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Zooarcheological evidence of livestock of the Neolithic-Bronze age in the prehistoric pile-dwelling settlements from Loewenberg, Switzerland

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Abstract

Switzerland is home to many archaeological sites in Central Europe, many of which are found in wetlands, resulting in well-preserved macrofauna that can be labeled with precision using dendrochronology. This region is important for our knowledge of the spread of culture and innovation through Central Europe during the Neolithic and Bronze Ages, its topography results in a natural corridor through which influences traveled from both the East and West. Cattle were the most common livestock in central Europe since the Neolithic Age. The historical records of the past are well preserved in the Lake Murten sediments. Although Pile dwellers populated the region for several thousand years, the Celtic-Latians and Romans left the first traces in the sedimentary record, starting in 400 BCE. This study is the first to combine and focus on NISP% (Number of Identified Specimens) and biometric data to investigate how cattle farming began in the region and how it has changed over time. We have studied and identified an unprecedented wealth of evidence in the form of bones and horns of early livestock and some wild animals from the prehistoric records of pile-dwelling settlements from the Neolithic to Bronze Age from the Loewenberg in Lake Murten, Switzerland, which was recorded in the 19th century and is presented in this article. The recorded number of individual bones fell in percentage as follows; the domestic dog with (20%), followed by the domestic cattle with (14%), sheep/goats, red deer, roe deer, and brown bear each provide (12%). Domestic pigs (9%), domestic horses (6%), and the lynx (3%) were recorded.

Keywords: Neolithic-Bronze Age, Prehistorical pile-dwelling settlements, Switzerland

Introduction

The Neolithic Age or New Stone Age is an archaeological period that marks the final division of the Stone Age. The "Neolithic package" includes the introduction of agriculture, the domestication of animals, and the transition from hunter-gatherers to a subsistence lifestyle. The Neolithic Age began approximately 12,000 years ago, with the emergence of agriculture in the Near East during the Paleolithic Age and later in other parts of the world. Approximately 6500 years ago (4500 BC), it was close to the east until the Chalcolithic transition (Bronze Age), marked by the development of metallurgy, and finally the Bronze Age and Iron Age. The Bronze Age refers to when people used copper from 2000 BC to 700 BC. In the Stone Age, flint was shaped and used as tools and weapons, but in the Bronze Age, stone was gradually replaced by copper. Bronze is prepared by melting tin and copper and mixing them. This serial property of 111 small individual sites encompasses the remains of prehistoric pile-dwelling (Stilt houses) settlements in and around the Alps built from around 5000 to 500 B.C. on the edges of lakes, rivers, or wetlands. Excavations, only conducted in some of the sites, have yielded evidence that provides insight into life in prehistoric times during the Neolithic and Bronze Age in Alpine Europe and the way communities interacted with their environment. 56 of these sites are in Switzerland. These settlements are a particularly well-preserved group are culturally rich in archaeological sites, and are one of the most important sites for the study of early agricultural societies in the region (UNESCO).

The lakeside settlements in the Alpine region (Most of which date from between 4300 and 700 BC) are among the most important examples of archaeological heritage in Europe. The special conditions underwater have led to an exceptionally good preservation of the organic materials. Remarkably well-preserved timber-built constructions and numerous artefacts made of wood, bark, and textiles as well as copious amounts of plant and animal remains constitute the outstanding scientific significance of the pile dwellings. It is these finds categories that have not been preserved in dry-land sites that provide us with detailed insight into the everyday life and culture of the early agrarian societies around the Alps. It is of great importance to be able to determine precise dates for finding assemblages and the constructional history of villages using dendrochronological analyses (Hafner & Schlichtherle, 2007). Neolithic and Bronze Age Settlement of Lake Murten The monuments located to the south of Lake Murten in Gren, France, have been on the UNESCO World Heritage List, including Gren-Spitz, since 2011 under the collective name Greng-Spitz (Corboud et al., 1992-2001; Mauvilly, 2019a, 2019b).

The current study published here is taken from “Pile-dwelling settlement in Lake Murten near Loewenberg/Canton Neuchâtel/Switzerland” and ranges from the Neolithic Age to the Bronze

Age. The date of discovery was given as around 1837 and the inscription “Cocce“ may point to the former collection of Igino Cocchi (Boessneck et al., 1971). No other information is available so far about the date of collection of documents from this prehistoric settlement. Pucher (2018) presented data with similar pathological changes from the same environment and was able to reconstruct the history in detail. In support of this view, the publication of our data, even without detailed stratigraphy, is justified. Lake Murten, the smallest of the three lakes in the Jura Mountains, carries many traces from the Neolithic and Bronze Age, such as Lake Biel and Lake Neuchâtel. Lake Murten is on the western side of Lake Neuchâtel and is connected to it by the Broy River. Approximately 40 prehistoric sites are currently known in the Murten Lake area and the coastal area near Grosse Moss, about half of which can be described as coastal. Most of the settlements are in Friborg’s canton, which has about two-thirds of the lakes (Hafner, 1989). Data from Neolithic to Bronze Age stacked houses at Lowenberg are essentially similar to data from what Pucher (2018) describes as the “toothless stag and the wolf”, that is, data from the wild farm of Bronze Age animals in Stilfries, Austria. Similar cases are known from Central Europe and for systematic data see Boessneck et al. (1971), Hildebrandt (1966), Hornberger (1970), Schmid (1972), and Teichert (1973 & 1988).

Fig. 1 shows Keller's schematic map of Lake Murten (1863). Löwenberg is the place where hitherto unknown bones were found. Keller (1860) mentioned Lake Murten, among others, in his list of new habitat groups. According to Colonel Schwa‘s report, there is a group in the lake in front of Motier, a bronze ax found at that time is in the Bern museum, and many goods are sold to Neuchâtel. The sale or exchange of archeological materials was common throughout the region in the last century.

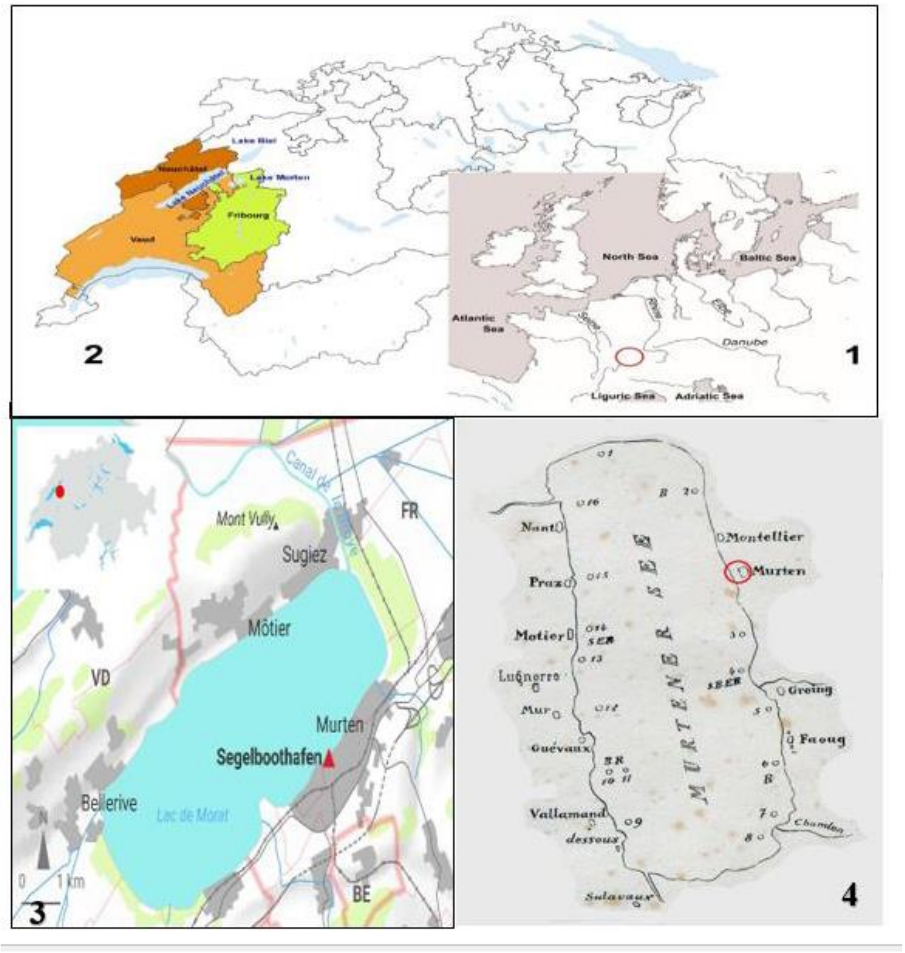

Figure 1. Sketch map of the three Swiss cantons of Vaud, Fribourg, Neuchâtel, and the three Swiss glacial lakes Biel, Neuchâtel, and Murten with the locations of Murten-Löwenberg at the lake Murten. **1:** Area of Central Europe; **2:** Area of central and western Swiss, **3:** Map of Murten - sailing boat harbor (Geodata: Federal Statistical Office, Swisstopo, OpenStreetMap), **4:** Schematic map of Lake Murten from Keller (1863) plate 17 (XVII).

Material and methods

This study is based on the identification of domestic/wild animal fossils collected from prehistoric group houses from the Neolithic to the Bronze Age in the Loewenberg area of Lake Murten (Morat). Lake Murten is rare among the three major lakes. After Lake Neuchâtel and Lake Biel, the lakes in Switzerland are Lake Jura, the Canton of Friborg, and the Canton of Vaud (Fig. 1). Many measurements included in this project were based on von den Dresch (1976) or were described as being performed similarly. Because most of the measurements were made by members of the same group in Basel who worked well together and previous studies were investigated, the benefits of having big data are expected to be greater than the problems caused by "analysis errors". This problem in archaeology Information on the search for errors is rare (Davis, 1996; Johnstone, 1999; Popkin et al., 2012; Elizabeth, 2021).

