Geophysical Research Abstracts
Vol. 17, EGU2015-15616, 2015
EGU General Assembly 2015


# Deep Biosphere Secrets of the Mediterranean Salt Giant

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One component of the IODP multi-platform drilling proposal called DREAM (Deep-Sea Record of Mediterranean Messisnian Events), plans to investigate the deep biosphere associated to the Messinian Salinity Crisis (MSC) Salt Giant. We propose that the MSC Salt Giant, because of the variety of chemical environments it produces, has the potential to harbour an unprecedented diversity of microbial life with exceptional metabolic activity. Gypsum and anhydrite deposits provide a virtually unlimited source of sulphate at depths where oxidants are a rarity in other sedimentary environments. When reduced organic carbon comes into contact with these minerals there is the potential for a dynamic deep biosphere community of sulphate reducers to develop, with implications for sedimentary biogeochemical cycles and the souring of cruide oil. But the thickness of the Messinian evaporites and the range of chemical environments it harbours poses fundamental questions: will the interaction of several extreme conditions of temperature, salinity, pressure and chemical composition limit the ability of microbes to take advantage of such favourable thermodynamic conditions? And has such a diverse set of physical and chemical environments fostered microbal diversity, rather than phylogenetic specialization, as recent research into deep Mediterranean brine systems seems to indicate ? Over three kilometres in thickness, approaching the known temperature limits of life and with fluids precipitating carbonate, sulphate, halite and potash salts, microbes living within and around the MSC Salt Giant will be subject to the most exotic combinations of extremes, and have likely evolved yet unknown adaptations. Gypsum and Halite crystals contain fluid inclusions that are a micro-habitat in which microbes survive for tens of thousands, to possibly millions, of years, posing the fundamental question of cells devoting nearly all of their energy flow to somatic maintenance needs, rather than growth and reproduction, and opening new avenues for research for life on other planets. Fluid inclusions and the microbes they contain also inform us on the chemical and physical conditions of the sedimentary environment at the moment of deposition. This information will be key in deciphering the complex succession of paleoclimatic and hydrological events that led to the formation of the MSC Salt Giant. Drilling the MSC Salt Giant is an unprecedented opportunity to sample and investigate this highly reactive association of microbial communities, pore fluids and minerals which is the modern analogue for ancient deep biosphere communities developed in the salt giants of the geological past.