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First Occurrence of Tetrapod Footprints from Westphalian Strata of the Sidi Kassem Basin, Central Morocco

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The Sidi Kassem Basin is the only limnic basin of Westphalian age in Morocco. It is built up of 1,250 m of alluvio-fluvial to lacustrine deposits that have so far yielded plant fossils and invertebrate remains only. Recent exploration for fossil tetrapod footprints in floodplain-deposits of the basin revealed a moderately diverse vertebrate ichnofauna composed of tracks assigned to cf. *Batrachichnus* Woodworth, 1900; cf. *Hylopus* Dawson, 1882; *Dimetropus* Romer and Price, 1940; and *Notalacerta* Butts, 1891. The tracks can be referred to temnospondyl, anamniote reptiliomorph, non-therapsid synapsid (pelycosaur), and captorhinomorph trackmakers. The described ichnoassemblage is important in at least three aspects: (1) It suggests an Early to mid-Pennsylvanian age for the footprint-bearing strata of the study area. (2) It is the oldest association of tetrapod footprints from Africa. (3) It is the first evidence of the relatively rare ichnogenera cf. *Hylopus* and *Notalacerta* outside of North America and Europe. Judged from the variety of tetrapod tracks and previously collected floral remains, the Sidi Kassem Basin must have represented a well-established continental ecosystem during Pennsylvanian time. Further exploration for trace and body fossils of Palaeozoic vertebrates in this basin may be important for the reconstruction of early tetrapod evolution.

Keywords Vertebrate ichnology, Early tetrapods, Biostratigraphy, Palaeoecology, Late Carboniferous, NW Africa

INTRODUCTION

Tetrapod footprints are among the most common fossils in Late Palaeozoic continental deposits (Haubold, 1971; Gand, 1988; Lucas and Heckert, 1995; Buta et al., 2005; Voigt, 2005). Despite their great abundance, our knowledge of vertebrate ichnofaunas from this period remains a patchwork because the vast majority of finds comes from deposits of latest Pennsylvanian (Gzehlian) and Early Permian (Asselian-Artinskian) age representing a rather narrow stratigraphic interval (Haubold, 2000; Voigt, 2005; Gand and Durand, 2006; Lucas and Hunt, 2006). Therefore, potentially track-bearing strata of older or younger age are of special interest for footprint exploration.

The Sidi Kassem Basin is the only limnic basin of Westphalian age in Morocco. It has long been known for Palaeozoic macrofloral remains (Termier, 1936; Pruvost and Termier, 1949). As the continental strata of the Sidi Kassem Basin represent a variety of sedimentary facies ranging from coarse-grained alluvial fan deposits to lacustrine limestone (Hoepffner et al., 2000), it was considered likely to find footprints there by systematic exploration. In April 2011, one week of field work was conducted in the Sidi Kassem Basin by the first two authors resulting in the collection of 59 specimens with plant fossils, invertebrate traces, and tetrapod footprints from five different localities.

This article focuses on the description of tetrapod footprints collected in the study area during 2011 field work. The material is outstanding because it is the first evidence of tetrapods in Westphalian strata of the Sidi Kassem Basin and it provides an independent control for the supposed age of the local fossil-bearing strata. Moreover, the described assemblage is the stratigraphically oldest record of tetrapod footprints from Africa and an important corrective for the definition of anatomically-controlled Late Palaeozoic tetrapod ichnotaxa.

Institutional abbreviation: CDUE–Department of Geology, Chouaïb Doukkali University El Jadida, Morocco.

LOCALITY AND GEOLOGICAL SETTING

The Sidi Kassem Basin refers to an isolated occurrence of Late Carboniferous (Westphalian) sedimentary rocks about 100 km SE of Rabat in the northwestern part of the Moroccan Meseta (Fig. 1). Between Ezzhiliga in the SW and Tiddas in

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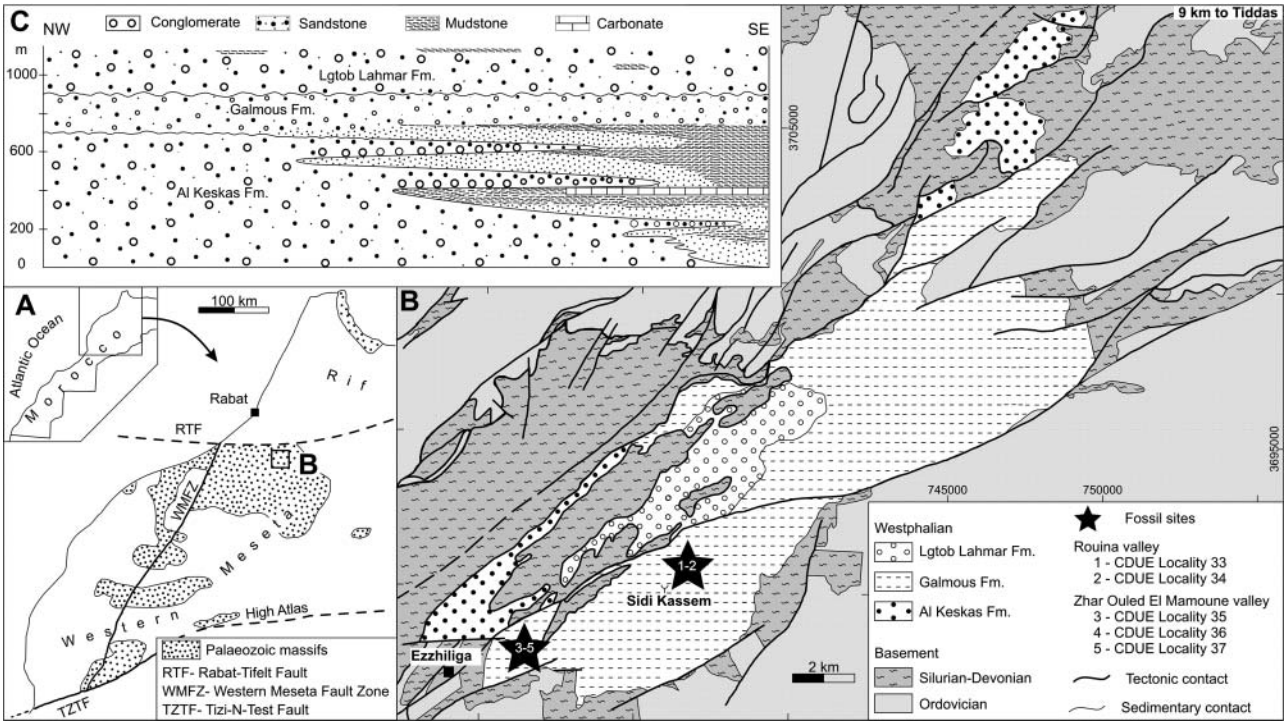

