Application of Computer Tomography (CT) for Search of Life in Extreme Environments

A. I. Tsapin; Jet Propulsion Laboratory/California Institute of Technology
M. C. Storrie-Lombardi; Jet Propulsion Laboratory/California Institute of Technology
G. McDonald; Jet Propulsion Laboratory/California Institute of Technology
K. H. Nealson; Jet Propulsion Laboratory/California Institute of Technology

First attempts to find life outside the Earth were made after Apollo missions brought lunar rock to the Earth. In 2008 we expect to work with Martian rocks. In both cases we have to search for life inside rocks or soil samples. During last 30-40 years a significant number studies were done on endolithic organisms. These organisms were found in rocks in Dry Valley (Antarctica), and in rocks in mines at different depths up to several km. To study endolithic microorganisms we need to have methods to visualize them inside their natural habitats - rocks. In this study we suggested to use computer tomography (CT) for that matter. Method of CT is based on interaction of X-rays with nuclei of atoms in sample. The information in CT experiments reflects the spatial distribution of sample density. In some cases it’s possible to visualize biofilms and areas inside rocks which were colonized by bacteria. We were able to image layers of algae, lichens and fungi inside and on the surface of rocks from Antarctic Dry Valley. CT data were supported with optical and electron microscopy studies. We are in process of improving this technique to achieve better spatial resolution, which now is about 300 - 500 micron. We applied successfully CT for imaging soil samples from desert environments (Death Valley).