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Structure and Biomineralization of Eukaryotic Biofilms in an Extreme Acidic Environment the Río Tinto (SW Spain).

V. Souza-Egipsy (1), A. Aguilera(1), E. Gonzalez-Toril(1), A. García-Moyano, (2) and R. Amils (1,2)

(1) Centro de Astrobiología (INTA-CSIC), Carretera de Ajalvir km 4, Torrejón de Ardoz, 28850 Madrid, Spain, (2) Centro de Biología Molecular (UAM-CSIC), Universidad Autonoma de Madrid, Cantoblanco, 28049 Madrid, Spain. souzaev@inta.es

Weathering of the massive sulfide ore body at the Iberian Pyritic Belt (Iberian Peninsula) has generated iron- sulphuric acid solutions with pH values ranging from 1 to 3 and high concentrations of toxic metals. Communities of chemolithotrophic bacteria catalyze the oxidation of iron and sulfur that generates this extreme environment. When these waters appear at the surface it is colonized by extremophiles microorganisms able to thrive under these harsh conditions. To enhance our ability to extract palaeobiological and paleoenvironmental information from ancient iron-rich deposits, we have studied the processes responsible for the development and preservation of fossils in modern acidic iron-rich environments in Rio Tinto (Huelva, Spain). We studied specimens collected from living and dry biofilms using different scanning electron microscopy and laser scanning confocal techniques. Microbial community structure was determined using 16S and 18S rDNA cloning and FISH techniques. Although it is known that iron-rich precipitation in acid environments are form as an abiotic process due to suprasaturating conditions, we have found that the biofilm presence induced diverse morphological textures indicatives of different microorganisms contributing to the microstructural development of the sediments. We have also found that the preservation of biotically produced microfabrics in the sediments reflects dynamic balances between population colonization, decomposition of organic matter and fast iron-rich mineral deposition. Major trends in preservation of the different biofilm components are defined by differences in the mode of fossilization, replacement, encrustation and permineralization. The application of *in situ* microscopy methods permitted describe

the relationship between biomineralization processes happening in the living community, the *post-mortem* degradation and detecting traces of the past presence of microbial communities in geological materials. The ability to observe these biosignatures in iron-rich sedimentary deposits aim to the goals of planetary geologists to determine whether signs of life can be detected in the rock record of terrestrial and extraterrestrial samples. Because the biosignatures cannot be mimicked by physical processes they serve as valuable tools for the reconstruction of past microbial communities in the geological record.