FIG. 1. General overview of the Sidi Kassem Basin: **A.** Geographic position of the study area in the northwestern part of the Moroccan Meseta. **B**. Simplified geological map after Razain et al., (2001) and Chévremont et al. (2001) with indication of CDUE fossil localities. **C.** Simplified lithostratigraphic subdivision of the basin filling.

the NE outcrops of these beds cover an area of approximately 30 km in length and 6 km in width. Interpreted to consist exclusively of continental deposits it is the only limnic basin of Westphalian age in Morocco (Termier, 1936). The Sidi Kassem Basin has been formed as an intramontane depression of the Mauretanide fold belt during the main phase of the Hercynian orogeny (Zahraoui, 1991; Michard et al., 2008). Its predominantly red siliciclastic rocks unconformably rest on strongly deformed basement of Ordovician to Devonian age. The basin fill is represented by a cumulatively 1,250 m thick succession of alluvio-fluvial to lacustrine deposits of conglomerates, sandstones, and mudstones with thin coal seams and freshwater limestones.

The lithostratigraphic framework of the sedimentary complex is difficult to understand due to abrupt facies changes, intraformational erosion, and late Hercynian deformation including faulting, folding, and even overthrusting of Westphalian sediments by Silurian-Devonian basement (Bensahal, 2001; Razin et al., 2001). Bensahal (2001) proposed a subdivision of the Westphalian succession (= Sidi Kassem Group sensu Razin et al., 2001) into three units. These are from base to top (Fig. 1B): (1) The Al Keskas Formation (~700 m), distributed in the southwestern and northeastern part of the basin, is volumetrically dominated by red conglomerates with minor portions of sandstone and mudstone and rare intercalations of lacustrine limestones at the top of the unit. Freshwater mollusks and ostracodes are the only fossil remains known from the Al Keskas Formation (Razin et al., 2001). The succession is organized in up to 140 m thick fining-upward cycles and has been interpreted as proximal to distal alluvial fan deposits (Ghazali, 2003). (2) The Galmous Formation (>300 m), covering most parts of the Sidi Kassem Basin, consists of greenish, fine-grained to conglomeratic sandstones interbedded with siltstones, claystones, and thin coal seams as well as a few lacustrine limestones in the lower part of the unit. Fine-grained deposits are more common than in the Al Keskas Formation and rich in macrofloral remains, particularly sphenophyte axes, pteridophytic foliage, and cordaite leaves (Pruvost and Termier, 1949). The succession of the Galmous Formation has been interpreted as distal alluvial fan to alluvial plain deposits (Ghazali, 2003). (3) The Lgtob Lahmar Formation (≥250 m) is restricted to the central part of the basin and overlies the Galmous Formation with still unclear sedimentary or tectonic contact. It is composed of reddish-brown, poorly sorted conglomerates with significant amounts of muddy matrix that have been interpreted as debris flows and mudflows on alluvial fans. Pteridophyte and cordaite remains in claystones are the only known fossils (Termier, 1936; Pruvost and Termier, 1949). The Al Keskas and Galmous formations, on the one hand, and the Lgtob Lahmar Formation, on the other, have been proposed to represent separate fining-upward megacycles (Hoepffner et al., 2000; Bensahal, 2001; Ghazali, 2003).

All fossils described in this article come from the Galmous Formation (Fig. 1B; CDUE localities 33–37). At three sites

