Acta zoologica cracoviensia, **45**(special issue): 117-131, Kraków, 29 Nov., 2002

Exploitation of Anseriformes at two Upper Palaeolithic sites in Southern Italy: Grotta Romanelli (Lecce, Apulia) and Grotta del Santuario della Madonna a Praia a Mare (Cosenza, Calabria)

Antonio TAGLIACOZZO and Monica GALA

Received: 7 Jan., 2002
Accepted for publication: 2 Mar., 2002

TAGLIACOZZO A., GALA M. 2002. Exploitation of Anseriformes at two Upper Palaeolithic sites in Southern Italy: Grotta Romanelli (Lecce, Apulia) and Grotta del Santuario della Madonna a Praia a Mare (Cosenza, Calabria). In: Proceedings of the 4th Meeting of the ICAZ Bird Working Group Kraków, Poland, 11-15 September, 2001. *Acta zoologica cracoviensia*, **45**(special issue): 117-131.

Abstract. In this paper the results of an analysis of bone surfaces of Anseriformes from the Epigravettian levels of Grotta Romanelli ("Terre brune" formation, levels A-E), are compared with new data from the level "L" of Grotta della Madonna. A large number of bird remains were found in these two caves: over 32,000 specimens (3,650 individuals) belonging to 109 species from Grotta Romanelli and over 7,400 bones (still under investigation) from Grotta della Madonna. In both sites many species from aquatic environments are present, mainly Anseriformes. However, at Grotta della Madonna there is a prevalence of duck species, that lived in the large delta. Among these Mallard *Anas platyrhynchos*, Pochard *Aythya ferina* and Tufted Duck *Aythya fuligula* are dominant. At Grotta Romanelli the coastal plain had abundant marshy areas, where geese were frequent (White-fronted Goose *Anser albifrons*, Bean Goose *Anser fabalis* and Brent Goose *Branta bernicla*). Despite the different composition of the two bird assemblages, there are similarities in the human traces left on the bones. A thorough analysis of all the bones of Anseriformes was carried out with an optical microscope. This was done so as to identify the precise location and character of the butchery marks. This, together with the analysis of burning traces, allowed the identification of analogous butchery strategies and cooking patterns for Anseriformes at both sites. Modifications on bone surfaces are particularly frequent on the humerus and coracoid. The breakage of many furculae of different species is probably the result of human activity, and is similar in the two sites.

Key words: Italy, Final Epigravettian, Anseriformes, taphonomy, butchering.

Antonio TAGLIACOZZO, Monica GALA, Soprintendenza Speciale al Museo Nazionale Preistorico Etnografico "L. Pigorini", Sezione di Paleontologia del Quaternario e Archeozoologia, Piazzale G. Marconi, 14, 00144 Roma, Italy and Istituto Italiano Paleontologia Umana, Piazza Mincio, 2, 00198 Roma, Italy.
E-mail: pigorini@arti.beniculturali.it
tagliant@tin.it
monarix@yahoo.it

I. INTRODUCTION

This paper presents the preliminary results of an analysis of Anseriforme bone surfaces of the Final Epigravettian levels (Upper Palaeolithic) from the coastal sites of Grotta Romanelli and Grotta del Santuario della Madonna di Praia a Mare, located in the southernmost part of Apulia and

on the Southern Thyrrhenian coast of northern Calabria respectively (Fig. 1) (STASI & REGALIA 1905; BLANC 1920; CARDINI 1972).

Fig. 1. Map of Italy showing the location of Grotta Romanelli (Lecce, Apulia) and Grotta della Madonna di Praia a Mare (Cosenza, Calabria).

Grotta della Madonna was continuously occupied from the Upper Palaeolithic until the Late Roman Period. Archeozoological and palaeoeconomic data from the Holocene layers have already been analyzed by TAGLIACOZZO (2000). In level L (dated by ^{14}C between 12,100±150 and 9,020±125 BP (ALESSIO et al. 1966, 1967), over 7,400 bird bones belonging to 79 species have been found and are still being studied.

At Grotta Romanelli the upper levels, "Terre brune" formation (layers A-E), have been dated between 11,930±520 and 9,980±100 BP (ALESSIO et al. 1964, 1967; VOGEL & WATERBOLK 1963). In these layers over 52,000 remains of mammals, birds, and fishes have been identified, and among these bird bones (over 32,000 of about 3,650 individuals) belonging to 109 different species.

Pier Francesco CASSOLI identified the bird remains found in these two caves. In an article (CASSOLI 1992) he discussed the palaeoclimatic and palaecological relationships between these two bird assemblages. Other studies have already been carried out on Grotta Romanelli, its paleoenvironment (CASSOLI et al. 1979) and palaeoeconomy (GALA 1996-1997; CASSOLI & TAGLIACOZZO 1997; CASSOLI et al. in press). The taphonomic analysis of the bone remains of many different species of geese and ducks has also been published previously (TAGLIACOZZO & GALA 2000).

The systematics and nomenclature adopted in this article follows the CD-rom edited by Oxford University Press: *The Complete Birds of the Western Palearctic* (1998), while data on the ecology of the different species are also from ARRIGONI DEGLI ODDI (1902), VOOUS (1960), and BRUUN & SINGER (1991). The anatomical terms used are based on COHEN & SERJEANTSON (1996).

A c k n o w l e d g e m e n t s. A particular thanks to P. F. CASSOLI for his fundamental contribution to the beginning of this research and to the Segretario dell'Istituto Italiano di Paleontologia Umana of Rome for allowing us to study this important prehistoric site. We also wish to

thank Ivana FIORE for her help in the taphonomic analysis of bone surfaces and for the acquisition and processing of computer images.

The S.E.M. photographs of the striae were taken at the laboratory of Paleontologia Umana, Dipartimento di Anatomia, Farmacologia e Medicina Legale dell'Università di Torino directed by prof. Giacomo GIACOBINI and at the ENEA (Ente Nazionale per le nuove tecnologie, l'Energia e l'Ambiente) – Unità Salvaguardia Patrimonio Artistico, Centro Ricerche Casaccia, in collaboration with F. PIERDOMINICI and G. TROJSI. The photographs of bone specimens were done by Damiano ROSA at the photographic laboratory of the Museo Nazionale Preistorico Etnografico "L. Pigorini" di Roma.

II. PALAEOECOLOGY

At Grotta Romanelli species of temperate climate living in a steppe environment are prevalent. In particular remains of Little Bustard *Tetrax tetrax* (LINNAEUS, 1758) (about 68% of the bird bones identified) are abundant, but there is also a high frequency of Great Bustard *Otis tarda* LINNAEUS, 1758. Boreal and arctic species, of lagoonal habitats are nonetheless numerous and are represented by Anseriformes, mainly White-fronted Goose *Anser albifrons*, Brent Goose *Branta bernicla* and Bean Goose *Anser fabalis* (Table I).

