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Results from Astrobiology Field Research Campaigns in Earth Extreme Environments

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Abstract

We conducted a series of field research campaigns in the extreme environment of the Utah desert relevant to habitability and astrobiology research in Mars environments, and in order to help in the interpretation of Mars missions measurements from orbit (MEX, MRO) or from the surface (MER, MSL). Keywords: astrobiology, habitability, life detection, field analog research, Earth-Mars, organics

Methods & Results

We deployed at Mars Desert Research station, near Hanksville Utah, a suite of instruments and techniques [1, 2, 9-11] including sample collection, context imaging from remote to local and microscale, drilling, spectrometers and Polymerase Chain Reaction PCR. We analyzed how geological and geochemical evolution affected local parameters (mineralogy, organics content, environment variations) and therefore the habitability and the signature of organics and biota.

Among the important findings of these field research campaigns are the diversity in the composition of soil samples even when collected in close proximity, the low abundances of detectable polycyclic aromatic hydrocarbons and amino acids and the presence of biota of all three domains of life with significant heterogeneity. An extraordinary variety of putative extremophiles, mainly Bacteria but also Archaea and Eukarya was observed [3,4,9]. A dominant factor in measurable bacterial abundance seems to be soil porosity and lower clay-sized particle content [6-8]. We discuss the protocol for sterile sampling, contamination issues, and the diagnostics of biodiversity via PCR and DGGE analysis in soils and rocks samples [10, 11]. We compare the 2009 campaign published results [0-9] to new measurements from 2010-2012 campaigns relevant to the detection of organics and signs of life.

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