Dogs from the Ig pile dwellings in the National Museum of Slovenia

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Izvleček

Med določanjem prazgodovinskih koščenih izdelkov, najdenih v 19. stoletju pri izkopavanjih v bližini Iga na Ljubljanskem barju, sem izmeril osem lobanjskih odlomkov psov in spodnje derače (M_1) 37 psov in 4 volkov, da bi rekonstruiral velikost in fizični tip prazgodovinskih živali. Na podlagi celih komolčnic (ulnae) še dveh osebkov sem ocenil plečno višino psov iz najdišča. Derače psov sem primerjal z derači volkov iz najdišča, za nameček pa sem primerjal še lobanjske mere in plečno višino z ustreznimi podatki rimskodobnih mestnih psov, ki so poznani po veliki variabilnosti v velikosti. Nazadnje sem ugotovitve z najdišča pri Igu primerjal s podatki za ostanke psov iz objezerskih naselbin v Švici in severni Italiji od neolitika do bronaste dobe. Izračuni so potrdili staro domnevo, da pripadajo ostanki psov, ki so bili najdeni pri Igu, barjanskemu (močvirskemu) tipu psa (*C. familliaris palustris*), ki ga širše obravnavam v svojem članku.

Abstract

Eight skull fragments from dogs as well as the lower carnassials (M_1) of 37 dogs and 4 wolves were measured in order to reconstruct the size and physical type of these ancient animals during the evaluation of prehistoric animal bone artifacts from the 19th century excavations in the Ljubljana Marshes near Ig. The complete ulnae of two additional individuals were used in estimating the withers height of dogs kept at this site. In addition to comparing the dog carnassials to those of coeval wolves, cranial dimensions and withers heights were both compared to similar measurements of Roman period urban dogs, known for their remarkable variability in size. Finally, the results from Ig were studied in light of Neolithic to Bronze Age dog remains from lacustral settlements in Switzerland and northern Italy. These calculations reconfirm that the dogs found at Ig were of the turbary dog type (*C. familiaris palustris*), a form evaluated within a broader context in this article.

INTRODUCTION

Archaeological excavations in the Ig area of the Ljubljana Marshland in Slovenia started in the third quarter of the 19th century (1875-1877) under the direction of Karel Dežman (Drobne 1975, 217). He was a natural scientist by profession (Bufon 1971, 195) who, in addition to his archaeological research, also identified the animal bones which he collected. Most of the material brought to light is kept in the National Museum of Slovenia in Ljubljana.

Animal remains in this collection have been evaluated with a palaeontological emphasis in the unpublished doctoral thesis of Dr. Katica Drobne, who also briefly discussed dog remains, and identified them as an early type, also known as "turbary dogs" (*Canis familiaris palustris;* Drobne 1963). More recently, Dežman's zoological descriptions have been revisited in the inventory books of the excavations in the Ig area (Deschmann 1875; 1876), with a special focus on bone manufacturing at the settlement. During the course of this work, some records have also been completed with bone measurements and other zoological detail on the basis of hands-on experience with the material. This offered an opportunity to carry out additional studies with an archaeozoological focus and review the cultural implications of dog remains.

Although the proportions between the remains of wild and domestic animals vary broadly between prehistoric sites in the Ljubljana region, the classical "quintet" of Neolithic domesticates, cattle, pig, sheep, goat and dog is known from many Eneolithic and Bronze Age pile dwelling settlements in the marshland area (Drobne 1983, 577). Of these animals, however, dog is of least direct economic importance and has been therefore seldom discussed in detail even in articulate archaeological interpretations of zoological data (e. g. Drobne 1983, 578; Greif 1997, 33).

Dog is known to have been the first animal to be domesticated, even before the Neolithic. This is not surprising given the immense adaptability shown by the broad geographical distribution of wolves in the northern hemisphere. Aside from the fact that carnivores are not directly dependent on specific forms of vegetation for food, ethological traits of the wolf pack have also helped these animals to fit almost seamlessly into the life of early human communities.

In this paper, a relatively small set of 66 dog remains from Ig is used to demonstrate the degree to which these animals correspond to the type described as "turbary dog" (*Torfspitz, Canis familiaris palustris*) from Swiss lake dwellings by Ludwig Rütimeyer (1862). These dogs were compared to both highly differentiated Roman Period "breeds" and present-day traditional sheepdogs from Hungary.

MATERIAL AND METHOD

While samples from Ig have not yet been included into recent investigations of absolute chronology in the Ljubljana Marshland (Velušček 1999, 67), on the basis of analogies in ceramic style, Dežman's collection, representing the V-VII phases of the marshland's prehistory, was assigned to the Eneolithic/ early Bronze Age. In Parzinger's (1984) widely used typochronological system the Early Bronze Age Ig "b" phase was actually equated with Horizon VI in the internal chronology of the Ljubljana Marshland, also marked by pottery of Vučedol type.

Of the 1,595 identifiable bone fragments studied to date, 66 (4.3%) come from dog (*Canis familiaris* L. 1758), while 8 bones derived from fox (*Vulpes vulpes* L. 1758) and 7 remains came from wolf (*Canis lupus* L. 1758). The total weight of 66 dog bones was over 1.25 kg (1260 g), while the rest of the material weighed 67.6 kg.

The small contribution (<5%) of dog remains to the number of fragments may be considered typical at many prehistoric pile dwellings. At the neighboring settlement of Parte, for example, dog remains comprised no more than 2% of the identifiable bones. Since the consumption of dog meat was largely abandoned by the Bronze Age in this part of Central Europe (Bökönyi 1974), the presence of this species at the site would be more convincingly shown by the incidence of dog gnawing on the bones of other animals. There are signs, however, that the material was collected selectively and that dog, as a relatively small bodied species, may be somewhat under-represented in this assemblage collected at Ig in the late 19th c. This possibility is clearly illustrated by the anatomical distribution of bones (*Table 1;* fox and wolf were included in *Table 1,* because the two wild canids potentially represent extreme sizes that, in principle, may occur among dogs as well).

The sporadic nature of dog remains should not be surprising in and of itself: Dog bones are often found disarticulated, dispersed in the refuse of lakeshore settlements (Schibler 1987a, 172; Bartosiewicz 1994, 65). Of the skeletal elements from Ig, however, skulls and mandibles with cheektooth rows dominate, possibly a sign of deliberate selection by the 19th c. excavators for the more spectacular finds (this tendency may be

Table 1: Canid remains by inventory numbers in the assemblage from Ig.

