Holocene macromammal remains from Grotta dell'Edera/Stenašca, Trieste Karst (excavations in 1990–2001)

Ostanki velikih sesalcev holocenske starosti iz jame Stenašca/Grotta dell'Edera na Tržaškem Krasu (izkopavanja v letih 1990–2001)

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Izvleček

Predstavljeni so rezultati zooarheološke in tafonomske analize ostankov velikih sesalcev iz jame Stenašca/Grotta dell'Edera) na Tržaškem Krasu. Najstarejše človekove sledi so datirane v mezolitik (sovterjen). Ljudje so se namreč v jami občasno zadrževali že v predborealu, intenzivneje pa so jo začeli obiskovati v borealu in v začetku atlantika. Zadnja faza prisotnosti mezolitskih skupin je časovno umeščena v kastelnovjen. Označujejo jo ostanki domačih in lovnih živali, pri čemer večji del kosti izkazuje sledi neposredne izpostavljenosti vremenskim pojavom. To bi lahko pričalo o razmeroma počasnem odlaganju omenjene plasti, ki je povzročilo nastanek palimpsesta, vendar bi dokončna razjasnitev problematike terjala več geoarheoloških podatkov. Za skupek živalskih ostankov iz neolitskih in eneolitskih plasti je značilna očitna prevlada kosti in zob drobnice, pa tudi postopna rast števila najdb domačega prašiča in goveda. Na podlagi prisotnosti posameznih kosti ovčjih in/ali kozjih zarodkov je mogoče sklepati na naraven pogin teh živali. Slednje kliče k previdnosti pri oceni starostnih profilov domestikatov z najdišč, ki so bila uporabljana kot staje.

Ključne besede: Tržaški Kras; Grotta dell'Edera/Stenašca; sovterjen; mezolitik; neolitik; eneolitik; zooarheologija; tafonomija

Abstract

The zooarchaeology and taphonomy of large mammal remains from Grotta dell'Edera (Trieste Karst, northern Italy) are presented in this paper. A Mesolithic (Sauveterrian) Preboreal assemblage testifies to a first human occupation, followed by a second longer Sauveterrian frequentation from the Boreal until the beginning of the Atlantic. The last Mesolithic groups are represented by a Castelnovian assemblage, in which the bones of domesticates were detected with wild games remains. The presence of weathered bones in this layer indicates possible slow sedimentation, which may have led to the formation of a palimpsest, but more geoarchaeological data are needed to clarify this context. Neolithic and Eneolithic layers are characterized by an overwhelming presence of caprines and by an increase in the domestic pig and cattle through time. A number of caprine foetal remains points to the presence of individuals accumulated due to natural death and to the caution needed in evaluating caprine age profiles from sites used as stables.

Keywords: Trieste Karst; Grotta dell'Edera/Stenašca; Sauveterrian; Mesolithic; Neolithic; Eneolithic; zooarchaeology; taphonomy

INTRODUCTION

Grotta dell'Edera (Stenašca) (*Figs. 1* and *2*) is a key site for the study of the first colonization of the Karst plateau (northern Adriatic) and for better understanding its neolithization process. This area se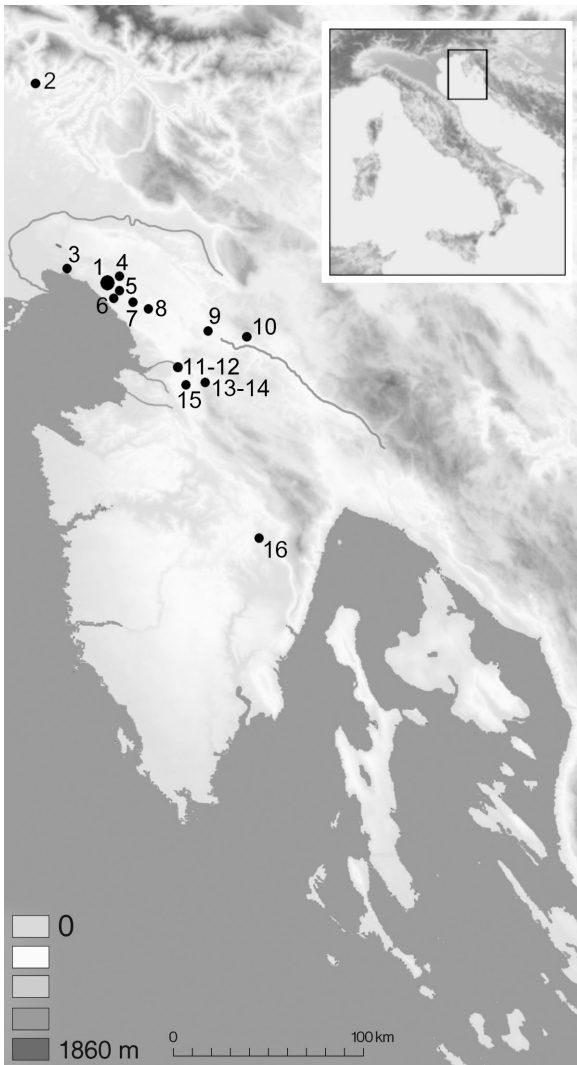ems to have been uninhabited for several millennia (Boschian, Fusco 2007) at least from the onset of the Upper Palaeolithic until the Mesolithic; the first traces of Anatomically Modern Humans date to the early Holocene. In addition, in most of the archaeological cave sites widespread over the Karstic plateau, the Mesolithic-Neolithic sequences are almost always incomplete (Biagi, 2003). From this perspective, Grotta dell'Edera is a unique site due to a stratigraphy that yielded Mesolithic Sauveterrian (Layers 3b–d) and Castelnovian (Layer 3a) remains, as well as Neolithic and Eneolithic ones (Layers 2–2a) (*Fig. 3*). Being the only detailed Mesolithic-Neolithic carbon-dated sequence of the Trieste Karst (*Fig. 4*), Grotta dell'Edera must be considered one of the most important cave-sites in the province of Trieste. Moreover, it was thoroughly excavated, with water sieving and flotation to recover small finds and plant remains. Excavation proceeded following stratigraphic criteria (arbitrary spits of 5 or 10 cm were used within the different layers).

For this reason, the analysis of animal remains uncovered at the site is a unique opportunity to collect data useful for the reconstruction of subsistence strategies of Mesolithic and Neolithic people that (re)colonized the plateau. Zooarchaeological remains were previously published in preliminary reports by Boschin and Riedel (2000; 2011) and, in a recent paper discussing caprines, mortality profiles (Boschin 2020) were published. The aim of this paper is to present a complete report on the zooarchaeology and taphonomy of the macromammal assemblage.

Fig. 1: Position of Grotta dell'Edera and other sites cited in the text. Dary streams indicate the water sources closest to Grotta dell'Edera.
Sl. 1: Lega Stenašce in drugih v besedilu obravnavanih najdišč. Vrisani so tudi vodni viri v neposredni bližini jame.
1 Grotta dell'Edera/Stenašca; **2** Riparo di Biarzo/Pečina pri Bjarču; **3** Grotta del Mitreo/Mitrejeva jama; **4** Grotta Benussi; **5** Grotta Azzurra/Pečina na Leskovcu; **6** Vlaška jama; **7** Grotta degli Zingari/Ciganska jama; **8** Grotta dei Ciclami/Orehova pejca; **9** Mala Triglavca; **10** Viktorjev spodmol; **11**, **12** Grotta degli Orsi/Medvedja jama, Grotta Piccola Pocala; **13**, **14** Podmol pri Kastelcu, Acijev spodmol; **15** San Rocco/Koromačnik; **16** Pupićina peć
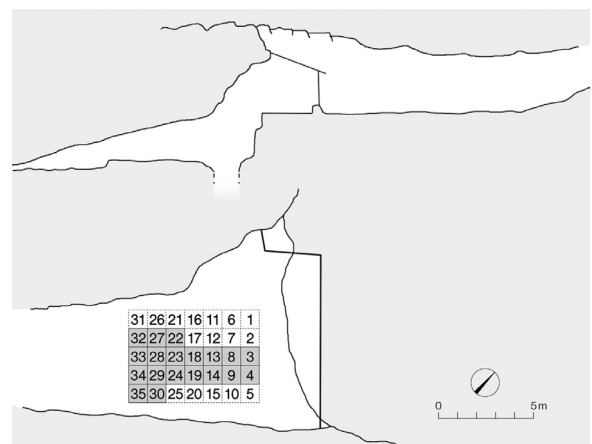

Fig. 2: Grotta dell'Edera. Site planimetry. Excavated squares are marked in grey.
Sl. 2: Stenašca. Planimetrija najdišča. Posamezni izkopani kvadranti (označeni sivo).

The cave is located in the north-western sector of the Trieste Karst (northeastern Italy). It opens at the bottom of a small sinkhole, at an altitude of about 230 m a.s.l., some 3 km from the present-day coastline (*Fig. 1*); its 10 m wide entrance faces N. E. (*Fig. 2*). The cave was first excavated by Giorgio Marzolini (1970), and the fieldworks were resumed in 1990 by the Ca'Foscari University of Venice and the University of California at Berkeley (USA) and directed by Paolo Biagi and Barbara A. Voytek (Biagi, Starnini, Voytek 1993).
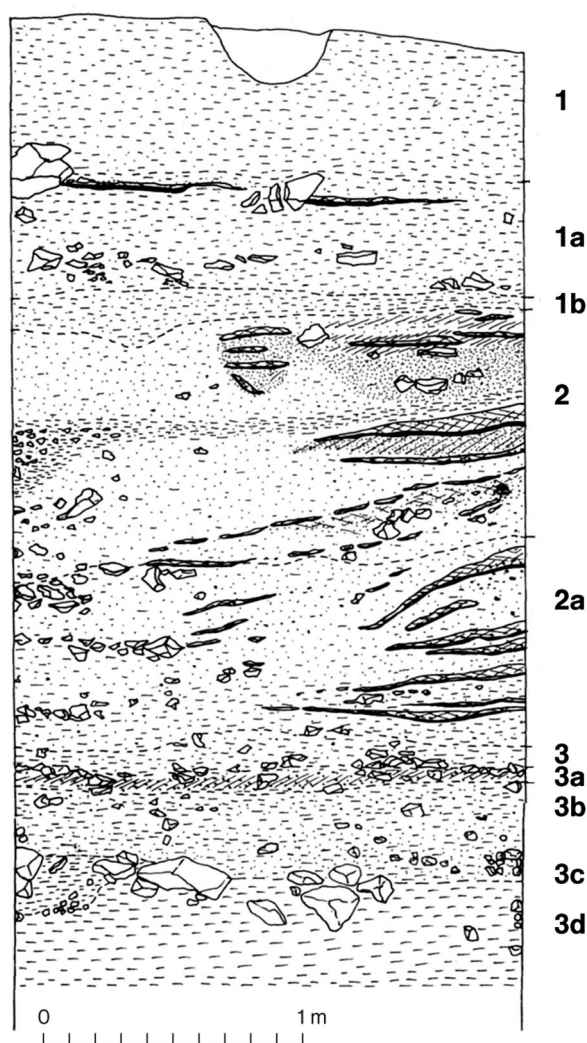

Fig. 3: Grotta dell'Edera. Site's stratigraphy; layers are labelled according to the 1990–2001 excavations. Layers: **3d–b** Mesolithic/Sauveterrian; **3a** Mesolithic/Castelnovian; **2a** Neolithic (Vlaška group); **2** Late Neolithic/Eneolithic; **1b** Bronze Age; **1a** Late Antiquity (Migration Period).
Sl. 3: Stenašca. Stratigrafija najdišča, izkopavanja 1990–2001. Plasti: **3d–b** mezolitik/sovterjen; **3a** mezolitik/kastelnovjen; **2a** neolitik (vlaška kulturna skupina); **2** pozni neolitik/eneolitik; **1b** bronasta doba; **1a** pozna antika (obdobje preseljevanja ljudstev).

The stratigraphical sequence includes both Pleistocene and Holocene sediments (Boschian 1997), but the archaeological layers cover only a Holocene time-span between the Preboreal and the Migration Period (Spataro 1999; Biagi, Spataro 2001; Biagi, Starnini, Voytek 2008) (*Fig. 3*).

Available geoarchaeological data suggest that the deepest layers investigated during the first excavations are related to a quite wet and cold Late Pleistocene phase (layers up to Layer 6 in Boschian, 1997, Fig. 3), which evolves towards slightly drier conditions (Layers 7–9). These phases were tentatively related to the Dryas III (Boschian 1997). Stony layers corresponding to the Mesolithic (Layers 10–12a) are characterized by intense human-related activities and thus are the uppermost Neolithic-Eneolithic levels 13–15. In general, a decrease in the external input of sediments is visible, along the Holocene sequence, probably due to climate amelioration and afforestation (even if this trend is partially inverted during a possibly more arid climatic phase corresponding to the Eneolithic). This interpretation appears to be confirmed by available archaeobotanical data (Nisbet 2000). During the Neolithic and the Eneolithic, most of the sediments are related to the accumulation of domestic livestock droppings (Boschian 1997).

To avoid misunderstanding, it has to be emphasized here that the naming of layers was changed during the most recent excavations. Layers composing the about 4 m thick newly excavated stratigraphy were labelled as follows, from bottom to top (*Figs.* 3 and *4*):

– *Layer 3d:* it is related to the cave's oldest human frequentation (Mesolithic, Sauveterrian), which took place during the Preboreal period (9810±70 uncal., GrN-23130; 9930±50 uncal., GrA-14108).

– *Layer 3c:* it yielded a living floor characterized by the presence of *in situ* faunal remains, lithics, and ash/charcoal lenses. It dates to the Boreal period (8350±120 uncal., GrN-25139; 8250±50 uncal., GrA-11818) and corresponds to a Sauveterrian occupation phase.

– *Layer 3b:* it yielded a Sauveterrian Mesolithic assemblage, and it is ascribable to the Boreal/beginning of the Atlantic period. Dates span from 8045±40 uncal. (GrA-14106) to 8110±90 uncal. (GrN-25138).

– *Layer 3a:* it is a hearth of about one metre in diameter which yielded a Late Mesolithic Castelnovian lithic assemblage together with a total amount of 17 potsherds; petrographic characterization of the latter revealed an allochthonous provenance
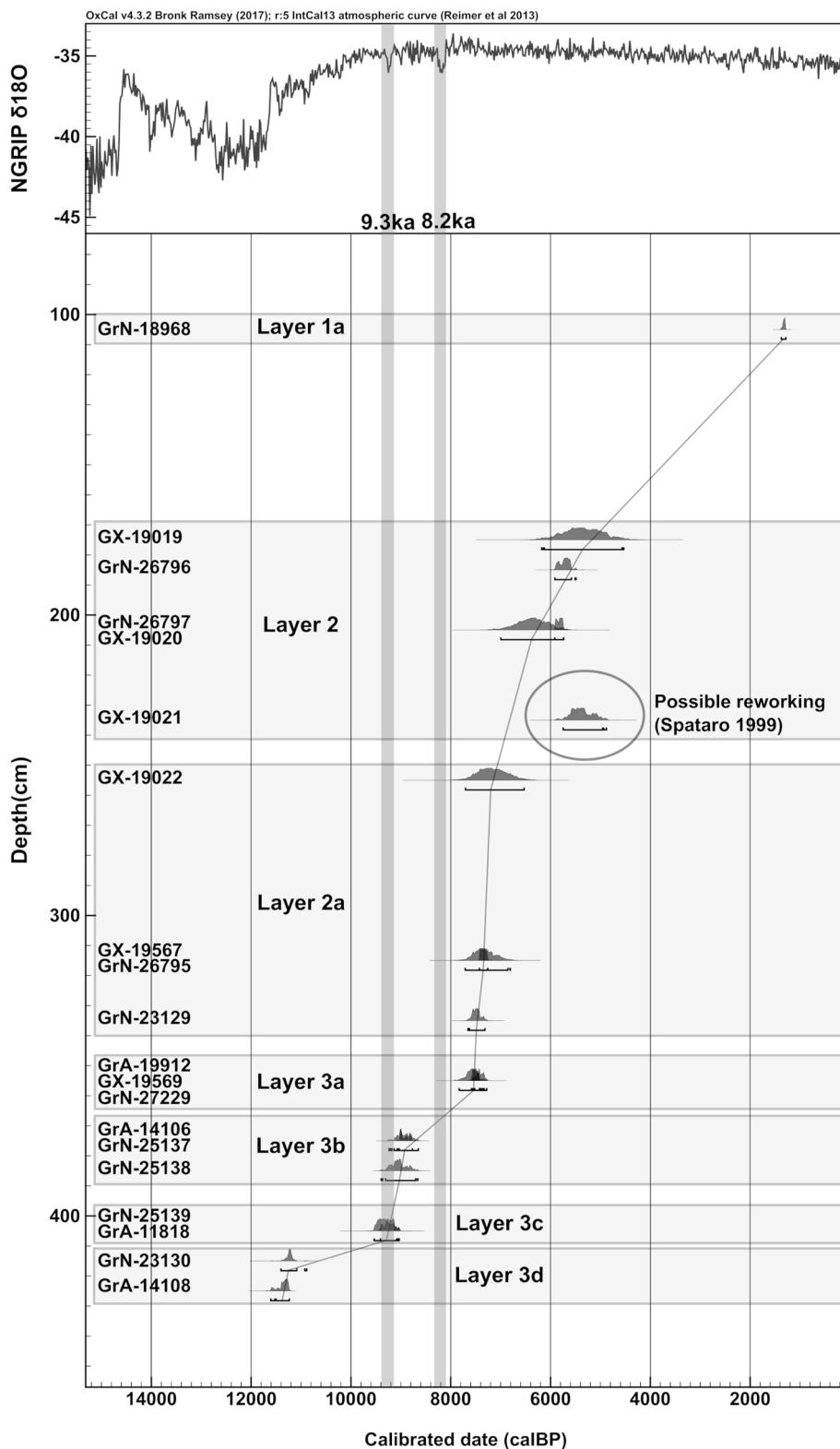
Fig. 4: Grotta dell'Edera. ^{14}C Dates; calibration was performed with the software Oxcal v4.3.2 (Bronk Ramsey et al. 2013), using the IntCal13 atmospheric curve (Reimer et al. 2013). Dates are from Spataro 1999; Biagi 2003; Biagi, Starnini, Voytek 2008.