(CDUE localities 33, 34, and 36), only surface collections were carried out; CDUE localities 35 and 37 have been studied in detail by measuring stratigraphic sections (Fig. 2). At CDUE locality 37, a 40 m thick succession of clastic deposits of the Galmous Formation is exposed on the right bank of the Oued Dfilet stream. The section starts with a ca. 6 m thick succession of interbedded, yellowish-green or limonitic-brown, trough cross-bedded sandstones and massive conglomerates characterized by commonly convex lower surfaces and abundant macrofloral remains (cordaitalean leaves, trunk fragments; Fig. 2A) (Unit 1). Unit 1 is overlain by 1.5 m of yellowish-green, uneven horizontally to very shallow trough cross-bedded siltstones and very fine-grained sandstones penetrated by root traces and invertebrate burrows (Unit 2). It is followed by 12 m of purple siltstone with $\leq$10 cm thick intercalations of sandy siltstone recording plant remains (pteridophyte foliage, cordaitalean leaves), root traces, and invertebrate burrows (Unit 3). Unit 4 ($\sim$7 m) is dominated by sandstone similar to unit 2. The section is terminated by a 13 m thick fining-upward succession of conglomerates and sandstones resembling unit 1 (Unit 5). We interpret the succession as deposits of a fluvial plain with wide and shallow, braided streams between extensive, vegetated, and at least temporarily exposed overbank areas. A systematic excavation 2×5 m in size was carried out at CDUE locality 35, which is about 50 m to the SE of CDUE locality 37. The studied section is 50 cm thick and mainly composed of greenish-grey, sandy deposits that correlate with fluvial sandstones ca. 5 m above the base of unit 5 at CDUE locality 37 (Fig. 2). The excavation site is dominated by approximately 1–6 cm thick, massive, uneven horizontally or very shallow trough cross-bedded fine-grained and medium-grained sandstones with variable amounts of plant remains and root traces. A few beds (1, 14, 20) are normally graded. Bedding surfaces with mud drapes may show current ripples (Fig. 2E), raindrop impressions, mud cracks, macrofloral remains, and invertebrate and vertebrate traces. The most fine-grained deposits are sandy siltstones and two layers (5, 10) with silty claystones, all of them lacking internal structures. With the exception of rare invertebrate traces and supposed microbially induced sedimentary structures ("elephant skin"; sensu Schieber, 2004) that both have been exclusively founded in silty claystones, these deposits contain the same sedimentary marks, plants and trace fossils as the sandstones. We interpret the succession at CDUE locality 35 as deposits in marginal parts of a low relief, laterally extensive ephemeral stream with shallow pools in abandoned, inactive parts of the river bed during water level fall.

MATERIAL AND METHODS

During field work in 2011, 59 specimens with plant fossils, invertebrate traces, and vertebrate traces were collected in the Sidi Kassem Basin at CDUE localities 33–37 (Table 1). The tracks are preserved on upper or lower bedding planes of fine-grained sandstones and have been gathered by surface collection and systematic excavation at CDUE locality 35. The ichnotaxonomic analysis is based on outline drawings, photographs, and measurements of the best-preserved tracks. Drawings were carried out on transparency film and digitalized with a vector-based drawing software. Photographs were taken in the field under natural light conditions and in the laboratory under spotlight. Measurements were taken according to the standard methods proposed by Haubold (1971), Leonardi (1987), and Voigt (2005).

Institutional abbreviation: CDUE—Department of Geology, Chouaib Doukkali University El Jadida, Morocco. Locality data are on file at the same institution.

SYSTEMATIC PALAEOICHNOLOGY

Due to poor preservation, the majority of tetrapod footprints cannot be assigned to a specific ichnotaxon. Among the better

TABLE 1
Specifications of CDUE locatities in the Galmous Formation of the Sidi Kassem Basin and their fossil record

CDUE locality number	Coordinates	Tetrapod ichnotaxa and fossils CDUE collection number
33: Rouina Valley	N 33° 19′ 43.593″ W 6° 27′ 29.122″	cf. *Batrachichnus* (306), tetrapod footprint indet. (308)
34: Rouina Valley	N 33° 20′ 10.102″ W 6° 27′ 22.319″	Plants remains, no materiel collected
35: Zhar Ouled El Mamoune Valley	N 33° 18′ 6.886″ W 6° 30′ 43.541″	cf. *Batrachichnus* (263), cf. *Hylopus* (267–268, 292), *Dimetropus* (264), *Notalacerta* (265), Tetrapod footprint indet. (266, 270, 272–279, 281, 283–287, 289, 293), Plants remains, invertebrate traces
36: Zhar Ouled El Mamoune Valley	N 33° 18′ 24.251″ W 6° 30′ 38.680″	Plants remains, invertebrate traces, no materiel collected
37: Zhar Ouled El Mamoune Valley	N 33° 18′ 8.547″ W 6° 30′ 45.427″	Plants remains, invertebrate traces, no materiel collected