Table I

Bones of particular species of Anseriformes from Grotta Romanelli and Grotta della Madonna: number of identified specimens (NISP) and minimum number of individuals (MNI)

Species	Grotta Romanelli Layer "terre brune"				Grotta della Madonna Layer L			
	NISP	%	MNI	%	NISP	%	MNI	%
Cygnus cygnus (LINNAEUS, 1758)	**16**	0.050	**6**	0.16	**18**	3.06	**2**	2.47
Anser fabalis (LATHAM, 1787)	**1399**	4.344	**175**	4.76	**3**	0.51	**1**	1.23
Anser brachyrhynchus BAILLON, 1833	**16**	0.050	**8**	0.22				
Anser albifrons (SCOPOLI, 1769)	**3473**	10.784	**511**	13.90	**24**	4.08	**4**	4.94
Anser erythropus (LINNAEUS, 1758)	**29**	0.090	**10**	0.27				
Anser anser (LINNAEUS, 1758)	**86**	0.267	**19**	0.52	**3**	0.51	**1**	1.23
Anser caerulescens (LINNAEUS, 1758)	**30**	0.093	**15**	0.41				
Branta leucopsis (BECHSTEIN, 1803)	**144**	0.447	**44**	1.20				
Branta bernicla (LINNAEUS, 1758)	**1859**	5.772	**280**	7.61				
Branta ruficollis (PALLAS, 1769)	**57**	0.177	**24**	0.65				
Tadorna tadorna (LINNAEUS, 1758)	**3**	0.009	**3**	0.08	**4**	0.68	**1**	1.23
Anas penelope LINNAEUS, 1758	**241**	0.748	**46**	1.25	**5**	0.85	**2**	2.47
Anas strepera LINNAEUS, 1758	**123**	0.382	**23**	0.63	**8**	1.36	**3**	3.70
Anas crecca LINNAEUS, 1758	**32**	0.099	**12**	0.33				
Anas platyrhynchos LINNAEUS, 1758	**43**	0.134	**13**	0.35	**263**	44.73	**28**	34.57
Anas acuta LINNAEUS, 1758	**28**	0.087	**10**	0.27	**37**	6.29	**7**	8.64
Anas querquedula LINNAEUS, 1758	**2**	0.006	**2**	0.05	**3**	0.51	**1**	1.23
Anas clypeata LINNAEUS, 1758	**9**	0.028	**3**	0.08				
Netta rufina (PALLAS, 1773)	**7**	0.022	**4**	0.11	**16**	2.72	**5**	6.17
Aythya ferina (LINNAEUS, 1758)	**46**	0.143	**12**	0.33	**86**	14.63	**7**	8.64
Aythya nyroca (GÜLDENSTÄDT, 1770)	**7**	0.022	**5**	0.14	**22**	3.74	**2**	2.47
Aythya fuligula (LINNAEUS, 1758)	**3**	0.009	**3**	0.08	**76**	12.93	**9**	11.11
Somateria mollissima (LINNAEUS, 1758)					**3**	0.51	**2**	2.47
Clangula hyemalis (LINNAEUS, 1758)	**5**	0.016	**3**	0.08				
Melanitta fusca (LINNAEUS, 1758)	**7**	0.022	**6**	0.16				
Bucephala clangula (LINNAEUS, 1758)	**1**	0.003	**1**	0.03	**3**	0.51	**1**	1.23
Mergellusus albellus (LINNAEUS, 1758)	**2**	0.006	**2**	0.05				
Mergus serrator LINNAEUS, 1758	**1**	0.003	**1**	0.03	**7**	1.19	**2**	2.47
Mergus merganser LINNAEUS, 1758					**7**	1.19	**3**	3.70
Oxyura leucocephala (SCOPOLI, 1769)	**2**	0.006	**2**	0.05				
TOTAL	**7671**	100.000	**1243**	100.00	**588**	100.00	**81**	100.00

Only a few specimens belong to birds of marine, wooded or rocky environments or to montane or subtropical species. The latter, of great ecological interest, are represented only by two species: the Pin-tailed Sandgrouse *Pterocles alchata* (LINNAEUS, 1766) and the Black-bellied Sandgrouse *Pterocles orientalis* (LINNAEUS, 1758) now living in an arid environment in southern France, the Iberian Peninsula, in North Africa and in the Near East (CASSOLI 1972, 1992). Among the marine birds the presence of North-Atlantic and subartic species should be mentioned. These belong to a typical maritime facies and include the Black-throated Diver *Gavia arctica* (LINNAEUS, 1758), the Red-throated Diver *Gavia stellata* (PONTOPPIDAN, 1763), the Great Black-backed Gull *Larus marinus* LINNAEUS, 1758, the Kittiwake *Rissa tridactyla* (LINNAEUS, 1758) and the Great Auk *Pinguinus impennis* (LINNAEUS, 1758) (BLANC 1928; CASSOLI & SEGRE 1985; CASSOLI 1992).

At Grotta della Madonna the "rock" species are prevalent, mainly due to the high frequency of Rock Dove *Columba livia* GMELIN, 1789. The greater incidence of Columbidae compared to montane species such as Alpine Chough *Pyrrhocorax graculus* (LINNAEUS, 1766) and Chough *Pyrrhocorax pyrrhocorax* (LINNAEUS, 1758), confirms a temperate climate throughout the period of the deposition of the final Epigravettian layer. However, there are also rare remains of birds reflecting colder phases such as the Black-throated Diver *G. arctica*, the Red-throated Diver *G. stellata*, the Whooper Swan *Cygnus cygnus*, the White-fronted Goose *A. albifrons*, the Eider *Somateria mollissima* (LINNAEUS, 1758), the Buzzard *Buteo buteo* (LINNAEUS, 1758), and the Herring Gull *Larus argentatus* PONTOPPIDAN, 1763. The large delta close to the cave allowed the capture of several species from lagoonal habitats: the Coot *Fulica atra* LINNAEUS, 1758, the Bittern *Botaurus stellaris* (LINNAEUS, 1758), the Great Crested Grebe *Podiceps cristatus* (LINNAEUS, 1758) and the Little Grebe *Tachybaptus ruficollis* (PALLAS, 1764) together with Anseriformes. Among these the Mallard *Anas platyrhynchos*, the Pochard *Aythya ferina* and the Tufted Duck *Aythya fuligula* are prevalent (Table I). It is also very interesting to note the presence of the Black-bellied Sandgrouse *P. orientalis*, a species of arid desert environment and warm climate already identified also at Grotta Romanelli.