Sl. 4: Stenašca. Datumi C^{14}; kalibriranje je bilo izvedeno z uporabo programskega paketa OxCal 4.3 (Bronk Ramsey 2009) ob upoštevanju krivulje IntCal13 (Reimer et al. 2013). Podatki so povzeti po: Spataro 1999; Biagi 2003; Biagi, Starnini, Voytek 2008.

and a mineral composition, which differs from that of ceramics from the more recent Layer 2a (Spataro 2001). A piece of charcoal dates to 6700±130 uncal. (GX-19569), whilst a sheep bone dates to 6620±60 uncal. (GrA-19912).

– *Layer 3:* it is a reworked level of about 20 cm in thickness, where potsherds and few lithic flakes of local raw material were uncovered. Up to this layer, sediments are mainly characterized by a more reddish colour.

– *Layer 2a:* it is a thick palimpsest, composed of six superimposed lenses of ash and charcoal. Most of the sediments are composed of burned domestic ungulates droppings. Fragments of potsherds are ascribed to the Vlaška group, considered as a local variant of Danilo Neolithic culture. Dates range from 6305±285 uncal. (GX-19022) to 6615±390 uncal. (GX-19568) (Biagi, Starnini, Voytek 2008).

– *Layer 2:* it is another palimpsest, whose upper part (at a depth of 170–180 cm) dates to an early phase of the Eneolithic (4680±325 uncal., GX-19019); another date, coming from a lower part of the layer (depth of 200–210 cm) is 5555±35 uncal. (GrN-18968).

– *Layer 1b:* probably reworked, it yielded few early Bronze Age remains.

– *Layer 1a:* it yielded scarce archaeological remains and a hearth dated to the Migration Period (1415±35 uncal., GrN-18968).

– *Layer 1:* it represents the top of the sequence, with scarce archaeological significance.

METHODS

Specimens discussed in this paper were identified at anatomic and taxonomic levels, using osteological comparative collections. The taxonomic nomenclature of domestic mammals was used following Gentry, Clutton-Brock, Groves (2004). In a previous report on Layers 2, 2a, 3, and 3a (Boschin, Riedel 2000), long bones were counted, and their different parts were considered as separate entities: for instance, if a femur was complete, it was counted three times (proximal, medial and distal), which means that the number of remains expressed in the tables in Boschin, Riedel (2000) does not correspond to the effective number of specimens found at the site. For this reason, the number of identified specimens (NISP) is used here to avoid mistakes in case other authors will use zooarchaeological data from Grotta dell'Edera. When possible, taxonomically unidentified speci-

mens were grouped according to anatomy (e.g., ribs, vertebrae, long bone diaphysis).

Minimum Number of Elements (MNE) and Minimum Number of Individuals (MNI) were counted considering side, size and ontogeny (see Lyman 2008 for a discussion on the meaning of these indexes). Proximal and distal portions of long bones are considered separately in counting MNE. MAU and MAU% (Minimum Animal Unit, Binford 1984) were used to evaluate skeletal frequencies. Bone density values were used following Lyman (1984); utility indices were used following Metcalfe, Jones (1988); Rowley-Conwy, Halstead and Collins (2002); Morin (2007).

Measurements were taken according to von den Driesch (1976) and are listed in the *Appendix*. Wear stages were measured according to Grant (1982) for the genera *Bos* and *Sus* and Payne (1973) for caprines. Identification of caprine foetal elements was carried out following Habermehl (1975); Ahmed (2008); Richardson et al. (1976) and Mcdonald et al. (1977). Age-at-death of roe deer and red deer were evaluated following Tomé and Vigne (2003), and Mariezkurrena (1983) and Habermehl (1985) respectively. The status of shaft portions at the moment of breakage (fresh or dry) was analysed using the Fracture Freshness Index (FFI) (Outram 2002).

Bone surface modifications were analysed with a 10X lens and, when necessary, with a binocular microscope; natural modifications were studied using present comparative materials collected on the field. In order to give more reliable data, only unburned fragments larger than 3 cm were considered in the analysis of weathering (cracks and exfoliation on bone surfaces).

Radiocarbon dates (*Fig. 4*) were calibrated with the OxCal 4.3 software (Bronk Ramsey 2009), using the IntCal 13 curve (Reimer et al. 2013). Statistics and graphs were performed using PAST software (Hammer, Harper, Ryan 2001) and R (*R Development Core Team* 2008).

RESULTS

Exclusion of a part of the faunal assemblage from the present study

Layer 2a was excavated in two distinct areas of the cave, the first represented by squares 3, 4, 8 and 9, and the second by squares 27–30 and 33–35. A different faunal composition was
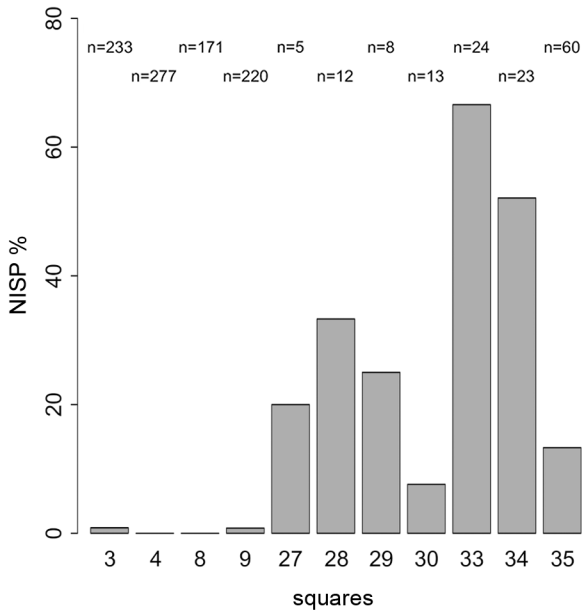
n=233   n=171   n=5   n=8   n=24   n=60
n=277   n=220   n=12   n=13   n=23

Fig. 5: Grotta dell'Edera. Layer 2a, abundance of wild taxa according to square.
Sl. 5: Stenašca. Plast 2a, količina ostankov divjadi po kvadrantu.

detected between the two groups of squares: in particular, a higher proportion of wild mammal remains was detected in the innermost portion of the excavated area (squares 27, 28, 29, 30, 33, 34, and 35; *Fig. 2*): even if the number of remains in this area is lower than in the squares closer to the cave entrance (number of specimens is between 91 in square 27 and 556 in square 35, and 1326, 1429, 989, 1197 in squares 3, 4, 8, and 9, respectively), the proportion of wild mammals ranges between 7.6% (square 30) and 66.6% (square 33). This is particularly high, considering that in squares 3, 4, 8, and 9 this proportion is less than 1% (*Fig. 5*). In addition to caprines (NISP = 101), red deer (NISP = 34), roe deer (NISP = 3), wild boar (NISP = 5), and badger (NISP = 3) were identified in Layer 2a in the innermost part of the cave. With regard to the preservation of bones, this differs between the two areas (see more details in the chapter dedicated to taphonomy), and sediment preserved in the marrow cavity of long bones varies from a red clay in squares 27–35 to a grey soil in squares 3, 4, 8, and 9. Noteworthy carnivore marks and digested remains are absent in Layer 2a in squares 27–35, thus excluding a bone accumulation by carnivores in this part of the cave. It is also important to mention that some possibly reworked areas were detected in squares 30 and 33 during the excavation of Layer 2a (Voytek's field notes; excavation

year 1998). Reworking can be the reason for the presence of Neolithic caprines mixed together with Mesolithic wild games. A part of the bones (NISP = 19) from squares 30, 34, and 35 was found in a Neolithic hearth called "feature 8" (Voytek's field notes; excavation year 1998). Among the identified specimens from this feature, 15 are ascribed to domestic caprines, three to "*Sus* sp." and one to red deer, but due to the presence of the possible stratigraphic disturbances as regards Layer 2a, in order to avoid misinterpretations, only remains coming from squares 3, 4, 8 and 9 will be considered in this paper.

Faunal composition

About 69,000 macromammal specimens were analysed, but due to strong fragmentation, only a small percentage was identifiable (*Tab. 1*). Sauveterrian samples are characterized by an overwhelming presence of red deer, roe deer, and wild boar (together they count for about 90% of NISP).
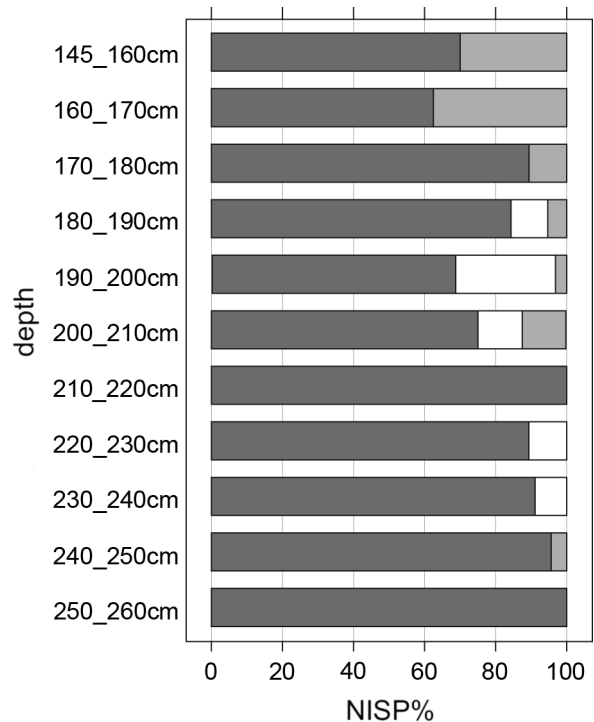

Fig. 6: Grotta dell'Edera. Layer 2, abundance of domestic taxa according to depth of artificial spits. Caprines (dark grey); cattle (white); pig (grey).
Sl. 6: Stenašca. Plast 2, količina ostankov domačih živali po globinah: drobnica (temno siva), govedo (bela) in domači prašič (siva).

	Taxa	NISP									
	Layer	1	1a	1b	2	2a	3	3a	3b	3c	3d
domesticates	*Bos taurus*	3	9	2	22	10	2	-	-	-	-
	Ovis/Capra	6	36	19	386	852	28	50	-	-	-
	Ovis aries	-	-	-	14	22	2	4	-	-	-
	Capra hircus	-	-	-	4	7	1	-	-	-	-
	Sus domesticus	1	20	8	44	4	-	1	-	-	-
	Canis familiaris	-	-	1	2	1	-	-	1	-	-
d/w	*Bos/Cervus*	-	-	-	12	9	1	-	-	-	-
	Sus sp.	-	-	-	4	-	2	7	-	-	-
wild	*Cervus elaphus*	-	-	-	9	3	24	49	355	527	76
	Capreolus capreolus	-	-	-	2	-	14	4	233	488	22
	Sus scrofa	-	-	-	2	-	9	2	175	428	23
	Bos primigenius	-	-	-	-	-	-	-	-	2	-
	Capra ibex	-	-	-	-	-	-	-	-	3	-
	Canis lupus	-	-	-	-	-	-	-	-	3	-
	Vulpes vulpes	-	-	-	2	-	1	1	4	10	3
	Meles meles	-	-	2	1	-	5	2	59	59	3
	Martes sp.	-	-	-	-	-	-	-	12	4	2
	Lutra lutra	-	-	-	-	-	-	-	4	5	-
	Ursus arctos	-	-	-	-	-	-	-	1	1	1
	Felis sylvestris	-	-	-	-	-	-	-	9	7	-
	Lynx lynx	-	-	-	-	-	-	-	-	1	-
	Lepus sp.	-	2	-	2	1	2	-	12	28	6
	Castor fiber	-	-	-	-	-	-	-	-	5	-
	Marmota marmota	-	-	-	-	-	-	-	-	1	-
	Erinaceus sp.	-	-	-	1	-	-	-	1	-	-
	NISP	10	67	32	507	909	91	120	866	1572	136

Tab. 1: Grotta dell'Edera. Identified specimens (NISP) according to layers.
Tab. 1: Stenašca. Taksonomsko opredeljeni ostanki (NISP) po plasteh.

Faunal composition of these levels does not show any clear diachronic trend.

The small assemblage from Layer 3a shows mixed characteristics: domestic animals are the most abundant, but there is also a high presence of wild ones (especially red deer). A very similar situation is also present in the small assemblage from the (possibly reworked) Layer 3.

In light of new revisions, the faunal composition of Layer 2a is characterized by a high proportion of domestic caprines (96.9% of NISP), few domestic cattle and pig remains, and rare wild mammal remains (0.4% of NISP).

Layer 2 reveals a slightly different situation: caprines are the most abundant mammals (79.7% of NISP), and both cattle and pig are more represented (4.3% and 8.7%, respectively). Furthermore, the proportion of wild taxa is slightly higher (3.7%). Even if geoarchaeological data indicate a possible reworking of domestic livestock droppings by prehistoric herders (Boschian 1997), it is interesting to note an increase in domestic pig and cattle remains from the bottom to the top of Layer 2 (*Fig. 6*). In particular, there is a significant correlation between a decrease in pig+cattle frequencies and the depth of spits (p = 0.007).

In Layers 1a and 1b, NISP is very low (67 and 32, respectively). Caprines are still the most abundant taxa, the domestic pig is more represented than cattle, and wild ungulates are absent.
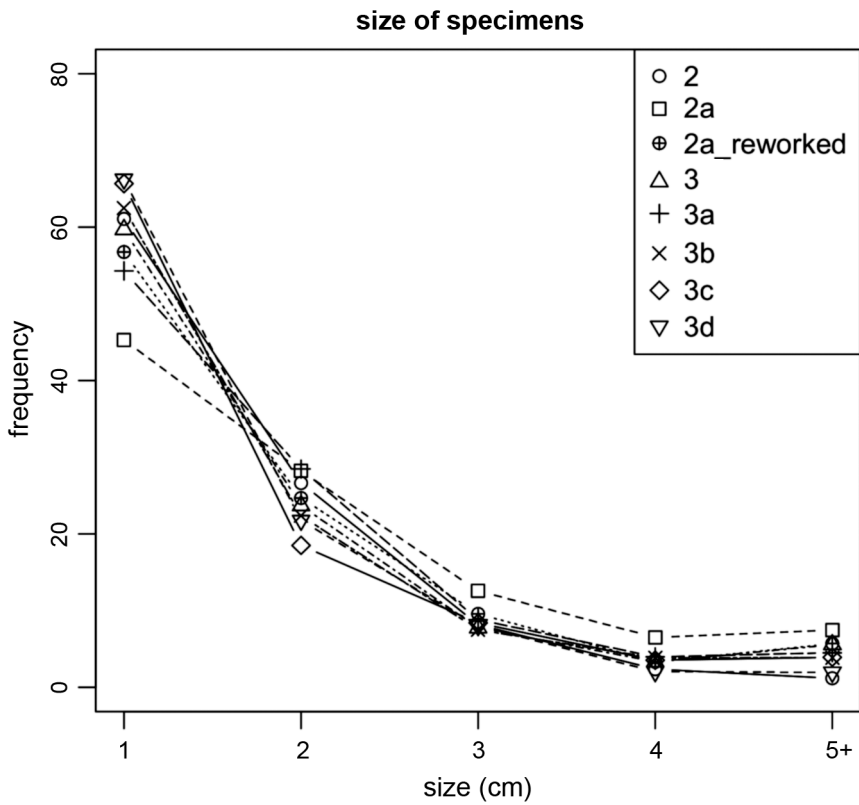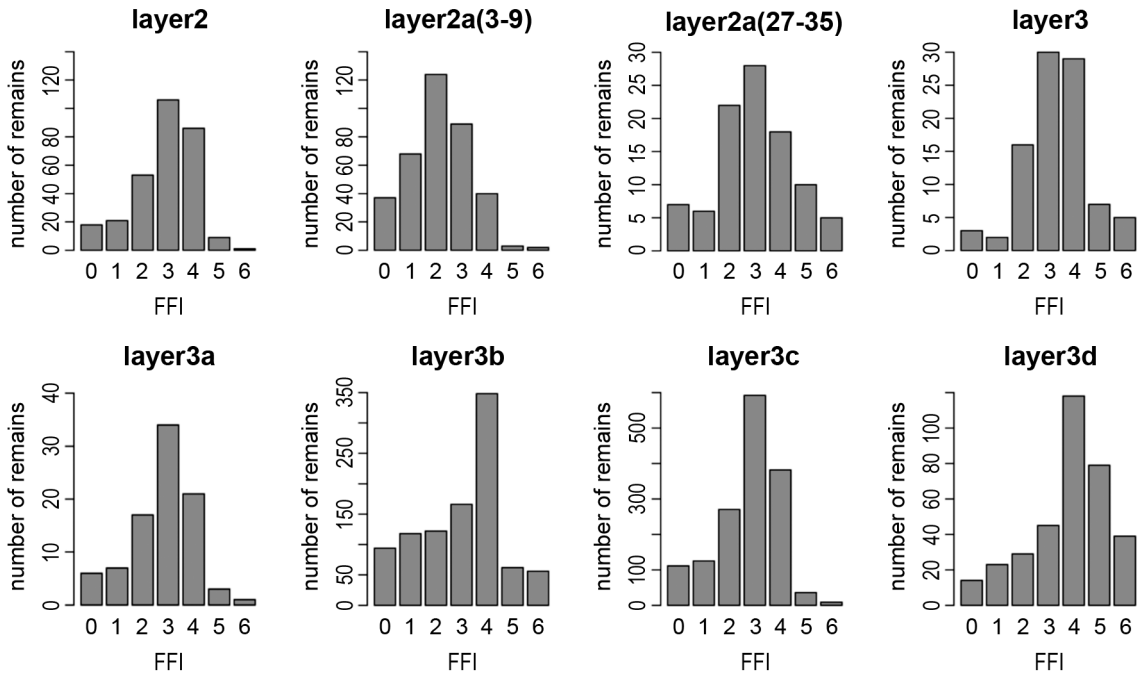
Fig. 7: Grotta dell'Edera. – *A*: Size of specimens. The total amount of specimens used in the analysis corresponds to NR in *Table 4*. – *B*: FFI scored on diaphyseal fragments.

