also present. *Myriophyllum verticillatum* prefers eutrophic freshwater conditions and is considered to be a thermophilous species.

The pollen spectrum of the gyttja from the bear skeleton is comparable with the pollen flora in the gyttja layer (2.95-2.85 m) corresponding to the beginning of the Preboreal chronozone. Pollen of birch is present with 45 % and pine with 15 %. Shrubs and herbs reach about 40 % of the total pollen flora. Pollen of *Myriophyllum verticillatum, Typha-Sparganium* and *Nymphaea* are frequent.

Corylus – Betula local PAZ. The uppermost part of the gyttja and the lowermost part of the *Carex* peat were deposited during early Boreal time when *Corylus* (hazel) immigrated after 9 500 B.P. (T. Nilsson 1961; Digerfeldt 1982; Thelaus 1989). Pollen of hazel occurs above 2.80 m and reaches very high values (c. 50 %) around 2.60 m depth. At the same depth some single pollen grains of *Ulmus* were noted. Pollen of shrubs and herbs together compose 10–18 % of the spectra.

In the pollen spectrum of the gyttja from the bear skeleton only 0.5 % *Corylus* was observed and no pollen grains of *Ulmus* (Fig. 4), which also supports the early Preboreal age of the gyttja found on the skeleton. Skeletons of bison found in Skåne have also been pollen-analytically dated to the same time interval (Fredskild 1966).

The vegetational development in western Skåne during the Preboreal is well documented by biostratigraphical investigations (Nilsson 1961; Berglund 1971; Robertsson 1973; Lemdahl 1988; Liedberg Jönsson 1988).

The transition from open vegetation dominated by shrubs and herbs to birch forests with some pine took place during this period. Changes of the vegetation within the lakes are also clearly reflected by the occurrence of several aquatic plants.

The Preboreal Fauna. The vegetational development during the Preboreal period is fairly well-known. Our knowledge of the fauna in Scandinavia, however, is limited. A picture based upon subfossils and archaeological finds from Skåne, Denmark and North-West Europe supplemented by ecological deductions is given as background to the Ugglarp brown bear find. This account is based on the following main works and the literature these authors mention. One single species, the bison, has been studied by Fredskild (1966). Information on the aurochs has been collected from Fredén (1984) and Ekström *et al.* (1989).

The most extensive work on faunal history in the Scandinavian peninsula is the volume by Sven Ekman (1922). In view of the age of his synthesis it has not been used here. The subfossil finds in Skåne have been treated by Liljegren (1975). Lepiksaar (1986) has recently summarized his wide knowledge of faunal history and includes finds from Sweden dated to the late Preboreal and Early Boreal periods. Aaris-Sørensen (1989) has presented an extensive study on the development since the Weichselian glacial of the climate, landscape, flora and fauna of Denmark.

The climate during the Preboreal period was very similar to that of today but a part of the Scandinavian peninsula was still covered by ice. As the Boreal period approached the summer temperature rose and became higher than today, while the winters had the same temperature as nowadays. The land bridge between Sweden and Denmark (Fig. 18) was important for the existence and spread of both flora and fauna.

As can be seen from Figure 4 the forests were dominated by birch and pine. A great many herbs and shrubs grew there, such as willows and junipers, thus creating an open birch forest. In these forests, alongside the rivers and small lakes many of the present animal species lived. Table 1 is a summary of the current knowledge about the fauna.

The bears had hardly any enemies, apart from man. The flora was rich, thus providing extensive nourishment for an omnivorous animal. Further more, the winter climate in Skåne created no hard hibernating conditions for the bears.

Table 1. Evidence of terrestrial mammals during the Late Preboreal and the Early Boreal periods.

Species		Evidence from Skåne	Sweden	Denmark	N. Europe	Probable Scandinavian
Wild boar	*Sus scrofa*		x	x		
Elk	*Alces alces*	x	x	x		
Red deer	*Cervus elaphus*	?	x	x		
Roe deer	*Capreolus capreolus*		x		x	
Reindeer	*Rangifer tarandus*	x	x			
Bison	*Bison bonasus*	x				
Aurochs	*Bos primigenius*	x	x	x		
Brown bear	*Ursus arctos*	x	x	x		
Wolf	*Canis lupus*		x		x	
Arctic fox	*Alopex lagopus*					x
Red fox	*Vulpes vulpes*		x		x	
Stoat	*Mustela erminea*					x
Weasel	*Mustela nivalis*					x
Pole cat	*Putorius putorius*					x
Pine marten	*Martes martes*				x	x
Badger	*Meles meles*		x		x	
Otter	*Lutra lutra*				x	x
Wild cat	*Felis silvestris*		x		x	
Lynx	*Lynx lynx*				x	x
Hedgehog	*Erinaceus europaeus*				x	x
Hare	*Lepus* sp.		tim.		x	
Beaver	*Castor fiber*		x	x		
Squirrel	*Sciurus vulgaris*					x
Bank vole	*Cleithronomys glareolus*		x			
Northern vole	*Microtus oeconomus*		x			
Field vole	*Microtus agrestis*		x			

THE RADIOCARBON DATING OF THE SKELETON

A second phalanx from the right, front paw of the bear has been dated by the tandem accelerator at the The Svedberg Laboratory, Uppsala University.

After cleaning, washing and crushing (mechanical treatment) the HCl-method was used as pretreatment (Olsson *et al.* 1974). A correlation corresponding to ^{13}C = –21‰ PDB has been made. The age in radiocarbon years was 9 355±130 (Ua –1287). The result is in good agreement with the pollenanalytical dating. The radiocarbon dating is thought to be reliable as the collagen product from the bone is of good quality and the bone does not seem to be influenced by external factors.

THE UGGLARP BEAR SKELETON, EARLIER RESULTS AND COMPARISON WITH THE PRESENT INVESTIGATION

COMPOSITION OF THE SKELETON

The Ugglarp bear skeleton is almost complete (Fig. 5). In Denmark a similar find came to light in Dyrhøjgårds Mose, Røsnæs, Sjælland. That bear is somewhat younger and dates back to the transition between the Boreal period and the Atlantic period, c. 8 000 B.P. (Nordmann 1944:70). To facilitate the understanding of the following osteological chapters a drawing of a bear with anatomical definitions is included (Fig. 6).

The Swedish find from Ugglarp has been on exhibition in Stockholm. Apparently some damage occurred during the display. It is not possible to say exactly what parts have disappeared but some comments can be made.

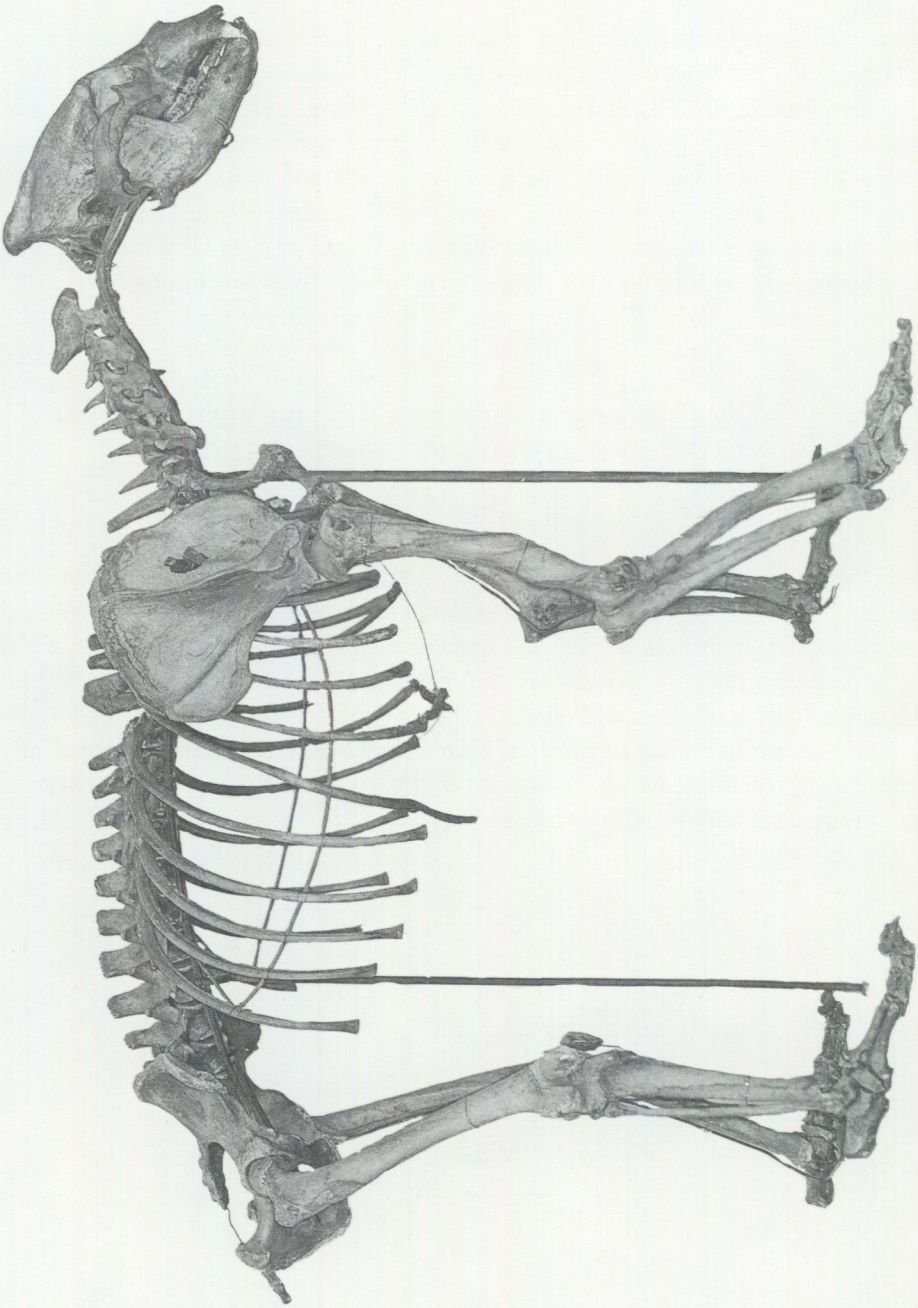

Fig. 5. The mounted brown bear skeleton from Ugglarp, Anderslöv parish, Skåne. Photo: Sven Stridsberg.

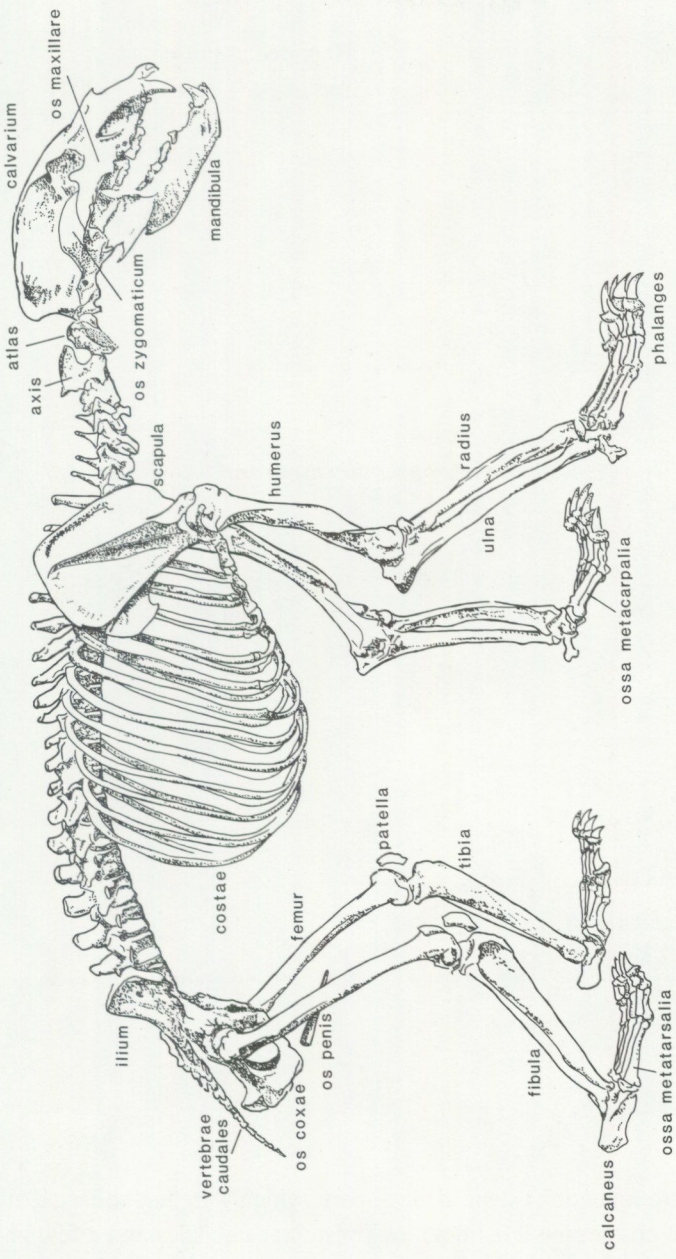

Fig. 6. A bear skeleton with anatomical definitions included. Redrawn from Blainville (1839-64). Drawing: Christin Andréasson.