III. TAPHONOMIC STUDY

A thorough analysis of all bones of Anseriformes was carried out under optical microscope. Some samples of cut marks were verified using the stereomicroscope (Fig. 2: 2-4; Fig. 5: 1-2; Fig. 6: 1-4) and the scanning electron microscope (S.E.M.) (Fig. 2: 1; Fig. 4: 9, 11). Provil-L silicon rubber and RBS polyurethane resin were employed to produce replicas for S.E.M. observation. This was aimed at the identification of the precise location and characters of the butchery marks. The striae identified have variable typology (thin, deep, long, short, transverse, longitudinal, etc.) and may be single (present only in one area of the bone), repeated (cases of cuts in several points of the same area) and multiple (in different areas of the same bone). The analysis of the striae, together with that of burning traces, allowed the identification of butchery strategies and cooking patterns adopted at both sites (Tables II, III).

The taphonomic analysis of a large sample of humeri and coracoids of all bird species and of the bone remains of many different species of geese and ducks from Grotta Romanelli has already been published (CASSOLI & TAGLIACOZZO 1997; TAGLIACOZZO & GALA 2000). From these studies it emerged that humeri and coracoids are the most frequent elements and also the most commonly modified among the bones of the different species (Table III). The observation on the location and the morphology of the traces on the humeri (Fig. 2) and on the coracoids revealed a systematic repetition of the actions made not only on the carcasses of Anseriformes, Otididae, and Columbiformes, but also on some species without a particular alimentary interest (eagles, hawks, owls, corvids). As regards the Anseriformes in particular some actions, related to carcass processing, seem to be carried out in a systematic manner on the swans and the largest geese as well as on the smallest ducks: disarticulation of the wing from the body, cooking of the wing, disarticulation of the distal elements from the humerus and disarticulation of the tibiotarsus from the tarsometatarsus. In other cases there

Table II

Anseriformes from Grotta della Madonna: relationship between the anatomical elements identified and those with marks produced by lithic tools (in italics)

SPECIES	CRANIUM	VERTE-BRAE	STERNUM	FURCULA	CORACOID	SCAPULA	HUMERUS	RADIUS	ULNA	CARPOMET.	PHAL. ANT.	PELVIS	FEMUR	TIBIO-TARSUS	FIBULA	TARSOMET.	PHAL. POST.	TOTAL	
NISP	NISP	NISP	NISP	NISP	NISP	NISP	NISP	NISP	NISP	NISP	NISP	NISP	NISP	NISP	NISP	NISP	NISP	NISP	% of bones with cut marks
Cygnus cygnus		9	2					1	1	1	3						1	**18**	
Anser fabalis					1 *1*	1 *1*						1						**3** *2*	66.7
Anser albifrons			2	2	7 *4*	2	4 *1*	1	1	2		1	1	1				**24** *5*	20.8
Anser anser			1							1				1 *1*				**3** *1*	33.3
Tadorna tadorna	1											1	1	1				**4**	
Anas penelope			1						2	1	1							**5**	
Anas strepera							1	2		5								**8**	
Anas platyrhynchos	21		8	20 *1*	35 *13*	27 *2*	50 *15*	25	10	8 *1*	9	7	5 *1*	27 *2*	1	7	3	**263** *35*	13.3
Anas acuta			1	7	6 *1*	6	5	2	2	2	1			5				**37** *1*	2.7
Anas querquedula									1	1				1				**3**	
Netta rufina			1	3		5	1					2		4				**16**	
Aythya ferina	7		6	1	12 *2*	6	15	7 *1*	10	6	3	1	4	5	1	2		**86** *3*	3.5
Aythya nyroca	2				1	2	4	5	1	4	1			2				**22**	
Aythya fuligula	1		4	7	17	12	12 *3*	7	7					6 *1*		3		**76** *4*	5.3
Somateria mollissima			1									2 *1*						**3** *1*	33.3
Bucephala clangula			1						1				1					**3**	
Mergus serrator			1	1			1				2			2				**7**	
Mergus merganser					1							1	3			2		**7**	
Total	32	9	29	41 *1*	80 *21*	61 *3*	93 *19*	50 *1*	36	31 *1*	20	16 *1*	15 *1*	55 *4*	2	14	4	**588** *52*	8.8

Table III

Number of identified specimens (NISP) and occurrence of cut marks from both sites. Percentage refers to the total NISP

	Grotta Romanelli				Grotta della Madonna			
			with cut marks				with cut marks	
Skeletal elements	Total NISP	%	NISP	%	Total NISP	%	NISP	%
Sternum	**363**	4.7	**2**	0.6	**29**	4.9		
Furcula	**450**	5.9	**2**	0.4	**41**	7.0	**1**	2.4
Coracoid	**2143**	27.9	**263**	12.3	**80**	13.6	**21**	26.3
Scapula	**1194**	15.6	**16**	1.3	**61**	10.4	**3**	4.9
Humerus	**2136**	27.8	**1272**	59.6	**93**	15.8	**19**	20.4
Radius	**88**	1.1	**3**	3.4	**50**	8.5	**1**	2.0
Ulna	**317**	4.1	**7**	2.2	**36**	6.1		
Carpometacarpus	**459**	6.0	**3**	0.7	**31**	5.3	**1**	3.2
Pelvis	**39**	0.5	**8**	20.5	**16**	2.7	**1**	6.3
Femur	**80**	1.0	**1**	1.3	**15**	2.6	**1**	6.7
Tibiotarsus	**230**	3.0	**5**	2.2	**55**	9.4	**4**	7.3
Other	**172**	2.2			**81**	13.8		
TOTAL	**7671**		**1582**	20.6	**588**		**52**	8.8

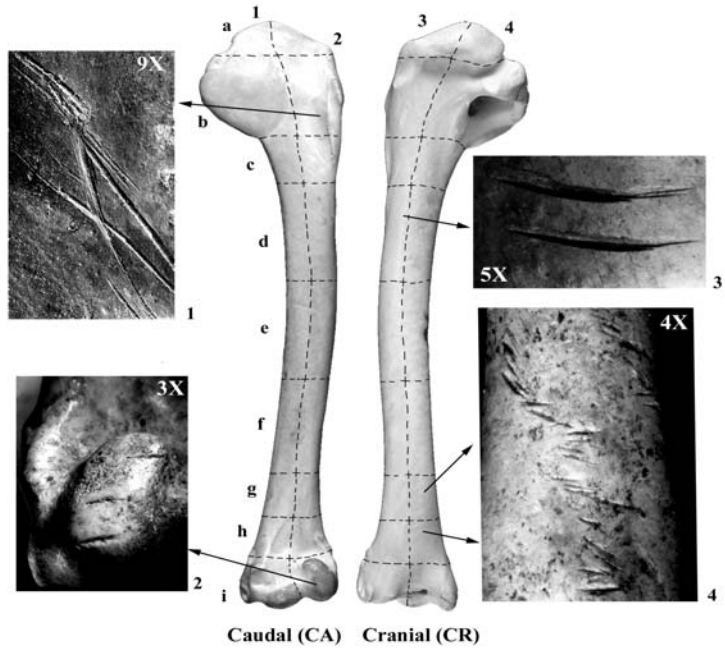

Fig. 2. Grotta Romanelli. Examples of cut marks on different areas of the humerus. 1, 4, *Anas penelope*, right humerus; 2, *Anser albifrons*, right humerus; 3, *Anser anser*, left humerus (1, image with S.E.M. 2-4, images with stereomicroscope).