Sl. 7: Stenašca. – *A*: velikost kostnih najdb. Skupno število primerkov, ki so bili upoštevani pri tej analizi, se ujema z vrednostjo NR v *tabeli 4*. – *B*: vrednosti indeksa FFI za odlomke diafiz.

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Preservation state of faunal remains

Fragmentation patterns observed in the different layers are quite similar and show a strong abundance of very small fragments (*Fig. 7a*). The 1 cm size class reaches a score between 45% (level 2a) and 66% (level 3d). Size classes over 3 cm cover a range between 24% (level 2a) and 4% (level 3d). None of the fragments smaller than 1 cm is considered here. The most fragmented samples are those from Layers 3d (the earliest one) and 2, whilst the least fragmented one is the sample from Layer 2a (squares 3, 4, 8 and 9).

The FFI (Fracture Freshness Index, Outram 2002) was counted using shaft fragments from all of the layers with the exception of levels 1, 1a, and 1b. The results are shown in *Fig. 7b*. The mean FFI score is often under three, thus corroborating the idea that the fragmentation pattern was partially created whilst the bones were fresh or near-fresh, but the high proportion of specimens showing scores between 3 and 6 indicates that some damage occurred after the bones were dried.

Bones from Layers 2 and 2a show fewer natural modifications. From Layers 3 to 3d, exfoliation, root marks, erosion cups, and cracks became more frequent on fragments.

Weathering processes (cracks and exfoliation on the surfaces) are visible on a number of remains from Layer 2 to 3c (*Tab. 2*). It is worth noting that there is a significant and positive correlation between the abundance of weathered specimens and the mean FFI values registered on diaphyses for each layer (P uncorr. = 0.001), thus corroborating

the hypothesis that perturbative processes affected bone samples, producing both bone breakage and surface modifications. It is intriguing to note that in the Mesolithic samples, weathering decreases in Layer 3c, when deposition of sediments appears to be faster. Within the more recent part of the sequence, bones from Layer 2a are better preserved than those from Layer 2, which appears to be characterized by slower sedimentation (*Fig. 4*).

Description of faunal remains

Red deer

Red deer is the most common wild species from the Mesolithic to the Eneolithic layers (*Tab. 1*). This situation seems to be common in the north Adriatic region (Turk et al. 1993, Tab. 6; Toškan, Dirjec 2004; Miracle 1997). Red deer remains are mostly represented by teeth, mandibles, and maxillary elements. Mortality profiles indicate the presence of a wide spectrum of age classes, including both young and adult individuals (*Tab. 3*). With regard to young individuals, it appears that most of them were killed from spring to late summer (*Fig. 8*).

Roe deer

At Grotta dell'Edera, as in other sites on the Karst (Cannarella, Cremonesi 1967; Cremonesi et al. 1984; Cremonesi 1984; Turk et al. 1992, Tab.

Layer	% of weathered remain	Sample size
2	30,1	216
2a (squares 4−9)	18,8	335
2a (squares 27−35)	60,9	92
3	68,8	128
3a	50,4	141
3b	59,4	498
3c	42,6	857
3d	84,7	131

Tab. 2: Grotta dell'Edera. Percentage of weathered remains according to layer. Only unburned specimens larger than 3 cm are considered.
Tab. 2: Stenašca. Delež kosti s sledmi izpostavljenosti vremenskim razmeram po plasteh. Upoštevani so bili zgolj nesežgani drobci velikosti nad 3 cm.

	Age classes	Layers					
		2	2a	3	3a	3b	3c
Cervus elaphus (Age classes in years)	0–1					3	4
	1–3					2	2
	3–5					1	2
	5–7					2	2
	>7					2	2
	Σ					10	12
Capreolus capreolus (Age classes in years)	foetus					0	1
	0–1					4	4
	1–2					1	2
	>2					0	1
	6					1	1
	Σ					6	9
Sus scrofa (Age classes in years)	foetus					1	1
	0–1					3	6
	1–2					3	3
	3–5					0	3
	>6					1	2
	Σ					8	15
Ovis/*Capra* Payne's (1973) age classes	foetal	5	5	0	1		
	A (0–2 months)	1	2	0	0		
	B (2–6 months)	2	2	1	1		
	C (6–12 months)	2	2	0	1		
	D (1–2 years)	0	2	0	0		
	E (2–3 years)	0	0	0	0		
	F (3–4 years)	1	2	0	0		
	G (4–6 years)	1	0	0	0		
	H (6–8 years)	0	1	0	0		
	I (8–10 years)	0	0	0	0		
	deciduous teeth dropped from jaws during life	3	7	2	3		
	Σ	15	23	3	6		

Tab. 3: Grotta dell'Edera. Age-at-death of individuals (MNI). Only more representative layers and taxa are considered. Absolute ages have to be considered approximate.
Tab. 3: Stenašca. Starost ob poginu/zakolu za posamezno žival (MNI). Upoštevane so zgolj bolje zastopane vrste in bogatejše plasti. Ocene absolutne starosti je treba obravnavati s previdnostjo.

2; Turk et al. 1993, Tab. 5; Toškan, Dirjec 2004), roe deer is less abundant than red deer. A different mortality profile (*Tab. 3*) is observed: young individuals are more represented than older ones. Regarding the seasonality pattern, this is the same as that of the red deer (*Fig. 8*).

Wild Boar/Domestic Pig

Specimens of the genus *Sus* are found in all of the layers. With regards to biometry, domestic individuals seem to be introduced from the Late Mesolithic Layer 3a, but the distinction between
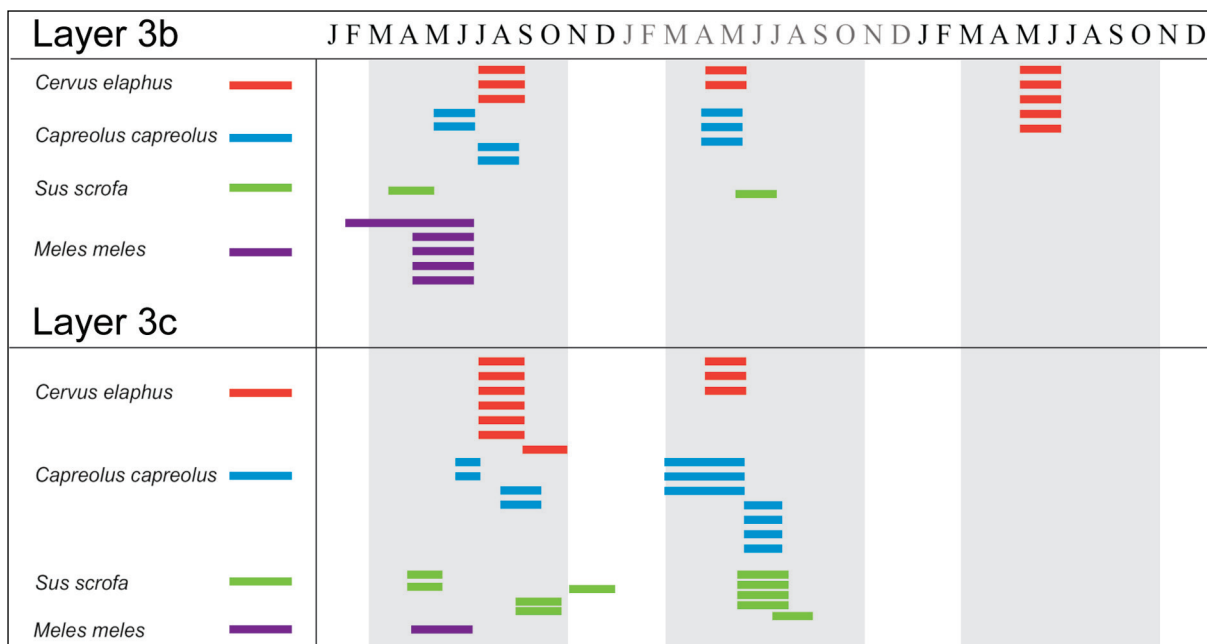
Fig. 8: Grotta dell'Edera. Season of death of selected species from Layers 3c and 3b. Each line represents a skeletal element. Letters on the top indicate months of the first three years of animals' life.
Sl. 8: Stenašca. Sezona pogina za izbrane vrste iz plasti 3c in 3b. Vsaka črta predstavlja posamezen skeletni element. Črke vzdolž zgornjega roba označujejo mesece v prvih treh letih življenja posamezne živali.
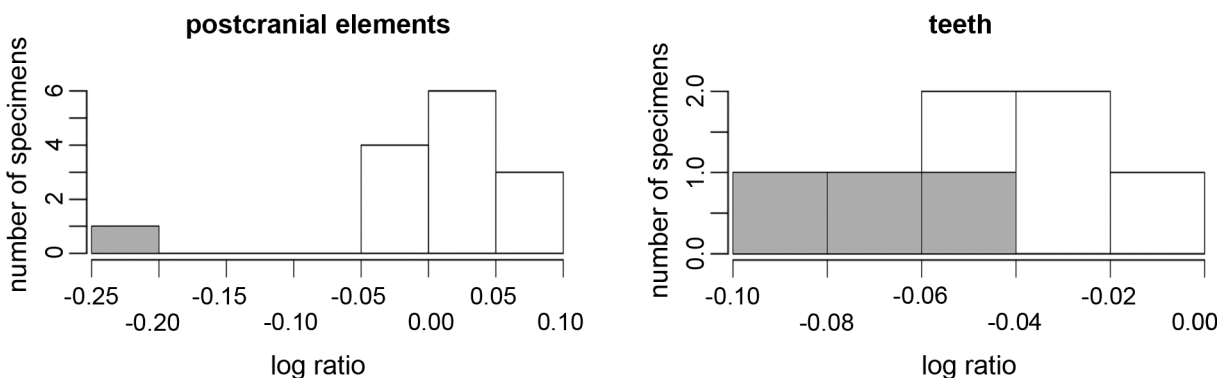
Fig. 9: Grotta dell'Edera. Body size of pigs: Neolithic-Eneolithic individuals (grey); Mesolithic individuals (white).
Sl. 9: Stenašca. Ocena velikosti prašičev: neolitsko-eneolitsko gradivo (siva); mezolitsko gradivo (bela).

two groups is sometimes impossible at the site. Even if the sample comprises very few data, individuals from the Neolithic layers are of smaller body size (*Fig. 9*). Using the standard for postcranial elements proposed by Payne and Bull (1988), the body size of Mesolithic individuals is similar to that of wild boars from Burgäschisee Süd (Switzerland, Neolithic, ca. 3000–2500 BC; Payne, Bull 1988) and also similar, but slightly smaller, to that of wild boars from Zalog pri Verdu (Slovenia; Toškan, Dirjec 2006). A putative domestic pig scapula from Layer 2 is much smaller, but its measurement (SLC), as suggested by Albarella, Payne (2005), is age-dependent and has to be considered with

care. Furthermore, the trend in tooth size is different between the Neolithic and Mesolithic layers (*Fig. 9*). Even if the sample is affected by a very reduced size, more unfused post-cranial elements were found in Neolithic layers than in Sauveterrian ones. In particular, considering Layers 2 and 2a together, more than 90% of limb bones (whole sample, n=14) belong to individuals younger than 31–35 months; in the Sauveterrian layers (whole sample, n=129), this percentage falls to 45%.

Sauveterrian wild boars show a different mortality profile than that of red and roe deer (*Tab. 3*). In particular, there are more young individuals (neonatal and foetuses included). Most of them

were killed from the spring to the autumn. Even though these data confirm those of the red and roe deer (*Fig. 8*), they are of more difficult interpretation, due to the fact that wild boar sows can have more than one litter a year. Indeed, due to trophic availability, two reproductive seasons can occur, respectively, around September and April-May (Massei, Toso 1993).

Domestic caprines

Sheep and goat are the most important domestic animals at Grotta dell'Edera. The first domesticates are those from the Late Mesolithic Layer 3a, where a direct radiocarbon date of a sheep bone fragment yielded a result of 6620±60 uncal BP (GrA-19820; Biagi 2003). Following Boessneck et al. (1964) and Payne (1985), sheep is more abundant than goat, as is often the case. Sex has been identified on
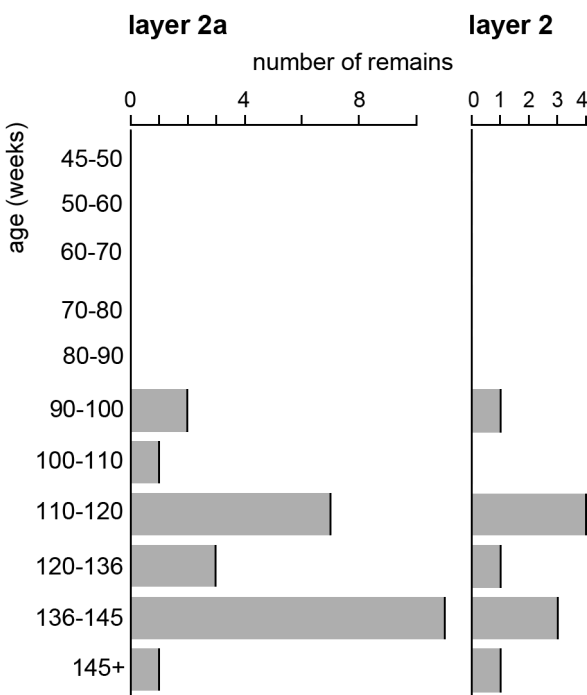

Fig. 10: Grotta dell'Edera. Age of caprine foetuses (in weeks) from Layers 2 and 2a. Bones corresponding to the age "145+" can also belong to new-borns. Age is estimated here following Habermehl (1975) and considering the bones as belonging to sheep. For a detailed discussion of foetal mortality at site see Boschin (2019).

Sl. 10: Stenašca. Starost ob poginu (v tednih) za zarodke drobnice iz plasti 2 in 2a. Kosti, ki so bile uvrščene v razred "145+", bi načeloma lahko pripadale komaj skotenim živalim. Starost ob poginu je bila ocenjena na podlagi smernic, ki jih je objavil Habermehl (1975), s predpostavko, da najdbe pripadajo ovcam. Za podrobnejšo obravnavo problematike smrtnosti zarodkov v Stenašci glej Boschin (2019).

a few fragmentary horn cores and pelvis bones: one sheep female horn core is from Layer 2; two sheep female horn cores (one hornless and one atrophied) and one cf. goat male horn core are from Layer 2a. Among innominate fragments, one sheep male, one sheep/goat male, two sheep/goat females and one cf. goat female were identified. Age-at-death is estimated using both teeth and long bones (foetuses) (*Tab. 3*). Age of most of the young animals is obtained from Pd4 and Pd3. All M3-in-eruption-age observations are obtained from the abrasion of the Pd4, estimated "n" (following Grant 1982). Since all of these teeth seem to have dropped from jaws of still-living animals, the M3-in-eruption-age was deleted from the mortality profile to avoid misinterpretations. Individuals corresponding to this age are reported as "deciduous teeth dropped from jaws during life" in *Tab. 3*. Indeed, even if the problem was highlighted in the previous report (Boschin, Riedel 2000), caprine individuals corresponding to that age were considered when mortality profiles from Grotta dell'Edera were compared with those from other sites (e.g. Mlekuž 2005). More than 35% of postcranial MNE (phalanxes excluded), both in Layers 2 and 2a, is related to foetal individuals (Boschin 2020). On the basis of bone length (Habermehl 1975), the bulk of samples appears to belong to late or very late gestation foetuses (estimated age between 110–120 and 136–145 days) (*Fig. 10*).

Cattle/Aurochs

Cattle remains of both wild and domestic form are rare at the site. Wild animals are represented in the Mesolithic only by two remains from Layer 3c.

Individuals from other prehistoric levels have a very large size, comparable with that of female aurochs (about 130 cm high or more; Boschin, Riedel 2000) and of domesticates from other Neolithic sites (such as Piancada in Friuli; Petrucci, Riedel, Pessina 2000).

