URLs

BIOGEOCHEMISTRY

# What lives beneath?

The conundrum of the presence of huge populations of sub-seafloor bacteria, despite the distinct lack of energy in this environment, has puzzled many observers. Reporting in *Nature*, Parkes *et al.* show that far from merely subsisting, sub-seafloor microorganisms actively thrive, using energy derived from processes that occur on geological timescales.

Understanding how subsurface prokaryotes sustain metabolic activity is important, not least because the subsurface is the largest single environment on the planet and might contain 50% of the total planetary prokaryotic biomass, but also because understanding how life is possible in these conditions could be relevant to the search for extraterrestrial life. Using information about energy flux at these typically deep environments, modelling predicts very slow or no metabolic activity of the resident flora. In terrestrial subsurfaces, microbial activity has been found at interfaces between different types of sediment, so Parkes *et al.* addressed the role of interfaces in the biology of sub-seafloor bacteria for the first time.

Two sites in the Pacific Ocean were chosen, one at the margin and the other in the open ocean, to depths of 400 m under the seabed. DNA was extracted from each site, and 16S rRNA sequencing showed that distinct populations were present at each sampling site. Whereas the diversity of representatives from the Bacteria was high, archaeal diversity was mainly restricted to crenarchaeotes. Samples from the margin and the open-ocean site were both diverse and active, although diatoms were always present at sites of prokaryotic activity in the open-ocean site. Measurements made allowed biogeochemical processes (methanogenesis and sulphate reduction) and the presence of bacterial growth (thymidine incorporation) to be correlated with prokaryotic activity.

Separation was noted between sulphate and methane zones but, intriguingly, methanogenesis was detected in the sulphate zone, which was a surprise, as sulphate reducers and methanogens were thought to compete. The depths of the sites sampled date back to the Pleistocene (0.8 million years ago) and Late Pleistocene (2 million years ago), therefore, ancient geological processes stimulated stable prokaryotic activity — there are indeed live and active bacteria in the sediment depths.

These exciting results indicate that geological processes have shaped microbial communities, and that these communities continue to contribute to the ecosystem through biogeochemical processes to the present day.

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**References and links**

**ORIGINAL RESEARCH PAPER** Parkes, R.J. *et al.* Deep sub-seafloor prokaryotes stimulated at interfaces over geological time. *Nature* **436**, 390–394 (2005)



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