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TITLE: Hydrothermal Vents and Methane Seeps: Rethinking the Sphere of Influence

AUTHOR: ['Lisa A. Levin', 'Amy R. Baco', 'David A. Bowden', 'Ana Colaço', 'Erik E. Cordes', 'Marina R. Cunha', 'Amanda W.J. Demopoulos', 'Judith Gobin', 'Benjamin M. Grupe', 'Jennifer Le', 'Anna Meta×as', 'Amanda N. Netburn', 'Greg W. Rouse', 'Andrew R. Thurber', 'Verena Tunnicliffe', 'C. L. Van Dover', 'Ann Vanreusel', 'Les Watling']

ABSTRACT:

Although initially viewed as oases within a barren deep ocean, hydrothermal vent and methane seep communities are now recognized to interact with surrounding ecosystems on the sea floor and in the water column, and to affect global geochemical cycles. The importance of understanding these interactions is growing as the potential rises for disturbance from oil and gas extraction, seabed mining and bottom trawling. Here we synthesize current knowledge of the nature, extent and time and space scales of vent and seep interactions with background systems. We document an expanded footprint beyond the site of local venting or seepage with respect to elemental cycling and energy flux, habitat use, trophic interactions, and connectivity. Heat and energy are released, global biogeochemical and elemental cycles are modified, and particulates are transported widely in plumes. Hard and biotic substrates produced at vents and seeps are used by ?benthic background? fauna for attachment substrata, shelter, and access to food via grazing or through position in the current, while particulates and fluid fluxes modify planktonic microbial communities. Chemosynthetic production provides nutrition to a host of benthic and planktonic heterotrophic background species through multiple horizontal and vertical transfer pathways assisted by flow, gamete release, animal movements, and succession, but these pathways remain poorly known. Shared species, genera and families indicate that ecological and evolutionary connectivity exists among vents, seeps, organic falls and background communities in the deep sea; the genetic linkages with inactive vents and seeps and background assemblages however, are practically unstudied. The waning of venting or seepage activity generates major transitions in space and time that create links to surrounding ecosystems, often with identifiable ecotones or successional stages. The nature of all these interactions is dependent on water depth, as well as regional oceanography and biodiversity. Many ecosystem services are associated with the interactions and transitions between chemosynthetic and background ecosystems, for example carbon cycling and sequestration, fisheries production, and a host of non-market and cultural services. The quantification of the sphere of influence of vents and seeps could be beneficial to better management of deep-sea environments in the face of growing industrialization.

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