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Forams of the Gulf of Mexico: Troubles in a sea of plenty

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The diverse habitats of the Gulf of Mexico seafloor support over 900 species of benthic Foraminifera, although only 35 are endemic. There are many regions within this “large marine ecosystem,” where various measures, including surface-water chlorophyll, indicate high productivity. Transport of nutrients, the driver of primary production, is particularly large:

- 1) at upwellings along the edges of the Loop Current (including part of the Campeche Bank) and
- 2) in areas of major fluvial discharge, most noticeably in the Mississippi and Atchafalaya deltas, where the rate of primary production may exceed 300 gC/m²/yr.

In addition, a separate source of primary production is present in the deeper Gulf, below the euphotic zone, where emanations from cold seeps (including methane and hydrogen sulfide) at faults caused by salt diapirism sustain chemosynthesis. Thus, for many foraminiferal communities of the Gulf of Mexico, food limitation is not a problem for survival or proliferation. Such problems, however, may arise from oxygen depletion or bottom-water toxicity. Extraordinary productivity in parts of the northern shelf due to excessive nutrient input by large rivers leads to seasonal eutrophication and seafloor hypoxia (O₂ <2mg/L) in which populations of diverse taxa, including Foraminifera, are drastically reduced. Apparently, epibenthic species, especially miliolids, are the most affected. Hydrocarbon emission at bathyal and abyssal cold seeps may also cause severe oxygen depletion, and in places H₂S toxicity, resulting in depression of alpha diversity. Many endobenthic species of these cold seeps, however, show unexpected tolerance to dysoxia or anoxia. The talk will deal with patterns of species distribution under such stress, and will bring to focus basic questions of opportunistic microhabitat adaptation by Foraminifera in extreme environments.