Element	Fox	Dog	Wolf	Total
neurocranium		B2257, B2258, B2259, B2260, B2272, B2277, B2389, B2390		**8**
zygomaticum		B2280		**1**
maxilla		B2265, B2267, B2268, B2270, B2271, B2273, B2276, B2283, B2284	B2220, B2230	**11**
mandibula with carnassial	B2242, B2247, B2248, B2315, B5543, B5544	B2227, B2243, B2244, B2245, B2246, B2249, B2250, B2251, B2252, B2253, B2254, B2255, B2256, B2285, B2287, B2288, B2289, B2290, B2291, B2292, B2293, B2294, B2295, B2296, B2297, B2298, B2299, B2302, B2303, B2304, B2306, B2309, B2310, B2313, B2314, B2316, B2360, B2373	B2224, B2225, B2226, B2228, B2229	**49**
ramus mand.		B2311, B2312, B2366		**3**
cervical vert.	B5533			**1**
ulna	B5471	B5451, B5462, B5465, B5468, B5470, B5471, B5473, B5749		**9**
Total	**8**	**66**	**7**	**82**
Weight (g)	**90**	**1260**	**207**	**1557**

Table 2: Literary sources used in the metric analysis of lower carnassials and withers heights (WH).

	Period	M_1	WH	Source
Feldmeilen-Vorderfeld	Neolithic	32	90	Eibl 1974
Seematte-Gelfingen/Egolzwil 2	Neolithic	3	28	Hescheler, Rüeger 1942
Seeberg Burgäschisee-Süd, Cortaillod	Neolithic	9	11	Boessneck et al. 1963
Twann, Cortaillod	Neolithic	133	145	Becker, Johansson 1981
Auvernier-La Saunerie	Late Neolithic	6	21	Stampfli 1976
Mondsee-See	Late Neolithic	7	2	Pucher, Engl 1997
Corded Ware/Horgen sites by Lake Zürich	Late Neolithic	n/a	20+51	Hüster-Plogmann, Schibler 1997
Barche di Solferino, Polada	Early Bronze Age	17	20	Riedel 1976
Peschiera	Middle Bronze Age	n/a	2	Riedel 1982
Tác-Gorsium	Roman	178	335	Bökönyi 1984

observed for most animal species represented in the collection).

Measurements were taken on mandibular M_1 (carnassial) teeth, skull remains and long bones. The standardized system and nomenclature of bone measurements was used following von den Driesch (1976). All measurements referred to in this paper are given in millimeters.

The metric evaluation of measurable bones from Ig was carried out against the background of dog remains from the Roman Period urban site of Tác-Gorsium in Pannonia (Bökönyi 1984). Gorsium dogs display a very broad spectrum of variability, comparable to that of modern dogs. The results were also viewed within the broader context of other Neolithic and Bronze Age lakeshore settlements in Switzerland, Austria and Italy (*Table 2*).

With the exception of the large and varied sample from Tác-Gorsium, where individual measurements were entered in the same analysis with the Ig specimens, only mean values and ranges were available is most of the literature.

Occasional comparisons to the traditional Hungarian breeds *puli, pumi,* and *mudi* were made on the basis of measurements from their breeding standards (Sárkány, Ócsag 1977), as well as the measurements of two *puli* skulls (Inv. nos. 73.50 and 73.60) in the Hungarian Agricultural Museum, Budapest. *Figures 9* and *10* show two dog skulls of *palustris* character from the type site of Lüscherz on Lake Biel (Switzerland). They are kept in the Museum of Natural History of Princeton University (Inv. nos. PU 2866 and PU 2867) and were identified by Sándor Bökönyi in 1967.

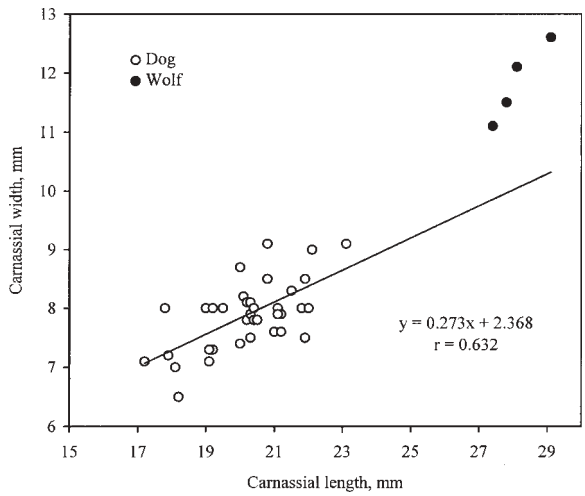

Fig. 1: The porportions of lower M1 tooth in dogs and wolves from the Ig pile dwellings.

RESULTS AND DISCUSSION

Owing to the selective nature of the assemblage, the morphometric reconstruction of dogs from Ig was carried out in three steps, in decreasing order of sample sizes. Tooth measurements were available in the greatest numbers, followed by cranial remains and only a few long bones.

Comparisons of carnassial measurements

Thanks to their protective layer of enamel and small size, teeth tend to be less fragmented than bones under ordinary circumstances. Lower M_1 teeth or "carnassials" are the largest tooth in the jaw of dogs. Its length and width can be used in characterizing overall body size, although an initial decrease in measurements caused by domestication tends to affect other bones in the skeleton more directly.

The Ig assemblage contained 37 measurable dog carnassials, some of them still attached to the mandible.

Table 3: Student's t-test of carnassial lengths.

	Ig	Gorsium
n	37	178
mean	20.3	20.9
sd.	1.4	1.9
cv.	0.069	0.091
t-value	1.803	
p-value	**0.073**	

Four additional specimens were identified as those of wolf on the basis of their unusually large size. *Figure 1* shows the bivariate plot of length to width proportions of these lower M_1 teeth in dogs and wolves from the Ig pile dwellings. The very distinct position of large wolf teeth in this graph is in itself indicative of the relatively small size of dogs identified at the site, as may be appraised in *Figure 3.*

The small size of these evidently domesticated animals could be better appreciated when studied against the background of a major series of data. In *Figure 2,* the distribution of lower M_1 tooth length in the prehistoric dogs from Ig is compared to that of Roman Period dogs from the urban settlement of Tác-Gorsium in Hungary (Bökönyi 1984, 208-210). In spite of the fewer carnassials recovered at Ig, the histogram suggests that these dogs tended to be, on average, smaller than their Roman Period counterparts. According to a Student's t-test, however, the small, 0.6 mm difference between the mean values is not significant (*Table 3*) on the $p < 0.05$ level of probability, because it is engulfed by the great variability of carnassial lengths from the Roman Period sample.

