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Research paper

Taphonomy and contextual Zooarcheology of the first Mesolithic hunting station in Thuringia, central Germany, (central Europe)

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Abstract

Taphonomy and contextual zooarcheology of the first Mesolithic hunting station in Thuringia, Central-Germany (Central Europe) was the study area of this paper. The new site at Göttern is of special importance as it is the first excavated hunting station in Thuringia. Until now, we have depended upon numerous discoveries of surface finds, special single finds and a few burials, for the exploration of the Mesolithic Era. Bone remains of wild boar/pig, red deer, moose, roe deer, aurochscattle, wild horse, brown bear, wolf/ dog, mouse and birds have been discovered.

Keywords: *Tophonomy; Contextual Zooarchology; Mesolithic; Göttern; Central Europe; Germany; Thuringia.*

1. Introduction

The Mesolithic is one of the most important era of the human history, because it includes the first economic revolution of humankind - the Agraric change. New structures of the social relations and dynamics of production, power relations in agrarian formations and ownership structures, cultural and sacred traditions and art were developed during this phase. There was a transition from the hunter-gatherer culture to agriculture. Hunter-gatherer culture is a type of subsistence lifestyle that relies on hunting and fishing animals and foraging for wild vegetation and other nutrients like honey for food. Until approximately 16,000 years ago, all humans practiced hunting-gathering continuity in Europe and the Mediterranean (Risch & Meller 2015). The changing flavor of Mesolithic meals from Hunter-Gatherer Contexts to agrarian is measurable with archaeobotanical methods such as pollen analysis. Behre (2007) presented a compilation of the evidence for Mesolithic agriculture in and around central Europe from many localities. While the origin of agriculture in the Fertile Crescent was a long and continuous process, two different processes have been proposed for the transition from foraging to farming in Europe. One is colonization by immigrants who brought domesticated crop plants and the adoption of fully developed agricultural system by Mesolithic people, as is mostly assumed for the start of the Linearbandkeramik (LBK), as the oldest rural culture of the Neolithic Age in Central Europe with permanent settlements (Fig. 1).
Current representations of the context of Palearctic Mesolithic animal bone remains can be found in Bartosiewicz 2020, Çakirlar & Aici 2020, Lõngas 2020, Monks 2020, Patel & Meadow 2020, Sergeantson 2020 and Vigne 2020. The Mesolithic in Thuringia dates from around 9,000 to 5,000 BC. After an initial period of reforestation in the late glacial period, large areas of Thuringia seem to have been cleared again in the late dryas. Sustainable afforestation then began in the Preboreal. The reduction of the vast treeless tundra by the sprawling forests led to a change in fauna and people had to adapt to the new conditions. So far, when researching the Mesolithic, we had to rely on numerous inventories of surface finds, special individual finds and a few burials. Bones from wild boar/domestic pig, red deer, elk, roe deer, aurochs/domestic cattle, wild horses/domestic horses, brown bears, wolves, domestic dogs, mice and birds have now been detected.
Typical finds from this era are geometric microliths. In peat horizons that arose around 6,000 BP, large amounts of grain pollen can be detected for the first time. This means that agriculture began at the end of the Mesolithic Era, which gives it a special meaning for archaeological research. The Göttern site is of particular importance as it is the first excavated open-air hunting station in Thuringia. It was preserved by the crash of the actual station in a doline and was able to survive largely undisturbed to this day. Part of the concentration of the finds was left in the ground for future research.
From August to November 2007 archaeological excavations were carried out in Göttern on the site "Über der Quelle". These excavations were necessary because during the preliminary investigation of the area in 2005, in the course of the planning for the relocation of the Highway 4 below a Weser Germanic burial ground, a layer within a sinkhole that contained Silex artifacts was identified. In 2007, a cut was made through the sinkhole to clarify the stratigraphic situation. A layer of eroded slope loam was visible in profile, in which the burial ground was sunk. Within this layer, two bottom fragments of a bell-shaped beaker of the Bohemian type were found, which is the only evidence of a bell-shaped beaker with floor decorations in Thuringia so far. There was a black clay layer with high organic content

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underneath the slope loam (Fig. 2-6). The lower part of the filling consisted of a yellow clay, which was disturbed by two cones of debris (Fig. 4). The sinkhole was then excavated east of the cut over an area of 25 square meters. A total of 36 flint artifacts were documented on site in the black organic clay layer. In the layer of lame underneath there were no more silices, but instead several hundred fragments of animal bones (Plate 1). An important observation was made in plane 17 (Plate 2). Here an accumulation of animal bones, burnt stones and charcoal fragments occurs, which can be interpreted as the remains of a fireplace. Several animal bones were anatomically connected in this plane.