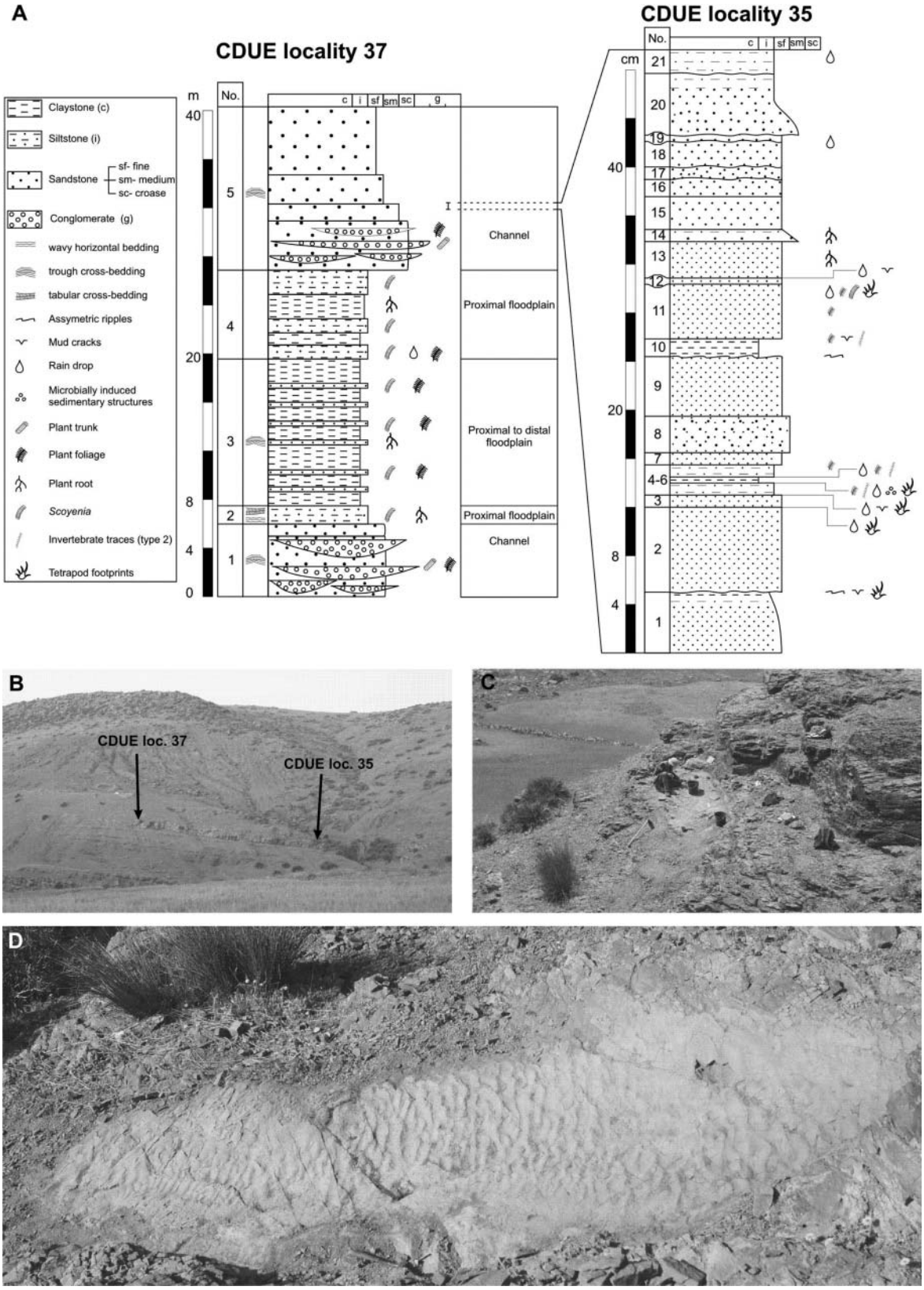

FIG. 2. Situation at CDUE localities 35 (= excavation site) and 37 in the Galmous Formation of the Sidi Kassem Basin: **A**, Stratigraphic sections. **B.** Distant view of both localities (left arrow = CDUE locality 37; right arrow = CDUE locality 35). **C–D.** Excavation site in April, 2011; surface with current ripples (D).

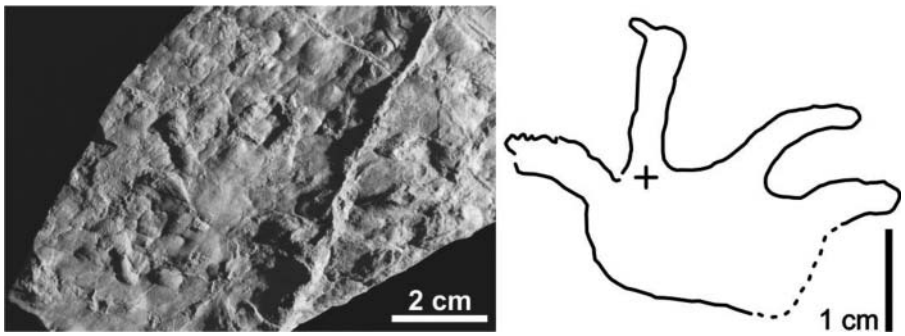

FIG. 3. Isolated manual track of cf. *Batrachichnus* Woodworth, 1900 from the Galmous Formation of the Sidi Kassem Basin (CDUE 263) preserved in convex hyporelief.

preserved material we identify specimens that can be assigned to four different vertebrate ichnotaxa: cf. *Batrachichnus* Woodworth, 1900; cf. *Hylopus* Dawson, 1882; *Dimetropus* Romer and Price, 1940; and *Notalacerta* Butts, 1891. Considering the overall poor preservation of the studied material we refrain from ichnospecific analyses.

cf. *Batrachichnus* Woodworth, 1900 (Fig. 3)

Type ichnospecies*: Batrachichnus salamandroides* (Geinitz, 1861).

Referred material: CDUE 263, single manual track from CDUE locality 35; specimen preserved by part and counterpart on surface with raindrop impression marks and cordaitalean leave impressions.

Description*:* CDUE 263 is an isolated plantigrade track of 25 mm in length and 40 mm in width showing four digits (I–IV) with rounded tips. Digits increase in length from I to III; digit IV is a little bit longer than I. All digits are slightly tapering from the base to the tip. Proximal parts of all digits are straight. The distal part of the first three digits is notably curved inward; digit IV is pointing outward. Mainly based on the well preserved proximolateral margin of the track, a straight to slightly concave proximal outline of the sole is inferred.

Discussion*:* CDUE 263 is the only specimen from the study area with an unambiguously tetradactyl imprint. Imprint morphology and size correspond well with larger imprints of *Batrachichnus* Woodworth, 1900 (Haubold, 1970, 1996; Voigt, 2005, 2007; Voigt et al., 2011a, b). Because the studied material includes just a single isolated manual track, we prefer to compare the specimen to this ichnogenus only. Tracks of *Batrachichnus* are usually referred to temnospondyls (Haubold, 1970, 1971, 1996, 2000; Gand, 1988; Voigt, 2005, 2007, 2012; Gand and Durand, 2006).

cf. *Hylopus* Dawson, 1882 (Fig. 4)

Type ichnospecies*: Hylopus hardingi* Dawson, 1882.

