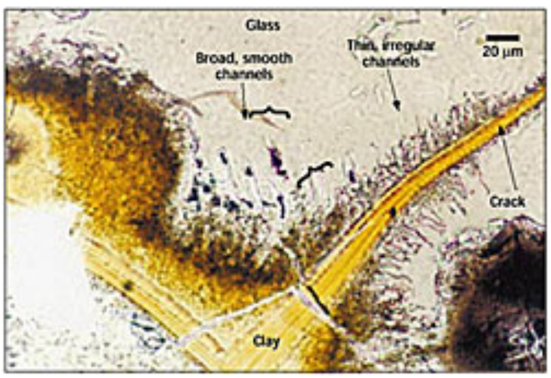
EVIDENCE FOR MICROBES IN OCEANIC BASALTS: GLASS-EATING BACTERIA?

Martin R. Fisk, College of Oceanic and Atmospheric Sciences, Oregon State University

Until recently, conventional wisdom held that Earth's subsurface was a sterile place, devoid of life. Exciting new results, however, indicate that this is far from the truth. Scientists have discovered evidence of organisms deep beneath Earth's crust on both continents and ocean floors. By studying new microbial life-forms, and the incredibly wide range of environments in which they live, we gain a much better understanding of how life began and evolved on Earth, and possibly other planets.

To this end, ODP (Ocean Drilling Program) has led the way in collecting subseafloor microbes to evaluate the exciting new paradigm of the so-called deep biosphere. The size of this biosphere is difficult to determine, and will require additional drilling to constrain. The concentration of living material in the oceanic crust is small, but because of the huge global volume of this material, it may contain a significant fraction of Earth's biomass [Parkes et al., 1994]. About 5% of oceanic crust consists of volcanic glass, intuitively a material inhospitable to life. Nevertheless, new microscopic examination and application of molecular genetic techniques on DSDP (Deep Sea Drilling Program) and ODP basalts collected near the Mid-Atlantic Ridge [Bougault et al., 1985] suggests that the rocks contain ample evidence of microbial life.



Photomicrograph shows 15 million year old volcanic glass with both thin, irregular and smooth, broad channels thought to have been created by microorganisms [*Furnes et al*., 1996; *Giovannoni et al*., 1996]. The volcanic glass also has a crack filled with clay (orange). The sample is from basalt recovered by drilling about 200 km west of the Mid-Atlantic Ridge beneath 400 m of sediment. Rock temperature before drilling was about 40° C.

The idea is that microbial activity, indicated by pitting of the glass, and the formation of intricate and branching burrows, helps weather and erode this volcanically derived material. The microbes may even be "eating" the glass, using it as an energy source. The most typical texture observed microscopically is thin irregular channels, about one mm in diameter and extending 20 to 40 mm into the glass (see photomicrograph). A better understanding of Earth's subsurface biosphere will result by examining other crustal rocks and new samples from future drilling that are free of contamination and are specially preserved immediately after collection. Microbes in volcanic crust may turn out to be important catalysts of chemical change. In this role, they would help regulate the cycling of elements between seawater and the oceanic crust. Microbes that derive their energy from inorganic chemical reactions suggests that life may thrive in previously unsuspected places, such as on Mars and Europa.

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