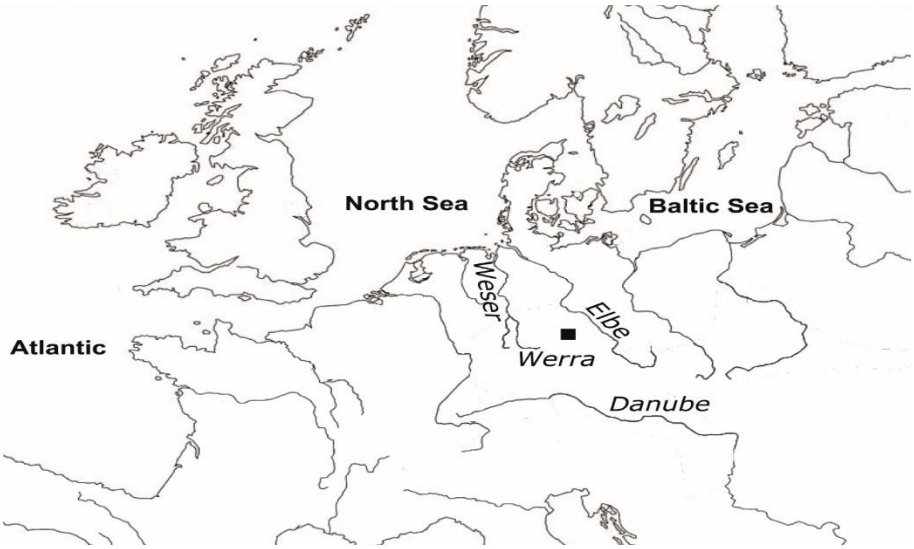

Fig. 1: Schematic Map of Nerthern and Central Europe Based A Map by Behre (2007) Modified and Expanded. Black Square: Central European Mesolithic Göttern Site - 9,501 To 8,940-8637 Cal BC Between the Larger Rivers Weser, Werra, Elbe and Danube.

2. Geographical and stratigraphical position

The place of discovery "Above the spring" in Göttern is positioned in the Free State of Thuringia in Germany, Central Europe with the coordinates: 11.46221 E 50.892537 N.
Geologically, the Göttern site is located in the Saalfeld fault zone, along a fault in the basement in the south-eastern part of the Thuringian Basin and was influenced by the formation of the Thuringian Forest and the Thuringian Slate Mountains. The actual site is located on a hillside with a slope of two meters, from the southeast to the northwest, directly at a break-off edge to the valley of the small river Magdel. The Göttern site is located in Central Germany between the larger rivers Weser, Werra, Elbe and Danube (see figure 1).
To date in the Göttern sinkhole (see Karl et al. 2011), two samples were examined and calibrated according to IntCal04 (Reimer et al. 2004). One animal bone (inventory number 07 / 138-540) showed no collagen preservation, making dating impossible. The surrounding sediment from 07 / 138-540 (yellow clay layer) resulted in Erl-11766: 9501 +/- 61 BP. The calibration showed an age of 9,137 BC to 8,972 BC (33.3% b. 1Sigma) or 8,940 BC to 8,637 BC (62.1% b. 2 Sigma).

3. Materials and methods

Under general procedure, each of the addressable fragments is recorded with its primary data according to a code system in Excel, whereby the parameters findings, animal species, bone type / skeletal part, bone part, side, gender, coarse age, fine age, pathology, slaughter and cutting traces, fire - and burn marks as well as the dimensions are taken into account. This procedure essentially corresponds to the "Knocod" system in Access according to Uerpmann (1978). The diagrams were generated directly from this as well as the secondary data. The age is determined according to Habermehl (1961). The measurements were taken with a digital caliper with 0.1 mm accuracy according to von den Driesch (1976). In principle, Albarella et al. (2020), Reichstein (1989) and Schmid (1972) followed. Abbreviations used in the text: GL = greatest length, GLl = greatest length lateral, Ll = outer length lateral, DD = thickness of the diapophysis, B = width, Bp = width proximal, Bd = width distal, GB = greatest width, Bl = width longitudinal, PL = Physiological length on the vertebral body, BFcr = width of the facies terminalis cranialis, BFcd = width of the facies terminalis caudalis, HFcr = height of the facies terminalis cranialis, HFcd = height of the facies terminalis caudalis, KD = crown thickness, D = thickness, KL = crown length, KB = Crown width, KH = crown height, P = premolar, M = molar, max = maxillary (upper jaw), mand = mandibular (lower jaw), WRH = height at withers, VWZ = migration period, SL-AW = Slavic-Avar, AM = Old Magyar, KHB– bone fracture, KB– bone burn, MIZ– minimum number of individuals, WRH– height at withers, FWK– meat value class, 1.0 or ♂ - male, 0.1 or ♀ - female, 0.01 or juv- juvenile, TA- animal species, KN- bone species, CM– Corpus mandibulae, BS– traces of processing, BssS– bite traces, GS– traces of usage, ZS– traces of decomposition.