Referred material: CDUE 267, 268, and 292, isolated manual tracks from CDUE locality 35, all preserved in convex hyporelief.

Description: Three specimens with isolated, incompletely preserved tracks that are about as wide as long (about 40–50 mm). Tracks are characterized by long, relatively thin, distally curved and slightly pointed digits that splay out. None of the referred specimens shows more than four digits. Some digits seem to be long, up to three times longer than the faint sole impression (e.g., CDUE 292; Fig. 4C). Adjacent digits may be of significantly different length. The total number of digits cannot be given by certainty but the arrangement and relative size of digits suggests pentdactyly with digit IV as the longest digit.

Discussion: Though the described material is of poor preservation, all specimens show features that are remarkably similar to tracks of *Hylopus* from the Mississippian Mauch Chunk Fm. of Pennsylvania (Lucas et al., 2006; Fillmore et al., 2012). The Moroccan and North American tracks match in size as well as the shape and orientation of digits. Manual tracks of *Hylopus* are digitigrade or semidigitigrade and have long, thin, curved digits of varied lengths. Pedal tracks of the same ichnogenus are plantigrade and have shorter, more equal-length digits than the manus imprints (Fillmore et al., 2012). Accordingly, we interpret CDUE 267, 268, and 292 as manual tracks assigning them tentatively to cf. *Hylopus*.

The ichnogenus *Hylopus* was introduced by Dawson (1882) and more or less extensively discussed later on (Matthew, 1904; Haubold, 1971; Sarjeant and Mossman, 1978; Sundberg et al., 1990; Cotton et al., 1995; Lucas et al., 2006; Vrazo et al., 2007; Fillmore et al., 2012). Tracks assigned to *Hylopus* became more and more commonly discovered in Mississippian and Pennsylvanian strata of North America (e.g., Sundberg et al., 1990; Lucas et al., 2006; Fillmore et al., 2012), though significant features of the ichnogenus such as the real number of digits in the manus imprint remain an open question. We interpret *Hylopus* to be the tracks of pentadactyl tetrapods (most likely anthracosaurs) based on personal observations of one of us (SV) on well-preserved trackways of the ichnogenus from the Mauch Chunk Formation. This important ichnotaxon is in need of comprehensive revision.

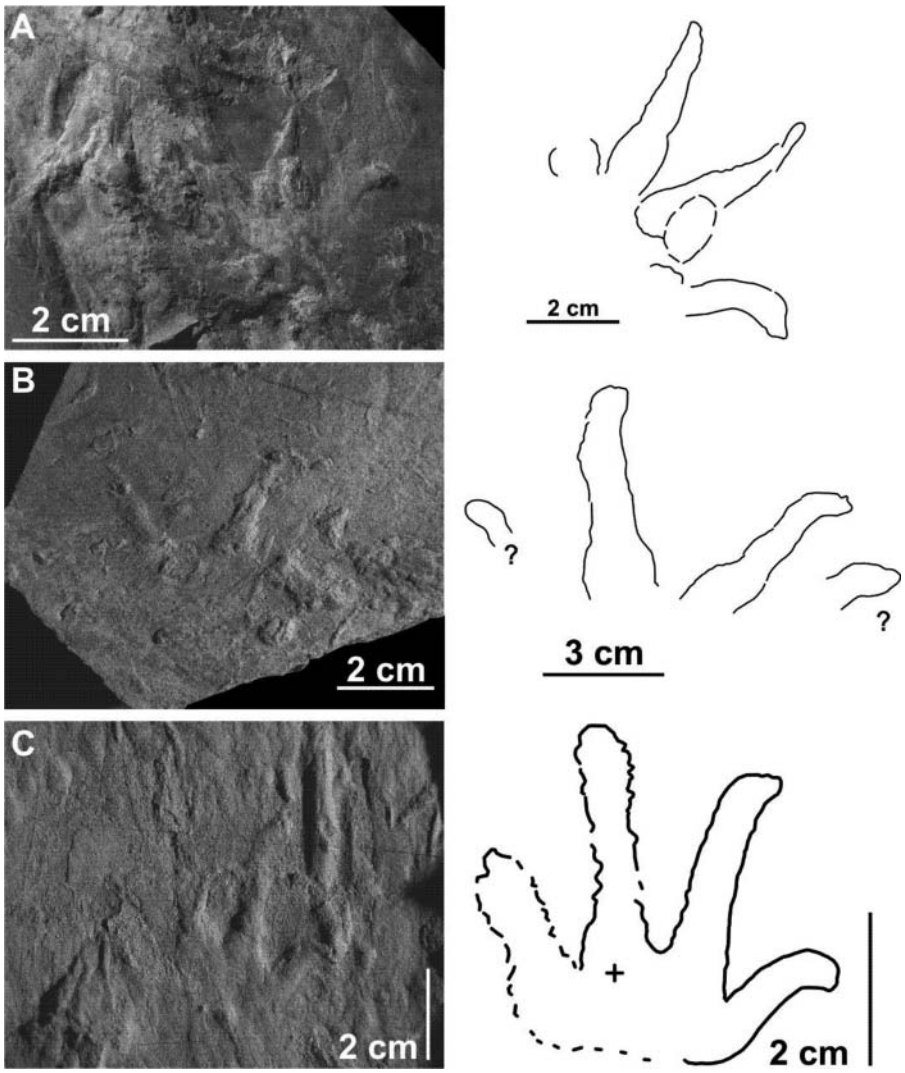

FIG. 4. Manual tracks of cf. *Hylopus* Dawson, 1882 from the Galmous Formation of the Sidi Kassem Basin: CDUE 267 (**A**), CDUE 268 (**B**), CDUE 292 (**C**). All tracks are preserved in convex hyporelief.

