Tectonic Hydrogeological Survey of the Rio Tinto Mars Analog: Implications for Mars Underground Water Fluxes

David Gomez-Ortiz
ESCET-Area de Geologia
Universidad Rey Juan Carlos
SPAIN
david.gomez@urjc.es

David Fernandez-Remolar
Olga Prieto-Ballesteros
Felipe Gomez-Gomez
Centro de Astrobiología, INTA
SPAIN

The Iberian Pyritic Belt (IPB) consists of a 250-km long geological unit in southern Iberian Peninsula, and contains massive sulfide deposits. Interaction between groundwater, sulfide deposits and sulfide-free rocks provides geochemical processes controlling the geochemistry of both surface fluids and groundwater. The resulting waters are characterized by an acidic chemistry and high concentrations of sulfur and iron in solution, which control the formation of analogous mineral associations recognized in Meridiani Planum. To understand the processes that drive the mineral formation of sulfur and iron bearing phases, special attention has been paid to the aquifer of Peña de Hierro (Rio Tinto, IPB). To obtain an accurate design of the fracture pattern present at the area, a tectonic study has been carried out. Three different fault systems (ESE-WNW, NNE-SSW and NNW-SSE) control the drainage pattern, the underground water fluxes, and recharge the aquifer from rainwater. The water level in the Peña de Hierro pit lake and different boreholes in the aquifer indicates that they are closely related by a groundwater flow along N140ºE fractures. These fractures intersect the topographic surface generating artesian springs of acidic water.

This research provides some insights to understand the formation of sulfur bearing compounds observed in Meridiani Planum and other regions of Mars. As observed in the Rio Tinto aquifers, long-term subsurface sulfur storage in form of secondary sulfides can be a reasonable source for sulfates after oxidation by meteoric solutions provided by formation of acidifying and oxidizing compounds that are sourced in photochemical reactionships in the Noachian Mars atmosphere.