



Mars Exploration Rover's image analysis: Evidence of Microbialites on Mars.

Giorgio Bianciardi (1), Vincenzo Rizzo (2), and Nicola Cantasano (3)

(1) University of Siena, Dpt. Medical Biotechnologies, Siena, Italy (gbianciardi@unisi.it), (2) National Research Council - retired -, Via Repaci 22, Rende, Cosenza, Italy, (3) National Research Council, Institute for Agricultural and Forest Systems in the Mediterranean, Rende Research Unit, Cosenza, Italy

The Mars Exploration Rovers, Opportunity and Spirit, investigated Martian plains, where sedimentary rocks are present. The Mars Exploration Rover's Athena morphological investigation showed microstructures organized in intertwined filaments of microspherules: a texture we have also found on samples of terrestrial (biogenic) stromatolites and other microbialites. We performed a quantitative image analysis to compare images of microbialites with the images photographed by the Rovers (corresponding, approximately, to 25,000/25,000 microstructures, Earth/Mars). Contours were extracted and morphometric indexes were obtained: geometric and algorithmic complexities, entropy, tortuosity, minimum and maximum diameters. Terrestrial and Martian textures present a multi-fractal aspect. Mean values and confidence intervals from the Martian images overlapped perfectly with those from the terrestrial samples. The probability of this occurring by chance is $1/28$, less than $p < 0.004$. Terrestrial abiogenic pseudostromatolites showed a simple fractal structure and different morphometric values from those of the terrestrial biogenic stromatolite images or Martian images with a less ordered texture ($p < 0.001$). Our work shows the presumptive evidence of microbialites in the Martian outcroppings: the presence of unicellular life widespread on the ancient Mars.