Dimetropus Romer and Price, 1940 (Fig. 5)

Type ichnospecies: *Dimetropus leisneranus* (Geinitz, 1863)

Referred material: CDUE 264, part and counterpart of an isolated manual track from CDUE locality 35. The specimen is part of an indistinctly preserved trackway that has been recorded by photograph and drawing only (Fig. 5A).

Description: CDUE 264 is a pentadactyl, plantigrade footprint that measures 70 mm in length and 42 mm in width. The track shows long and slender, distally pointed digits of the following proportions: I<II∼V<III<IV. All digits are straight; digits I to IV are subparallel to each other as well as subparallel to the longitudinal axis of the track. Digit V is slightly pointing outward; the interdigital angle I/V measures 36°. The proximally elongated heel of the imprint reaches approximately 60% of the length of the imprint. Judged from the excavated step cycle, tracks are arranged in a way that the manual track of one side of the trackway is nearly opposite a pedal track of the other side. Deviation of manual and pedal tracks from the trackway midline is variable; both imprints may be placed subparallel to the midline or pointed inward. Length of stride and pace can be estimated to be 150 mm; the trackway width is ∼100 mm. Left and right tracks are separated by a straight to partially curved, almost continuous tail or body trace that ranges in width from 5–25 mm.

Discussion: Imprint morphology and trackway pattern, that is, the elongated heel as well as the shape, orientation, and proportion of the digits, strongly support assignation of the discussed tracks to *Dimetropus* Romer and Price, 1940. CDUE 264 is interpreted to be a manual track based on size and position relative to the biggest tracks of the excavated trackway. Because of the relatively poor preservation, the described tracks from the Sidi Kassem Basin are referred to *Dimetropus*

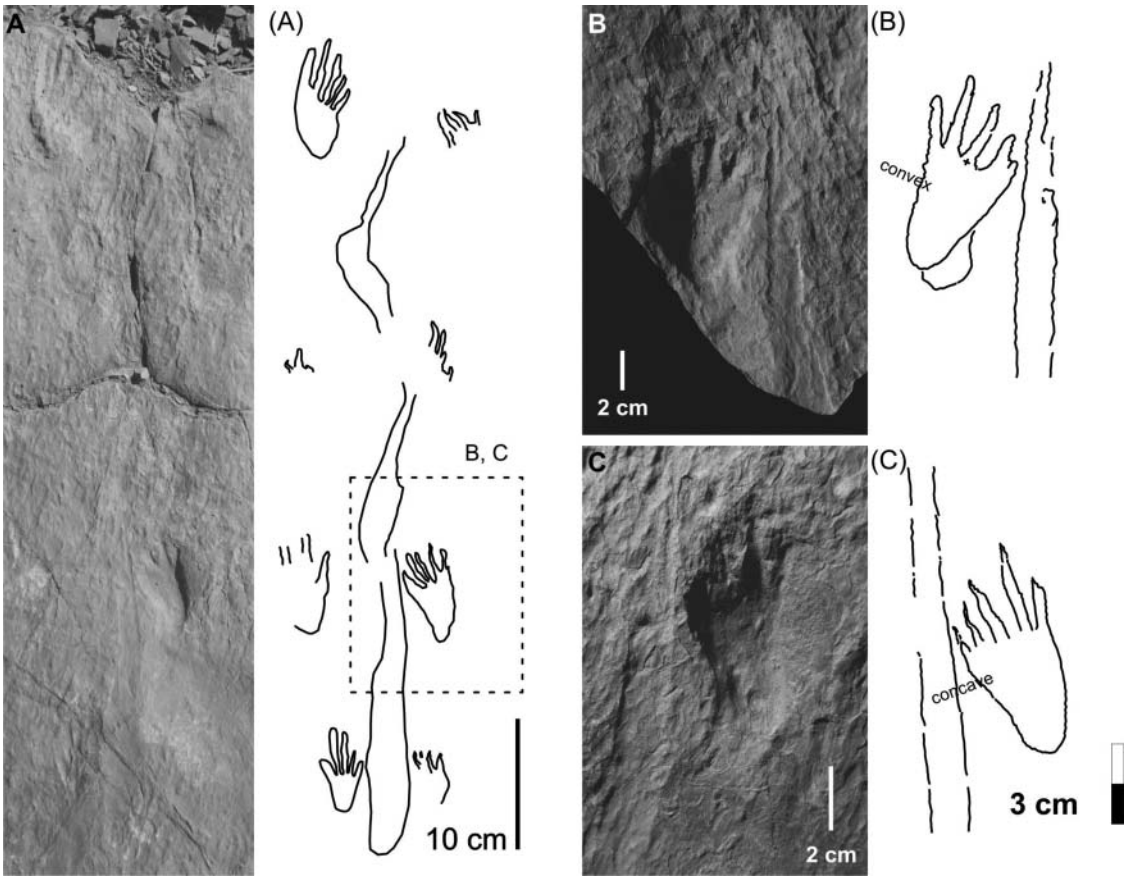

FIG. 5. Indistinct trackway with tail or body trace assigned to *Dimetropus* Romer and Price, 1940 from the Galmous Formation of the Sidi Kassem Basin. **A**, overview of the trackway, **B**-**C**, close-up of best-preserved track as photographs and sketches. A, field photograph showing concave epirelief of the trackway; B-C, CDUE 264, isolated manual track preserved in convex hyporelief (B) and concave epirelief (C).

with open nomenclature on the ichnospecies level. *Dimetropus* subsumes tracks of a wide range of Late Carboniferous and Early Permian non-therapsid synapsids including edaphosaurids, sphenacodontids, ophiacodontids, and caseids (Haubold, 2000; Voigt, 2005; Voigt and Ganzelewski, 2010; Voigt et al., 2011b; Lagnaoui et al., 2012, 2013a, b, c).