Visually, a negative skew is apparent in the size distribution of Roman Period dog carnassials in *Figure 2,* although not even the large teeth reached the size of the wolf carnassials from Ig (these latter were, naturally, not included in the Student's t-test). The figure clearly shows the narrow range of size variability in the Ig sample compared to that of Roman Period domestic dogs.

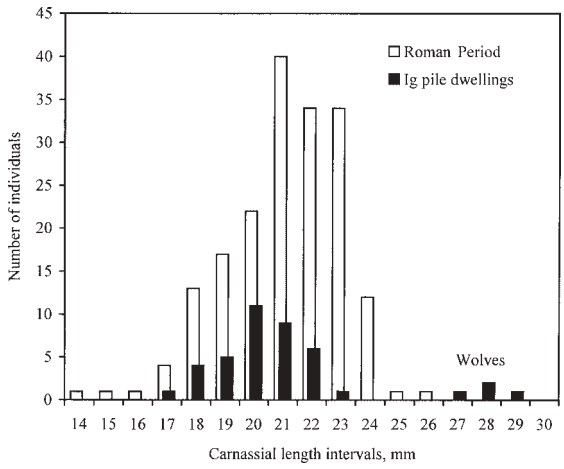

Fig. 2: The size distribution of lower M1 tooth length in Prehistoric and Roman dogs.

Cranial dimensions

The impression that the carnassial teeth from Ig represent relatively small dogs was tested next on bone remains. Of these, fragments of eight skulls (6 neurocranium and 2 viscerocranium) are easiest to evaluate. They originate from apparently small dogs with light builds. The measurements available on these animals are summarized in *Table 4.* In the absence

Fig. 3: Buccal aspects of jaws from adult wolves and dogs from Ig. From top to bottom: wolf, left (Inv. no. B2224); dog, left (Inv. no. B2249), wolf, right (Inv. no. B2225); dog right (Inv. no. B2244).

Table 4: Measurements of dog skull fragments (for abbreviations see *Table 5:* column 2).

Inv. no.	Weight (g)	A-N	Ot-Ot	Eu-Eu	Ect-Ect	Ent-Ent	A-B	Cond.	St-P
B2257	64	88.1	50.0	52.3	43.6	28.0	45.1	31.1	
B2258	55	89.1	51.1	52.2	44.0	32.4	42.9	32.9	
B2259	57	90.9	53.9	56.6	42.3	33.1	43.1	35.0	
B2260	49	95.1	53.5	57.1	44.2	36.1	43.5	35.2	
B2267	24								62.2
B2268	17								78.2
B2277	18							32.2	
B2390	22						50.2	34.0	
mean	**38.3**	**90.8**	**52.1**	**54.6**	**43.5**	**32.4**	**44.9**	**33.4**	**70.2**
***puli* (n=2)**	n/a	93.1	54.3	56.2	50.8	31.8	47.9	31.4	70.2

of wolf skulls, cranial measurements of the Ig dogs are compared to two, small Hungarian sheep dogs (*puli*).

Prehistoric cranial dimensions from Ig compare well with measurements taken on the skulls of present day sheep dogs represented by the *puli* in this table.

Following the logic of the previous analysis, the skull fragments from Ig were also compared to the measurements of Roman Period dogs from Tác-Gorsium (Bökönyi 1984, 204-206). Given the relative uniformity of the Ig skulls listed in *Table 4,* these measurements were converted into standard scores, using the univariate parameters of cranial dimensions listed in *Table 5.*

The advantage of using standard scores is that they help to integrate all sorts of fragmentary measurements (in this case, 33 cranial data from Ig) through the use of a larger and better known, standard set of dimensions (the dogs from Tác-Gorsium), against which they can be studied (Bartosiewicz 1989, 620, Fig. 146). Parameters of the Roman Period dogs listed in *Table 5* were used in the following formula:

Standard score = (x-m)/s
x = measurement of the Ig dog
m = the Roman Period mean of the same measurement
s = the Roman Period standard deviation of the same measurement

Using this formula, various measurements taken on the Ig skull fragments could be compared to the standardized mean values (m=0) of Roman Period dogs, their standard deviations serving as the unit of difference. The resulting standard scores were plotted against the Roman Period standard in *Figure 4.* The distribution of cranial measurements in dogs from the Ig pile dwellings is concentrated between the -1 and -2 standard deviation distances from the mean of Roman Period dogs. This is indicative of the same trend that has been observed in the case of carnassial teeth: with one exception, the measurements of dog skulls from Ig fall short of the Roman Period average.

The frontal widths measured between the orbits of four dogs from Ig (Inv. nos. B2257, B2258, B2259, B2260) correspond closely to the values cited for modern "Collie-like" pariah dogs from the Middle East (Menzel 1960, 27), as well as those of the *puli* breed skulls (*Table 6*) in the collections of the Hungarian Agricultural Museum, Budapest (Inv. nos. 73.50 and 73.60).

Hypothesizing that typological similarities between these three forms also mean high correlations between overall skull measurements, the major dimensions of the Ig skulls may be reconstructed as being similar to those of Middle Eastern pariah dogs and *puli*.

Table 5: Univariate parameters of dog skull measurements from Roman Tác-Gorsium (Bartosiewicz 2000: 184, *Table 2*).

Measurement* (mm)		n	mean	sd.	min.-max.	cv.
breadth at the auditory meatuses	Ot-Ot	35	62.2	5.3	44.5-72.0	0.085
breadth of the brain case	Eu-Eu	37	61.9	4.2	47.0-70.5	0.068
greatest frontal breadth	Ect-Ect	39	53.5	7.1	38.0-70.0	0.133
occipital height	A-B	34	48.3	4.8	35.0-57.0	0.099
breadth of the condylus occipitalis	Cond. occ.	34	38.6	3.6	28.0-46.0	0.093
palatal length	St-P	36	93.6	10.3	64.0-108.0	0.110

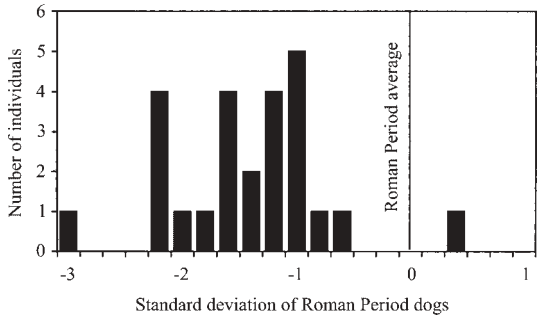

Fig. 4: The distribution of cranial measurements in dogs from the Ig pile dwellings.

