

ASPECTS OF THE BIODIVERSITY, BIOGEOGRAPHY AND ECOLOGY OF DEEP-SEA BENTHIC FORAMINIFERA

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Traditionally, benthic foraminifera have been the domain of geologists who focus their studies on the predominantly calcareous species that have a good fossil record. A substantial body of information, derived mainly from geological investigations, indicates that some species, notably those inhabiting abyssal depths, have cosmopolitan distributions, at least at the morphological level. Recent molecular studies have shown that one calcareous morphospecies (*Epistominella exigua*) is genetically homogeneous in different oceans. On the other hand, species from sublittoral and bathyal continental margin settings appear to exhibit a much higher degree of biogeographic patterning. Biological studies, however, are revealing that these 'hard-shelled' taxa represent only a fraction of foraminiferal diversity in the deep sea. 'Primitive' single-chambered morphospecies with little fossilisation potential abound in deep-sea settings and are particularly common in oligotrophic and extreme hadal environments. They range from tiny agglutinated spheres a few tens of microns in size to giant xenophyophores with dimensions exceeding 10cm. The recent application of 'massive sequencing' to deep-sea sediments suggests that much 'hidden' foraminiferal diversity remains to be uncovered (unpublished results, B. Lecroq and J. Pawlowski, University of Geneva). Our understanding of the biology of these richly diverse protistan assemblages is fragmentary. Given their sheer abundance, foraminifera undoubtedly play an important role in ecological and biogeochemical processes in the deep ocean, for example the cycling of organic carbon. Recent studies suggest that some calcareous species are highly efficient consumers of labile organic matter, while monothalamous species, in general, probably have lower metabolic rates and ingest bacteria and more degraded organic material. Clearly, much remains to be learnt about the basic biology, as well as the biodiversity and biogeography, of modern deep-sea benthic foraminifera.

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