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The fauna of Cerè Cave (Venetia Region, Northern Italy). II – *Marmota marmota* Linnaeus, 1758 remains. A short cranial and mandibular morpho-dimensional analysis

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Abstract: The analysis of the composition of the faunistic association of Cerè Cave (Verona, Venetia Region) continues, after the study effected on the fossils of *Ursus spelaeus* Rosenmüller-Heinroth, 1794, with the one on the *Marmota marmota* L., 1758 remains. The great quantity of the specimens has permitted to advance a detailed morpho-dimensional study of the cranial and mandibular remains. The preliminary results evidence that the population of this zone of the Verona area is in size very similar to the recent and actual marmots of the Piedmont and of the area neighbouring Como (Bulgarograsso and Olgiate Comasco villages –Lombardy–) and that the components are smaller than the Pleistocenic ones of Parmorari (Liguria Region).

Riassunto: L'analisi della composizione dell'associazione faunistica della Grotta del Cerè (Verona) prosegue con lo studio dei resti di *Marmota marmota* L., 1758 dopo quello compiuto sui fossili di *Ursus spelaeus* Rosenmüller-Heinroth, 1794. Il notevole quantitativo di resti ha permesso di condurre uno studio morfo-dimensionale particolarmente approfondito sui fossili craniali e mandibolari. I risultati preliminari evidenziano, per la popolazione di questa zona del Veronese, dimensioni molto prossime a quelle delle marmotte recenti ed attuali del Piemonte e dell'area intorno a Como (Bulgarograsso ed Olgiate Comasco) ed inferiori rispetto a quelle delle marmotte pleistoceniche di Parmorari (Liguria).

Key words: *Marmota*, Cerè Cave, comparison, Upper Pleistocene-Holocene

INTRODUCTION

Marmots are surely vertebrates that mark the actual alpine fauna. Their habitat of life is a fundamental element in order to explain the paucity of remains of these vertebrates. Anyway, various studies are effected about the specimens stored in different institutes of research (AIMAR 1982, SANTI *et al.* 2002).

This note has two goals: to continue the analysis of the faunistic association that lived in the Upper Pleistocene-Holocene times in the Cerè Cave (Verona, Venetia Region) (Fig. 1), after that the fossils of bears have been first analysed (ROSSI & SANTI 2001), and secondly to give an enlargement of the knowledge about the alpine marmots, not only with a morphological analysis, but with the comparison to what is known in literature, too.

PREVIOUS STUDIES

The former studies about marmots began in the second half of the nineteenth century (SANTI *et al.* 2002 and reference therein) concerning the fossils coming from Piedmont and Lombardy. Referring to the «Three Venetia» region, DAL PIAZ (1900) described in his study some bones discovered in S. Donà di Lamon Cave (Belluno Province), while FABIANI (1903) described one mandible found in San Bernardino Cave (Vicenza zone, Berici Hills). Besides,

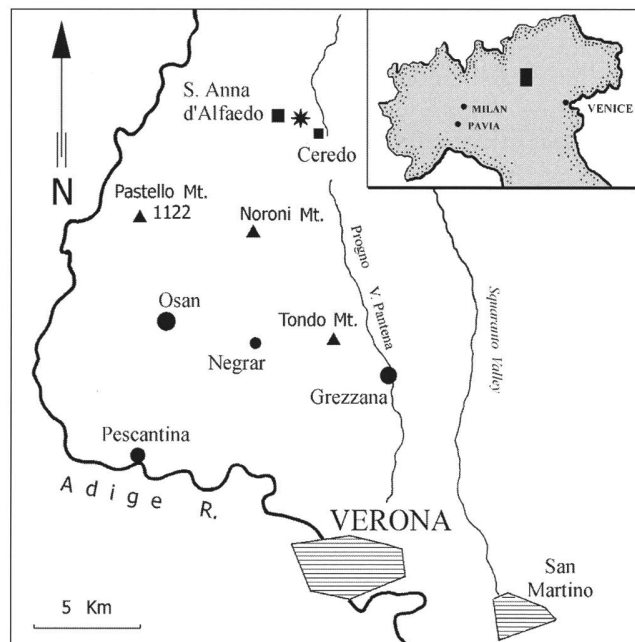


Fig. 1 – Geographical position of the Cerè Cave (Verona Province).

a new discovery was made in Velika Jama Cave (Friuli Region) by GORTANI (1909) and inside the Mala Peci Cave (near Cividale del Friuli) by LEONARDI (1933). Anyway, these remains were reported in secondary position in comparison to the ones of Fontana Marella Cave (Varese zone,

Lombardy) described by AIRAGHI (1922). VENZO (1954) studying in particular the marmots population from Sambughetto Valstrona Caves (near Orta Lake), advanced merely climatic considerations. Marmots, like other animals of similar habitat, should be related to a withdrawal phase of the ices (Interstadium Würm I/ Würm II) that made this area habitable again. Some phylogenetic analyses were led by GIACOBINI (1992) and MEIN (1992), while AIMAR (1992) furnished a morphometric examination of the Pleistocene and actual marmots remains coming from Parmorari (Borgio Verezzi -Savona-, Liguria Region) and from Piedmont. Studies effected by CHALINE (1972) and PATOU (1987) mostly considered the effects of human action on the marmot remains from De la Passagère de Méaudré Cave (Vercors, France). Lastly, a morpho-anatomical examination was achieved by SANTI *et al.* (2002) on the specimens coming from Bulgarograsso and Olgiate Comasco in the Como Province (Lombardy), while DI CANZIO & PETRONIO (2001) gave notice of the finding of a mandible in Cola Cave (L'Aquila).