Table 2. Missing skeletal elements of the Ugglarp bear.

Elements missing in 1989	Reported as present (x), missing (–) by Holst (1902)
Atlas	
Costae	–
Vertebrae caudales	
Maxilla;	
Incisivi 6	–
Caninus sin,	x
P1-P3 sin,	
M1 sin	
P1-P4 dext	
Mandibula;	
Incisivi 6	–
P1-P4 sin,	
M3 sin	–
Caninus dext,	x
P1-P3 dext,	
M1 dext	
Fibula sin	–
Os penis	x
Metacarpalia, metatarsalia	
Os metacarpale 2 sin et 3 dext;	x
Os metatarsale 1 dext, 4 sin et 4 dext	
Phalanges	–

Holst (1902:69) mentions some skeletal parts which were not collected at the find site; a couple of costae, the left fibula, two vertebrae caudales and a few phalanges. Further, a number of teeth were not found (see Table 2). Apparently, all four canini were preserved when the bear was found but now only two remain.

It can be seen from the mounted skeleton that more parts of the paws have been preserved, as metal strings show where further bones were attached. Judging by Holst's

text all metapodials were present from the beginning. Now two metacarpals and three metatarsals have disappeared. Phalanges from the right front and hind paws are missing. Evidently, visitors to the Museum in Stockholm have removed these small bones, as they are relatively easy to dislodge. Further, prominent teeth such as the canini have also been stolen.

Most regrettable is the disappearance of the baculum/os penis, as this bone easily reveals the sex of the bear to the spectator as well as the scientist.

This damage shows some problems with subfossil finds on display. Now the bear skeleton in the exhibition of the Geological Survey of Sweden in Lund is protected by a show-case.

THE SEX, SIZE AND AGE OF THE BEAR

It is well known that a sexual dimorphism exists in the brown bear (Rode 1935:35-37; Koby 1949:681). Kurtén (1955) discusses this matter in detail. Zachrisson and Iregren (1974:68–69, 72) follow the question of sexual dimorphism in the recent Swedish brown bear. They demonstrate significant differences between the sexes in eight different measurements of teeth, tooth rows, cranial lengths and breadths. Others, such as Noe-Nygaard (1983:321), doubt the existence of sexual dimorphism in bear.

The presence of an os penis makes the sex determination easy in the case of the Ugglarp bear. Regarding the cranial measurements (Table 3) the following can be said vis-à-vis recent male bears from Sweden. Definitions of all measurements can be found in Tables 13a-c in the Appendix. All the measurements of the Ugglarp bear exceed the maximum values of recent males except the length of the muzzle (Prosthion – Middle of frontal) and the breadth of the upper caninus. These values exceed the mean values, however. On the other hand, Zachrisson & Iregren (1974:76-78) and Iregren (1989) have shown that the bears of modern Sweden have diminished in size as compared with individuals from the 18th and 19th centuries.

Table 3. Cranial measurements (mm) of the brown bear from Ugglarp.
Definitions from von den Driesch (1976:42–46, 60–62 U=Ursus) and from *Zachrisson & Iregren* (see numbers in italics) (1974:44–45).

Calvarium

No	sin	dx	No	sin	dx	No	sin	dx
1	368		2	339		3	321	
4	125		5	197		7	199	
9	157		12	121		13	176	
15	95.9	95.0	16	54.5	55.0	17	40.0	–
U16a	17.0	–	U16a	12.5	–	U16b	–	(21.5)
U16b	–	(17.5)	U16c	(34.0)	(33.5)	U16c	(20.0)	(19.5)
19	16.5	–	23	181		24	159	
25	73.0		27	38.0		28	18.5	
29	95.5		30	233		31	89.0	
32	115		33	79.5		34	92.0	
35			40	93.5		*22b*	56.0	
26	91.0		*27*	82.0		*28*	144	
29c	78.5	78.5	*29d*	72.5	72.0	*31c*	24.0	–
36	19.5	19.5	*39*	33.0	32.5	*41a*	13.5	–
15a	92.0	96.5	*43*	20.5	18.0	*44*	20.5	18.5

Mandibula

No	sin	dx	No	sin	dx	No	sin	dx
1	(253)	(252)	3	234	233	4	218	216
5	197	197	7	123	122	8	118	119
9	94.0	-	U9	71.0	71.0	11	45.0	49.0
48b	194	194	U14	110	108	U15	47.5	47.5
51	43.5	46.5	U8	87.0	83.0	*58*	20.5	–
U12	(25.0)	(24.5)	*60*	24.5	24.5	U12	(15.0)	(16.0)
U11	22.0	-	14	22.0	22.5	U11	(11.5)	–
U13	-	(22.5)	*66*	20.5	(21.5)	U13	-	(16.5)
68	(23.0)	-	*69a*	16.5	18.0	*69b*	14.0	–
71	52.5	51.0	*71a*	(35.5)	38.5	17	22.5	22.0
73	55.5	57.5						

Compared with the bears from the 18th and 19th centuries (Zachrisson & Iregren 1974: Tab. 16) nine of the Ugglarp cranial values exceed the maximum values and nine the mean values. Measurements of the post-cranial skeleton of the Ugglarp bear are found in Tables 4 and 5.

Table 4. Postcranial measurements (mm) of the bear from Ugglarp. Measurements defined according to von den Driesch (1976).

Axis			Humerus sin	dx	Pelvis	sin	dx	
LCDe	75.5		GL	351	351	GL	–	333
LAPa	100		Bp	76.0	76.5	LAR	53.5	54.0
BFcr	57.5		SD	33.0	31.5	LS	123	
BPacd	52.0		Bd	104	103	SH	46.0	46.0
BPtr	88.0		Radius sin	dx	SB	28.5	29.0	
SGW	40.5		GL	294	298	LFo	(77.0)	(76.5)
PFcd	37.5		Bp	42.5	41.5	GBA	186	
Scapula	sin	dx	SD	25.0	25.0	GBTi	184	
HS	–	272	Bd	58.0	59.5	SBI	133	
SLC	–	78.5	Ulna	sin	dx	Femur	sin	dx
GLP	–	66.0	GL	342	341	GL	383	383
LG	–	59.0	Dpa	66.0	67.0	GLC	403	401
BG	–	41.0	BPc	56.0	56.0	BTr	50.5	53.0
Patella	sin	dx	Tibia	sin	dx	SD	35.0	35.0
GL	53.5	50.5	GL	287	292	Bd	83.5	82.0
GB	40.0	40.5	Bp	86.0	86.5	Fibula	sin	dx
			SD	25.0	26.0	GL	–	264
			Bd	61.0	(61.0)	Calcaneus	sin	dx
						GL	(83.0)	(84.5)
						Talus	sin	dx
						GL	(45.0)	(45.0)

Note. All the postcranial elements were measured in position of the mounted skeleton. Phalanges were measured but the values are not published here.

Table 5. Measurements (mm) of the metapodials of the bear from Ugglarp. Measurements defined according to von den Driesch (1976).

Ossa metacarpalia

Element	1 sin	1 dx	2 sin	2 dx	3 sin	3 dx	4 sin	4 dx	5 sin	5 dx
GL	78.0	–	–	–	(87.5)	–	86.0	–	87.5	89.0
Bd	19.0	19.5	–	21.5	20.0	–	(19.5)	21.5	(23.0)	22.5

Ossa metatarsalia

Element	1 sin	1 dx	2 sin	2 dx	3 sin	3dx	4 sin	4 dx	5 sin	5 dx
GL	68.5	–	–	(74.5)	84.0	(83.0)	–	–	94.5	94.5
Bd	17.0	–	18.5	17.5	18.5	19.0	–	–	21.5	20.5

It is equally important, however, to compare the Ugglarp find with other subfossil finds. Few skeletal parts of brown bear have been found in Sweden, therefore Danish finds are included in this comparison (Table 6, Fig. 18). The Ugglarp bear is a fairly small individual compared with the Danish and other Swedish finds (Tables 7–12).

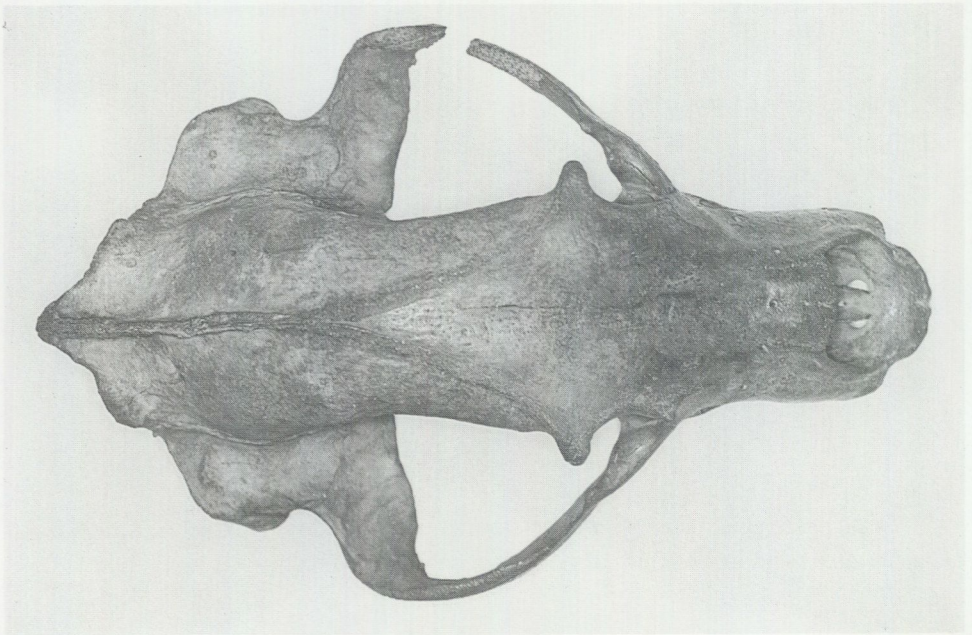

Fig. 7. Skull of the Ugglarp bear, seen from above. Scale about 1/3. Photo: Sven Stridsberg.

