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ANALYSIS OF MICROBIAL DIVERSITY BY PCR IN A MARS ANALOGUE ENVIRONMENT – THE MARS DESERT RESEARCH STATION

Abstract

The search for traces of life on Mars, past or present, is one of the main goals of several planned future Mars mission. These investigations will require the detection of markers that indicate the presence of life. Deoxyribonucleic acid (DNA), the long-term storage molecule of genetic information, found in all living organisms on Earth, is considered to be such a 'biosignature' of life. With the help of the Polymerase Chain Reaction (PCR) technique, it is possible to detect even smallest amounts of DNA. The compactness of the semi-automated PCR instruments allows an effective and robust routine sample analysis. During the EuroGeoMars simulation campaign at the Mars Society's Mars Desert Research Station (MDRS) in Utah, in February 2009, one of the major biological questions asked was: Is it possible to analyze on-site, in the habitat laboratory, soil samples for their content of microbial life? Our goal was to establish for the first time a culture-independent, routine sample analysis for detection of DNA of microorganisms based on the PCR technique, reaching far beyond the techniques that other crews applied at MDRS before. Soil samples were collected from different locations and sampling depths. The microbial DNA was extracted and used for PCR analysis of the highly conserved ribosomal DNA to identify representatives of the different groups of microorganisms (bacteria, archaea and eukarya). The diversity of the microbial communities in the collected samples was analyzed with respect to sampling depth and the presence or absence of vegetation. For the first time, we have demonstrated that direct on-site DNA analysis by PCR is possible at MDRS, a simulated planetary habitat in an extreme environment that serves as a model for the preparation and optimization of techniques to be used for future Mars exploration.