

Superhabitability in ultradeep rocky environments

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It is challenging for life to proliferate in cold rocky habitats deeply isolated from photosynthetic organic matter. Although fluid circulation is previously considered to be necessary for supplying energy sources and oxidants, it is also considered that substrates available within the rocky environment are diluted by fluid circulation. As the abundance of microbial life within the rock matrix is largely unknown, I developed nanoscale analytical procedures to unveil the distributions of microbial cells, organic matters and low-temperature minerals. As a result of applying the analytical procedures to various deep-sea and subsurface rocky environments such as deep-sea hydrothermal vents, deep-sea ferromanganese crusts and deep seafloor basaltic rocks, it is unexpectedly unveiled that the rocky habitats are superhabitable with cell densities locally exceeding 10^{10} cells/cm³. The superhabitability might be explained by the coexistence of solid silicate phases such as smectite clays that play roles in concentrating nutrients from the ambient fluid. In this presentation, I will introduce the analytical procedures and main results obtained from the ultradeep rocky habitats.

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