Global Chemosynthetic Life Corridor Hypothesis: Theoretical Basis and Verification

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Abstract:
The discovery of deep-sea chemosynthetic ecosystems overturned the traditional life paradigm that "all things grow relying on the sun." However, for a long time, whether large-scale chemosynthetic life communities commonly exist in hadal trenches deeper than 6000 m has remained an unsolved mystery of the deep sea, constraining systematic understanding of the survival limits of deep-sea chemosynthetic life, biogeographic zoning, population connectivity, evolutionary novelty, and their role in the deep-sea carbon cycle and deep biosphere. Based on manned submersible exploration of hadal seafloors worldwide, this paper proposes the "Global Chemosynthetic Life Corridor (GCLC)" hypothesis, suggesting that there exists a vast belt of chemosynthetic life likely stretching for tens of thousands of kilometers at trench bottoms globally. The presentation analyzes the theoretical basis of the GCLC hypothesis, encompassing core elements such as the key material sources that build the chemosynthetic life corridor, deep biogeochemical drivers, and fault fluid channels, and provides distribution predictions, verification examples, and future research directions in related fields for the GCLC hypothesis in major hadal trenches worldwide.