Remarkable decadal stability at Lau Basin hydrothermal vents (Southwest Pacific)

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Hydrothermal vents are generally considered to be extremely dynamic and ephemeral. When active, vents transform the deep seafloor, creating structures of metal-rich deposits while providing the energy source for dense assemblages of chemosynthesis-based communities. If venting arrests, or after a catastrophic event, entire vent fields and vent-associated communities can be eradicated. Temporal studies on mid-ocean ridges have also shown that nascent communities can be established within one year, but comparable baseline information is largely unknown for vent systems within back-arc basins, volcanic arcs, and intra-plate volcanoes. Within the Lau back-arc basin, over a decade-long monitoring program, we find these hydrothermal vents can provide remarkably stable habitats. Contrary to our expectations, there was no evidence of changes at any of 4 different vent fields in the Lau Basin (e.g., fluid flux variability or catastrophic lava flow). Using precision spatial-temporal in situ measurements and photo-documentation, we resolved structural, thermal, and ecological stability on active hydrothermal vents over a decade. Here in the Southwest Pacific, industrial mining at hydrothermal vents is imminent. Our study provides information contrary to that used by the mining industry for its environmental impact assessments. These new findings should be incorporated into predicting and mitigating the effects of mining activities in these vent ecosystems and into monitoring potential recovery post-mining. This evidence of longevity and habitat stability at back-arc basin hydrothermal vents does not align with widely accepted generalizations, challenging the way we think about vent ecosystems and highlighting the need to study a broader scope of tectonic and volcanic settings.