4. Taphonomic relationships

Below the slope loam there was a black clay layer with a high organic content (Fig. 2). The lower part of the filling consisted of a yellow clay, which was disturbed by two cones of debris (Fig 3). The sinkhole was then excavated east of the cut over an area of 25 square meters. A total of 36 flint artifacts were documented in situ in the black organic clay layer. No more silices were found in the layer of clay below, but instead several hundred fragments of animal bones. An important observation was made on plane 17 (Fig. 4-5). An accumulation of animal bones, burnt stones and charcoal occurs here, which can be interpreted as the remains of a fireplace. There were also several animal bones in the anatomical association in this plane. To date the sinkhole Göttern (see Karl et al. 2011), two samples were meas-

ured and interpreted according to IntCal04 (Reimer et al. 2004). One animal bone (Inv.-No.: 07 / 138-540) showed no collagen preservation, making dating impossible. The surrounding sediment from 07 / 138-540 (yellow clay layer) revealed.

The salvaged bone material is very poorly preserved. On the one hand, the bone substance was loosened by acidic soil water and largely only passed down as a soapy, greasy mass (appendix 2). Only a few larger remnants of limb bones and especially tooth enamel were present in a consistency that was barely sufficient to be able to be preserved with complex preparation. On the other hand, the enclosing sediment was very fine-grained and showed a very high organic content, partly with a charcoal character (Muddy). Due to the high organic and water content, severe shrinkage occurred after recovery, which made the maintenance process even more difficult (Tables 1-2).

Overall, the distribution of material among the individual finds was already fragmentary. Only the remains of a horse's hind leg were still partially in situ (inventory number 07 / 138-548). The otherwise almost always present fracture surfaces, especially on larger bone fractures below the reading finds, could be impact marks, although they were probably caused by a dramatic environmental event. This is supported by the extreme material scattering of small and very small fragments (Appendix 1), the corresponding stones in situ and the largely missing stratigraphy in the find area. The influence of running water must be taken into account because there are seven shell limestones with clear traces of flushing (Table 1; Fig. 1). The sediment body (calcium carbonate) has eroded to such an extent that the harder edges of the enclosed mussel shells made of aragonite (bivalves) are exposed and stand out sharply. Occasionally there are smaller, indeterminable residues with clear traces of burn or annealing (Plate 1; Fig. 3).

Fig. 2: Detail from Profile E, Section 2 (See Fig. 3, Left Part).

Fig. 3: Overview of Profile E, Section 2

Fig. 4: Section of Area 2, Plane 17 with Stones and Animal Bones in Situ.

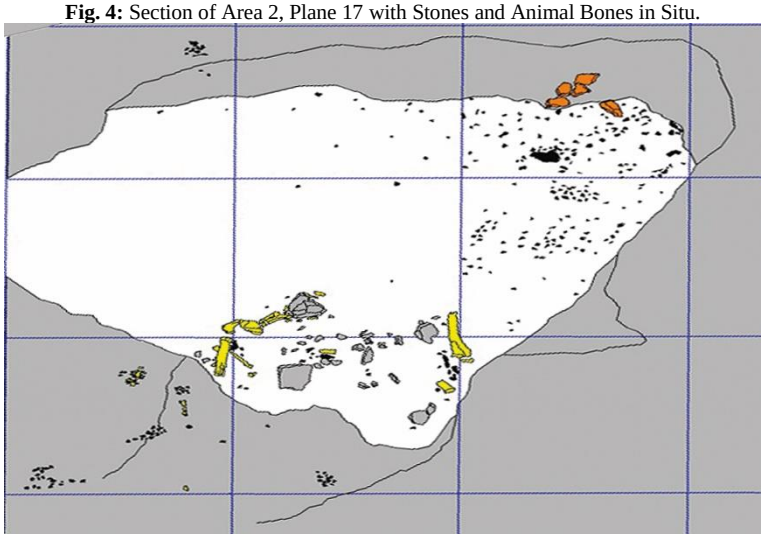

Fig. 5: Plane Drawing of the Fireplace as in 4a. All Observed Stones (Gray), Heat-Cracked Stones (Orange), Animal Bones (Yellow) and Charcoal (Black) from Surface 2- Plane 17.

Plate: 1: Some Burned Bones and Some Other Remains of Bones.

5. Finding of animal's bones

5.1. Sus scrofa Linnaeus, 1758 (pig) plate 2, figs. 8-10, 12-15

Apart from a distal radius fragment (07 / 138-324), there are mainly tooth remnants from pigs. A canine fragment of the crown (07 / 138-241), a heavily chewed P3 inferior (07 / 138-460), a presumed P4 fragment inferior (07 / 138-291), a complete P3 successor tooth (07/138 -465) and an? M fragment (07 / 138-226). Removable dimensions are shown in Table 2. Some pig teeth show strong abrasions of the tooth crowns (plate 2, figures 10 to 14), which is to be seen as a clear sign of domestication!

