Abstract # 12948 (Oral Presentation)-The Tinto River, A Model System for an Iron World

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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).

Given these characteristics, we postulate that the Tinto River, and other natural acidic environments, are relics of an iron world, in which the basic metabolism of iron-chemolithotrophic organisms control the conditions of the system.

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Abstract # 12975-Microbial Hyperdiversity in Cuatro Ciénegas Coahuila

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The study of Bacteria communities is an exciting new field of ecology, where new molecular techniques are helping to answer some long standing questions regarding community structure. Our first task was to develop the correct biochemical methods for isolation and identification of this very diverse array of Prokaryotes given the particular characteristics of Cuatro Ciénegas (CCB) environments. Multivariate statistical analysis was applied to classify information from ca. 3000 different isolates.

DNA was isolated from 250 isolates that represented the biochemical diversity of these microbes, and the gene 16S was amplified using general primers (515FPL and 1492 RPL). RFLP analysis was done using 5 enzymes (SauIII, AluI, HinfIII, HhaI, and HaeIII). All the 250 analyzed strains proved to be distinct. DNA sequences were obtained for some the extreme halophytes. It is interesting that some of the halophytic bacteria were identified with the DNA 16S sequences as generalist bacteria that can survive a wide range of salinity, while others are similar to marine Eubacteria found previously in hydrothermal vents (*Halomonas elongata, Chromohalobacter canadensis,* and *Marinococcus halophilus*). A massive sequencing effort of 500 representatives of the cultivable bacteria is being conducted to gain further information regarding these microbes.

The cultivable microbial diversity in CCB was so enormous for our samples that we decided to characterize the community structure before choosing a specific group of bacteria for population genetic analysis. We collected 10 water samples across a gradient in salinity, pH, and temperature of superficial water as well as 8 samples from deep springs and 3 samples of deep subterranean water (more than 200 m below the valley). DNA was extracted in situ using specific kits. Also, water and sediment samples were plated in situ using 12 different media; total DNA of the microbes that grew in the plates was also extracted. Bacteria and Archaea did grow in the selected media, and a salt range has been established for each clone in order to determine its environmental tolerances. The ribosomal gene 16S was amplified using PCR for both total DNA and cultivable DNA, and TRFLP data were obtained for each site for both types of samples. Comparative analysis of the community patterns will tell us not only differences among sites and how much of the diversity we are losing by growing the prokaryotes on plates, but it will tell us also the abundance of the main OTUs in each site.

Abstract # 12992-A Summary of NAI Field Expeditions

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Field work is an important part of the research of the NASA Astrobiology Institute. It brings together scientists from a myriad of disciplines though shared scientific interests. Field work can also be very interesting to the general public. The efforts by a multidisciplinary team of field scientists can result in discoveries that combine to construct a more complete understanding of the world. This is of particular interest for the general public, whose exposure to astrobiology is often limited to the reporting of discoveries in the popular media. Also, the reporting of discoveries made in the field may serve to draw more people, scientists and non-scientists, into astrobiology.

For these reasons and more, NAI Central has been soliciting information about field expeditions as part of the NAI annual report. The data collected from NAI Year 2, 3 and 4 have been analyzed to summarize NAI field expeditions and to answer the following questions:

Which sites around the world are being visited?
Which sites are of particular interest to astrobiologists?
What is being researched?
What have they found?
Which sites are, or can be, highlighted to the general public?

To date, NAI scientists have made over 200 expeditions on all seven continents plus the oceans. Field work has been conducted at Yellowstone National Park, Western Australia, the Antarctic, the Rio Tinto in Spain, and hydrothermal vent fields on the Endeavour segment of the Juan de Fuca Ridge. These are good examples of sites important to astrobiologists, and they may be interesting to a broader audience. These sites are highlighted on the poster with photographs and research summaries.

Abstract # 12994-A Comparison of 16S rDNA Sequences from Cyanobacteria That Build Thalassic Teepees and Athalassic Mats in Evaporitic, Gypsiferous Environments

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Halotolerant cyanobacteria can form vertically stratified communities in both thalassic (marine) and athalassic (non-marine) hypersaline environments. Such communities are also known to have formed in old (> 1,000 years b.p.) sedimentary evaporites. Using denaturing gradient gel electrophoresis (DGGE) separation of PCR-amplified 16S rDNA alleles from cyanobacteria, we compared two microbial communities from geographically separated, hypersaline environments in which gypsum is precipitating. One occurs as vertically stratified endolithic