SHORT-SCALE GEOLOGICAL CONTEXT DETERMINES FUNCTIONAL MICROBIAL COMMUNITY COMPOSITION IN A DEEP-SUBSURFACE MARS ANALOGUE F. Puente-Sánchez[1], A. Arce-Rodríguez[2,3], M. Oggerin[1], Y. Blanco[1], M. García-Villadangos[1], M. Moreno-Paz[1], I. Gallardo-Carreño[1], N. Rodríguez[1], R. Amils[4], K. Timmis[2] and V. Parro[1]. Centro de Astrobiología. Ctra de Torrejón a Ajalvir km 4. 28850, Torrejón de Ardoz, Spain (puentesf@cab.inta-csic.es); [2]Institut für Mikrobiologie, Technische Universität Braunschweig, BS, Germany; [3]Helmholtz-Zentrum für Infektionsforschung. BS. Germany; [4]Centro de Biología Molecular "Severo Ochoa" (UAM-CSIC), Cantoblanco, Madrid, Spain.

Introduction: The deep-subsurface have often been thought to be an inhospitable environment due to its inaccessibility and extreme water and energy deprivation. However, this isolation also results in very stable settings in which life can - albeit very slowly – develop while being sheltered from the surface conditions. Its massive volume and heterogeneity can also host a plethora of unique habitats in which microorganisms can thrive independently from light by using several alternative energy sources. The vast potential of deep-subsurface environments, however, remains mostly unexplored, especially in the continental crust.

The Iberian Pyrite Belt (IPB, southwest of Spain) is a massive sulphide deposit that fuels the unique extreme ecosystem of Rio Tinto. Additionally, its subsurface is considered to be a good Mars analogue because of the presence of jarosite and related sulphate minerals. The Mars Analog Rio Tinto Experiment (MARTE, CAB-NASA) drilling campaign found evidences of a sulfur- and iron-driven ecosystem in the deep subsurface of the IPB, down to a depth of 166 meters below the surface (mbs) [1].

A new 613 m deep borehole was recently performed in the context of the European Research Council project IPBSL (Iberian Pyrite Belt Subsurface Life) [3]. Microbial presence throughout the borehole was studied by a mixture of Illumina and 454 high-throughput sequencing of the 16S rRNA gene, as well as by using a 450 antibody-containing microarray specially designed for the search of microbial biomarkers [2]. The results were confirmed by Catalyzed Reported Deposition Fluorescence in Situ Hybridization (CARD-FISH). Finally, a full metagenomic characterization of selected samples is underway in order to determine the genetic and metabolic traits required for thriving in the harsh conditions of the deep-subsurface.

The results revealed the presence of an endolithic community adapted to the dry conditions of this deep-rock ecosystem, with many of its members bearing similarity to extremophilic bacteria found in deserts and permafrost. Interestingly, the community composition detected in the IPBSL borehole was very different from the one detected in the MARTE borehole, in spite of the horizontal distance between the two sites being of only 300 meters. These findings are however well explained by the geomineralogical characteristics of both sampling sites, which result in differences in pyrite content and water permeability.

The two boreholes studied in this work represent two different scenarios for a hypothetical Martian subsurface biosphere (past/wet and present/dry), and constitute a clear example of the large habitat heterogeneity that is possible in deep-subsurface environments, even at relatively short scales.

References: [1] Puente-Sánchez et al. (2013). Geobiology *12, 34-47*. [2] Parro et al. (2011), Astrobiology *11, 969-96*. [3] We would like to express our thanks to the whole MARTE and IPBSL teams.

Additional Information: The present work was supported by the European Research Council Advanced Grant No. 250350.