Their greatest lengths may have been around 170 mm, with basal lengths of 150 mm and greatest (=zygomatic) breadths of c.a. 80 mm. In Hilzheimer's (1932) classification of Roman dog skulls, the estimated 150 mm basal lengths of Ig dogs again correspond to the grey zone between small and medium size groups (*Table 7*).

This simple comparison, naturally, is no substitute for in-depth craniological analyses based on a series of skulls. It would be even more erroneous to suggest that the three forms were to any extent related. In the absence of better preserved archaeological skulls, these dimensions are presented only to highlight the point that the primitive character and remarkably average size of skeletal remains from Ig is indeed reminiscent of small mongrels and traditional breeds of comparable size.

The estimation of withers height

The trend observed in both carnassial and cranial measurements was additionally tested using the two long bones preserved in full length. The estimated withers height of the two individuals was calculated by multiplying the greatest length of these bones with the coefficient developed by Koudelka (1885). The

Fig. 5: Frontal aspects of three dog neurocrania (From top to bottom: Inv. no. B2258, B2259 and B2260).

Table 6: Comparison of mean cranial measurements of Ig dogs, pariah dogs (Menzel 1960) and *puli.*

Measurement, mm		**Ig**	**Pariah dogs**	***Puli***
number of individuals		4	2	2
breadth between orbits	Ent-Ent	**32.4** (sd.=2.9)	**31.0**	**31.8**
greatest length	A-P	?	166.0	168.5
basal length	B-P	?	146.8	149.4
greatest breadth	Zyg-Zyg	?	81.0	82.4

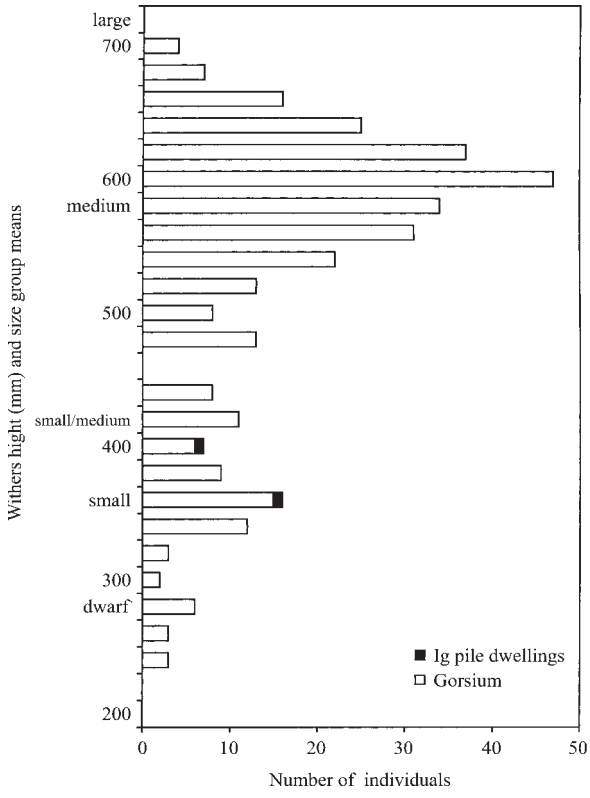

Fig. 6: Estimated withers heights of two dogs from the Ig pile dwellings in relation to the range of Roman "breeds" from Gorsium.

resulting values are shown in *Table 8*.

These two withers height estimates can be most spectacularly compared to both modern day Hungarian sheep dogs of comparably small statures (*puli, pumi, mudi:* Sárkány, Ócsag 1977) and placed within the relevant size categories of Roman Period dogs established at Tác-Gorsium by Bökönyi (1984, 66). They are sorted in increasing order of withers height in *Table 9.*

As marked with boldface figures within the series listed in *Table 9,* the dogs from Ig fall within the category of small Roman dogs, the larger specimen being as tall as a *puli*, but close to the lower limit of other sheepdogs as well. Similarly to the Ig dogs, these traditional breeds represent a transition between Bökönyi's "small" and "small/medium" size groups.

Figure 6 shows the estimated withers heights of the two dogs from the Ig pile dwellings in relation to the range of Roman Period dogs represented by

Table 7: Size criteria for Roman Period dog skulls (Hilzheimer 1932).

Size group	Basal length, mm
small	110-130
medium	150-160
large	170-180

Table 8: Withers height estimates (WH) based on the greatest lengths (GL) of two ulnae from Ig.

Inv. no.	Weight (g)	GL	WH
B5468	8.0	146.1	390.1
B5470	7.0	130.3	347.9

335 long bones in the assemblage from Tác-Gorsium (Bökönyi 1984). In accordance with the observations made on carnassial teeth and cranial measurements, the estimated statures of the Ig dogs indeed correspond to that of small and small/medium size Roman dogs that form a distinct group within the size distribution of estimates from Tác-Gorsium. The large group of medium size Roman Period dogs in *Figure 6* may correspond to the size gap between the carnassial teeth of Ig dogs and wolves observed in *Figures 1* and *2.*

Comparisons to dogs from other pile dwellings

Size is a trait inherited additively, that is, in crossing large and small individuals, medium size offspring may be expected. Extremely large or small strains may be maintained only by consciously selecting for either extreme. The so-called panmixis of dog populations, breeding without human control, favors the emergence of small/medium size individuals. This seems to be expressed in the similar stature of Ig and the traditional sheepdogs studied here. Far from representing direct morphological continuity, this correspondence may result from the fact that in the recent past, prior to sports breeding, probably little effort was expended on influencing the exterior appearance of these breeds. The resulting animals

Table 9: Withers heights for Roman Period size groups from Tác-Gorsium (Bökönyi 1984, 66), Ig dogs and traditional Hungarian sheepdogs.

