Geochemical evolution and bioenergetic potential of shallow-sea hydrothermal fluids from Panarea Island (Italy)

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The shallow-sea hydrothermal fluids off Panarea Island, Italy are hot (up to 135 °C), acidic (pH 1.9-5.7), and sulfidic (up to 1 mM). Vent and pore fluids at three sites were sampled and analyzed for major and minor elements, redox-sensitive compounds, and strontium isotopes. These data were used to describe the geochemical evolution of the fluids and to evaluate the catabolic potential of 61 inorganic redox reactions for *in situ* microbial communities. Based on the geochemical data, the fluids divide into three distinct types, all depleted in Mg^{2+} and SO_4^{2-}. Types 1 and 2 are much more saline than seawater, but to different degrees, whereas Type 3 fluids are seawater-like with respect to most major ions. Type 1 fluids are interpreted to be derived from a very high salinity hydrothermal reservoir fluid, while Type 2 results from the discharge of a lower salinity reservoir fluid which has perhaps undergone phase separation. Type 3 fluids may result from hydrothermal alteration of seawater in the shallow subsurface by discharging gases. Gibbs energies (ΔG_r) of redox reactions that couple potential terminal electron acceptors (O_2, NO_3^-, Mn^{IV}, Fe^{III}, SO_4^{2-}, S^0, CO_2,) with potential electron donors (H_2, NH_4^+, Fe^{2+}, Mn^{2+}, H_2S, CH_4) were evaluated at *in situ* temperatures and compositions. Per mole of electron transferred, the range of ΔG_r spans from near 0 to -120 kJ (mol e-)$^{-1}$. When these Gibbs energies of reaction are normalized per kilogram of hydrothermal fluid, sulfur oxidation reactions are the most exergonic, while the oxidation of Fe^{2+}, NH_4^+, and Mn^{2+} are moderately energy yielding. The results of these calculations are consistent with available molecular microbiology (16S rRNA) data, which suggest that aerobic oxidation of H_2S may be the most common metabolism in the hydrothermal springs near Panarea.

New Sr-Nd-Pb isotopic data on Graciosa island lavas (Azores)

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The Graciosa island belongs to the Central Group of the Azores archipelago, to the east of the Mid-Atlantic Ridge. Three main volcanic complexes are recognized, in order of decreasing age: the Serra das Fontes Volcanic Complex (620±120 Ky [1]) composed of basaltic effusive products, the Serra Branca Volcanic Complex (350±40 Ky [1]) which presents trachytic products and the most recent Vitória-Vulcão Central Volcanic Complex formed by basaltic to trachytic terms and divided into two units: Vitória and Vulcão Central, being the latter the youngest volcanic unit [2].

A selection of nine lavas from the three volcanic complexes (basalt to trachyte compositions) have been analyzed for Sr-Nd-Pb isotopic systems. They display a small variability of $^{87}Sr/^{86}Sr$ (0.703356 and 0.703576) and $^{143}Nd/^{144}Nd$ (0.512883 to 0.512964) isotope ratios, and the Pb-Pb isotope ratios correlate positively ($^{206}Pb/^{204}Pb$ from 19.419 to 20.096; $^{207}Pb/^{204}Pb$ from 15.588 to 15.659; $^{208}Pb/^{204}Pb$ from 39.038 to 39.520). These new Sr, Nd and Pb isotopic data suggest the involvement of two mantle components: a depleted MORB and an enriched HIMU.

The oldest samples (Serra das Fontes, Serra Branca and Vitoria Unit) of the northern half of the island have homogeneous isotopic ratios with a high influence of the MORB mantle component. In contrast, the youngest samples from the southern part of the island (Vulcão Central Unit) present more radiogenic isotopic compositions. This suggests that during the formation of Graciosa island, the composition of the mantle and/or conditions of melt generation varied with time, as recently reported in other islands from central Azores [3].

[1] Feraud *et al*.. (1989) *Earth Planet.Sci. Lett*. **46**, 275-286. [2] Gaspar (1996) PhD thesis. [3] Hildenbrand *et al*.. (2012) *AGU Fall Meeting* **DI51A-2352**.

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