The Puncoviscana ichnofauna of northwest Argentina: A glimpse into the ecology of the Precambrian-Cambrian transition

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The Puncoviscana Formation consists of a thick and folded succession of sandstones, mudstones, conglomerates, and slates of Late Precambrian to Early Cambrian age, representing the metasedimentary basement of northwest Argentina. The Puncoviscana ichnofauna was documented in a series of papers by Aceñolaza and Durand (1973, 1982, 1984, 1986, 1987), Durand and Aceñolaza (1990), Durand (1992, 1993, 1994, 1996), Durand *et al.* (1994), and Aceñolaza *et al.* (1999). Recent research allows to re-evaluate its paleoenvironmental and paleoecological significance. The Puncoviscana ichnofauna includes a wide variety of ichnotaxa such as *Nereites, Oldhamia, Cochlichnus, Glockerichnus, Helminthopsis, Helminthorhaphe, Helminthoidichnites, Treptichnus,* and *Monomorphichnus,* as well as several kinds of arthropod trackways. Feeding, grazing and crawling traces are represented. Though currenty referred to the archetypal *Nereites* ichnofacies, the Puncoviscana ichnofauna includes a number of elements from the *Cruziana* ichnofacies. The presence of the socalled *Nereites* ichnofacies in the Puncoviscana Formation has been historically regarded as evidence for the deep-water origin of these strata (e.g. Durand and Aceñolaza, 1990; Durand, 1993). Current depositional models for the Puncoviscana Formation envisage accumulation from turbidity currents in submarine fans(Jezek, 1990). However, this environmental interpretation is difficult to reconcile with the fact that behavioral patterns typical of the *Nereites* ichnofacies are found in Precambrian-Cambrian shallow- marine deposits, suggesting that these feeding strategies evolved in shallow water and laten migrated to the deep sea (Crimes and Anderson, 1985). Precambrian-Cambrian deep- marine deposits typically lack trace fossils or host very simple forms (e.g. Vidal *et al., 1994).* Accordingly, either the Puncoviscana ichnofauna represents an early attempt to colonize the deep sea or the trace fossil-bearing strata were formed in shallow water. Although further work is needed, preliminary results suggest that the latter hypothesis is most likely, as indicated by the presence of interferente ripples, wrinkle marks, and probable wave ripple lamination. Regardless of its depositional environment, the Puncoviscana ichnofauna provides valuable information to understand the ecology of the Precambrian-Cambrian transition. Recent research indicates that Vendian-Early Cambrian ecosystems were remarkably non-actualistic and characterized by resistant microbial matgrounds (Seilacher, *1999).* Ichnologic and sedimentologic analysis suggests that the Puncoviscana ichnofauna reflects lifestyles related to microbial mats that protected the sediment from erosion. The presence of wrinkled surfaces and palimpsest ripples suggests stabilization by microbial binding. Structures previously considered as graphoglyptids, such as *Protopaleodictyon* and *Squamodictyon,* are interpreted here as wrinkle marks. Close association of the ichnogenus *Oldhamia* with such wrinkled surfaces and palimpsest ripples may indicate a feeding strategy of undermat mining (cf. Omarini *et al., 1999).* Guided meandering trails such as *Nereites* may also represent mining of microbial mats. The Puncoviscana ichnofauna encourages comparison with other Vendian-Early Cambrian assemblages in terms of taxonomic composition, feeding strategies, and ethologic significance.

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