SHORT DESCRIPTION OF THE REMAINS

Marmota marmota L., 1758 remains (12 skulls and 73 mandibles) kept in the Museo Civico di Storia Naturale of Verona are not complete. In the skulls, the zygomatic arches are lacking at least on one side, and the nasals are often lacking, too. In the mandibles the erosion has acted more on the bone extremities, near the incisive part of the coronoid process and on the angular process. The cheek-tooth row are very well preserved. They are decidedly important as morphometric key and almost ever complete. According to Chaline (pers. comm.) should be interesting to use the new methods of geometrical morphology for the skulls and the Fourier analysis for the mandibles. These methods are impossible to use in this work because of lowest number and incompleteness of specimens. Tab.1 shows some biometrical data on the analysed remains utilising the parameters codified by VON DRIESCH (1976).

DISCUSSION

The useful morphometric parameters and the comparison with the material known in literature, coming from North Italy localities (Parmorari, near Como and Piedmont), have permitted to advance some relations and to explain their meaning. Skulls present a smaller size in comparison to the ones coming from Parmorari (Upper Pleistocene), but they are similar to the ones which belong to the marmots coming from Como and Piedmont (Upper Pleistocene-Holocene). Similar observations can be advanced utilising other parameters. These data confirm the ones for the marmots of Como Province advanced by SANTI *et al.* (2002): for them the authors support the hypothesis of the appurtenance to different races respect to the ones from Piedmont and Parmorari and everyone should be linked to the typical ecological niche. For us, an important

morphometric element is given by the relation between the *Length of the diastema* and the *Length of the cheektooth row*: In fact, the Cerè marmots have a intermediate size between the marmots coming from Piedmont (smallest) and from Como, too (bigger in size). The Cerè remains are characterised by maximum values of the length of the diastema corresponding to the minimum ones of the Parmorari marmots, but however similar to the specimens from Como Province and bigger than the specimens from Piedmont (SANTI *et al.* 2002). These last seem to have a lowermost size between the considered populations, whatever relation is used. The dimensions of the Cerè marmots are in general similar to the ones of Como. This could mean that the evolution trend has first foreseen the bigger sizes corresponding to the Parmorari specimens (more ancient) and successively, the smaller ones corresponding to the Como and Cerè marmots (more recent).

For the mandibles, the morphometric element that mostly shows up is the great variability of the sturdiness degree of the mandibles, also inside the single population, probably linked to differences in the habitat. In fact, the morphometric parameters almost ever present a great hori-

Tab. 1 - Minimum, Maximum values, means and standard deviation for the parameters referring to the skulls, mandibles and teeth of *Marmota marmota* L., 1758. Parameters are referred to VON DRIESCH (1976) schemas.

Skull (n. 12)-Parameters	Min	Max	Mean	St. Dev.
Total length	86	91	89.25	0.707
Condylbasal length	82	88	85.88	2.720
Basal length	81.5	86	84.5	2.041
Dental length	41.5	51	48.5	4.000
Greatest nasals length	33.5	39.5	36	2.549
Frontal length	58	62	60.3	1.643
Viscerocranium length	24	37	31.58	4.454
Cheektooth length	20	25	22	1.658
Diastema length	22	25	23.58	1.021
Breadth of occipital condyles	17	20	18.38	0.993
Breadth across acoustic meatus	38	43.5	40.9	2.074
Neurocranium breadth	33	29.5	31.38	1.493
Oral zygomatic breadth	60	57	58.5	2.121
Palatal breadth	16	13.5	14.42	0.917
Mandible (n. 73)-Param.	Min	Max	Mean	St. Dev.
Greatest length	52	63	59.35	3.300
Cheektooth length	11.5	24.5	19.82	1.417
Length M3-infradentale	28	39.5	34.32	1.937
Diastema length	10	19	14.49	1.762
Height vertical ramus	26	32.5	29.9	1.926
Mandible height in front P3	15	22	18.89	1.223
Teeth-Parameters	Min	Max	Mean	St. Dev.
M ¹ (Length) (n.6)	4	5	4.25	0.418
M ¹ (Breadth) (n.6)	5	5.5	5.08	0.204
M ² (Length) (n.7)	4	5	4.5	0.408
M ² (Breadth) (n.7)	5	5.5	5.14	0.244
M ³ (Length) (n.7)	5	6	5.57	0.450
M ³ (Breadth) (n.7)	5	6	5.43	0.393
M ₁ (Length) (n.81)	4	5.5	4.33	0.418
M ₁ (Breadth) (n.81)	4	5.5	4.56	0.426
M ₂ (Length) (n.71)	4	5.5	4.5	0.474
M ₂ (Breadth) (n.76)	4.5	6.5	5.87	0.369
M ₃ (Length) (n.69)	4.5	6.5	5.51	0.499
M ₃ (Breadth) (n.62)	5	6	5.47	0.392

zontal distribution. Also in the mandibles case, the Parmorari marmots are always bigger in comparison to the ones of the specimens from the others deposits, furnishing the data corresponding to the skulls, too. The considerations advanced by SANTI *et al.* (2002) for the Como marmots are valid for the Cerè population, too. In fact, the mandible of the Parmorari marmot is more strong in comparison to the ones of Como, Piedmont and Cerè.

A SHORT CONCLUSIVE REMARKS

The morphometric analysis of the skull and mandibular remains of the population of *Marmota marmota* L., 1758 of Cerè has shown that their dimensions were similar to the ones of the Como (Bulgarograsso and Olgiate Comasco) and Piedmont marmots (SANTI *et al.* 2002). Therefore, it is possible to ascribe them to the Upper Pleistocene-Lower Holocene. The preliminary analysis of the skulls and of the mandibles does not show a clear separation between the actual populations and the more ancient one of Parmorari. A large variability, probably linked to a little variation of the habitat conditions, is defined.

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