Nitrogen dynamics in oceanic basement and its implications for HCN and abiotic organic synthesis

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Seawater is constantly circulating through oceanic basement as a low-temperature fluid (<150°C). Passive off-axis hydrothermal convection of seawater in older crust is in general a Rayleigh-Benard type circulation driven by the heat flow from the underlying, cooling crust. Convection even in quite old crust is, however, in most cases still related to the original convection at the spreading ridge axis, although off-axis hydrothermal systems driven by exothermic hydration processes do exist in ultramafic rocks. One example is the Lost City hydrothermal system near the Mid-Atlantic Ridge. Results from the ODP Leg 201 reveal that fresh seawater is channeled upwards into deep-sea sediments from the rocks underneath. This happens still 40 Ma or more after formation of the basement and can be seen in concentration profiles of dissolved nitrate in sediment porewater from ODP Sites 1225 and 1231. This means that nitrogen that has been oxidized at the Earth's surface may be continuously transported by ocean water down into reducing environments of mafic or ultramafic rocks in oceanic basement. On the early Earth, oxidized nitrogen compounds (NO_2^- and NO_3^-) may have been formed from N_2 in a redox neutral atmosphere by lightning, corona discharge and impacts and subsequently transported by fluid circulation into reducing environments of the lithosphere. Among aqueous environments, hydrothermal systems represent regions of the highest NH_3 conversion rates and stability on the Earth. Layer silicates, like smectites, and zeolites have high cation exchange capacity (CEC). The CEC of minerals is generally determined in the laboratory by the uptake and release of ammonium ions (NH_4^+) of a 1 M ammonium acetate solution. The adsorption properties of zeolites are very powerful, and particularly molecules with dipolar moments such as H_2O, NH_3, CO and HCN are strongly adsorbed. In experiments at temperatures of about 250-325°C, CO+ NH_3 adsorbed on zeolites react to give HCN. In the same experiments, several amino acids and the puric substance adenine have been found [1].

[1] Fripiat *et al*. (1972) *Clays Clay Min*. **20**, 331-339.

A new trend for the Cape Verde hotspot magmas: Isotopic evidence from Boa Vista

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Cape Verde hotspot volcanism has lasted for >20 Ma, shows great isotopic diversity (EM1, HIMU) and is therefore well suited for studies of mantle plume dynamics. Third largest in the archipelago, the eastern island Boa Vista was formed relatively early, mainly 16-5 Ma, from nephelinitic-basanitic-basaltic magmas and derivatitve phonolites and trachytes. We present isotopic data showing that the early hotspot magmas of Boa Vista are distinct from both the HIMU-trend of the northern islands and the EM1-trend of the southern, constituting a third trend for Cape Verde hotspot. With time the Boa Vista compositions evolved away from the other Cape Verde compositions. The oldest Boa Vista rocks have radiogenic Pb comparable to early Santo Antão ($^{206}Pb/^{204}Pb$ = 19.7) but with lower $^{143}Nd/^{144}Nd$. Pb trends towards less radiogenic compositions with $^{208}Pb/^{204}Pb$ intermediate between the northern and southern islands. A new end member for Cape Verde is defined with Sr and Nd isotope compositions intermediate between northern and southern islands and $^{208}Pb/^{204}Pb$ lower than in southern islands (i.e. $\Delta 8/4 \approx 0$) at $^{206}Pb/^{204}Pb$ = 19.0. Most of the melts defining this end member suffered little modification prior to eruption (10-15 wt% MgO).

The Boa Vista data demonstrate that Cape Verde magmas had contributions from at least three distinct mantle compounds.

Boa Vista magmas with relatively unradiogenic Pb tend to have melted at shallower level by less degree of melting of a more depleted source (lower L/HREE, SiO_2 and Zr) but with relatively lower $^{143}Nd/^{144}Nd$, and the source is likely part of plume mantle.

The possible mantle setup under Cape Verde to explain the lateral and temporal distribution of components for the magmas of the archipelago will be discussed.