Size group	mean	min.-max.
Roman Period		
dwarf	281.3	228-342
small	**368.5**	**349**-425
small/medium	420.5	349-470
medium	579.1	482-681
large	711.0	710-712
Ig (n = 2)	**369.0**	**348-390**
Traditional breeds		
puli F	390.0	310-470
pumi	395.0	**350**-440
mudi	410.0	350-470
puli M	420.0	340-500

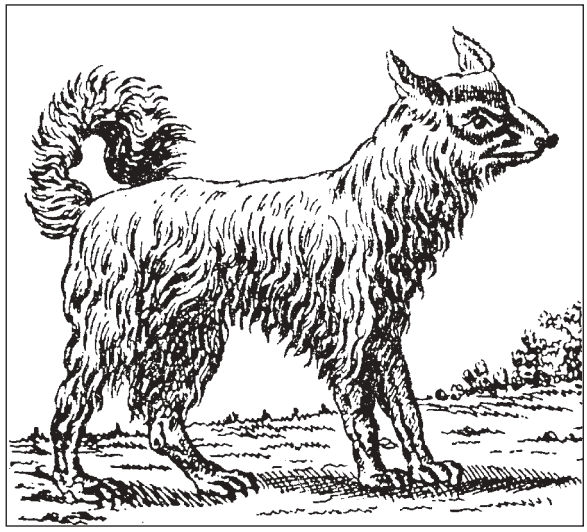

Fig. 7: The 1815 picture of the traditional sheepdog, the *pumi* (Sárkány, Ócsag 1977).

were, first of all, non-distinct in their appearance (*Figure 7*). It is also worth mentioning that the original German name given to *palustris* type dogs by Rütimeyer (1862), "*Torfspitz*" (turbary spitz) also refers to a modern breed of comparable withers height and skeletal makeup.

The best preserved skull from Ig is shown in *Figure 8.* Its fine overall conformation, narrow and short snout, medium steep forehead and vaulted brain case correspond to the general constitutional type of small/medium size traditional dogs cited as analogous forms in this paper. A similar type of skull was identified from another pile dwelling in the Ljubljana Marshland, Maharski Prekop, by Dr. Katica Drobne (Bartosiewicz 1999, 314, Fig. 2). On the basis of a skull fragment from the nearby pile dwelling settlement of Parte, it may be hypothesized that at least some of the dogs there were of *palustris* type (Rütimeyer 1862). A complete tibia from the same site also belonged to Bökönyi's (1984, 66) small/medium size group.

Turbary dogs were discovered at all Swiss Neolithic pile dwellings (such as the type site of Lüscherz on Lake Biel; *Figures 9* and *10*) and have been identified at numerous other prehistoric sites across Europe (Bökönyi 1974, 317).

In *Figure 11,* the already discussed mean carnassial lengths from Ig are presented within the broader context of parameters observed at some lacustrian settlements in Switzerland. The largest samples from neolithic Feldmeilen-Vorderfeld and Twann (*Table 2;* Eibl 1974, Becker and Johansson 1981) suggest that these dogs were of sizes similar to those at Ig. Since they are somewhat smaller, however, they reconfirm the observation that (in spite of the lack of statistically significant differences in this paper), the carnassials of turbary dogs should be smaller than

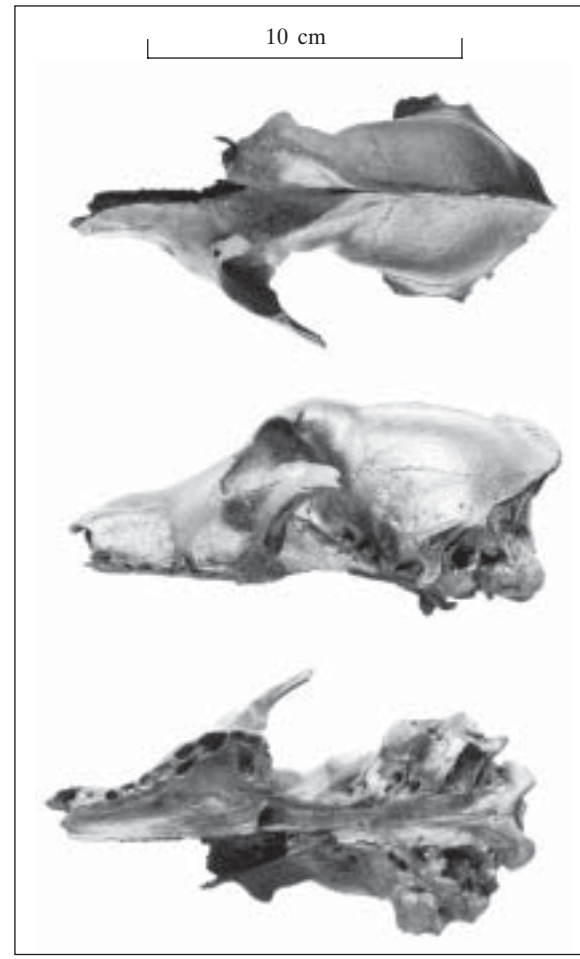

Fig. 8: Skull of an adult dog from Ig (Inv. no. B2257. From top to bottom: frontal, lateral and basal aspects).

the average of Roman dogs at Tác-Gorsium (the great size variability of this urban sample is again obvious in *Figure 11*).

A similar comparison between estimated withers heights (*Figure 12*) again reveals the relatively small size of the two Ig individuals that is evidently a product of small sample size. In this regard, the Ig dogs are comparable only to their Horgen Period counterparts in the Lake Zürich region and those at Feldmeilen-Vorderfeld of the major faunal samples. (*Table 2;* Eibl 1974). The large Cortaillod culture sample from Twann (Becker and Johansson 1981), on the other hand, yielded estimates that reflect the same size relation to Roman Period dogs in this graph that was observed in the case of carnassials (*Figure 11*). This again warns us that withers heights calculated for only two dogs at Ig must be interpreted cautiously.

Never-the-less, these comparisons show, that the dog remains from Ig convincingly fit within the overall type of turbary dogs as defined on the basis of finds from pile dwellings along the shores of Swiss lakes.

Fig. 9: Skull of an adult dog from Lüscherz, Switzerland (Inv. no. 2866. From top to bottom: frontal, lateral and basal aspects).

