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Iron world and its astrobiological implications: The Tinto River case

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Extreme ecosystems have recently attracted considerable interest, not only because they

prove that life is robust and adaptable, but also because their existence increases the

probability of finding life elsewhere in the universe. Most of the best characterized

extreme habitats on Earth correspond to geophysical constraints to which opportunistic

microorganisms have adapted. However, some extreme acidic environments are unique in

that they are the product of biological activity (chemolithotrophy).

The Tinto River (Huelva, Southwestern Spain) is an unusual acidic ecosystem (100 km

long, mean pH of 2.3) containing a high concentration of heavy metals and an unexpected

level of microbial diversity (1,2). In the past, the extreme conditions of the river were

considered the result of intense mining activity. The geomicrobiological analysis of the

Tinto ecosystem strongly suggests that these conditions are the result of the metabolic

activity of chemolithotrophic prokaryotes, mainly iron-oxidizers (3). The system seems to

be controlled by iron, which is not only used as an electron donor, but also as an electron

acceptor, allowing a full iron cycle to operate. Furthermore, ferric iron is responsible for

the maintenance of the constant pH of the ecosystem and can protect the different

organisms thriving in its waters from radiation.

Laminar, iron-rich stromatolitic formations are generated by the precipitation of different

iron minerals on the surface of the biofilms that cover most of the rocks in the river and

the riverbed. These structures are similar to ancient massive bioinduced laminated iron

bioformations formed long before the first mining activities started in the area 5000 years

ago. The existence of these ancient iron-rich deposits formed prior to any known mining

activity, under hydrochemical conditions similar to modern deposits, is considered a

strong argument in favor of a natural origin of the river (4,5).

Recently, the source area of the Tinto ecosystem has been used like an environmental scenario for new technology validation for astrobiology space missions. M.A.R.T.E. (Mars Analog Research Technology Experiment) was a multidisciplinary project for technology development in the NAI framework.

REFERENCES

1.- López-Archilla, A.I., Marín, I., Amils, R. (2001) Microbial Ecol., 41: 20-35.

2.- Amaral-Zettler, L.A., Gómez, F., Zettler, E., Keenan, B.G., Amils, R., Sogin, M.

(2002) Nature, 417: 137.

3.- González-Toril, E., Gómez, F., Rodríguez, N., Fernández-Remolar, D., Zuluaga, J.,

Marín, I., Amils, R., (2002) Hydrometall., in press.

4.- Amils, R., González-Toril, E., Gómez, F., Fernández-Remolar, D., Rodríguez, N.

(2000) Spring Meeting American Geophysical Society, Abstract B22B-05.

5.- Fernández-Remolar, D.C., Rodríguez, N., Gómez, F., Amils, R. (2003) J. Geophys. Res.,

108, No.E7 doi. 10.1029/2002JE001918