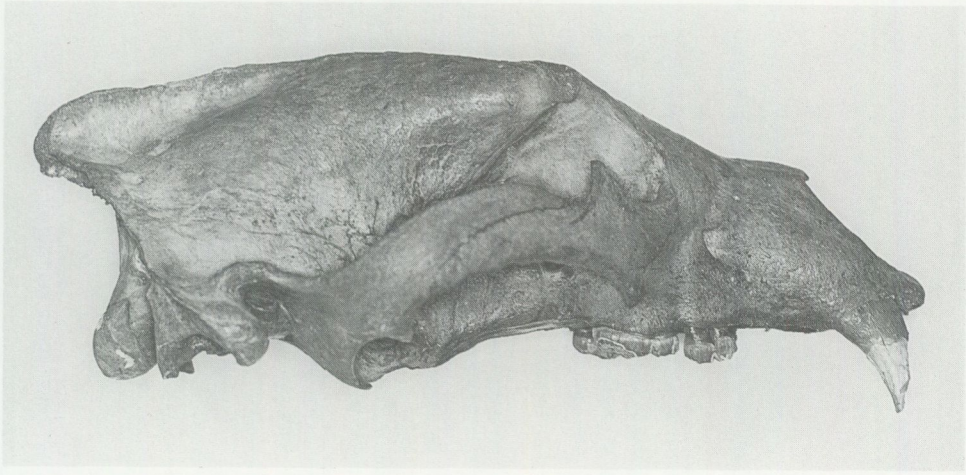

Fig. 8. Skull of the Ugglarp bear, right lateral view. Scale about 1/3. Photo: Sven Stridsberg.

Fig. 9. Skull of the Ugglarp bear, seen from below. Scale about 1/3. Photo: Sven Stridsberg.

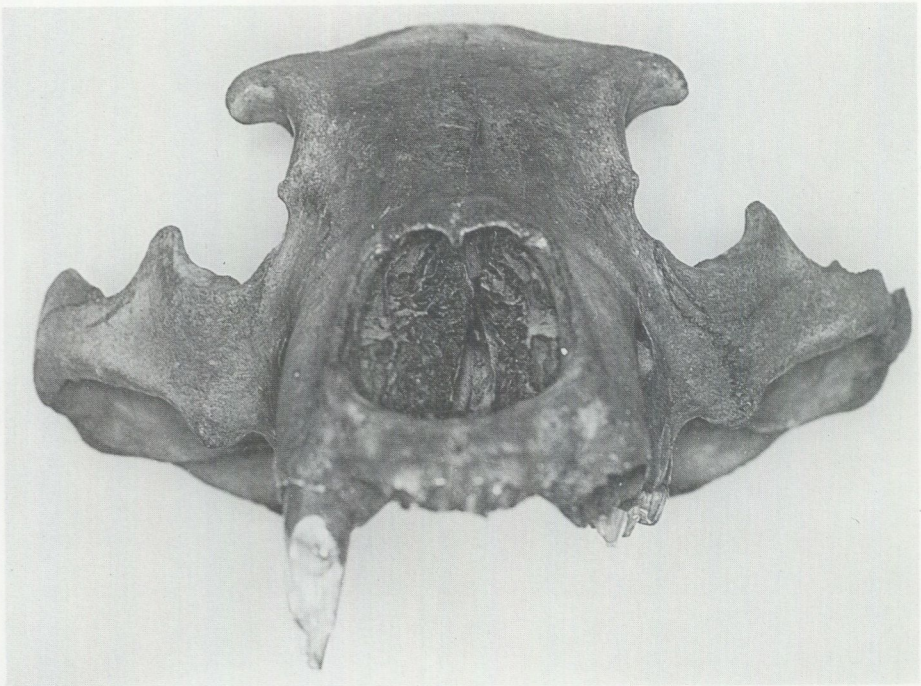

Fig. 10. Skull of the Ugglarp bear, frontal view. Scale about 1/2. Photo: Sven Stridsberg.

Most of its cranial measurements are smaller than the values of bears from the Preboreal and Boreal periods. On the other hand, the Ugglarp bear is larger than the individuals from the Atlantic and Subboreal periods.

The Ugglarp bear is evidently an adult individual. All the teeth have erupted, including the canines, which prove that the bear had reached the age of two years (Couturier 1954:145). Further, the fusion is completed in the long bones as well as the vertebrae. The epiphyses of the front leg in the black bear fuse between the ages of six and eight years (Marks & Erickson 1966).

We assume, however, that the Ugglarp individual is much older. Most of the sutures of its cranium were obliterated. The only sutures not completely closed were the suture of the os zygomaticum. Figures 7–11 show the calvarium from different views. Couturier (1954:87) mentions that most of the sutures of the brown bear are closed at the age of 20. Marks and Erickson (1966) reports on suture closure up to the age of eight years in the black bear. This age was certainly passed by the Ugglarp individual.

Other findings too support the judgement that this bear is an old male. As reported below on pathology, rheumatoid changes in the right front paw are attributed to old age. A tooth loss of the right maxilla indicates old age as well.

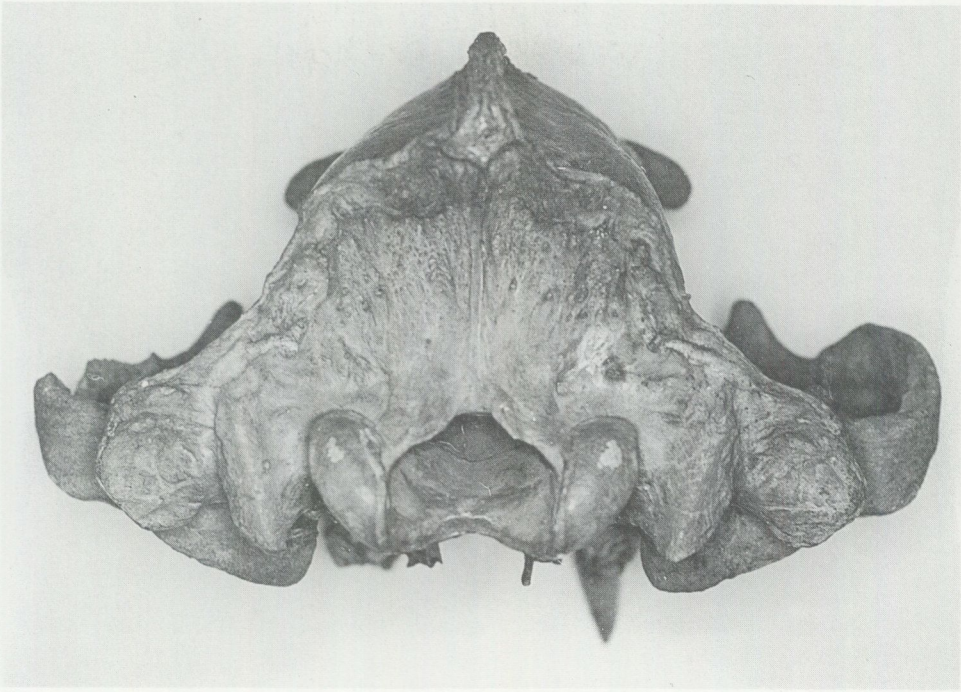

Fig. 11. Skull of the Ugglarp bear, seen from behind. Scale about 1/2. Photo: Sven Stridsberg.

PATHOLOGICAL EVALUATION

Since the discovery of the Ugglarp bear skeleton a fracture of the left scapula has been observed. During the present investigation further signs of pathology and old age were found. All these significant conditions have been studied by Prof. Dr. Angela von den Driesch in Munich, who however interpreted the changes by evaluating the photographs.

In the publication from 1902 Holst describes the changes of the scapula as a fracture with exostoses. He then tries to interpret the cause of the damage and claims that the fracture is healed. Holst (1902:6) paints a vivid picture of the bear falling from a tree or fighting with an aurochs. We agree with his interpretation that this is a fracture but do not regard it as healed (Figs. 12–13).

An abnormal change of the left os coxae was noticed (Figs. 14–15) by the present investigators. Angela von den Driesch interprets this as a healed fracture. The ilium has been broken but the healing was not wholly successful as it resulted in a new angle of the wing of the ilium. Notwithstanding that changes of the scapula and the pelvis oc-

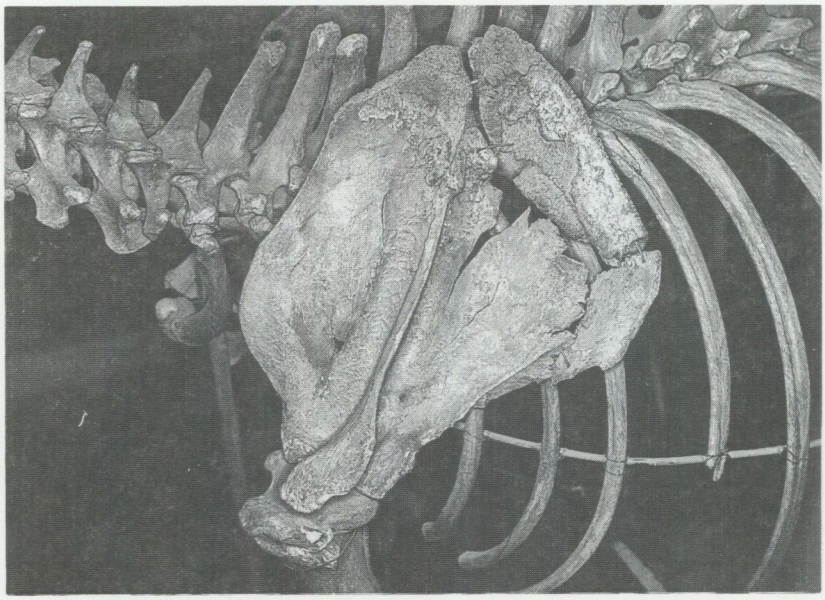

Fig. 12. Left scapula of the Ugglarp bear with unhealed fracture. Lateral view. Scale about 1/4. Photo: Sven Stridsberg.

Fig. 13. Left scapula of the Ugglarp bear, medial view. Scale about 1/3. Photo: Sven Stridsberg.

Fig. 14. The Ugglarp bear. Left lateral view of the pelvis. Scale about 2/3. Photo: Sven Stridsberg.

Fig. 15. The Ugglarp bear. Dorsal view of the pelvis and spine. Note the unnatural angle of the ilium wing showing the healed fracture. Scale about 2/3. Photo: Sven Stridsberg.

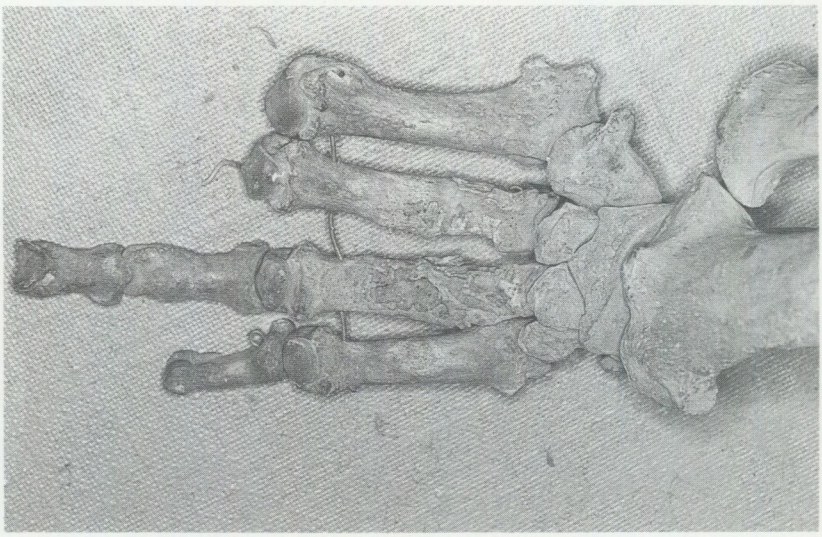

Fig. 16. The Ugglarp bear. The right front paw showing signs of periostitis - a type of rheumatoid illness. Scale about 2/3. Photo: Sven Stridsberg.

Fig. 17. The Ugglarp bear. Right maxilla missing P4 and with closed alveolus - a sign of old age. Scale about 1/1. Photo: Sven Stridsberg.

cur on the left side they are not interpreted as results of one single accident. We believe, that the healed fracture of the pelvis dates further back. However, it is difficult to conclude what caused the injuries.

Iregren found the same type of fracture in a recent brown bear skeleton from Jokkmokk in Northern Sweden. This leads us to the conclusion that accidents causing fractures like these occur rather frequently in bears because of their way of living. We may also assume that the fractures are easily healed and give few complications.

