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TITLE: Oxygen and organic matter thresholds for benthic faunal activity on the Pakistan margin oxygen minimum zone (700?1100m)

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ABSTRACT:

A transition from fully laminated to highly bioturbated sediments on continental margins is thought to derive from increased animal activity associated with increasing bottom-water oxygen concentration. We examined faunal community responses to oxygen and organic matter gradients across the lower oxygen minimum zone (OMZ) on the bathyal Pakistan margin, where sediments grade from fully laminated sediment at 700 m (0.12 mL L?1 O2 [5 ?M]) to highly bioturbated sediment at 1100 m (0.23 mL L?1 O2 [10 ?M]). High-resolution sampling of the seafloor (every 50 m water depth) was conducted along a single transect during inter- and post-monsoon periods in 2003 to address (a) the existence of oxygen thresholds regulating macrofaunal abundance, composition, diversity and lifestyles, (b) the interactive effects of organic matter quantity and quality, (c) associated community effects on sediment structure, and (d) potential seasonality in these processes. Macrofaunal biomass and bioturbation depth were positively correlated with organic matter availability, which peaked at 850?950 m (3.39?3.53% Org. C). In contrast, macrofaunal diversity (H?), dominance (R1D), and burrow number exhibited threshold responses at oxygen concentrations of 0.12?0.20 mL L?1 [5?9 ?M]), with few animals and highly laminated sediments present below this concentration and most taxa present in fully bioturbated sediments above it. The highly mobile, burrowing amphinomid polychaete Linopherus sp. exhibited almost complete dominance and high density at 750?850 m (0.12?0.14 mL L?1 O2 [5?6 ?M]), but despite its activity, sediment laminae remained faintly visible. Formation of permanent burrows and detritivory were dominant macrofaunal lifestyles within the OMZ, allowing laminae to persist at surprisingly high animal density and biomass. Results reflect a shift from organic matter to oxygen regulation of body size and biogenic structures following the monsoon. This study suggests that for assemblages evolving under permanent severe hypoxia, food availability remains a significant determinant of animal abundance and biogenic structure depth. Oxygen influences patterns of diversity and dominance and interacts with organic matter to generate abrupt faunal transitions on the Pakistan margin.

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