Massively parallel tag sequencing of bacterial communities on basalts and extinct sulfides reveals substrate endemic populations

JASON B. SYLVAN[1], BETH N. ORCUTT[1,2], BRANDY M. TONER[3] AND KATRINA J. EDWARDS[1]

[1]University of Southern California, Los Angeles, CA (*correspondence: jsylvan@usc.edu)
[2]Aarhus University, Aarhus, DENMARK
[3]University of Minnesota, Twin Cities, St. Paul, MN

Mineral-microbe interactions and biologically mediated alteration processes may propagate well into the subseafloor, making it is important to ground our understanding of these processes where samples can be accessed and hypotheses tested. We used massively parallel tag sequencing of the V6 region of 16S rRNA to assess bacterial community structure on seafloor exposed basalts from 9°N East Pacific Rise (EPR) and Hawaii and extinct hydrothermal sulfide chimneys from 9°N EPR. Basalts harbored much more diverse communities than extinct chimneys or background seawater, including Acidobacteria, Actinobacteria and Chloroflexi, which were absent from the other substrates. Epsilon-proteobacteria and Aquificales, two classes common to active chimneys, were both absent from extinct sulfides, which were dominated by Proteobacteria and Bacteriodetes. There was a clear relationship by age between the basalt samples; younger samples were more similar to each other than to older samples. Sulfide samples grouped according to assumed time since most recent hydrothermal activity. Not surprisingly, Proteobacteria and Bacteriodetes were the most commonly shared tags between samples. Tags endemic to basalts were dominated by alpha- and gamma-proteobacteria whereas tags endemic to sulfides were dominated by alpha-, delta- and gamma-proteobacteria and a high proportion of Nitrospira. Full-length 16S rRNA clone libraries yielded generally similar results to the V6 tag sequencing, with some exceptions possibly due to the shorter amplicon length used here. This study shows that diverse bacterial communities, unique to their substrate type, inhabit cold temperature seafloor rock habitats. This is the first in-depth investigation of bacterial communities on extinct hydrothermal chimneys. Extinct chimneys and the massive sulfides on which they reside represent an abundant, globally distributed substrate for the unique bacterial assemblage which likely plays an important role in deep ocean metal cycling.

Trace element transport by COHS fluids in the deep lithosphere: A fluid inclusion perspective

CSABA SZABÓ[1]*, MÁRTA BERKESI[1], KÁROLY HIDAS[2], TIBOR GUZMICS[1], ROBERT J. BODNAR[3] AND JEAN DUBESSY[4]

[1]Lithosphere Fluid Research Lab, Eötvös University Budapest, Budapest, 1117, Hungary (*cszabo@elte.hu, marta.berkesi@gmail.com, tibor.guzmics@gmail.com)
[2]Instituto Andaluz de Ciencias de la Tierra, Universidad de Granada, Granada, 18002, Spain (karoly.hidas@gmail.com)
[3]Fluids Research Laboratory, Virginia Tech, Blacksburg, VA 24061, USA (rjb@vt.edu)
[4]UMR G2R et CREGU, Nancy University, BP-70239, 54506-Vandoeuvre-les Nancy Cedex, Nancy, France (jean.dubessy@g2r.uhp-nancy.fr)

In this work isolated fluid inclusions and coexisting silicate melt and fluid inclusions from a well-studied set of peridotite xenoliths [1, 2] from the Carpathian-Pannonian region (Hungary) are described to document the role of melt/fluid rock interaction in driving metasomatic processes associated with transporting incompatible elements and volatiles in the deep lithosphere.

The silicate melt inclusions are partially crystallized glass inclusions and possess trachyandesitic major element composition [1]. The fluid inclusions, present as either isolated inclusions or coexisting with silicate melt inclusions, are negative crystal shaped and show one visible fluid phase at room temperature. Low- and high-T heating-freezing experiments coupled with Raman microspectroscopy confirmed that both the coexisting and the isolated fluid inclusions are CO_2-dominated, but contain small amounts of H_2O as well [2]. Additionally, H_2S and solid carbonate (magnesite) are common phases in the fluid inclusions.

Trace element analysis of host minerals, silicate melt inclusions and/or fluid inclusions by *in situ* LA-ICP-MS indicates that both the isolated H_2O-bearing, CO_2-rich fluid inclusions and those coexisting with silicate melt inclusions (1) contain characteristic trace elements, such as LILE, MREE and in some cases Ti, Nb and (2) show trace element distributions similar to silicate melt inclusions. Consequently, CO_2-rich fluids with low H_2O content, may act as metasomatic agents in the deep lithosphere to produce the characteristic trace element signatures observed in metasomatized lithospheric mantle.

[1] Szabó *et al*. (2009) *Island Arc* **18**, 375–400. [2] Berkesi *et al*. (2009) *J. Raman Spect*. **40**, 1461–1463.