

116903 of a thin radius and a peculiar structure of the transverse loops of the folded walls) which suggest that the Salento specimen belongs to a new fossil species.

*Cetopirus* is currently known as an exclusive phoront of the right whale (Balaenidae: *Eubalaena* spp.), which inhabits the North Atlantic (as *E. glacialis*). The fossil distribution of *Eubalaena* spp. includes the Pliocene-Holocene of the Northeastern Atlantic coast and the Pliocene of Italy. The rich Italian Pliocene record of Balaenidae includes other two genera (*Balaena* and *Balaenula*) and also a neonate specimen; on the contrary, no right whales have been found in Italian Quaternary deposits. Since the high host specificity of whale barnacles is believed to date to the Pliocene, the presence of *Cetopirus* sp. nov., along with remains of *Coronula bifida*, in the lower Pleistocene beds of Otranto supports: (1) the permanence of Balaenidae in the Mediterranean during the early Pleistocene (as the *Coronula bifida* specimens do with regard to Balaenopteridae), despite the absence of Quaternary fossil balaenids and the lack of an extant Mediterranean population of right whales; (2) the existence of a baleen whale migratory route active between the central Mediterranean and the North Atlantic during the Plio-Pleistocene, since both balaenids and balaenopterids are now represented only by species that are to some extent migratory (moreover, *Coronula bifida* has been recorded - as *Coronula barbara* - in the early Pleistocene Red Cragg Formation of South England); (3) the utilization of the early Pleistocene shallow sea, covering the easternmost part of Salento, as a breeding area shared by Balaenidae and Balaenopteridae, thus evoking the sympatric distribution (a most unusual case among the extant mysticetes) which has been hypothesized for *Eubalaena japonica* and *Megaptera novaeangliae* with respect to some putative low-latitude winter grounds (e.g., the Hawaiian waters).

#### FIRST FOSSIL RECORD OF STOMACH CONTENT FOR A BALEEN WHALE: FISH REMAINS ASSOCIATED TO A CETOTHERIIDAE FROM THE MIOCENE OF THE PISCO FORMATION (PERU)

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During their evolutionary history, ancestors of modern baleen whales progressively replaced their teeth with horny structures known as baleens, thus abandoning a primitive raptorial feeding in favor of various bulk-filter feeding strategies. Among extant mysticetes, Balaenidae and Neobalaenidae slowly skim for plankton near the sea surface, Eschrichtiidae forage for benthic invertebrates on shallow sea floors, and Balaenopteridae engulf huge amounts of prey

and water while swimming fast (a feeding performance considered to be the largest biomechanical event that ever existed on Earth). Based on morphofunctional analyses of fossil skeletons, some forms of Cetotheriidae s.s. (a cosmopolitan family of mysticetes ranging from the Miocene to the Pleistocene) were proposed to feed like balaenopterids.

In the middle-late Miocene Peruvian beds of the Pisco Formation exposed at Cerro Colorado (the type locality of the giant raptorial sperm whale *Livyatan melvillei*), fossil skeletons referred to a 5-8 m long cetotheriid sharing similarities with *P. nana* represent about a fifth of the whole vertebrate assemblage. This whale mainly differs from *P. nana* in having a larger size and more reduced or absent contact between the premaxillae and the anteroposteriorly elongated nasals. In 2014, an almost complete and fully articulated skeleton of this cetotheriid was partially excavated for taphonomic study. An accurate preparation in the field revealed the presence of tightly packed fish remains between the posterior ribs, a location most likely occupied by the caudal lobe of the forestomach of the whale. Detailed taphonomic observations were made in the field and several hundred of photos of the exposed bones were taken in order to elaborate an orthogonal 3D image of the entire skeleton. Small samples of the intercostal aggregate of bones and scales were investigated through a high resolution micro-CT scanning, revealing a complex architecture of fragmentary, deeply mingled clupeid fish remains. All the identified fossil elements (including a well-diagnostic opercle) are fully compatible with the extant pacific sardine, *Sardinops sagax*.

This discovery represents the first fossil record of a stomach content for a mysticete and the first direct evidence that the edentulous mysticetes (Chaemysticeti) have a long history as fish eaters. Since only Balaenopteridae are currently known as piscivores among modern mysticetes, this fossil record may suggest that some members of the extinct Cetotheriidae already experimented engulfment feeding. Anyway, other feeding strategies (e.g., suction feeding) could account for epipelagic fish consumption. Further specimens of the Cerro Colorado cetotheriid will be examined during next fieldwork seasons in order to clarify its feeding ecology. This work also reports the most ancient record of the genus *Sardinops* in the Southern Hemisphere, occurring near the Serravallian peak of productivity and cooling phase. It is noteworthy that the most ancient (and most robust) evidence of piscivory by a cetotheriid whale from the Southern Hemisphere corresponds to the first large-scale expansion of *Sardinops*, the latter event likely resulting from enhanced primary productivity.