5.2. Bos primigenius Bojanus, 1827 (ur, cattle) plate 2, 17-22, 12, 26

There are also are primarily tooth remnants from cattle, such as a presumed M1 fragment with root and crown remnants (07 / 138-377), an M3 successor tooth inferior (07 / 138-318), an M3 successor tooth inferior without a root (07 / 138-247), one M1 inferior (07 / 138-268), two P or M fragments (07 / 138-314 and 328), two P fragments superior (07 / 138-267, and 328), two M inferior (07 / 138-244 and 516), the latter heavily chewed and one M indet. (07 / 138-366). Only among the "reading findings 1" are seven strongly fragmented remains of extremity bones (07 / 138-230), which definitely belong here due to the thickness of the substantia compacta. There are also P or M fragments, jaw and limb remains. Removable dimensions are shown in Table 3.

5.3. Cervus elaphus Linnaeus, 1758 (red deer) plate 2, 1-7, 23a-d

The red deer is sin through an almost complete metatarsus. (07 / 138-360), which lacks the proximal end. Four trunk vertebrae (07 / 138-304 and 243) probably also belong here. Furthermore, a P3 permanent tooth inferior (07 / 138-397) and the root with crown base of an M2 inferior (07 / 138-341) show corresponding characteristics. Removable dimensions are shown in Table 4.

5.4. Alces alces Linnaeus, 1758 (moose) plate 2, 7, 11

A smashed molar fragment and a heavily shaved premolar fragment can be assigned to the elk.

5.5. Capreolus capreolus Linnaeus, 1758 (deer) plate 2, 17

A characteristic premolar 1 and a scapula fragment come from the deer.

5.6. Equus caballus, Linnaeus, 1758 * (horse) plate 2, ab. 25, 29, 30a-b, 31-32

The remains of the horse can be identified most reliably in the present finds. A metatarsus dex. was in situ with the os cuneiform, os scaphoideus and metatarsus II (07 / 138-548). Since the epiphyses are completely ossified, the individual age is lesser than 1.25 years. Further limb remains are a tibia sin. if the proximal end is broken off (07 / 138-543), a calcaneus fragment (07 / 138-545) and a suspected humerus fragment (07 / 138-249). An incisive (07 / 138-393) and an extremely wide and crooked M-fragment (07 / 138-275) can be addressed on tooth remnants. Removable dimensions are shown in Table 5.

5.7. Canis lupus, Linnaeus, 1758 (Wolf, dog) plate 1, figure 33

Only a characteristic distal tibial fragment (07 / 138-435) with a width of 30.0 is available from this predator.

5.8. Ursus arctos Linnaeus, 1758 (Brown bear) plate 2, figure 28

A badly shattered right distal tibia fragment and a humerus fragment come from the brown bear.

5.9. Rodentia gen. et spec. indet. (Mouse) plate 2, figure 16

An isolated inferior incisive comes from a small rodent, presumably smaller than hamster, most likely a real mouse (Murinae). Removable dimensions are: 07 / 138-391 - L = 7, W = 1 mm.

5.10. Aves indet. (Vogel) plate 1, figure 3

Two burned-out long bone fragments are present in the burned bone of a bird.

6. Withers heights, meat value classes

While the few remains of large mammals such as *Sus scrofa, Cervus elaphus* and *Bos primigenius* do not allow a decision according to wild animal or domestic animal breed, in my opinion such an attempt can only be undertaken for the extremity remains of *Equus caballus.* If at all, a comparison can only be made with data from larger series, whereby the study by Ambos & Müller (1980) offers the largest scope of material. According to these authors, it is always of particular interest whether the horses were steppe horses. In general, long metapods indicate a dry steppe or desert-like climate, while relatively short metapods indicate a moist climate in a tree-steppe or forest landscape. Based on the metatarsus of Göttern (07 / 138-548) with a GL of 270 mm, the following height at the withers is averaged according to the information from Ambos & Müller (1980) as in Table 6.

According to Ambos & Müller (1980), the metapodial indices are very variable in the various horses, whereas the Mt: Mc index is less. In many horses, the metacarpus and metatarsus are either equally short or relatively long. They include indices of Avar and Western European prehistoric horses for comparison, with the series largely agreeing in terms of the accumulation, only the Avar horses differ slightly in the mean values. The indices of Göttern fit into the variance spectrum as shown in Table 7. In the evaluation, material from five contiguous centuries was taken into account, in particular: Migration period (5th-6th centuries), Slavic-Avar period (7th-8th centuries), Mikulčice (8th-9th centuries) and Old Magyar Time (10th century). The distribution of values shows that the horses were in a fairly large area of roughly the same size over this period, with a marked range of variation. Local peculiarities are very difficult to prove and relate in particular to the proportions of the skull and pelvis, which cannot be traced back to the material of Göttern, not even the stenonine or caballine tooth type (Karl, 2013).