Results

Recorded bones of different animal species

The skeletal zone terminology used in this study is shown in Fig. 2. The highest number of individual bones falls on the domestic dog with 7 (20%), followed by the domestic cattle with 5 (14%), sheep/goats, red deer, roe deer, and brown bear each provide 4 (12% each), domestic pigs 3 (9%), domestic horse 2 (6%), and the lynx 1 (3%). The proportion of bones in the trunk skeleton was the highest at 30 (88%), closely followed by the zeugopodium with 3 (9%) and the stylopodium with only 1 (3%) bone fragment (Fig. 3-4) and (Tables 1-6).

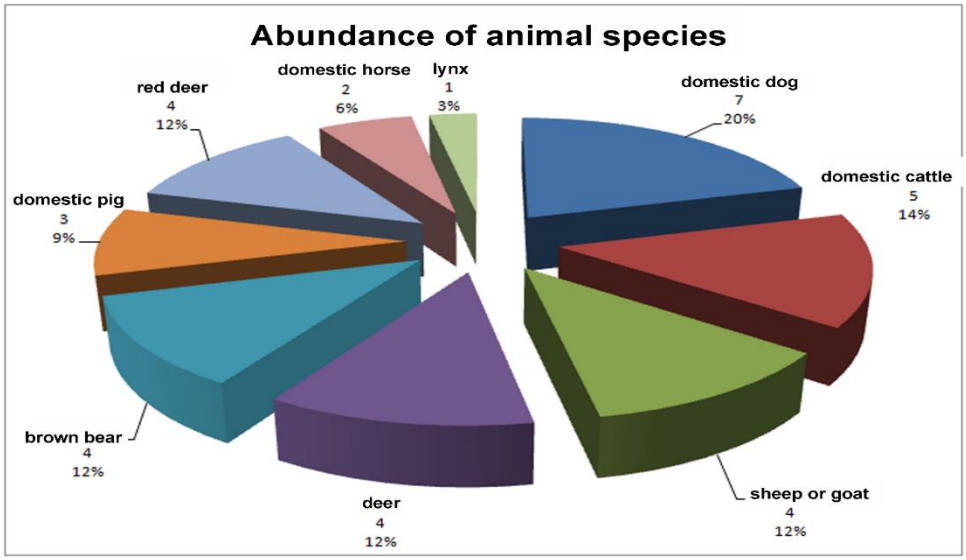

Figure 2. Abundance of animal species (n, %) from Murten-Löwenberg

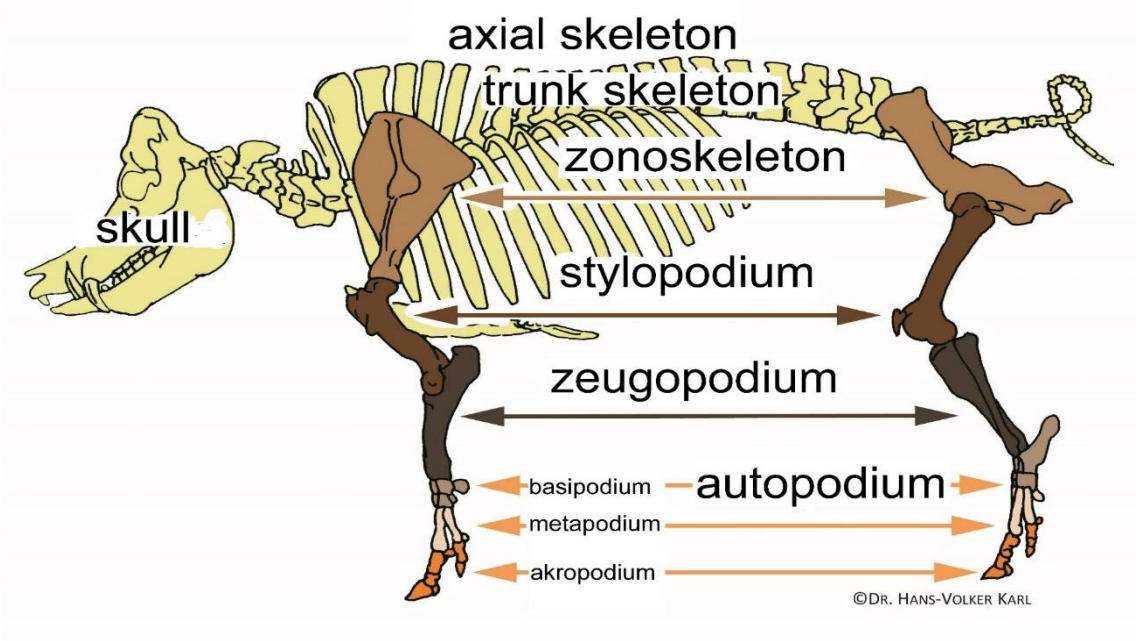

Figure 3. Schematic representation of the skeletal zones using the example of a pig skeleton

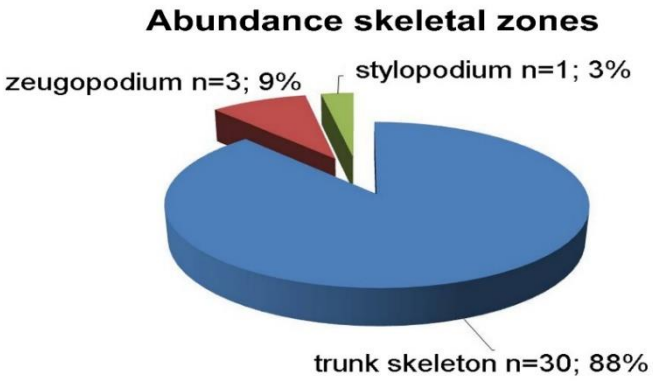

Figure 4. Abundance of the skeletal zones (n,%) of Murten-Löwenberg

Table 1. Abundance of animal species and bone types across the skeletal zones (Fig. 3)

Animal Species	n	%	Trunk skeleton	Zonoskeleton	Stylopodium	Zeugopodium	Autopodium
domestic pig, *Sus scrofa* f. *domestica* (L., 1758)	3	9	No. 34-half of the mandible left juv. No. 40 maxilla fragment right No. 41-Mandibula half right No. w. nr. Mandibula				
sheep or goat *Ovis gmelini* Blyth, 1841 f. *aries* / *Capra aegagrus* f. *hircus* (L., 1758)	4	12	No. 18-Mandibula left No. 19 pair of horn cones No. 20 pair of horn cones No. w. nr.-Mandibula left				
domestic dog C*anis lupus* f. *familiaris* (L., 1758)	7	20	LNo.12-Mandibula right No. 25-Mandible No. w. nr.-Mandibula left No.w. nr.-Mandibula right Cocce 1837-Mandibula half left			No. w. nr.-Ulna left No.w. nr.-Ulna right	
domestic cattle *Bos primigenius* f. *taurus* (L., 1758)	5	17	No. 43-Mandibula right No. 51-molar sup. No. 52-premolar inf. No. 44 horn cone fragment		No. 68 humerus fragment prox.		
domestic horse *Equus caballus* L., 1758	2	6	No.w. nr.-Incisivum inf. No. w. nr.-Premolar inf.				
brown bear *Ursus arctos* L., 1758	4	12	No.11-Mandibula right No. 22-half of the mandible No. 23-half of the mandible No. 23-Cranium				
lynx *Lynx lynx* L., 1758	1	1	No. 96-Mandibula half right				

red deer *Cervus elaphus* L., 1758	4	12	No. 10 antler fragment, idol No. 65 Atlas No. 72 antler fragment			No. 57-Metacarpus left	
deer *Capreolus capreolus* (L., 1758)	4	12	No. 50.-Antler rod left, real skull, crippled, 1st, philistine No. 47.-Antler rod left, real skull, crippled, 1st, philistine No. 17-Mandibula half right No. 49 antler bar left, real skull, crippled, 3 pieces				
Gesamt	**34**	**100**	**30**	**0**	**1**	**3**	**0**

Table 2. Temporal correlation according to tooth dimensions on the lower jaw in domestic cattle. Measuring distances according to von den Driesch (1976), Indices according to Boessneck et al. (1971), Hildebrandt (1966), and Hornberger (1970).BG = occupied areas, FG = free or unoccupied areas

	Molar row			**M3**		
	MW	**min**	**max**	**MW**	**min**	**max**
Neolithic	89	72	102	38	28	47
Bronze Age	83	76,3	97	35,5	29	42
Iron Age	82,5	68	94	34,5	27,5	42,5
Roman period BG	87	72,5	105,5	36,5	27,5	47
Roman period FG	80,5	71	96	34	28	42
middle Ages	80	68	95	33,7	28	43
Lö 43	85,8			37		

Table 3. Measurements of Skull

Code	**animal species**	**1**	**7**	**9**	**13**	**15 dex**	**15 sin**	**29**	**31**	**32**	**33**	**35**	**37**	**38**	**M3 dex**	**M3 sin**	**M2 dex**	**M2 sin**	**C dex**	**Csin**
No.23	Brown bear	326,5	180	163	171	72	71	89	74	107	80	71	48	71	37x18	38x19	21x16	22x15,5	23x16	22x16

Table 4. Measurements of horn cones

Code	**animal species**	**L straight**	**L curved**	**D**	**U**
No.-44	Domestic cattle, left	230	323	55,5	183