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#### FOSSIL VERTEBRATES FROM THE LATEST MESSINIAN OF MONCUCCO TORINESE (AT)

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Recent systematic excavations carried out by the researchers of the Dipartimento di Scienze della Terra di Torino, led to the discovery of a huge amount of fossil vertebrates in the Messinian deposits of Moncucco Torinese (AT), in the Torino Hill. Detailed stratigraphic analyses revealed that the fossiliferous deposits can be correlated to the second step of the post-evaporitic phase of the Messinian Salinity Crisis (MSC) between 5.42 and 5.33 Ma. The precise chronological range of the fossil-bearing layers associated to the scattered record of vertebrate fossil remains in the Miocene of Italy, makes the site of Moncucco Torinese a key locality for the study of the faunal dispersals during the Messinian. Furthermore, the diverse and abundant vertebrate association yields crucial and precise palaeoecological and biochronological information.

Fish remains belong to several families (Myctophidae, Bythitidae, Sciaenidae, Gobiidae, Moridae, Gadidae) indicating that marine conditions were restored in the paleo-Mediterranean basin during the last part the MSC, and that sedimentation took place in coastal lagoonal environments.

The herpetofauna includes more than 20 taxa, among which *Chelotriton* and *Scolecophidia* indet., which are identified for the first time in Italy.

Birds consist of at least 10 taxa, documented by sparse and fragmented remains, mostly belonging to the order Passeriformes. A strigid and a small *Plaeortyx* are also present.

Among mammals, ungulates are represented by two perissodactyls, *Dihoplus schleiermacheri* and *Tapirus arvernensis*, and five artiodactyl taxa. An outstanding cervid antler belongs to *Pliocervus*. Carnivores are well documented by four different species. A fragmented cranium belongs to a viverrid, whereas other remains attest to the presence of two felids and one small-sized ursid. Noteworthy, Moncucco Torinese recorded the co-occurrence of two cercopithecids, the colobine *Mesopithecus* and the papionin cf. *Macaca*. Rodents and insectivores are diverse and abundant. In particular, the former are highly diverse suggesting a complex patchwork of palaeoenvironments including open and forested habitats.

The fossil vertebrate association of Moncucco Torinese is an important source of data that underlines the prominent role of the Italian Messinian communities in increasing our knowledge about the palaeoecological, palaeobiogeographical and biochronological aspects of the Neogene vertebrate fauna of Europe.

#### WHAT CAN A SHELL TELL? THE STORY OF THE MULTIPROXY BIVALVE *ARCTICA ISLANDICA*

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Fossil carbonate bivalve shells are archives which can tell us several stories. In this prospect, one of the main character of the Quaternary marine evolution is represented by the multitasking bivalve *Arctica islandica*; its performances range from the field of biostratigraphy, palaeoclimatology and sclerochronology, but these are only some of its numerous 'talents'. Among bivalve molluscs, *Arctica islandica* is known as the Methuselah because of its remarkable lifespan of up to 500 years.

It represents one of the most important boreal guests, which migrated from higher northern latitudes into the Mediterranean Sea in consequence of the climatic cooling leading to the Middle Pleistocene glaciations. For this reason, since the eighties, *A. islandica* was considered one of the main markers of the Pliocene-Pleistocene boundary (1.8 m.y.), remaining in office until 2010, when, the boundary was lowered at 2.6 m.y. After that it was used to mark the Gelasian-Calabrian boundary.

However, *A. islandica* has its most significant impact in the field of palaeoclimate and palaeoenvironmental reconstructions, recording seawater changes in its shell in the form of variable growth increment widths and variable geochemical properties. It is in fact an excellent proxy for studies of ancient ocean conditions because it sensitively and faithfully records the primary seawater isotope composition with no vital effect in its shell layers.

A sclerochemical study performed on *A. islandica* shells from the Arda River marine succession (Castell'Arquato, Northern Italy) highlights the potential of this species in recording the past seasonal variation occurred during its lifespan. This study allowed to reconstruct in details the climate evolution of the Mediterranean area prior to the Middle Pleistocene continental glaciation, showing that seasonality was the main variable involved in the climate change. The establishment of widespread populations of cold guests in the Mediterranean Sea at about 1.8 m.y. was, in fact, triggered by extreme seasonality; after this episode, the analyzed shells record an increasing trend in seasonality approaching the Middle Pleistocene Transition and the beginning of the continental glaciations in the Northern Hemisphere, which is, however, decoupled from a concomitant cooling of the average seawater temperatures.

The examples here presented emphasize the multitasking role of *A. islandica* during the Quaternary, making it a very powerful tool for numerous and diversified studies.

#### THE OCCURRENCE OF THE EXTINCT SHARK GENUS *SPHENODUS* IN THE JURASSIC OF SICILY

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