In Fig. 16 some changes, which are interpreted as the results of a natural ageing process, are to be seen. Metacarpal bones of the right front paw show periostitis, a type of rheumatoid illness.

Further, Fig. 17 shows a part of the calvarium from below. The number of premolars of bears vary individually (e.g. Degerbøl 1933:499). In this case, however, the upper right P4 was lost during life. This phenomenon too is judged as a sign of old age. This loss was noticed by Holst (1902).

THE UGGLARP BEAR IN COMPARISON WITH OTHER SCANDINAVIAN BROWN BEAR FINDS

DISTRIBUTION AND DATING OF BROWN BEAR FINDS IN SWEDEN AND DENMARK

Subfossil finds of vertebrates in Skåne have been compiled and elucidated by Liljegren (1975). An article on the occurrence of brown bear in Southern Scandinavia was published by Iregren in 1988. The latter includes finds from Skåne, Bornholm and Själland. A Bronze age dwelling site in Ängdala, Malmö (MHM 6120) has further yielded bear bones (Nyegaard 1983).

The distribution of brown bear in the Scandinavian peninsula in general was treated by Ekman in 1922 and recently by Lepiksaar (1986). Further, contributions on bear finds in Northern Sweden are available (Iregren 1973; Zachrisson & Iregren 1974; Ekman & Iregren 1984).

Danish brown bear finds have been more thoroughly studied and dated mainly by pollen analysis. Bear finds have been published by Jessen (1924, 1929), Degerbøl (1933), Aaris-Sørensen (1980, 1989), Noe-Nygaard (1983) and Richter (1986).

The datings (Table 6) of the finds have been collected from all the above mentioned works. Contradictions have been discussed with Kim Aaris-Sørensen and Knud Rosenlund, on whose judgements the Danish datings are based. The Swedish datings have been penetrated in collaboration with Ronnie Liljegren, who has a thorough knowledge of the Swedish subfossil bone material. Fig. 18 shows the distribution of subfossil bear finds. The localities have been compiled from the maps in the articles by Jessen (1929), Degerbøl (1933) and Noe-Nygaard (1983) in Denmark and Skåne. The zoo-

logists in Copenhagen have helped with completing Fig. 18. One of the Danish finds – a mandible from Faurbo Knold, Jutland – can be seen in Fig. 19. This Alleröd find is among the oldest evidence of brown bear in Scandinavia.

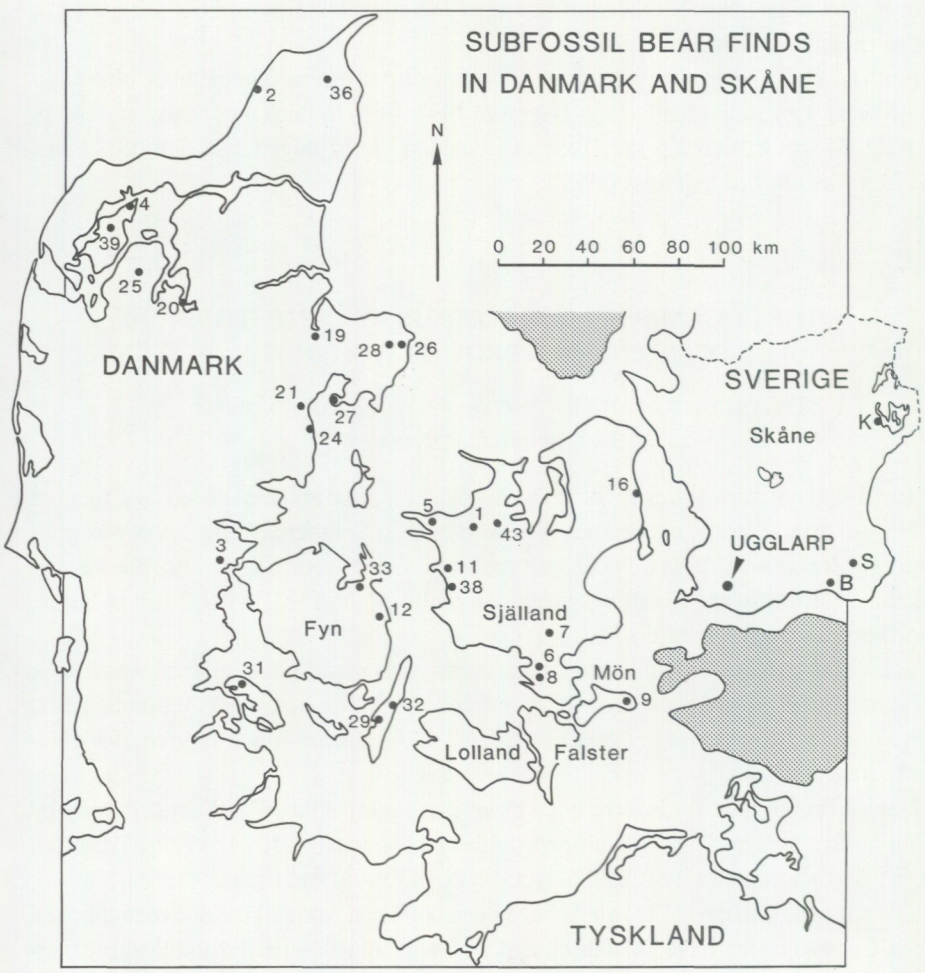

Fig. 18. Distribution of subfossil bear finds in Denmark and Skåne. Numbers according to Table 6. (After Jessen 1929, Degerbøl 1933 and Noe-Nygaard 1983.) B=Breasten, K=Karstad, S=Smedstorp. The extension of land and sea (screened) at the beginning of the Preboreal (after Krog 1972). Drawing: Christin Andréasson.

Fig. 19. A bear find of Alleröd date from Faurbo Knold, Jylland (Fig. 18 no 2). The left mandible lacks all teeth and the surface is heavily weathered. Photo: Ole Bang Berthelsen, Geological Museum, Copenhagen.

Table 6. Danish brown bear finds, their composition and age.

Datings	No	Site	Calvaria	Mandible	Skeleton	Dentes
			measured +, not investigated - not present/not mensurable 0			
Pleistocene:						
Alleröd	1	Faurbo Knold	0	0	x	
	2	Nørre Lyngby	0	0	0	
Holocene:						
Preboreal	3	Almind Mose	0	x	0	
	4	Hundsø Mose, Mors	x	0		
Boreal	6	Lundby I, II	x		x	
	7	Holmegård	x		x	
	8	Sværdborg I	x	x	x	x
	11	Maglemose, Mullerup			x	x
	12	Skalkendrup Mose	x	x		
	15	Fyn	–	–		
Late Boreal	5	Dyrhøjgårds Mose	x	x	x	
Atlantic, early	16	Bøgebakken				–
Atlantic, late	20	Virksund	x		x	
	21	Braband		x		
	24	Flynderhage				
Atlantic/ Subboreal	39	Galtrup kær, Mors		x		
Subboreal	19	Dyrholmen			x	
	26	Kainsbakke	x	x		
	27	Holme Skanse				
	28	Ørum Å			x	
	29	Lindø 1			–	
	31	Bundsø			x	
	32	Spodsbjerg			–	
	33	Dræby Mark			–	
Age uncertain	9	Kamsmose	x	x	x	
	25	Jebjerg	x			
	36	Hørmested		x		
	38	Kirke-Stillinge		x		
	40	Glæsborg Mose, Djursland			x	
	41	Langeland				x
	42	Morsø				x
	43	Trønninge Enge, Kundby				x

The numbering of the sites has been made by us. All Danish bear localities known cannot be found in this table. Further, not all of these find sites are marked on Figure 18, as the exact positions of these finds are not known.

THE SYSTEMATIC POSITION OF THE UGGLARP BEAR AND THE QUESTION OF POST-GLACIAL DWARFING IN BEAR

The recent brown bear in North-West Europe as well as in most parts of Europe belongs to the subspecies *Ursus a. arctos* L. Holocene finds of brown bear from Denmark and Sweden have been described under different names as *Ursus a. fossilis* Holst (Holst 1902), *U. a. nucifragus* Lönnberg (Lönnberg 1923) and *U. a. nemoralis* Degerbøl (Degerbøl 1933). The two first mentioned works stress the large general size and the very large size of the teeth of the subfossil finds. Degerbøl (1933) proves, however, that not all subfossil bears have larger teeth than all recent ones. Further, morphological differences between the subfossil and the recent bears are discussed by Degerbøl. He defines and separates the early Holocene bear from the recent subspecies as well as from the brown bear of Late Glacial date.

Erdbrink (1953:440), however, concludes "I do not see that there is any reason for the assumption that these Danish finds belong to a certain subspecies". Erdbrink notes the large size but interprets this in the following way: "This probably indicates that the surroundings in Scandinavia (during the Late Glacial- and Postglacial times) must have been almost ideal for *U. arctos*". Kurtén (1959), on the other hand, considers Degerbøl justified in naming a subspecies, but discusses the choice of the actual name in connection with the rules for systematic classification.

Subfossil finds of the Danish brown bear have recently been penetrated again. Aaris-Sørensen (1989:173–174) agrees with Degerbøl (1933) that the size of the bear has decreased since the Wechselian glaciation. Richter, on the other hand, disagrees (Richter 1986:129–130). Aaris-Sørensen (1989:173–175), however, emphasizes that the decrease in size of mammals probably ends before the late Boreal. A gradual decline in size, as Richter (1986:130) hypothesizes, is not to be expected in our opinion.

To illustrate the size of the subfossil and the recent brown bear further some graphs have been drawn. They are based on our measurements in this article as well as other publications (Iregren 1989; Zachrisson & Iregren 1974). Some unpublished measurements of recent bears by Iregren were also used. A few published values of specimens, which are not easily available, have been included (Degerbøl 1933: the bear find from Fyn and a Norwegian recent population; Richter 1986: Kainsbakke, individual 2288).

Only measurements of teeth have been used by us when constructing the graphs as the largest number of available measurements concern dentition. Fig. 21 shows lengths and breadths of the second upper molar. This tooth was mentioned by Degerbøl (1933:515–516) because of its large size in the subfossil bears. Fig. 20 concerns the first lower molar and Fig. 22 deals with the third lower molar. Danish and Swedish subfossil finds are grouped into a Preboreal, a Boreal and a Subboreal group. The latest of these finds dates back to about 4 150±70 years B.P. (K-4463 Richter 1986:125). The youngest finds to the right in the graphs concern the last millennium. Data on two recent or sub-recent populations include bears from Norway and from Northern Sweden.

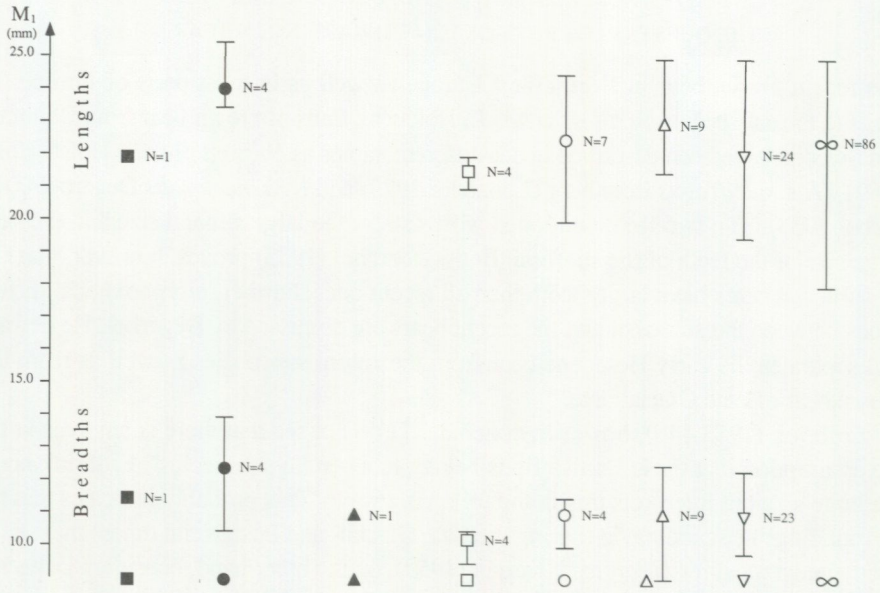

Fig. 20. Lengths (above) and breadths (below) for the first lower molar in brown bear. Mean values, number of measurements as well as minimum and maximum values are marked in chronlogical order (see below) from the left to the right. Subfossils from Denmark and Skåne dated to the Preboreal, Boreal and Subboreal periods. Further samples from the 10th–11th century (Frösön, Middle Sweden), the 10th–14th century (Unna Saivats, Northern Sweden), 18th–19th century (bear graves, Northern Sweden), Norway 19th century and Sweden 19th–20th century. Drawing: Christin Andréasson.

