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ICHNOFOSSILS AND MICROBIAL ACTIVITY IN THE PRECAMBRIAN / CAMBRIAN TRANSITION OF NORTHWESTERN ARGENTINA

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INTRODUCTION

Increasingly, microbial communities have become more considered by several authors, and now are recognized as important players among the Late Proterozoic and the Early Paleozoic biota. The macrobenthic fauna that lives associated to microbial mats and biofilms is in a great maner the responsible of the perturbations observed on stratal surface of sediments. These bioactivities are recorded in a varied spectrum of paleoenvironments, from shallow to deep-water setting. Microbial mats are regarded as an important feeding source exploted by organisms since the end of the Proterozoic (Vendian). Stress relationships between microbial mats / biofilms and macroorganisms changed in time since the Vendian to the Post-Cambrian, fact that is reflected in the great disturbance seen on siliciclastic facies (Hagadorn and Bottjer, 1999; Bottjer *et al.*, 2000).

GEOLOGY OF THE NEOPROTEROZOIC-EARLY PALEOZOIC IN NW ARGENTINA

In this opportunity we describe several cases of biodisturbance represented by trace fossils and wrinkle structures in the siliciclastic Puncoviscana Formation *s.l.* (Vendian/Tommotian). This unit displays a wide regional distribution in the northwestern provinces of Argentina, as a part of the Eastern Cordillera, the Puna high plateau and the Pampean Ranges (21° 30´ to 31° S and 65° to 67° W). Lithologically, the early mentioned formation is represented by a highly folded, low metamorphosed thick sequence of turbidites, pelagic clays and scarce limestones, with a varied and important ichnofauna (Aceñolaza and Durand, 1986; Aceñolaza *et al.*, 2000, with references).

The spatial distribution of the different ichnofossils within these platforms, pointed out that the related biota lived in different paleoenvironmental conditions of a same relatively shallow

sea, within the western margin of Gondwana. Regional studies have allowed us to corroborate at least three ichnoassociations, whose chronological and spatial distribution is being a matter of debate (Aceñolaza and Alonso, 2000):

a) *Beltanelliformis* ichnoassociation, with only few genus without an important bathimetric and chronologic signification (*Sewkia*, *Planolites* and *Beltanelliformis* associated to some forms assigned to *Protopaleodyction* and cf. *Squamodictyon*, that are nowadays interpreted as wrinkle structures with a possible biomat origin. This kind of ichnofossils are found in heterolithic facies, characterized by an alternate succession of fine to mid sandstones with shales characterizing the proximal facies of the early mentioned basin (Jezek, 1990). The best outcrops are found in Tucumán Province (Cumbres Calchaquíes and Choromoro), Catamarca (La Cébila Creek) and Angulos (La Rioja Province).

b) The richer *Nereites* ichnoassociation usually appears in thinner sandy facies, within the interfase sandstone-shale, and displays ichnospecies as *Neonereites uniseriales*, *N. biserialis*, *Cochlichnus*, *Tasmanadia*, *Helminthoidichnites*, *Taphrehelminthopsis* and *Glockerichnus*. It has been interpreted as of an intermediate to distal setting within the platform (Jezek, 1990). The best outcrops belonging to this ichnoassociation are placed south of Salta City (Los Guachos, Campo Quijano and Cachi localities)

c) The *Oldhamia* ichnoassociation is the most varied on ichnospecies, with several types of *Oldhamia* (*O. radiata, O. flabellata* and *O. antiqua*), *Monomorphichnus, Cochlichnus, Dimorphichnus, Diplichnites* and *Protichnites* among others. This set of traces is localized in fine sandstones and shales, representatives of distal facies within the platform (Jezek, 1990). Good outcrops are found in San Antonio de los Cobres, Abra Blanca, Muñano (Salta) and La Ovejería (Catamarca).