Table 5. Measurements teeth

Code	**animal species**	**tooth**	**L basal**	**L alveolar**	**B basal**	**B alveolar**	**CH**
Lö 51	Domestic cattle	M3 sup dex	27,2	31,5	25	20,5	25
Lö 52	Domestic cattle	M2 inf sin		24,3		16,3	15
Lö o Nr	Domestic horse cab	M1o2 inf dex	27,5	26,8	16,6	17,5	39,8
Lö o Nr	Domestic horse cab	I inf		9,1		13,5	29,8

Table 6. Measurements Mandibles

Code	animal species	1	2	3	4	5	6	7	7a	8	9	9a	9c	10	11	12	13	14	15	15a	15b	15c	16	16a	16b	16c	17	18	19	20	22
No 43	Domestic cattle, right	344,5	366,5	234,5	241	235	296,5	135,2		85,8	48,6			37/12	94,2	130,5	[39,3]	[174]		68,6	43,4	32,1	R[52]								
Löw 17	Deer, right							65,9		38,4	26,1			14,7/8,1	[80]					22,2	15,1	14,1									
Cocce 1834	sheep or goat, left	156,2	165	43,5	116,1	34,2	2824	16,1		49,4	24,3			22,4/8	32,8	63,4	59	87,9		33,6	23,7	15,1	R[20,6]								
Lö 18	sheep or goat, left	[142,5]		46,8	[95,1]	113,9	138,9	65,1		43	29			20,4/8,1	[28,8]	61,9	58			26,6	20,4	16,6									
Lö o.Nr.	Domestic pig, left	110			152,3	149,3	122,8		88,7	42,4		32	41	31/14,7	44,2	46,4								45,2	39,1	37					
Lö o.Nr.	Domestic pig, left	110		66,8	121,4	151,7	112,4	103,8	85,3	57,6		34,2	47,6	im DB	39,2	46,4								45	37,6	35,9					
Lö 41	Domestic pig, right			76,9						66,2				34,6/15,8																	
Lö 26	Lynx, right					36,3		14,6			19,7			19,5																	
Lö unl.	Domestic dog, left	153,7	146,4	138,5	136	135	136	89		85	75			42,2	47,2	42,4	26,1		25,9				7,2/7,3				12,4	62.4	28,7	25	177,144
Lö unl.	Domestic dog, right	154,6	149	141,7	142	135	142	94		86	78			38	49	40,5	25,5		11x8				12x8				13	59	27	23	180,29
Lö 12	Domestic dog, right	171	166	164	151	144	151	101		91	86			46	49,5	29	28	27	12x10								14	68	28	24,5	200,86
Löw 25a	Domestic dog, right	130	133,5	128	116	111	117,5	77		72,5	67,5			34,5	38	32	21	20	9x6				6x3				12	54	23	21	161,54
Löw 25b	Domestic dog, left	130	134	127	116	111	118	78		72	66,5			36	38	32,5	22	21	9x6				5x4				12	54	25	19	162,14
Cocce 1837	Domestic dog, left	126			113			68		62	49			26	35	22	20	17	7x6				F				11		21	16	
Lö 11	Brown bear, right	302,5	301	202,5	201	191	200	119,5		84,5																	17	91	43	39	
Lö 23a	Brown bear, right	237	233	220	204,5	218	233	115		82																	16	100	38	36,5	281,93
Lö 23b	Brown bear, left		233	219	189			81																					42	35	281,93
Lö 22a	Brown bear, right							111		76																			50	46	
Lö 22b	Brown bear sin							111		65																			54	44	

Atlas

Code	animal species	GL	GLF	GB	BFcd	H	BFcr
Lö 65	Red deer	115	80	128	66,9	60	72

Humerus

Code	animal species	GL	BT	KD
Lö 68	Domestic cattle, left	123,6	-	41,8

Metacarpus

Code	animal species	GL	Bd	GLI	LI	Bp	KD	KU
Löw/57	Red deer, left	279,0	45,2	273,0		46,0	25,7	86,0

Ulna

Code	animal species	LO	KTO	Tpa
Lö o.Nr.	Domestic dog, left	29,9	20,1	24,4
Lö o.Nr.	Hund, right	31,5	21,1	26,7

Minimum Individual Numbers (MIN)

The distribution of the number of individuals in the Löwenberg sample is divided into pig n=4 (Plate 1), sheep or goat n=4 (Plate 2), domestic cattle n=4 (Plate 3: 1-10), domestic horse n=2 (Plate 7: 8-11), domestic dog n=5 (Plate 4: 2-6; Plate 5; Plate 6: 1-4), red deer n=3 (Plate 3: 11-12; Plate 7: 1-7), deer n=4 (Plate 6: 5-9), brown bear n=4 (Plate 8 & 9) and lynx n=1 (Plate 4: 1).

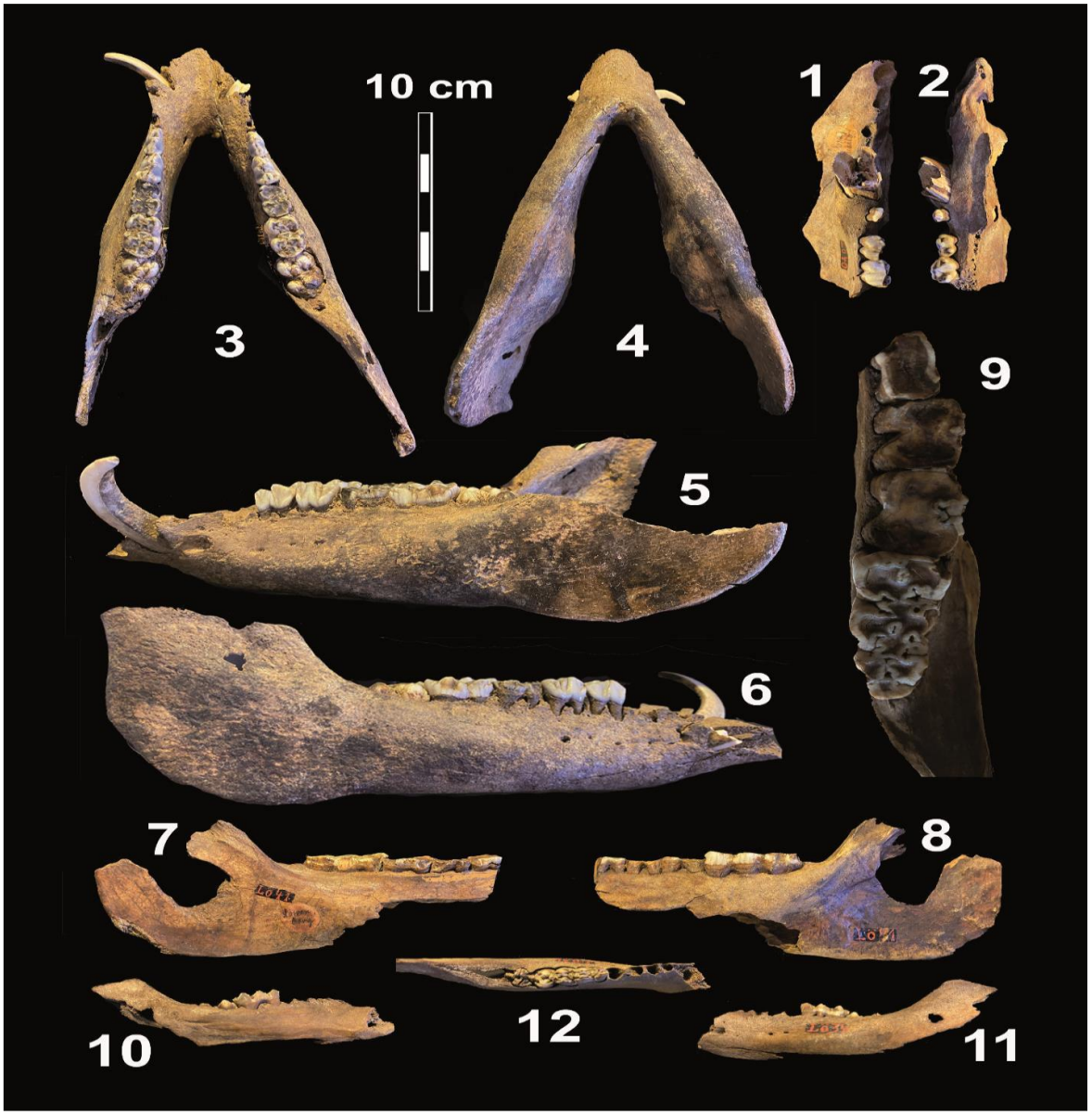

Plate 1. Domestic pig: 1) Rostrum fragment (Lö 40) dexter lateral with maxilla fragment and Os incisivi, 2) Rostrum fragment (Lö 40) dexter palatinal with maxilla fragment and Os incisivi, 3) Mandibula (Lö no.) alveolar, 4) Mandibula (Lö no. No.) ventral, 5) mandible (Lö o. No.) lateral sinister, 6) mandible (Lö no.) lateral dexter, 7) half of the mandible (Lö 41) dexter buccal, 8) half of the mandible (Lö 41) dexter lingual, 9) half of the mandible (Lö 41) dexter alveolar, 10) half of the mandible (Lö 34) juvenile sinister lingual, 11) half of the mandible (Lö 34) juvenile sinister buccal, 12) half of the mandible (Lö 34) juvenile sinister alveolar; (Scale 10 cm).