The individuals from archaeological finds derive from Northern Sweden only. It must be emphasized, however, that the number of specimens from non-recent populations is small.

To conclude (Figs. 20–22, Tables 7–12): For numerical reasons it cannot be said that there are any size changes during the time span between the bears from the Preboreal to the Subboreal, c. 10 000–4 000 B.P. Further, a size gradient from the end of the Weichselian glaciation to the present seems very unlikely because of the several alterations in climate and subsequent changes in living conditions for the bear. The metrical values overlap to a very great extent but a change in mean values might exist. Our present hypothesis is, until further subfossil material has been dated and evaluated, that the early Holocene bears belong to the same subspecies as the bears of Scandinavia today. Thus, we regard the Ugglarp bear as belonging to the subspecies *Ursus arctos arctos*.

Another, but still important, factor is the human impact on the biotopes of the bear in Scandinavia as well as in the Baltic countries (Paaver 1965:112). The intense hunting during the last centuries has taken far too large a toll of these populations. In Swe-

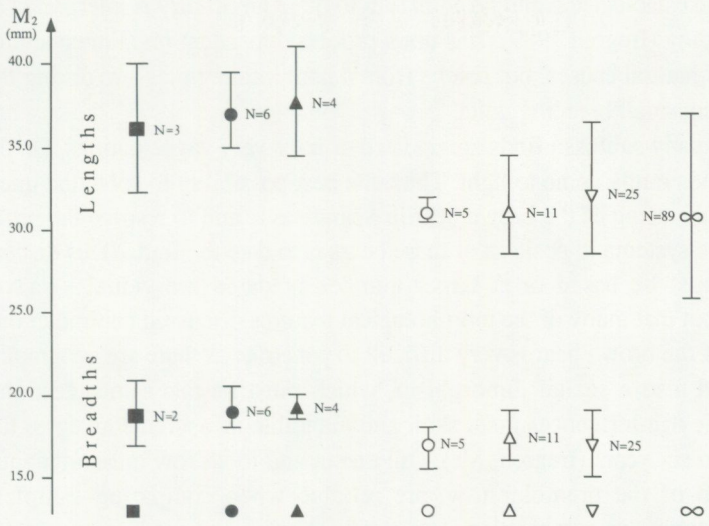

Fig. 21. Lengths (above) and breadths (below) for the second upper molar in brown bear. Mean values, number of measurements as well as minimum and maximum values are marked in chronological order (see below) from the left to the right. Subfossils from Denmark and Skåne dated to the Preboreal, Boreal and Subboreal periods. Further samples from the 10th–14th century (Unna Saivats, Northern Sweden), 18th–19th century (bear graves, Northern Sweden), Norway 19th century and Sweden 19th–20th century. Drawing: Christin Andréasson.

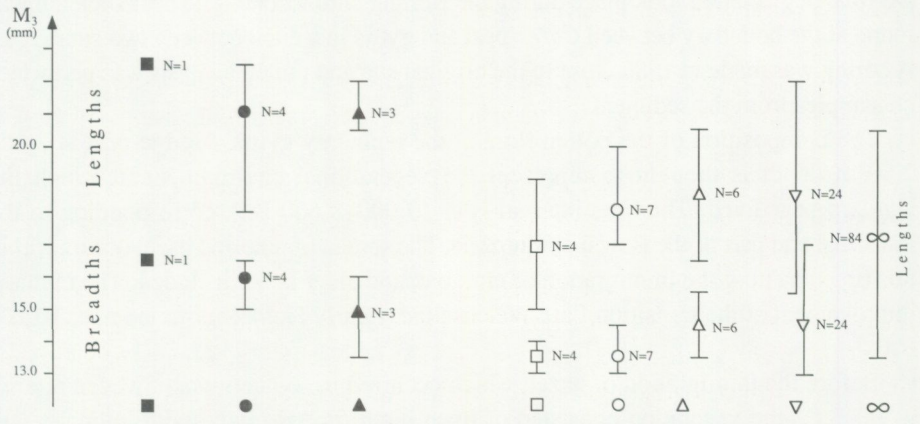

Fig. 22. Lengths (above) and breadths (below) for the third lower molar in brown bear. Mean values, number of measurements as well as minimum and maximum values are marked in chronological order (see below) from the left to the right. Subfossils from Denmark and Skåne dated to the Preboreal, Boreal and Subboreal periods. Further samples from the 10th–11th century (Frösön, Middle Sweden), the 10th–14th century (Unna Saivats, Northern Sweden), 18th–19th century (bear graves, Northern Sweden), Norway 19th century and Sweden 19th–20th century. Drawing: Christin Andréasson.

den; the size decline established from the 18th/19th to the 20th century is interpreted as an effect of inbreeding (Iregren 1989). It is not a process dependent on climate and/or vegetation or other natural causes, but results from a hard hunting pressure during the 19th century creating small breeding units.

Unfortunately, many subfossil finds are undated or have very vague datings. On the other hand, new finds rarely come to light. Thus, the best possibility to solve the question of postglacial dwarfing of the brown bear in Scandinavia and to resolve the problems concerning the systematic position of these bears is to date the finds. This discussion, evidently, must be based on a larger number of dated individuals. Paaver (1965:102) points out that many of the morphological features discussed contradict one another. The size of the brown bear is very difficult to penetrate as there are geographical differences and also a sexual dimorphism, which must be taken into account. Further, ontogenetic age influences most skull and mandible measurements up to the age of about five to six years (Iregren, Ms). Only teeth and tooth row measurements, with the exception of the premolar row, are reliable when comparing samples/ populations of unknown age composition.

SUMMARY

The Ugglarp bear lived in a hummocky landscape with numerous small lakes southeast of Malmö. The hummocky moraine was formed during the late Weichselian and the final deglaciation took place during the Bölling chronozone. The bear skeleton was found at the boundary between *Carex* peat and gyttja in a ditch between two small fens. A coring was made in 1988 close to the original site and pollen analysis was performed on samples from the sediments.

The composition of the pollen flora at the boundary gyttja – sedge peat at 2.60–2.80 m depth is thought to represent the vegetational environment in which the Ugglarp bear lived. The time interval is c. 10 000–8 600 B.P. corresponding to the Preboreal and part of the Boreal chronozone. The spread of pine and hazel occurs within this time span but the immigration of elm, oak and alder is not included. The climatic improvement at the transition Late Weichselian – Early Holocene started at c. 10 200 B.P.

Before the immigration of hazel, which occurred in southernmost Sweden after c. 9 500 B.P., the vegetation consisted of open birch forests mixed with junipers, willows and herbs. A rich herb flora existed and some Late-Glacial pioneer plants still occurred sporadically. The vegetation in the lake included water plants such as myriad leaf, white water-lily, pondweed, burreed, bulrush and reed-mace. The presence of thermophilous plants such as meadow-sweet, myriad leaf and reed-mace indicates a favourable climate at the start of the Holocene. The lake water was rich in mineral salts and

had a high transparency, as can be concluded from the macro- and microflora. When pine and hazel spread the forests became denser during the Early Boreal.

The pollenanalytical dating of a small piece of gyttja from a tooth alveolus gives a maximum age of the bear in the Preboreal chronozone. The result of the ^{14}C-dating of the bear to 9 355±130 B.P. is in good agreement with the pollenanalytical dating.

The Ugglarp bear skeleton is the oldest brown bear find in Sweden. It has been re-studied regarding morphology, size and pathology. Its old age and its sex have been confirmed. A greater number of measurements of cranium and skeleton have been taken. The broken and healed pelvis was not noticed before, nor the rheumatoid changes of the right front paw.

The measurements of the Ugglarp bear have been compared with subfossil finds from Denmark and Skåne. Further, archaeological specimens from Denmark and Sweden have been measured as well as recent bears from Sweden. Moreover, published measurements of Norwegian bears from the 19th century have been used in the discussion of the systematic position of the Ugglarp bear and its size. The specimen is not a very large individual, on the contrary it can be considered rather small. Until further datings and studies have been performed regarding a possible postglacial dwarfing it is believed to belong to the same subspecies as the recent brown bear of Scandinavia, e.g. *Ursus arctos arctos* L.

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Several colleagues have helped us during our work. The manuscript, including the troublesome tables, was typed by Eva Janselius. The diagrams and figures were drawn by Christin Andréasson. The English language was corrected by Theodosia Gray.

Most of the skeletal photographs were taken by Sven Stridsberg, who several times has placed himself at our disposal. We thank the staff of the Zoological and Geological Institutes of Copenhagen University for making all the specimens available and for fruitful discussions. Recent brown bear skulls were studied in the Museum of Natural History in Stockholm. Vivianne Berg-Madsen greatly assisted by conveying Swedish bear skulls from the collections at the Geological Survey in Uppsala.

Another important contribution was made by Johannes Lepiksaar, who kindly translated Russian text concerning bears in the volume by K. Paaver. Further, Angela von den Driesch was kind enough to study photographs of the Ugglarp bear in order to evaluate the traumas and other skeletal changes.

The Danish bears and their datings have been discussed with Kim Aaris-Sørensen and Knud Rosenlund. The Swedish datings have been evaluated in collaboration with Ronnie Liljegren, who has a thorough knowledge of Swedish subfossil bone material. Jonas Ekström, Ronnie Liljegren and Urve Miller gave us valuable comments on the manuscript. To all those mentioned above we express our sincere gratitude.

REFERENCES

AARIS-SØRENSEN, K., 1980: Depauperation of the mammalian fauna of the island of Zealand during the Atlantic period. – Videnskabelige Meddelelser fra dansk naturhistorisk forening, 142:131–138.

– 1989: Danmarks forhistoriske dyreverden. Fra istid till vikingetid. Gyldendal, 252 pp. København.

BERGLUND, B.E., 1966: Late-Quaternary vegetation in eastern Blekinge, south-eastern Sweden. A pollen-analytical study. 1. Late glacial time. – Opera Botanica 12:1, 180 pp.

– 1971: Late-Glacial stratigraphy and chronology in south Sweden in the light of biostratigraphic studies on Mt. Kullen, Scania. – Geologiska Föreningens i Stockholm Förhandlingar 93:11–45.

BERGLUND, B.E. & RALSKA-JASIEWICZOWA, M., 1986: Pollen analysis and pollen diagrams. *In* B.E. Berglund, (ed.) "Handbook of Holocene Palaeoecology and Palaeohydrology", p. 455–484. Wiley, New York.

BLAINVILLE, H.M.D., de 1839–1864: Ostéographie ou description iconographique comparée du squelette et du système dentaire des mammifères recents et fossiles pour servir de base à la zoologie et à la geologie. Tome II e. Paris.

COUTURIER, M.A.J., 1954: L'ours brun, *Ursus arctos* L., Grenoble.

DANIEL, E., 1977: Beskrivning till jordartskartan Trelleborg NO. — Sveriges geologiska undersökning. Ae 33, 80 pp.

DEGERBØL, M., 1933: Danmarks pattedyr i sammenligning med recente former. – Videnskabelige Meddelelser fra dansk naturhistorisk forening, 96:357–641.

DIGERFELDT, G., 1982: The Holocene development of Lake Sämbosjön. 1. The regional vegetation history. University of Lund, Department of Quaternary Geology, report 23, 24 pp.

