ID: W2415582084

TITLE: Methane seepage effects on biodiversity and biological traits of macrofauna inhabiting authigenic carbonates

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ABSTRACT:

Authigenic carbonate rocks at methane seeps are recognized as hosting diverse and abundant invertebrate assemblages, with potential forcing from fluid seepage and hydrography. Mensurative studies of carbonate macrofauna (>0.3 mm) at Hydrate Ridge, OR revealed little effect of water depth and overlying oxygenation (at 600 m and 800 m) but a large influence of seepage activity on density, taxonomic composition, diversity, and biological traits (feeding, lifestyle, motility, size and calcification). Rocks exposed to active seepage had 3?4× higher total macrofaunal densities than under inactive conditions. Assemblages exhibited higher species richness and reduced evenness (greater dominance) under active seepage than inactive conditions, but no difference in H? or rarefaction diversity. Actively seeping sites were characterized by errant (motile), bacterial grazing, small- and medium-sized, heavily calcified species, whereas inactive sites exhibited a greater diversity of feeding modes and more burrowers, sessile, large and lightly calcified species. Active rocks supported more exogonid (Syllidae), ampharetid, and cirratulid polychaetes, provannid snails, pyropeltid limpets, nemerteans, and sponges; whereas inactive rocks supported higher densities of ophiuroids, isopods, gammarid amphipods, hydroids, Typosyllis (Syllidae) and tanaids. Transplant experiments, in which rocks were transferred between active and inactive sites at Hydrate Ridge North (600 m), revealed that assemblages respond within 13 months to increase or cessation of seepage, taking on the feeding, size and calcification characteristics of the background fauna at the new site. Lifestyles and motility patterns shifted more slowly as the sessile, attached species did not track seepage as quickly. Provannid snails and pyropeltid limpets rapidly colonized rocks transplanted to active sites and disappeared when transplanted to inactive sites. Given the known variability of fluid fluxes and rapid community response, a mosaic of communities changing in space and time is hypothesized to generate the relatively high species diversity at methane seeps.

SOURCE: Deep-sea research. Part 2. Topical studies in oceanography/Deep sea research. Part II, Topical studies in oceanography

PDF URL: https://www.sciencedirect.com/science/article/am/pii/S0967064516301527

CITED BY COUNT: 21

PUBLICATION YEAR: 2017

TYPE: article

CONCEPTS: ['Authigenic', 'Ecology', 'Biology', 'Bioturbation', 'Dominance (genetics)', 'Tide pool', 'Geology', 'Sediment', 'Habitat', 'Paleontology', 'Biochemistry', 'Gene']