Dog

The earliest dog remains are that from Layer 3b. It is a fused IV metatarsus that belongs to a small individual (withers height of about 48 cm, using the factor proposed by Clark 1995; measurements are: GL: 67.6; SD: 5.2; Bd: 8.5). Other Sauveterrian dogs similar in size were recovered in Slovenia

(Pohar 1984), whilst a Castelnovian remain was identified at Viktorjev spodmol in the Slovenian Karst (Toškan, Dirjec 2004). Other bones from Layer 2 of Grotta dell'Edera also belong to small individuals. A talus from Layer 1b (Bronze Age) is 25.6 mm long, belonging to an individual that is still showing a small size. Dogs similar in size are present elsewhere during the same period (for instance, see De Grossi Mazzorin, Tagliacozzo 1997).

Other taxa

An upper premolar, a proximal metacarpus and a distal femur from Layer 3c are attributed to ibex. Few specimens of this taxon were recognized in the Grotta Azzurra/Pečina na Leskovcu on the Trieste Karst (Cannarella, Cremonesi 1967). Due to the high fragmentation, the femur was previously attributed with a high level of uncertainty to a chamois (Boschin, Riedel 2011), but the comparison with other modern ibex bones seems to exclude this possibility. With regards to neighbouring regions, *Rupicapra* specimens were identified in Late Pleistocene/early Holocene sites in Slovenia at Betalov spodmol (Toškan, Dirjec, Bavdek 2014), Istria (Miracle 1997; Miracle, Galanidou, Forenbaher 2000) and in Riparo di Biarzo in the Natisone/Nadiža valley (Rowley-Conwy 1996).

Badger is present in most of the layers (*Tab. 1*). It is the most common carnivore, as observed in other cave sites of the area (Cannarella, Cremonesi 1967; Cremonesi 1984; Cremonesi et al. 1984; Bon 1996; Miracle 1997; Toškan, Dirjec 2004). Age profiles show the presence of adult and young individuals. One from Layer 3b is younger than 3–4 months, and one in Layer 3d is about 4 months old (following Habermehl 1985).

Marten is represented by few specimens from several layers. With regards to mandible, skull, and teeth, Mesolithic remains appear to belong to the pine marten *Martes martes* (following Hans, Steiner 1986). Specimens from Layers 3 and 2a were given only generic determination. Beech marten *Martes foina* is present in the Neolithic site of the Grotta degli Zingari/Ciganska jama (Bon 1996) and its occurrence at Grotta dell'Edera cannot be ruled out.

The otter is represented by some long bones, one *talus* and one mandible from Layers 3b and 3c. All of the long bones are completely ossified and belong to adult individuals.

Fox bones were identified in both the Neolithic and Mesolithic levels. All of the individuals are adult.

Wild cat remains were found both in Mesolithic and Neolithic layers, whilst a lynx mandible comes from level 3c. This animal is very rare in the territory and was recognized only in few cave sites (Cremonesi 1984; Toškan, Dirjec 2004; possibly also Turk et al. 1993, Tab. 5). Measurements (M/1, length = 15.4) fit in the variability of extant *Lynx lynx* (Hemmer 1993).

The brown bear is present in the three earliest levels with one specimen in each. This taxon is not frequent in the other sites of the area (Toškan, Dirjec 2004; Turk, Toškan, Dirjec 2004).

The wolf is represented by three specimens from Layer 3c. Hare is represented by few remains. In other sites, the species was identified as *Lepus europaeus* (Cannarella, Cremonesi 1967; Cremonesi 1984; Cremonesi et al. 1984; Bon 1996; Toškan, Dirjec 2004). Since diagnostic elements at Grotta dell'Edera are missing (skull fragments), distinguishing between the various taxa (i.e. *L. europaeus, L. timidus* and *L. corsicanus*) is not possible.

Marmot is present with a distal femur in Layer 3c. It would be the only identified Holocene specimen of this taxon from the Karst, even if putative Holocene marmot remains were found at Betalov spodmol (Postojna, SW Slovenia; Toškan, Dirjec, Bavdek 2014).

Beaver is represented by few bones from Layer 3c. This animal was also identified in the Grotta Azzurra/Pečina na Leskovcu (Cannarella, Cremonesi 1967), and an unpublished beaver femur, found by Karl Moser in the Vlaška jama, is part of the zooarchaeological collections of the Naturhistorisches Museum Wien. In addition, this taxon was also identified at Mala Triglavca (Turk, Toškan, Dirjec 2004).

Hedgehog is present only in Layers 2 and 3b. The taxonomic identification is uncertain between the species *europaeus* and *roumanicus*, whose geographical distributions show an overlap in the Karst territory today (Lapini et al. 1996).

Human modifications on bones

Burned bones

Burned fragments were retrieved in the whole sequence and are very abundant in Layers 2 and 3d. In this level, they are concentrated in squares 3, 8, 9, and 23. In Layers 3a and 3b, they are less numerous (they are concentrated in squares 3 and 8 in 3b), whilst in the other Layers (2a, 3, 3c) they never rich 20% (*Tab. 4*).

	% of burned specimens	% of calcined among burned	NR
2	36,5%	8,5%	8061
2a	17%	2%	4941
3	11%	0,3%	1655
3a	22,6%	0,5%	2179
3b	23%	3,5%	15107
3c	15%	3,1%	31212
3d	35%	0%	4106

Tab. 4: Grotta dell'Edera. Abundance of burned specimens per layer. (NR = total number of remains: burned and unburned; in each layer).
Tab. 4: Stenašca. Številčnost sežganih ostankov po plasteh. (NR = skupno število ostankov: sežganih in nesežganih; po plasteh).

Other human modifications

Butchering marks were analysed throughout the sequence. Samples from Layers 2 and 2a are quite poor in this kind of traces, and only some cuts on shaft portions and some butchering marks on few caprine and pig vertebrae were observed. In addition, rare impact scars were identified among diaphyseal fragments (one in Layer 2), and cone flakes due to bone breakage were detected both in Layer 2 (n = 11) and 2a (n = 4). Only two impact scars and two cone flakes were identified among remains from Layer 3a.

Butchering marks are more frequent in Layers 3b and 3c. Indeed, there are anthropic modifications related to all phases of carcass treatments on ungulate remains (skinning, disarticulation, filleting and bone breakage). There are 13 impact scars on diaphysis in Layer 3b and 44 in Layer 3c; 18 cone flakes are in Layer 3b and 44 in Layer 3c. Marrow extraction or grease-rendering activities are also indicated by phalanges that show a standardized fragmentation. In addition, a number of human modifications were detected on lagomorph, marmot, and carnivore remains. These latter are summarized in *Tab. 5*. Worked bones are very rare (Biagi, Starnini, Voytek 2008).

Evidence of commensalisms

Evidence of bone modifications by carnivores and small rodents was recognized in the cave. Most of the gnawing marks were observed in Layers 3b (on 38 specimens) and 3c (on 53 specimens) and appear to have been largely caused by small carnivores, such as dog, fox, or badger. They consist of small punctures, pitting furrows, or intensively chewed or scooped-out epiphysis. Some small specimens from Layer 2a (n = 6) and 3c (n = 6) appear to be affected by digestive processes.

A proximal roe deer humerus from Layer 3b shows both gnawing marks and burned surfaces, whilst two roe deer tarsals from Layer 3c, which belong to the same individual, show gnawing marks (on the talus) and cut marks (on the cubonavicular).

Body part profiles

Body parts are shown in *Tabs. 6–8*, but they were analysed in-depth only for Layers 2 and 2a (domestic caprines), and 3b and 3c (red deer, roe deer and wild boar) (*Tab. 9*); data from other layers were not taken into account due to the sample size. With regards to the main taxa, with the exception of Layer 3c, there is no significant correlation between body part representation (MAU%) and structural bone density. An insignificant correlation was detected in most of the samples also between body part representation (MAU%) and Standardized Food Utility Index (SFUI) (*Tab. 10*). It is worth noting that the relationship is always negative. Since percussion marks testified to the exploitation of phalanges for marrow extraction in Sauveterrian Layers 3b and 3c, a relation between the Unsaturated Marrow Index (UMI) and MAU% was tested. P-values are always not significant (for red deer, roe deer, and Neolithic caprines), ranging from 0.16 (caprines, Layer 2) and 0.93 (roe deer, Layer 3b).

Among the identified specimens, head elements are the best represented in all cases. This is probably due to the good identifiability of teeth. Among the Sauveterrian taxonomically unidentified specimens, the most abundant are shaft fragments, ribs, vertebrae, and teeth fragments (*Tab. 11*). Among caprines in Layers 2 and 2a, the lack of phalanges has to be underlined.

DISCUSSION

Sauveterrian

Hunter-gatherers from Layer 3d are among the first humans to frequent the Trieste Karst after the Late Glacial. Several data seem to suggest that the area was uninhabited (or rarely frequented

Taxon	Element	Anthropic modification	Layer	NISP	Supposed Action
Canis lupus	pubis	cut marks	3c	1	disarticulation/filleting
Canis lupus	scapula	cut marks	3c	1	disarticulation
Martes sp.	cuboid	calcined	3c	1	intentionally burned
Meles meles	femur	carbonized	3b	1	burned
Meles meles	humerus	carbonized	3b	1	burned
Meles meles	mandible	carbonized	3b	1	burned
Meles meles	metapodial	carbonized	3c	1	burned
Meles meles	metapodial	carbonized	3c	6	burned
Meles meles	metapodial	carbonized	3c	2	burned
Meles meles	phalanx	carbonized	3b	1	burned
Meles meles	phalanx	carbonized	3b	1	burned
Meles meles	phalanx	carbonized	3c	1	burned
Meles meles	phalanx	carbonized	3c	1	burned
Meles meles	phalanx	carbonized	3c	1	burned
Meles meles	phalanx	carbonized	3c	1	burned
Meles meles	radius	carbonized	3c	1	burned
Felis silvestris	radius	cut marks	3c	1	filleting
Lynx lynx	mandible	cut marks	3c	1	skinning
small carnivore	calcaneum	cut marks	3c	1	disarticulation
small carnivore	caudal vertebra	calcined	3c	1	intentionally burned
small carnivore	innominate	carbonized	3b	1	burned
small carnivore	metapodial	calcined	3c	1	intentionally burned
small carnivore	metapodial	carbonized	3c	1	burned
small carnivore	metapodial	carbonized	3c	1	burned
small carnivore	metapodial	cut marks+calcined	3c	1	burned + disarticulation
small carnivore	metapodial	fresh bone fracture	3c	1	disarticulation
small carnivore	metapodial	fresh bone fracture	3c	1	disarticulation
small carnivore	phalanx	calcined	3c	1	intentionally burned
small carnivore	phalanx	calcined	3c	1	intentionally burned
small carnivore	phalanx	carbonized	3c	1	burned
small carnivore	proximal ulna	cut marks+carbonized	3c	1	burned + disarticulation
small carnivore	radius	fresh bone fracture	3c	1	disarticulation
small carnivore	ulna	carbonized	3c	1	burned
Lepus sp.	calcaneum	carbonized	3c	1	burned
Lepus sp.	cervical vertebra	carbonized	3b	1	burned
Lepus sp.	metapodial	calcined	3c	1	intentionally burned
Lepus sp.	metapodial	calcined	3b	1	intentionally burned
Lepus sp.	phalanx	calcined	3c	1	intentionally burned
Lepus sp.	phalanx	calcined	3c	1	intentionally burned
Lepus sp.	phalanx	calcined	3c	1	intentionally burned
Lepus sp.	ulna	carbonized	3b	1	burned
Marmota marmota	femur	carbonized	3c	1	burned

Tab. 5: Grotta dell'Edera. Anthropic modifications on lagomorph, rodent and carnivore remains.
Tab. 5: Stenašca. Popis zajčjih, glodavskih in zverskih kosti s sledmi človekovih dejavnosti.

Layer	Bt 2	2a	3	C/O 2	2a	3	3a	CH 2	2a	3	Oa 2	2a	3	3a	Sd 2	2a	3a
Antler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Horn core	-	-	-	-	-	-	2	1	1	-	1	1	-	-	-	-	-
Skull	1	3	-	32	52	3	1	-	-	-	1	1	-	-	4	-	-
Maxilla	1	1	-	3	7	-	2	-	-	-	-	-	-	-	-	-	-
Mandible	-	1	-	5	26	-	1	-	-	-	-	-	-	-	1	-	-
Isolated teeth	10	1	-	139	217	20	15	-	-	-	-	2	-	-	18	-	1
Hyoid	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-
Vertebrae	1	-	-	26	32	1	10	-	-	-	-	1	1	-	4	-	-
Ribs	-	1	-	71	332	2	5	-	-	-	-	-	-	-	2	-	-
Sternum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scapula	3	-	-	6	9	-	1	-	1	-	-	-	-	2	2	-	-
Humerus	-	-	-	8	17	-	-	-	-	-	-	-	-	-	-	-	-
Radius	-	-	-	4	16	1	2	1	-	-	-	-	-	-	-	-	-
Radius-ulna	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Ulna	-	-	-	5	11	-	-	-	-	-	-	1	-	-	-	-	-
Carpals	-	-	-	14	3	-	4	1	-	-	-	-	1	-	-	-	-
Metacarpal	-	-	1	11	19	-	3	-	-	-	1	4	-	-	-	-	-
Plesiometacarpal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Innominate	-	1	-	3	6	-	-	-	1	-	-	2	-	-	-	-	-
Femur	1	-	-	4	13	-	2	-	-	-	-	1	-	-	1	1	-
Patella	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-
Tibia	-	-	-	6	21	-	-	-	-	-	-	-	-	-	-	-	-
Fibula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	-
Malleolar	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-
Tarsals	-	1	-	7	7	1	-	-	1	1	-	1	-	-	-	-	-
Metatarsal	1	1	-	18	33	-	-	1	1	-	4	2	-	-	2	-	-
Metapodial	2	-	-	14	18	-	2	-	-	-	3	4	-	-	2	1	-
Phalanxes	2	-	-	6	7	-	-	-	2	-	3	2	-	2	5	-	-
Sesamoidal bones	-	-	1	-	1	-	-	-	-	-	-	-	-	-	2	-	-
Σ	22	10	2	386	852	28	50	4	7	1	14	22	2	4	44	4	1

Tab. 6: Grotta dell'Edera. Body parts (NISP) of domestic ungulates.
Tab. 6: Stenašca. Zastopanost anatomskih regij (NISP) pri domačih kopitarjih.
Bt: *Bos Taurus*; **C/O**: *Capra/Ovis*; **Ch**: *Capra hircus*; **Oa**: *Ovis aries*; **Sd**: *Sus domesticus*

by humans) during the Upper Palaeolithic due to environmental constraints (harsh conditions, aridity, rocky landscape poorly covered by vegetation; Boschian, Fusco 2007). At the beginning of the Holocene, with the onset of more humid conditions, followed by the spread of wooded environments, the Karst became more suitable for humans. At the same time, human groups were also pushed northwards by the marine transgression, which led to the reduction of the Adriatic Plain. A different situation, more vegetated and suitable for hunter-gatherers, characterized the nearby regions, such as Istria, where both Upper Palaeolithic and Mesolithic sites have been found (Boschian, Fusco 2007; Jamnik et al. 2015; Pilaar-Birch, Miracle 2017). Human presence in Layer 3d occurred just after the abrupt warming oscillation at the end of the Greenland Stadial 1 (Rasmussen et al. 2007). It appears as an isolated episode of frequentation, followed by a long period of absence, until the 9.3kyrs event, a period of widespread climatic deterioration (Fleitmann et al. 2008), when hu-

Layer	Cc						Ce							Ss						Ci	Bp
	2	3	3a	3b	3c	3d	2	2a	3	3a	3b	3c	3d	2	3	3a	3b	3c	3d	3c	3c
Antler	-	1	-	1	-	-	-	-	-	-	3	20	1	-	-	-	-	-	-	-	-
Horn core	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Skull	-	-	1	10	22	2	-	-	1	5	4	16	1	-	-	-	2	14	1	-	-
Maxilla	-	-	-	2	2	1	-	-	-	-	1	4	1	-	-	-	1	2	-	-	-
Mandible	-	1	-	1	10	-	3	-	2	-	7	11	2	-	1	-	5	3	-	-	-
Isolated teeth	1	2	1	28	43	3	1	1	3	15	92	103	33	1	2	-	19	50	5	1	-
Hyoid	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Vertebrae	-	3	-	32	42	-	1	-	4	2	23	31	1	-	-	-	6	38	1	-	-
Ribs	-	1	-	18	32	-	-	-	1	4	34	23	2	-	-	-	4	6	-	-	-
Sternum	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Scapula	-	-	-	3	4	-	-	-	1	1	5	-	1	-	-	-	3	5	-	-	-
Humerus	-	-	-	3	12	2	-	-	1	-	5	5	1	-	-	-	3	11	1	-	-
Radius	-	-	-	2	10	-	-	-	-	1	1	6	1	-	-	-	3	18	-	-	-
Radius-ulna	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Ulna	-	1	-	6	6	1	1	1	-	3	6	6	-	-	-	-	8	16	1	-	-
Carpals	-	-	-	6	10	-	-	-	-	1	6	11	3	-	-	-	3	10	-	-	-
Metacarpal	-	-	-	9	34	1	-	-	1	3	25	30	1	-	1	-	8	20	-	1	-
Innominate	-	1	-	4	3	-	-	-	-	-	6	9	-	-	-	-	2	6	1	-	-
Femur	-	1	-	9	5	-	-	-	1	-	2	9	-	-	-	-	2	2	1	1	-
Patella	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	2	-	-	-
Tibia	-	1	1	7	10	1	-	-	-	-	3	5	1	-	-	-	1	12	-	-	-
Fibula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	9	-	-	-
Malleolar	-	-	-	-	1	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
Tarsals	-	-	-	15	28	-	-	-	1	3	8	17	4	-	-	-	4	6	-	-	2
Metatarsal	1	1	-	12	31	1	1	-	1		27	38	3	-	-	-	4	21	4	-	-
Metapodial	-	-	-	7	16	-	1	-	2	1	5	15	4	-	1	2	20	38	-	-	-
Phalanxes	-	1	1	49	134	9	1	1	4	9	82	142	12	1	3	-	68	116	6	-	-
Sesamoidal bones	-	-	-	9	33	1	-	-	-	1	8	22	4	-	-	-	5	23	2	-	-
Σ	2	14	4	233	488	22	9	3	24	49	355	527	76	2	9	2	175	428	23	3	2

Tab. 7: Grotta dell'Edera. Body parts (NISP) of wild ungulates.
Tab. 7: Stenašca. Zastopanost anatomskih regij (NISP) pri divjih kopitarjih.
Cc: *Capreolus capreolus*; **Ce**: *Cervus elaphus*; **Ss**: *Sus scrofa*; **Ci**: *Capra ibex*; **Bp**: *Bos primigeniusv*

man frequentation is testified to by evidence from Layer 3c. The presence of hunter-gatherer groups in the Edera Cave became more stable, as testified by ^{14}C dates of the overlying Layer 3b (*Fig. 4*). Evidence of the latter layer is the last occurrence of Sauveterrian techno-complex at Grotta dell'Edera; indeed, it seems that a lack of frequentation which lasted for about one thousand years, may also be partially related to the 8.2kyrs event, another period of climatic deterioration (Rasmussen et al. 2007). This climatic event can be detected more

clearly (was it also more intense?) than the one at 9.3kyrs in the isotopic record registered in a stalagmite from the Grotta Savi on the Trieste Karst (Borsato et al. 2003).