Only the extremity data suggest a steppe horse type. In the total length of the metatarsus (GL) Göttern (07 / 138-548) is in the maximum value of the ancient Magyar and is significantly smaller than that from the Migration Period, the Slavic-Avar period and from Mikulčice. In the proximal width (Bp) and the distal width (Bd) as well as the diapophyseal thickness (DD) the ratios are reversed. Here the values are well above the old Magyar and are roughly in the mean of the other samples. The corresponding dimensions of Oberdorla (Teichert, 1974) are somewhat higher. The greatest lengths lateral (GLl) range from 211.0 to 269 (ø 245.69) and the greatest lengths (GL) from 218.0 to 277.0 (Ø 270.25), n = 16. The calculated withers high (WRH) range from 112.0 to 143.0 (ø 139.81) and 113.0 to 145.0 (ø 141.01). With a shorter overall length, Göttern (07 / 138-548) was significantly higher, i.e. more powerfully built, especially in the median and distal widths. The GL of the Bernburg culture from Großobringen are even shorter with 261.0 (n = 1), WRH = 136.0-137.0 (Barthel, 1985) and the Latène period from Großfahner from 237.0 to 245.0 (ø 241, 5), n = 4, (Barthel, 1982). The WRH calculated for this range based on the GL from 124.0 to 128.7 (ø 126.25) or on the GLl from 122.0 to 126.3 (ø 124.3). The Bronze Age mare von Unterhautzenthal had a WRH between 135.0 and 140.0 (Pucher 1992). But this has a long and slender metatarsus. Overall, all horses compared here were relatively small, up to a WRH of 147.0. They are now considered ponies. Since domestication in mammals initially begins with gracilization, the Eastern European groups seem to have continued to be cultivated.

While the wild horses from Ehringsdorf near Weimar from the Eemian period were still relatively tall animals, a continuous decrease in size from the Eemium to the Holocene can be demonstrated (Musil, 1977). This smaller type corresponds to Göttern (07 / 138-548). Because of the wide range of variations already mentioned, a decision between wild horses or domestic horses cannot be made clearly here. In any case, the metatarsus indicates a very primitive type. Pucher (1992) considers it probable that post-domestication also occurred in horses, similar to cattle and pigs, in the course of the late Neolithic and the entire Bronze Age beyond the Eastern European domestication center. Genes from other wild populations could have flowed into the population of the sparsely imported domestic horses and largely match the appearance of the domestic animals to the respective wild forms. That was certainly promoted by loose pasture farming.

For distal tibia widths for Bronze Age dogs from Oberdorla, Teichert (1974) gives values from 21.0 to 23.0 (Ø 21.57) with n = 7 and for a Latency dog from Schönburg, Burgenkandkreis with 22.0. Here the value of Göttern (07 / 138-435) is significantly higher at 30.0. Even for large dogs, Teichert (1968) only provides distal tibia widths of 22.0 to 25.0 (Bulldog recent), 21.0 to 22.0 (schnauzer recent) and 22.0 to 25.0 (Kunersdorf desert, n = 3) together. Because of its size, the tibial remnant is counted as a wolf by Göttern.

Meat value classes are quality standards in meat evaluation. Reconstructing these for prehistoric finds is another main goal of zooarcheology. The corresponding skeletal zones and meat value class indicators (Karl, 2017) of Göttern are distributed as shown in Figure 6 and allow the corresponding parts of carcasses to be reconstructed. The meat value class A indicates the use of the best meat and is indicated by the bones of the zonoskeleton and the stylopodium (scapula, pelvis, humerus, femur = 33%). Their presence suggests consumption and storage in the find area. The meat value class B is associated with the use of less valuable meat, which is indicated by the bones of the skull and the zeugopodium. These are mainly debris (lower jaw, radius, ulna, tibia = 22%). The bones associated with meat value class C, such as the maxilla and autopodium, point to a slaughter area (upper jaw, carpalia, metacarpus, tarsalia, metatarsus, phalanges = 45%). The relatively high proportion of classes A and C characterizes the sinkhole area near the Göttern as a hunter's station.

Plate. 2: Animal's Bones Remains.

7. Environmental analysis

The environmental analysis based on the environmental demands of the previously known species shows the following distribution: forest 75% (*Sus, Cervus, Alces, Capreolus, Canis, Ursus*), open terrain 12.5% (*Equus*) and mixed area 12.5% (*Bos*). As a result, the Holocene environment can be reconstructed by Göttern as a large forest with an adjacent open landscape, partly as dry land (steppe). Presumably, parts of the forest were floodplain (alluvial forest), marshland and small permanent water bodies. Despite the fragmentary proportions, a list of species can be compiled which, apart from *Canis lupus* and the rodent teeth, only includes large mammals. Most likely, there was a forest edge zone with flowing water. The small rodent can come from both areas (wood mouse or field mouse) just like birds. Compare the diagram for the abundance analysis of the animal species of Göttern in Figure 6.

