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FOSSIL TURTLE AND WHALE BARNACLES (CRUSTACEA: CIRRIPEDIA: CORONULOIDEA) KEPT AT THE NATURAL HISTORY MUSEUM OF PISA UNIVERSITY: AN ANNOTATED CATALOGUE

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Abstract - Fossil turtle and whale barnacles (Crustacea: Cirripedia: Coronuloidea) kept at the Natural History Museum of Pisa University: an annotated catalogue. In this short paper the collection of fossil coronuloid barnacles kept at the Natural History Museum of Pisa University is presented and briefly commented. It consists of one hundred and twenty-seven catalogued specimens and features one species of turtle barnacle (Chelonibia testudinaria) and three species of whale barnacles (†Cetopirus fragilis, represented in this collection by the holotype and only known specimen, †Coronula bifida, and Coronula diadema). The paleontological collection of fossil turtle and whale barnacles kept at the Natural History Museum of Pisa University stands out as one of the most important collections of coronuloid barnacles in Italy and all over Europe. doi: 10.2424/ASTSN.M.2016.18

Key words - Chelonibia, Cetopirus, Coronula, Invertebrate Paleontology, Museology, Museo di Storia Naturale (Calci, Pisa)

Riassunto - Cirripedi fossili simbionti dei vertebrati marini (Crustacea: Cirripedia: Coronuloidea) nelle collezioni del Museo di Storia Naturale dell’Università di Pisa: un catalogo annotato. In questa breve nota viene presentato e brevemente commentato il catalogo relativo alla collezione paleontologica di crostacei coronuloidei del Museo di Storia Naturale dell’Università di Pisa. Essa consiste di centoventisette reperti catalogati, qui riferiti a una specie di Chelonibiidae (Chelonibia testudinaria) e a tre specie di Coronulidae (†Cetopirus fragilis, rappresentato in questa collezione dall’olotipo e unico esemplare noto, †Coronula bifida e Coronula diadema). La collezione di coronuloidei fossili del Museo di Storia Naturale dell’Università di Pisa è sicuramente tra le più importanti d’Italia e d’Europa. doi: 10.2424/ASTSN.M.2016.18

Parole chiave - Chelonibia, Cetopirus, Coronula, Paleontologia degli Invertebrati, Museologia, Museo di Storia Naturale (Calci, Pisa)

Introduction

Cirripedes assigned to the superfamily Coronuloidea are known as epizoic phoronts of various marine vertebrates (including toothed and whalebone whales, sea turtles, and sirenians; as such, they are also called “turtle and whale barnacles”) and invertebrates (crabs and horseshoe crabs). These crown-shaped, suspension-feeding barnacles attach on a motile, long-living substrate, thus exploiting a continuous flow of seawater and nutrients. Generally speaking, turtle and whale barnacles are uncommon as fossil remains, and their paleontological record is therefore still fragmentary and scattered. Nevertheless, fossil and subfossil coronuloid barnacles help to find answers to open questions dealing with the origin and evolution of this unusual group of cirripedes (e.g., Ross & Newman, 1967; Harzhauser et al., 2011; Collareta et al., 2016a), the origin and history of cetacean migrations (e.g., Bianucci et al., 2006a, b; Collareta et al., 2016b; Bosselaers & Collareta, 2016), and the relationship of ancient human populations with marine trophic resources (e.g., Marean et al. 2007; Blick et al. 2011; Álvarez-Fernández et al. 2014; Collareta et al., 2017). In this short paper I provide an annotated catalogue of the fossil turtle and whale barnacles kept at the Museo di Storia Naturale dell’Università di Pisa (hereinafter: MSNUP) and briefly discuss the importance of this rich paleontological collection.