The mentioned ichnoassemblages are also representative of differents feeding behaviors interpreted to be vinculated to the biomats and biofilms (grazing and mining). *Cochlichnus, Helmintoida, Helminthopsis, Helminthorhape, Helminthoidichnites, Nereites, Neonereites, Oldhamia, Planolites, Scolicia, Taphrehelminthopsis, Torrowangea* and *Treptichnus* usually appear related to wrinkle structures assigned to *Kinneyia, Paliella, Protopaleodictyon, Squamodictyon* and others of a possible microbial origen (Hagadorn and Bottjer, 1999). In the other hand, the relation of *Asaphoidichnus, Didymaulichnus, Dimorphichnus, Diplichnites, Glockeria, Monomorphichnus, Multipodichnus, Phycodes, Protichnites, Protovirgularia* and *Tasmanadia* to wrinkle structures could be interpreted within the paleoecologic framework as of a second order feeding group.

ON SOME PALEOGEOGRAPHIC ASPECTS

Data given by sedimentology and structural geology let us recognize that these ichnoassociations appear in elongated bands of general NE/SW direction by the side of the Rio

de La Plata Craton. Paleocurrent measurements and lithologic types support the idea of a cratonic origen for the materials deposited in the Puncoviscana basin (Jezek, 1990). Most of the material seems to be deposited during the early moments of the Pampean Orogen, or together with the opening of the latter. Immediately to the west, and bordering this Puncoviscana basin, are displayed the *Nereites* and *Oldhamia* ichnoassociations (Fig. 1). If we consider that *Oldhamia* is regarded as an Early Cambrian ichnogenus in several places (Crimes, 1994, 2000; Lindholm and Casey, 1990), we interpret that within this earlier band we should place the corresponding Neoproterozoic/ Lowermost Cambrian transition. This appreciation will contribute to the interpretation of the evolution and timing of the levels that are cropping out in the mentioned band.

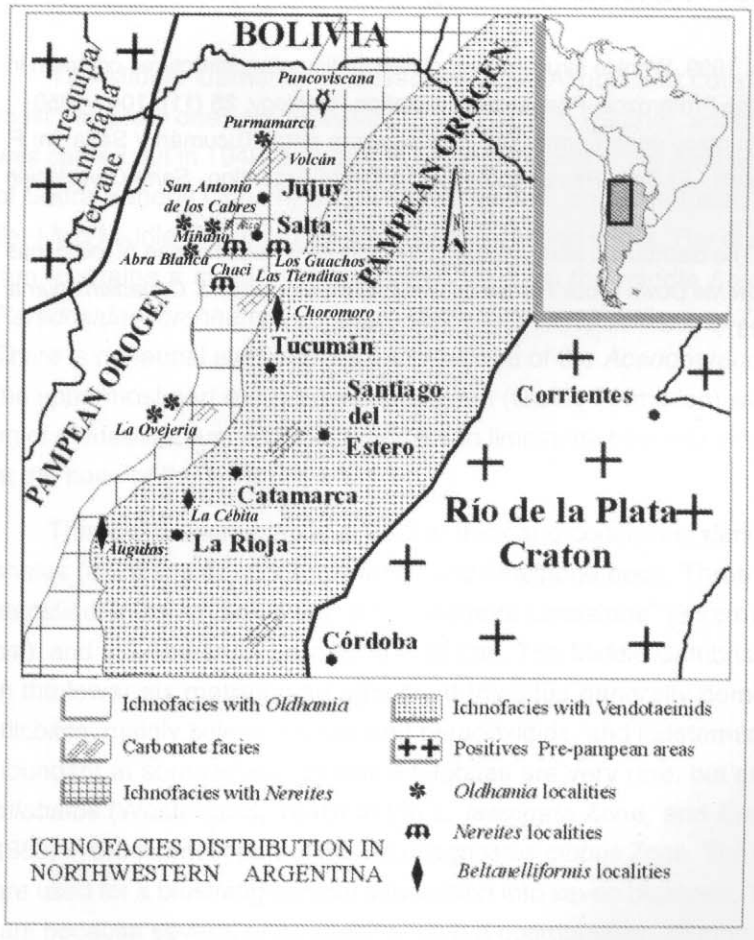

Fig.1. Hypothetic distribution scheme of ichnofacies in the Pampean Orogen in north-western Argentina (After Aceñolaza and Alonso, 2000).

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