Río Tinto subsurface habitats of chemolithotrophic cryptic communities, a terrestrial analog of underground habitats in Mars

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Underground Mars regions stay as the most promising habitats to find extant microbial communities: they are physically and chemically stable areas and are also protected against UV radiation. To thrive under the current Mars conditions, the microorganisms should have a metabolism based on chemical reactions that are fed on inorganic redox couples. Chemolithoautotrophs should thrive under negligible oxygen concentrations, suggesting that the cryptic communities of Mars could be composed of anaerobic microbes. Recent discoveries done by the Opportunity rover concerning to the chemistry of the ancient water bodies on Mars suggest that the hypothetical cryptic chemilithotrophs of Mars may be composed of acidophilic microbes. MARTE (Mars Analog Río Tinto Experiment) project has as one of the main objectives searching for chemolithoautotrophic cryptic communities in the basement of the acidic Río Tinto Mars analog. Field surveying geology, TEM (Transitory ElectroMagnetic) subsurface sounding, and two 2003-2004 drilling campaigns were performed to characterize and sample the underground habitats occurring in the Río Tinto basement. Such a habitat is physically represented by thrusting and normal faults, which affect to a volcanosedimentary complex enriched in pyrite deposits. They are the pathways for recharging aquifers that become acidic by microbial oxidation of the pyrite. Such an activity produces a characteristic mineralogy zoning from ferric oxyhydroxides and iron sulfates to metallic sulfides corresponding to neutral oxygenated, acidic aerobic and acidic anaerobic underground habitats. This mineral framework can be understood as a large-scale biomarker that, when used with nay other evidences, may be applied for Mars underground exploration.