Fate of prebiotic adenine

THOMAS K. HANSSON, COREY A. COHN, HÅKAN S. LARSSON, STEPHEN J. SOWERBY, AND NILS G. HOLM

thomas.hansson@geo.su.se
nils.holm@geo.su.se

Equilibrum adsorption isotherm data for the purine base adenine has been obtained on several prebiotically relevant minerals by frontal anaysis using water as a mobile phase. Adenine is far displaced toward adsorption on pyrite (FeS_2), quartz (SiO_2) and pyrrhotite (FeS), but somewhat less for magnetite (Fe_3O_4) and forsterite (Mg_2SiO_4). The prebiotic prevalence of these minerals would have allowed them to act as sink for adenine; removal from the aqueous phase would confer protection from hydrolysis as well , establishing a nonequilibrium thermodynamic framework for increased adenine synthesis. Our results provide evidence that adsorption phenomna may have been critical for the primordial genetic architecture.

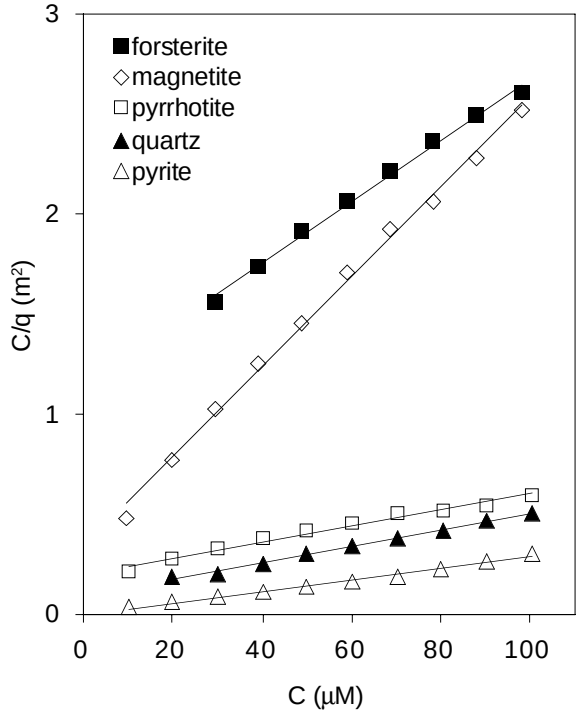

Fig. 1. Langmuir plots for adenine adsorbed to pyrite, pyrrhotite, magnetite, forsterite and quartz at 30°C. The slope is in inverse proportion to the theoretical limit of adsorbed solute.

Rare gas and Sr-Nd-Pb-Hf isotope systematics of Deccan flood basalts

T. HANYU[1], T. J. DUNAI[2], G. R. DAVIES[2], S. NAKAI[3], I. KANEOKA[3], T. FUJII[3] AND T. SANO[4]

[1]Institute for Frontier Research on Earth Evolution, Japan Marine Science and Technology Center, Yokosuka, Japan (hanyut@jamstec.go.jp)
[2]Faculteit der Aardwetenschappen, Vrije Universiteit Amsterdam, Amsterdam, The Netherlands (dunt@geo.vu.nl, davg@geo.vu.nl)
[3]Earthquake Research Institute, University of Tokyo, Bunkyo-ku, Tokyo, Japan (snakai@eri.u-tokyo.ac.jp, kaneoka@eri.u-tokyo.ac.jp, fujii@eri.u-tokyo.ac.jp)
[4]College of Environment and Disaster Research, Fuji Tokoha University, Fuji, Shizuoka, Japan (sano@fuji-tokoha-u.ac.jp)

Rare gas isotopes as well as Sr-Nd-Pb-Hf isotopes of samples from the Deccan flood basalt province are presented. Although high $^3He/^4He$ ratio up to 14 Ra has been reported for the early igneous event prior to main Deccan volcanism (Basu et al., 1993), nine clinopyroxene separates from the main Deccan province have relatively low $^3He/^4He$. These samples can be divided into two groups according to their $^3He/^4He$ of the first crushing step; three samples have uniform $^3He/^4He$ between 3.2 and 3.5Ra (Group-A) and the others have 1.6Ra or less (Group-B). This grouping by $^3He/^4He$ is irrespective of major element composition or He concentration, but is related to age corrected Sr-Nd-Hf isotope ratios. Groups -A and -B define different data arrays in Sr-Nd and Sr-Hf isotope diagrams, in which both arrays trend towards the Ambenali Formation. In the Deccan Province, the Ambenali Formation has isotopic compositions most typical of depleted source. The early igneous event with a primitive He isotopic character presumably records direct melting of the starting plume (Basu et al., 1993). The isotopic correlations recorded by the main magmatic sequences, however, demonstrate that mixing of enriched components to a depleted upper mantle signature is the main control on the isotopic and trace element character of Deccan magmatism (e.g.; Peng et al., 1998). Group-A array suggests that the mixing endmember is enriched mantle that has a time-integrated ^4He enrichment. Mixing such components produces large Nd and Hf isotope variations in contrast to uniform $^3He/^4He$. On the other hand, the mixing endmember needed to explain the data of Group-B has a very low $^3He/^4He$. Bulk assimilation of continental crust best explains the resulting trend toward enriched Sr-Nd-Pb-Hf isotope ratios and low $^3He/^4He$.

References

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