

**Keep your head high: skulls on stakes and cranial trauma in Mesolithic Sweden**Sara Gummesson<sup>1</sup>, Fredrik Hallgren<sup>2</sup> & Anna Kjellström<sup>1,\*</sup>

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*The socio-cultural behaviour of Scandinavian Mesolithic hunter-gatherers has been difficult to understand due to the dearth of sites thus far investigated. Recent excavations at Kanaljorden in Sweden, however, have revealed disarticulated human crania intentionally placed at the bottom of a former lake. The adult crania exhibited antemortem blunt force trauma patterns differentiated by sex that were probably the result of interpersonal violence. Remains of wooden stakes were recovered inside two crania, indicating they had been mounted. Taphonomic factors suggest that the human bodies were manipulated prior to deposition. This unique site challenges our understanding of the handling of the dead during the European Mesolithic.*

*Keywords:* Sweden, Mesolithic, burial practices, non-lethal violence, blunt force trauma

**Supplement 1. Osteological methods**

The osteological methods used for the analysis of the human bones follow standard protocols presented in Buikstra and Ubelaker (1994, and references therein). Morphological sex assessments were made according to Acsádi and Nemenskéri (1970). Morphological features in Mesolithic remains (especially crania), however, are often more robust than contemporary reference material; therefore an intra-study seriation was performed (cf. Jacobs 1995). No post-cranial elements could be assessed based on morphology or metrics.

Age of adults was assessed based on the level of cranial synostosis (Meindl & Lovejoy 1985) and tooth wear for molars (after Brothwell 1981) and for remaining teeth after Smith (1991). The individuals were divided into six age groups after Buikstra and Ubelaker (1994: 9);

Infans (0–3 years), Infans II (3–12 years), Juvenilis (12–20 years), Young Adult (20–35 years), Middle Adult (35–50 years), Old Adult (50+). Several of the elements could only be assessed as coming from adults (i.e. >20 years) based on size and development stage. The age determination of young individuals was based on bone length (Jeanty 1983; Fazekas & Kósa 1978).

All elements were examined macroscopically and all anomalies were documented. When possible without causing any damage, elements were examined using light microscopy (×40). The classification of observed skeletal changes follow Ortner (2000) and Aufderheide and Rodrigues-Martin (1998), unless otherwise stated. Trauma was categorized as antemortem (showing signs of healing), perimortem (fresh bone characteristics) or postmortem (dry bone characteristics), according to the SWGANTH (2011:2f). Furthermore, type of trauma was identified as blunt force trauma (BFT) or sharp force trauma (SFT) (Wenham 1989; Kimmerle & Baraybar 2008; Crowder *et al.* 2013). The results of the previous odontological analysis by Verner Alexandersen (2011) have, with some minor revisions, been incorporated here.

Animal bones were analysed macroscopically and each specimen was identified separately to anatomical element, species, genus or familia. Age estimations were, when possible, done according to Weinstock (2009), Magnell and Carter (2007), Habermehl (1985) and Bull and Payne (1982).

Element distribution, fragmentation and surface preservation and other depositional factors (rate of burial, environment and fracture patterns) were recorded, as the taphonomic history of the assemblage needed to be considered in order to be able to interpret the results.

Documentation follows criteria for weathering presented by Behrensmeyer (1978) and Noe-Nygaard (1995: 69–71), fragmentation and fracture patterns follows methods presented by Outram (2001).

## References

- ACSÁDI, G. & J. NEMESKÉRI. 1970. *History of Human Life Span and Mortality*. Budapest: Akadémiai Kiadó.
- ALEXANDERSEN, V. 2011. *Undersøgelse af Tænderne fra Kanaljorden*. Unpublished manuscript.

