Disponible en ligne sur www.sciencedirect.com
ScienceDirect
C. R. Palevol 8 (2009) 67–78
COMPTES RENDUS PALEVOL

Paléontologie générale

Empreintes de pas de reptiles au Pic des Merveilles dans le Permien du massif du Mont-Bego (Alpes-Maritimes)☆

Pascal Barrier [a], Christian Montenat [a], Henry de Lumley [b,*]

[a] *Département géosciences (IGAL), institut polytechnique LaSalle-Beauvais, 19, rue Pierre-Waguet, BP 30313, 60026 Beauvais cedex, France*
[b] *Institut de paléontologie humaine, fondation Albert-1er Prince de Monaco, 1, rue René-Panhard, 75013 Paris, France*

Reçu le 5 mai 2008 ; accepté après révision le 21 octobre 2008
Disponible sur Internet le 20 janvier 2009

Présenté par Henry de Lumley

Résumé

Les terrains permiens affleurant au revers méridional du massif du Mercantour (dôme de Barrot, Mont-Bego et vallée des Merveilles) n'avaient pas livré, jusqu'à présent, de traces de pas de vertébrés contrairement à d'autres régions du Sud-Est de la France (Provence, Estérel). Des découvertes bien localisées stratigraphiquement (partie supérieure de la formation de Meraviglie), réalisées dans le Parc national du Mercantour, à l'occasion d'études géologiques, viennent combler cette lacune. Les empreintes de pas récoltées se rapportent toutes au même type d'ichnite, *Varanopus curvidactylus* Monodie, 1929, présent dans le Permien moyen de différents bassins du Midi de la France. Cette attribution demande à être confirmée par la découverte de nouvelles empreintes. Malgré des conditions d'affleurement peu favorables et une déformation tectonique souvent intense (fracturation, début de schistosité, développement d'un réseau de filons quartzeux, occasionnellement à épidote), les traces et les figures sédimentaires associées (rides de courant, fentes de dessiccation, traces de gouttes de pluie, films cyanobactériens, bioturbations d'annélides) permettent d'attribuer l'environnement de dépôt au sommet de la formation terrigène de Meraviglie à une basse plaine d'inondation deltaïque de bord de lac. ***Pour citer cet article : P. Barrier et al., C. R. Palevol 8 (2009).***

Abstract

Vertebrate footprints at the Pic des Merveilles from the Permian of the Mont-Bego massif (Alpes–Maritimes, France). The Permian formations outcropping on the southern side of the Mercantour massif (Barrot dome; Mont-Bego and the Vallée des Merveilles) have not, up until now, yielded vertebrate footprints, unlike other southern French regions (Lodévois, Provence). However, this has now changed. Discoveries have been made, first on loose blocks and then in stratigraphy (upper part of the Meraviglie or Merveilles formation), during a geological survey in the national Mercantour Park. These footprints belong to the same ichnite type, *Varanopus curvidactylus* Monodi, 1929. Nonetheless, this attribution needs to be confirmed by subsequent footprint discoveries. Despite unfavourable outcropping conditions and often intense tectonic deformation (fracturation, beginning of schistosity, network of quartzous vein, occasionally with epidote), the traces and the associated sedimentary features (current ripples, mudcracks, raindrop imprints, cyanobacterial mats, annelid bioturbations) allow us to correlate the depositional environment

☆ Cette découverte a été effectuée dans le cadre des travaux de troisième année des élèves géologues de l'institut polytechnique LaSalle-Beauvais, département géosciences (IGAL) avec la collaboration de Erika Devièse, Guillaume Faye, Baptiste Lepillier, Mélanie Louterbach, Mathieu Mazière, Delphine Moine, Arnaud Pontoiseau, Marie Sutra et Alexia Valle.

* Auteur correspondant.
Adresse e-mail : iph@mnhn.fr (H. de Lumley).

