

Middle–Late Triassic ichnoassemblages from Irohalene area (Argana Basin, Western High Atlas, Morocco): sedimentological and ichnological analyses

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Abstract:

Middle to Late Triassic redbeds of the Timezgadiouine Formation (T4-T5, Anisian-Carnian) in the Irohalene area (Argana Basin, Western High Atlas, Morocco) consist of cyclical clastic sedimentary rocks, which are mainly composed of conglomerates, sandstones, siltstones, claystones and mudstones, that were deposited in an alluvial plain to mudflat environment with ephemeral rivers and lakes. Sedimentological analysis allowed identification of seventeen different facies, grouped into fluvial, alluvial fan, flood plain and lacustrine associations. These sequences contain numerous ichnogenera of vertebrates and invertebrates, associated with plants, conchostracans and isolated fish remains.

Vertebrate tracks and trackways, are assigned to *Parachirotherium* isp., *Atreipus-Grallator* isp., *Grallator-Eubrontes* isp., *Brachychirotherium* isp., *Apatopus lineatus*, *Rhynchosauroides* isp., and indeterminate ichnotaxa, attributed to dinosauromorphs/crocodylian-stem archosaurs, and lepidosauro-morphs/archosauro-morphs. Invertebrate traces include the ichnogenera *Arenicolites* isp., *Scoyenia gracilis*, *Taenidium barretti*, *Palaeophycus tubularis*, *Lockeia* isp., *Spongeliomorpha carlsbergi*, *Petroxestes* isp., *Skolithos verticalis* and *Rhizoconcretion* isp. They can be assigned to annelid and/or polychaete worms, mayfly larvae, beetles and bivalves.

Ichnoassemblages provide the opportunity to observe palaeoecological diversity and allow more detailed palaeoenvironmental reconstructions, reflecting energy changes and palaeohydrological fluctuations. The ichnoassemblages from Irohalene area show a subtle change in ichnocoenoses. Five ichnocoenoses were distinguished: 1) *Scoyenia–Rhizoconcretion*, generated in low-energy floodplain environment; 2) *Arenicolites*, developed in higher flow velocities of active palaeochannels; 3) *Taenidium–Scoyenia*, formed in low energy sandy colonization of inactive palaeochannels; 4) *Arenicolites* horizontal meniscate burrows, the most common ichnocoenosis in the Irohalene, reflecting intermediate conditions between ichnocoenoses 2 and 3; 5) *Lockeia–Petroxestes*, formed in a marginal lake.

Keywords: ichnocoenosis, invertebrates, vertebrates, palaeoenvironment, Argana, Morocco