Flourishing chemosynthetic life at the greatest depths of hadal trenches

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Abstract

Hadal trenches, some of the Earth's least explored and understood environments, have long been hypothesized to harbor chemosynthesis-based communities. Despite increasing attention, actual documentation of such communities has been exceptionally rare. Here, we report the discovery of the deepest and the most extensive chemosynthesis-based communities known to exist on Earth during an expedition to the Kuril-Kamchatka Trench and the western Aleutian Trench using the manned submersible *Fendouzhe*. The communities dominated by siboglinid Polychaeta and Bivalvia span over a remarkable distance of 2500 km at depths from 5800 to 9533 m. These communities are sustained by hydrogen sulfide and methane-rich fluids that are transported along faults traversing deep sediment layers within trenches, where methane is produced microbially from deposited organic matter as indicated by isotopic analysis. Given geological similarities with other hadal trenches, such chemosynthesis-based communities might be more widespread than previously anticipated. These findings challenge current paradigms regarding life at extreme limits and carbon cycling in the deep ocean.