



# A KOGIID SPERM WHALE FROM THE LOWER PLIOCENE OF THE NORTHERN APENNINES (ITALY)

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## BULLET-POINTS ABSTRACT

- We report on a new specimen of Kogiidae from S. Andrea Bagni, a Zanclean fossiliferous site of northern Italy.
- This specimen consists of a partially complete cranium, one vertebra, one fragment of rib, and one tooth.
- The S. Andrea Bagni kogiid is recognized as representative of a new taxon in the subfamily Kogiinae.
- Association of this specimen with teeth of deep-water squaloids provides interesting palaeoecological hints.

## KEYWORDS:

Adriatic palaeo-area;  
Mediterranean Basin;  
Physeteroidea;  
palaeoecology;  
psychrosphere.

## INTRODUCTION

Among modern toothed whales (Cetacea: Odontoceti), dwarf and pygmy sperm whales [*Kogia sima* (Owen, 1866) and *Kogia breviceps* (de Blainville, 1838)], respectively) are the only living members of the physeteroid family Kogiidae, known as diminutive and largely unknown relatives of the great sperm whale (*Physeter macrocephalus* Linnaeus, 1758). Extant kogiids inhabit tropical to temperate open-sea environments outside the Mediterranean Basin (e.g. McAlpine, 2002). The fossil record of Kogiidae is to date represented by a few skulls and more abundant isolated ear bones from Neogene deposits of the Northern Hemisphere (e.g. Barnes, 1973; Pilleri, 1987; Cigala Fulgosi, 1996; Bianucci & Landini, 1999; Lambert, 2008; Whitmore & Kaltenbach, 2008; Bianucci et al., 2011; Vélez-Juarbe et al., 2015, 2016), with the significant exception of the late Miocene record from the Pisco Formation of southern Peru (de Muizon, 1988; Collareta et al., 2017).

Here we report on a new fossil kogiid specimen collected by one of us (F.C.F.) at S. Andrea Bagni (Parma Province, Italy), a site where lower Pliocene marine mudstones (“blue clays” *sensu lato*) are exposed. These sediments have also yielded a rich deep-water elasmobranch assemblage [including teeth attributed to rare squaloid sharks such as *Scymnodalatias* aff. *garricki* Kukuev & Konovalenko, 1988, *Scymnodon ringens* Barbosa du Bocage & Brito Capello, 1864, and *Zameus squamulosus* (Günther, 1877)] which depict the presence of psychrospheric water masses of Atlantic origin in the Adriatic palaeo-area during a phase of remarkable “oceanization” of the Mediterranean Basin (Cigala Fulgosi, 1986; 1996).

## MATERIALS AND METHODS

The kogiid specimen from S. Andrea Bagni, which is currently stored at Museo di Storia Naturale dell'Università di Pisa as MSNUP I-17603, consists of a partially complete cranium (lacking the basicranium and the left part of the supracranial basin), one vertebra, one fragment of rib, and one isolated tooth.

## DISCUSSIONS AND CONCLUSIONS

MSNUP I-17603 belongs to a new taxon of Kogiidae sharing various similarities with the recently described *Nanokogia isthmia* Vélez-Juarbe et al., 2015, from the upper Miocene of the Chagres Formation of Panama. MSNUP I-17603 mainly differs from *N. isthmia* by displaying two well-distinct fossae on the right side of the supracranial basin (here interpreted as accommodating the vocal chamber and the case for the spermaceti organ, respectively) and a proportionally longer rostrum; it further differs from the late Pliocene Mediterranean species *Kogia pusilla* (Pilleri, 1987) by the larger size and a different architecture of the supracranial basin. A low temporal fossa and the absence of dental enamel may suggest that, like the dwarf and pygmy sperm whales, MSNUP I-17603 was a suction feeder rather than a raptorial predator; however, the presence of an unusually long rostrum indicates that the foraging technique of this extinct form differed somewhat from that of modern kogiids, which in turn feature the shorter rostrum among extant odontocetes. Our preliminary phylogenetic analysis recovers MSNUP I-17603 as a member of the subfamily Kogiinae, which includes *Kogia* spp., *Koristocetus pescei* Collareta et al., 2017, *N. isthmia*, and *Praekogia*

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How to cite: Collareta et al. (2018). A kogiid sperm whale from the lower Pliocene of the Northern Apennines (Italy).

*Fossilia*, Volume 2018: 13-14. <https://doi.org/10.32774/FosRepPal.20.1810.031314>

FOSSILIA - Reports in Palaeontology

*cedronensis* Barnes, 1973. Although *Koristocetus* is recovered as the earliest branching lineage of Kogiinae, the relationships among *Kogia* Gray, 1846, *Nanokogia* Vélez-Juarbe et al., 2015, *Praekogia* Barnes, 1973, and MSNUP I-17603 are unresolved in our strict consensus tree.

Since modern kogiids do not inhabit the Mediterranean Sea, and considering also that they are believed to forage on deep-water cephalopods and fish at or beyond the edge of the continental shelf, the association of MSNUP I-17603 with a psychrospheric elasmobranch assemblage could prove noteworthy. Indeed, at the beginning of the Pliocene, the Gibraltar connection was likely deep and controlled by estuarine dynamics, thus allowing the passage of deep-water organisms (some of which constitute the core of the diet of extant *Kogia*) from the northern Atlantic Ocean to the Mediterranean Basin (Cigala Fulgosi, 1996, and references therein). More generally, the finding of MSNUP I-17603 suggests that our knowledge of the evolutionary path of kogiid sperm whales is still far from being exhaustive, as well as our understanding of their past diversity, disparity, and distribution.

#### ACKNOWLEDGEMENTS

Our gratitude to Chiara Sorbini, Felix G. Marx, Simone Casati, Aldo Marcelo Benites Palomino, and two anonymous reviewers.

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Manuscript received 8 July 2018

Received after revision 4 October 2018

Accepted 5 October 2018