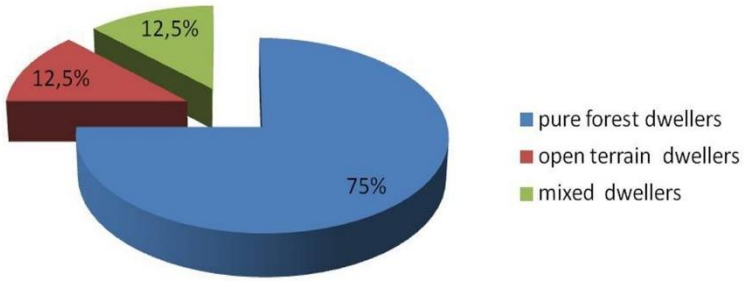

Fig. 6: Diagram for the Ecological Abundance Analysis of the Animal Species of Göttern Site.

8. Conclusions

The site Göttern was thus dated with a range from 9501 to 8940-8637bc and positioned in the transition area of the Palaeolitic from 2 million to 8,000 bc to the Mesolithic beginning around 8,000 bc and extending to 6,000 bc. The population here was just in the transition from foraging to farming in Europe, with features of domestication in abrasion types of some teeth. The typical silices finds from this site are geometric microliths in Mesolithic style.
Supplementary materials 1: Tables:

Table 1: Sus Scrofa, Teeth

inventory number	total length	width	thickness	tooth length	tooth width	tooth height
07/138-241	37,52	13,14	7,68	-	-	-
07/138-465	-	-	-	33,97	16,07	13,97
07/138-324	-	85,0 (distal)	-	-	-	-

Table 2: Bos Primigenius, Teeth

inventory number	crown height	crown thickness	crown height	crown height with root
07/138-247	24,50	16,60	53,66	-
07/138-268	24,50	16,60	(46,29)	-
07/138-267	29,42	17,23	50,56	-
07/138-244		18,85		74,48
07/138-516	27,02	16,40	54,17	-
07/138-366	24,33	15,80	52,42	-

Table 3: Cervus Elaphus, Teeth and Metatarsus

inventory number	B_p	Bl	DD	PL	BF_{cr}	HF_{cr}	BF_{cd}	HF_{cd}
07/138-360	40,83	43,23	26,14	-	-	-	-	-
07/138-243	-	-	-	58,71	(40,0)	36,93	(31,85)	29,95
07/138-243	-	-	-	59,53	41,37	38,47	37,88	37,16
07/138-304	-	-	-	55,28	(37,81)	34,11	(33,25)	(25,27)

Table 4: Equus Caballus, Metatarsus and Tibia

inventory number	total length	total length lateral	length latera	distal thickness	proximal width	distal width	total width	smallest thickness	smallest height	smallest width
07/138-548	270,0	264,0	262,0	35,37	52,4	53,5	-	-	-	-
07/138-545	-	-	-	-	-	-	46,0	-	-	-
07/138-543	(293,0)	-	-	-	-	70,94	-	46,5	-	-
07/138-393	-	-	-	-	-	-	-	-	17,84	11,85

Table 5: Reconstruction of the Withers Height in Horses Using the Metatarsus

Göttern site	total length metatarsus	withers height	gender
07/138-548	270,0	135,88	1,0?

Table 6: Comparison of the Indices of Selected Prehistoric Horses

Comparison samples	total length min.	total length max.	total length average	proximal width min.	proximal width max.	distal width min.	distal width max.	distal thickness min.	distal thickness max.
Großfahner	237	245	241	40	45	41	45	25	29
Oberdorla	218	277	247,5	39	52	47	44	29	30
Großobringen	261	261	261	52	52	50	50	35	35
Slavic-Avar	231	292	261,5	41	55	36	54	27	38
Mikulčice	245	282	263,5	43	54	44	53	28	35
Migration period	259	275	267	47	52	48	51	29	33
Göttern	270	270	270	52,4	52,4	53,5	53,5	35,37	35,37

Appendix 1:

Catalog of the bone remains.

Catalog of the bone remains

Finding no.	Fund label no. date	Refered material	Inventory number
52	19043 28.06.2007	Roe deer, first left premolar, ?humerus, dist., dex. Ur/ cattle, Talus, sin., Humerus, dist., sin., Brown bear, humerus fragment, dist.,	07/138-220
52	19042 28.06.2007	Wild boar / domestic pig, 3rd molar fragment	without number
LF	19017 04.07.2007	Ur / cattle, fragmented bones	07/138-230
57 Pl. 1	19111 06.08.07	indeterminable bone splinter	07/138-235
52 Pl. 2	19113 13.08.07	indeterminable bone splinter	07/138-237