Notalacerta Butts, 1891 (Fig. 6)

Type ichnospecies: *Notalacerta missouriensis* Butts, 1891.

Referred material: CDUE 265, incomplete trackway with at least four tracks and discontinuous tail or body trace from CDUE locality 35, preserved by part and counterpart.

Description: CDUE 265 shows a number of plantigrade to semiplantigrade tetrapod tracks that measure 25–35 mm in length and 20–25 mm in width. Completely preserved imprints are always pentadactyl with digits increasing in length from I to IV; digit V is about as long as II. The imprints are rotated slightly outward relative to the trackway midline. Digits are long and slender; distally pointed tips seem to be the result of claws. Digit tip dragging marks are ubiquitous. Digits seem to be two to three times longer than the proximally rounded sole impression. A tail or body drag mark can be seen at the beginning and end of the trackway segment.

Discussion: Regarding the imprint morphology, especially the number, shape and relative length of digits, the described tracks are most similar to captorhinomorph footprints of the ichnogenera *Robledopus* Voigt et al., 2013; *Notalacerta* Butts, 1891; *Varanopus* Moodie, 1929; and *Hyloidichnus* Gilmore, 1927. Only two of them, *Robledopus* and *Notalacerta*, are commonly associated with tail or body traces (Haubold, 1971; Chesnut et al., 1994; Voigt et al., 2013). *Robledopus* had only been known from Permian deposits of New Mexico and characterized by strongly outward directed pes imprints, inward directed manus imprints, and relatively short manual digits (Voigt et al., 2013). The more lacertoid imprint morphology and parallel directed tracks of CDUE 265 are much more consistent with *Notalacerta*. Accordingly, we assign the Moroccan tracks to this ichnogenus. Important records of *Notalacerta* come from Pennsylvanian strata of North America (Butts, 1891; Lewis, 1973; Chesnut et al., 1994; Lucas et al.,

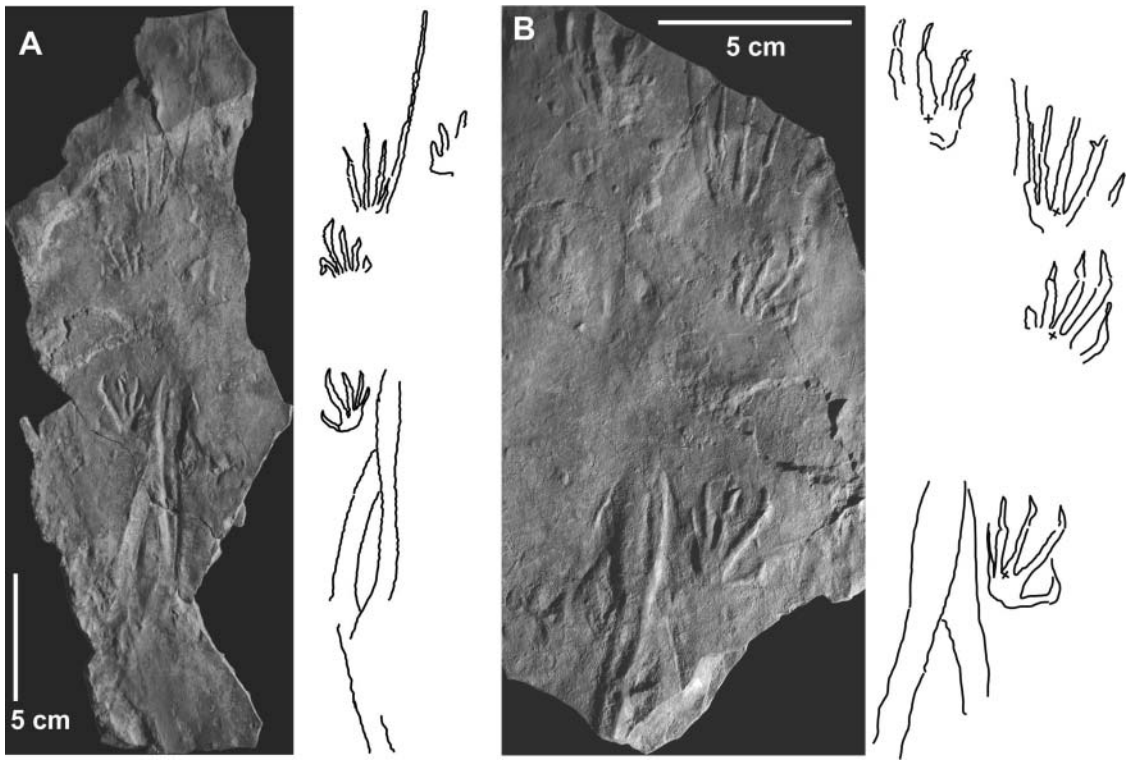

FIG. 6. Photographs and sketches of incomplete trackway with tail / body traces of *Notalacerta* Butts, 1891 from the Galmous Formation of the Sidi Kassem Basin: CDUE 265, tracks preserved in concave epirelief (**A**) and convex hyporelief (**B**).

2004; Haubold et al., 2005). Tracks of this ichnogenus are usually referred to basal europtilian (Voigt et al., 2013).

