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TITLE: Faunal responses to oxygen gradients on the Pakistan margin: A comparison of foraminiferans, macrofauna and megafauna

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ABSTRACT:

The Pakistan Margin is characterised by a strong mid-water oxygen minimum zone (OMZ) that intercepts the seabed at bathyal depths (150?1300 m). We investigated whether faunal abundance and diversity trends were similar among protists (foraminiferans and gromiids), metazoan macrofauna and megafauna along a transect (140?1850 m water depth) across the OMZ during the 2003 intermonsoon (March?May) and late/post-monsoon (August?October) seasons. All groups exhibited some drop in abundance in the OMZ core (250?500 m water depth; O2: 0.10?0.13 mL L?1=4.46?5.80 ?M) but to differing degrees. Densities of foraminiferans >63 ?m were slightly depressed at 300 m, peaked at 738 m, and were much lower at deeper stations. Foraminiferans >300 ?m were the overwhelmingly dominant macrofaunal organisms in the OMZ core. Macrofaunal metazoans reached maximum densities at 140 m depth, with additional peaks at 850, 940 and 1850 m where foraminiferans were less abundant. The polychaete Linopherus sp. was responsible for a macrofaunal biomass peak at 950 m. Apart from large swimming animals (fish and natant decapods), metazoan megafauna were absent between 300 and 900 m (O2 <0.14?0.15 mL L?1=6.25?6.69 ?M) but were represented by a huge, ophiuroid-dominated abundance peak at 1000 m (O2 ?0.15?0.18 mL L?1=6.69?8.03 ?M). Gromiid protists were confined largely to depths below 1150 m (O2 >0.2 mL L?1=8.92 ?M). The progressively deeper abundance peaks for foraminiferans (>63 ?m), Linopherus sp. and ophiuroids probably represent lower OMZ boundary edge effects and suggest a link between body size and tolerance of hypoxia. Macro- and megafaunal organisms collected between 800 and 1100 m were dominated by a succession of different taxa, indicating that the lower part of the OMZ is also a region of rapid faunal change. Species diversity was depressed in all groups in the OMZ core, but this was much more pronounced for macrofauna and megafauna than for foraminiferans. Oxygen levels strongly influenced the taxonomic composition of all faunal groups. Calcareous foraminiferans dominated the seasonally and permanently hypoxic sites (136?300 m); agglutinated foraminiferans were relatively more abundant at deeper stations where oxygen concentrations were >0.13 mL L?1(=5.80 ?M). Polychaetes were the main macrofaunal taxon within the OMZ; calcareous macrofauna and megafauna (molluscs and echinoderms) were rare or absent where oxygen levels were lowest. The rarity of larger animals between 300 and 700 m on the Pakistan Margin, compared with the abundant macrofauna in the OMZ core off Oman, is the most notable contrast between the two sides of the Arabian Sea. This difference probably reflects the slightly higher oxygen levels and better food quality on the western side.

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