Fig. 3. Grotta Romanelli. 1, *Anser caerulescens,* right humerus with cut marks on areas CA2bc and traces of burning on the head. 2, detail of no. 1.

seems to be a partial difference in the treatment of animals of different sizes: different areas of burning on the coracoids of geese (on the distal end) and ducks (on the proximal end), different locations for the prevalence of striae on the humerus of swan (CA1h and CR4i areas), geese (CA2bc areas), and ducks (CR3cd areas). The humeri of swans from Grotta Romanelli show cuts on the caudal and cranial faces of the distal portion of the diaphysis. These traces are produced during the disarticulation of the humerus from the radius-ulna. The humeri of the geese show cut marks, especially on the caudal face, in the area between the pectoral crest and the bicipital surfaces that often run along the bicipital furrow (Fig. 2: 1). These traces are more difficult to attribute to a particular action, above all because they are longitudinal and run along the bone at the point of the insertion of the front deltoid muscle. One may suggest that these traces were also the product of a reduction of the carcasses of large birds into smaller portions (slicing/filleting) and perhaps recovering bone and wings of the rarest species that were of smaller size. In the humeri of ducks and some geese, cut marks are found most frequently on the cranial face of the proximal part of the diaphysis near the deltoid crest (Fig. 2: 3). These traces are considered to be the result of filleting. The Anseriformes from Grotta della Madonna (a total of 588 fragments), show a clear prevalence of remains belonging to the wing, mainly humeri (93) and coracoids (80) (Table II). These are followed by scapulae, tibiotarsi and radii. Tarsometatarsi, femora, pelves and vertebral elements are less numerous. Some bone remains show evidence of carnivore or rodent gnawing, however most of the birds are the result of human hunting and the taphonomic study of bone surfaces supports the hypothesis for their exploitation for food or other purposes.

Of the 18 species of Anseriformes identified, 8 present bones with cut marks (Table II). Notwithstanding the higher number of humeri, the anatomical element most commonly having striae is the coracoid (21 specimens), followed by the humerus (19 specimens) (Tables II, III). Other incisions were detected on the tibiotarsus, scapula, furcula, radius, ulna, carpometacarpus, pelvis and femur. Most of the Anseriformes that present bones with cut marks are also associated with burning, especially on the articular ends, although some bones have only butchering or burning traces.

In order to demonstrate either similarities or differences in the butchering strategies for the different Anseriformes, the main results of the analysis of human modifications will be described in the following paragraphs for each bone element.

S t e r n u m

Because of the fragility of the bone and the difficulty in its attribution, only 29 fragments of sterna have been determined to species level. The best preserved portion of the sternum is the one that includes the coracoidal grooves and the external spine. In some cases the apex of the keel and part of the long area for rib attachments is also preserved. Some sterna show burning traces (in one case the specimen reached the typical white/gray color of the calcined bone), but there is no particular area where such traces are concentrated.

F u r c u l a

Only one furcula of *Anas platyrhynchos*, out of a total of 41, shows cut marks near the furcular process. The scarce presence of striae does not exclude a treatment of this anatomical element during butchering activities, in fact often there are fractures on this bone that, because of their recurrence and outline, may be considered intentional. Since in birds the two clavicles are fused, we find one complete clavicle and the other one often broken close to the furcular apophysis (Fig. 4: 1-2). In many cases these fractures have traces of burning. Such modifications may be related to the acquisition and consumption of the breast meat.

C o r a c o i d

The high number of coracoids belonging to the different Anseriformes is due in part to the robustness of the bone itself. In fact 80 coracoids have been determined to species level and more than half of them are complete or lack only a small portion of the bone.

In Figure 5 the areas into which the bones have been divided for the taphonomic analysis are indicated and those where butchering and burning marks are more frequent are shown.

From Table IV it is evident that the areas of the coracoid most frequently involved in butchering activities are: D2f and D2g, close to the distal end usually above the medial angle (Fig. 4: 3; Fig. 5). It is probable that these incisions on the coracoid have been produced after the carcass had been subdivided into two halves, otherwise it would not have been possible to reach such an internal portion of the bone, protected by the mass of the breast muscle.

The proximal area (a and b) is only rarely affected by butchering marks (one coracoid of *Anser albifrons,* one of Pintail, *Anas acuta* and two coracoids of *Aythya ferina*). These incisions represent probably the occasional disarticulation of the coracoid from scapula, humerus and furcula instead of a separation from the sternum as in the case of most coracoids of the Anseriformes. A particular case is represented by two coracoids of *Aythya ferina* where cut marks and burning traces are present in area V4b below the glenoid facet. A coracoid of *Anser albifrons* revealed filleting marks on the ventral face of the bone (area V4ef).

Table IV

Grotta della Madonna: coracoids of Anseriformes with modifications; cut marks and relative percentage; distribution in the different areas and in the different views (see also Fig. 5)

CORACOID		with cut marks		Dorsal					Lateral					
	NISP	NISP	%	2b	2e	2f	1g	2g	1a	4b	4e	4f	3g	4g
Anser fabalis	**1**	**1**	100.00				1	1						
Anser albifrons	**7**	**4**	57.1	1		3		1			1	1		1
Anas platyrhynchos	**35**	**13**	37.1		1	12		8					1	
Anas acuta	**6**	**1**	16.7						1					
Aythya ferina	**12**	**2**	16.7							2				
TOTAL	**61**	**21**	34.4	**1**	**1**	**15**	**1**	10	**1**	**2**	1	1	**1**	1

