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ARCHAEA

Kings of the sea floor?

The vast microbial sedimentary ecosystem that resides below the sea floor is predominantly made up of Archaea, report Julius Lipp and colleagues in a recent *Nature* paper. By examining lipid concentration as a tracer for microbial biomass in marine sediments, Lipp *et al*. further predict that the marine subsurface ecosystem stores 90 petagrams (Pg; 1×10^{15} g) of cellular carbon.

It has long been apparent that a vast sedimentary ecosystem resides beneath the sea floor, and microbial life has been reported as deep as 1,600 m below the sea floor. Although drilling expeditions have shown that these ecosystems contain a diversity of Archaea and Bacteria, it has been impossible to determine which is more abundant. Furthermore, predictions of the cellular carbon stored in these ecosystems have ranged from 56 to 303 Pg.

To examine these issues, Lipp and colleagues measured the concentration of intact polar lipids (IPLs), which they argue provide a robust basis for predicting the biomass and for broadly analysing the composition of the marine subsurface ecosystem. Measuring IPLs at different depths, from 0.01 to 367 m below the sea floor, from marine sites around the world, they report that 87% of the IPLs in sediments that are deeper than 1 m are of archaeal origin. Although this analysis concurs with DNA-based approaches, and with recent considerations that Archaea are better suited for survival in the low-energy conditions of the deep sea bed, these findings do not necessarily mean that Archaea dominate the biogeochemical processes of the deep subsurface.

Further analysis revealed that IPL concentrations are proportional to total organic carbon (TOC) concentrations. Extrapolating from their data, the authors predict that the marine subsurface sediments inhabited by microorganisms contain 4×10^5 Pg of TOC — approximately 2.5% of the estimated TOC in the Earth's crust — and 90 Pg of cellular carbon.

As the authors note, "the environmental functions, strategies of survival and growth ... and physiologies of the key phylogenetic groups that presumably contribute largely to this biomass pool remain to be clarified."

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ORIGINAL RESEARCH PAPER Lipp, J. S., Morono, Y., Inagaki, F. & Hinrichs, K.-U. Significant contribution of Archaea to extant biomass in marine subsurface sediments. *Nature* 20 July 2008 (doi:10.1038/nature07174)

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