- AUFDERHEIDE, A. C. & C. RODRIGUES-MARTIN. 1998. *The Cambridge Encyclopaedia of Human Paleopathology*. Cambridge: Cambridge University Press.
- BEHRENSMEYER, A. 1978. Taphonomic and ecologic information from bone weathering. *Paleobiology* 4: 150–162.
- BROTHWELL, D. R. 1981. *Digging up Bones*. Third edition. Oxford University Press. Oxford.
- BUIKSTRA, J. E. & D. H. UBELAKER. 1994. *Standards for data collection from human skeletal remains. Arkansas Archaeological Survey Research Series, Fayetteville, AK, No. 44*.
- BULL, G. & PAYNE, S. 1982. Tooth eruption and epiphyseal fusion in pigs and wild boar. I Wilson, B. Grigson, C & Payne, S. Ageing and Sexing Animal Bones from Archaeological Sites. *Oxford: BAR British Series* 109: 55–71.
- CROWDER, C., C. W. RAINWATER & J. S. FRIDIE. (2013). Microscopic analysis of sharp force trauma in bone and cartilage: A validation study. *Journal of Forensic Sciences* 58: 1119–1126.
- FAZEKAS, I. & F. KOSA. 1978. *Forensic Fetal Osteology*. Akadémiai Kiadó, Budapest.
- HABERMEHL, K. H. 1985. *Alterbestimmung bei Wild- und Pelztieren*. 2nd ed. Hamburg and Berlin: Paul Parey.
- JACOBS, K. 1995. Returning to Oleni' ostrov: Social, Economic, and Skeletal Dimensions of a Boreal Forest Mesolithic Cemetery. *Journal of Anthropological Archaeology* 14(4):359–403.
- JEANTY, P. 1983. Fetal limb biometry. *Radiology* 147: 601–602.
- KIMMERLE, E.H. & J.P. BARAYBAR (ed.) 2008. *Skeletal Trauma: Identification of Injuries Resulting from Human Remains Abuse and Armed Conflict*. Boca Raton: CRC Press.
- MAGNELL, O. & R. Carter 2007. The Chronology of Tooth Development in Wild Boar – A Guide to Age Determination of Linear Enamel Hypoplasia in Prehistoric and Medieval Pigs. *Veterinarija ir zootechnika* 40: 43–48.
- MEINDL, R.S. & C.O. LOVEJOY. 1985. Ectocranial suture closure: a revised method for the determination of skeletal age at death based on lateral-anterior sutures. *American Journal of Physical Anthropology* 68: 57–66.
- NOE-NYGAARD, N. 1995. Ecological, Sedimentary and Geochemical Evolution of the Late-glacial to Postglacial Åmose Lacustrine Basin, Denmark. *Fossils and Strata* 37. Oslo: Scandinavian University Press. Oslo.
- ORTNER, D. J. 2003. *Identification of Pathological Conditions in Human Skeletal Remains*. 2nd ed. San Diego: Academic Press.

OUTRAM, A. 2001. A new approach to identifying bone marrow and grease exploitation: why the indeterminate fragments should not be ignored. *Journal of Archaeological Science* 28:401–410.

SMITH, B. H. 1991. Standards of human tooth formation and dental age assessments, in Kelly M.A. & C. S. Larsen (ed.) *Advances in Dental Anthropology*. New York: Wiley-Liss: 143–168.

Scientific Working Group for Forensic Anthropology (SWGANTH). 2011. Trauma Analysis. Available at: <http://swganth.startlogic.com/Trauma%20Rev0.pdf> (accessed 12 May 2016).

WEINSTOCK, J. 2009. Epiphyseal Fusion in Brown Bears: A Population Study of Grizzlies (*Ursus arctos horribilis*) from Montana and Wyoming. *International Journal of Osteoarchaeology*. 19: 416–423.

WENHAM, S. J. 1989. Anatomical Interpretations of Anglo-Saxon Weapon Injuries, in: Chadwick Hawkes, S. (ed.) *Weapons and Warfare in Anglo-Saxon England*. Oxford: Oxford University Committee for Archaeology, pp. 123–139.

## Supplement S2.

Table S2. Osteological finds (human and animal) from Kanaljorden, including dates.