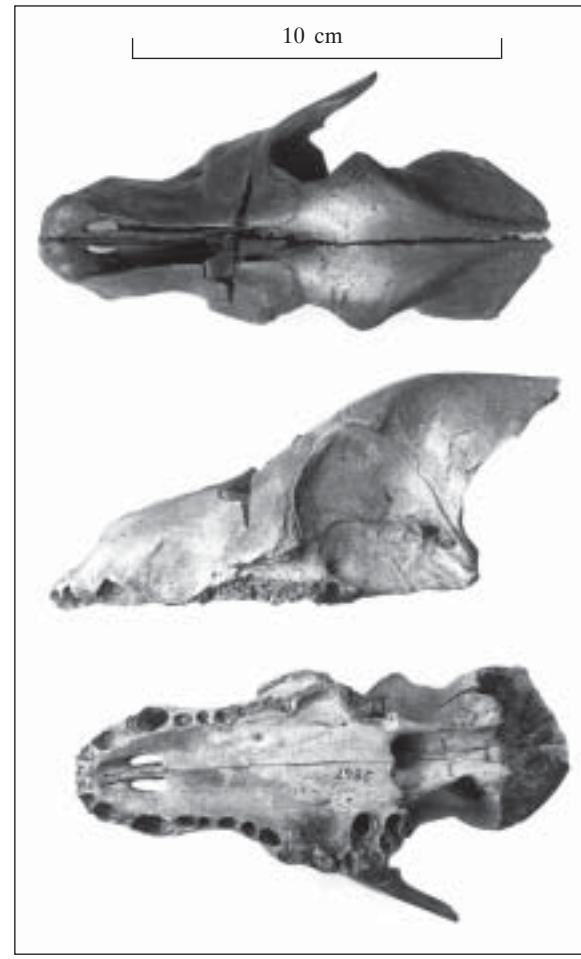

Fig. 10: Skull of an adult dog from Lüscherz, Switzerland (Inv. no. 2867. From top to bottom: frontal, lateral and basal aspects).

They may also be characterized by Riedel's (1976, 292) description of the Early Bronze Age dogs from the pile dwelling of Barche di Solferino as dogs of "uniform osteological characters with only some size variability [and a] skull ... with slightly sunken profile". These animals of *palustris* type are straight-legged.

CONCLUSIONS

In this paper, three different kinds of dog remains (teeth, skulls and long bones) from the pile dwellings at Ig have been compared to a set of osteological data from Roman Period Tác-Gorsium and modern breeds. The results of metric analyses confirm each other:

1. The Ig carnassial teeth originate from small individuals, way below the size range of local wolves and are possibly smaller than the average of Roman dogs from Tác-Gorsium.

2. Most skull measurements available for study fall short of their respective Roman Period averages.

3. Estimated withers heights of the Ig individuals fall within the category of small Roman Period dogs, the larger specimen being as tall as a female *puli*.

4. In addition to size, the overall shape of bones also corresponds to turbary dogs from other pile dwellings.

Following the morphometric analyses, the question remains, how the traits observed zoologically can be interpreted within an archaeological context.

Pariahs and modern breeds

Linking form directly with specialized dog function, however, is a modern concept that depends on cultural variables and should therefore be avoided. The temptation of identifying tiny lapdogs and mighty guardians at Ig is tempered by the fact that turbary dogs may be considered the possibly most average looking animals (medium size, medium gracile, straight-legged etc.).

The two Ig specimens were of notably small stature. Many Horgen Period dogs with comparably small bodies were similar to foxes in size at the site of Mozartstrasse near Lake Zürich (Schibler 1987b, 194). The same trend is also apparent at Twann in some of the graphs of bone measurements published by Becker and Johansson (1981, 50-51, Figs. 56, 58, 61). Although jackal (*Canis aureus* L. 1758) has long been ruled out as the ancestor of domestic dogs, in terms of size and behavior these dogs, descendants of the mighty wolf, may have been quite jackal-like. Naturally, we know nothing of their non-osteological characteristics, such as the color of their coat or the shape of their ears or tails. The general, jackal-like appearance of many pariah dogs (gracile skeleton, grey tawny, brownish or yellow-red color, upright ears), has been described originally from Western Asia and India (Dennis-Bryan, Clutton-Brock 1988, 20; Pariah means a member of a low caste in South India, originating from the 17th century Tamil word *paraiyan, i. e.* drummer, so called because members of this caste were the drummers at festivals). The term pariah dog is not meant to reflect any direct Asian connection in this case. It only refers to animals which have not yet been bred and live in a semi-feral state within the human environment. Evolution cannot be reversed, therefore even in the case of panmixis, dogs will never regress to the full physiognomy of wolves, shaped by endless numbers of generations prior to domestication. Owing to the fast reproduction rate of multipara dogs, however, breeds can be selected in a relatively short time. Meanwhile a flexible, forms in a panmictic dog population can also quickly blend into animals of optimal size and shape that may be characterized by a particular physiognomy.

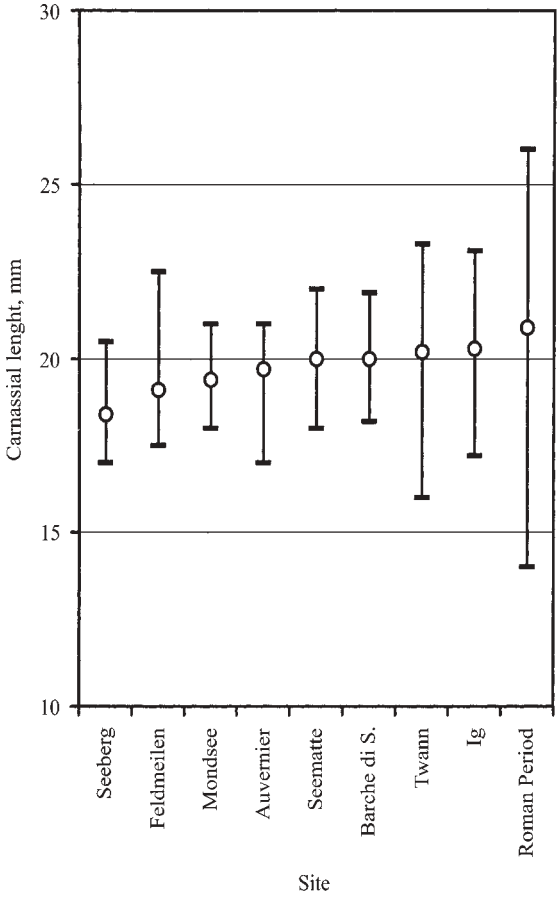

Fig. 11: Mean values and ranges of lower M1 tooth length of dogs from prehistoric pile dwellings and Roman Gorsium.

