Living (stained) benthic foraminifera from the Mozambique Channel (eastern Africa): Exploring deep-sea biodiversity and biogeochemistry of unicellular fossilizing meiofauna

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This study was done in the framework of the PAMELA project (“Passive Margin Exploration Laboratories”) funded by TOTAL and Ifremer. Live (Rose-Bengal stained) deep-sea foraminiferal faunas have been studied at four stations between 530–3200-m depth in the Mozambique Channel (eastern Africa) to understand how complex environmental conditions (e.g., organic matter, oxygenation) control (1) their ecological structure (i.e., diversity, standing stocks, and microhabitats) and (2) their geochemical signatures (stable isotopes, and trace elements). Two upper-slope stations, located at 530- and 780-m depth off Madagascar, are bathed by well-oxygenated bottom waters. They are characterized by fine sediments enriched in highly degraded organic matter (low amino-acid bio-availability and reduced chlorophyllic freshness). Mineralization of organic compounds results in relatively moderate oxygen penetration depth (i.e., 15 and 30 mm) in sediment. Interestingly, foraminiferal simple diversity (S) is exceptionally high at both sites. The higher standing stocks are observed in the 780-m deep station, where peculiar sedimentary facies of organic matter focusing are recorded (OC >2.0% DW). Redox conditions and sedimentary organic matter control the composition and the vertical distribution (i.e. microhabitat) of benthic faunas at both upper-slope sites. Bolivina alata, Bulimina marginata, Haplophragmoides bradyi and Nouria compressa are relevant bio-indicators of enhanced burial of organic matter prevailing at the 780-m deep station (i.e., eutrophic settings), whereas Uvigerina hispida and Uvigerina semiornata are dominant at the 530-m deep station (i.e., relatively mesotrophic settings). Two other stations are located on well-ventilated terraces from the deep-sea canyons of Tsiribihina and Zambezi (>3000-m depth). They are characterized by carbonate ooze, which is depleted in degraded organic matter and, where oxygen penetration depth is relatively deep (i.e., > 80 mm). Because of food scarcity, foraminiferal simple diversity (S) and standing stocks are relatively low, and agglutinated and organic-walled taxa dominate foraminiferal faunas. Hospitella fulva, a foraminifera belonging to Allogromiida, occupy very deep infaunal microhabitat, what disrupts the classical scheme of microhabitat patterns in oligotrophic settings.

Keywords: Mozambique Channel, Foraminifera, Diversity, Microhabitat, Sedimentary Organic Matter, Stable Isotopes and Trace Elements

