

Iberian Pyrite Belt Subsurface Life (IPBSL), a drilling project of astrobiological interest

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The geomicrobiological characterization of Río Tinto, Iberian Pyrite Belt (IPB), has proven the importance of the iron cycle, not only in generating the extreme conditions of acidity and high concentration of heavy metals of the habitat, but also in maintaining the high level of microbial diversity detected in the ecosystem. It has been hypothesized that the extreme conditions found in the Tinto basin are the product of the subsurface chemolithotrophic metabolism of microorganisms thriving on the high concentration of metal sulfides (mainly pyrite) of the IPB. To test this hypothesis, a drilling project (IPBSL) is currently under development to provide evidence of subsurface microbial activities and the potential resources to support them. A dedicated geophysical characterization of the area selected two drilling sites due to the possible existence of water with high ionic content. Two wells have been drilled so far in the selected area, 340 and 630 meters deep, 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 microbial oxidation of pyrite. Ion chromatography of water soluble compounds from uncontaminated core samples showed the existence of putative electron donors (hydrogen, ferrous iron, methane and nitrite in addition of metal sulfides), electron acceptors (ferric iron, sulfate and nitrate) as well as variable concentration of metabolic organic acids (mainly acetate, formate, propionate and oxalate), which are strong indications of the presence of active subsurface ecosystems associated to the high sulfidic mineral content of the IPB. The geological, geomicrobiological and molecular biology analysis which are under way, should allow the characterization of this ecosystem of astrobiological interest.