Sauveterrian faunal composition of Grotta dell'Edera is not different from those from other cave sites in the Karst territory and Istria (Cannarella, Cremonesi 1967; Cremonesi 1984; Cremonesi et al. 1984; Bon 1996; Miracle 1997; Miracle, Galanidou, Forenbaher 2000; Toškan, Dirjec 2004). Identified thanatocoenoses appear to be

	Cf				Cl	Vv						Mm						M sp.		
	Layer																			
	2	2a	3b	3c	3c	2	3	3a	3b	3c	3d	2	3	3a	3b	3c	3d	3b	3c	3d
Skull	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	3	-	-	-	-
Maxilla	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	1	-	-
Mandible	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	1	-
Isolated teeth	-	1	-	-	-	-	-	-	-	3	1	1	-	-	16	8	1	5	-	-
Vertebrae	-	-	-	-	-	-	-	-	1	1	-	-	-	-	1	2	-	-	-	-
Ribs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	2	-	-	-	-
Sternum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
os penis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Scapula	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Humerus	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	1	-	-
Radius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	1	1	-
Radius-ulna	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ulna	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	1	-
Carpals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	2	-	-	-	-
Metacarpal	-	-	-	-	-	-	-	-	1	-	-	-	1	1	6	8	-	2	-	1
Innominate	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Femur	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1	-	-	-	-
Patella	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tibia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Tarsals	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	1	-	-	-	-
Metatarsal	1	-	1	-	-	2	-	-	-	1	-	-	-	-	4	7	-	-	-	-
Metapodial	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	12	-	-	-	-
Phalanxes	1	-	-	1	-	-	-	1	1	2	2	-	3	1	8	10	2	1	-	-
Σ	2	1	1	3	1	2	1	1	4	10	3	1	5	2	59	59	3	12	4	2

Tab. 8: Grotta dell'Edera. Body parts (NISP) of carnivores, lagomorphs, rodents and insectivores.
Cf: *Canis familiaris*; **Cl**: *Canis lupus*; **Vv**: *Vulpes vulpes*; **Mm**: *Meles meles*; **M sp.**: *Martes* sp; **Lut**: *Lutra lutra*; **Ua**: *Ursus arctos*; **Fs**: *Felis silvestris*; **Ll**: *Lynx lynx*; **L. sp.**: *Lepus* sp; **Cas**: *Castor fiber*; **Mar**: *Marmota marmota*; **E. sp.**: *Erinaceus* sp.

composed by taxa that may have been hunted in the wooded environments surrounding the cave. Exceptions consist of taxa that could have been hunted in other areas more or less far from Grotta dell'Edera: in this regard, otter and beaver probably lived in freshwater habitats around the Karst, such as along the rivers Timavo (Reka), Isonzo (Soča), Vipacco (Vipava), Ospo (Osp) or Rižana. As for the otter, the small *polje* of Doberdò (Doberdob) and that of Pietrarossa (Prelosno jezero), located on the western side of Karst plateau, may have also represented suitable environments.

Elk was not identified at Grotta dell'Edera, but its remains, even if rare, were yielded by early Holocene deposits of the area: Viktorjev spodmol (Toškan, Dirjec 2004), Vlaška jama (unpublished material collected by Karl Moser; Naturhistorisches Museum Wien, Archäologisch-Zoologische Sammlung) and Grotta Benussi (Riedel 1976).

A suitable environment for some of the above-mentioned taxa was probably also represented by the Gulf of Trieste: indeed, sedimentological and geological evidence (Marocco 1991; Boschian 1993) indicates a considerably reduced sea covered area (especially in the north-western side) during the early Holocene. A relatively small plain crossed by small freshwater streams (there are many underwater springs along the present-day coastline) must have been a very resourceful environment for Mesolithic groups. Pond-turtle remains found at Grotta dell'Edera (Delfino, Bressi 2000) also suggest the exploitation of this area.

Marmot and ibex definitely inhabited the Karst plateau during the various arid phases of

Lut		Ua			Fs		L1	L sp.						Cas	Mar	E sp.		
Layer																		
3b	3c	3b	3c	3d	3b	3c	3c	2	2a	3	3b	3c	3d	3c	3c	2	3b	
-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	Skull
-	-	-	-	-	-	-	-	-	1	-	-	2	-	-	-	-	-	Maxilla
1	-	-	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-	Mandible
-	-	1	-	1	1	-	-	-	-	1	-	11	3	1	-	-	-	Isolated teeth
-	2	-	-	-	-	-	-	-	-	-	1	1	-	1	-	-	-	Vertebrae
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Ribs
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Sternum
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	os penis
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Scapula
1	1	-	-	-	-	-	-	-	-	1	1	1	-	-	-	-	-	Humerus
-	-	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	Radius
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Radius-ulna
-	2	-	-	-	-	-	-	1	-	-	2	-	-	-	-	-	-	Ulna
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Carpals
-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	Metacarpal
-	-	-	-	-	1	1	-	-	-	-	1	-	-	1	-	1	1	Innominate
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	Femur
-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	Patella
-	-	-	-	-	-	-	-	-	-	-	2	1	1	-	-	-	-	Tibia
1	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	Tarsals
-	-	-	-	-	2	1	-	1	-	-	-	5	-	-	-	-	-	Metatarsal
-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	Metapodial
-	-	-	-	-	1	2	-	-	-	-	1	6	2	2	-	-	-	Phalanxes
4	5	1	1	1	9	7	1	2	1	2	12	28	6	5	1	1	1	Σ

Tab. 8: Stenašca. Zastopanost anatomskih regij (NISP) pri zvereh, zajcih in glodavcih.
Cf: *Canis familiaris*; **Cl**: *Canis lupus*; **Vv**: *Vulpes vulpes*; **Mm**: *Meles meles*; **M sp.**: *Martes* sp; **Lut**: *Lutra lutra*; **Ua**: *Ursus arctos*; **Fs**: *Felis silvestris*; **Ll**: *Lynx lynx*; **L. sp.**: *Lepus* sp; **Cas**: *Castor fiber*; **Mar**: *Marmota marmota*; **E. sp.**: *Erinaceus* sp.

the Upper Pleistocene: ibex was recovered in a number of cave sites ascribable to this period (Caverna degli Orsi; Boschian 2001; Caverna Piccola Pocala, unpublished material identified by the author, collections of the Natural History Museum of Trieste) and in some quarries along rocky slopes behind the city of Trieste (unpublished material identified by the author, collections of the Natural History Museum of Trieste). Furthermore, marmot was identified in some Upper Pleistocene sites (for instance Bartolomei 2004), but the specimen from Grotta dell'Edera is the only one from a Holocene deposit on the Trieste Karst. Noteworthily, the presence of both ibex and marmot at Grotta dell'Edera corresponds to the cooler oscillation at 9.3kyrs (Rasmussen et al. 2007).

Faunal composition from the Sauveterrian layers indicates the presence of wooded vegetation (red deer, roe deer, wild boar) and open environments (ibex, marmot, hare), whose presence decreased moving from the Boreal to the Atlantic period. This reconstruction is in agreement with archaeo-botanical data (Galizia Vuerich, Princivalle 1994; Nisbet 2000) that indicate the presence of a boreal forest of *Pinus* and *Betula*, probably mixed with grasslands, during the early Holocene. Moreover, sedimentological evidence indicates a scarcely af-forested territory with easily erodible soils during this phase (Boschian 1997). Therefore, especially during Preboreal and early Boreal, residual open landscapes may have favoured ibex and marmot. The presence of taxa related to arid open environ-ments was also detected among small mammals in

MNE	*Capra/Ovis*		*Capreolus capreolus*		*Cervus elaphus*		*Sus scrofa*	
Layer	**2**	**2a**	**3b**	**3c**	**3b**	**3c**	**3b**	**3c**
Maxilla	5	12	5	9	7	8	13	33
Mandible	10	7	6	7	10	11	12	22
Hyoid	2	2	0	0	1	0	0	0
Atlas	0	1	2	0	0	0	0	0
Axis	2	0	0	1	0	0	0	0
Cerv. Vert.	4	4	2	4	5	3	1	19
Thor.Vert.	2	10	6	4	3	5	1	10
Lumb. Vert.	4	5	7	7	3	5	4	4
Sacrum	0	0	0	1	2	2	0	3
Caud. Vert.	3	0	0	2	1	1	0	0
Ribs	0	20	0	0	0	0	4	6
Sternum	0	0	0	0	0	0	0	0
Scapula	4	6	2	2	2	0	3	5
Humerus p.	5	6	0	3	2	1	0	1
Humerus d.	6	9	2	5	2	2	3	4
Radius p.	3	6	2	2	1	4	1	7
Radius d.	4	7	0	4	0	1	0	5
Ulna p.	4	12	5	4	5	5	6	11
Ulna d.	0	0	0	1	1	0	2	3
Carpals	15	2	5	10	6	11	3	10
Pelvis	2	5	3	1	4	3	2	6
Femur p.	1	3	1	2	2	0	1	1
Femur d.	2	3	2	3	0	4	1	0
Patella	1	1	0	0	0	0	1	2
Tibia p.	2	7	3	5	1	2	0	3
Tibia d.	3	6	2	3	1	2	1	6
Fibula/Malleollar	0	0	1	1	0	3	3	5
Tarsals	8	5	15	26	7	17	4	6
Metapodial p.	11	13	1	11	8	12	10	17
Metapodial d.	13	15	9	10	10	12	6	18
Metapodial lat.	0	0	0	9	0	0	6	18
Phalanx 1	5	5	17	38	16	23	15	27
Phalanx 2	3	1	10	22	12	23	14	22
Phalanx 3	0	1	10	15	7	11	16	18
Phalanx lat. 1	0	0	0	8	2	8	6	12
Phalanx lat. 2	0	0	0	5	4	21	7	15
Phalanx lat. 3	0	0	1	0	0	0	10	22
Sesamoides	0	1	9	33	8	22	5	23
Σ	124	175	128	258	133	222	161	364

Tab. 9: Grotta dell'Edera. Minimum number of elements of main taxa.
Tab. 9: Stenašca. Vrednost indeksa najmanjše število ostankov (MNE) za posamezne skeletne elemente najpomembnejših taksonov.
Vert.: Vertebra. – **Cerv.**: cervical. – **thor.**: thoracic. – **Lumb.**: lumbar. – **Caud.**: caudal. – **p.**: proximal. – **d.**: distal. – **lat.**: lateral.

	Layer	MAU% vs Bone density	MAU% vs SFUI
Ovis/Capra	2	0,09	0,72
Ovis/Capra	2a	0,57	0,8
Cervus elaphus	3b	0,14	0,14
Cervus elaphus	3c	0,0003	0,05
Capreolus capreolus	3b	0,06	0,38
Capreolus capreolus	3c	0,01	0,02
Sus scrofa	3b	-	0,06
Sus scrofa	3c	-	0,12

Tab. 10: Grotta dell'Edera. p-values of non-parametric Spearman's correlation between MAU% and Bone density and MAU% and SFUI according to main taxa and layers.
Tab. 10: Stenašca. p-vrednosti za neparametrični Spearmanov test soodvisnosti med MAU % in strukturno gostoto kostnine ter med MAU % in SFUI za najpomembnejše taksone in plasti.

the Boreal sample from Mala Triglavca (Toškan, Kryštufek 2006; Toškan 2009) and Grotta degli Zingari (Bartolomei 2001). A broadleaf forest covered the territory during the Atlantic period (Nisbet 2000), leading to the extinction of open-environments-related taxa.

Slicing cut marks, percussion marks, cones, and burned specimens point to Mesolithic people as the main accumulators of Sauveterrian faunal assemblages. In addition, among the few gnawed bones, some of them were previously modified by humans. Taphonomy also ruled out an intrusive origin of rodents, lagomorphs and carnivores, indicating the exploitation of a wide variety of taxa, as observed in other Mesolithic sites of northern Italy (Crezzini et al. 2014).

A reduction of skeletal portions by means of percussion is attested on limb bones. Lower frequency of axial elements can be due to their lower identifiability, and this is testified by the high quantity of ribs and vertebrae among unidentified fragments. Thus, ungulate carcasses were likely brought complete to the site. Available data do not support the idea that selected parts were brought to site depending on their utility as food resources or, more specifically, as sources of fat. Regardless, once carcasses were processed on-site, every part was exploited, including the small quantity of marrow within a single phalanx.

Differences in age-class distribution observed among main wild ungulate taxa (red deer, roe deer and wild boar) are probably due to the different composition of herds and to their behaviour. Data on tooth eruption confirm that hunting activities were mainly carried out in a period between spring and autumn (*Fig. 8*).

Among mammal taxa, hunting activities are mainly focused on three species, no one of which is clearly dominant considering NISP. In addition, the spectrum of exploited animal resources is completed by other mammals, pond turtle (Delfino, Bressi 2000) and possibly birds (the analysis is still in progress), whilst consumption of land snails is difficult to evaluate (Girod 2003; Bonizzoni et al. 2009). As seen in other sites, the diet was also integrated with water molluscs and fish. In particular, a shift from the exploitation of fresh-water resources, to marine ones was observed through the Mesolithic (Cannarella, Cremonesi 1967) and can be linked to marine transgression. The fact that hunting activities are not focused on a single taxon, together with the evidence of transport to the site of complete carcasses and of their intensive exploitation, as well as the killing season mainly covering spring to early autumn months, make the Sauveterrian bone assemblage from Grotta dell'Edera very similar to those from Croatian sites (Pilaar-birch, Miracle 2017). At this stage of research, more data, especially those coming from the study of lithic implements (raw materials, lithic technology, use-wear) are needed to thoroughly understand the role played by Grotta dell'Edera in

Skeletal elements	Layer		
	3b	3c	3d
Head elements	48	27	1
Isolated teeth	65	116	12
Vertebrae	53	45	1
Ribs	94	165	4
Sternum	-	1	-
Innominate	6	7	-
Diaphysis	161	233	67
Basipodial	7	11	-
Metapodial	11	22	1
Phalanges	4	26	7
Sesamoidal bones	1	14	1

Tab. 11: Grotta dell'Edera. Sauveterrian layers: elements identified only at general anatomic level.
Tab. 11: Stenašca. Sovterjenske plasti, skeletni elementi so opredeljeni zgolj na ravni splošne anatomske pripadnosti.

the subsistence strategies of Sauveterrian groups (hunting camp, shelter for the whole group, etc.).