Qu. XII			
52			
Pl. 2	19114	indeterminable bone splinter	07/138-238
Qu. II	13.08.07		
52			
Pl. 3	19116	indeterminable bone splinter	07/138-240
Qu. II	14.08.2007		
52			
Pl. 3	19117	Wild boar / pig, upper right canine fragment	07/138-241
Qu. II	14.08.2007		
52			
Pl. 3	19118	indeterminable bone splinter	07/138-242
Qu. II	14.08.2007		
52			
Pl. 3	19119	indeterminable bone splinter	07/138-243
Qu. II	14.08.2007		
52			
Pl. 3	19120	indeterminable bone splinter	07/138-244
Qu. II	14.08.2007		
52			
Pl. 4	19122	indeterminable bone splinter	07/138-246
Qu. IV	15.08.2007		
52			
Pl. 4	19123	Ur / cattle, 3rd left lower molar	07/138-247
Qu. IV	15.08.2007		
52			
Pl. 4	19125	indeterminable bone splinter	07/138-249
Qu. II	15.08.2007		
52			
Pl. 5	19126	indeterminable bone splinter	07/138-250
Qu. IV	16.08.2007		
52			
Pl. 5	19127	indeterminable bone splinter	07/138-251
Qu. IV	16.08.2007		
52			
Pl. 5	19129	indeterminable bone splinter	07/138-253
Qu. II	16.08.2007		
52			
Pl. 5	19130	indeterminable bone splinter	07/138-254
Qu. II	16.08.2007		
52			
Pl. 5	19131	indeterminable bone splinter	07/138-255
Qu. II	16.08.2007		
52			
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Pl. 17 Qu. IV 52	02.11.2007 7855		
Pl. 17 Qu. VIII 52	05.11.2007 7859	indeterminable bone splinter	07/138-549
Pl. 17 Qu. IV 52	08.11.2007 7188	?Arvicola, mouse, right indeterminate incisive	07/138-553
Lesef.	25.20.2007	11x indeterminable bone splinter	07/138-554

Appendix 2:

Very small bone fragments from indeterminate mammals

Finding	Find	Quadrant	Plane	Remarks	Number
07/318-316	52	VII	4	indeterminable bone splinter	1
07/318-290	52	XII	5	indeterminable bone splinter	1
07/318-292	52	XIV	9	indeterminable bone splinter	1
07/318-295	52	V	4	indeterminable bone splinter	1
07/318-293	52	V	4	indeterminable bone splinter	1
07/318-448	52	XIII	8	indeterminable bone splinter	1
07/318-319	52	VII	4	indeterminable bone splinter	1
07/318-339	52	XIII	3	indeterminable bone splinter	7
07/318-514	52	X	13	Carpale or tarsal	1
07/318-362	52	VII		indeterminable bone splinter	4
07/318-345	52	V	6	indeterminable bone splinter	1
07/318-235	52		1	indeterminable bone splinter	26
07/318-265	52	VIII	6	indeterminable bone splinter	2
07/318-253	52	II	5	indeterminable bone splinter	2
07/318-315	52	I	5	indeterminable bone splinter	1
07/318-367	52	V	10	indeterminable bone splinter	1
07/318-302	52	I	5	Vertebral fragment	1
07/318-306	52	V	5	Vertebral fragment	1
07/318-255	52	II	5	indeterminable bone splinter	4
07/318-281	52	XII	4	Skull fragment	1
07/318-306 o. 326 ?	52	VIII	4	indeterminable bone splinter	1
07/318-266	52	IV	7	indeterminable bone splinter	1
07/318-518	52	II		Profil 0-8 o. 0-P	3
07/318-242	52	II		1 Root fragment	29
07/318-246	52	IV	4	indeterminable bone splinter	6
07/318-257	52	VIII	4	indeterminable bone splinter	2
07/318-418	52	XI	5	Long bone fragment	1
07/318-250	52	IV	5	indeterminable bone splinter	7
07/318-237	52	II		indeterminable bone splinter	8
07/318-256	52	VIII	4	indeterminable bone splinter	2
07/318-547	52	IX	17	4 (s. Pl 17)	1
07/318-301	52	I	5	Scapular fragment	1
07/318-238	52	XII		indeterminable bone splinter	10
07/318-300	52	I	5	Vertebral fragment	1
07/318-409	52	IX	4	2 rib fragments	10
07/318-394	52	V	11	indeterminable bone splinter	2
07/318-495	52	IX	11	indeterminable bone splinter	1
07/318-374	52	V	10	indeterminable bone splinter	1
07/318-384	52	V	10	indeterminable bone splinter	1
07/318-488	52	II	13	indeterminable bone splinter	3
07/318-468	52	IX	8	indeterminable bone splinter	2
07/318-416	52	IX	4	indeterminable bone splinter	4
07/318-390	52	V	11	indeterminable bone splinter	2
07/318-484	52	II	12	indeterminable bone splinter	1
07/318-512	52	XII	13	indeterminable bone splinter	1
07/318-474	52	IX	8	indeterminable bone splinter	1
07/318-285	52	IV	11	indeterminable bone splinter	2
07/318-372	52	V	10	indeterminable bone splinter	1
07/318-261	52	II	6	indeterminable bone splinter	6
07/318-423	52	VI	5	root fragment	1
07/318-407	52	IX	4	indeterminable bone splinter	1
07/318-410	52	IX	4	indeterminable bone splinter	1
07/318-469	52	IX	8	indeterminable bone splinter	1
07/318-321	52	VII	4	indeterminable bone splinter	1
07/318-254	52	II	5	indeterminable bone splinter	3
07/318-483	52	II	12	indeterminable bone splinter	1
07/318-381	52	V	10	indeterminable bone splinter	3
07/318-378	52	V	10	indeterminable bone splinter	3
07/318-263	52	IV	11	indeterminable bone splinter	2
07/318-424	52	XI	5	indeterminable bone splinter	4
07/318-269	52	XII	5	indeterminable bone splinter	2
07/318-383	52	V	10	indeterminable bone splinter	4