Nomenclatural Remarks

There is some confusion in literature regarding the nomenclature of the wall plates of coronuloids, and especially turtle barnacles. Here I follow Blick et al. (2011) in discriminating the lateral compartments of Chelonibiidae between latera (singular: latus) and carinolatera (singular: carinolatus) as commonly done when dealing with Coronulidae (e.g., Buckeridge, 1983). The rostrum of Blick et al. (2011) is here referred as rostrum sensu stricto (hereinafter: rostrum s.s.), whereas the shell element constituted by the partial fusion of the rostrum s.s. with the two adjacent rostrolatera is here referred as compound rostrum. Opercular plates of Coronuloidea are overly rare in the fossil record (e.g., Harzauser et al., 2011), and no opercular plate has been detected to date in the paleontological collection of turtle and whale barnacles of the MSNUP. Nevertheless, here I describe as complete those shells which preserve all the wall elements, that is: rostrum (compound rostrum in Chelonibiidae), right latus, right carinolatus, carina, left carinolatus, and left latus.

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COTULGAUE

Class MAXILLOPODA Dahl, 1956
Subclass CIRRIPEIDA Burmeister, 1834
Order Sessilia Lamarck, 1818
Suborder BALANOMORPHA Pilsbry, 1916
Superfamily CORONULOIDEA Newman & Ross, 1976
Family CHELONIBIIDAE Pilsbry, 1916
Genus Chelonia Leach, 1817
Chelonia testudinaria (Linnaeus, 1758)

Material. MSNUP I-16914, complete and articulated shell; MSNUP I-16915, articulated compound rostrum and right latus; MSNUP I-16916, articulated shell lacking the right carinolatus, having an incomplete, very juvenile shell (MSNUP I-16917) attached to the rostrum and right latus; MSNUP I-16918, incomplete articulated compound rostrum, right latus, and left latus; MSNUP I-16919, incomplete articulated shell, constituted by part of the compound rostrum, right latus, and part of the left latus, right carinolatus, and carina; MSNUP I-16920, MSNUP I-16921, MSNUP I-16922, MSNUP I-16923, four incomplete compound rostra; MSNUP I-16924, isolated rostrum s.s.; MSNUP I-16925, MSNUP I-16926, two isolated right rostrolatera; MSNUP I-16927, MSNUP I-16928, two isolated left rostrolatera; MSNUP I-16929, MSNUP I-16930, MSNUP I-16931, three right lateral compartments (lata or carinolatera); MSNUP I-16932, MSNUP I-16933, MSNUP I-16934, MSNUP I-16935, MSNUP I-16936, MSNUP I-16937, MSNUP I-16938, MSNUP I-16939, eight left lateral compartments (lata or carinolatera); MSNUP I-16940, MSNUP I-16941, two carinae; MSNUP I-16942, anatomically indeterminable fragment.

Notes. The fossil specimens of Chelonia testudinaria kept at the MSNUP were collected by Giovanni Bianucci from upper Pliocene (Piacenzian) shallow-marine deposits exposed at Casenuove (Empoli municipality, Tuscany, Italy) in association with a partial skeleton of a baleen-bearing whale belonging to an indeterminate species of the family Balaenidae (Bianucci et al., 2016a). On the basis of biostratigraphic, functional, and actualistic considerations, Collareta et al. (2016a) proposed that the cirripedes were hosted on the baleen whale. This record indicates that mysticete cetaceans can be added to the list of the possible hosts of the barnacles of the genus Chelonia, thus suggesting that the whale barnacles could have originated from an ancient event of dispersal of Chelonia (or a similar ancestor) on baleen whales (Collareta et al., 2016a). The record from Casenuove represents one of the largest accumulations of fossil or subfossil remains of turtle barnacles reported to date from a single taphonomic scenario.

Genus Coronula Lamarck, 1802
†Coronula bifida Bronn, 1831
Material. MSNUP I-16900, MSNUP I-16901, MSNUP I-16902, complete and articulated shells; MSNUP I-16904, isolated right compartment; MSNUP I-16905, two articulated partial compartments, including a left lateral compartment; MSNUP I-16906, isolated left compartment; MSNUP I-16907, one almost complete and articulated shell; MSNUP I-16908, seven compartments, including two rostra, three left lateral compartments, two right lateral compartments, and one carinolateral compartment.
compartments, one right lateral compartment, and one indeterminable compartment; MSNUP I-16909, disarticulated rostrum, right lateral compartment, and left lateral compartment; MSNUP I-16910, isolated rostrum; MSNUP I-16911, isolated carina; MSNUP I-16912, isolated left compartment; MSNUP I-16913, isolated right compartment.

