PALEOECOLOGICAL AND PALEOENVIRONMENTAL IMPLICATIONS OF DISTINCT PRESERVATION OF *DIPLICHNITES GOULDI*

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Diplichnites gouldi has been attributed to myriapod activity and is present in the fossil record since the Lower Paleozoic. It is characterized by two rows of gently curved, non-serial paired podial imprints, transversal and external to the trackway axis. *Diplichnites gouldi* with simple podial imprints are abundant in Carboniferous-Permian rhythmites of the Itararé Group (Paraná Basin, south Brazil). *Diplichnites gouldi* with ornamented podial imprints and longitudinal furrows occur in Triassic deposits of the same basin, in a *Scoyenia* association. Experimental analysis shows that myriapod trackways preserve better in humid silt and mud, which are plastic enough to imprint the podia ornaments. Its preservation potential, however, is very low. Otherwise, *D. gouldi* with simple podial imprints and without the paired longitudinal furrow is commonly found in the fossil record, preserved as undertracks. These are related to microbial mats, which guarantee a major resistence against erosion of the substrate surface, but inhibit preservation of the ornaments produced by the podia. Thus, *D. gouldi* simple preservational form of the Itararé Group represents colonization of humid substrates covered by microbial mats. Wrinkle marks are good evidence of the biomat in these beds. The Triassic ornamented *D. gouldi*, on the other hand, is preserved in very fine-grained sandstones and may have been produced on the bare humid surface. In both cases, therefore, the subaerial exposure of the substrate surface is evident, as myriapods are terrestrial in origin, have tracheal respiration and are unable to walk in wet substrates.

ICHNOLOGY OF THE GLACIAL TO POST-GLACIAL TRANSITION IN THE IMPERIAL FORMATION (LATE CARBONIFEROUS), SAN RAFAEL BASIN, ARGENTINA

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Ichnological approaches analysing the Carboniferous glaciogenic successions in Argentina flourished during the last decade. However, studies focused on the San Rafael Basin are lacking and isolated references about trace fossils were not included in an stratigraphic framework. We report trace fossils recorded at the Valle Grande locality that represents one of the most well exposed sections of the Imperial Formation in the San Rafael Basin. The Imperial Formation is a well known late Carboniferous unit composed of three members. The lower, unconformably overlies Devonian turbidites, and it is composed of regularly stratified sandstones and mudstones with some intervals containing dark grey claystones. Trace fossils recorded in this interval include grazing and locomotion structures. The middle member commences with light coloured sandstones resting on an erosional unconformity and comprises slumped and convoluted sandstone beds followed by glaciogenic diamictites and thinning- and coarsening-upward stratigraphic intervals. Trace fossils are form intensely bioturbated levels composed exclusively of the ichnogenus *Didymaulichnus*, which is restricted to late glaciogenic and post-glacial claystones. In the thinning-upward interval, locomotion traces are preserved as hypichnial trails while on the top of rippled beds abundant grazing traces have been observed. Trace fossils

of the Imperial Formation resemble those reported from the Paganzo Basin. However, the San Rafael Basin has been previously considered as an archetypal marine basin based on marine invertebrates recorded in the upper member and the presence of hummocky-like sedimentary structures. This interpretation needs to be reviewed to take into account ichnologic evidence.

UNLOCKING BLACK SHALE SEQUENCE STRATIGRAPHY WITH TRACE FOSSIL DOMAINS IN THE SILURIAN OF SW BOLIVIA

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Sedimentological and ichnological studies of the Silurian/Devonian Kirusilla, Tarabuco and Santa Rosa formations around Padcaya, Tarija, Tarabuco and Cochabamba localities, SW Bolivia, have allowed to use trace fossil domains and trace fossil stacking patterns to understand cryptic sedimentary successions, such as those in the Kirusilla Formation, which is composed mainly by marine black shales. This Silurian-Devonian succession bears *Arenicolites, Bergaueria, Chondrites, Cruziana, Cylindrichnus, Dictyodora, Diplichnites, Gordia, Gyrochorte, Helminthopsis, Monomorphichnus, Nereites, Palaeophycus, Phycodes, Planolites, Protopaleodictyon, Rhizocorallium, Rosselia, Rusophycus, Scolicia, Skolithos, Taphrhelminthopsis, Teichichnus, Zoophycos*, and some ichnofabrics, such as the *"panda eyes"* and the *"isolated fine tubes"*, included in the *Skolithos, Cruziana* and *Nereites* ichnofacies. Besides, these organic sedimentary structures are organised in domains, which are defined as those areas or fief dominated by one or two characteristic ichnogenera or an ichnofabric. These domains may vary lateral and vertically to other domains allowing ichnological models to be built. Furthermore, with trace fossil stacking patterns the sequence stratigraphy framework can be inferred. On the basis of these concepts, domains and trace fossils stacking patterns in the Kirusilla Formation have been recognised, which have helped to recognise parasequences, parasequence sets and systems tracks. In this sense, the outer shelf black shale shallowing-upward trend is *non-bioturbation* → *isolated fine tubes*-domain → *Planolites/Phycodes*-domain → *Chondrites*-domain → *Zoophycos*-domain. Likewise, towards the heterolithic and sandy shallower facies of the Kirusilla, Tarabuco and Santa Rosa formations the trend consists of *Protopaleodictyon*-domain → *panda eyes*-domain → *Phycodes*-domain → *Scolicia*-domain → *Cruziana*-domain → *Rosselia*-domain → *Skolithos*-domain. This trend is also supported by classical facies analysis in non-cryptic sedimentary successions. In other words, trace fossils can be used as a powerful tool to unlocking the sequence stratigraphy framework in black shales.

PHYMATODERMA-BEARING TURBIDITES (OLIGOCENE, TIERRA DEL FUEGO): ICHNOLOGIC IMPLICATIONS FOR DISCRIMINATION OF SUSTAINED AND EPISODIC GRAVITY FLOW DEPOSITS

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Distinguishing sustained, long-lived, from episodic, short-lived, gravity flow deposits only through physical sedimentary features could be problematic. Careful ichnologic analysis is an important tool for discrimination of sustained and episodic gravity flow deposits, as shown from two stacked first order cycles in deep-water