

BIOMEX: Three different steps to approach a systematic determination of habitats and stable biosignatures in space- and Mars-like environments

Jean-Pierre de Vera¹ and BIOMEX-team²

¹German Aerospace Center (DLR), Institute of Planetary Research, 12489 Berlin, Germany

²BIOMEX-team: Ute Böttger¹, Andreas Lorek¹, David Wolter¹, Heinz-Wilhelm Hübers¹, Rosa de la Torre Noetzel, Francisco J. Sánchez (INTA, Madrid, Spain), Daniela Billi, Mickael Baqué, Cyprien Verseux (Uni Tor Vergata, Rome, Italy), Petra Rettberg, Elke Rabbow, Corinna Panitz, Günther Reitz, Thomas Berger, Ralf Möller, Maria Bohmeier, Stefan Leuko, Gerda Horneck (German Aerospace Center, Cologne, Germany), Frances Westall (University of Orléans, France), Jochen Jänchen (TH Wildau, Germany), Jörg Fritz (Museum für Naturkunde, Berlin, Germany), Cornelia Meyer (Horizontereignis gUG, Berlin, Germany), Silvano Onofri, Laura Selbmann, Laura Zucconi, Claudia Pacelli (University della Tuscia, Viterbo, Italy), Natalia KozYROVSKA (IMBG, Natl. Acad. Sci., Kyiv, Ukraine), Thomas Leya (Fraunhofer IZI-BB, Potsdam, Germany), Bernard Foing (ESA/ESTEC, Noordwijk, Netherlands), René Demets (HE Space for ESA, Noordwijk, Netherlands), Charles S. Cockell, Casey Bryce (University of Edinburgh, UK), Karen Olsson-Francis (Open University, Milton-Keynes, UK), Dirk Wagner, Paloma Serrano (GFZ Potsdam, Germany), Howell G.M. Edwards (University of Bradford, UK), Jasmin Joshi, Björn Huwe (University of Potsdam, Germany), Ueli Grossniklaus, Moritz Rövekamp (University of Zürich), Pascale Ehrenfreund, Andreas Elsaesser (Leiden University, Leiden, Netherlands), Dirk Schulze-Makuch, Nina Feyh, Ulrich Szewzyk (TU Berlin, Germany), Sieglinde Ott, Joachim Meessen (Heinrich-Heine-University, Institute of Botany, Düsseldorf, Germany).

BIOMEX (Biology and Mars Experiment) is a space experiment on the exposure platform EXPOSER2 launched by the Progress 56 mission on 24 July and placed on the outer side of the Russian Zvezda Module of the International Space Station (ISS). Twenty-five international institutes are working together and sharing different methods, planetary simulation facilities, and logistics to obtain information about the vitality of the tested microorganisms and the stability of biomolecules as possible biosignatures. This experiment comprises three investigational steps from the field to space: (i) field work with sample collection and habitat characterization at field sites with or without Mars analogy, (ii) Mars simulation experiments in the lab and (iii) exposure to real space conditions. For the second and third steps some of the microorganisms and bio-molecules are embedded in Marsanalog regolith mixtures, placed in compartments enriched with Mars-like CO₂-atmosphere and exposed to solar irradiation levels approaching those affecting the surface of Mars to test habitability on Mars, as well as the ability to detect the selected, Mars-exposed bio-molecules. One of the aims of this experiment is to investigate the specific bio-related spectra of resistant molecules obtained by fluorescence analysis, Raman-spectroscopy, IR- and UV/VIS spectrometry before and after simulated and real space exposure. The obtained database of stable bio-molecules will support future exploration missions to Mars whose main goal is the search for life.