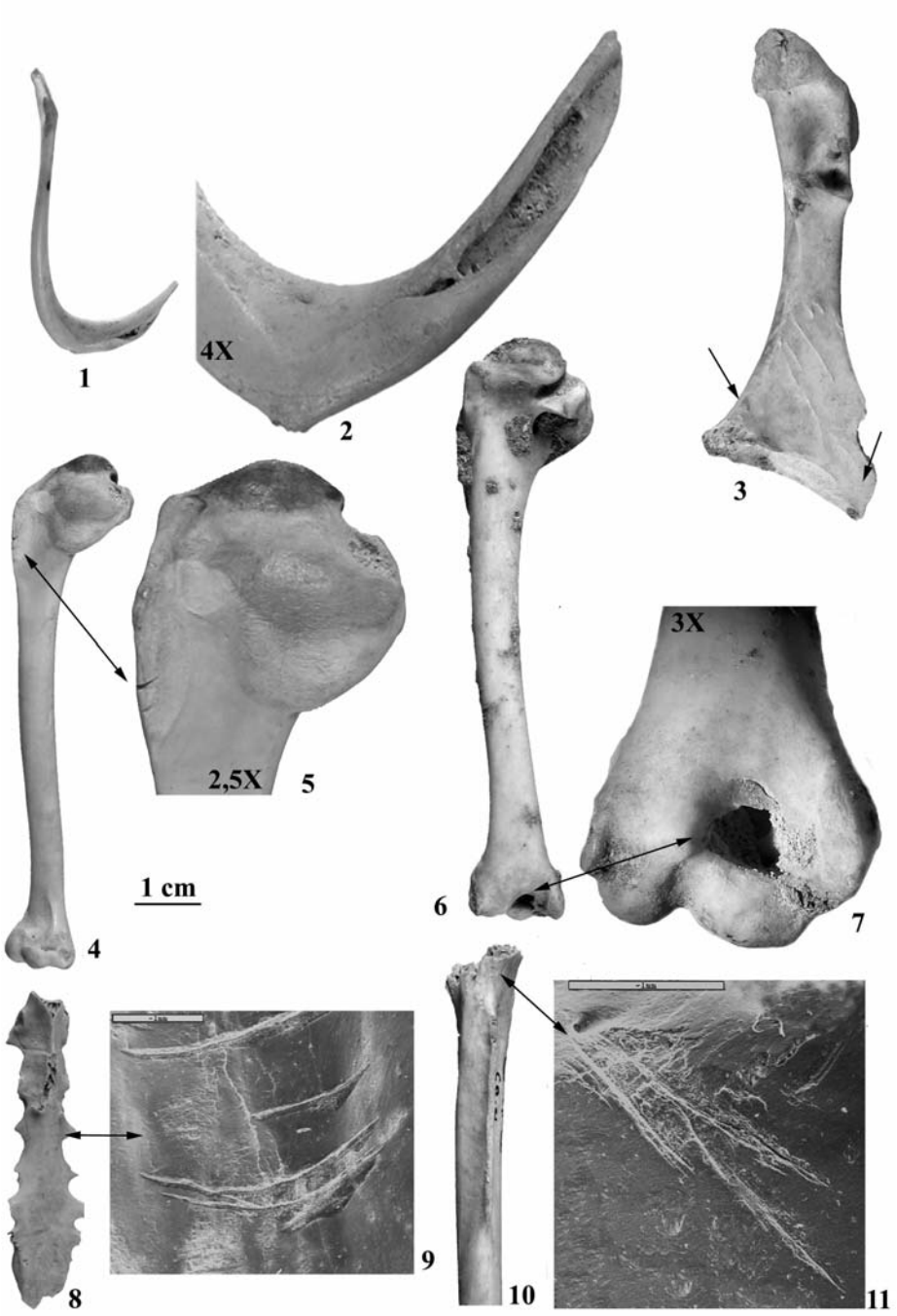

Fig. 4. Grotta della Madonna. 1, *Anas platyrhynchos*, furcula showing intentional breakage. 2, detail of no. 1 (image with stereomicroscope). 3, *Anser fabalis,* right coracoid with cut marks on area D1-2g and traces of burning on the distal ends (see also Fig. 5,2). 4, *Aythya fuligula,* right humerus with cut marks on area CA2b and traces of burning on the head. 5, detail of no. 4 (image with stereomicroscope). 6, *Anas platyrhynchos*, left humerus with perforation on the distal end. 7, detail of no. 6 (image with stereomicroscope). 8, *Somateria mollissima*, synsacrum with cut marks on the ventral face. 9, detail of some striae of no. 8 (image with S.E.M.). 10, *Anser anser*, left tibiotarsus with cut marks. 11, detail of some striae of no. 10 (image with S.E.M.).

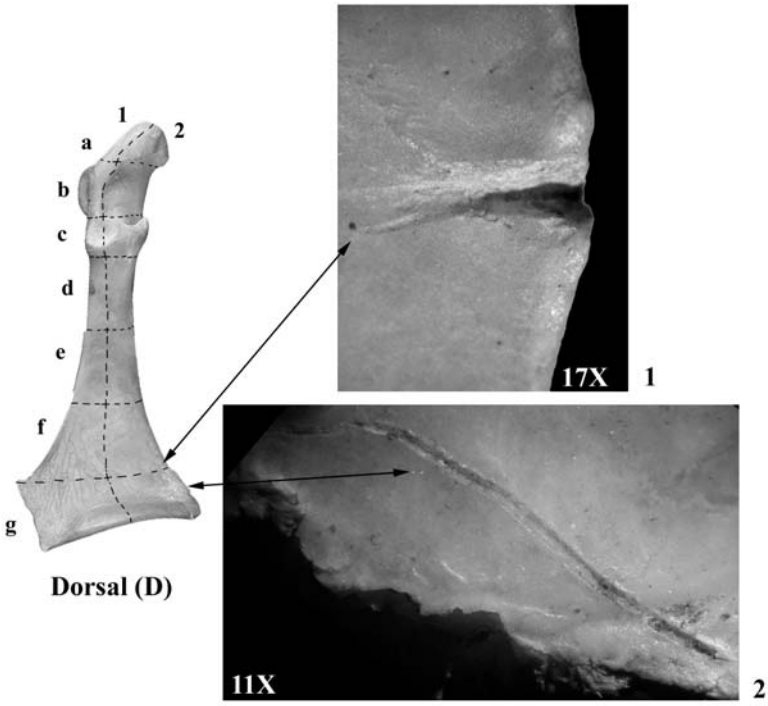

Fig. 5. Grotta della Madonna. Examples of cut marks on different areas of the coracoid. 1, *Anas platyrhynchos*, left coracoid; 2, *Anser fabalis*, right coracoid (images with stereomicroscope).

As regards burning traces, most of them are located on the distal end (sternal facet) (Fig. 4: 3; Fig. 7) although there are some cases of burning on the proximal portion or on the procoracoid process.