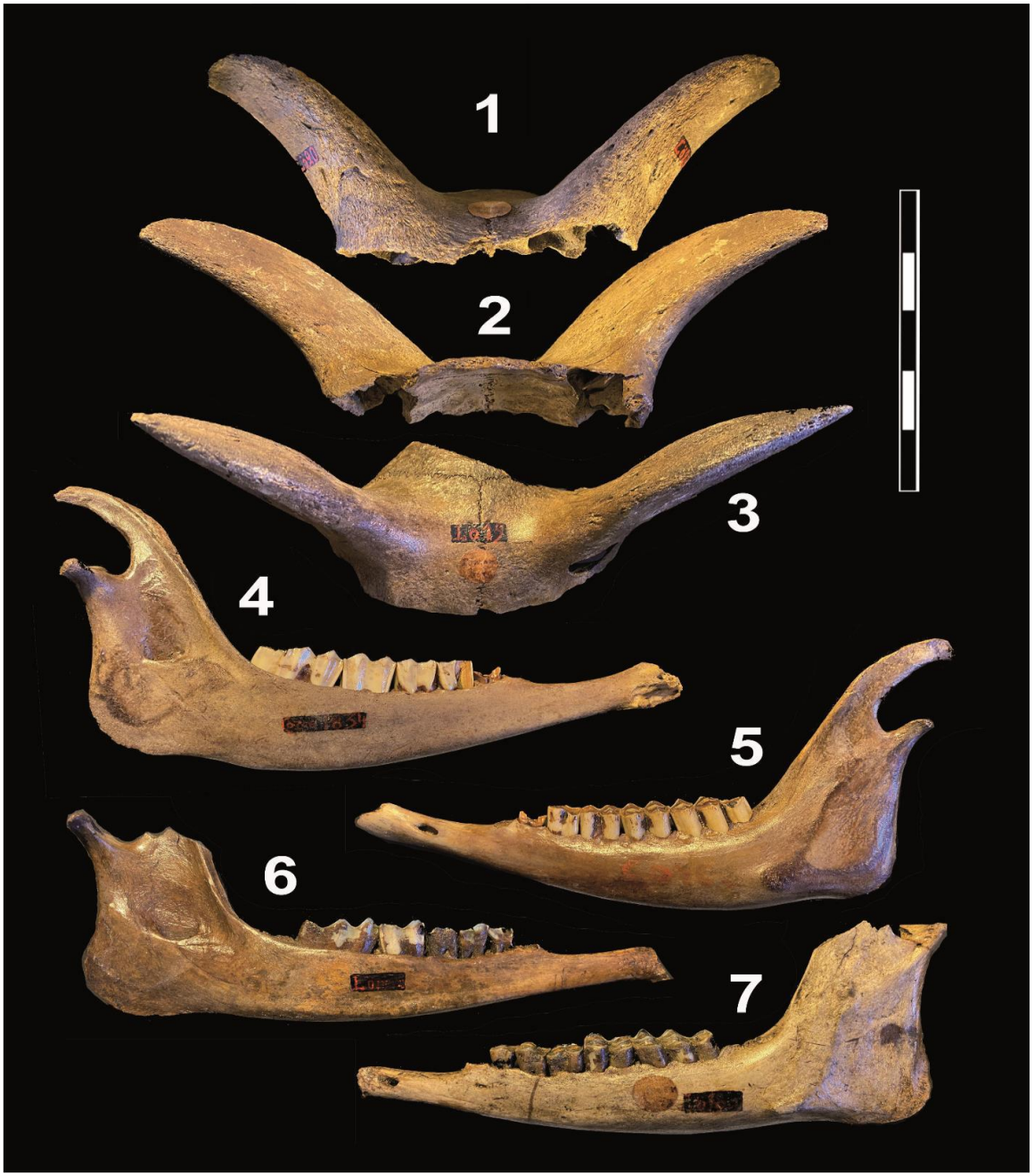

Plate 2. Sheep or goat: 1) skull fragment with pair of horn cones (Lö 20) frontally, 2) skull fragment with pair of horn cones (Lö 19) occipital, 3) skull fragment with pair of horn cones (Löw 19) dorsally, 4) mandible (Cocce, 1834) sinister lingual, 5) mandible (Cocce, 1834) sinister buccal, 6) mandible (Lö 18) sinister lingual, 7) mandible (Lö 18) sinister buccal; (Scale 10 cm).

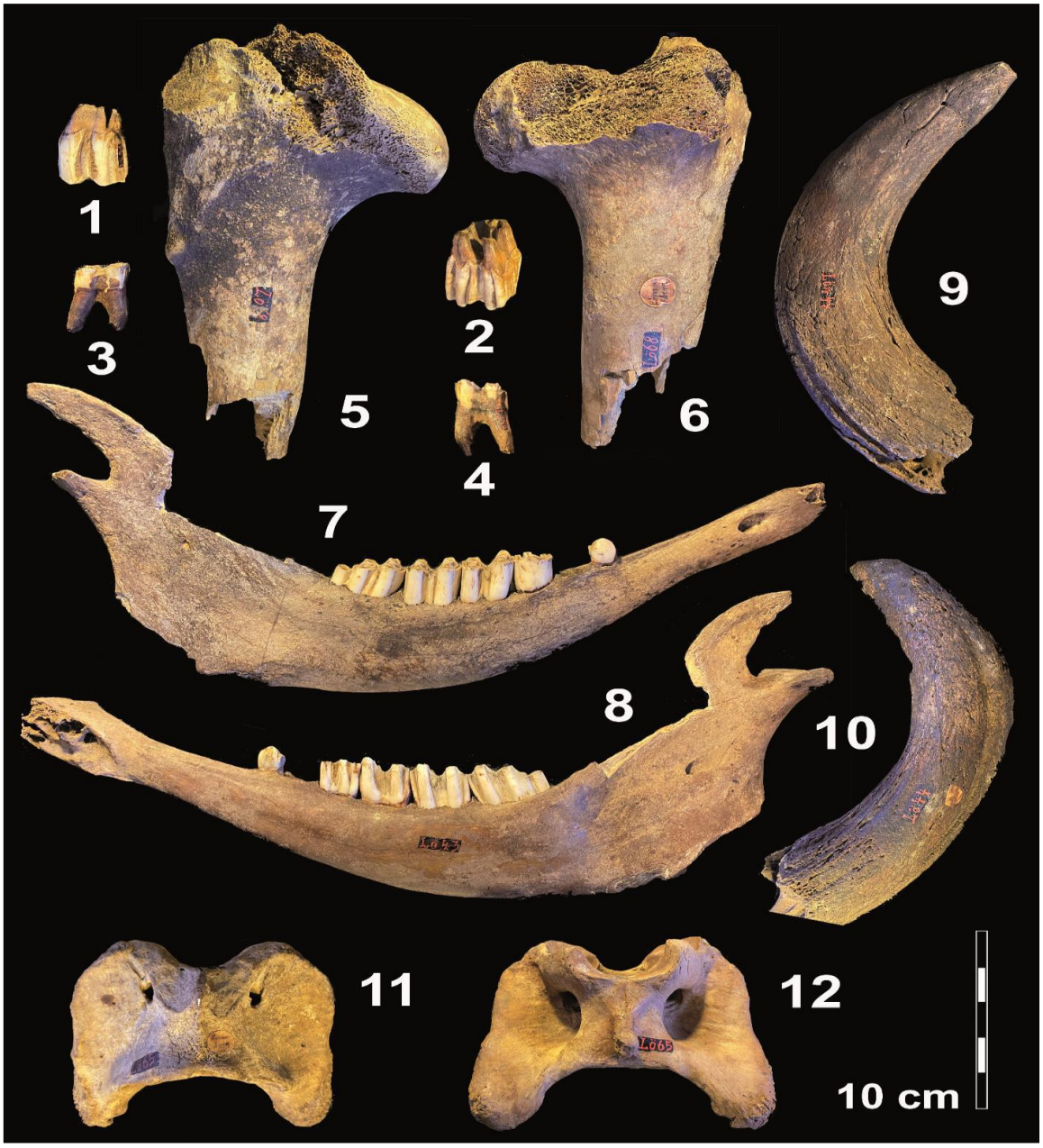

Plate 3. Domestic cattle (1-10), red deer (11-12): 1) molar (Lö 51) superior lingual, 2) molar (Lö 51) superior buccal, 3) premolar (Lö 52) inferior buccal, 4) premolar (Lö 52) inferior lingual, 5) humerus fragment (Lö 68) sinister (Lö 68) proximal lateral, 6) humerus fragment (Lö 68) sinister proximal medial, 7) mandible (Lö 43) dexter buccal, 8) mandible (Lö 43) dexter lingual, 9) horn cone fragment (Lö 44) distal ventral, 10) horn cone fragment (Lö 44) distal dorsal, 11) atlas (Lö 65) dorsal, 12) atlas (Lö 65) ventral; (Scale 10 cm).

