



AN *INTICETUS*-LIKE (CETACEA, ODONTOCETI) CHEEK TOOTH FROM THE PIETRA LECCESE (MIOCENE, SOUTHERN ITALY)

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BULLET-POINTS ABSTRACT

- We report the find of an *Inticetus*-like cheek tooth from the Miocene of southern Italy.
- We identify this specimen as belonging to cf. *Inticetus* sp.
- This finding brings evidence of faunal exchanges between the Mediterranean Sea and the Pacific Ocean.
- This faunal exchange likely happened via the Central America Seaway.

INTRODUCTION

Teeth in mammals are often important for the systematic study of the fossil components of this class, like the order Rodentia, for which teeth are highly diagnostic and many fossil species are known only by their dental remains. However, teeth have not the same taxonomic value in all groups of mammals: for cetaceans, teeth often cannot define a particular species, although some odontological features contribute to identify certain families. Here we report the find of an isolated cetacean tooth collected near the village of Melpignano (Lecce Province, southeastern Italy) from the “Pietra leccese” formation. Pietra leccese is a Miocene (upper Burdigalian to lower Messinian) calcarenite that is renowned worldwide for its abundant content of fossil marine vertebrates, which includes turtles, bony and cartilaginous fishes, and particularly cetaceans (both odontocetes and mysticetes). Cetacean remains include the holotypes of *Archaeoschrichtius ruggeroi* Bisconti & Varola, 2006 (Mysticeti, Eschrichtiidae), *Messapicetus longirostris* Bianucci et al., 1992 (Odontoceti, Ziphiidae), *Rudicetus squalodontoides* (Capellini, 1878) (Odontoceti, Kentriodontidae), and *Zygophyseter varolai* Bianucci & Landini, 2006 (Odontoceti, Physeteroidea), as well as several odontocete remains belonging to Squalodontidae and Eurinodelphinidae (Bianucci & Varola, 2014).

MATERIALS AND METHODS

The cetacean dental specimen here described is stored at the Museo Civico di Storia Naturale di Comiso with catalogue number MCSNC 4457 (Insacco, 2014). It exhibits a roughly half-circular and laterally com-

pressed crown with an almost smooth enamel surface. This tooth bears several large accessory denticles: along the anterior side there are four denticles, whereas six denticles take place on the posterior side. The denticles are radially positioned and slightly bowed toward the main cusp, forming an arc. Their size gradually decreases moving to the base of the crown; moreover, in this region, there are weak subvertical grooves on the enamel. Although most of the root is missing, we thought that the tooth was originally double rooted because of the presence of a slight incision under the base of the crown. Considering the Miocene age of MCSNC 4457, we hypothesize that it represents a cheek tooth belonging to a basal member of the clade Neoceti (i.e. Mysticeti + Odontoceti).

In order to identify the bearer of this tooth, we compared MCSNC 4457 to several groups of early branching fossil neocetes. The selection of the taxa used in this study was mainly based on morphological similarities with the Melpignano specimen. Among basal mysticetes, *Coronodon havensteini* Geisler et al., 2017, a fossil whale recently discovered from the Oligocene of the South Carolina (Ashley Formation), shows important morphological affinities with MSNC 4457, including the presence of several broad-based accessory denticles that form an arc and smooth surface of the enamel. We also compared MCSNC 4457 with Squalodontidae, a family of basal odontocetes characterized by having laterally compressed postcanine teeth with several accessory denticles (Dal Piaz, 1916; Rothausen, 1958; 1961; 1967; 1968). Finally, we compared the tooth from Melpignano with *Inticetus vertizi* Lambert et al., 2018, a highly autapomorphic heterodont toothed whale from the early Miocene of Peru

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(Chilcatay Formation). This species, that form the monospecific family Inticetidae, bears laterally flattened cheek teeth with multiple large and bowed denticles, that give a half-circular shape to the postcanine teeth.

RESULTS AND DISCUSSIONS

The only known mysticete with a cheek tooth morphology similar to MCSNC 4457 is *Coronodon havensteini* (Geisler et al., 2017). However, accessory denticles in *C. havensteini* are erect while those of MCSNC 4457 are weakly bowed. Furthermore, *C. havensteini* has been dated to the lower Oligocene (Rupelian) (Geisler et al., 2017) whereas the Pietra leccese lower portions are late Burdigalian in age. Hence, MCSNC 4457 is likely too young to be considered a cheek tooth of *C. havensteini*. Therefore, our morphological observations, coupled with the chronostratigraphic considerations, prevent any tentative attribution of MSNC 4457 to *C. havensteini* or other *Coronodon*-like toothed mysticetes. Alternatively, we hypothesised that MCSNC 4457 could belong to a member of the basal odontocetes family Squalodontidae (e.g. *Squalodon Grateloup, 1840* and *Eosqualodon Rothausen, 1968*). However, squalodontids generally have more vertical and less pronounced denticles than our specimen, in addition to strong ornamentation of the enamel and a more triangular and pointed shape of the cheek teeth. The squalodontid-like *Neosqualodon Dal Piaz, 1904* exhibits more evident accessory denticles, but these are less numerous (normally numbering three on the distal side and two on the mesial side) and less bowed than MCSNC 4457. Moreover, the teeth of *Neosqualodon* are much smaller than MCSNC 4457. Consequently, the morphological distance precludes the belonging of the tooth from the Pietra leccese to any member of Squalodontidae. The greatest similarities can be found with the cheek teeth of *Inticetus vertizi* from Peru. Indeed, MCSNC 4457 shares with the double-rooted cheek teeth of *Inticetus* a laterally compressed and half-circular crown, with several large and bowed denticles, and reduced ornamentation. Furthermore, in both the holotype of *I. vertizi* and the specimen from Pietra leccese, slight subvertical grooves are present on the enamel. The only morphological difference between MCSNC 4457 and the cheek teeth of *I. vertizi* is the smaller number of denticles in the postcanine teeth of the latter (Lambert et al., 2018). *I. vertizi* is dated to the early Miocene (Burdigalian) (Lambert et al., 2017), a time span that is compatible with the stratigraphic range of Pietra leccese. Therefore, based on morphological and chronostratigraphic considerations, we identified MCSNC 4457 as belonging to cf. *Inticetus* sp.

CONCLUDING REMARKS

From a palaeobiogeographical point of view, the presence of forms close to *Inticetus* Lambert et al., 2018 in both the southeastern Pacific Ocean and the Medi-

terranean Sea could be due to a faunistic interchange between the Indo-Pacific Ocean and the Mediterranean Sea through the Tethyan Seaway, the latter passage being still active in early Miocene times (Reuter et al., 2009). More probably, inticetids dispersed via the Central America Seaway: indeed, the Panama Isthmus did not exist until latest Miocene times (Jacobs et al., 2004), so it is plausible that inticetids dispersed through the Atlantic Ocean, thus recalling what has been proposed by Bianucci et al. (2016) for the beaked whale genus *Messapicetus* in late Miocene times.

In conclusion, the find of MCSNC4457 provides new hints about the biogeographical relationships between the Pacific and the Atlantic-Mediterranean realms in Miocene times and suggests that our knowledge on the distribution patterns of the *Inticetus*-like heterodont odontocetes is still fragmentary.

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