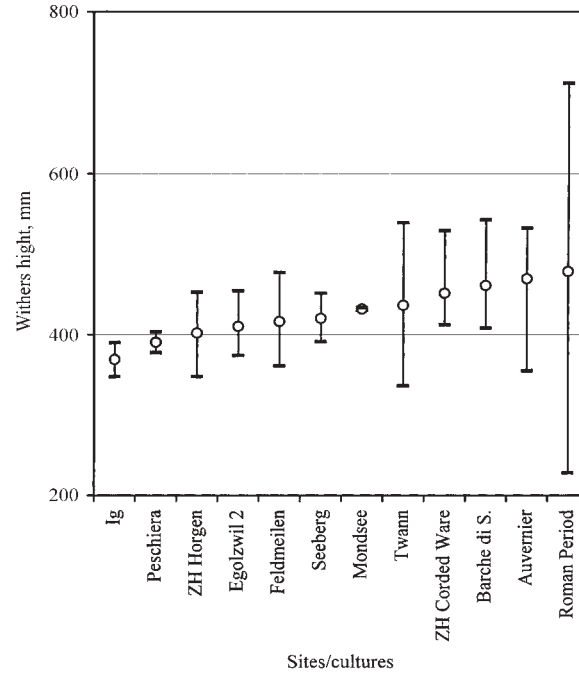

Fig. 12: Mean values and ranges of estimated withers heights of dogs from prehistoric pile dwellings and Roman Gorsium.

The function of turbary dogs

At major prehistoric settlements such dogs must have been tolerated as scavengers. This would have made their relationship to the human population reminiscent to that of pariah dogs. Dogs being strongly territorial, spontaneous alarming, may have been another simple function. Neither of these two basic tasks require special physical features, stray dogs breeding freely in panmixis can perform them just as well. In active guarding (e.g. fighting off wolves), larger and stronger dogs would have been preferred.

Given the alternating importance of hunting and animal keeping at these settlements, the basic instincts of medium size dogs under discussion here may also have been exploited for these two purposes without conscious, target-oriented selection. Hunting in this

case, however, may have been limited to opportunistic use such as alarming, chasing and stopping the prey, a tactic used by wolves in cooperative hunting and also taken advantage of in herding. Discussing this possibility, however, remains speculative since, aside from the artifacts indicative of active hunting, nothing is known of actual hunting techniques (Greif 1997, 33). Of the Hungarian sheep-herding dogs mentioned in this paper, the *pumi* is reputed to have been very adept, even in boar hunting (Sárkány, Ócsag 1977, Abb. 44).

It may be hypothesized, moreover, that more specialized forms of dog use would have given rise to a more specific physiognomy, not detected in the bone remains under discussion here. It is at this point where comparisons to the reference assemblage from the Roman Period urban site of Tác-Gorsium is especially useful. It may represent the first time in Europe when at least some dogs were most likely to have been *bred*. Rather than a breed, prehistoric turbary dogs should be looked upon as a general form created by the selective pressures of a similar way of life in proximity to humans at pile dwelling settlements. Naturally, migration and the exchange of dogs between settlements can not be ruled out, but here it did not produce animals that would have stood out from the general mold.

Selection pressures and the looks of turbary dogs

Large canid bones at Ig unquestionably came from wolves. Dog remains of comparable size are, however, entirely missing. Crossings between domestic dogs and their wild ancestor would also have produced large offspring, transitional in size between wolves and the domestic form recognized at Ig. Unless robust guard or hunting dogs were explicitly needed, it was probably easier to control smaller, less dangerous, spitz-like animals at lacustrian settlements where even space may have been limited.

Osteologically, such phaenotypes seem to develop locally when dogs are more subject to natural rather than artificial selection. This has been the case even with communities of stray dogs in many European cities today. Buffon's 18th c. illustration of a "Turkish blend" of dogs, also known as the infamous "dogs of Stambul" may aid our imagination (*Figure 13*). Pucher and Engl (1997, 38) even raise the possibility that the gracile phaenotype of turbary dogs may have carried the marks of chronic malnourishment. This hypothesis would again reinforce the image of scavenging pariah dogs.

There is no way of telling whether prehistoric dogs had shaggy, curly or woolly coats like Hungarian sheepdogs, or their ears were upright, crooked or floppy. Extreme, disfunctional mutations of any sort, however, probably made survival for the individual difficult in a human environment that remained very competitive for these dogs.

For one thing, the dogs from Ig were not small enough to be considered "dwarf" forms that could have survived only as pets but would have been eliminated by stronger competitors among average pariah dogs. The bones of such luxury lap dogs are best known from high status Roman and medieval urban settlements or palaces.

The "lowest common denominator" represented by classical, medium size pariah dogs and the dog remains of prehistoric pile dwellings share similar traits. The overall "jackal look" of many modern pariah dogs seems to coincide with an optimal body size whose lower limits are defined by the hierarchy of the pack. Scavenging, however, does not require the size and physical strength of wolves. Moreover, an upper size limit may be subconsciously reinforced by humans, many of whom would not tolerate the presence of too large, "wolf-like" beasts around the settlement.

Fig. 13: Buffon's depiction of Turkish pariah dogs from the German edition of *Histoire Naturelle.*

Archaeological implications

It is suggested here that the skeletal structure of prehistoric turbary dogs, as well as that of some traditional, medium-size sheepdogs included in the study is the function of the same processes that have shaped classical pariah dogs throughout western and southwestern Asia and, in fact, many urban areas of the world. This does not mean genetic relationships between distant strains such as Central European and South Asian dogs. It illustrates, however, that such phaenotypes may develop under similar pressures in the proximity of humans but without consciously controlled breeding.

The homogeneity of turbary dogs (including those from the site of Ig) suggests that, regardless of technical innovations, population movements or, alternatively, invigorated pottery trade, attitudes toward dogs in pile dwellings may have created similar phaenotypes of dogs across the region. In this regard, dog remains do not contribute to the discussion concerning competing eastern, southern and western effects observed in the pottery styles. They are rather indicative of continuity in one segment of the way of life along the lakeshores of Central Europe.

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BARTOSIEWICZ, L. 1989, Animal remains from the fort. - In: D. Gabler (ed.), *The Roman fort of Ács-Vaspuszta (Hungary) on the Danubian limes,* BAR Brit. Ser. 531, Part ii, 600-623.

BARTOSIEWICZ, L. 1994, Late Neolithic dog exploitation: chronology and function. - *Acta Arch. Acad. Sc. Hung.* 46, 59-71.