EKMAN, J. & IREGREN, E., 1984: Archaeo-zoological investigations in northern Sweden. Early Norrland 8, Stockholm. Kungliga Vitterhets-, Historie- och Antikvitetsakademien, 99 pp.

EKMAN, S., 1922: Djurvärldens utbredningshistoria på Skandinaviska halvön. Stockholm.

EKSTRÖM, J., FURUBY, E. & LILJEGREN, R., 1989: Om tillförlitlighet och otillförlitlighet i äldre pollenanalytiska dateringar. *In* Iregren, E. & Liljegren, R. (eds.). Faunahistoriska studier tillägnade Johannes Lepiksaar. University of Lund, Institute of Archaeology. Report series No 33:13–20.

ERDBRINK, D.P., 1953: A review of fossil and recent bears of the Old World, 2 Vols, Deventer.

FAEGRI, K. & IVERSEN, J., 1975: Textbook of Pollen Analysis. 295 pp. Munksgaard, Copenhagen.

FREDÉN, C., 1984: Faunahistoriska notiser om några av naturhistoriska museets daterade subfossila fynd. Göteborgs Naturhistoriska Museum. Årstryck 1984:31–45.

FREDSKILD, B., 1966: Pollenanalytisk datering af nogle svenske bisonfund. Geologiska Föreningens i Stockholm Förhandlingar 88:213–226.

HOLST, N.O., 1902: Några subfossila björnfynd. Sveriges geologiska undersökning. Serie C 189, 38 pp.

IREGREN, E., 1973: 3000-årigt björnfynd i Ströms socken. - Jakten i Jämtland och Härjedalen, 22:19-20.

– 1988: Finds of brown bear *(Ursus arctos)* in southern Scandinavia indications of local hunting or trade? – Trade and Exchange in Prehistory. Studies in Honour of Berta Stjernquist. Acta Archaeologica Lundensia, Ser. in 8° No 16:295–308.

– 1989: Size of brown bear *(Ursus arctos* L.) in northern Sweden during the last millenium. – ArchaeoZoologia, Vol. 2 (1.2), 1988:165–178.

– Manuscript. The influence of individual age on metric values – a case study of the brown bear (*Ursus arctos* L). Lecture presented during the 6th International Conference, International Council for Archaeozoology, May 1990, Washington D.C.

JESSEN, K., 1924: Et Bjørnefund i Allerødgytje i Danmark. – Meddelelser fra Dansk geologisk Forening, Bd. 6.

– 1929: Bjørnen (Ursus arctos L.) i Danmark. – Meddelelser fra Dansk geologisk Forening Bd 7, 16 pp.

KOBY, F.Y., 1949: Le dimorphisme sexuel des canines d'*Ursus arctos* et d'*Ursus spelaeus*. – Revue Suisse de Zoologie 56: 675–687.

KROG, H., 1972: The early Post-glacial development of the Store Belt as reflected in a former fresh water basin. – Danmarks geologiske undersøgelse, årbog 1972, 37–47.

KURTÉN, B., 1955: Sex dimorphism and size trends in the cave bear, *Ursus spelaeus* Rosenmüller et Heinroth. – Acta Zoologica Fennica 90, 48 pp.

– 1959: On the bear from the Holsteinian interglacial. – Stockholm Contributions in Geology 2:73–102.

LEMDAHL, G., 1988: Palaeoclimatic and palaeoecological studies based on subfossil insects from Late Weichselian sediments in southern Sweden. Lund University, Department of Quaternary Geology. Thesis 22, 113 pp.

LEPIKSAAR, J., 1986: The Holocene History of Theriofauna in Fennoscandia and Baltic Countries. – *In* L.-K. Königsson (ed.) Nordic Late Quaternary Biology and Ecology. Striae 24:51–70.

LIEDBERG JÖNSSON, B., 1988: Late Weichselian macrofossil flora in western Skåne, southern Sweden. Lund University, Department of Quaternary Geology. Thesis 24, 80 pp.

LILJEGREN, R., 1975: Subfossila vertebratfynd från Skåne. – University of Lund. Department of Quaternary Geology, Report 8, 187 pp.

LÖNNBERG, E., 1923: Notes on a new Subfossil bear from Sweden. – The Annals and Magazine of Natural History. Ser. 9, Vol. 11:502–506.

MARKS, S.A. & ERICKSON, A.W., 1966: Age determination in the black bear. – Journal of Wildlife Management 32:389–410.

NILSSON, T., 1935: Die pollenanalytische Zonengliederung der spät- und postglazialen Bildungen Schonens. – Geologiska Föreningens i Stockholm Förhandlingar 57:385–562.

– 1961: Ein neues Standardpollendiagramm aus Bjärsjöholmsjön in Schonen. – Lunds universitets årsskrift N.F. 56, 34 pp.

NOE-NYGAARD, N., 1983: A new find of brown bear *(Ursus arctos)* from Star Carr and other finds in the Late Glacial and Post Glacial of Britain and Denmark. – Journal of Archaeological Science 10:317–325.

NORDMANN, V., 1944: Jordfunde pattedyrlevningar i Danmark. – Dansk Natur, 112 pp. Hagerup. Köpenhamn.

NYEGAARD, G., 1983: Dyreknogler fra yngre bronzealdersbopladser i Sydskandinavien. Konferensspeciale, forhistorisk arkeologi, København. Duplicate.

OLSSON, I.U., EL-DAOUSHY, M.F.A.F., ABD-EL-MAGEED, A.I. & KLASSON, M., 1974: A comparison of different methods for pretreatment of bones, I. – Geologiska Föreningens i Stockholm Förhandlingar 96:171–181.

PAAVER, K., 1965: Formirovanie teriofauny i izmencivost' mlekopitajuscich Pribaltiki v holocene. German translation: Die Entstehung der Säugetierfauna und die Variabilität der Säugetiere des Ostbaltikums im Holozän, 499 pp. Tartu.

RICHTER, J., 1986: Brown bear *(Ursus arctos)* from Kainsbakke, East Jutland. – Journal of Archaeological Science 5:125–134.

RINGBERG, B., 1980: Beskrivning till jordartskartan Malmö SO. – Sveriges geologiska undersökning. Ae 38, 179 pp.

RINGBERG, B., 1988: Late Weichselian geology of southernmost Sweden. – Boreas 17:243–263.

ROBERTSSON, A.-M., 1973: Late-glacial and preboreal pollen and diatom diagrams from Skurup, southern Scania. – Sveriges geologiska undersökning. C 679, 75 pp.

RODE, K., 1935: Untersuchungen über das Gebiss der Bären. – Monographien zur Geologie und Palaeontologie, Serie II, H. 7, 162 pp.

THELAUS, M., 1989: Late Quaternary vegetation history and palaeohydrology of the Sandsjön-Årshult area, southwestern Sweden. – Lund University, Department of Quaternary Geology. Thesis, Vol. 26, 76 pp.

WELINDER, S., 1971: Tidigt postglacialt mesoliticum i Skåne. Acta Archaeologica Lundensia, Ser in 8°, min. No 1, 227 pp.

WESTERGÅRD, A.H., 1906: Platålera, en supramarin hvarfig lera från Skåne. – Geologiska Föreningens i Stockholm Förhandlingar 28:408–414.

– 1912: Beskrifning till kartbladet Trelleborg. – Sveriges geologiska undersökning. Aa 146, 85 pp.

VON DEN DRIESCH, A., 1976: A guide to the measurement of animal bones from archaeological sites. Peabody Museum Bulletins no 1, 137 pp.

ZACHRISSON, I. & IREGREN, E., 1974: Lappish bear graves in Northern Sweden. An archaeological and osteological Study. – Early Norrland 5. Kungliga Vitterhets-, Historie- och Antikvitetsakademien, 113 pp.

APPENDIX

Table 7. Finds and datings of brown bear in Denmark.
Measurements of calvaria. (Kainsbakke 26:2288 measured by Richter (1986).)
Definitions from von den Driesch (1976: 42-46, U=Ursus).
Definitions from Zachrisson & Iregren (1974).

Datings	Preboreal	Boreal	Late Boreal	Subboreal				Uncertain	
Find nos/ Measurement nos	4	12	5	26 2184	26 2288	26 2549	26 2549	9	25
1	401	390	396	-	343	-	-	409	337
2	362	364	364	-	319	-	-	-	-
3	341	345	343	-	302	-	-	-	304
4	(93.5)	93.0	102	-	84	-	-	-	-
5	248	252	244	-	2197	219	-	-	-
6	220	207	219	-	-	-	-	-	-
7	230	211	222	-	188	-	-	-	184
8	176	178	196	-	-	-	-	176	-
9	198	199	198	-	164	187	-	-	168
12	133	142	126	-	-	127	-	148	122
13	196	187	186	-	170	-	-	-	173
23	176	-	180	-	-	-	-	-	-
24	165	164	155	-	-	-	-	-	137
25	74.0	76.0	68.5	-	64	-	-	-	-
27	32.5	38.0	32.5	-	34	-	-	-	35.0
28	20.0	18.5	20.5	-	28	-	-	-	19.5
29	114	104	99.5	-	97	-	-	-	103
30	223	-	232	-	-	-	-	-	-
31	77.5	77.5	84.0	-	67	77.5	-	-	71.0
33	82.0	90.0	80.5	-	75	94.0	-	-	72.5
34	94.5	106	89.0	-	88	95.0	-	97.0	88.0
40	86.0	82.0	77.0	-	83	-	-	-	82.0
7	211	201	197	-	-	-	-	-	182
22b	62.0	65.0	58.0	-	-	66.0	-	66.5	61.0
26	96.0	-	-	-	-	-	97.0	-	-
27	87.0	85.5	77.0	-	-	-	88.0	79.5	-

Table 7 (continued). Finds and datings of brown bear in Denmark. Measurements of calvaria.

	Preboreal		Boreal									
Find nos	4 sin	4 dx	6 sin	7 sin	8 sin	8 sin	8 sin	11 sin	12 sin	12 dx	5 sin	5 dx
Measurement nos												
15	107	109	-	-	-	-	-	-	112	109	105	104
15a	157	157	-	-	-	-	-	-	169	169	157	156
16	63.0	-	63.0	56.5	58.5	-	-	-	64.5	62.5	55.5	55.0
17	43.0	43.5	-	-	-	-	-	-	48.5	47.0	48.0	47.5
U16a	17.0	16.0	-	-	-	-	-	-	19.0	19.0	16.5	16.5
U16a	12.0	11.0	-	-	-	-	-	-	15.5	16.0	12.0	11.5
19	-	-	-	-	-	-	-	-	18.5	19.5	17.0	16.5
U16b	24.0	24.0	25.0	-	23.0	(20.0)		22.5	25.5	25.0	22.5	-
U16b	17.0	17.0	20.5	-	17.0	-		16.5	(19.0)	19.0	16.5	-
U16c	40.0	40.0	39.5	-	37.0	36.5	(35.0)	-	39.0	40.0	35.0	34.5
U16c	21.0	20.0	20.0	-	19.0	18.0	(18.0)	-	20.5	20.5	18.5	18.5
28	157	157	-	-	-	-	-	-	169	169	157	156
29b	-	97.0	-	-	-	-	-	-	-	-	-	-
29c	86.5	88.0	-	-	-	-	-	-	92.0	90.5	-	80.0
29d	79.0	80.5	-	-	-	-	-	-	82.5	82.5	75.0	72.5
31b	-	32.5	-	-	-	-	-	-	-	-	-	-
31c	23.0	23.0	-	-	-	-	-	-	28.0	28.5	-	24.0
36	-	-	22.0	19.5	20.5	-	-	-	22.5	22.0	20.5	22.0
39	-	-	(40.0)	35.0	36.5	-	-	-	39.5	39.5	33.0	33.5
41a	24.5	22.0	-	-	-	-	-	-	24.0	23.0	-	25.0
41b	28.5	29.0	-	-	-	-	-	-	32.5	32.0	31.0	33.0
43	-	-	-	-	-	-	-	-	30.0	-	26.0	26.0
44	23.0	20.5	-	-	-	-	-	-	(21.0)	-	19.0	19.0

Table 7 (continued). Finds and datings of brown bear in Denmark. Measurements of calvaria.

