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Diverse dinosaur ichnoassemblages from the Lower Cretaceous Dasheng Group in the Yishu fault zone, Shandong Province, China

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ABSTRACT

New dinosaur track assemblages were discovered recently in the Tianjialou Formation of the Lower Cretaceous Dasheng Group in Shandong Province, China. Theropods are represented by the trackways of two different medium-sized groups: (1) tridactyl tracks with a typical mesaxonic shape; (2) functionally didactyl tracks attributed to deinonychosaurian theropods. The latter report, the third from the Cretaceous of Shandong Province, enlarges the global record of didactyl theropod tracks, until now sparsely documented from only a few locations in Asia, North America and Europe. A number of features in the dromaeosaur trackway suggest the assignment to cf. *Dromaeosauripus*. Several medium-sized trackways resemble the narrow-gauge, small manus ichnogenus *Parabrontopodus*, and one large trackway is characterised by a wide-gauge and large manus, similar to *Brontopodus*. This suggests the co-occurrence of two different sauropod groups. A further component in these ichnoassemblages is a tetradactyl morphotype and trackways of ornithischian affinity that are tentatively attributed to psittacosaurs.

1. Introduction

The famous Tanlu fault zone, which extends NNE–SSW for more than 3000 km, forms a conspicuous geological feature along the northeastern margin of the Asian continent (Zhang et al., 2003: Fig. 1A). A series of folded mountain systems and basins extends along the middle Tanlu fault zone, called the Yishu fault zone (along Zhucheng–Junan–Linshu–Tancheng) between the Shandong Province and the Jiangsu Province, in eastern China.

Extensive outcrops of Cretaceous strata, bearing abundant dinosaur tracks, were discovered in the Yishu fault zone. The localities that have so far been described include the Houzuoshan Dinosaur Park, Junan County, Shandong Province (Li et al., 2005a,b, 2007; Lockley et al., 2007, 2008), the Zhangzhuhewan tracksite, Zhucheng City, Shandong Province (Xing et al., 2010a), and the Nanguzhai tracksites, Donghai County, Jiangsu Province (Xing et al., 2010b). Additionally, several tracksites have been discovered in the Jiaolai Basin, eastern Shandong Province, such as the Huanglonggou tracksite from Zhucheng City (Li et al., 2011). This latter tracksite was excavated in 2010, and thousands of tracks were discovered.

The tracksites we describe here were also discovered in the Yishu fault zone. In 2005, a number of tracks were found by local quarry workers at Ji Mountain (in Chinese: Jishan) at the northern margin of the Maling Mountain (in Chinese: Malingshan) range, Linshu County, Shandong Province, approximately 24 km north of the Nanguzhai tracksites (Fig. 1A). At the end of 2010, the Linshu Land and Resources Bureau organised the protection and excavation of the Jishan tracksites. In 2011, the first author was invited by the Linshu Municipal Bureau to study dinosaur track material from the exposures of the area. In 2012, financed by the Qijiang International Dinosaur Tracks Symposium, a detailed study of the tracksite was carried out.

