Microbially-mediated cycling of metals in deep subsurface fluids at Henderson Mine, Colorado

E.D. SWANNER AND A.S. TEMPLETON

Department of Geological Sciences, University of Colorado, Boulder, CO 80305 (elizabeth.swanner@colorado.edu)

Deep mines are an opportunity to study the organisms inhabiting the terrestrial subsurface, and the geochemical cycles they mediate. Metal-rich (Fe, Mn, Zn, Mo), briny fluids at circumneutral pH and ~40°C drain from boreholes in the granite-hosted, molybdenite orebody of Henderson Mine, Colorado, 3000' below the Earth's surface. When the reduced fluids are released into the oxic mine shaft, thick mats of amorphous Fe- and Mn-oxides, and sulfate minerals precipitate. Organic carbon is detected only in micromolar quantities, while CO_2 is abundant, implying an autotrophic system. Successful culturing enrichments were made by inoculating the mineral mats and water samples into a FeS and O_2 gradient stabilized by a gel agar [1]. After a stable community developed, DNA was extracted, and a subset of the 16S genes representing the organisms in the culture was sequenced. Interestingly, the data revealed the presence of known Fe-reducers, denitrifiers, and S-oxidizers, but sequences of potential Fe-oxidizers were conspicuously absent. Several of the cultured sequences are also present in clone libraries that correspond to organisms detected *in situ* [2]. Subsequently, substrates were removed from the cultures in order to isolate organisms that mediate specific redox cycles. These experiments suggest that subsurface life is abundant and actively cycling rock-derived substrates.

[1] Emerson, D. & C. Moyer (1997) *Appl. Envir. Microbiol.* **63**(12) 4784-4792. [2] Sahl, J. W., R. Schmidt *et al.* (2008) *Appl. Environ. Microbiol.* **74**(1) 143-152.

Geochemical, geological and geophysical inferences for the origin of the South Kauai Swell

L. SWINNARD[1], M. GARCIA[1]*, D. WEIS[2], G. ITO[1], A. FLINDERS[1], T. BIANCO[1], B. APPELGATE[1], B. TAYLOR[1], C. BLAY[3], S. YAMASAKI[4] AND T. TAGAMI[4]

[1]Dept. of Geology-Geophysics, Un. Hawaii, Honolulu, HI, USA (*correspondence: mogarcia@hawaii.edu)

[2]Dept. of Earth & Ocean Sciences, Univ. British Columbia, Canada

[3]TEOK, Kauai, USA

[4]Dept. of Geology and Mineralogy, Kyoto Univ. Japan

Submarine volcanism is widespread around the Hawaiian Islands. One enigmatic submarine feature is the South Kaua'i Swell (SKS), spanning ~5000 km^2 with an estimated volume ~3000 km^3 or 5% of the total volume of the Kaua'i volcano. Its origin is controversial: landslide, secondary volcanism or separate shield? A fall 2007 bathymetric, geophysical, and JASON2 ROV sampling expedition examined the SKS in detail to determine its origin. Over 400 coned shaped seamounts, typically 1000 m wide and 100 m tall with variable acoustic backscatter, were identified. Submersible observations and sampling indicate the seamounts are dominantly fragmental lava debris with no intact pillows. Many of the deposits are monomict suggesting a nearby origin, although others have rounded, matrix-supported clasts suggesting a landslide origin. XRF major and trace elements, ICM-PS trace element and Pb, Sr, Nd and Hf isotopic data were collected on lavas from 15 seamounts. Samples from all but two of the seamounts are tholeiitic and geochemically similar to Kaua'i shield lavas but extend to higher Zr/Nb (14 vs. 12) and $^{208}Pb^*/^{206}Pb^*$ (0.960 vs. 0.948), and lower ε_{Nd} (6.9 vs. 7.6) values. Preliminary gravity analyses show a broad, low-amplitude (~10 mGal) residual gravity high that is centered ~50 km south of Kaua'i indicating slightly elevated crustal densities. These lithologic, compositional and gravity results support either: (1) a huge landslide from an early Kaua'i shield or (2) a separate submarine shield that experienced extensive explosive volcanism and erosion. A landslide origin is not supported by one available K-Ar date (3.9 Ma); more ages are in progress and will be reported. Resolving the origin of the SKS will provide a better understanding of the dynamics of the Hawaiian plume for producing cross-strike volcanism or confirm the importance of landslides in the formation of Hawaiian shield volcanoes.