BARTOSIEWICZ, L. 1999, Recent developments in archaeozoological research in Slovenia. - *Arh. vest.* 50, 285-295.

BARTOSIEWICZ, L. 2000, Metric variability in Roman period dogs in Pannonia provincia and the Barbaricum, Hungary. - In: S. J. Crockford (ed.), *Dogs through time: an archaeological perspective,* BAR Int. Ser. 889, 181-192.

BECKER, C. and F. JOHANSSON 1981, *Tierknochenfunde.* - Die neolithischen Ufersiedlungen von Twann 11, Bern.

BOESSNECK, J., J.-P. JÉQUIER and H. R. STAMPFLI 1963, *Seeberg Burgäschisee-Süd* 3. *Die Tierreste,* Acta Bernensia 2, Bern.

BÖKÖNYI, S. 1974, *History of domestic mammals in Central and Eastern Europe*. - Budapest.

BUFFON, G. L. L. (1749-1788), *Histoire naturelle.* - Paris.

BUFON, Z. 1971, K stopetdesetletnici prirodoslovnega muzeja Slovenije v Ljubljani (Zum hundertfünfzigjährigen Jubiläum des Naturgeschichtlichen Museums in Ljubljana). - *Argo* 10, 164-200.

DENNIS-BRYAN, K. and J. CLUTTON-BROCK 1988, *Dogs of the last hundred years at the British Museum (Natural History).* - London.

DESCHMANN, K. 1875, Die Pfahlbaufunde aus dem Laibacher Moore. - *Verhandlungen der k. u. k. geologischen Reichsanhalt* 15, 275-284, Wien.

DESCHMANN, K. 1876, Bericht über die Pfahlbautenaufdeckungen im Laibacher Moore. - *Sitzber. Phil.-hist. Cl. k. k. Akad. Wiss.* 84, 471-484, Wien.

DRIESCH, A. von den 1976, *A guide to the measurement of animal bones from archaeological sites.* - Peabody Museum Bulletin 1, Cambridge, Mass.

DROBNE, K. 1963, *Subfosilni živalski ostanki iz mostiščarske dobe na Ljubljanskem Barju* I-II. - Dissertation, Inštitut za geologijo Univerze v Ljubljani, Ljubljana.

DROBNE, K. 1975, Fauna količarskih naselbin na Ljubljanskem barju. - *Arh. vest.* 24, 217-224.

DROBNE, K. 1983, Bronzezeitliche Wild- und Haustiere am Ljubljaner Moor (Jugoslawien). - In: M. Kubasiewicz (ed.) *Archaeozoology* I. *Proceedings of the 3rd Conference of the International Council for Archaeozoology 1978*, 577-579, Szczecin.

EIBL, F. 1974, *Die Tierknochenfunde aus der neolitischen Station Feldmeilen-Vorderfeld am Zürichsee* I. *Die Nichtwiederkäuer*. - Diss. Institut für Paläoanatomie, Domestikationsforschung und Geschichte der Tiermedizin der Universität München, München.

GREIF, T. 1997, Prazgodovinska kolišča na Ljubljanskem barju. - *Arheo* 18, 1-95.

HESCHELER, K. and J. RÜEGER 1942, Die Reste der Haustiere aus den neolitischen Pfahlbaudörfern Egolzwil 2 (Wauwilersee, Kt. Luzern) und Seematte-Gelfingen (Baldeggersee, Kt. Luzern). - *Vierteljahrschrift der Naturforschenden Gesellschaft Zürich* 87, 383-486.

HILZHEIMER, M. 1932, Römische Hundeschädel aus Mainz, ein fränkischer Hundeschädel und ein Hundeschädel des 15. oder 16. Jahrhunderts ebendaher. - *Biol. gen.* 8, 91-126.

HÜSTER-PLOGMANN, H. and J. SCHIBLER 1997, Archäozoologie. - In: J. Schibler et al. (eds), *Ökonomie und Ökologie neolitischer und bronzezeitlicher Ufersiedlungen am Zürichsee,* Monographien des Kantonsarchäologie Zürich 20, 40-121.

KOUDELKA, F. 1885, *Das Verhältnis der Ossa longa zur Skeletthöhe bei Säugertieren*. - Verh. d. Naturforsch. Verein 24, Brünn.

MENZEL, K. M. 1960, *Pariahunde.* - Die Neue Brehm Bücherei, Wittenberg Lutherstadt.

PARZINGER, H. 1984, Die Stellung der Uferrandsiedlungen bei Ljubljana im äneolitischen und frühbronzezeitlichen Kultursystem der mittleren Donauländer. - *Arh. vest.* 35, 13.

PUCHER, E. and K. ENGL 1997, *Studien zur Pfahlbauforschung in Österreich. Materialen* I - *Die Pfahlbaustationen des Mondsees. Tierknochenfunde*. - Mitt. Prähist. Komm. 33.

RIEDEL, A. 1976, La fauna del villaggio preistorico di Barche di Solferino. - *Atti del Museo Civico di Storia Naturale - Trieste* 29/4, 215-318.

RIEDEL, A. 1989, Die Fauna einer bronzezeitlichen Siedlung

bei Peschiera am Gardasee. - *Rivista di Archeologia* 6, 23-27.
RÜTIMEYER, L. 1862, *Die Fauna der Pfahlbauten der Schweiz*. - Neue Denkschrift der all. Gesellschaft d. ges. Naturwissnschaften 19.
SÁRKÁNY, P. and I. ÓCSAG 1977, *Ungarische Hunderassen*. - Budapest.
SCHIBLER, J. 1987a, Osteoarchäologische Untersuchungen der neolitischen Knochenkomplexe. - In: P. J. Suter (ed.), *Zürich "Kleiner Hafner",* 167-179, Zürich.
SCHIBLER, J. 1987b, Die Stichprobenanalyse des Tierknochenmaterials. - In: E. Gross et al. (eds), *Zürich "Mozartstrasse". Neolitische und bronzezeitliche Ufersiedlungen* 1, Berichte der Zürcher Denkmalpflege, Monographien 4, 190-197.
STAMPFLI, H. R. 1976, *Osteo-archaeologische Untersuchung des Tierknochenmaterials der spätneolitischen Ufersiedlung Auvernier La Saunerie nach den Grabungen 1964 und 1965*. - Solothurn.
VELUŠČEK, A. 1999, Neolithic and Eneolithic Investigations in Slovenia. - *Arh. vest.* 50, 59-72.

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