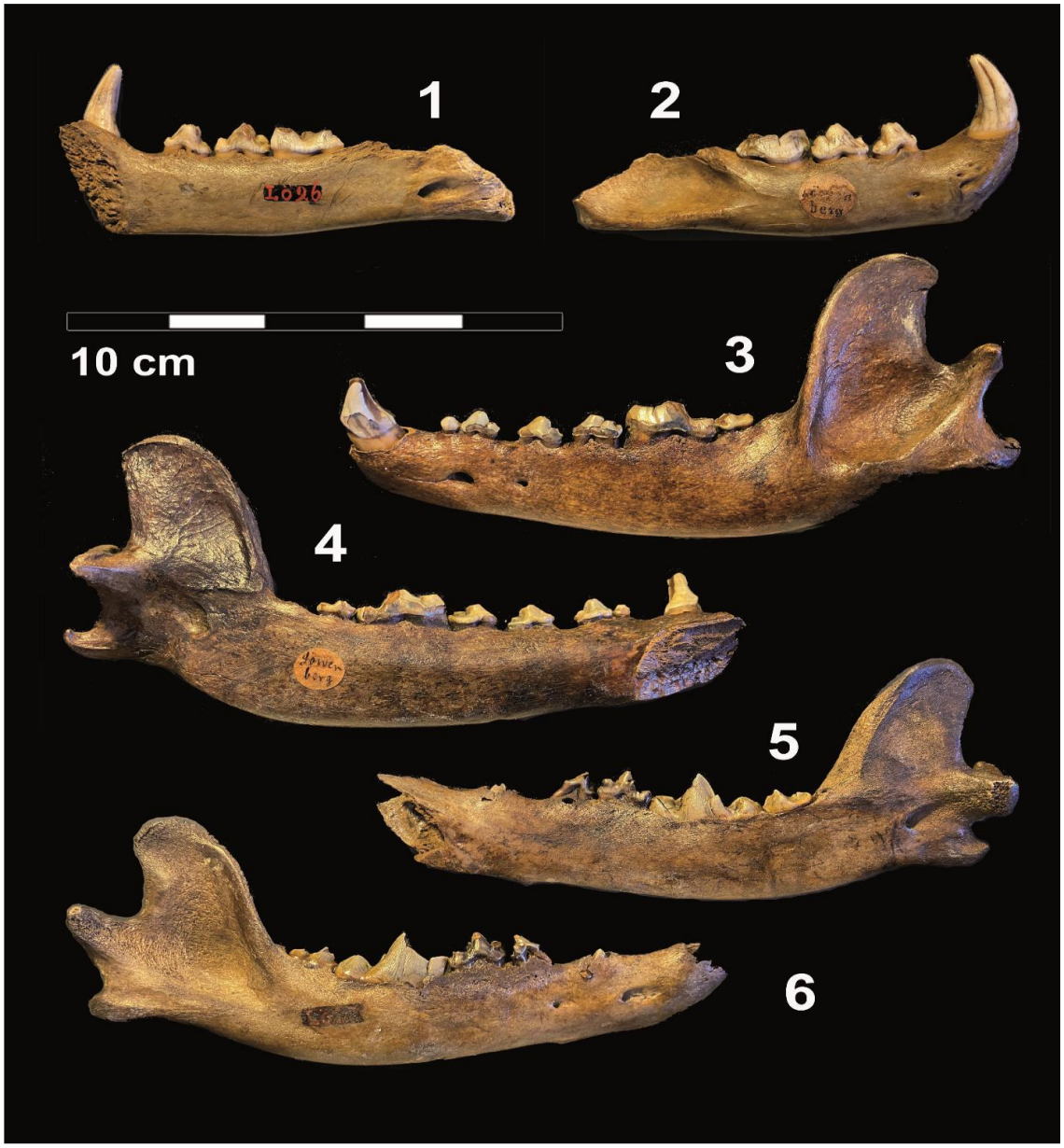

Plate 4. Lynx (1), domestic dog (2-6): 1) half of the mandible (Lö 96) dexter lingual, 2) half of the mandible (Lö 96) dexter buccal, 3) half of the mandible (Lö no number) sinister buccal, 4) half of the mandible (Lö no number) sinister lingual, 5) half of the mandible (Lö no number) dexter lingual, 6) half of the mandible (Lö no number) dexter buccal; (Scale 10 cm).

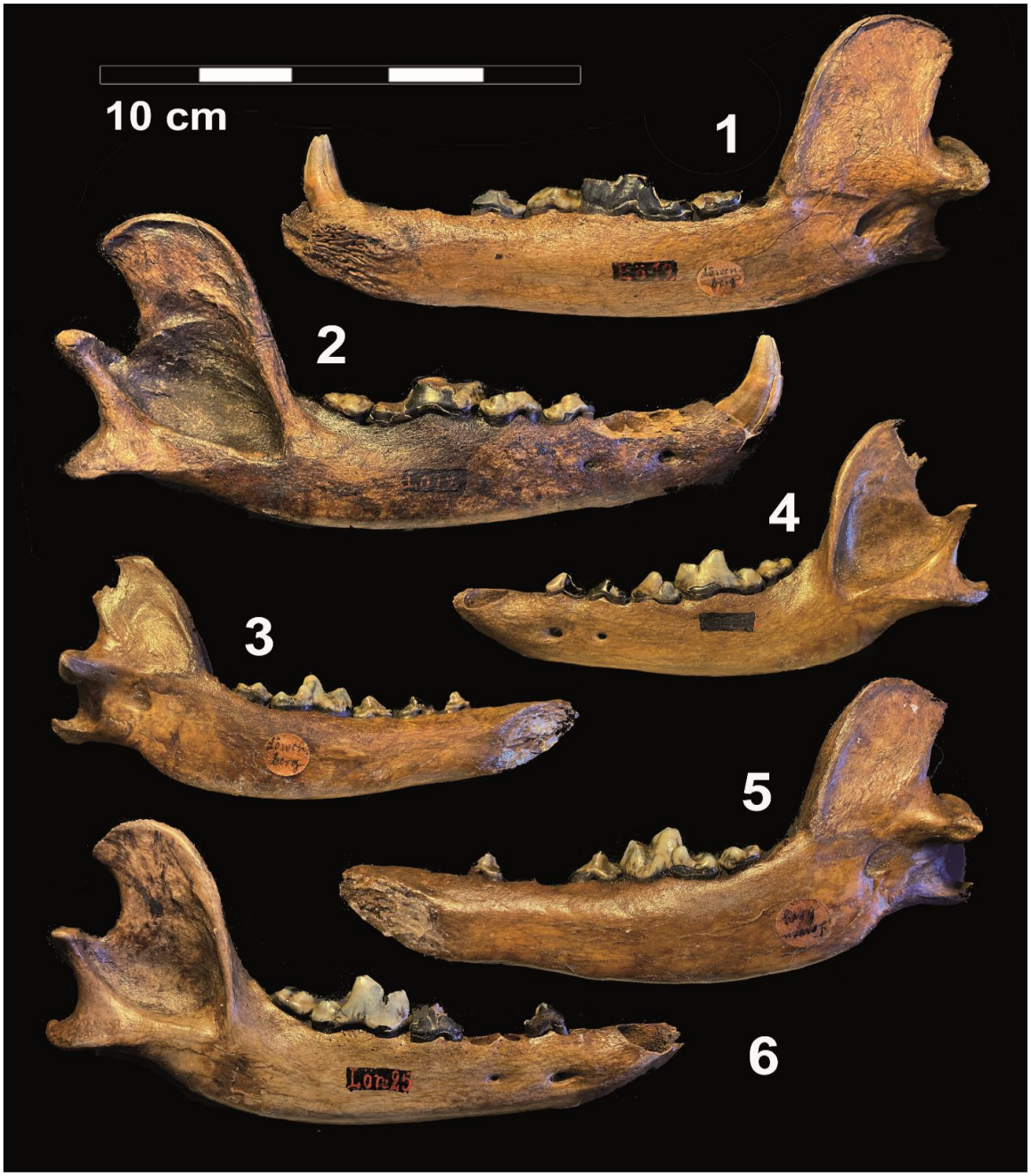

Plate 5. Domestic dog: 1) half of the mandible (Lö 12) dexter lingual, 2) half of the mandible (Lö 12) dexter buccal, 3) half of the mandible (Löw 25) sinister lingual, 4) half of the mandible (Löw 25) sinister buccal, 5) half of the mandible (Löw 25) dexter lingual, 6) half of the mandible (Löw 25) dexter buccal; (Scale 10 cm).

Plate 6. Domestic dog, (1-4), deer (5-9): 1) half of the mandible (Cocce, 1837) dexter lingual, 2) half of the mandible (Cocce, 1837) dexter buccal, 3-4) ulnae (Lö o. No.) sinister et dexter, 5) Half of the mandible (Lö 17) dexter buccal, 6) Half of the mandible (Lö 17) dexter buccal, 7) Antler rod (Lö 49) sinister, real skull, crippled, 1-2 with traces of dissection, 8) Antler rod (Lö 50) exosteoses, traces of dissection; (Scale 10 cm).

