

Pressure-induced phase transition in cavansite – A rare zeolite from the Deccan Trap, India

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We present here for the first time the experimental results on the pressure dependence of the electrical resistivity of Cavansite, a rare zeolites from the Deccan Trap, India. The cavansite sample has been characterized by powder X-ray diffraction, thermal analyses, solid-state nuclear magnetic resonance and X-ray photoelectron spectroscopic methods. The Deccan Traps, famous as a prolific source of zeolites specimens, currently covers an area of approximately 500, 000 square km in western India, but probably used to cover at least 1.2 million square kilometres after deposition in the late Cretaceous[1]. Cavansite, Ca (VO) Si₄O₁₀. 4 H₂O, occurs in cavities in tholeiitic basalts of the Deccan Volcanic Province, and in pores of altered basalt breccias and tuffaceous andesite. XRD studies show the presence of seven distinct lines all of them could be indexed to a orthorhombic cell with a= 0.979nm, b= 1.364nm, and c= 0.963 nm. The calculated density is 2.33 g/cc. NMR studies of cavansite, show that Si atoms in tetrahedral coordination with O atoms, whereas V atoms exist in highly distorted environment of O atoms. The ⁵¹V –NMR studies show that vanadium atom is in the square-pyramidal coordination typical of the 4- and 5- valent states. High-pressure electrical resistivity [2] studies show that Cavansite undergoes pressure-induced amorphization at about 6.5 GPa. The pressurized sample show partial dehydration of the Cavansite sample.

[1] Parthasarathy, G. *et al.* (2008) *Geochimica et Cosmochimica Acta* **72**, 978-988. [2] Parthasarathy G. (2007) *Materials Letters*. **61**, 4329-4331

Sulfur and carbon cycling in the late Archean Hamersley Basin

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Sulfur isotopes display mass independent fractionation (MIF) according to pyrite morphology in some late Archean Hamersley Basin sediments [1]. These data provide valuable insight into the distribution of late Archean microbial habitats when analysed in the context of depositional environment and the carbon isotope systematics of the host rock.

In the shallow water sediments of the ~2.6 Ga Wittenoom and Carawine Formations, variably negative organic carbon isotopic compositions occur without a corresponding carbonate carbon isotope depletion, while multiple pyrite morphologies exhibit little variation in sulfur MIF values in individual samples. This pyrite displays two distinct sulfur isotope distribution patterns. One is indicative of microbial sulfate reduction in a somewhat oxidised environment, with low negative $\Delta^{33}\text{S}$ corresponding to a diverse range of positive and negative $\delta^{34}\text{S}$ values. The other may represent an atmospheric mixing array with positive $\Delta^{33}\text{S}$ values corresponding to generally positive $\delta^{34}\text{S}$ [2]. Regardless of morphology, the pyrite in each sample contains sulfur from a common source

In the relatively deeper water sediments of the ~2.7 Ga Jeerinah Formation, morphology dependent pyrite sulfur MIF occurs together with depleted carbonate carbon isotope compositions and the strongly depleted organic carbon isotope values that are common in the organic rich sediments of the Hamersley Basin. The samples exhibit positive sulfur MIF values and can be separated into two populations. One comprises an atmospheric mixing array similar to that of the overlying shallow water sediments, the other may be the result of multi-stage sulfur cycling, involving both oxidising and reducing processes and/or metabolisms. This trend is characterised by positive $\Delta^{33}\text{S}$ and a range of $\delta^{34}\text{S}$ values. Biological multi-stage carbon cycling, possibly involving methanogenesis, methanotrophy and anaerobic methane oxidation, may have lead to the strongly depleted organic and carbonate carbon isotopes, which occur in the same anaerobic deeper water sediments that contain evidence of multi-stage sulfur cycling and multiple sulfur sources.

[1] Partridge *et al.* (2008) *EPSL* **272**, 41-49. [2] Ono *et al.* (2003) *EPSL* **213**, 15-30.