Microbial biofilms on stone surfaces

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Microbial biofilms, consisting of green algae, filamentous fungi and bacterial organisms cover solid surfaces, such as plastic material, glass and natural stone. In the presented study, biofilm samples from diverse natural and dimension stone surfaces where taken and used to analyze the diversity of bacteria, green algae and filamentous fungi in a comparative approach. Organisms, isolated from the sites and kept in pure cultures were used to unravel their mechanisms for adhesion to stone surfaces and their strategies for endolithic growth [1].

Overall microbial diversity markedly differs with respect to certain features of the stone surface. Analysis of cloned rDNA sequences obtained from environmental DNA revealed that surfaces covered with thin gypsum crusts are preferentially colonized by unicellular cyanobacteria. On other surfaces (sandstone, limestone), green algal species dominate.

Among heterotrophic bacteria, actinomycetales and other actinobacteria represent the most dominant groups. Among the filamentous fungi, not just typical colonizers of the oligotrophic stone surface could be detected, but also insect- and plant-associated species. Structural analyses of isolated organisms from all groups revealed features suitable for surface adhesion. Thin polysaccharide layers, down to some tens of nanometers in thickness, cover the rigid cell walls and act as surface adhesive agents.

[1] Hoppert *et al.* (2004) *Environ. Geol.* **46**, 421-428.

Helium and carbon geochemistry of hydrothermal fluids on the Southern East Pacific Rise at 11-32 ˚S

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We report the concentrations and isotopic compositions of He, CO_2, and CH_4 in 34 samples of hydrothermal fluids, collected from 10 sites at 11°18S' – 31°50'S on the Southern East Pacific Rise (SEPR). The SEPR is one of the fastest spreading mid-ocean ridges on earth, with spreading rates ranging from 10 to 15cm/yr.

CO_2 was the most abundant dissolved gas in all samples, with the end-member concentration varying from 6.4 to 130 mmol/kg. Aqueous H_2, the next most abundant volatile species, varied from 140 to 1400 μmol/kg. Dissolved CH_4, CO, and He were present at substantially lower concentrations. The helium isotope ratio, $^3He/^4He$ (R/Ra), varies from 7.5 to 9.4 (average 8.5), and $\delta^{13}C_{(CO2)}$ and $\delta^{13}C_{(CH4)}$ values range from -11.3 to -2.8‰ and -43.4 to -16.5‰, respectively.

We have recognized two areas with significant anomalies in $CO_2/^4He$ (45000) and $^3He/^4He$ (8.2-9.4) ratios: one is between 31.2ºS and 31.8ºS, and the other (weaker and widespread) anomalies occur between 17.4 and 21.6ºS. Our results support the suggestion made from a rare gas study by Kurz *et al.* (2005) [1] that the mantle underneath the SEPR is heterogeneous and that the two areas with anomalous gas chemistry represent hot spots.

Concentrations of H_2, CH_4, CO_2 and H_2O in the hydrothermal fluids were used to evaluate the degree of chemical equilibrium, $CO_2 + 4H_2 = CH_4 + 2H_2O$; the $\delta^{13}C_{(CO2)}$ and $\delta^{13}C_{(CH4)}$ values were used to evaluate the degree of isotopic equilibrium between the carbon species. The results indicate that the gases species retained chemical equilibrium at 600-800ºC, and isotopic equilibrium at 400-800ºC.

[1] Kurz M., Moreira M., Curtice J., Lott III D., Mahoney J., & Sinton J. (2005), *Earth and Planetary Sci. Lett.* **232**, 125-142.