Datings	Atlantic		Subboreal				Uncertain					
Find nos	20	20	26 2184	26 2549	26 2549	26 2288	9	9	25	25	40	40
Measurements nos	sin	dx	dx	sin	sin		sin	dx	sin	dx	sin	dx
15	-	-	103	108	107	-	106	108	102	102	-	-
15a	-	-	-	159	156	123	161	162	-	-	-	-
16	(59.5)	-	56.0	61.5	61.5	-	62.5	63.0	55.5	57.5	-	-
17	-	-	45.5	45.0	44.5	-	43.5	43.0	45.0	42.5	-	-
U16a	16.0	16.5	16.0	-	18.0	14	18.5	19.0	16.5	16.0	-	-
U16a	12.5	13.0	11.0	-	13.5	13	13.5	14.0	13.5	13.5	-	-
19	-	-	14.0	16.0	16.0	-	(18.0)	(19.5)	15.0	15.5	-	-
U16b	24.0	24.0	24.0	23.0	-	-	24.5	23.5	21.0	21.5	-	22.0
U16b	18.0	18.0	17.5	18.5	-	-	19.5	19.0	18.0	18.0	-	17.0
U16c	38.5	39.0	(34.5)	38.5	-	36	39.0	39.5	34.5	35.5	36.0	34.0
U16c	19.0	19.0	18.5	20.0	-	19	22.0	21.5	19.0	18.5	19.0	(18.5)
28	-	-	-	159	156	-	161	162	146	148	-	-
29b	-	-	-	-	-	-	-	-	-	-	-	-
29c	-	-	81.5	86.5	86.0	-	88.5	88.0	78.5	80.5	-	-
29d	(75.5)	-	72.0	79.0	79.5	-	82.0	82.5	71.5	73.0	-	-
31b	-	-	-	-	-	-	-	-	-	-	-	-
31c	-	-	24.5	23.0	24.0	-	25.0	24.5	22.5	23.5	-	-
36	21.0	-	19.5	20.5	20.5	-	23.5	24.0	20.5	18.5	-	-
39	-	-	35.0	37.0	39.0	-	40.5	38.0	33.5	35.5	-	-
41a	-	-	22.5	22.0	22.0	-	-	-	22.0	21.5	-	-
41b	-	-	32.0	28.5	28.5	-	-	-	29.5	31.5	-	-
43	-	-	-	-	31.0	-	-	-	26.0	-	-	-
44	-	-	-	-	22.0	-	-	-	-	-	-	-

Table 8. Finds and datings of brown bear in Denmark.
Measurements of mandibula. (Kainsbakke 26:2288 measured by Richter (1986).)
Definitions from von den Driesch (1976:60-62)
Definitions from Zachrisson & Iregren (1974:44-45)

Datings	Pre-boreal	Boreal				Late Boreal		Atlantic	Subboreal				
Find nos	3	8	8	12	12	5	5	21	39	26 2151	26 2295	26 2765	26 2898
Measurement nos	sin	sin	dx	sin	dx	sin	dx	dx	dx	sin	dx	sin	dx
1	-	-	-	(268)	(272)	266	260	-	(279)	-	-	-	(255)
3	-	-	-	(248)	(251)	246	242	-	(256)	-	-	-	(245)
4	-	-	-	230	229	232	226	-	241	-	208	-	-
5	-	-	-	207	210	212	206	-	220	-	201	-	-
7	-	-	-	132	133	126	127	(116)	134	-	120	120	-
8	-	-	-	129	130	122	121	(113)	132	-	118	118	-
9	-	-	-	-	-	-	-	-	-	-	90.0	-	-
U9	(77.5)	-	-	74.0	77.0	68.0	68.0	(69.0)	70.0	(68.0)	68.0	(66.5)	72.5
11	-	50.0	50.0	53.0	53.5	53.5	53.0	44.0	62.5	-	(35.0)	(48.0)	-
U11	-	24.0	25.5	-	-	-	23.5	-	24.0	-	-	-	-
U11	-	14.0	13.0	-	-	-	12.0	-	12.5	11.0	-	-	-
14	-	(25.0)	25.0	25.5	25.5	24.0	21.0	24.5	25.0	(20.5)	21.5	-	25.0
U12	-	-	-	27.0	27.5	25.5	25.0	25.5	-	25.0	-	24.0	-
60	-	-	-	27.5	26.5	(23.0)	(23.0)	24.5	24.5	22.5	22.5	22.5	24.5
U12	-	-	-	-	-	15.0	15.5	14.0	-	15.5	-	14.5	-
U13	-	22.0	22.5	-	-	21.0	22.0	-	-	22.0	20.5	20.5	-
66	(21.5)	-	-	22.0	23.0	21.0	20.0	(19.0)	-	21.5	19.0	20.0	20.0
U13	-	16.5	16.5	-	-	16.0	16.0		-	(16.0)	(13.5)	15.0	-
17	(14.5)	-	-	26.5	26.5	18.0	19.5	20.5	22.0	20.5	21.5	20.5	28.0
U14	-	-	-	115	114	116	116	-	113	-	102	-	125
48b	-	-	-	204	207	210	200	-	214	-	197	-	-
U15	49.5	-	-	56.5	56.0	49.0	50.0	40.0	52.5	-	45.5	-	57.5
51	(46.5)	43.0	41.5	54.5	55.5	48.0	48.0	39.0	52.5	-	47.0	-	55.0
U8	-	-	-	89.5	90.5	81.0	82.0	(83.5)	88.0	-	(82.0)	-	(86.5)
68	-	-	-	-	-	27.5	26.5	23.0	-	-	-	-	-
69a	-	16.0	15.5	21.0	21.5	17.0	16.5	16.5	-	-	-	-	-
69b	17.0	14.5	14.5	18.0	-	15.5	14.5	14.5	-	-	-	-	-
70	-	56.0	55.0	58.0	54.5	57.5	59.0	46.5	65.0	-	52.0	(54.0)	-
71	-	40.0	37.5	42.0	42.5	45.0	45.0	33.5	49.5	(37.0)	-	-	-
73	-	-	-	63.5	65.0	57.5	57.0	-	62.5	-	(52.5)	-	64.5
101	45.5	-	-	55.5	54.0	49.0	50.5	38.5	59.5	-	46.5	-	57.0

Table 8 (continued). Finds and datings of brown bear in Denmark. Measurements of mandibula.

Datings		Uncertain						
Find nos	9 sin	9 dx	36 sin	38 dx	41 dx	42 dx	43 sin	43 dx
Measurement nos								
1	(274)	-	-	-	-	-	-	-
3	(258)	-	-	-	-	-	-	-
4	234	(233)	-	-	-	-	-	-
5	216	(215)	193	176	-	-	-	-
7	129	(128)	115	111	-	-	-	-
8	128	126	115	110	-	-	-	-
9	-	-	90.0	87.0	-	-	-	-
U9	(75.5)	74.5	67.0	66.5	-	-	-	-
11	(55.0)	(51.0)	46.0	33.5	-	-	-	-
U11	(26.0)	26.0	-	-	-	-	-	-
U11	13.0	12.5	-	-	-	-	-	-
14	25.0	25.0	24.5	22.5	-	-	-	-
U12	26.0	25.5	-	-	-	-	-	-
60	24.5	26.0	23.5	20.5	-	-	-	-
U12	17.0	18.0	-	-	-	-	-	-
U13	22.5	22.0	-	-	-	-	-	-
66	21.0	22.5	19.0	-	-	-	-	-
U13	(16.5)	17.0	-	-	-	-	-	-
17	20.5	21.5	18.5	20.0	-	-	-	-
U14	124	126	94.0	-	-	-	-	-
48b	216	214	193	175	-	-	-	-
U15	55.0	53.5	44.0	39.0	-	-	-	-
51	48.5	51.5	47.5	34.5	-	-	-	-
U8	91.5	91.0	81.0	81.0	-	-	-	-
68	-	-	-	-	-	-	-	-
69a	-	-	-	-	-	-	-	-
69b	15.5	16.5	-	-	14.0	16.5	15.0	15.0
70	-	-	-	-	-	-	-	-
71	(37.0)	-	34.0	36.5	-	-	-	-
73	61.5	57.0	-	-	-	-	-	-
101	48.0	52.5	45.0	39.0	-	-	-	-

Table 9. Postcranial measurements of Danish brown bear finds.
Vertebral column and anterior extremity.
Measurements defined according to von den Driesch (1976).

Datings	Alleröd	Boreal					Boreal/ Atlantic		Subboreal			Uncertain	
Finds	1	6	7	8	11	12	5		19	28	31	9	
Measurements													
Atlas													
BFcr		-		-	-	-	-		(82.0)	-	-	-	
GLF	-	-		-	-	-	-		(67.5)	-	-	-	
LAd	-	-		-	-	-	-		36.0	-	-	-	
Axis													
LCDe	-	-		-	-	-	82.0		-	-	-	-	
LAPa	-	-		-	-		91.5		-	-	-	-	
BFcr	-	-		-	-	-	65.5		-	-	-	69.5	
BPacd	-	-		-		-	-		-	-	-	-	
BPtr	-	-		-		-	92.5		-	-	-	-	
SGW	-	-		-		-	48.5		-	-	-	51.5	
PFcd	-	-		-		-	38.5		-	-	-	-	
Scapula							sin	dx					dx
HS							(276)	277				-	-
GLP							78.0	79.5				-	-
LG							63.0	64.0				-	71.0
BG							38.5	39.5				-	58.0
Humerus							sin	dx		sin		sin	dx
GL	-	-		-	-	-	363	367	-	-	-	-	397
Bp	-	-		-	-	-	69.5	72.0	-	-	-	-	90.5
SD	-	-		-	-	-	35.0	32.0	-	-	-	33.5	32.5
Bd	-	-		-	-	-	101	102		86.5	-	116	117
Radius	sin						sin	dx					
GL.	274	-	-	-	-	-	311	313	-	-	-		
Bp	38.5	-	-	-	-	-	42.5	42.0	-	-	-		
SD	19.0	-	-	-	-	-	29.0	27.0	-	-	-		
Bd	(50.5)	-	-	-	-	-	63.5	64.5	-	-	-		
Ulna							sin	dx					
GL	-	-	-	-	-	-	363	366	-	-	-	-	
DPA	-	-	-	-	-	-	57.0	60.5	-	-	-	-	-
BPc	-	-	40.5	-	-	43.0	48.0	53.0	-	-	-	-	-

Table 10. Postcranial measurements of Danish brown bear finds.
Pelvic girdle and posterior extremity.
Measurements defined according to von den Driesch (1976).

Datings	Allerød	Boreal						Late Boreal		Subboreal			Uncertain	
Finds	1	6	7	8		11	12	5		19	28	31	9	
Measurements														
Femur			dx	sin	dx			sin	dx					dx
GL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GLC	-	-	-	-	-	-	-	417	414	-	-	-	-	456
BTr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DC	-	-	-	-	54.0	-	-	-	-	-	-	-	-	55.5
SD	-	-	-	-	-	-	-	33.0	32.5	-	-	-	-	36.0
Bd	-	-	75.5	84.0	85.5	-	-	79.5	80.0	-	-	-	-	92.5
Patella					dx									
GL	-	51.0	-	-	51.5	-	-	-	-	-	-	-	-	-
GB	-	36.5	-	-	42.0	-	-	-	-	-	-	-	-	-
Tibia				-	dx			sin	dx				sin	
GL	-	-	-	-	292	-	-	304	304	-	-	-	331	-
Bp	-	-	-	-	(83.0)	-	-	82.0	81.0	-	-	-	103	-
SD	-	-	-	-	26.0	-	-	23.0	24.0	-	-	-	31.5	-
Bd	-	-	-	-	61.5	-	-	61.5	63.0	-	-	-	76.0	-
Fibula														
GL	-	-	-	-	-	-	285	-	-	-	-	-	-	-
Calcaneus					dx							sin		dx
GL	-	-	-	-	91.0	-	-	-	-	-	-	101	-	(93.5)
GB	-	-	-	-	54.0		-	-	-	-	-	-	-	-

Table 11. Measurements (mm) of brown bear metapodials. Danish finds.
Measurements defined according to von den Driesch (1976).