S c a p u l a

Compared to the furcula and the sternum, scapulae are more abundant both in number of specimens and in modified bones: 61 of which 3 are incised (Tables II, III). The striae are well visible on the lateral face, both in the proximal area, below the glenoid facet (*Anser fabalis* and *Anas platyrhynchos*) or close to the furcular facet (*A. platyrhynchos*), and on the body of the bone (*A. platyrhynchos*). Such striae are surely related to the disarticulation of the wing from the body. Some burning traces are present on the edges of the fractures of the scapulae.

H u m e r u s

The humerus is the most common bone in the Epigravettian levels of Grotta della Madonna: 15.8% of all Anseriformes bones (Tables II, III). The humeri with butchering marks represent 20.4% of those present and belong to three species: *Anser albifrons*, *Anas platyrhynchos* and *Aythya fuligula*. Most of the humeri show a combination of incisions and combustion traces.

The subdivision of the bone into several areas (Fig. 6) led to the conclusion that the proximal regions CA2ab4a3b and the body of the bone (areas CR3cd) are well attested as having human modifications while only in three cases have striae been detected on the distal ends (area CA1i and CR3-4i) (Table V). Traces of fire are very frequent on the articular head of the humerus (area a; Fig. 4: 4-5) while burning on the distal condyles is rare (area i).

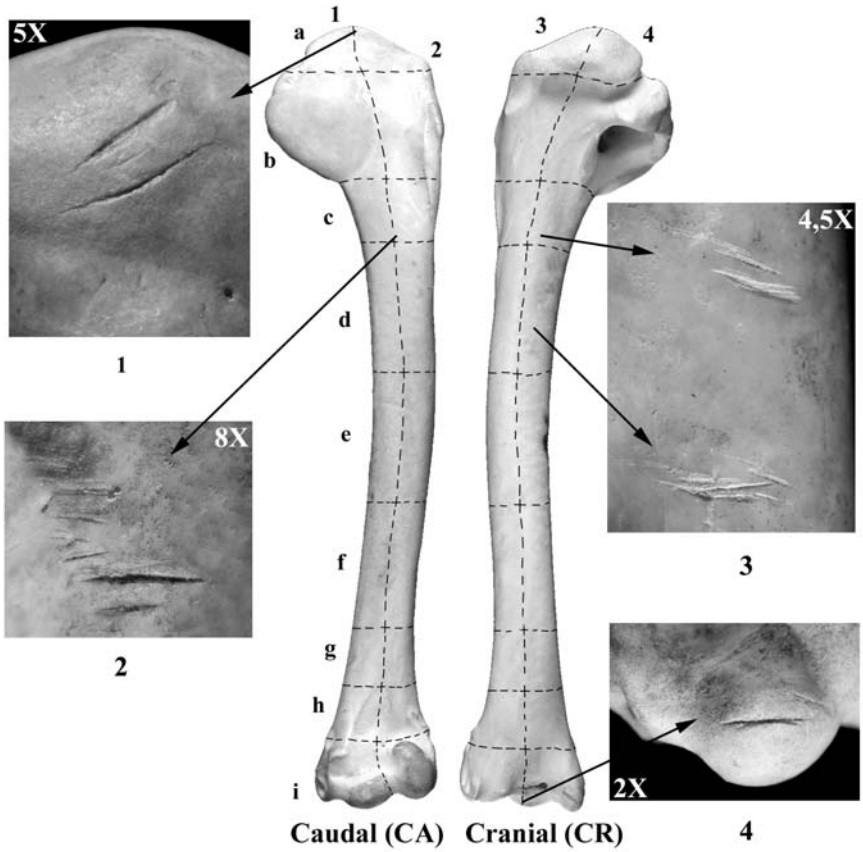

Fig. 6. Grotta della Madonna. Examples of cut marks on different areas of the humerus of *Anas platyrhynchos* (images with stereomicroscope).

Table V

Grotta della Madonna: humeri of Anseriformes with modifications; cut marks and relative percentage; distribution in the different areas and in the different views (see also Fig. 6)

HUMERUS		with cutmarks		Caudal										Cranial								
	NISP	NISP	%	1a	2a	1b	2b	1c	2c	1d	2d	1e	1i	4a	3b	4b	3c	4c	3d	4d	3i	4i
Anser albifrons	**4**	**1**	25												1		1					
Anas platyrhynchos	**50**	**15**	30		3	1	4	2	2	2	1	1	1	4	3	2	4	2	4	1	1	1
Aythya fuligula	**12**	**3**	25	1	1	1			1					1								
TOTAL	**66**	**19**	28.8	**1**	**4**	**2**	**4**	**2**	**3**	**2**	**1**	**1**	**1**	**5**	**4**	**2**	**5**	**2**	**4**	**1**	**1**	**1**

In the proximal area, short and deep striae, parallel or perpendicular to the main axis of the bone on the caudal face (Fig. 6: 1), and oblique on the cranial one, are related to the disarticulation of the humerus from the scapula and the coracoid and to the cutting of the pectoral muscles. The incisions in area CA2b (parallel to the pectoral crest) may also be referred to the same action.

On the caudal face of the humerus, in the area of the bicipital surface (areas CA1bc), some striae, often repeated, have been detected; most of them are long and longitudinal, and to a lesser extent oblique and short. These striae indicate the cutting of the most external muscular masses such as the pectoral, the biceps, and the triceps or to a deeper level the anterior deltoid. The marks close to the articular head may be due to the disarticulation of the humerus from the pectoral girdle, while the purpose of those identified on the bicipital surface is still not clear.

On the cranial face of the humerus, in correspondence to the pectoral crest (areas CR3b), there are many short and deep cuts that may be related to cutting the posterior deltoid, of the ligaments, of the wing membrane and of the anterior and posterior dorsal muscles. On the same area and on the diaphysis of the humerus (areas CA1-2cd and CR3-4cdh), several oblique, thin and long filleting marks are present.

Perforations have been identified on thae crnial face of some humeri, in the olecranon fossa (Fig. 4: 6-7). These may have been produced during the disarticulation of the humerus from the radius-ulna (LAROULANDIE 2000). During the forced extension of the wing, in fact, the olecranon of the ulna penetrating the fossa of the humerus produces perforations (often associated with damage to the distal part of the humerus).

R a d i u s

Notwithstanding the fragility, the radius is the best represented element of the forearm (50 specimens). Sure proofs of human intervention were detected on a radius of *Aythya ferina*: in the proximal portion some marks produced during the disarticulation of the forearm from the humerus have been identified. On several radii burning traces are present usually located on the body of the bone.

