

Gregarious behaviour in theropod dinosaurs inferred from new data on *Therangospodus oncalensis* from the Berriasian Fuentesalvo tracksite (Villar del Río, Soria, Spain).

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A considerable amount of evidence of gregariousness or herding in different groups of dinosaurs has been discovered in recent years, and the clearest ones have been obtained from the study of footprints. One of the most interesting areas in Europe for the study of possible evidence of gregariousness is the Early Cretaceous megatracksite of the Cameros Basin (Moratalla & Sanz, 1997). In its lower part is included the Oncala Group, in which has been recognised almost one hundred tracksites of tetrapod tracks s. Particularly abundant are the tracks attributed to small and medium-sized theropod dinosaurs, like those found in Fuentesalvo site, the type locality of *Therangospodus oncalensis*. During cleaning and conservation works in Fuentesalvo we have discovered new trackways assigned to this ichnotaxon, making it possible for us to produce a more precise description of it.

Fuentesalvo locality is situated in Villar del Río (Soria). It is located in the Huérteles Alloformation of the Oncala group, deposited in shallow saline lacustrine environments), and dated as Berriasian (Martín-Closas & Alonso Millán, 1998).

The Fuentesalvo ichnological record is composed by 77 footprints (no undertracks), although only the 60 belonging to the trackways 1 to 12 are studied in this work. The footprints, preserved as concave epirrelief, are tridactyl mexasonic and show a single tapering pad on each toe. In the best-preserved ones, a further rounded pad, which was the heel and represents only around a third of the footprint length, can be seen. No marks attributed to nails or claws are observed. In some cases the toe II print may even be unconnected with the rest of the footprint. The angle between the prints of toes II and III, is smaller than the angle between toes III and IV. All the Fuentesalvo tracks are medium-sized, most of them displaying a length greater than the width (with an average of 22.9 cm in length, 20.0 cm in width and a L/W ratio of 1.16). The step length in the 12 studied trackways show an average of 58.8 cm, and a stride length average of 113.4 cm. The trackways are narrow (the step angle average is 169°).

The footprints of *Therangospodus oncalensis* presents greater length than width, relatively long toes with acuminate terminations and presence of a medial notch, allow us to include within the theropod ichnological group, as the type-trackway (Moratalla, 1993; Lockley *et al.*, 2000). As the average of the hip height of the Fuentesalvo trackmakers is 96 cm, the trackmaker can therefore be interpreted as a theropod of medium size, although as yet there are not enough data to attribute the tracks to any of the known clades from the Jurassic-Cretaceous transition.

In addition to similar morphometric characteristics, most of the trackways at the Fuentesalvo site show comparable size and biometrical features (45 out of 48 measured hip height calculations falls within the range of 0.8 to 1.1 metres), which indicates that, in terms of size and age a homogeneous population of a single theropod species could have produced these tracks. In the other side, the very similar orientation of most of the trackways (11 of them show a range of variation of only 15°, so was almost parallel) and estimated speed (between 0.92 and 1.09 m/s), as well as the fact that all are found in the same stratigraphical level, support the hypothesis that this population were a group of dinosaurs moving together. A final consideration is the observation of insufficient intertrackway spacing between some trackways (at least in the ones where the separation between the central lines is less than the sum of the trackway widths), which is explained by the movement of this group, due to the large number of individuals that comprise, not on a broad front but in several waves (at least three, the number of parallel trackways that shows superimposed footprints) as a herd. This means that the trackmarker of *Therangospodus oncalensis* was liable, at least at times, to move around in herds displaying gregarious behaviour.

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