1631-0683/$ – see front matter © 2008 Académie des sciences. Publié par Elsevier Masson SAS. Tous droits réservés.
doi:10.1016/j.crpv.2008.11.001

of the upper Meraviglie terrigenous formation with a deltaic lower flood plain of a lakeshore. ***To cite this article: P. Barrier et al., C. R. Palevol 8 (2009).***

Mots clés : Permien ; Ichnologie ; Traces de pas ; Reptiles ; Vallée des Merveilles ; Mercantour ; France

Keywords: Permian; Ichnology; Footprints; Reptile; Vallée des Merveilles; Mercantour; France

Abridged English version

The Permian Meraviglie (or Merveilles) formation outcropping on the southern side of the Mercantour massif have recently yielded reptile footprints, in the Vallée des Merveilles, in the centre of the Mont-Bego region (Figs. 1–3). Unfavourable outcropping conditions and often intense tectonic deformation of the Permian layers (fracturation, beginning of schistosity, network of quartzous vein development, occasionally with epidote) reinforce the interest of these finds and provide reason to believe that the future will yield more samples.

The footprints were found in zone IV, on the southern side of the Pic des Merveilles and in zone X, on the western side of Mont-Bego (Figs. 1 and 4).

Geological context

The different outcropping sedimentary formations date back to the Permian. Four main ensembles have been identified: Inferno, Meraviglie (or Merveilles), Bego and Capeirotto formations. They are mainly detrital, more or less coarse (Inferno, Bego) or made up of violet or green pelites with rare coarse beds (Merveilles and Capeirotto) (Figs. 3 and 4). A phase of more or less intense schistosity has sometimes obliterated the sedimentary features.

The Merveilles formation, in which the reptile footprints have been discovered, corresponds to the edge of a floodplain with annelid bioturbation, in the lower alluvial fan. The sedimentary features are richer in this series: thin stratification, cyano-bacterial structure, raindrop imprints, ripple-marks and mud-cracks bearing the vertebrate footprints. The deposit thus corresponds to a superficial sub-aquatic environment (flood plain) undergoing slight variations. Some periodic floods brought small quantities of detrital elements.

The reptile footprints

Approximately 15 footprints have been discovered: imprints and their positive, isolated or in pairs (hand/foot), perhaps with the beginning of a track (step). They are preserved on greenish grey or violet grey pelite plates, affected by deformations of diverse origins: sedimentary (desiccation crack, ripple-marks and raindrop impacts) or tectonic (friction, first stage of schistosity).

These well-preserved prints (Figs. 5–8) belong to the same ichnologic type; they were made by a very small lizard-like pentadactyl, digitigrade to semiplantigrade quadruped (Table 1, Fig. 5). They show a predominance of finger IV, and a regular decrease in size from IV to I. Finger V, when present, is only indicated by a pointed trace (clawmark). Fingers IV to II, and even finger I, are thin with an incurved, "hooked" distal extremity, sometimes bearing thin clawmarks. In several cases, a rather long plantar sole is developed behind the fingers, however its posterior contour is not clear (Fig. 5). The finger pads cannot be discerned. The hand and foot form a well-separated pair, the hand being in a slightly internaI position on the track. Hand and foot display very little difference in size or shape. The measurements are approximative (Table 1 and Fig. 5). The dimensions of the autopode vary in length according to the presence or absence of the plantar sole. More importantly, certain traces have been deformed ulteriorly by tectonics, undergoing stretching or compression (Table 1 and Fig. 7). There is no tail imprint associated with the footprints.

These traces are relatively homogeneous, especially when we take account of the deformations linked to the sediment and ulterior rock deformation. They are typically pentadactyl foot–hand couples with curvilinear and slightly clawed fingers. Only about a centimetre long, they are amongst the smallest known.

This lizard-like group includes a fair number of ichnogenera with small-sized traces. Some morphological comparisons can be made with the ichnogenera *Hyloidichnus* and *Dromopus* which are nonetheless of a much bigger size. The closest similarities appear to be with the ichnotaxa *Varanopus curvidactylus* Monodi 1929 and *Microsauripus acutipes* Moodi 1929, that show traces measuring only a centimetre. *M. acutipes* is probably synonymous with *V. curvidactylus* [7].

The measurements of the footprints taken from the Merveilles formation are compatible with those from more complete samples [1,5–8]. It is noteworthy that the traces from the Vallée des Merveilles sometimes display the mark of a discreet plantar sole