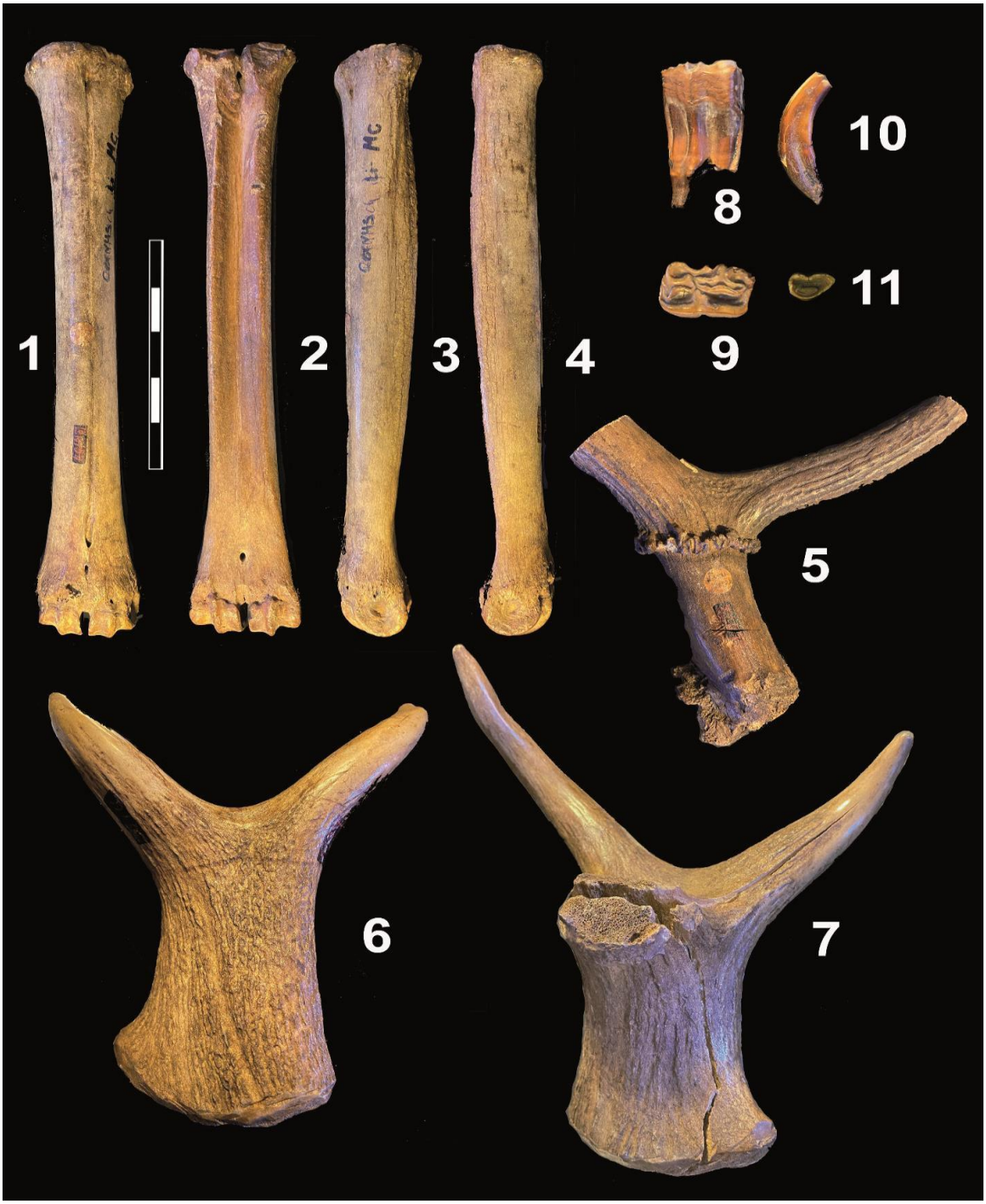

Plate 7: Red deer (1-7), domestic horse (8-11): 1) metacarpus (Löw/ 57) sinister dorsal, 2) metacarpus (Löw/ 57) sinister plantar, 3) metacarpus (Löw/ 57) sinister lateral, 4) metacarpus (Löw/ 57) sinister medial, 5) antler fragment (Lö 72) skull-like, 6) antler fragment, idol (Lö 10) carved from the crown of an eight- or ten-ender, from behind, 7) like Figure 6 from the front, 8) premolar (Lö no.) inferior lingual, 9) premolar (Lö no) inferior occlusal, 10) incisive (Lö no.) inferior lateral, 11) incisive (Lö no.) inferior occlusal; (Scale 10 cm).

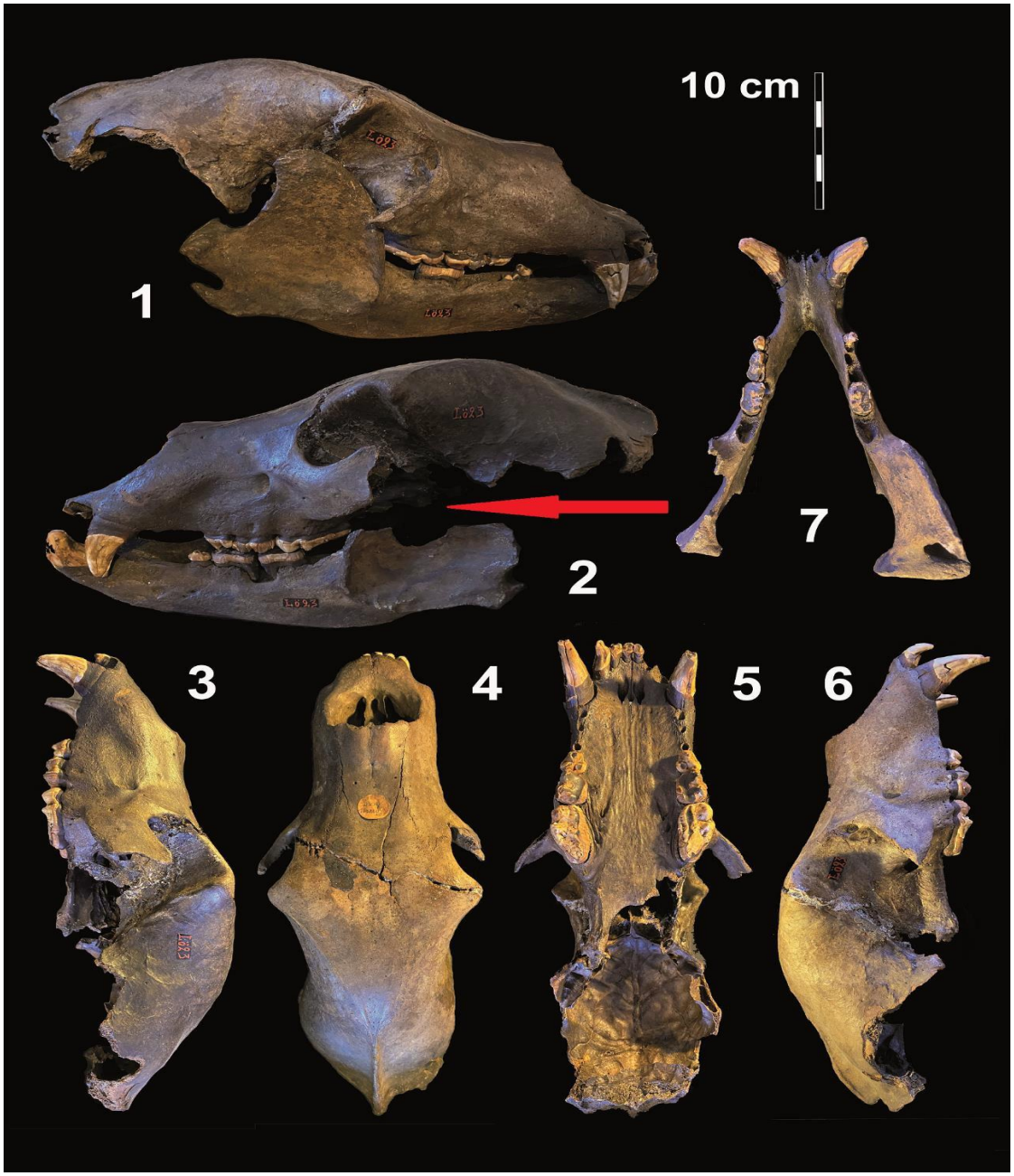

Plate 8: Brown bear: 1) Cranium (Lö 23) and mandible (Lö 23) lateral dexter, 2) Cranium (Lö 23) and mandible (Lö 23) lateral sinister, 3) Cranium (Lö 23) lateral sinister, 4) Cranium (Lö 23) dorsal, 5) cranium (Lö 23) palatal, 6) cranium (Lö 23) lateral dexter, 7) mandible (Lö 23) alveolar; (Scale 10 cm).