Castelnovian

In Layer 3a, faunal composition radically changes from that of the underlying phase, due to the appearance of domestic ungulates (mainly caprines). In light of revisions, no cattle are found in this late Castelnovian level (it has been dated to 6390±60 BP, GrA-19820; Biagi 2003) and only one specimen can be ascribed quite confidently to a domestic pig. Domesticates account for 44% of NISP. These values are totally different from the slightly older Castelnovian spit of Viktorjev spodmol near Škocjan (Slovenian Karst), where domesticates, with the exception of a dog, are absent (Toškan, Dirjec 2004, Sipts 10–19 in Table 16.7; NISP = 131). Radiometric date of Layer 3a of Grotta dell'Edera is similar to the one of the middle Neolithic level I at Pupićina peć in Istria (Forenbaher, Kaiser, Miracle 2004). In that case, the faunal composition is very different, showing a higher proportion of domesticates (considering cattle, pig and caprines, it ranges between 94.5% and 96.5%, depending on the quantity of domestic pig remains among the category "*Sus*"). Dates of Layer 3a are also similar to those of overlaying Layer 2a, where caprines are the dominant species. The high number of fragments affected by weathering indicates a possible slow burial of remains and point to the formation of a short-term palimpsest, whose components (Neolithic and Castelnovian) would be difficult to tell apart. Archaeological and chronological data from the region seem to indicate possible interrelationships between the last hunter-gatherers and the first farmers (Biagi 2003), and re-analysis of faunal data from Layer 3a cannot confirm or reject the hypothesis that the Castelnovian hearth would attest a contact between the two groups. Regardless of whether the presence of domesticates in the Castelnovian phase due to a palimpsest or to the effective contact between Mesolithic hunter-gatherers and Neolithic groups, the direct date of an *Ovis* bone (7566–7470 cal BP, GrA-19912; Biagi 2003) points to a quite old presence of domesticates in the area of the Trieste bay. Indeed, it is contemporaneous with the oldest Neolithic dates obtained at Pupićina Cave (7463–7326 cal BP, OxA-8471; 7621–7465 cal BP, Beta-131625; Miracle, Forenbaher 2006), thus indicating that the spread of Neolithic (Da-

nilo) influences to the Karst plateau did not take place after the arrival of this culture in Istria but simultaneously.

Neolithic-Eneolithic

Layer 2a (Vlaška group) is characterized by an overwhelming presence of domesticates (*Tab. 1*), among which caprines are dominant. The same situation was recognized in Layer 6 at Grotta del Mitreo/Mitrejeva jama (Petrucci 1997), and in Levels G, H, and I at Pupićina peć (Miracle 2006); wild game is more represented in Layer 5 of Grotta degli Zingari/Ciganska jama (Bon 1996) and in Layer 8 of Grotta dei Ciclami/Orehova pejca (Riedel 1969) but some doubts have been cast on the stratigraphic reliability of this site (Radmilli 1981). At Grotta dell'Edera, sheep is more abundant than goat (*Tab. 1*) like at Pupićina peć and Grotta del Mitreo/Mitrejeva jama. The high proportion of goat horn cores at Grotta dei Ciclami/Orehova pejca (Riedel 1969) can be due to the very selective recovering of bones at the site.

The percentage of wild animals NISP varies between 0 and 43% (Me = 13.5%) throughout the Neolithic-Eneolithic sequence unearthed at Podmol pri Kastelcu in the Slovenian Karst (Turk et al. 1993, Tab. 6). At this site, caprines are the most abundant mammals among domesticates, while the most important wild game is red deer. During phase 1 (Neolithic-Eneolithic) at the nearby Acijev spodmol (Slovenian Karst, Turk et al. 1992, Tab. 2), domesticates represented between 68% up to 82% of the total NISP. Again, caprines account for the great majority of this finds.

In any case, when faunal composition is discussed, some important factors have to be considered: the small size of some samples, the uncertain stratigraphic interpretations of some excavations (e.g., Grotta dei Ciclami/Orehova pejca), and the possible incomplete recovering of faunal remains in others (at Grotta degli Zingari/Ciganska jama there are 239 identified remains out of 261, whilst at Grotta del Mitreo/Mitrejeva jama 224 out of 237). In some caves, the high proportion of badger remains could suggest a possible disturbance caused by the digging activity of this animal. At Grotta degli Zingari/Ciganska jama, for instance, this species is the most abundant (NISP = 66), and the presence of a badgers' sett was hypothesized (Bon 1996).

Regarding anthropogenic stratigraphic disturbances, the possibly reworked area detected in Layer 2a of Grotta dell'Edera is paradigmatic: the apparent contribute of hunting to Neolithic subsistence economy, testified by the presence of wild game remains (published in Boschin, Riedel 2000), can be mainly due to the reworking of cave sediments by Neolithic shepherds. The latter burned coprogenic materials, mainly composed of caprine dung, organizing it in small heaps (Boschian 1997). An *ab antiquo* reworking due to Neolithic people is testified to at Grotta Azzurra/Pečina na Leskovcu also by the occurrence of Mesolithic artefacts together with the dung of domesticated animals (Boschian, Montagnari-Kokelj 2000). Reworking of the deposit was also detected at Mala Triglavca in the Slovenian Karst (Mlekuž et al. 2008). At Grotta dell'Edera, ^{14}C dates testify for other reworkings of cave soil by shepherds (Spataro 1999) in the later Neolithic/Eneolithic Layer 2.

The overwhelming presence of caprines in Layer 2a was probably favoured by the rocky environment and by the vegetation of the Karst: *Selserio-Quercetum petraeae* is considered as the climax vegetation of the area (Poldini 1980), and its undergrowth is mainly made of Poaceae. Even if secondary successions could have characterized vegetation dynamics of the area in Neolithic times (Turk et al. 1993; Kaligarič, Culiberg, Kramberger 2006), anthropogenic modification of vegetation was not necessary for Neolithic shepherds, who probably took advantage of these particular woods that offer optimal food for grazers.

In Layer 2, caprines are still the most abundant domesticates at Grotta dell'Edera, but cattle and pig remains also increase, especially in the uppermost spits of the layer. A decrease in caprines can also be observed in the small samples from the younger Layers 1b and 1a. The same trend is observed at Pupićina peć from Layers I and H (Vlaška group) to Layer G (Eneolithic). At Grotta del Mitreo/Mitrejeva jama, in the small sample from Layer 6, there are no pig and cattle specimens (Vlaška group, NISP = 34), while these taxa became more abundant in the overlaying Layers 5 to 3 (Late Neolithic-Eneolithic) (Petrucci 1997). Layer 2 of Grotta dell'Edera is also characterized by a slight increase in wild game (from 0.4% of NISP in Layer 2a to 3.7% in Layer 2). This could indicate a change towards more diversified subsistence strategies.

Given that Payne's age classes A, B and C (0–2 months, 2–6 months and 6–12 months respectively) are all represented at the site, slaughtering (or natural death) of caprines is compatible both with a continuous presence at the site across all seasons (if one litter a year is hypothesized) or with a seasonal frequentation, if two litters are considered.

The high percentage of possible caprine foetal individuals (5 out of 23, 21.7% of MNI in Layer 2a; 5 out of 15, 33.3% of MNI in Layer 2) could be indicative of a high mortality, thus testifying to livestock whose survival was still strongly dependent on natural constrains (pathogenic agents, stress events during gestation). A more conservative interpretation is that this abundance could be related to the nature of the site (i.e., a sheepfold) and its use. Indeed, a site frequentation during ewes' pregnancy and birth season can favour a selective accumulation of bones belonging to foetal individuals due to abortion (Boschin 2020). One foetal individual was also detected both in Layers 2 and 2a among cattle remains. Even though age estimation of foetuses is based on modern reference data and some of these individuals could be new-borns, caprine foetuses appear to cover a variety of prenatal ages, not only placed at the end of gestation; they can also testify the death of pregnant individuals (*Fig. 10*). This fact also points to a significant problem in evaluating the presence of young individuals belonging to Payne's A and B age classes (0–2 months and 2–6 months respectively) (Payne 1973). Were they killed by humans following peculiar production strategies, or did they die due to adverse conditions? Indeed, it was observed that the causes of miscarriage (e.g., infections, nutritional stress) can also lead to the natural death of lambs (Boschin 2020 and references therein).

Both in Layer 2a and 2, only a few caprine individuals are represented. Even if data are sparse, it was demonstrated that caprine mortality profiles from Grotta dell'Edera resemble the theoretical model (Payne 1973) considered as indicative of the exploitation of milk and dairy products (Boschin 2020). Nonetheless, the same study pointed to the fact that if the presence of foetuses and very young lambs can be related to natural mortality, kill-off data should be considered with care in the analysis of a site with a specific function (i.e., a sheepfold). The exploitation of milk can be better detected by the analysis of chemical residues on vessels. In this perspective, interesting results, indicating the presence of dairy products at Mala Triglavca on the Karst plateau already at 7565–7474 cal BP (Poz-48540), have been achieved by Budja et al.

(2013). Even if dropped deciduous teeth confirm the use of the cave as a stable for animals, butchering marks testify to an occasional *in situ* consumption of domestic mammals, thus indicating that the cave was not only used as a sheepfold. Percussion marks and cones detected both in Layers 2 and 2a point to the need for shepherds to extract marrow, perhaps for feeding purposes. The presence of dry-bone fractures on limb bone elements is not in contrast with the abovementioned picture and can be explained by a further post-depositional bone breakage due to ungulate trampling. The integration of diet with animal fat (and also other animal resources, see Budja et al. 2013) would not be surprising, if we consider that few (or perhaps no) evidence of agricultural activities is available for the Karst in this period, even if it has been demonstrated that plants were surely part of the diet of Neolithic groups of the area (Budja et al. 2013). While Neolithic settlements might have been submerged by the rise of sea level during the Holocene (Benjamin, Bonsall 2009), recent revision of materials from old excavations and the analysis of new finds (Bernardini, Betic 2008; Bernardini et al. 2017) point to the presence of possible open-air sites (San Rocco and Zaule) in the relatively fertile territory corresponding to the present-day coastal turbiditic hilly belt and plains in the south-western part of the province of Trieste. Unfortunately, no evidence is available so far on the agricultural vocation of these sites and on their possible relationships with the cave sites on the Karst plateau. Similarly, even if the presence of Danilo potsherds in open-air sites of the Friuli Plain, such as Sammardenchia and Fagnigola, points to the spread of the Danilo culture westwards, there are still no clear data on the relationships occurred between the settlements of the plain and the cave sites on the Karst plateau.

CONCLUSION

Faunal remains from Grotta dell'Edera represent the most important early Holocene bone assemblage from the Trieste Karst. The results show a first attempt of exploitation of this territory by Sauveterrian hunter-gatherers about 11,000 years ago (Layer 3d) in a period in which the plateau was probably still degraded, arid, and poorly vegetated. A more stable frequentation took place during the Boreal period/Early Atlantic at about 9300–8800 years ago. Hunting activities seem to follow a seasonal pattern and affect a broad spectrum of resources, whilst carcasses were intensively exploited. These data make it possible to compare Grotta dell'Edera with Mesolithic sites of Croatia (Pilaar-Birch and Miracle 2017).

The neolithization process and the arrival of domesticates were placed by Biagi, Starnini, Voytek (2008) in the first half of the 8th millennium BP and the first livestock was mainly composed by caprines, probably more adapted to the pastures offered by the Karst plateau. The territory was highly suitable for Neolithic shepherds, due to the presence of caves that were used to stable flocks. Cattle and pig became more important in later times, but they were always subordinated to caprines.

Even if the Trieste Karst is characterized by a high concentration of cave sites that yielded Mesolithic and Neolithic remains, there are no extensive excavations, and some faunal assemblages were not studied from a taphonomic point of view and sometimes not even from a zooarchaeological one. As a result, available raw data about the exploitation of faunal resources by Mesolithic, Neolithic and Eneolithic human groups are very scarce, and research is far from the possibility of drawing a synthesis about hunting/herding strategies, and human mobility across the territory. As an example, the faunal assemblage from Pupićina peć should be considered the only "representative enough" Neolithic sample for the whole Karst and Istria. Data from Grotta dell'Edera can be improved in future research by means of isotopic studies and more in-depth age estimations of individuals and seasonality data (e.g., by means of thin slices), but more excavations would be necessary to better contextualize any new result.

Illustrations: Fig. 3 (drawing: Paolo Biagi) / *Slikovno gradivo: Sl. 3* (risba: Paolo Biagi)

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Ostanki velikih sesalcev holocenske starosti iz jame Stenašca/Grotta dell'Edera na Tržaškem Krasu (izkopavanja v letih 1990–2001)

Povzetek

Uvod

Stenašca (Grotta dell'Edera) (*sl. 1* in *2*) je ključno najdišče za proučevanje najzgodnejše poselitve kraške planote (severni Jadran) in razumevanja njene neolitizacije. Najmanj v obdobju od mlajšega paleolitika do mezolitika je bilo območje domnevno neposeljeno (Boschian, Fusco 2007), saj najstarejše sledi prisotnosti anatomsko modernega človeka datirajo v zgodnji holocen. Ob tem je treba navesti, da je v večini jamskih najdišč s Krasa nepopolno zastopano tudi mezolitsko-neolitsko sosledje plasti (Biagi 2003). Prav v tem je Stenašca v lokalnem kontekstu edinstvena, saj so tu mezolitski (sovterjenski in kastelnovjenski), neolitski in eneolitski sedimenti (*sl. 3*). Ker gre za edino najdišče s Krasa z dobro datiranim prehodom med mezolitikom in neolitikom (*sl. 4*), ga je treba razumeti kot eno najpomembnejših jamskih najdišč v tržaški pokrajini.

Stenašca leži na severozahodnem delu Tržaškega Krasa, slabe 3 km od današnje morske obale. Njen 10 m širok vhod se odpira proti severovzhodu na dnu manjšega brezna na nadmorski višini pribl. 230 m (*sl. 1* in *2*). Prva izkopavanja je v jami organiziral G. Marzolini (1970), leta 1990 sta terensko raziskovanje nadaljevali univerza Ca' Foscari iz Benetk in Kalifornijska univerza iz Berkeleyja (ZDA) pod vodstvom arheologov P. Biagi in B. A.

Voytek (Biagi, Starnini, Voytek 1993). V tem času je bilo izkopanih pribl. 4 m sedimenta, pri čemer so bile prepoznane naslednje plasti (sosledje je podano od spodaj navzgor; *sl. 3* in *4*).

– *Plast 3d*: gre za plast s sledmi iz časa prvih človekovih obiskovanj jame, tj. iz predboreala (9810±70 uncal., GrN-23130; 9930±50 uncal., GrA-14108). Zbrano arheološko gradivo sodi v mezolitk (sovterjen).

– *Plast 3c*: vključuje ostanke hodne površine z *in situ* odkritimi živalskimi in kamnitimi najdbami ter lečami pepela/oglja. Datirana je v boreal (8350±120 uncal., GrN-25139; 8250±50 uncal., GrA-11818), kar se časovno ujema z drugo sovterjensko fazo človekovih obiskovanj.

– *Plast 3b*: nastala je v obdobju prehoda med borealom in atlantikom (razpon datacij: od 8045±40 uncal. [GrA-14106] do 8110±90 uncal. [GrN-25138]). Vključuje mezolitsko (sovterjensko) arheološko gradivo.

–*Plast 3a*: gre za ognjišče premera pribl. 1 m, kjer je bilo odkrito kamnito gradivo iz mlajšega mezolitika (kastelnovjen) in 17 odlomkov lončenine. Kot je pokazala petrografska analiza, naj bi se minerološka sestava slednjih razlikovala od sestave lončenine iz mlajše plasti 2a, kar priča o njihovem alohtonem izvoru (Spataro 2001). Starost drobca oglja iz te plasti je bila z metodo radioaktivnega

ogljika ocenjena na 6700±130 uncal. (GX-19569), starost odlomka ovčje kosti pa na 6620±60 uncal. (GrA-19912).

−*Plast 3*: gre za premešano plast debeline pribl. 20 cm s posameznimi odlomki lončenine in nekaj kamnitimi odbitki lokalnega izvora. Do te plasti sedimente označuje rdečkasta obarvanost.

−*Plast 2a*: debela plast, palimpsest, ki ga sestavlja navpično sosledje šestih leč pepela in oglja. Sediment večinoma vključuje sežgane iztrebke kopitarjev. Odlomki lončenine so bili pripisani vlaški kulturni skupini, razumljeni kot lokalna različica neolitske danilske kulture. Datumi, pridobljeni z metodo radioaktivnega ogljika, se razvrščajo med 6305±285 uncal. (GX-19022) in 6615±390 uncal. (GX-19568) (Biagi, Starnini, Voytek 2008).

−*Plast 2*: palimpsest, katerega zgornji del (globina od 170 do 180 cm) datira v zgodnjo fazo eneolitika (4680±325 uncal., GX-19019). Drug razpoložljiv datum ^{14}C, ki se nanaša na vzorec iz spodnjega dela plasti (globina od 200 do 210 cm), je bil ocenjen na 5555±35 uncal. (GrN-18968).

−*Plast 1b*: najverjetneje premešana; vključevala je nekaj zgodnjebronastodobnih ostankov.

−*Plast 1a*: vključevala je pičlo število arheoloških najdb in ognjišče, datirano v pozno antiko, (1415±35 uncal., GrN-18968).

−*Plast 1*: vrhnja plast s pičlim številom arheoloških ostankov.

