

Hydrothermal stability of adenine under controlled fugacities of N₂, CO₂ and H₂

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Demonstrating that organic compounds are stable at high temperatures is important in the context of Archean hydrothermal systems as potential sites for the synthesis of the first organic molecules on Earth. Among such molecules, amino acids have been the subject of numerous studies (e.g. Miller and Bada, 1988; Shock, 1990; Andersson and Holm, 2000). In contrast, nucleic acid bases have received much less attention. Consequently, the present experimental study was undertaken to investigate the stability of adenine at 300°C. The experiments were carried out in sealed autoclaves under fugacities of gaseous CO₂, N₂ and H₂ representative of those encountered in marine hydrothermal systems. The fluid phase was generated from the decomposition of oxalic acid, sodium nitrite and ammonium chloride, and the oxidation of metallic iron. The results of the experiments seem to indicate that the concentration of adenine stops decreasing after ~ 96 hours (Figure 1). This suggests that an equilibrium state may have been established between adenine and the inorganic constituents of the fluid phase, which is corroborated by independent thermodynamic calculations.

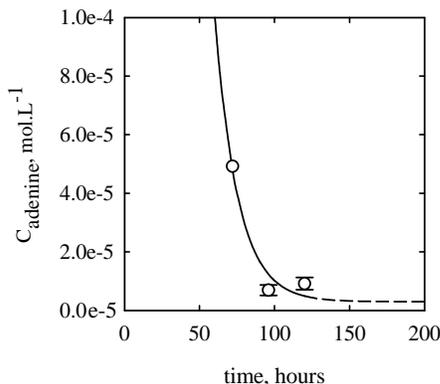


Figure 1: Evolution of the concentration of adenine as a function of time. The dashed extension represents an extrapolation beyond the duration of the experiments.

References

- Andersson E. and Holm N.G. (2000) *Orig. Life Evol. Biosph.* **30**, 9-23.
Miller S.L. and Bada J.L. (1988) *Nature* **334**, 609-611.
Shock E.L. (1990) *Geochim. Cosmochim. Acta* **54**, 1185-1189.

The importance of constant flux proxies in paleoceanography

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For all paleoceanographic reconstructions from marine archives a precise chronology is the most essential prerequisite for reliable estimates of processes in the past and for compatibility between different records. All paleoceanographic studies, in particular those aiming at the reconstruction of fluxes from pelagic sediments (for example those on paleoproductivity or dust fluxes) face two main additional problems which complicate a reliable application. For some components of interest (such as organic carbon or biogenic opal) only a small and even variable fraction may be preserved between signal formation in surface waters and deposition in the sediments. The second problem which can affect all paleoceanographic reconstructions from marine sediments is sediment redistribution by currents or within nepheloid bottom layers. These processes can alter the true signatures to variable extents thereby completely masking the original signatures. This is of course particularly important in dynamic bottom current regimes but sediment redistribution can also be active at any other location.

In order to overcome and, in the optimal case, quantify and correct for these effects, a number of so-called constant flux proxies have been developed and applied. The most frequently used of those is the U-series nuclide ²³⁰Th, which is produced at a constant rate in the water column of the Ocean from homogeneously distributed uranium, and which is only advected with water masses to a very limited extent due to its high particle reactivity. Other examples are ³He derived from interplanetary dust particles (IDPs), which are deposited on the surface of the earth at a nearly constant rate or, less frequently used, cosmogenic ¹⁰Be.

I will give an overview of these constant flux proxies and discuss recent new findings on their strengths and weaknesses. As in most cases in paleoceanographic and geochemical research, none of these proxies is perfect but in view of the possibly huge misinterpretations occurring without their use, their application is absolutely crucial for any reliable paleoceanographic reconstruction. This is because effects of sediment redistribution cannot be readily identified from sedimentary parameters, they may occur at unexpected locations, and places with potentially focussed sediments are preferentially chosen as coring sites due to the expectable high time-resolution of the records.