The artificial Martian meteorite experiment *STONE-1*

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The 28 SNC meteorites identified to date are all igneous rocks, being basalts or basaltic cumulates. The lack of sedimentary rocks in this inventory is therefore surprising, in view of the collisional history of Mars and the likelihood that Mars experienced warmer conditions, possibly with a significant hydrosphere, earlier in its history. To address the possibility that sedimentary rocks ejected by impact from the surface of Mars may have reached the Earth, but did not survive terrestrial atmospheric entry, an experiment was performed in which samples of dolomite, a simulated Martian regolith (basalt fragments in a gypsum matrix) and a basalt were fixed to the heat shield of a recoverable FOTON capsule and flown in low Earth orbit. Temperatures attained during re-entry were high enough to melt basalt and the silica fibres of the heat shield and were therefore comparable to those experienced by meteorites. The dolomite sample survived space flight and atmospheric re-entry, in part, as did fragments of the simulated Martian regolith, allowing detailed examinations of these artificial meteorites to be conducted for chemical, mineralogical and isotopic modifications associated with atmospheric re-entry. The carbon isotopic signatures were analysed on the leading and trailing surfaces of the residual carbonate. $\delta^{13}C$ reductions were observed. They are in accord with kinetic isotopic fractionation having accompanied thermal degradation of the dolomite during re-entry. However, secondary carbonates formed by post-flight reaction with atmospheric carbon dioxide would also have lowered $\delta^{13}C$ values of the remaining dolomite. Oxygen three-isotope measurements of the silica ‘fusion crust’ formed on the sample holder during atmospheric re-entry fit on a mixing line, with tropospheric O_2 and the interior of the sample holder as end members.

Reference

Brack, A., Baglioni, P., Borruat, G., Brandstätter, F., Demets, R., Edwards, H.G.M., Genge, M., Kurat, G., Miller, M.F., Newton, E.M., Pillinger, C.T., Roten, C.-A. and Wäsch, E. (2002). Do meteoroids of sedimentary origin survive terrestrial atmospheric entry? The ESA artificial meteorite experiment *STONE*, *Planet. Space Sci.* **50**, 763-772.

Paleosalinity reconstruction of Lake Issyk-Kul utilizing dissolved noble gases in sediment pore water

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Dissolved atmospheric noble gases in environmental aquatic systems are proxies for the water temperature, salinity and atmospheric pressure prevailing when the respective waters were last in contact with the atmosphere. In this study we discuss the use of lacustrine sediment pore water as a new noble gas archive for the history of the physical conditions of the overlying water body.

It has been shown that the concentrations of dissolved atmospheric noble gases in lakes closely correspond to the in-situ temperature and salinity of the water, and to the mean atmospheric pressure at the lake surface. During sedimentation part of the water at the sediment/water interface is incorporated into the sediment pore space. Therefore the noble gas concentrations in the pore water are expected to carry information about the past physical conditions of the overlying water.

Lake Issyk-Kul (Kyrgyzstan) is a large alpine lake situated in a semi-arid environment and has no outflow. Therefore the lake is slightly saline (6 g/kg). The lake level and the lake water balance are expected to react sensitively to changes of the hydrological regime of the catchment area. The reconstruction of historic shore-lines suggest large lake level variations in the past.

The noble gas concentrations of the Lake Issyk-Kul sediment pore water show a distinct variation with sediment depth. The noble gas distribution correlates with the mineralogical composition of the sediment matrix.

This noble gas signal allows the quantification of past water salinity and/or lake level fluctuations. At ca. 90 cm sediment depth, the noble gas concentrations suggest a salinity maximum of more than twice the present salinity, corresponding to a drastic drop of the lake level. This salinity maximum might provide an explanation for the characteristic composition of biological species in Lake Issyk-Kul because only species with high salinity tolerance can persist under such variable salinity conditions.