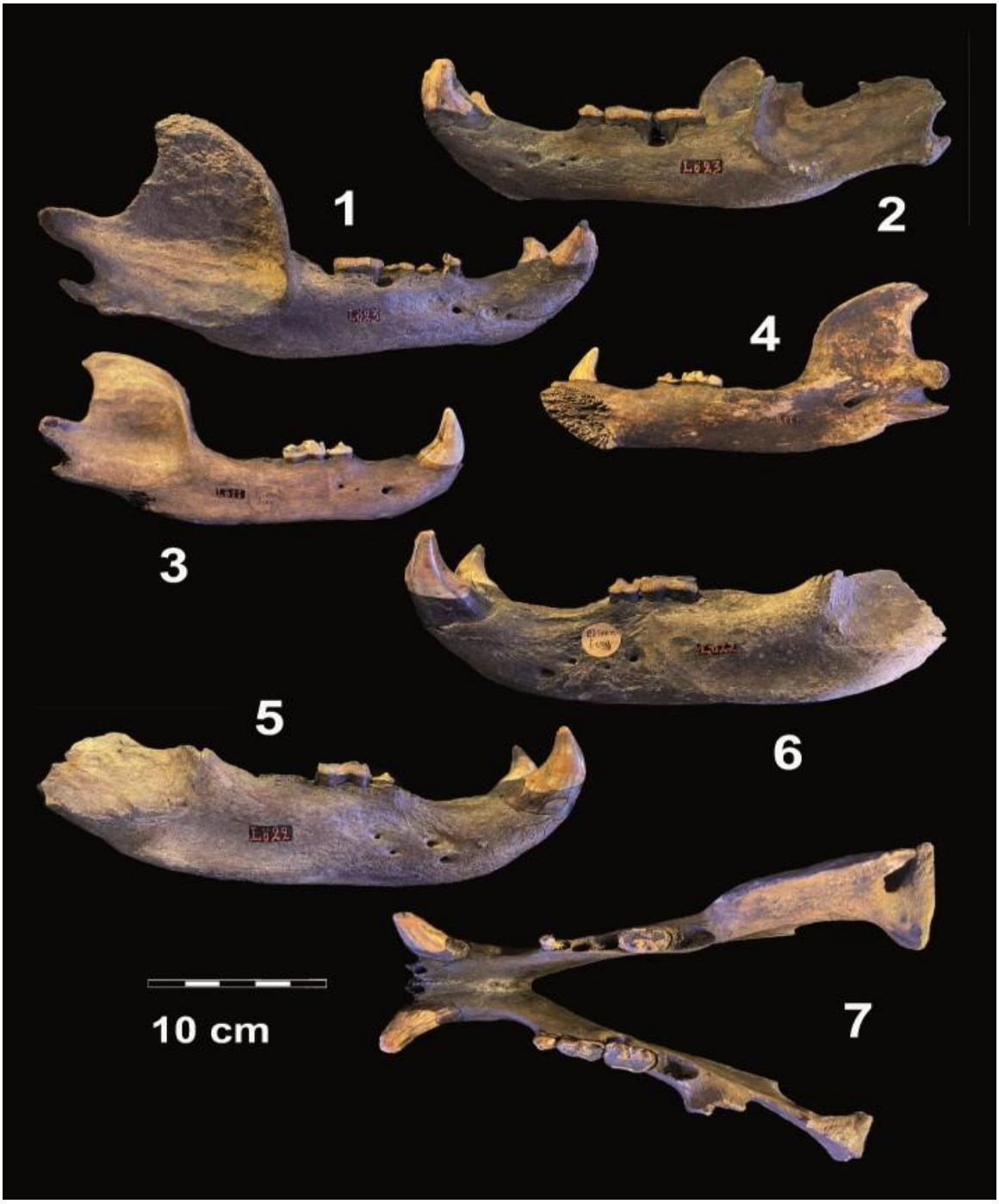

Plate 9: Brown bear: 1) mandible (Lö 23) lateral dexter, 2) mandible (Lö 23) lateral sinister, 3) mandible load (Lö 11) dexter buccal, 4) mandible load (Lö 11) dexter lingual, 5) mandible (Lö 22) lateral dexter, 6) mandible (Lö 22) lateral sinister, 7) mandible (Lö 22) alveolar; (Scale 10 cm).

Gender determination

The sex determination of the horn cone from domestic cattle Lö 23 revealed a circumference at the base of 183 mm that overlaps with that of bulls (215-120/ MW 169 mm) or oxen (258-150/ MW 190 mm), with a large diameter of 55.5 mm, which is below the MW of bulls (56.1 and 60.9 mm) and oxen (57.8 and 59.3 mm), but above that of cows (42.1 and 43.9 mm). The entire length of 230 mm corresponds to that of oxen (258-150/ MW 190 mm; 180-150/ MW

168, bulls (200-135/ MW 156.6 mm) and cows ((145)-(80) / MW 114.6 mm or (160-80/ MW 117.7 mm) are significantly lower, so that Lö 23 is probably a remnant of the ox's horn cone.

Height at the withers (HWR)

The measurements for the right cattle mandible Lö 43 lie between the average values of the Bronze Age cattle and those of the Roman Age cattle in the studied areas (Fig. 5).

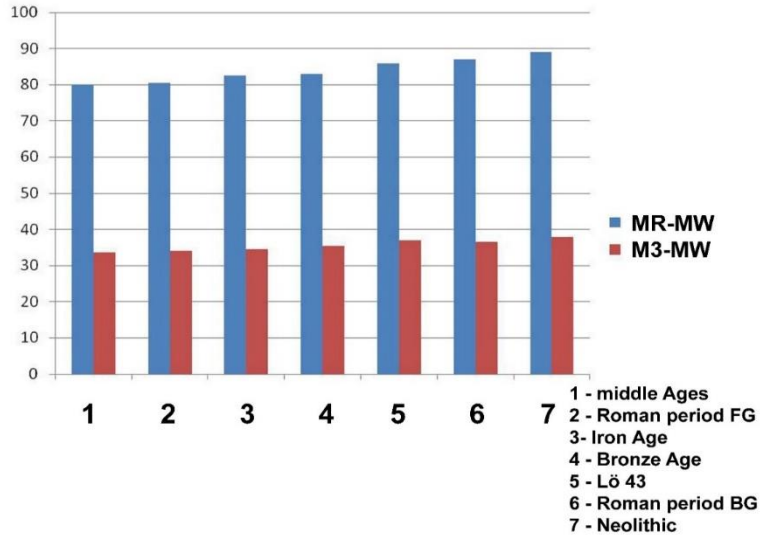

Figure 5. Correlation of the molar row and M3 measurements of S. No. 43 with the corresponding average values of different epochs for temporal classification.

Pathological changes

Pathological changes are the most important characteristics of domestic changes:

1) Deformations of deer antlers

2) Drastic degree of abrasion of all teeth and scene control of the dog‘s teeth (Kulissenstellung)

3) Severe stomatopathy of the bear jaw remains with tooth loss and inflammatory jaw changes.

Figure 6 shows x-rays of the rostral skull region of the Wartburg bear skull (*Ursus americanus* (Fig. 1)) TLDA No. 322 from dorsal = Fig. 1 and a comparison skull of *Ursus arctos* Lö 23 (Fig. 2) to show the different formation of the uniform Foraman palatinum minor (fpmi) in *Ursus arctos* (present) and *Ursus americanus* (much smaller and covered) and the position of the foramina palatinum major (fpma). The lighter area denotes the nasal opening. Note the behavior of the posterior border (na) with respect to the expansion of the olfactory bulb cavity (boh) (Karl 2009).

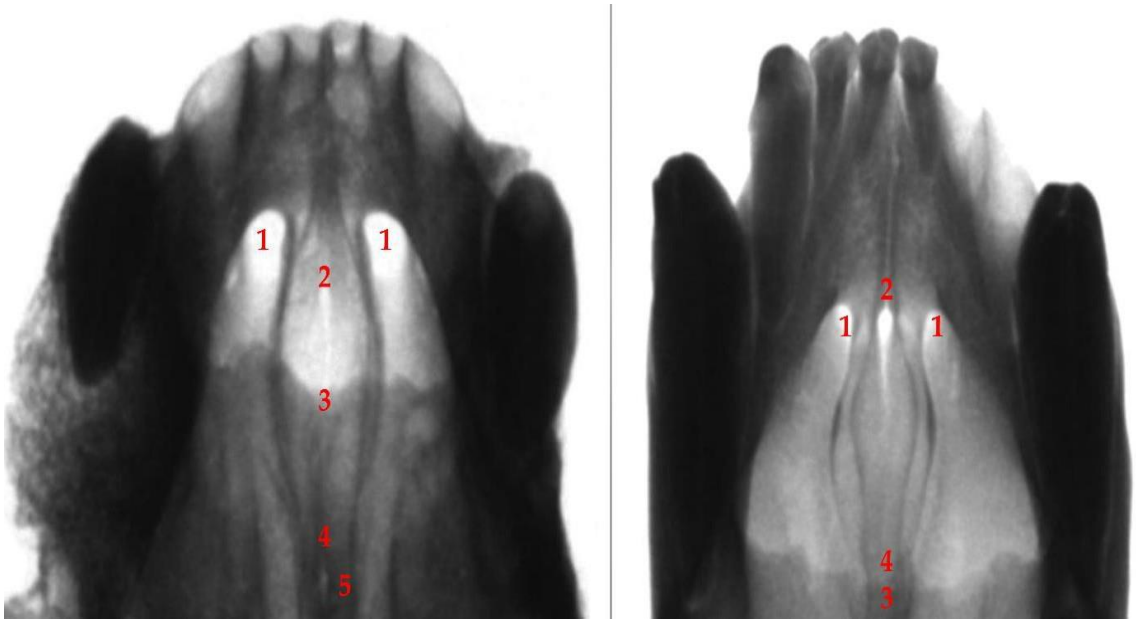

Figure 6: Radiographs of the rostral skull region of the Wartburg bear skull (*Ursus americanus* (Fig. 1)) TLDA No. 322 from dorsal = Fig. 1 and the comparison skull of *Ursus arctos* Lö 23); according to Karl (2009).

Traces of meat cutting

The arrow on plate 8, figure 2, shows the direction of impact with a sharp object. It is unclear whether this is a slaughter blow or traces of dismemberment. Figure 5 shows the opened cranial cavity. The left angular process was also chopped off, but it is intact on the right side.

Cult object or idol

A worked deer antler fragment is depicted in panel 7, figures 6-7, which can only be interpreted as a cattle idol. According to Arnold et al., (2004), what was striking at the end of the fourth century was sophisticated antler processing for the production of various devices. Fishing harpoons and crude pottery also appeared. The numerous bronze-age finds show that the area around Lake Murten was still populated around 1000 BC. In addition to whole antlers, fragments of Cervus elaphus were found, small parts of which were made into tools. Tools made from bone and horn. These are usually still very well preserved and appear as knives, needles, awls, chisels, spatulas, harpoons, etc. (Keller, 1860, 1863, 1866, 1876). Comparable cult objects made from deer antlers, such as those from Löwenberg, are not known.

Pet breed characteristics

Only the true-skull horn cones Lö19 and 20 from Löwenberg allow a comparison with the horn stage of young animals from a sheep population related to the Skudden (Comparison to Plate 2, Fig. 1-3).

Figure 7. Young animals of a sheep population related to the Skudden in the horn stage of the Löwenberge's skull-free horn cones S. no. 19 and 20, comparison to plate 2, Fig. 1-3.