(\*Sex was determined only genetically (Lazaridis *et al.* 2014) as morphological traits were not present or were too badly preserved. L= left, R= right; F= female, M= male, Y.= Young, Mi.= Middle, O.= Old)

Find No.	Species	Bone element	Side	N	Sex	Age	Comment	<sup>14</sup> C- date (BP)	<sup>14</sup> C lab- ID
295	Human	Crania	L+R	1	F	Adult	Ind 1	6701±64	Ua-42116
296	Human	Crania	L+R	1	M	O. Adult	Ind 2	6734±30	Ua-51722
297	Human	Crania	L+R	1	M	Mi. Adult	Ind 3	6877±69	Ua-42117
298	Human	Tooth (Maxilla)	R	1	F *	Adult	Ind 4	6842±68	Ua-42118
299	Human	Maxilla, Tooth	L+R	1		Adult	Ind 5a	6677±31	Ua-51716
299	Human	Crania	L+R	1		Adult	Ind 5b	6917±93	Ua-42119
299	Human	Tooth (Maxilla)	R	1		Adult	M2; Ind 5c		
299	Human	Tooth (Maxilla)		1		Adult	M3; Ind 5d		
300	Human	Crania	L+R	1		Adult	Ind 7: Preserved brain tissue and wooden stake	7013±76	Ua-42121
301	Human	Crania	L+R	1		Adult	Ind 8	6969±67	Ua-42122
302	Human	Crania	L+R	1	M	Adult	Ind 9	6919±64	Ua-42123
303	Human	Crania, Ribs, Scapula, Ulna, Femur, Tibia		1		Foetus	Ind 10		
305	European pond turtle	Carapax		5				6853±55	Ua-42124
306	Human	Mandible	L+R	1	M	Adult	Ind 12 (additional date 7212±109, Ua-42125)	6773±30	Ua-51723
307	Human	Crania	R	1		Adult	Could be fitted with 317		
308	Human	Tooth (Mandible)	L	1		Adult	Could be fitted with 306		
309	Human	Crania	L+R	1	M	Y. Adult	Could be fitted with 314	6836±32	Ua-51717
310	Boar	Rib	L	1			No. 13		
311	Human	Ulna	R	1		Adult		6965±31	Ua-51718
312	Human	Femur	R	1		Adult			
313	Human	Femur	R	1		Adult		6758±32	Ua-51719
314	Human	Crania	L+R	1	M	Adult	Could be fitted with 309		
315	Human	Femur	R	1		Adult			
316	Human	Humerus	R	1		Adult			
317	Human	Crania	L+R	1	F	Adult	Could be fitted with 307		
318	Human	Crania	L+R	1	M	Adult	With preserved wooden stake	6770±31	Ua-51720
342	Human	Crania	L+R	1		Adult			
343	Human	Tooth		1		Adult			

SUPPLEMENTARY MATERIAL

351	Human	Femur	R	1		Adult		6836±41	Ua-38872
352	Human	Tibia	R	1		Adult			
363	Human	Crania	L+R	1	F	Adult	Could be fitted with 295		
364	Human	Crania	L+R	1		Adult	Ind 6	6863±75	Ua-42120
365	Human	Lumbar vertebra		1		Adult			
366	Human	Thoracic vertebra		1		Adult			
1913	Human	Crania	R	1	F	Adult	Could be fitted with 307 + 307; Found inside 295	6735±44	Ua-42645
3001	Boar	Talus	R	1					
3002	Boar	Rib	L	1					
3003	Boar	Rib	R	1					
3004	Wild boar	Tibia	L	1		3,5 – 5 yr			
3005	Mammal	Unident.		1					
3007	Boar	Humerus	R	1					
3008	Boar	Tibia	R	1		> 31-35 mo.			
3010	Boar	Ulna	L	1		< 5 yr			
3011	Boar	Rib II	R	1					
3012	Ungulate	Rib		1					
3013	Mammal	Unident.		1					
3014	Mammal	Unident.		4					
3015	Boar	Thoracic vertebra		1					
3016	Mammal	Ossa plana		1					
3017	Boar	Rib	L	1					
3018	Boar	Rib		1					
3019	Ungulate	Rib		1					
3020	Mammal	Rib		1					
3021	Boar	Lumbar vertebra		1					
3022	Ungulate	Rib		1					
3023	Boar	C3	L	1					
3024	Mammal	Rib		1					
3025	Mammal	Unident.		5					
3026	Boar	Fibula	L	1					
3027	Boar	Tibia	L	1					
3028	Red deer	Phalanges 2		1					
3029	Mammal	Ossa longa		1					
3031	Boar	Rib II	L	1					
3032	Moose	Talus	L	1					
3033	Mammal	Unident.		2					
3034	Cervid	Antler		1	M				