07/318-350	52	III	8	indeterminable bone splinter	4
07/318-356	52	V	8	indeterminable bone splinter	1
07/318-296	52	V	4	indeterminable bone splinter	1
07/318-430	52	VII	8	indeterminable bone splinter	2
07/318-313	52	I	5	indeterminable bone splinter	1
07/318-358	52	XIII	5	indeterminable bone splinter	1
07/318-343	52	V	6	indeterminable bone splinter	1
07/318-385	52	V	10	indeterminable bone splinter	1
07/318-363	52	VII	4	indeterminable bone splinter	2
07/318-375	52	V	10	indeterminable bone splinter	2
07/318-286	52	IV	11	indeterminable bone splinter	1
07/318-320	52	V	5	indeterminable bone splinter	1
07/318-508	52	IX	11	indeterminable bone splinter	1
07/318-346	52	V	6	indeterminable bone splinter	1
07/318-333	52	VII	5	indeterminable bone splinter	1
07/318-142	52	IX	3	indeterminable bone splinter	1
07/318-370	52	V	10	indeterminable bone splinter	3
07/318-352	52	V	8	indeterminable bone splinter	1
07/318-357	52	V	8	indeterminable bone splinter	1
07/318-336	52	I	6	indeterminable bone splinter	1
07/318-294	52	V	4	indeterminable bone splinter	1
07/318-351	52	III	8	indeterminable bone splinter	1
07/318-348	52	III	8	indeterminable bone splinter	3
07/318-420	52	XI	5	indeterminable bone splinter	2
07/318-349	52	III	8	indeterminable bone splinter	4
07/318-264	52	VIII	6	indeterminable bone splinter	1
07/318-382	52	V	10	indeterminable bone splinter	2
07/318-431	52	XI	6	indeterminable bone splinter	1
07/318-419	52	XI	5	indeterminable bone splinter	1
07/318-329	52	III	5	indeterminable bone splinter	2
07/318-457	52	XIII	8	indeterminable bone splinter	1
07/318-369	52	V	10	indeterminable bone splinter	1
07/318-395	52	V	11	indeterminable bone splinter	1
07/318-388	52	V	10	indeterminable bone splinter	2
07/318-450	52	XIII	8	indeterminable bone splinter	1
07/318-386	52	V	10	indeterminable bone splinter	1
07/318-371	52	V	10	indeterminable bone splinter	1
07/318-373	52	V	10	indeterminable bone splinter	1
07/318-355	52	V	8	indeterminable bone splinter	1
07/318-340	52	IX	3	indeterminable bone splinter	1
07/318-320	52	VII	4	indeterminable bone splinter	1
07/318-364	52	VII	4	indeterminable bone splinter	2
07/318-354	52	V	8	indeterminable bone splinter	1
07/318-408	52	IX	4	indeterminable bone splinter	1

Appendix 3:

Real micro-bone remnants approximately 1 mm, indeterminable - saponified and cannot be preserved.

Finding	Find	Quadrant	Plane	Number
07/318-471	52	IX	8	1
07/318-511	52	XII	13	1
07/318-398	52	V	11	1
07/318-277	52	VI	4	1
07/318-264	52	IV	11	1
07/318-413	52	IX	4	1
07/318-365	52	VII	4	1
07/318-389	52	V	11	1
07/318-307	52	V	5	1
07/318-482	52	II	12	1
07/318-404	52	XIII	8	1
07/318-259	52	IV	6	1
07/318-532	52	IX	12	1
07/318-501	52	IX	11	1
07/318-478	52	IX	8	1
07/318-506	52	IX	11	1
07/318-400	52	V	11	1
07/318-415	52	IX	4	1
07/318-497	52	IV	11	1
07/318-308	52	V	5	1
07/318-403	52	VII	5	1
07/318-396	52	V	11	1
07/318-421	52	XI	5	1
07/318-305	52	III	4	1
07/318-387	52	V	10	1
07/318-376	52	V	10	1

07/318-380	52	V	10	1
07/318-394	52	V	6	1
07/318-368	52	V	19	1
07/318-353	52	V	8	1

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