Discussion

Bouyer and Boisaubert (1992) and Schwab (1984) examined and described archeological excavations of Lake Morat (also known as Lake Murten) near Loewenberg. Morel and Muller (1997) conducted an archeological study in Lake Neuchâtel. Housing developments on Swiss lakes began in the mid-19th century. It is especially worth mentioning here the pioneers Keller (1865) and Pallmann (1866). During this period, Rütimeyer (1861) published the first important text on archeozoology. The closest comparison is the Hauterive-Champréveyres site on neighboring Lake Neuchâtel, which dates from the Middle Neolithic to the Bronze Age. Around 3800 BC and remained in the area for approximately 2000 years. The type of archeological material found at the site corresponds to the ancient Cortaillod culture. In the 19th century, there was construction for residential and commercial purposes made on both sides of the lake. Approximately 1,800 types of flint tools/bones have been recorded during construction (Morel & Müller, 1997). The following animals can be identified in Hauterive-Champréveyres, Mammals: horse (*Equus ferus*), cattle (*Bovinae indet*.), reindeer (*Rangifer tarandus*), Alpine ibex (*Capra ibex*), reindeer/deer/ibex (*Rangifer* /*Cervus*/*Capra*), domestic dog (*Canis lupus* f. *familiaris*), arctic fox, snow fox or arctic fox (*Vulpes lagopus*), red fox (*Vulpes vulpes*), Eurasian lynx or northern lynx (*Lynx lynx*), stoat (*Mustela erminea*), alpine marmot (*Marmota marmota*), mountain hare (*Lepus timidus*/ brown hare (*Lepus europaeus*);

birds: black-throated grebe (*Gavia arctica*), black-necked grebe (*Podiceps nigricollis*), whooper swan (*Cygnus cygnus*), ducks (*Anatidae sp*.), golden eagle (*Aquila chrysaetus*), ptarmigan (*Lagopus* sp.), birds (*Aves indet*.) and fishes: lake trout (*Salmo trutta*), arctic char (*Salvelinus alpinus*), European grayling (*Thymallus thymallus*), roach (*Rutilus rutilus*), burbot (*Lota lota*).

Keller (1863) listed the following animal remains from Lake Murten according to the identification of Professor Rütimeyer in Basel: *Esox lucius* (pike), *Pelophylax* kl. *esculentus* (pond frog), *Accipiter gentilis* (hawk), *Anas platyrhynchos* (mallard), *Sciurus europaeus* (Eurasian squirrel), *Castor fiber* (beaver), *Meles meles* (badger), *Canis lupus* (wolf), *Canis lupus* f. *familiaris* (domestic dog), *Vulpes vulpes* (red fox), *Martes martes* (pine marten), *Martes foina* (stone marten), *Mustela erminea* (stoat), *Mustela putorius* (polecat), *Felis silvestris* f. *catus* (domestic cat), *Sus scrofa* (wild boar), *Sus scrofa* f. *demestica* (domestic pig), *Equus caballus* (domestic horse), *Capreolus capreolus* (deer), *Cervus elaphus* (red deer), *Alces alces* (moose), *Capra domesticus* (domestic goat), *Ovis ammon* f. *aries* (sheep), *Bos primigenius* (aurochs), *Bos primigenius* f. *taurus* (domestic cattle).

The pile-dwelling settlement of Hauterive-Champréveyres is also one of the largest Swiss lakeside villages of the Late Bronze Age. The excavation site covered 8700 m². The finds are spread over the entire Late Bronze Age, which shows a period of settlement of almost 200 years, probably in two phases. Dendrochronological analysis of the piles revealed an age between 1050 and around 871 BC. Three main phases of tree felling are significant and correspond to the construction and expansion phases. At its maximum extent, the village covered an area of around 8700 m². Fishing and hunting are evidenced by bone remains of sea fish and seabirds and 648 single and double bronze hooks in the find. In the swampy areas the hare, the hedgehog, some birds, and, to a lesser extent, the red deer were hunted. But remains of voles (*Arvicolinae ind*.) and the house or black rat (*Rattus rattus*) were also found. For domestic animals, the surrounding poor meadows were usually only suitable for raising goats, which value leaves and bushes and, in contrast to sheep, which prefer meadows, adapt well to slopes or hills. Goats would then be bred for milk production and sheep for wool production. Although the cattle are poorly adapted to the mountainous terrain and its arid climate and require a large amount of fodder, they are nevertheless well represented in the Hauterive-Champréveyres area and were probably used for agricultural traction. The pig is also frequently represented in the finds and generally makes up 20% of the bone material in the Bronze Age in the Central Plateau. Its presence in dogs and horses has been documented in the Hauterive-

Champréveyres area, but in smaller amounts of bone than the other species mentioned (Cattin, 2009, Morel & Müller, 1997, Oppliger et al., 2014, Stopp, 2015; Studer, 2005).

In the article "From Camp to Food or from Food to Camp? Magdalen hunting and migration as an example of Champréveyres and Monruz (Neuchâtel, Switzerland)" Müller (2006) describes how some Lahu hunter-gatherer peoples. The two Magdalen stations on Lake Neuchâtel are the best-preserved open-air ruins in Europe. With the abundance of coal, finding a stove is out of the question. For the construction of the stove, rubble and stone slabs were used, and placed on the brushwood-like fuel (creeping willow). This meant that the stones had to be removed and re-stacked for each new firing cycle. These stones were collected from the surrounding area and some were reused from fireplaces from previous visits. With the help of the composition of the broken stones, the chronological sequence of the fireplaces can be worked out, which suggests that only 2 to 3 fireplaces were in use at the same time during an inspection. The 12 fireplaces in Champréveyres and the approximately 40 in Monruz are therefore not to be viewed as "settlement units", but rather the result of several, successive inspections. However, the duration of the visits as well as the absences, and thus the rhythm of the changes of location, cannot be limited with the help of the stone material; Here considerations about hunting strategy are informative. Wild horses make up most of the prey, and hunting horses near camps is impossible because they have to run so far. Instead, it can be felt that the event is happening from several kilometers away. Since each horse weighs approximately 300 kilograms, its transportation becomes surprising. It is logical to assume that the camp was set up at the site of the slaughter, as the proximity of the bones often shows that the visible objects contain all the body parts in the desired quantity. Slaughtered animals can be removed and eaten or stored for later consumption. During this time, humans have the opportunity to hunt other small animals found in the immediate area. These can also be transported to storage from greater distances. The length of stay will be between one and several weeks. This is evidenced by the estimated reuse time of the furnace; Some reusable cycles are 20 cycles. some are up to 50 cycles. After another successful horse hunt, the campsite was moved to the local hunting site. The two sites of Champréveyres and Monruz have been visited repeatedly in a cycle of constant location changes. In some cases, the time between two inspections may have only been a few weeks. But there are also fireplaces in which two well-separated layers of charcoal make it likely that it may have been one or more years. In summary, the two open-air sites of Champréveyres and Monruz can be interpreted as places that, probably due to hunting strategy peculiarities, repeatedly enabled successful horse hunting and were therefore visited several times. Marciniak et al. (2017) examined the isotopic

characterization of domestic animals as it relates to birthing location and seasonality, diet, pasturing pattern, foddering, and climatic conditions of herding and to determine variation between these aspects of cattle and caprine husbandry of the Neolithic Linearbandkultur (LBK) and Trichterbecherkultur (TRB) communities from Kopydłowo in Kujavia—one of the major centers of early farming in the European lowlands. According to Elizabeth (2021), Cattle were the most common domestic livestock animal throughout much of the Neolithic period in the area now occupied by modern-day Switzerland, home to a significant number of sites dating to between approximately 4400 and 2500 cal BC. According to Göldi in 1914, the Ibex, *Capra ibex*, was present in the area of the inhabitants of the pile-dwelling villages in central Switzerland, but certainly only in the wider area. He was already a mountain animal back then. One is necessarily led to this conclusion by the sparse finds of a single horn cone from the Meilen pile dwelling and various jaw fragments and horn cones from the Greng pile dwelling in Lake Murten. Due to the changes during domestication, no relationship to the sheep or goat mandibulae can be seen. The latest discovery in the Mürten Lake settlement confirms that people began to place storks in their homes for other important purposes as well. According to Hafner and Schlichtherle (2006/2007), 750 points are currently identified as pile-dwelling sites in six Alpine countries, of which, 450 are located in Switzerland. These sites are found especially in western Switzerland, Known as the region of three Lakes (i.e. Lakes Birn, Morat, and Neuchâtel), in the Lake Zurich area, and in the lakes that form the border between Switzerland and Germany and between Switzerland and France. These are the two largest bodies of water in Central Europe and together with the northern foothills of the Alps form the main area of the pile-dwelling phenomenon.

Conclusions

The zooarchaeological analysis of fossils from domestic and some wild animals found at the prehistoric pile dwelling settlements of the Loewenberg in Lake Murten, Switzerland, provides important information about the history and changes in the evolution of early cattle husbandry in central Europe during the Neolithic to Bronze Age. At Loewenberg, domesticating of both cattle and caprines was important, but cattle were far more important than pork, and lamb, in the subsistence throughout this period. Cattle increased from the early stages of settlement to the later stages. This is a regional phenomenon that may be challenged by farmer‘s cattle breeding strategies. Wild auroch hunting and cattle hybridization with local aurochs may also explain the large population in these areas, but this theory requires further investigation. Data from Lowenberg‘s initial decisions are too limited to provide definitive statements about the

product's importance, but dental mortality data revealed that using the drug to kill bacteria after breastfeeding produces more milk for human consumption. Macroscopic information confirms that domestic animals were mainly used for carcass products (meat, fur, horns, hides, and dairy products). The paleogenetic data from the region will be important to place the amplification of this study in their regional and supra-regional context and to understand how cattle husbandry emerged and evolved in the central European region and neighboring cannot be done without discussing cultural preferences, cultural patterns, health, and environmental changes from the Neolithic to the Bronze Age.

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