SUPPLEMENTARY MATERIAL

3035	Boar	Rib	L	1					
3036	Boar	Thoracic vertebra		1					
3037	Boar	Rib		1					
3041	Mammal	Unident.		1					
3042	Mammal	Unident.		1					
3043	Mammal	Rib		1					
3044	Mammal	Unident.		1					
3045	Brown bear	Rib	R	1					
3047	Boar	Temporal	R	1					
3048	Mammal	Unident.		1					
3049	Mammal	Unident.		2					
3050	Mammal	Unident.		5					
3051	Ungulate	Metapodium		1	< 3 yr				
3053	Ungulate	Vertebra		1		Thoracicae/lumbalis			
3057	Mammal	Ossa longa		1					
3059	Boar	Phalanges (1)		1					
3060	Mammal	Unident.		1					
3061	Mammal	Unident.		3					
3062	Boar	Tibia		1			6776±31	Ua-51724	
3063	Mammal	Rib		1					
3064	Boar	Sacrum		1					
3065	Boar	Sacrum		1					
3066	Boar	Femur	L	1					
3067	Ungulate	Rib		1					
3068	Mammal	Unident.		1					
3070	Mammal	Unident.		1					
3071	Mammal	Unident.		2					
3072	Boar	M.c. III	L	1					
3073	Brown bear	Mandible, Teeth	L+R	1	Adult				
3074	Brown bear	Incisivi (Mandible)		1					
3075	Brown bear	Rib	R	1					
3076	Boar	Rib	R	1					
3078	Boar	Mandible		1					
3079	Ungulate	Hip bone		1			6754±30	Ua-51725	
3080	Boar	Lumbar vertebra		1					
3081	Boar	Humerus		1	> 12-23 mo.				
3082	Ungulate	Rib		1					
3083	Wild boar	Humerus	R	1	> 12-23 mo.				

SUPPLEMENTARY MATERIAL

3084	Beaver	Mandible, Tooth	L	1		> 8 mo.			
3085	Wild boar	Rib IV	R	1					
3086	Boar	Scapula	R	1		> 7-9 mo.			
3087	Brown bear	Rib	L	1					
3088	Ungulate	Lumbar vertebra		1					
3089	Ungulate	Rib		1					
3090	Boar	Lumbar vertebra		1					
3091	Brown bear	Hip bone	R	1					
3092	Mammal	Scapula		1					
3093	Moose	Rib	R	1					
3094	Moose	Metapodium		1		< 3 yr			
3095	Moose	Metapodium		1		< 3 yr			
3096	Mammal	Unident.		1					
3098	Brown bear	Rib	L	1					
3099	Ungulate	Scapulae	L	1					
3100	Boar	Humerus	L	1					
3101	Brown bear	Radius	L	1					
3102	Wild boar	Radius	L	1		~ 3,5 - 4 years			
3103	Brown bear	Rib	R	1					
3104	Boar	Mandible, Teeth	R	1	F	>13-21 mo.			
3105	Boar	Thoracic and lumbar vertebra		4			Ve.Th. 13, Ve.Lu. 2 -3		
3106	Moose	Calcaneus	L	1					
3107	Boar	Thoracic vertebra		1					
3108	Moose	Radius	L	1		> 1 yr		6703±46	Ua-44257
3109	Boar	Rib	L	1					
3110	Boar	Rib IV	R	1					
3111	Brown bear	Rib	L	1					
3112	Brown bear	Rib	R	1					
3113	Red deer	Hip bone	R	1					
3114	Boar	Rib III	L	1					
3115	Boar	Rib	R	1					
3116	Red deer	Radius	R	1					
3118	Boar	T.C.	R	1					
3119	Moose	Atlas		1		> 3 mo.			
3120	Wild boar	Calcaneus	R	1					
3121	Ungulate	Ossa longa		1					
3122	Boar	Talus	R	1					



