



The invertebrate trace fossil *Labyrinthichnus* in the Late Triassic red beds of the Argana Basin (Western High Atlas Mountains, Morocco)



Alfred Uchman^{a, *}, Abdelouahed Lagnaoui^{b, c}, Hafid Saber^b

^a Institute of Geological Sciences, Jagiellonian University, Gronostajowa 3a, 30-387, Kraków, Poland

^b Laboratory of Geodynamic and Geomatic, Department of Geology, Faculty of Sciences, Chouaib Doukkali University, B. P. 20, 24000, EL Jadida, Morocco

^c Institute of Geology and Petroleum Technologies, Kazan (Volga Region) Federal University, Kremlyovskaya Str. 18, 420008, Kazan, Russia

ARTICLE INFO

Article history:

Received 20 August 2016

Received in revised form

22 April 2017

Accepted 24 April 2017

Available online 25 April 2017

Keywords:

Ichnology

Ichnotaxonomy

Red beds

Fluvial sediments

Triassic

Moroccan High Atlas

North Africa

ABSTRACT

Labyrinthichnus terrerensis Uchman and Álvaro, 2000, a cylindrical, intrastratal, passively filled trace fossil composed of irregular nets and branched galleries, so far known from Miocene marginal lacustrine clastic sediments, was found in Carnian alluvial-plain sediments of the Argana Basin, Morocco. This is the oldest occurrence of this rarely reported trace fossil. Associated tetrapod footprints and invertebrate trace fossils (*Diplopodichnus*, *Scoyenia*, *Spongeliomorpha*, *Taenidium*, cf. *Helminthoidichnites*, and others) point to the *Scoyenia* ichnofacies typical of inundated and desiccating sediments. Co-occurring current-ripples, mudcracks and raindrop imprints confirm this interpretation. The trace fossils reflect changing consistency from softground (cf. *Helminthoidichnites*; *Diplopodichnus*) to firm ground (e.g., *Spongeliomorpha*). Beside beetles and their larvae, fly larvae are considered as possible tracemakers of shallow *Labyrinthichnus terrerensis* on the basis of similarities to recent burrows.

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1. Introduction

Several less common trace fossils are known only from a few occurrences, some because of their real rarity and others because of insufficient survey. A closer search for such trace fossils may drive several researchers to notice it in the field, so it loses the status of rarity. Potentially, they can become important components of ichno-coenoses and elements of palaeoenvironmental characteristics.

In this paper, the continental maze-like invertebrate burrow *Labyrinthichnus* known so far from the Miocene, is presented for the first time from Triassic red beds. It is very well preserved, with several morphological details and occurs in a well-defined horizon bearing vertebrate footprints and other invertebrate burrows and trails. The main aim of this paper is a presentation and interpretation of this newly discovered *Labyrinthichnus*, which increases our knowledge of this rarely reported ichnogenus.

2. Geological setting

The Argana Basin is situated between Marrakech and Agadir at

the south-western edge of the High Atlas mountain range in central Morocco (Fig. 1). It is a basin about 20 km wide and 70 km long, NNE-SSW trending area of excellently exposed Permian and Triassic continental deposits that rest on metamorphic Palaeozoic basement. The 2000–5000 m-thick succession of red-beds is subdivided into three formations and eight members (Fig. 2A): (1) the Permian Ikakern Formation (members T1–T2; 900–1800 m); (2) the Early-Late Triassic Timezgadiouine Formation (T3–T5; 1000–2000 m); and (3) the Late Triassic Bigoudine Formation (T6–T8; 300–1500 m) (Tixeront, 1973; Brown, 1980; Jalil, 1999; Hofmann et al., 2000; Medina et al., 2001; Klein et al., 2010, 2011; Voigt et al., 2010, 2011; Hminna et al., 2012; Lagnaoui et al., 2012, 2016; Lagnaoui, 2014a, b; Lagnaoui and Saber, 2015).

The invertebrate traces described herein come from the uppermost unit of the Timezgadiouine Formation (T5, Irohalene Member). The Irohalene Member (T5) lies conformably above the Aglegal Member (T4) and is conformably overlain by the Tadart Oudou Member (T6). Between Ameskrout in the southwest and Imi-N-Tanoute in the north-eastern part of the basin, the thickness of the Irohalene Member varies non-systematically between 200 and 500 m. The member consists of a mud-dominated succession that is characterised by increasingly common intercalations of sandstone in the upper part (100–200 m), interpreted as a low-

* Corresponding author.