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TITLE: Variations in bioturbation across the oxygen minimum zone in the northwest Arabian Sea

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ABSTRACT:

Oxygen minimum zones are expected to alter substantially the nature, rates and depths of bioturbation along continental margins, yet these effects remain poorly studied. Using excess 210Pb profiles, sediment X-radiography and box-core samples for macrofauna, we examined bioturbation processes at six stations (400, 700, 850, 1000, 1250 and 3400 m deep) along a transect across the oxygen minimum zone (OMZ) on the Oman margin. Bottom-water oxygen concentrations ranged from ?0.13 ml l?1 at 400 m to ?2.99 ml l?1 at 3400 m. 210Pb mixed-layer depth and bioturbation intensity (Db) exhibited high within-station variance, and means did not differ significantly among stations. However, the mean mixed-layer depth (4.6 cm) for pooled OMZ stations (400?1000 m depths, 0.13?0.27 ml l?1 bottom-water oxygen) was half that for stations from similar water depths along well-oxygenated Atlantic and Pacific slopes (11.1 cm), suggesting that oxygen stress reduced 210Pb mixing depth on the Oman margin. Modal burrow diameter and the diversity of burrow types at a station were highly correlated with bottom-water oxygen concentration from the edge to the core of the Oman OMZ (Spearman's rho?0.89, p?0.02), suggesting that these parameters are useful proxies for bottom-water oxygen concentrations under dysaerobic conditions. In contrast, neither the maximum diameter and nor the maximum penetration depth of open burrows exhibited oxygen-related patterns along the transect. Reduced 210Pb mixing depth within the Oman-margin OMZ appeared to result from a predominance of surface-deposit feeders and tube builders within this zone, rather than from simple changes in horizontal or vertical distributions of macrofaunal abundance or biomass. The number of burrow types per station was highly correlated with macrofaunal species diversity, suggesting that burrow diversity may be a good proxy for species diversity in paleo-dysaerobic assemblages. We conclude that bottom-water oxygen concentrations of 0.13?0.27 ml l?1 substantially alter a number of bioturbation parameters of importance to diagenetic and biofacies models for continental margins.

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