U l n a

No butchering marks have been identified on the 36 ulnae analyzed; however, the fact that the articular ends are often broken may indicate an anthropic action on this element, probably aimed to the reduction of the wing into smaller portions. Burning traces are also present.

C a r p o m e t a c a r p u s

Only one carpometacarpus of *Anas platyrhynchos* of the 31 belonging to the Anseriformes from Grotta della Madonna is incised (Tables II, III). Striae are evident on the diaphysis of the major metacarpal, on the ventral face. In some cases fractures of the articular ends are also evident, often associated to burning.

P e l v i s

This anatomical portion is particularly rare (16 fragments) and even more rare are butchering marks: only one pelvis of *Somateria mollissima* presents a series of deep cuts transversal to the axis of the bone (Fig. 4: 8-9).

F e m u r

The femurs are not numerous (15 elements) and only in one case (*Anas platyrhynchos*) present cuts on the proximal portion of the diaphysis on the caudal face. Burning marks on the distal condyles and on the trochanter are more frequent.

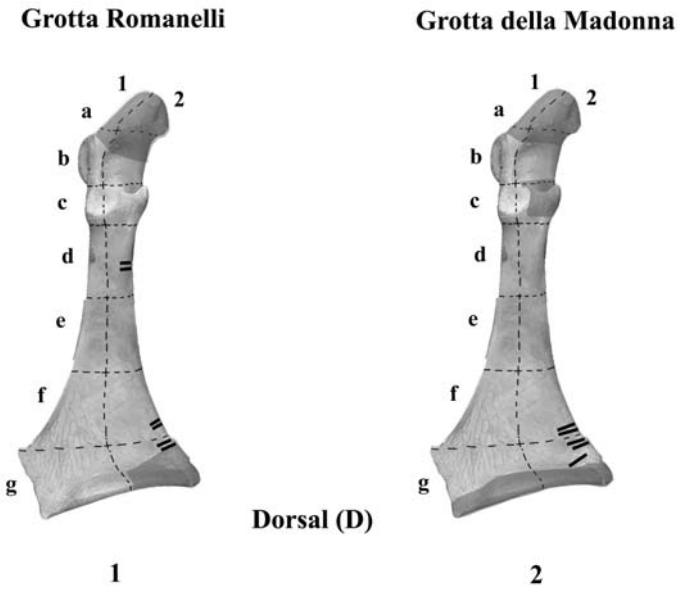

Fig. 7. Areas where cut marks and burning (in dark grey) are most frequent on the coracoid.

T i b i o t a r s u s

Remains of tibiotarsi are more abundant (55) and 4 of them present butchering marks. In three cases the striae are localized on the cranial face of the distal condyles, maybe related to cutting the biceps, while in one case they are present on the proximal portion of the diaphysis (Fig. 4: 10-11). On some diaphyseal fragments there are some intentional fresh bone fractures.

T a r s o m e t a t a r s u s

None of the 14 specimens analyzed show evidence of butchering marks although some burning traces are present.

IV. GENERAL COMMENTS

Despite the different composition of these two bird assemblages, there are similarities in the human traces left on the bones. Numerically the most representative bones of Anseriformes found in these two caves are the humerus and the coracoid. These bones also present the highest percentage of modifications. At Grotta Romanelli surface modifications on the scapula, pelvis and ulna are relatively common while those on the carpometacarpus, radius, sternum and furcula are less frequent. At Grotta della Madonna instead, butchering marks are also relatively numerous on the tibiotarsus and scapula and more rare on the furcula, carpometacarpus, pelvis and femur.

The small number of cut marks on furcula, radius, carpometacarpus, femur, and tarsometatarsus does not exclude the processing of these anatomical elements. Some of the breakages found especially on the furcula and on the radius, ulna and carpometacarpus seem in fact intentional, due to their frequency and outline. These modifications are still being studied, therefore an exact quantification is at the moment still not possible. Traces of burning seem especially common in proximity of these breakages.

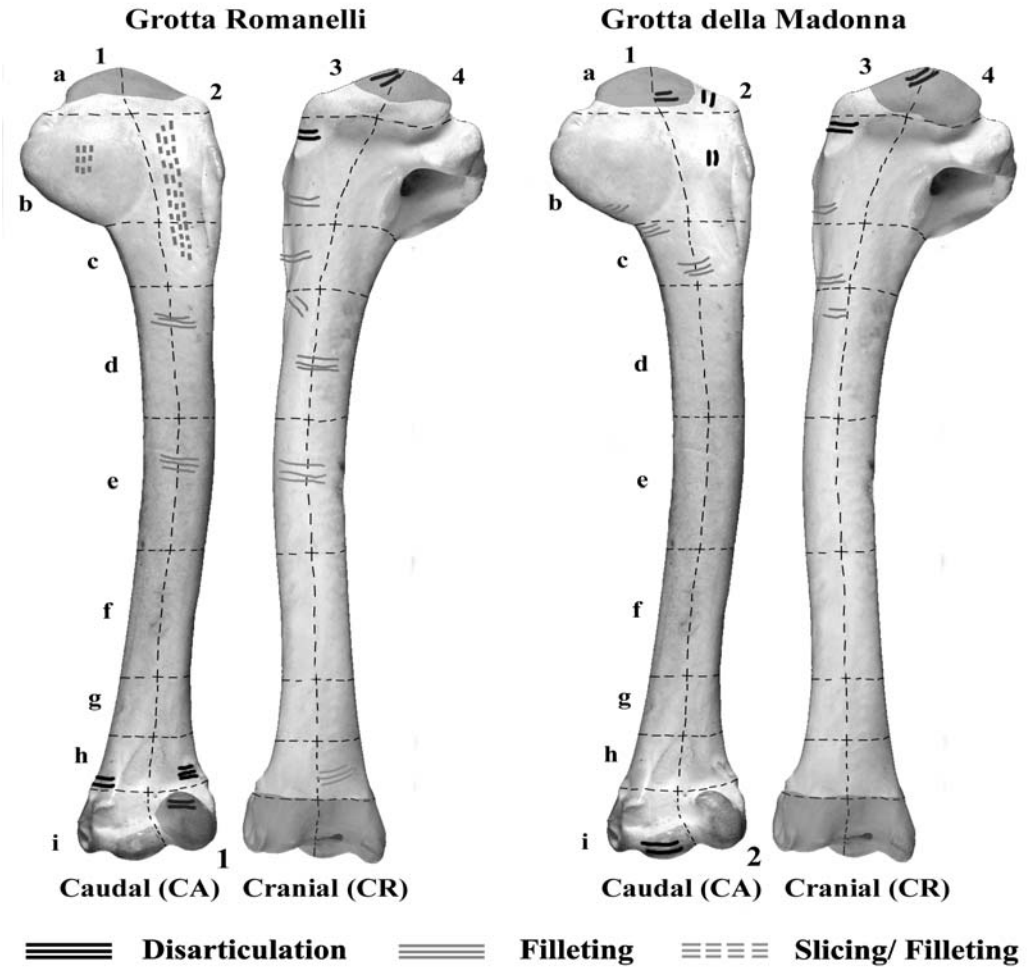

Fig. 8. Areas where cut marks and burning (in dark grey) are most frequent on the humerus.