SUPPLEMENTARY MATERIAL

3123	Wild boar	Mandible, Teeth	L+R	1	M	>7 yr		
3124	Mammal	Rib		1				
3125	Red deer	Thoracic vertebra		1				
3126	Boar	Thoracic vertebra		1			6685±42	Ua-44258
3127	Mammal	Rib		1				
3128	Boar	Radius	R	1		< 4 yr		
3129	Brown bear	Incisivi (Mandible)	L	1				
3130	Mammal	Unident.		1				
3131	Ungulate	Rib		1				
3132	Cervid	Scapula	L	1			Cervus/Alces	
3133	Wild boar	Humerus	L	1		> 19 -23 mo.		
3134	Pike	Precaudal vertebra		1				
3135	Salmonid	Caudal vertebra		1				
3136	Ungulate	Femur?	L	1				
3137	Mammal	Unident.		1				
3138	Ungulate	Ossa longa		1				
3139	Pike	Vertebra		1			6746±61	Ua-44259
3140	Mammal	Unident.		1				
3141	Boar	Femur	R	1		< 3,5 yr		
3142	Wild boar	Mandible	L+R	1	M		6780±53	Ua-44260
3143	Brown bear	Rib	L	1				
3144	Wild boar	Maxilla, Teeth	R	1	M			
3145	Boar	Mandible, Teeth	L	1	M	> 19 -21 mo.		
3146	Boar	Lumbar vertebra		1				
3147	Boar	Sacrum		1				
3148	Boar	Rib	R	1				
3149	Boar	Mandible	R	1				
3150	Boar	Rib	R	1				
3151	Ungulate	Rib		1				
3152	Moose	Phalanges (1, Ant.)		1				
3153	Cervid	Antler		1	M			
3154	Ungulate	Rib		1				
3155	Boar	Femur	L	1		< 2,5 yr		
3156	Boar	Sternum		1				
3157	Boar	C.I.	L	1				
3158	Moose	Radius	L	1		<3 yr	6802±40	Ua-44261
3159	Boar	Lumbar vertebra		1			Ve. Lu. No.2/3.	

SUPPLEMENTARY MATERIAL

3160	Boar	Lumbar vertebra		1					
3161	Ungulate	Scapula		1					
3162	Ungulate	Thoracic vertebra		1					
3163	Mammal	Unident.		1					
3164	Boar	Lumbar vertebra		1			Ve. Lu. No. 3	6935±47	Ua-44262
3166	Moose	Talus	L	1				6802±43	Ua-44263
3167	Boar	Talus	R	1					
3168	Wild boar	Humerus	R	1		> 1 yr			
3169	Boar	Femur	L	1		Subadult			
3170	Ungulate	Rib		1			Dexter?		
3171	Boar	Femur	R	1					
3172	Brown bear	Ulna	L	1		5-6 yr			
3173	Wild boar	Talus	R	1					
3174	Brown bear	Ulna	L	1				6705±43	Ua-44264
3175	Boar	Rib	R	1					
3177	Wild boar	Hip bone	R	1		> 1 yr			
3178	Red deer	Radius	R	1					
3179	Mammal	Unident.		1					
3180	Pike	Vertebra		1					
3181	Pike	Vertebra		1					
3182	Mammal	Sacrum		1					
3183	Roe deer	Thoracic vertebra		1			Ve. th 11/12/13		
3184	Boar	Hip bone	L	1					
3185	Ungulate	Lumbar vertebra		2					
3186	Roe deer	Tibia	R	1		> 18 mo.			
3187	Boar	Sternum		1					
3188	Unident.	Unident.		2					
3189	Red deer	Antler		1					
3190	Ungulate	Tibia		1					
3191	Badger (Meles meles)	Crania		1					
3192	Red deer	Lumbar vertebra		1					
3193	Roe deer	Lumbar vertebra		3			Ve.Lu. No. 2, 4, 6		
3194	Brown bear	Humerus	L	1		6-9 yr			
3195	Pike	Precaudal vertebra		1					
3196	Wild boar	Scapula	R	1					
3199	Brown bear	Humerus	L	1		Adult		6634±45	Ua-44265
3200	Human	Lumbar vertebra		1		Adult			

