

A NEW SPERM WHALE OCCURRENCE FROM THE MIOCENE OF SOUTHERN ITALY: DIGITAL IMAGING AND RETRODEFORMATION AS TOOLS FOR THE SYSTEMATIC STUDY OF A BASAL PHYSETEROID

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Here we report on the discovery of a new sperm whale (Cetacea: Odontoceti: Physeteroidea) specimen from the Pietra leccese, a Miocene calcareous formation exposed in Salento Peninsula (southern Italy) and widely known for its abundance of fossil marine vertebrates. This partial skeleton, kept at the Museo di Storia Naturale dell'Università di Pisa (MSNUP) with accession number MSNUP I-17604, was found inside six quarry slabs. It displays a significant degree of dorsoventral diagenetic compression; furthermore, it is still partially entombed within the host rock. These issues led us to pursue the imaging of this specimen via computed tomography (CT). Our main goal was to obtain a digital model of the fossil that could be retrodeformed for adequately serving the systematic study of this remarkable specimen. The CT-scan was performed at the Cisanello University Hospital (Pisa, Italy), and the resulting data were imported in the open-source platform 3D Slicer, where we manually segmented the fossil bones. In order to retrodeform the skull of MSNUP I-17604, we imported the mesh obtained from the CT-scan within the open-source platform Blender and we scaled the model to reverse the effects of diagenetic compression. As a proxy, we used the foramen magnum, which we assumed having a circular shape originally. We substantiated this assumption by measuring the height and transverse width of the foramen magnum in several extant and fossil specimens of toothed whales, including various members of Physeteroidea. The CT-scan revealed that MSNUP I-17604 includes an incomplete cranium, a partial mandibular ramus, two detached teeth and two vertebrae that are still embedded within the calcareous matrix, plus five detached and fully prepared teeth. Despite the presence of a hard entombing rock and conspicuous diagenetic deformation, we obtained a digital 3D model of the skull with a good level of detail. A preliminary analysis of the retrodeformed model allows for observing that MSNUP I-17604 is a longirostrine sperm whale that exhibits a highly asymmetrical skull. Asymmetry is particularly evident with respect to the supracranial basin, whose posterior margin is distinctly displaced posterolaterally on its left side. This highly idiosyncratic feature indicates that MSNUP I-17604 represents a new, still undescribed physeteroid taxon. The open pulp cavity of the teeth and the limited degree of apical erosion of the crown suggest that MSNUP I-17604 was a young individual at the time of death. Our cladistic phylogenetic analysis recovers MSNUP I-17604 as more related to extant *Physeter* than to living *Kogia*, and possibly as a stem physeterid. Taking its place besides *Zygophyseter varolai* and a recently described unnamed physeteroid, MSNUP I-17604 demonstrates that an unexpected diversity of sperm whales inhabited the central Mediterranean Sea during the time of deposition of the Pietra leccese formation.