The oldest record (pre-Callovian) of thyreophoran dinosaur tracks in the Southern Hemisphere: ichnological and geological implications

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The track record of thyreophorans is well known in the Jurassic, but it is restricted to the Northern Hemisphere. Only in the Cretaceous it is documented around the world. Some ichnogenera attributed to thyreophorans are well documented in the Jurassic of Europe, North America and also in Northern Africa. Conversely, in the Southern Hemisphere, the oldest documented thyreophoran tracks were described in the Jurassic–Cretaceous boundary, particularly in South America; but the stegosaurian or ankylosaurian affinity of some trackways remains debatable. These groups only present unequivocal tracks in the Upper Cretaceous. In this work, an isolated track from the Middle Jurassic of the Neuquén Basin in Patagonia of Argentina is reported. It is a well preserved pes documented on the top of a 3D fluvial dune. It is subtriangular to subrounded distally, with a well impressed heel, and three very short digit impressions of similar length which are not rotated. The track is slightly longer than wide, with an L/W ratio in agreement with the ichnogenus Deltapodus. However, since it is an isolated track and differs in the digit morphology from the holotype, the assignment to this ichnogenus remains tentative. The continental deposits containing the track belong to the Lajas Formation (Aalenian to Callovian). This unit have been traditionally interpreted like marine or marginal marine (deltaic) in outcrops. It constitutes the regressive phase of the first full paleopacific transgression in the Neuquén Basin. The lower boundary of the unit is transitional while the upper one is an unconformity intra-Callovian in age. The track is recorded in the lowermost part of the unit possibly overlying the intra-Bajocian unconformity in the Covunco area, and documents the first documented subaerial exposition for the unit. The thyreophoran affinity is supported osteologically for an almost complete skull discovered in the underlying Los Molles Formation (mainly Toarcian), but the material is under review and it could be assignable to stegosaurians, which were already documented in outcrops of the Early Cretaceous La Amarga Formation (post-Hauterivian). The track constitutes the oldest dinosaur record in the basin, but also the oldest track with thyreophoran affinity in the Southern Hemisphere. Other dinosaur tracks recorded in the basin are dominantly Cretaceous and correspond to theropods and sauropods.

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