SUPPLEMENTARY MATERIAL

3201	Cervid	Tibia	L	1					
3202	Mammal	Ossa plana		1					
3204	Wild boar	Talus	L	1					
3205	Boar	Fibula	L	1					
3206	Mammal	Unident.		1					
3207	Brown bear	Rib	R	1					
3208	Brown bear	Humerus	R	1					
3209	Brown bear	Rib	L	1					
3211	Ungulate	Rib		1				Dexter?	
3212	Ungulate	Ribs		2					
3213	Ungulate	Rib		1					
3214	Boar	Ulna	L	1					
3215	Boar	Scapulae	L	2					
3216	Wild boar	Lumbar vertebrae		2				Ve. Lu. No. 2-4	
3217	Wild boar	Mandible	L+R	7		>14- 21 mo.			
3218	Boar	Lumbar vertebra		1					
3219	Wild boar	Mandible, Teeth	L+R	2	M	2-7 yr			
3220	Mammal	Unident.		1					
3221	Boar	Humerus	L	1		> 12-23 mo.			
3223	Wild boar	Thoracic vertebra		1				Ve.Th. No. 3	
3224	Boar	Femur	L	1		3,5 -5 yr			
3225	Mammal	Unident.		1					
3227	Wild boar	Humerus	L	1		> 19- 23 mo.			
3228	Wild boar	Scapula	R	1					
3309	Brown bear	Scapula	L	1					
3310	Wild boar	Thoracic vertebra		1				Ve.Th. No. 4/5/6	
3311	Brown bear	Rib	L	1					
3312	Brown bear	Mandible, Teeth	R	1		Adult			
3314	Wild boar	Mandible, Teeth	L+R	1	F	19 -35 mo.			
3401	Ungulate	Rib	L	1					
3402	Wild boar	Ulna	L	1		< 4 yr			
3403	Wild boar	Ulna	L	1		< 4 yr			
3405	Mammal	Unident.		1					
3406	Mammal	Unident.		1					
3442	Wild boar	T3	L	1					
3443	Wild boar	T4	L	1					
3444	Wild boar	T.C.	L	1					

SUPPLEMENTARY MATERIAL

3446	Wild boar	Ulna	L	1	< 4 yr		
3447	Wild boar	Rib III	L	1			
3448	Mammal	Ossa plana		1			
3450	Mammal	Ossa plana		1			
3451	Mammal	Ossa plana		1			
3459	Ungulate	Ribs		4			
3460	Mammal	Unident.		1			
3461	Mammal	Unident.	L	1			
3462	Wild boar	M.c. IV	L	1			
3464	Unident.	Unident.		1			
3465	Boar	Fibula	R	1			
3466	Wild boar	Femur	L	1	< 4 yr		
3467	Boar	Lumbar vertebra		1		Ve. Lu. No. 1/2.	
3471	Wild boar	Sternum		1			
3472	Ungulate	Ossa longa		1			
3473	Brown bear	Vertebra cervicale I- V		5			
3475	Ungulate	Vertebra		1			
3476	Roe deer	Tibia	R	1			
3636	Red deer	Tibia		1			
3650	Mammal	Ossa longa		1			
3653	Ungulate	Ossa longa		1			
3657	Boar	Fibula	L	1	< 31-35 mo.		
4148	Mammal	Ribs		3			
4149	Mammal	Rib		1			
4150	Mammal	Rib		1			
4151	Ungulate	Rib	R	1			
4152	Mammal	Unident.		1			
4153	Mammal	Ossa longa		1			
4154	Mammal	Ossa longa		1			
4155	Mammal	Unident.		2			
4156	Mammal	Unident.		1			
4157	Boar	C4	L	1			
4158	Boar	C3	L	1			
4159	Red deer	Lumbar vertebra		1			
4160	Red deer	Lumbar vertebra		1			
4161	Roe deer	Lumbar vertebrae		3		Ve. Lu. No. 5, 4, 3(?)	
4162	Brown bear	Radius	L	2			
4163	Mammal	Rib?		1			

