4.1.16

Extremely perseverant microbes isolated from a deep-sea hydrothermal vent system

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One aspect of astrobiology currently under investigation at JPL is the detection and characterization of microbes displaying unique survival capabilities in unfavorable environmental conditions. Samples were obtained from the Kali chimney, part of a deep-sea hydrothermal vent field in the Rodriguez Triple Junction, Indian Ocean (~2,240 m) and the microbial diversity examined by both molecular and traditional, culture-based methods. Based on *rrn* sequences retrieved from the chimney and its surrounding environment, novel, phylogenetically distinct microorganisms appear to be prevalent, but proved uncultivable with present-day techniques. Water, sediment, and animal samples were obtained directly from, as well as at variable distances (2-20 m) around the chimney to elucidate changes in the microbial profile. Following DNA extraction, samples were subjected to eukaryal, archaeal, and eubacterially biased PCR conditions (SSU rDNA-targeted) and clone libraries were constructed. Several archaeal sequences were retrieved and were identified to the species level. Sequences arising from methanogens, sulfate-reducers, and uncultured marine archaea were predominant. A total of 46 isolates were chosen for exposure to a number of environmental stresses, such as desiccation, 5% liquid H_2O_2, UV_{254}, and 0.5 Mrad γ-radiation. Isolates exhibited varying levels of resistance to the above conditions were observed, most intriguing was the survival to a UV-radiation dose of more than 1,000 J/m^2. The most resistant isolate, HS3s-03b, identified as a *Psychrobacter* sp., survived all treatments. In addition when this isolate was exposed to simulated Mars irradiation levels (59 W/m^2 total UV flux) the vegetative cells of this non spore-forming microbe maintained a LD_{90} of 24 sec., that is comparable to the LD_{90} of a standard UV dosimetric spore.

4.1.17

Sulphate-oxygen isotope records from carbonate associated sulphate

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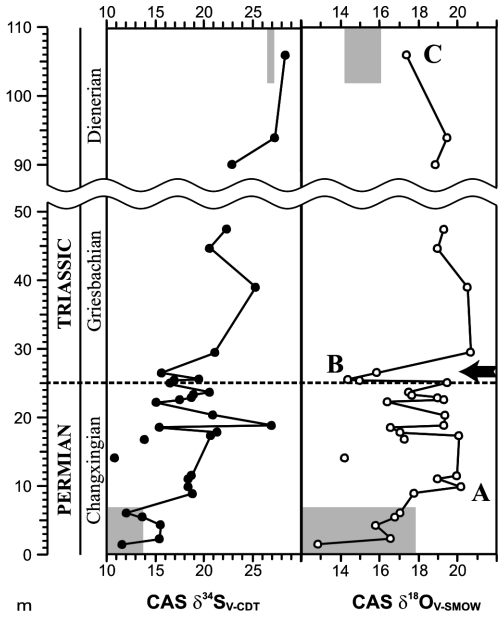
Sulphate contained in the crystal lattice of carbonate minerals (carbonate associated sulphate, CAS) is becoming more widely recognised as a reliable sulphur-isotope proxy for ancient seawater. Here we present evidence that the oxygen-isotope compositions of CAS in 250 Ma old Permo-Triassic limestones from Siusi in northern Italy also retains a primary seawater signature.



The evidence that the CAS-oxygen data represent a seawater record is twofold: 1) They coincide, or are close to, known evaporitic values at the bottom and top of the succession (shaded boxes). 2) The data co-vary with variations in CAS-sulphur isotopes.

Like the sulphur isotopes, CAS-oxygen record a period of anoxia in the late Permian and one in the earliest Triassic, with substantially heavier values at these times. However, the CAS oxygen records reveals three features not recorded the sulphur isotope record: (A) They reach a peak before that of the sulphur isotope curve, indicating some kind of new equilibrium, either between the total volume of anoxic and oxic waters, or between water and sulphate oxygen. (B) A notable decline directly preceding the well known negative carbon isotope excursion interpreted as a sudden deoxygenation event caused by methane gas-hydrate release. (C) A steady decline in the Dienerian recording the decline in global anoxia, not recorded in the CAS-sulphur record.