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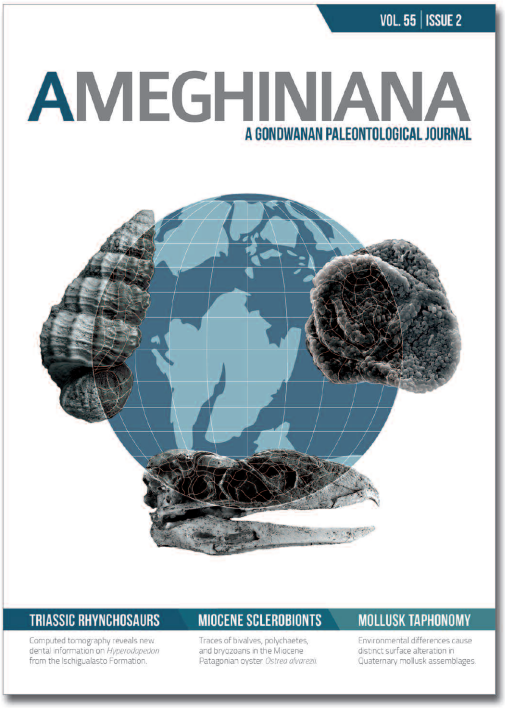

ANATOMY OF THE DOLPHINS-INSIGHTS INTO BODY STRUCTURE AND FUNCTION

Bruno Cozzi, Stefan Huggenberger & Helmut Oelschläger. Elsevier Academic Press, 438 pp, ISBN 978-0-12-407229-9.

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Since the Eocene rise of the Pelagiceti, cetaceans have occupied all oceans, producing an ever-expanding fossil record that reveals astonishing macroevolutionary shifts. Fossils, particularly those of the crown Odontoceti (toothed whales, dolphins) are readily interpreted with reference to living species. So, at the start, we emphasize that this is an important volume for paleocetologists. This marvellous book on dolphin anatomy elucidates form and function mainly in the bottlenosed dolphin, *Tursiops truncatus*, and a few other Delphinidae. The authors seduce us with anatomy in 10 chapters, complementing and expanding on "classical" monographic works such as Fraser and Purves (1960) on the anatomy of hearing, or Slijper (1936) on form and function of living species. The volume is richly illustrated by M. Demma, U. Gorter, and J. Oelschläger.

We concentrate below on those chapters that are a "must-read" for paleocetologists—those mentioning the skeleton and osteological correlates of soft tissues (muscles, nerves, vessels). We comment little on the other chapters, noting that these could contribute structural patterns to be mapped onto phylogenies.

Chapter 1 introduces size, mass, and diagnostic features. It reviews odontocete classification using formal superfamilies—an approach that is increasingly questionable because of the highly variable supra-familial taxon ranks produced by phylogenetic studies. There is an excellent summary of the anatomical adaptations of dolphins to aquatic life (with cross-reference to chapters that will develop the subject further) and a brief natural history of the eight species considered throughout the book. Then, the authors present an illustrated overview on the most important literature on anatomy since Aristotle's time. Surprisingly, Chapter 1 and others barely mention phylogeny, in spite of the path of cetacean evolution explored by W.H. Flower in the 1860s, leading to the rich diversity of recent publications on odontocete phylogenetics. Evolutionary history will provide the answers to many questions on modern anatomy, some noted below.

Chapter 2 is an excellent review of hydrodynamics. In dolphins, facial muscles of expression are now hidden under hydrodynamically-adapted dermis and blubber, and neomorphic structures are prominent. For example, the flukes have osteological correlates in the squared-off caudal vertebrae, but the dorsal fin lacks skeletal correlates.

Locomotion and osteology in Chapter 3 provide information to interpret fossils. It includes exquisite figures of skulls, including plates from Van Beneden and Gervais. Labelled photographs show some details relevant to fossil odontocetes; a more useful level of detail was given by Rommel (1990). Generally the photos are informative and crisp; in some, the lighting is too flat, while others have intrusive shadows. Skull terminology varies between authors. Footnotes (p. 40) alert us to problems that may be solved by an evolutionary approach, for example terminology related to the incisive bone and its associated teeth. The os incisivum of Nomina Anatomica Veterinaria is widely termed premaxilla in comparative anatomy including cetacean evolutionary studies. The authors question the homology of teeth in the cetacean premaxilla, but homology is clear in fossil stem delphinoids such as *Kentriodon* and, indeed, in stem Cetacea (Archaeoceti). The sections on the postcranial skeleton and on myology are important and useful summaries, revealing patterns applicable to fossil Cetacea.

Diving is considered in Chapter 4, including a review of functional complexes in the head, with skeletal features around the nares and larynx. Readers are reminded of the vestigial internal carotid artery, and the cranial blood supply via the spinal meningeal arteries.

Chapter 5, on head and senses, covers complex organ systems in detail, with some (unavoidable) repetition. This chapter contains important musculoskeletal information for the paleocetologist, with revealing and helpful labelled graphics showing the same sections as sawn and CT and MRI images. There are comments on skull form, including

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the thin zygomatic arch (jugal) with its small masseter, which the authors attribute to reduced biting forces. Jugal reduction occurs, however, in early fossil odontocetes with relatively large temporal fossae. Mixed vernacular and Latin terms remind us of the lack of consensus, and versatility, in nomenclature (pp. 144–145). The authors review senses including electroreception and magnetosensation. Hearing is one of the keys to successs for living cetaceans, and the similarity of modern and fossil tympanoperiotic bones suggests this was the case through most of cetacean history. The section on hearing is a valuable summary (pp. 171–192) for pa-leontology, given our increasing use of earbones in phylogenetic studies. The authors consider the soft and bony tissues of the outer, middle and inner ear, including the often-neglected semicircular canals.

Brain anatomy, in Chapter 6, is important to cetacean biologists because of the question of "intelligence". Yet, fossils have limited contribution here. We can judge the importance of senses from features of foramina, canals, and sulci, but these inferences are complicated by the possible influence of blood vessels and muscles. The account of cranial nerves and their function is particularly useful because cranial nerve foramina include important landmarks to help homologise skull components. The endocrine system is described in Chapter 7, which includes accounts of nerves in the forelimbs, cervical region, and spinal column.

Chapter 8, feeding and digestion, includes a short account of teeth, baleen, and associated soft tissues of the mouth. The evolution of feeding styles is a fast-moving topic, covered elsewhere in journal articles on tooth form and microstructure, and on suction feeding.

Chapter 9, urinogenital system, offers little immediately applicable to fossils. Neurobiology and evolution in Chapter 10 is a concluding review of earlier chapters. The one cladogram (p. 412) is too simple to be of much value. Here, as with others, evolutionary inference is based on living species without phylogenetic context. Thus, the fluvial *Platanista gangetica*, with its vestigial eyes, is identified as archaic; yet the species is structurally hugely disparate (autapomorphic) compared with other odontocetes.

In this exquisite, data-rich volume, the lack of evolutionary context is the outstanding omission. The summaries of osteological-soft tissue correlates make this book a prime source of information for paleocetologists.

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