Notes. The fossil remains of †Coronula bifida kept at the MSNUP were collected by Angelo Varola (specimens MSNUP I-16900 to MSNUP I-16902, Otranto (MSNUP I-16904), Uggiano La Chiesa (MSNUP I-16900 to MSNUP I-16906) and the late Elena Menesini (specimens MSNUP I-16907 to MSNUP I-16913) from shallow-marine deposits belonging to the Plio-Pleistocene Uggiano La Chiesa Formation. These specimens come from various localities of the eastern coast of Salento, including Sant’Andrea (MSNUP I-16900 to MSNUP I-16902), Otranto (MSNUP I-16904), Uggiano La Chiesa (MSNUP I-16905), Rocca Vecchia (MSNUP I-16906 to MSNUP I-1698 and MSNUP I-16910), Santa Foca (MSNUP I-16909), and an unknown locality "southwest to Otranto" (MSNUP I-16911 and MSNUP I-16912). In particular, MSNUP I-16904 was found in a marly horizon which features also the holotype of †Cetopirus fragilis, MSNUP I-16903. Menesini (1968) described and figured some of the specimens she collected, recognizing among them representatives of two subspecies: the nominotypical †Coronula bifida bifida (Brong, 1831) and †Coronula bifida barbara (Darwin, 1854). However, this subspecific taxonomy had no following in subsequent works. Considering that extant Coronula diadema (Linnaeus, 1767) preferentially attaches on humpback whales (the balaenopterid Megaptera novaeangliae (Borowski, 1781)) and detachment of whale barnacles (the balaenopterid Megaptera novaeangliae (Linnaeus, 1767) prefers on humpback whales, the Canoa and Tablazo Formations (Canoa basin, Ecuador) (Bianucci et al., 2006a, b). In the light of the preferential host-specificity of †Coronula bifida on humpback whales, and considering that this mysticete species currently use the shallow-marine coastal waters in front of the emerged Canoa basin as a breeding ground, Bianucci
et al. (2006a, b) inferred that during the early Pleistocene the Canoa Basin was placed on the seasonal migration route of humpback whales (or related forms) and that these whales remained in the Canoa Basin for sufficient time (breeding?) for large accumulations of Coronula diadema to form. The record from the Canoa and Tablazo Formations represents one of the largest accumulations of fossil or subfossil remains of whale barnacles known worldwide.

CONCLUDING REMARKS

The paleontological collection of Coronuloidea of the MSNUP, consisting of one hundred and twenty-seven catalogued specimens, features one species of turtle barnacle (*Chelonibia testudinaria*) and three species of whale barnacles (**†Cetopirus fragilis**, represented in this collection by the holotype and only known specimen, **†Coronula bifida**, and *Coronula diadema*). The study of this material allowed significant progress in the systematics, taphonomy, phylogeny, paleoecology, and paleobiogeography of coronuloid barnacles, thus providing also insights on the paleobiology of their vertebrate hosts (Menesini, 1968; Bianucci, 1996; Bianucci et al., 2006a, b; Collareta et al., 2016a, b). The collection of fossil turtle and whale barnacles kept at the MSNUP stands out as one of the most rich and diverse paleontological collections of Coronuloidea in Italy and all over Europe.

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This work is dedicated to the memory of the late Ludovico Galleni, distinguished biologist and supporter of the major role of paleontology in deciphering the dynamics of Evolution and envisioning Biosphere as a whole.

REFERENCES


Dahl T., 1856. Some crustacean relationships. In: *Brüggemann’s Biological Museum*.


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