SUPPLEMENTARY MATERIAL

4164	Mammal	Unident.		1				
4169	Ungulate	Lumbar vertebra		1				
4170	Boar	Crania		1		Subadult		
4171	Boar	Crania		3		Subadult		
4172	Mammal	Ossa longa		1				
4173	Mammal	Ossa longa		5				
4174	Mammal	Unident.		6				
4175	Mammal	Unident.		1				
4176	Mammal	Ossa longa		1				
4179	Boar	Humerus	L	1		> 12-23 mo.		
4180	Moose	Radius	R	1		< 1 yr		
4187	Perch	Caudal vertebra		1				
4188	Percidae	Precaudal vertebrae		2				
4189	Moose	Radius		1		< 1 yr	Dexter?	
4204	Ungulate	Ossa longa		1				
4205	Ungulate	Ossa longa		1				
4206	Mammal	Ossa longa		1				
4207	Ungulate	Ossa longa		1				
4208	Mammal	Unident.		13				
4209	Mammal	Unident.		3				
4210	Mammal	Unident.		4				
4352	Human	Crania	R	1		Y. Adult	6896±31	Ua-51721
4780	Boar	Humerus	L	1				
4953	Pike-perch	Crania	R	1				
4954	Perch	Crania	R	1				
5043								

### Supplement 3. Sex assessments

Biological sex was assessed according to morphological features of the bones (see Supplement 1). Additionally, a molecular genetic analysis of the sex on several of the bones was conducted (Lazaridis *et al.* 2014). The results did not influence the osteological assessments, but are in agreement with the results (Table S3). Several of the morphologically sexed bones were not sampled for DNA analysis. One find (298), a loose third molar, could not be assessed morphologically, but was sexed genetically.

**Table S3. Morphological and genetic sex assessments. F= female, M= male.**

Find no.	Morphological sex assessment	Genetic sex (Lazaridis <i>et al.</i> 2014)
295 (Ind 1)	F	XX
296 (Ind 2)	M	XY
297 (Ind 3)	M	XY
298 (Ind 4)		XX
302 (Ind 9)	M	XY
306 (Ind 12)	M?	XY
309	M	
314	M	
317	F?	
318	M?	
363	F	
1913	F?	

### References

LAZARIDIS, I., N. PATTERSON, A. MITTNIK, G. RENAUD, S. MALLICK, K. KIRSANOW, P. H. SUDMANT, J. G. SCHRAIBER, S. CASTELLANO, M. LIPSON, B. BERGER, C. ECONOMOU, R. BOLLONGINO, Q. FU, K. I. BOS, S. NORDENFELT, H. LI, C. DE FILIPPO, K. PRÜFER, S. SAWYER, C. POSTH, W. HAAK, F. HALLGREN, E. FORNANDER, N. ROHLAND, D. DELSATE, M. FRANCKEN, J. M. GUINET, J. WAHL, G. AYODO, H. A. BABIKER, G. BAILLIET, E. BALANOVSKA, O. BALANOVSKY, R. BARRANTES, G. BEDOYA, H. BEN-AMI, J. BENE, F. BERRADA, C. M. BRAVI, F. BRISIGHELLI, G. B. BUSBY, F. CALI F, M. CHURNOSOV, D. E. COLE, D. CORACH, DAMBA L,G. VAN DRIEM, S. DRYOMOV, J. M. DUGOUJON, S. A. FEDOROVA, I. GALLEGU ROMERO, M. GUBINA, M. HAMMER, B. M. HENN, T. HERVIG, U. HODOGLUGIL, A. R. JHA, S. KARACHANAK-YANKOVA, R. KHUSAINOVA, E. KHUSNUTDINOVA, R. KITTLES, T. KIVISILD, W. KLITZ, V. KUČINSKAS, A. KUSHNIAREVICH, L. LAREDJ, S. LITVINOV, T. LOUKIDIS, R. W. MAHLEY, B. MELEGH, E. METSPALU, J. MOLINA, J. MOUNTAIN, K. NÄKKÄLÄJÄRVI, D.

