ID: W2171691207

TITLE: The Discovery of New Deep-Sea Hydrothermal Vent Communities in the Southern Ocean and Implications for Biogeography

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ABSTRACT:

Since the first discovery of deep-sea hydrothermal vents along the Galápagos Rift in 1977, numerous vent sites and endemic faunal assemblages have been found along mid-ocean ridges and back-arc basins at low to mid latitudes. These discoveries have suggested the existence of separate biogeographic provinces in the Atlantic and the North West Pacific, the existence of a province including the South West Pacific and Indian Ocean, and a separation of the North East Pacific, North East Pacific Rise, and South East Pacific Rise. The Southern Ocean is known to be a region of high deep-sea species diversity and centre of origin for the global deep-sea fauna. It has also been proposed as a gateway connecting hydrothermal vents in different oceans but is little explored because of extreme conditions. Since 2009 we have explored two segments of the East Scotia Ridge (ESR) in the Southern Ocean using a remotely operated vehicle. In each segment we located deep-sea hydrothermal vents hosting high-temperature black smokers up to 382.8°C and diffuse venting. The chemosynthetic ecosystems hosted by these vents are dominated by a new yeti crab (Kiwa n. sp.), stalked barnacles, limpets, peltospiroid gastropods, anemones, and a predatory sea star. Taxa abundant in vent ecosystems in other oceans, including polychaete worms (Siboglinidae), bathymodiolid mussels, and alvinocaridid shrimps, are absent from the ESR vents. These groups, except the Siboglinidae, possess planktotrophic larvae, rare in Antarctic marine invertebrates, suggesting that the environmental conditions of the Southern Ocean may act as a dispersal filter for vent taxa. Evidence from the distinctive fauna, the unique community structure, and multivariate analyses suggest that the Antarctic vent ecosystems represent a new vent biogeographic province. However, multivariate analyses of species present at the ESR and at other deep-sea hydrothermal vents globally indicate that vent biogeography is more complex than previously recognised.

SOURCE: PLoS biology

PDF URL: https://journals.plos.org/plosbiology/article/file?id=10.1371/journal.pbio.1001234&type=printable

CITED BY COUNT: 247

PUBLICATION YEAR: 2012

TYPE: article

CONCEPTS: ['Hydrothermal vent', 'Oceanography', 'Deep sea', 'Biological dispersal', 'Ridge', 'Fauna', 'Invertebrate', 'Chemosynthesis', 'Biogeography', 'Marine ecosystem', 'Polychaete', 'Geology', 'Biology', 'Ecology', 'Paleontology', 'Ecosystem', 'Hydrothermal circulation', 'Population', 'Demography', 'Sociology']