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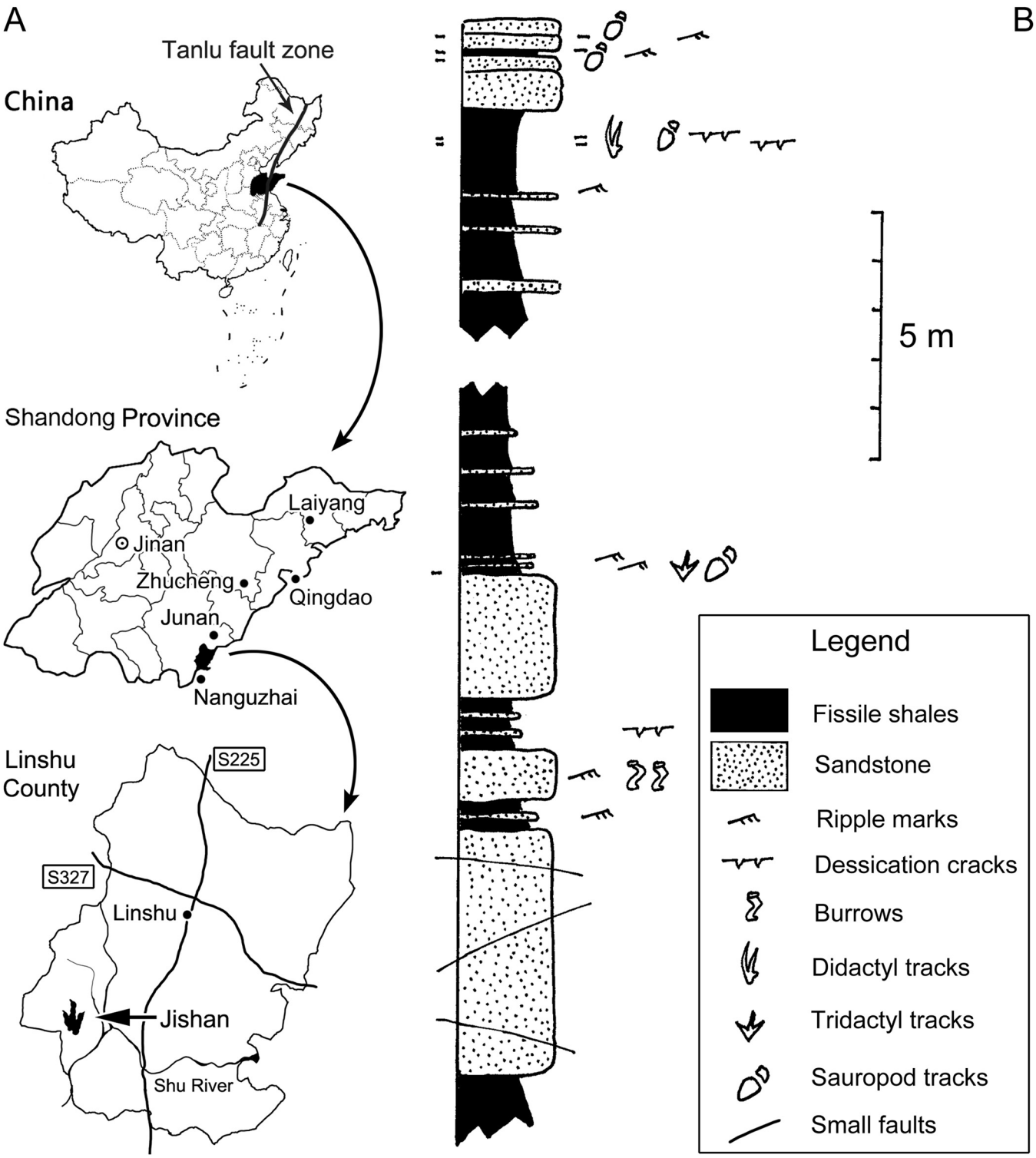

Fig. 1. Geographical setting (A) showing the location (footprint icon) of the Jishan dinosaur tracksites in Linshu County, Shandong Province, China. Stratigraphic section (B) of Lower Cretaceous strata as logged at the Jishan Site I with the position of the track-bearing levels.

2. Institutional abbreviations

CLS = Costalomo site, Burgos Province, Spain; HDT = Huaxia Dinosaur Tracks Research and Development Center, Gansu, China; LCU = Las Cuestas tracksite, Cameros Basin, Spain; LRH–dz = Li Rihui–Dasheng, Qingdao Institute of Marine Geology, China Geological Survey, China; LS = Linshu County Bureau of Land and Resources, Shandong, China; ZPAL = Institute of Palaeobiology of the Polish Academy of Sciences, Warsaw, Poland.

3. Geological setting

The Yimu fault zone and the Jialai Basin Cretaceous strata are divided into the Lower Cretaceous Laiyang and Qingshan groups