NESHEVA, T. NYAMBO, L. OSIPOVA, J. PARIK, F. PLATONOV, O. POSUKH, V. ROMANO, F. ROTHHAMMER, I. RUDAN, RUIZBAKIEV R, H. SAHAKYAN, A. SAJANTILA, A. SALAS, E. B. STARIKOVSKAYA, A. TAREKEGN, D. TONCHEVA, S. TURDIKULOVA, I. UKTVERYTE, O. UTEVSKA, R. VASQUEZ, M. VILLENA, VOEVODA M, C. A. WINKLER, YEPISKOPOSYAN L, P. ZALLOUA, T. ZEMUNIK, A. COOPER, C. CAPELLI, M. G. THOMAS, A. RUIZ-LINARES, S. A. TISHKOFF, L. SINGH, K. THANGARAJ, R. VILLEMS, D. COMAS, R. SUKERNIK, M. METSPALU, M. MEYER, E. E. EICHLER, J. BURGER, SLATKIN M, S. PÄÄBO, KELSO J, D. REICH, J. KRAUSE. 2014. Ancient human genomes suggest three ancestral populations for present-day Europeans. *Nature* 513 (7518): 409-413.

#### Supplement 4.

**Table S4. Elements with pathologies and trauma from Kanaljorden, Sweden. (L= left, R= right; BLT= blunt force trauma; SFT= sharp force trauma).**

Find no:	Bone element	Side	Trauma (SWGANTH)	Trauma type	Other skeletal changes
295	<i>Temporal</i>	R	Antemortem	BFT	
296	<i>Parietal</i>	L	Peri-/Postmortem ?	SFT	
296	<i>Nasal</i>	R	Ante-/Peri-or Postmortem	BFT	
296	<i>Palate</i>	L + R			<i>Torus palatinus</i> (slight change)*
297	<i>Parietal</i>	L + R	Antemortem	BFT	
297	<i>Temporal</i>	L	Perimortem	SFT	
302	<i>Frontal</i>	R	Antemortem	BFT	
302	<i>Parietal</i>	L	Perimortem?	SFT	
302	<i>Frontal</i>	L			<i>Hyperostosis frontalis interna (HFI)**</i>
306	<i>Mandibule</i>	L			<i>Mesial new bone formation</i>
307	<i>Parietal</i>	R	Antemortem	BFT	
307	<i>Parietal</i>	R	Antemortem	BFT	
309	<i>Parietal</i>	L	Antemortem	BFT	
309	<i>Temporal</i>	R	Antemortem	BFT	
313	<i>Femur</i>	R	Perimortem (?)	SFT	
315	<i>Femur</i>	R	Perimortem	BFT	
363	<i>Parietal</i>	L	Antemortem	BFT	
363	<i>Parietal</i>	L	Antemortem	BFT	
363	<i>Parietal</i>	L	Antemortem	BFT	
363	<i>Parietal</i>	L	Antemortem	BFT	

363	<i>Parietal</i>	R	Antemortem	BFT	
364	<i>Palate</i>	L + R			<i>Torus palatinus</i> (slight change)*
365	<i>Lumbar vertebra</i>				Degenerative changes: "lipping", inferior surface***
366	<i>Thoracic vertebra</i>				Degenerative changes: "lipping", superior and inferior surface. Schmorl's nodes***
1913	<i>Temporal</i>	R			Erosion TMJ, possible osteoarthritis****

\* García-García et al. 2010

\*\* Aufderheide & Rodrigues-Martin 1998; She & Szakacs 2004

\*\*\* Aufderheide & Rodrigues-Martin 1998; Resnick & Niwayama 1988

\*\*\*\* Resnick & Kransdorf 2005

## References

AUFDERHEIDE, A. C. & C. RODRIGUES-MARTIN. 1998. *The Cambridge Encyclopaedia of Human Paleopathology*. Cambridge University Press: Cambridge.

GARCÍA- GARCÍA, A.S., MARTÍNEZ-GONZÁLEZ, J-M., GÓMEZ-FONT, R., SOTO-RIVADENERIA, Á., OVIDEO-ROLDÀN, L. 2010. Current status of the torus palatinus and torus mandibularis. *Med Oral Patol Oral Cir Bucal*. 2010 Mar 1;15 (2):e353-60.

SHE, R. & SZAKACCS, J. 2004. Hyperostosis frontalis interna: case report and review of literature. *Ann Clin Lab Sci*. 2004; 34(2):206-8.

RESNICK, D. & NIWAYAMA, G. 1988. *Diagnosis of Bone and Joint Disorders, Vol 5*. Saunders, Philadelphia.

RESNICK, D. & KRANSDORF, M.J. 2005. *Bone and Joint Imaging*. Elsevier Saunders, Richmond.