The identification of the areas of the humerus and the coracoid, where the cut marks were found most frequently, and their morphology allowed the documentation of a systematic repetition of actions performed on the carcasses of Anseriformes (Figs. 7, 8). On the humeri and coracoids traces of disarticulation (short, deep and transverse marks in areas CA2ab, CA1-2hi, CR3-4ab of the humerus and in areas D2dfg of the coracoid) are more frequent than filleting marks (long, superficial, oblique marks in areas CA1-2bcde, CR3-4bcde, CR4h of the humerus).

On the humeri of ducks from the two caves cut marks are found most frequently on the proximal part of the diaphysis in correspondence with the pectoral crest (Fig. 8). These traces are considered to be the result of filleting. Traces of burning are more frequent on the head of the humerus and on the distal end of the coracoid of the Anseriformes of the two caves (Fig. 7). Some traces of burning were also located on the distal condyles of the humerus and on the proximal portion of the coracoid.

Further taphonomic analysis carried out on other taxonomic groups of birds from the two caves will allow to shed more light on our knowledge of the bird exploitation in the Upper Paleolithic in Southern Italy.

REFERENCES

ALESSIO M., BELLA F., CORTESI C. 1964. University of Rome, Carbon-14 Dates III. *Radiocarbon*, **7**: 218.

ALESSIO M., BELLA F., BACHECHI F., CORTESI C. 1966. University of Rome, Carbon-14 Dates IV. *Radiocarbon*, **8**: 401-404.

ALESSIO M., BELLA F., BACHECHI F., CORTESI C. 1967. University of Rome, Carbon-14 Dates V. *Radiocarbon*, **9**: 354-357.

ARRIGONI DEGLI ODDI E. 1902. Atlante ornitologico. Uccelli Europei. Milano (1985 ristampa anastatica. Milano).

BLANC G. A. 1920. Grotta Romanelli. I.- Stratigrafia dei depositi e natura e origine di essi. *Archivio per l'Antropologia e la Etnologia*, **50**: 65-103.

BLANC G. A. 1928. Sulla presenza di *Alca impennis* Linn. nella formazione pleistocenica superiore di Grotta Romanelli in Terra d'Otranto. *Archivio per l'Antropologia e la Etnologia*, **58**: 156-200.

BRUUN B., SINGER A. 1991. Uccelli d'Europa. Mondadori, Milano.

CARDINI L. 1972. Praia a Mare. Relazione degli scavi 1957-1970 dell'Istituto di Paleontologia Umana. *Bullettino di Paletnologia Italiana*, **79**(1970): 31-59.

CASSOLI P. F. 1972. Lo Pteroclide (Aves) fossile nei livelli del Paleolitico superiore e medio nel Pleistocene dell'Italia Meridionale. *Quaternaria*, **16**: 225-245.

CASSOLI P. F. 1992. Avifauna del Pleistocene superiore delle Arene Candide, Praia e Grotta Romanelli (Italia). *Quaternaria Nova*, **II**: 239-246.

CASSOLI P. F., GALA M., TAGLIACOZZO A. in press. La caccia e l'utilizzo alimentare degli uccelli a Grotta Romanelli durante le fasi finali del Pleistocene. *Studi di Antichità, Lecce*.

CASSOLI P. F., SEGRE A. G. 1985. Alca impenne (*Alca impennis*) del Pleistocene d'Italia. The great Auk in the Italian Pleistocene. Atti III Convegno Italiano di Ornitologia, Dipartimento di Biologia Animale dell'Università Pavia: 251-254.

CASSOLI P.F., SEGRE A.G., SEGRE E. 1979. Evolution morphologique et écologique de la côte de Castro (Pouilles) dans le Pléistocène final. [In:] SONNEVILLE-BORDES D. (eds) – La fin des temps glaciaires en Europe, Colloques Internationaux C.N.R.S., **219**: 325-332.

CASSOLI P. F., TAGLIACOZZO A. 1997. Butchering and Cooking of Birds in the Paleolithic Site of Grotta Romanelli (Italy). *International Journal of Osteoarchaeology*, **7**: 303-320.

COHEN A., SERJEANTSON D. 1996. A manual for the identification of bird bone from archaeological sites. Archetype Publications, London.

GALA M. 1996-1997. Sfruttamento e strategie di macellazione nel giacimento dell'Epigravettiano finale di Grotta Romanelli (LE). Tesi di Laurea in Lettere, Università di Roma "La Sapienza".

LAROULANDIE V. 2000. Taphonomie et Archéozoologie des Oiseaux en Grotte: Applications aux sites Paléolithiques du Bois-Ragot (Vienne), de Combe Saunière (Dordogne) et de la Vache (Ariège). Thèse de Doctorat en Préhistoire et Géologie du Quaternaire, Université de Bordeaux "Bordeaux I".

STASI P. E., REGALIA E. 1905. Grotta Romanelli (Castro, Terra d'Otranto), seconda nota, due risposte ad una critica. *Archivio per l'Antropologia e la Etnologia*, **35**(1): 113-169.

TAGLIACOZZO A. 2000. I dati archeozoologici, strategie di allevamento e caccia a Grotta della Madonna di Praia a Mare (CS), nel quadro del Neolitico, Eneolitico e Età del Bronzo dell'Italia Meridionale. [In:] L. BERNABO' BREA, M. CAVALIER , A. TAGLIACOZZO – La Grotta del Santuario della Madonna (Praia a Mare – Cosenza). Livelli olocenici. Memorie dell'Istituto Italiano di Paleontologia Umana, 6, il Calamo. Pp: 101-150.

TAGLIACOZZO A., GALA M. 2000. Sfruttamento e macellazione degli Anseriformi nel giacimento dell'Epigravettiano finale di Grotta Romanelli (LE). Atti del 2° Convegno Nazionale di Archeozoologia, Asti 14-16 novembre 1997. Abaco Edizioni, Forlì. Pp: 151-166.

VOGEL J. C., WATERBOLK H. T. 1963. Groningen Radiocarbon dates 4. *Radiocarbon*, **5**: 170.

VOOUS K. H. 1960. Atlas of European Birds. Nelson.