Taksonomsko in anatomsko opredeljevanje živalskih ostankov je potekalo ob sprotni konzultaciji primerjalnih osteoloških zbirk. Nomenklatura domačih živali sledi smernicam, ki so jih objavili Gentry, Clutton-Brock, Groves (2004). V preliminarni arheozoološki objavi subfosilne favne iz plasti 2, 2a, 3 in 3a (Boschin, Riedel 2000) je količina najdb podana kot število ohranjenih delov posameznih kosti in ne kot dejansko število dokumentiranih kostnih drobcev. Tako je bil, denimo, nepoškodovan primerek stegnenice štet kar trikrat, tj. po enkrat za ohranjen proksimalni, medialni in distalni del kosti. Kvantitativni podatki iz omenjene objave zato ne zrcalijo dejanskega števila odkritih in analiziranih najdb, temveč posredno tudi stopnjo njihove fragmentiranosti. Zaradi enostavnejše primerjave rezultatov iz Stenašce z izsledki podobnih analiz z drugih najdišč je v tem članku količina živalskih ostankov podana kot število opredeljenih primerkov (Number of Identified Specimens; NISP). Taksonomsko neopredeljene najdbe so bile, kjer je bilo to mogoče, grupirane na podlagi anatomske pripadnosti (npr.

rebra, vretenca, diafize dolgih kosti). Pri računanju najmanjšega števila elementov (Minimum Number of Elements; MNE) in najmanjšega števila osebkov (Minimum Number of Individuals; MNI) so bili upoštevani anatomska stran (tj. levo-desno) in velikost posamezne najdbe, kakor tudi starost pripadajoče živali ob poginu (za razpravo o pomenu obeh navedenih indeksov glej Lyman 2008). Podatki o gostoti kostnine posameznih skeletnih elementov izbranih živalskih vrst so povzeti po Lymanu (Lyman 1984). Pri indeksih uporabnosti so bile upoštevane smernice, ki so jih objavili Metcalfe, Jones (1988), Rowley-Conwy, Halstead, Collins (2002) in Morin (2007). Metrični podatki so bili zbrani v skladu z navodili von den Driescheve (von den Driesch 1976) in so podani v prilogi. Beleženje stopnje obrabe žvekalne površine kočnikov pri živalih iz rodov *Bos* in *Sus* sledi smernicam Grantove (Grant 1982), pri drobnici pa objavi Payna (Payne 1973). Taksonomska opredelitev kosti in zob ovčjih oziroma kozjih zarodkov je bila izvedena na podlagi kriterijev, ki so jih predstavili Habermehl (1975), Ahmed (2008), Richardson et al. (1976) in Mcdonald et al. (1977). Starost ob poginu pri jelenjadi in srnjadi je bila ocenjena po metodi, kot jo podajajo Tomé, Vigne (2003), Mariezkurrena (1983) in Habermehl (1985). Svežost posameznih kosti ob njihovem razbitju je bila ugotavljana z uporabo indeksa svežosti loma (Fracture Freshness Index oziroma FFI; Outram 2002). Spremembe na površini kosti so bile analizirane pod najmanj 10-kratno povečavo in ob uporabi primerjalne zbirke modernega kostnega gradiva, ki je bilo nabrano na planem. Proučevanje sledi izpostavljenosti vremenskim razmeram (tj. razpok, luščenja površine kosti) je zajelo zgolj nesežgane kostne odlomke velikosti nad 3 cm. Datumi, pridobljeni z metodo radioaktivnega ogljika, so bili kalibrirani z uporabo programskega paketa OxCal 4.3 (Bronk Ramsey 2009) in ob upoštevanju krivulje IntCal 13 (Reimer et al. 2013). Statistična analiza in priprava grafikonov sta bili izvedeni s pomočjo programskih paketov PAST (Hammer, Harper, Ryan 2001) in R (R Development Core Team 2008).

Rezultati

Analiziranih je bilo približno 69.000 ostankov velikih sesalcev, vendar je bila stopnja določljivosti gradiva zaradi izrazite razdrobljenosti najdb skromna (*tab. 1*). Med ostanki iz sovterjenskih plasti močno prevladujejo kosti in zobje jelena,

srne in divjega prašiča (njihov skupni delež presega 90 odstotkov vseh taksonomsko opredeljenih najdb). Vrstna sestava tega gradiva ne izkazuje diahronih sprememb.

Za skromen skupek kosti iz plasti 3a je značilna večinska zastopanost domačih živali, vendar je soliden tudi delež divjadi (predvsem jelen). Podobno sliko kaže skromen nabor najdb iz (morda premešane) plasti 3.

Za plast 2a je treba na podlagi rezultatov revizije (kvadranti 27–35 pri tem niso bili upoštevani zaradi morebitne prisotnosti divjadi iz mezolitskih kontekstov; *sl. 5*) ugotoviti očitno prevlado drobnice (96,9 % NISP), prisotnost nekaj posameznih ostankov goveda in domačega prašiča ter maloštevilne najdbe divjadi (0,4 % NISP). Zelo podobno sliko kaže plast 2. Najbolje zastopan takson je tudi v tem primeru drobnica (79,9 % NISP), deleži goveda (4,3 % NISP), domačega prašiča (8,7 % NISP) in divjadi (3,7 % NISP) so komaj kaj večji. Zanimivo je, da je od spodnjega proti zgornjemu delu omenjene plasti zaznati postopno rast števila govejih in prašičjih najdb (*sl. 6*). Vendar pa je ob tem treba opozoriti, da je na podlagi razpoložljivih geoarheoloških podatkov obravnavana plast domnevno premešana, saj naj bi prazgodovinski pastirji prerazporejali v jami akumulirane živalske iztrebke (Boschian 1997). Število taksonomsko opredeljenih živalskih ostankov v plasteh 1a in 1b je pičlo (tj. 67 oziroma 32 primerkov). Najbolje zastopan takson ostaja drobnica, delež ostankov prašiča presega delež ostankov goveda, najdb divjadi pa ni.

Vzorec fragmentiranosti gradiva se med posameznimi plastmi bistveno ne razlikuje, saj so vzdolž celotnega stratigrafskega stolpca znatno zastopani zelo majhni kostni drobci (*sl. 7A*). Indeks svežosti loma (FFI; Outram 2002) je bil izračunan za odlomke iz vseh plasti z izjemo plasti 1, 1a in 1b. Rezultati so prikazani na *sliki 7B*.

Sledi izpostavljenosti vremenskim razmeram (razpokanost, luščenje površine) so bile opažene na številnih najdbah iz plasti 2 do 3c (*tab. 2*). Zanimivo je, da v okviru sedimentov mezolitske starosti od plasti 3c navzdol številčnost takšnih najdb upade, domnevno zaradi hitrejše sedimentacije. Podobno so kosti iz plasti 2a bolje ohranjene od tistih iz plasti 2, ki naj bi se odlagala počasneje (*sl. 4*).

Sežgani ostanki so bili odkriti vzdolž celotnega stratigrafskega stolpca, vendar so najbolje zastopani v plasteh 2 in 3d (*tab. 4*). Zasekanine in vrezi so bili odkriti predvsem na kosteh kopitarjev, v posameznih primerih pa tudi na ostankih zajcev, svizcev in zveri (*tab. 5*).

Več deset analiziranih živalskih najdb je obgrizenih, tako od zveri kot glodavcev. Pretežni del takšnih kosti izvira iz plasti 3b (38 primerkov) in 3c (53 primerkov). Posebno omembo zasluži prstnica srne iz plasti 3b, ki je obgrizena in sežgana, ter dve nartni kosti iste vrste iz plasti 3c, izmed katerih je ena (skočnica) obgrizena, na drugi (kvadratnočolničasta kost) pa so bili opaženi vrezi.

Podatki o zastopanosti posameznih skeletnih elementov so podani v *tabelah 6* do *8*, vendar so podrobneje obravnavani le v primeru plasti 2 in 2a (drobnica) oziroma 3b in 3c (jelen, srna, divji prašič) (*tab. 9*). Zgolj v navedenih primerih je bilo namreč mogoče oblikovati zadovoljivo velike in torej kolikor toliko reprezentativne vzorce. Z izjemo plasti 3c soodvisnost med številčnostjo kosti iz posameznih anatomskih regij (MAU %) in strukturno gostoto teh kosti ni statistično značilna. Enako praviloma velja za korelacijo med zastopanostjo posameznih anatomskih regij (MAU %) in standardiziranim indeksom prehranske uporabnosti (SFUI) pripadajočih kosti (*tab. 10*). Med taksonomsko opredeljenimi ostanki so najbolje zastopani skeletni elementi glave, in to v vsaki izmed analiziranih plasti. Ugotovitev kaže pripisati enostavnejšemu opredeljevanju zob v primerjavi s kostnimi drobci. Med taksonomsko neopredeljenimi ostanki sovterjenske starosti prevladujejo odlomki diafiz dolgih kosti, reber, vretenc in zob.

Sklep

Živalski ostanki iz Stenašce so najpomembnejši arheozoološki zbir zgodnjeholocenske starosti z območja Tržaškega Krasa. Prve sledi prisotnosti sovterjenskih lovcev in nabiralcev v tej jami so datirane v čas pred približno 11.000 leti (plast 3d), ko je bila planota najbrž še degradirana, sušna in slabo poraščena. Intenzivnejše obiskovanje jame se je domnevno začelo v borealu in na začetku atlantika, v obdobju pred približno 9.300 do 8.800 leti. Lov naj bi se tedaj večinoma izvajal sezonsko (*sl. 8*), nabor plenjenih živali pa je bil razmeroma širok (veliko je predvsem ostankov jelena, srne in divjega prašiča). V tem smislu kaže Stenašca številne podobnosti s sočasnimi najdišči na Hrvaškem (Pilaar-Birch, Miracle 2017).

V plasti 3a se vrstna sestava zbira živalskih ostankov v primerjavi z ugotovitvami iz spodaj ležečih sedimentov bistveno spremeni, saj se pojavijo najdbe domačih kopitarjev (44 % NISP; prevladujejo ostanki drobnice). Pri tem je revizija

gradiva iz te plasti, datirane v obdobje mlajšega kastelnovjena (6390±60 BP, GrA-19820, Biagi 2003), pokazala na odsotnost kosti ali zob goveda. Datacija plasti 3a je podobna dataciji plasti 2a, ki leži neposredno nad njo in kjer prav tako prevladujejo ostanki drobnice. Pogostnost najdb s sledmi izpostavljenosti vremenskim razmeram bi lahko kazala na počasno sedimentacijo in oblikovanje kratkotrajnega palimpsesta s kastelnovjenskimi in neolitskimi elementi. Arheološki in kronološki podatki iz regije pričajo o verjetni interakciji med zadnjimi lovci-nabiralci in prvimi kmetovalci (Biagi et al. 2003). Tukaj predstavljeni rezultati analize živalskih ostankov iz plasti 3a teze o tem, da bi tam odkrito kastelnovjensko ognjišče utegnilo dokazovati stik med navedenima skupinama, niti ne potrjujejo niti ne zavračajo.

Biagi, Starnini in Voytek (2008) postavljajo začetek procesa neolitizacije Krasa in pojav domestikatov v prvo polovico 8. tisočletja pred sedanjostjo. Veliko naj bi bilo predvsem drobnice, ki je bila domnevno bolj prilagojena na pašo v tedanji lokalni krajini. Kras je bil neolitskim živinorejcem naklonjen tudi zaradi možnosti uporabe številnih jam za staje. Pomen goveda in domačega prašiča se je sčasoma nekoliko okrepil, vendar ni nikoli presegel vloge ovce in koze.

Podatki o starosti drobnice ob poginu/zakolu dovoljujejo razmišljanja o tem, da so bile črede v jami vse leto. To naj bi veljalo, če je bila kotitev na leto le ena. V gradivu so bili namreč zastopani vsi trije najzgodnejši starostni razredi po Paynu: A (0–2 meseca), B (2–6 mesecev) in C (6–12 mesecev). Če sta bili kotitvi dve, bi te iste podatke o starosti ovci in koz ob smrti lahko razumeli kot indic za predvsem sezonsko prisotnost čred v obravnavani jami.

Pomenljiv je podatek o bržčas znatni zastopanosti ostankov zarodkov ovc in/ali koz v plasteh 2 in 2a (*tab. 3*), saj bi to lahko podkrepilo tezo o uporabi jame za stajo. Če je bila Stenašca obiskovana (tudi) v času neposredno pred kotitvijo in med njo, je prisotnost kosti zarodkov kot posledica splavov pravzaprav pričakovana (Boschin 2019). Žal je bila metodologija za oceno starosti zarodkov ob poginu oblikovana na podlagi študije sodobnih ovc in koz, zaradi česar bi utegnile nekatere od omenjenih kosti pripadati že skotenim živalim. Vendar pa naj bi vsaj nekateri primerki iz Stenašce poginili precej pred kotitvijo, kar prepričljivo dokazuje pogin brejih samic (*sl. 10*). Odprto ostaja še vprašanje o razlogih za smrt jagnjet in kozličev obeh najzgodnejših starostnih razredov po Paynu,

tj. razredov A (0–2 meseca) in B (2–6 mesecev) (Payne 1973). So bili ti načrtno zaklani v skladu z izbrano politiko reje ali so poginili zaradi neugodnih razmer? Dejavniki, ki lahko sprožijo splav (npr. okužbe, prehranski stres), utegnejo namreč povzročiti tudi naravni pogin jagnjet/kozličev (Boschin 2019 in tam navedena literatura).

Smrtnostni profil za drobnico, ki sicer temelji na razmeroma pičlem zbiru podatkov, je v splošnem zelo podoben teoretičnim modelom vzreje teh živali s ciljem pridobivanja mleka in mlečnih izdelkov (Payne 1973; Boschin 2019). Vendar pa je treba zaradi odkritja ostankov zarodkov in komaj skotenih mladičev, izmed katerih so vsaj nekateri utegnili poginiti naravne smrti, ocene starosti drobnice ob poginu/zakolu jemati zelo previdno. Toliko bolj zato, ker je bila Stenašca zelo verjetno periodično uporabljana kot staja za živino. Pridobivanje mleka je mogoče verodostojneje oceniti z analizo organskih ostankov na lončenini. V tem smislu kaže omeniti rezultate takšnih raziskav na gradivu iz še ene kraške jame s tega območja, tj. Male Triglavce pri Divači. Zanimivo je namreč, da rezultati dokazujejo človekovo uporabo mleka in mlečnih izdelkov že pred okvirno 7500 leti (7565–7474 cal BP; Poz-48540) (Budja et al. 2013).

Nedavna revizija že pred časom izkopanega arheološkega gradiva in analiza novih najdb (Bernardini, Betic 2008; Bernardini et al. 2017) sta nakazali verjeten obstoj najdišč na prostem (San Rocco, Žavlje/Zaule) na razmeroma rodovitnem območju turbiditnega hribovja in nižin vzdolž današnjega obalnega pasu na jugozahodu tržaške pokrajine. Žal podatki o kmetijskih aktivnostih tedanjih prebivalcev teh naselbin niso znani, tako kot tudi ne podatki o njihovem odnosu do jamskih najdišč s Krasa. To velja kljub odkritju lončenine danilske kulture na nekaterih tedanjih najdiščih na prostem iz Furlanije (npr. Sammardecchia, Fagnigola), ki sicer kažejo na širitev te kulture tudi na območja zahodno od kraške planote.

Kljub velikemu številu jamskih najdišč z mezolitskim in neolitskim gradivom na območju Tržaškega Krasa ta nikoli niso bila obsežneje terensko raziskovana. Tudi živalski ostanki so bili pogosto analizirani zgolj parcialno ali pa še to ne. Zato na podlagi razpoložljivih arheozooloških podatkov za obdobje mezolitika, neolitika in eneolitika ni mogoče podati celovite slike o strategijah živinoreje in lova ter o vzorcih človekove mobilnosti na tem območju. Pravzaprav kaže kot edino zares reprezentativno neolitsko najdišče za celoten prostor Krasa in Istre omeniti hrvaško Pupićino peć. Podatke iz

Stenašče bi bilo mogoče v prihodnje obogatiti z analizami stabilnih izotopov, detajlnejšo študijo starosti živali ob poginu/zakolu, preučevanjem indicev o sezoni človekovih obiskov jame (npr. s histološkimi analizami kostnine) ter predvsem z nadaljnjim terenskim raziskovanjem.

Prevod: Borut Toškan

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App. 1: Grotta dell'Edera. Measurements taken on animal bones.
Meas: Measurement; **M**: Upper molar tooth; **M/**: lower molar tooth; **D**: Upper deciduous tooth; **D/**: lower deciduous tooth; **Mc**: Metacarpal; **Mt**: Metatarsal. (Measurement's codes are from: Von den Driesch 1974).
Pril. 1: Stenašca. Metrični podatki za živalske ostanke.
Meas: dimenzija; **M**: zgornji kočnik; **M/**: spodnji kočnik; **D**: zgornji mlečni zob; **D/**: spodnji mlečni zob; **Mc**: dlančnica; **Mt**: stopalnica. (Označbe posameznih dimenzij so povzete po: von den Driesch 1974).