Ossa metacarpalia

Finds	8	8	8	8	8	8	20
Elements	1 dx	3 sin	3 sin	3 dx	5 sin	5 dx	1 dx
GL	64.0	90.0	80.0	89.5	95.5	85.0	75.0
Bd	15.0	20.5	18.0	-	23.0	20.5	17.0

Ossa metatarsalia

Finds	8	8	9	9	9
Elements	4 dx	4 dx	3 dx	4 dx	5 dx
GL	88.0	91.5	-	(97.0)	-
Bd	19.5	20.0	22.0	22.5	22.5

Table 12. Finds and datings of brown bear in Skåne, Sweden.
Measurements of crania.
Definitions according to von den Driesch (1976:42-46, 60-62, U=Ursus) and in accordance with *Zachrisson & Iregren* (1974:44-45).

Datings	Late glacial Preboreal?	Subboreal?	Uncertain	Subboreal?		
Finds	Tjustorp bog Smedstorp SGU 7711	Breasten Stora Herrestad bog Stora Herrestad	Karstad Lake Oppmannasjön Österslöv SGU 77l3	Breasten Stora Herrestad bog Stora Herrestad		
Calvaria Measurement nos				Mandible Measurement nos	sin	dx
1	(324)	(382)	-	1	(264)	(265)
2	(300)	(355)	-	3	(246)	(245)
3	(285)	(333)	-	4	228	228
4	-	92.5	-	5	209	211
5	-	(242)	-	7	125	126
6	180	-	-	8	124	124
7	175	215	-	9	-	-
8	(142)	-	-	U9	70.5	71.0
9	(164)	(179)	-	11	52.0	51.5
12	(118)	(120)	-	U11	-	-
13	(160)	(181)	-	U11	-	-
23	139	190	-	14	22.5	23.5
24	138	155	-	U12	-	-
25	60.5	79.5	-	*60*	26.0	26.0
27	31.5	34.0	-	U12	-	-
28	18.0	21.0	-	U13	-	-
29	94.0	96.5	-	*66*	16.0	17.0
30	-	254	-	U13	-	-
31	63.0	77.5	-	17	16.0	15.5
32	89.5	132	-	U14	116	-
33	61.0	80.5	-	*48b*	206	209
34	79.0	97.5	-	U15	46.0	47.0
35	63.5	81.5	87.5	*51*	45.0	46.0
40	74.5	98.5	-	U8	86.5	86.5
7	175	198	-	*68*	-	29.5
22b	53.5	71.5	74.5	*69a*	18.0	17.0
26	63.0	-	-	*69b*	16.0	16.0
27	62.0	84.0	(92.5)	*70*	56.5	55.5
				71	39.5	41.0
				71a	-	-
				73	66.0	63.5
				101	46.5	45.5

Table 12. Finds and datings of brown bear in Skåne, Sweden. Measurements of calvaria only (continued).

Datings	Late glacial Preboreal?		Subboreal?		Uncertain	
Finds	Tjustorp bog Smedstorp SGU 7711		Breasten Stora Herrestad bog Stora Herrestad		Karstad Lake Oppmannasjön Österslöv SGU 7713	
Calvaria Measurement nos						
	sin	dx	sin	dx	sin	dx
15	89.0	89.5	110	108	104	-
15a	93.5	95.5	108	109	109	-
16	51.0	52.5	61.0	61.5	58.5	-
17	36.0	36.5	47.5	45.5	42.5	43.5
U16a	-	15.0	-	-	-	18.5
U16a	-	12.0	13.5	-	-	13.0
19	15.0	14.5	17.5	16.5	18.0	17.5
U16b	22.0	-	22.0	23.0	-	-
U16b	16.5	-	17.0	17.5	-	-
U16c	32.5	33.0	40.0	40.0	-	-
U16c	17.5	17.0	19.5	20.0	-	-
28	(136)		(159)		153	
29b	78.0	78.5	-	-	-	-
29c	-	-	-	84.0	84.0	
29d	67.0	67.0	80.0	80.0	78.5	-
31b	25.0	25.0	-	-	-	-
31c	-	-	-	20.5	23.5	23.0
36	20.0	20.0	20.5	21.5	19.5	20.0
39	29.5	31.0	39.5	39.5	34.0	-
41a	-	-	-	27.0	26.0	26.5
41b	27.5	27.0	28.5	31.0	32.0	31.5
43	(23.5)	-	29.0	28.5	-	-
44	-	-	18.5	-	-	-

Table 13a. Definitions of measurements, calvarium.
Definitions 1-40 from von den Driesch (1976:42-46, U=Ursus).
Definitions 7-44 from Zachrisson & Iregren (1974:44-45).

1	Total length: Akrokranion - Prosthion
2	Condylobasal length: aboral border of the occipital condyles - Prosthion
3	Basal length: Basion - Prosthion
4	Basicranial axis: Basion - Synsphenion
5	Basifacial axis: Synsphenion - Prosthion
6	Neurocranium length: Basion - Nasion
7	Upper neurocranium length: Akrokranion - Frontal midpoint
8	Viscerocranium length: Nasion - Prosthion
9	Facial length: Frontal midpoint - Prosthion
12	"Snout" length: oral border of the orbits (median) - Prosthion
13	Medial palatal length: Staphylion - Prosthion
15	Length of cheektooth row: M2 - P1
15a	Aboral border of the alveolus of M2 - oral border of the alveolus of C
16	Length of molar row: M2 - M1
17	Length of premolar row: P1 - P4
U16a	Length of P4
U16a	Greatest breadth of P4
U16b	Length of M1
U16b	Breadth of M1
U16c	Length of M2
U16c	Breadth of M2
19	Length of P4, alveolar dimension
23	Greatest mastoid breadth: Otion - Otion
24	Breadth dorsal to the external auditory meatus
25	Greatest breadth of the occipital condyles
27	Greatest breadth of the foramen magnum
28	Height of the foramen magnum: Basion - Opisthion
29	Greatest neurocranium breadth: Euryon - Euryon
30	Zygomatic breadth: Zygion - Zygion
31	Least breadth of skull= breadth at the postorbital constriction
32	Frontal breadth: Ectorbitale - Ectorbitale
33	Least breadth between the orbits: Entorbitale - Entorbitale
34	Greatest palatal breadth: measured across the outer borders of the alveoli
35	Least palatal breadth: measured behind the canines
40	Height of the occipital triangle: Akranion - Basion
7	Length of braincase: Basion - frontal midpoint
22b	Minimum breadth of the palate at ant. border of P4
26	Facial breadth across maxilla/zygomaticum suture in orbit
27	Facial breadth across infraorbital foramina
28	Length of cheektooth row: M2 to Prosthion
29b	Length, alveolar dimension: P2-M2
29c	Length, alveolar dimension: P3-M2
29d	Length, alveolar dimension: P4-M2 (also in von den Driesch)
31b	Length, alveolar dimension: P2-P4
31c	Length, alveolar dimension: P3-P4
36	Length of M1, alveolar dimension
39	Length M2, alveolar dimension
41a	Length of diastema: C post. border to P3 ant. border
41b	Length of diastema: C post. border to P4 ant. border
43	Length of C alveolus
44	Breadth of C alveolus

Table 13b. Definitions of measurements, mandibula.
Definitions 1-17 from von den Driesch (1976:60-62, U=Ursus).
Definitions 48b-101 from Zachrisson & Iregren (1974).

1	Total length: length from the condyle process - Infradentale
3	Length from the indentation between the condyle process and the angular process - Infradentale
4	Length: the condyle process - aboral border of the canine alveolus
5	Length from the indentation between the condyle process and the angular process - aboral border of the canine alveolus
7	Length: the aboral border of the alveolus of the M3 - aboral border of the canine alveolus
8	Length of the cheektooth row, M3 - P1
U8	Length of the cheektooth row: P4 to M3, measured along the alveoli
9	Length of the cheektooth row, M3 - P2
U9	Length of the molar row, M3 - M1
11	Length of the premolar row, P1 - P4
U11	Length of M1
U11	Breadth of M1
U12	Length of M2
U12	Breadth of M2
U13	Length of M3
U13	Breadth of M3
14	Length of M1, alveolar dimension
U14	Height of the vertical ramus: basal point of the angular process - Coronion
U15	Height of the mandible behind M2
17	Greatest thickness of the body of the jaw (below M1)
48b	Distance from notch between condyle and angle to oral border of P1
51	Height of the mandible behind P4
58	Length of the tooth row: oral border of P3 to aboral border of P4
60	Length of M2, alveolar dimension
66	Length of M3, alveolar dimension
68	Length of the canine alveolus
69a	Breadth of the canine alveolus
69b	Breadth of the canine
70	Length: aboral border of the canine - oral border of M1
71	Length: aboral border of the canine - oral border of P4
71a	Length: aboral border of the canine - oral border of P3
73	Breadth over the condyle
101	Depth at M2

Table 13c Definitions of postcranial measurements.
Definitions from von den Driesch (1976).

Atlas	
BFcr	(Greatest) breadth of the Facies articularis cranialis
GLF	Greatest length from the Facies articularis cranialis to the Facies articularis caudalis
LAd	Length of the Arcus dorsalis, median
Axis	
LCDe	(Greatest) length in the region of the corpus including the dens
LAPa	(Greatest) length of the arch including the Processus articulares caudales
BFcr	(Greatest) breadth of the Facies articularis cranialis
BPacd	(Greatest) breadth across the Processus articulares caudales
BPtr	(Greates) breadth across the Processus transverci
SBV	Smallest breadth of the vertebra
BFcd	(Greatest) breadth of the Facies terminalis caudalis
Scapula	
HS	Height along the spine
SLC	Smallest length of the Collum scapulae
GLP	Greatest length of the Processus articularis
LG	Length of the glenoid cavity
BG	Breadth of the glenoid cavity
Humerus	
GL	Greatest length
Bp	(Greatest) length of the proximal end
SD	Smallest breadth of diaphysis
Bd	(Greatest) breadth of the distal end
Radius	
GL	Greatest length
BP	(Greatest) breadth of the proximal end
SD	Smallest breadth of the diaphysis
Bd	(Greatest) breadth of the distal end
Ulna	
GL	Greatest length
DPA	Depth across the Processus anconaeus
BPc	(Greatest) breadth across the coronoid process
Pelvis	
GL	Greatest length of one half
LAR	Length of the acetabulum on the rim
LS	Length of the symphysis
SH	Smallest height of the shaft of ilium
SB	Smallest breadth of the shaft of ilium
LFo	Inner length of the Foramen obturatum
GBA	Greatest breadth across the acetabula
GBTi	Greatest breadth across the Tubera ischiadica
SBI	Smallest breadth across the bodies of the ischia

Table 13c (continued).

Femur

GL	Greatest length
GLC	Greatest length from Caput femoris
BTr	(Greatest) breadth of the region of the Trochanter tertius
DC	(Greatest) depth of the Caput femoris
SD	Smallest breadth of the diaphysis
Bd	(Greatest) breadth of the distal end

Patella

GL	Greatest length
GB	Greatest breadth

Tibia

GL	Greatest length
Bp	(Greatest) breadht of the proximal end
SD	(Smallest) breadth of the diaphysis
Bd	(Greatest) breadth of the proximal end

Fibula

GL	Greatest length

Calcaneus

GL	Greatest length
GB	Greatest breadht

Talus

GL	Greatest length

Metapodials

GL	Greatest length
Bd	(Greatest) breadth of the distal end

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