PALAEOECOLOGICAL AND BIOSTRATIGRAPHICAL IMPLICATIONS

Sedimentological and structural analyses indicate that the continental deposits of the Sidi Kassem Basin formed in an intramontane basin of the Mauretanide fold belt during the main (= Pennsylvanian) phase of the Hercynian orogeny of what is now NW Africa (Zahraoui, 1991; Michard et al., 2008). Based on biostratigraphic data, the continental deposits of the Sidi Kassem Basin are also considered to be of Pennsylvanian age (Termier, 1932). The most precise dating as Kasimovian is suggested by macrofloral remains (Termier, 1936; Pruvost and Termier, 1949; Roch, 1950; Chakiri, 1991; Tahiri, 1991), whereas Broutin gives a Westphalian B-C (upper Bashkirian to lower Moscovian) age based on palynological data (personal communication by Broutin in Ghazali, 2003).

The tetrapod ichnofauna described herein indicates a Pennsylvanian age for the track-bearing strata of the Galmous Formation of the Sidi Kassem Basin. Though *Batrachichnus*, *Dimetropus*, and *Notalacerta* occur in Pennsylvanian as well as Permian strata (Haubold, 1971; Calder et al., 2004; Lucas, 2007; Voigt, 2005; Voigt and Ganzelewski, 2010; Voigt et al., 2013), *Hylopus* is only known from pre-Permian deposits (Dawson, 1882; Sternberg, 1933; Haubold, 1971; Sarjeant and Mossman, 1978; Sundberg et al., 1990; Mossman and Grantham, 1996, 2000; Lucas et al., 2006; Fillmore et al., 2012). More precisely, a pre-Late Pennsylvanian age is suggested taking into account that there is no evidence of *Dromopus* tracks from the study area. The first occurrence of the almost ubiquitous *Dromopus* is in Late Pennsylvanian strata of North America and Europe (Marsh, 1894; Haubold, 1996; Voigt, 2005; Lucas, 2007). According to the present state of knowledge on the stratigraphic distribution of Palaeozoic tetrapod footprints, an early to mid-Pennsylvanian age is most likely for the track-bearing horizons of the Sidi Kassem Basin. This ichnofauna almost certainly predates the hitherto oldest record of tetrapod footprints on the African continent, which were latest Pennsylvanian tracks of *Dromopus* from the Moroccan Souss Basin (Hmich et al., 2006).

All tetrapod tracks from the Sidi Kassem Basin are preserved in greenish-grey siliciclastic sediments. They are associated with abundant macrofloral remains assigned to sphenophytes (*Calamites*, *Annularia*), pteridospermatophytes (*Mixoneura*, *Neuropteris*, *Odontopteris*, *Pteridospermopsida*), and coniferophytes (*Cordaites*, *Cardiocarpus*). Track-bearing surfaces are commonly covered by raindrop impressions, current ripples, and microbially induced sedimentary structures, whereas mudcracks are rare and shallow. Most tracks are deep imprints that have been made on wet mud. All data give

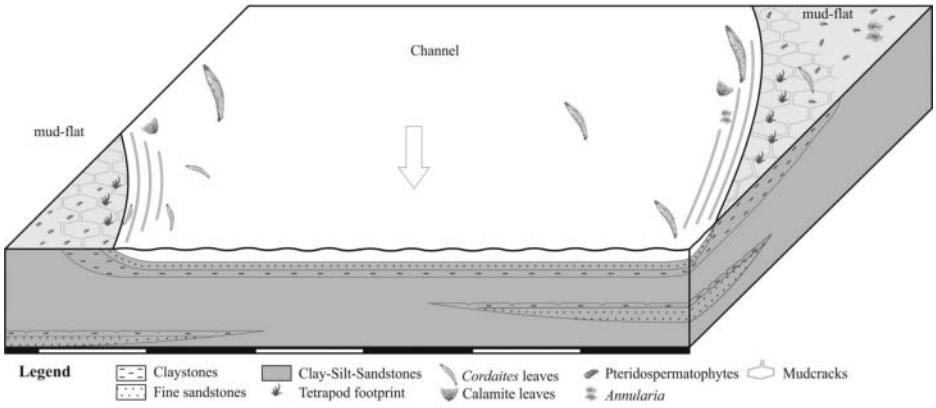

FIG. 7. Schematic reconstruction of the depositional environment of the Galmous Formation in the Sidi Kassem Basin at CDUE locality 35 showing a shallow channel during waning flood.

evidence that deposition of the Galmous Formation took place in a reducing fluvial environment with sufficient moisture and low-energy settings affected by periodically subaerial or subaqueous conditions. (Fig. 7; see also Ghazali, 2003).

CONCLUSIONS AND PERSPECTIVES

This article describes the first occurrence of tetrapod footprints from Westphalian strata of the Sidi Kassem Basin. The recently collected footprints are assigned to the ichnogenra cf. *Batrachichnus*, cf. *Hylopus*, *Dimetropus*, and *Notalacerta* and represent the oldest vertebrate tracks discovered in Africa. They can be referred to amphibian (temnospondyls, anthracosaurs) and reptilian (pelycosaurs, captorhinomorphs) trackmakers. The tetrapod ichnofauna suggests a pre-Late Pennsylvanian (most likely an early to mid-Pennsylvanian) age for the track-bearing strata of the Sidi Kassem Basin. According to this faunistic and stratigraphic interpretations, the occurrence may be of great importance for the reconstruction of the evolution of early tetrapods, especially basal amniotes, wherefore fossil exploration in the Sidi Kassem Basin should be continued and extended.

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