Taxon	Layer	Element	Meas. 1		Meas. 2		Meas. 3		Meas. 4	
Bos sp.	**2a**	Talus	GLl	69	GLm	64,1	Dl	38,4	Bd	42,5
Bos taurus	**1a**	M/3	L	36,5	B	14				
Ovis aries	**2a**	Scapula	GLP	32,2						
Ovis aries	**2a**	Radius	Bp	27,1	BFp	24,7				
Ovis aries	**2a**	Metacarpus	Bd	24,8						
Ovis aries	**2a**	Metacarpus	Bd	24,2						
Ovis aries	**2a**	Talus	GLl	31,5	GLm	29,5	Dl	17,6	Bd	19,6
Ovis aries	**2a**	Talus	GLl	29	GLm	27,7	Dl	16,3	Bd	18,8
Ovis aries	**2a**	Metatarsus	Bd	22,8						
Ovis aries	**2a**	Metatarsus	Bd	27						
Ovis aries	**2a**	Phalanx 1	GLpe	31,5	Bp	10,8	SD	8,6	Bd	9,8
Ovis aries	**2a**	Phalanx 1	GLpe	38,8	Bp	13,7	SD	11,5	Bd	13,2
Ovis aries	**2a**	Phalanx 1	GLpe	36,2	Bp	12,6				
Ovis aries	**2a**	Phalanx 1	GLpe	36,5	Bp	11,3				
Ovis aries	**3a**	Phalanx 1	GLpe	31,1	SD	9,2				
Ovis aries	**3a**	Phalanx 2	GL	18,5	Bp	11,5	SD	8,4	Bd	8,5
Capra hircus	**2a**	Scapula	SLC	19						
Sus domesticus	**1b**	M\3	L	29	B	18				
Sus domesticus	**2**	M\3	L	34,5						
Sus domesticus	**2**	M/2	L	21						
Sus domesticus	**2**	M/3	L	35						
Sus domesticus	**2**	Scapula	SLC	18,2						
Sus scrofa	**3**	M\3	L	38,8						
Sus scrofa	**3b**	M/1	L	19,4						
Sus scrofa	**3c**	D\4	L	18,5						

Taxon	Layer	Element	Meas. 1		Meas. 2		Meas. 3		Meas. 4	
Sus scrofa	**3c**	M\1	L	18,3						
Sus scrofa	**3c**	M\1	L	19,3						
Sus scrofa	**3b**	Radius	Bp	32						
Sus scrofa	**3b**	Ulna	DPA	56	SDO	40,6	LO	72,6		
Sus scrofa	**3b**	MC IV	Bp	18,8						
Sus scrofa	**3b**	MC IV	Bp	21,8						
Sus scrofa	**3b**	Talus	Gll	47,1	GLm	42,5				
Sus scrofa	**3b**	Phalanx 1	BP	15,6						
Sus scrofa	**3b**	Phalanx 1	BP	23,6						
Sus scrofa	**3b**	Phalanx 1	BP	21						
Sus scrofa	**3b**	Phalanx 1	BP	22,1						
Sus scrofa	**3c**	Scapula	GLP	44	LG	36,4	BG	28,6		
Sus scrofa	**3c**	Humerus	Bd	54,4	BT	41,3				
Sus scrofa	**3c**	Humerus	Bd	55,1	BT	40,4				
Sus scrofa	**3c**	Humerus	Bd	44,3	BT	36,3				
Sus scrofa	**3c**	Radius	Bp	32,2						
Sus scrofa	**3c**	Radius	Bp	31,4						
Sus scrofa	**3c**	Radius	Bd	41,5						
Sus scrofa	**3c**	Ulna	DPA	37,5	SDO	27,5	BPC	23,4		
Sus scrofa	**3c**	Ulna	BPC	22,5						
Sus scrofa	**3c**	Ulna	BPC	20,7						
Sus scrofa	**3c**	MC IV	Bp	23,4						
Sus scrofa	**3c**	Tibia	Bd	36,3						
Sus scrofa	**3c**	Talus	Gll	48,9						
Sus scrofa	**3c**	Talus	Gll	49,6	GLm	45,5				
Sus scrofa	**3c**	Calcaneum	GL	95,5						
Sus scrofa	**3c**	Mt III	Bp	18,3						
Sus scrofa	**3c**	Mt III	Bp	20						
Sus scrofa	**3c**	Phalanx 1	BP	18,6						
Sus scrofa	**3c**	Phalanx 1	BP	18,1						
Sus scrofa	**3c**	Phalanx 1	BP	18,1						
Sus scrofa	**3c**	Phalanx 1	BP	19,5						
Sus scrofa	**3c**	Phalanx 2	GL	26,1						
Sus scrofa	**3c**	Phalanx 2	GL	29	Bp	20,1	SD	15,8	Bd	18,1
Sus scrofa	**3c**	Phalanx 2	GL	30	Bp	21,5	SD	17,1	Bd	21,5
Sus scrofa	**3c**	Phalanx 2	GL	30,2	Bp	19,6	SD	16,4	Bd	15,8
Sus scrofa	**3c**	Phalanx 2	GL	30,3	Bp	19,3	Bd	16,8		
Sus scrofa	**3d**	Humerus	BT	43						
Cervus elaphus	**3a**	Radius	Bd	59						
Cervus elaphus	**3a**	Ulna	BPC	28,5						
Cervus elaphus	**3b**	M/3	L	36,6						
Cervus elaphus	**3b**	M/3	L	29,1						
Cervus elaphus	**3b**	Scapula	GLP	67,1	LG	55,9	BG	49,5		

Taxon	Layer	Element	Meas. 1		Meas. 2		Meas. 3		Meas. 4	
Cervus elaphus	**3b**	Humerus	Bd	58,4	BT	50,3				
Cervus elaphus	**3b**	Radius	Bp	59,2	BFp	54,5				
Cervus elaphus	**3b**	Ulna	DPA	49,2	SDO	48,8	LO	70,8	BPC	26,6
Cervus elaphus	**3b**	Ulna	DPA	48,9						
Cervus elaphus	**3b**	Metacarpus	Bd	37,9						
Cervus elaphus	**3b**	Talus	GLl	54,3	GLm	49,4	Dl	29	Bd	32,5
Cervus elaphus	**3b**	Metatarsus	Bd	42						
Cervus elaphus	**3b**	Metatarsus	Bd	43,6						
Cervus elaphus	**3b**	Metatarsus	Bd	42,2						
Cervus elaphus	**3b**	Phalanx 1	Bp	21,2						
Cervus elaphus	**3b**	Phalanx 1	Bp	19,8						
Cervus elaphus	**3b**	Phalanx 1	Bp	23,6						
Cervus elaphus	**3b**	Phalanx 1	Bp	21,8						
Cervus elaphus	**3b**	Phalanx 1	Bp	25						
Cervus elaphus	**3b**	Phalanx 1	Bp	21,8						
Cervus elaphus	**3b**	Phalanx 1	Bp	19,5						
Cervus elaphus	**3b**	Phalanx 2	Bp	18,8						
Cervus elaphus	**3b**	Phalanx 2	Bp	20,3						
Cervus elaphus	**3b**	Phalanx 2	Bp	19						
Cervus elaphus	**3c**	Maxilla	20	114,4	21	69,2	22	45,3		
Cervus elaphus	**3c**	Maxilla	22	46,4						
Cervus elaphus	**3c**	Mandible	7	125,1	8	79,4	9	45,8		
Cervus elaphus	**3c**	Mandible	7	49,3						
Cervus elaphus	**3c**	M/3	L	33,4						
Cervus elaphus	**3c**	M/3	L	33,9						
Cervus elaphus	**3c**	Radius	Bp	49,4	BFp	46,7				
Cervus elaphus	**3c**	Ulna	DPA	26,3	SDO	22,5	LO	30		
Cervus elaphus	**3c**	Ulna	BPC	34,2						
Cervus elaphus	**3c**	Metacarpus	Bp	44,6						
Cervus elaphus	**3c**	Metacarpus	Bp	41,9						
Cervus elaphus	**3c**	Metacarpus	Bd	40,7						
Cervus elaphus	**3c**	Metacarpus	Bd	41,8						
Cervus elaphus	**3c**	Talus	GLl	57,6	GLm	53	Dl	30,4	Bd	35,4
Cervus elaphus	**3c**	Talus	GLl	55,4	GLm	52,1	Dl	29,2	Bd	34,1
Cervus elaphus	**3c**	Calcaneum	GL	116,5						
Cervus elaphus	**3c**	Metatarsus	Bd	42,1						
Cervus elaphus	**3c**	Phalanx 1	Bp	21,2						
Cervus elaphus	**3c**	Phalanx 1	Bp	23,1						
Cervus elaphus	**3c**	Phalanx 1	Bp	22,4						
Cervus elaphus	**3c**	Phalanx 1	Bp	20,2						
Cervus elaphus	**3c**	Phalanx 1	Bp	21,3						
Cervus elaphus	**3c**	Phalanx 1	Bp	21,6						
Cervus elaphus	**3c**	Phalanx 1	Bp	24						

Taxon	Layer	Element	Meas. 1		Meas. 2		Meas. 3		Meas. 4	
Cervus elaphus	**3c**	Phalanx 1	Bp	19,4						
Cervus elaphus	**3c**	Phalanx 1	Bp	20,5						
Cervus elaphus	**3c**	Phalanx 2	Bp	19,2						
Cervus elaphus	**3c**	Phalanx 2	Bp	20,4						
Cervus elaphus	**3c**	Phalanx 2	Bp	20,7						
Cervus elaphus	**3c**	Phalanx 2	Bp	20,6						
Cervus elaphus	**3c**	Phalanx 2	Bp	22,3						
Cervus elaphus	**3c**	Phalanx 2	Bp	23						
Cervus elaphus	**3c**	Phalanx 2	Bp	18,1						
Cervus elaphus	**3c**	Phalanx 2	Bp	22,2						
Cervus elaphus	**3c**	Phalanx 2	Bp	19,9						
Cervus elaphus	**3c**	Phalanx 2	Bp	17,8						
Cervus elaphus	**3d**	Mandible	8	75,6						
Cervus elaphus	**3d**	M/3	L	31,4						
Cervus elaphus	**3d**	Metacarpus	Bd	39,4						
Cervus elaphus	**3d**	Talus	GLl	56	GLm	52,4	Dl	29,3	Bd	35,1
Cervus elaphus	**3d**	Phalanx 2	GL	38,7	Bp	19,6	Bd	17,3		
Cervus elaphus	**3d**	Phalanx 2	Bp	21,8						
Capreolus capreolus	**3b**	Maxilla	22	30,4						
Capreolus capreolus	**3b**	Maxilla	21	28,3						
Capreolus capreolus	**3b**	Scapula	SLC	8,9						
Capreolus capreolus	**3b**	Humerus	Bd	27,5	BT	25,3				
Capreolus capreolus	**3b**	Humerus	Bd	27,2	BT	23,3				
Capreolus capreolus	**3b**	Ulna	DPA	25,6	SDO	21,6	LO	31	BPC	15,9
Capreolus capreolus	**3b**	Ulna	DPA	24,1	SDO	21,7	LO	29,6	BPC	15,3
Capreolus capreolus	**3b**	Tibia	Bd	27,6						
Capreolus capreolus	**3b**	Talus	GLl	29,7	GLm	29,4	Dl	17,1	Bd	20,5
Capreolus capreolus	**3b**	Talus	GLl	31,3	GLm	30,2	Dl	16,9	Bd	20
Capreolus capreolus	**3b**	Talus	GLl	31,2	Bd	20,4				
Capreolus capreolus	**3b**	Talus	GLl	28,7	GLm	27,6	Dl	15,4	Bd	18,7
Capreolus capreolus	**3b**	Talus	GLl	31,7	Dl	16,9	Bd	19,9		
Capreolus capreolus	**3b**	Metatarsal	Bd	25,1						
Capreolus capreolus	**3b**	Phalanx 1	Bp	12,3						
Capreolus capreolus	**3b**	Phalanx 1	Bp	10,6						
Capreolus capreolus	**3b**	Phalanx 2	Bp	12,3						
Capreolus capreolus	**3b**	Phalanx 2	Bp	11,8						
Capreolus capreolus	**3b**	Phalanx 2	Bp	10,6						
Capreolus capreolus	**3c**	Maxilla	22	28						
Capreolus capreolus	**3c**	Maxilla	21	35,4						
Capreolus capreolus	**3c**	M/3	L	15,6						
Capreolus capreolus	**3c**	M/3	L	15,8						
Capreolus capreolus	**3c**	Scapula	SLC	7,9	BG	18,8	LG	20,7	GLP	27,6
Capreolus capreolus	**3c**	Scapula	BG	20,4	LG	22,8				

Taxon	Layer	Element	Meas. 1		Meas. 2		Meas. 3		Meas. 4	
Capreolus capreolus	**3c**	Humerus	Bp	31,3						
Capreolus capreolus	**3c**	Humerus	Bd	27						
Capreolus capreolus	**3c**	Radius	Bp	54,1	BFp	50,8				
Capreolus capreolus	**3c**	Radius	Bd	25						
Capreolus capreolus	**3c**	Radius	Bd	26,8						
Capreolus capreolus	**3c**	Ulna	DPA	26,6	SDO	22,6	LO	32		
Capreolus capreolus	**3c**	Ulna	BPC	13,8						
Capreolus capreolus	**3c**	Metacarpus	Bp	19,8						
Capreolus capreolus	**3c**	Metacarpus	Bd	22,9						
Capreolus capreolus	**3c**	Metacarpus	Bd	21,8						
Capreolus capreolus	**3c**	Tibia	Bd	27,1						
Capreolus capreolus	**3c**	Talus	GLl	29,5	GLm	28,8	Dl	15,9	Bd	19,3
Capreolus capreolus	**3c**	Talus	GLl	30,3	GLm	28,7	Dl	16,9	Bd	19,5
Capreolus capreolus	**3c**	Talus	GLl	32	GLm	29,1	Dl	18,2	Bd	19,1
Capreolus capreolus	**3c**	Talus	GLl	29,2	GLm	28,5	Dl	15,8	Bd	19,2
Capreolus capreolus	**3c**	Talus	GLl	29,9	GLm	28,7	Dl	16,5	Bd	17,6
Capreolus capreolus	**3c**	Talus	GLl	31	GLm	28,6	Dl	17,3	Bd	20,9
Capreolus capreolus	**3c**	Talus	GLl	31,4	GLm	30,2	Dl	16,7	Bd	19,7
Capreolus capreolus	**3c**	Talus	GLl	30,1	GLm	28,8	Dl	16,9	Bd	20,5
Capreolus capreolus	**3c**	Talus	GLl	30,4	GLm	28,7	Dl	17,5	Bd	19,3
Capreolus capreolus	**3c**	Talus	GLl	28	Dl	15,4				
Capreolus capreolus	**3c**	Calcaneum	GL	64,3						
Capreolus capreolus	**3c**	Calcaneum	GL	65,1						
Capreolus capreolus	**3c**	Calcaneum	GL	64,5						
Capreolus capreolus	**3c**	Phalanx 1	Bp	12						
Capreolus capreolus	**3c**	Phalanx 1	Bp	11,8						
Capreolus capreolus	**3c**	Phalanx 1	Bp	11,6						
Capreolus capreolus	**3c**	Phalanx 1	Bp	12,9						
Capreolus capreolus	**3c**	Phalanx 1	Bp	11,6						
Capreolus capreolus	**3c**	Phalanx 1	Bp	10,4						
Capreolus capreolus	**3c**	Phalanx 1	Bp	11,5						
Capreolus capreolus	**3c**	Phalanx 1	Bp	12,3						
Capreolus capreolus	**3c**	Phalanx 1	Bp	12,2						
Capreolus capreolus	**3c**	Phalanx 1	Bp	10,2						
Capreolus capreolus	**3c**	Phalanx 1	Bp	13,4						
Capreolus capreolus	**3c**	Phalanx 1	Bp	11,8						
Capreolus capreolus	**3c**	Phalanx 1	Bp	13,2						
Capreolus capreolus	**3c**	Phalanx 1	Bp	11,7						
Capreolus capreolus	**3c**	Phalanx 2	Bp	9,6						
Capreolus capreolus	**3c**	Phalanx 2	Bp	12,2						
Capreolus capreolus	**3c**	Phalanx 2	Bp	10,6						
Capreolus capreolus	**3c**	Phalanx 2	Bp	10,7						
Capreolus capreolus	**3c**	Phalanx 2	Bp	11,8						
Capreolus capreolus	**3c**	Phalanx 2	Bp	10,8						

Taxon	Layer	Element	Meas. 1		Meas. 2		Meas. 3		Meas. 4	
Capreolus capreolus	3c	Phalanx 2	Bp	13,8						
Capreolus capreolus	3c	Phalanx 2	Bp	12,3						
Capreolus capreolus	3d	Phalanx 2	Bp	10,9						
Capreolus capreolus	3d	Phalanx 2	Bp	10,2						
Capreolus capreolus	3d	Phalanx 2	GL	26,6						
Canis familiaris	2	Phalanx 2	GL	10	Bp	6,5	Bd	6		
Canis familiaris	1b	Talus	GL	25,6						
Canis familiaris	3b	Mt IV	GL	67,6	SD	5,2	Bd	8,5		
Canis lupus	3c	Scapula	GLP	38,5	SLC	30,8	LG	29,8	BG	22
Canis lupus	3c	Phalanx 1	GL	28,1	Bp	10,2	SD	6,6	Bd	8,3
Vulpes vulpes	3b	Mc IV	GL	44,2	Bd	5,2				
Meles meles	3b	Mc I	GL	28,3						
Meles meles	3b	Mc 3	GL	29,9	Bd	6,6				
Meles meles	3b	Mt IV	GL	32,1	Bd	6,2				
Meles meles	3c	Mc III	GL	34,4	Bd	6,8				
Meles meles	3c	Mc III	GL	31,7	Bd	6,2				
Meles meles	3c	Mc IV	GL	29,8	Bd	7				
Meles meles	3c	Mt III	GL	32,8	Bd	6,7				
Meles meles	3c	Mt III	GL	31,8	Bd	6				
Meles meles	3c	Mt III	GL	33,2	Bd	6,9				
Meles meles	3c	Mt IV	Bd	6,8						
Martes sp.	3b	Humerus	Bd	15						
Martes sp.	3b	Radius	GL	52,2	Bp	6,2	SD	3,4	Bd	8,5
Martes sp.	3c	Radius	Bd	6,1						
Lutra lutra	3b	Humerus	Bd	27,4						
Lutra lutra	3b	Talus	GL	18,4						
Lutra lutra	3c	Ulna	DPA	12,7	SDO	11,6	BPC	7,5		
Lutra lutra	3c	Ulna	DPA	11,8	SDO	10,5				
Lynx lynx	3c	Mandibula	7	15,5						