

Quantification of morphological variation in Late Triassic to Early Jurassic theropod tracks of southern Africa

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Abstract:

The Upper Triassic-Lower Jurassic of southern Africa preserves a plethora of dinosaur tracks. In this study, we examine ~200, high-quality tridactyl tracks attributed to theropod trackmakers in the Elliot [subdivided into the lower (IEF) and upper (uEF)] and basal Clarens formations to quantify track morphological variation across a time span of ~35 million years.

Statistical methods, such as canonical variance and principal component analysis (PCA), show that the tracks in the IEF and Clarens Formation form two distinct morphological clusters, while the tracks in uEF span across these two tight domains. Stratigraphic trends, from oldest to youngest, include: an average increase in track lengths (TL) and track widths (TW), a slight increase in TL/TW ratios, and a decrease in digit III projection. These temporal changes can be summarized into an overall decrease in mesaxony. These results, though to different degrees, are mirrored in statistical tests comparing the ~200 tracks based on the size class of these tridactyl tracks (e.g., small < 15 cm, large > 25 cm). This correlation between stratigraphic and size class trends would be expected, because the size class distribution is closely linked to stratigraphy; e.g., IEF primarily preserves tracks that are < 25 cm long, while the Clarens Formation predominantly preserves tracks that are > 30 cm long. Classical systematic ichnological treatment combined with PCA mostly assign these theropod tracks to the *Grallator*-*Anchisauripus*-*Eubrontes* plexus, within which an increase in track size and a decrease in digit III projection are observed (OLSEN et al., 1998).

Keywords: Upper Triassic, Lower Jurassic, Karoo Basin, theropod tracks, geostatistics

References

OLSEN, P.E., SMITH, J.B. & McDONALD, N.G. (1998): Type material of the type species of the classic theropod footprint genera *Eubrontes*, *Anchisauripus*, and *Grallator* (Early Jurassic, Hartford and Deerfield basins, Connecticut and Massachusetts, USA). *Journal of Vertebrate Paleontology*, 18: 586-601.