

Iberian Pyrite Belt Subsurface Life (IPBSL), a drilling project in a geochemical Mars terrestrial analogue

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Abstract

Iberian Pyrite Belt Subsurface Life (IPBSL) is a drilling project specifically designed to characterize the subsurface ecosystems operating in the Iberian Pyrite Belt (IPB), in the area of Peña de Hierro, and responsible of the extreme acidic conditions existing in the Rio Tinto basin [1]. Rio Tinto is considered a good geochemical terrestrial analogue of Mars [2, 3]. A dedicated geophysical characterization of the area selected two drilling sites (4) due to the possible existence of water with high ionic content (low resistivity). Two wells have been drilled in the selected area, BH11 and BH10, of depths of 340 and 620 meters respectively, with recovery of cores and generation of samples in anaerobic and sterile conditions. Preliminary results showed an important alteration of mineral structures associated with the presence of water, with production of expected products from the bacterial oxidation of pyrite (sulfates and ferric iron). Ion chromatography of water soluble compounds from uncontaminated samples showed the existence of putative electron donors (ferrous iron, nitrite in addition of the metal sulfides), electron acceptors (sulfate, nitrate, ferric iron) as well as variable concentration of metabolic organic acids (mainly acetate, formate, propionate and oxalate), which are strong signals of the presence of active subsurface ecosystem associated to the high sulfidic mineral content of the IPB. The system is driven by oxidants that appear to be provided by the rock matrix, only groundwater is needed to launch microbial metabolism. The geological, geomicrobiological and molecular biology analysis which are under way, should allow the characterization of this ecosystem of paramount interest in the design of an astrobiological underground Mars exploration mission in the near future.

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