

# First reports of a distinctive theropod track assemblage from the Jinju Formation (Lower Cretaceous) of Korea provides strong correlations with China



Kyung Soo Kim<sup>a</sup>, Jong Deock Lim<sup>b</sup>, Martin G. Lockley<sup>c,\*</sup>, Lida Xing<sup>d</sup>, Su Jin Ha<sup>e</sup>,  
Cheong Bin Kim<sup>f</sup>, In Sung Paik<sup>g</sup>, Jae Hong Ahn<sup>h</sup>, Seok Chan Mun<sup>a</sup>

<sup>a</sup> Department of Science Education, Chinju National University of Education, Jinyangho-ro 369beon-gil, Jinju, Gyeongnam, 52673, South Korea

<sup>b</sup> Natural Heritage Center, National Research Institute of Cultural Heritage, 927 Yudeng-ro, Seo-gu, Daejeon, 35204, South Korea

<sup>c</sup> Dinosaur Trackers Research Group, University of Colorado Denver, PO Box 173364, Denver, CO 80217-3364, USA

<sup>d</sup> School of the Earth Sciences and Resources, China University of Geosciences, Beijing, China

<sup>e</sup> Department of Geological Sciences, Pusan National University, Busandaehak-ro 63beon-gil, Geumjeong-gu, Busan, 46241, South Korea

<sup>f</sup> Department of Physics Education, Suchon National University, 255, Jungang-ro, Suncheon, Jeollanam-do, 57922, South Korea

<sup>g</sup> Department of Earth Environmental Sciences, Pukyong National University, 45, Yongso-ro, Nam-gu, Busan, 48513, South Korea

<sup>h</sup> Graduate School of Culture Technology, Korea Advanced Institute of Science and Technology, 291, Daehak-ro, Yuseong-gu, Daejeon, 34141, South Korea

## ARTICLE INFO

### Article history:

Received 12 January 2017

Received in revised form

2 August 2017

Accepted in revised form 6 August 2017

Available online 8 August 2017

### Keywords:

Cretaceous

Theropods

Footprints

Korea

## ABSTRACT

Despite the extreme, well-documented abundance of tracks of herbivorous dinosaurs (ornithopods and sauropods), avian theropods and pterosaurs, from the Cretaceous of Korea the footprints of non-avian theropods have previously been reported only sporadically from the Cretaceous Gyeongsang Supergroup of Korea, without clear attribution to any ichnogenus. Here we report an assemblage of well-preserved theropod tracks from the Lower Cretaceous (?Aptian) Jinju Formation of the Jinju City area that contains distinctive ichnogenera including *Grallator sensu lato*, *Corpulentapus* and *Asianopodus*. These ichnotaxa were previously only known to co-occur in the Lower Cretaceous of China. In combination with other track evidence from the Lower Cretaceous of both China and Korea, this assemblage strengthens previous interpretations of the distinctive, apparently endemic nature of many East Asian dinosaurian ichnotaxa. The assemblage also helps refine debate over the age of track assemblages in the Lower Cretaceous of East Asia, and differences between assemblages from the lower and upper stages of the Lower Cretaceous.

© 2017 Elsevier Ltd. All rights reserved.

## 1. Introduction

The Cretaceous of Korea has become globally-famous for a rapidly growing number of tetrapod track assemblages found in Gyeongsang Basin and other smaller basins. Yang (2015) reported that well over 120 papers on Korean tetrapod tracks had been published since he first reported tetrapod tracks in 1982. That number has grown annually while the southern part of the Korean peninsula has been named the Korean Cretaceous Dinosaur Coast (KCDC) and considered for World Heritage status. Landmark

volumes were published by *Cretaceous Research* (2006: see Matsukawa et al., 2006) and *Ichnos* (2012: see Lockley et al., 2012a, b) in which multiple track assemblages were described. The majority of these were reported from the Gyeongsang Supergroup in the Gyeongsang Basin (Fig. 1). This supergroup is divided into the lower Sindong Group, traditionally regarded as Hauterivian to Aptian in age, and containing the track-bearing ?Aptian-age Jinju Formation discussed here, and the Upper Hayang Group containing the ?Albian-Cenomanian age, track-rich Haman and Jindong formations (Kang and Paik, 2013): Fig. 1. All these formations have yielded a remarkable abundance and diversity of tetrapod track types, including 17 new ichnospecies representing saurischian and ornithischian dinosaurs, birds (avian theropods), pterosaurs (Lockley et al., 2012a), a lizard (K-S Kim et al., 2017a), a mammal (K-S Kim et al., 2017b) and small crocodylomorph ichnotaxa (Park et al., 2016).

Abbreviations: NHCG, National Heritage Center (Geology); CUE, Chinju National University of Education; UCM, University of Colorado Museum of Natural History; HTD, Hotan-dong.

\* Corresponding author.

E-mail address: [martin.lockley@ucdenver.edu](mailto:martin.lockley@ucdenver.edu) (M.G. Lockley).

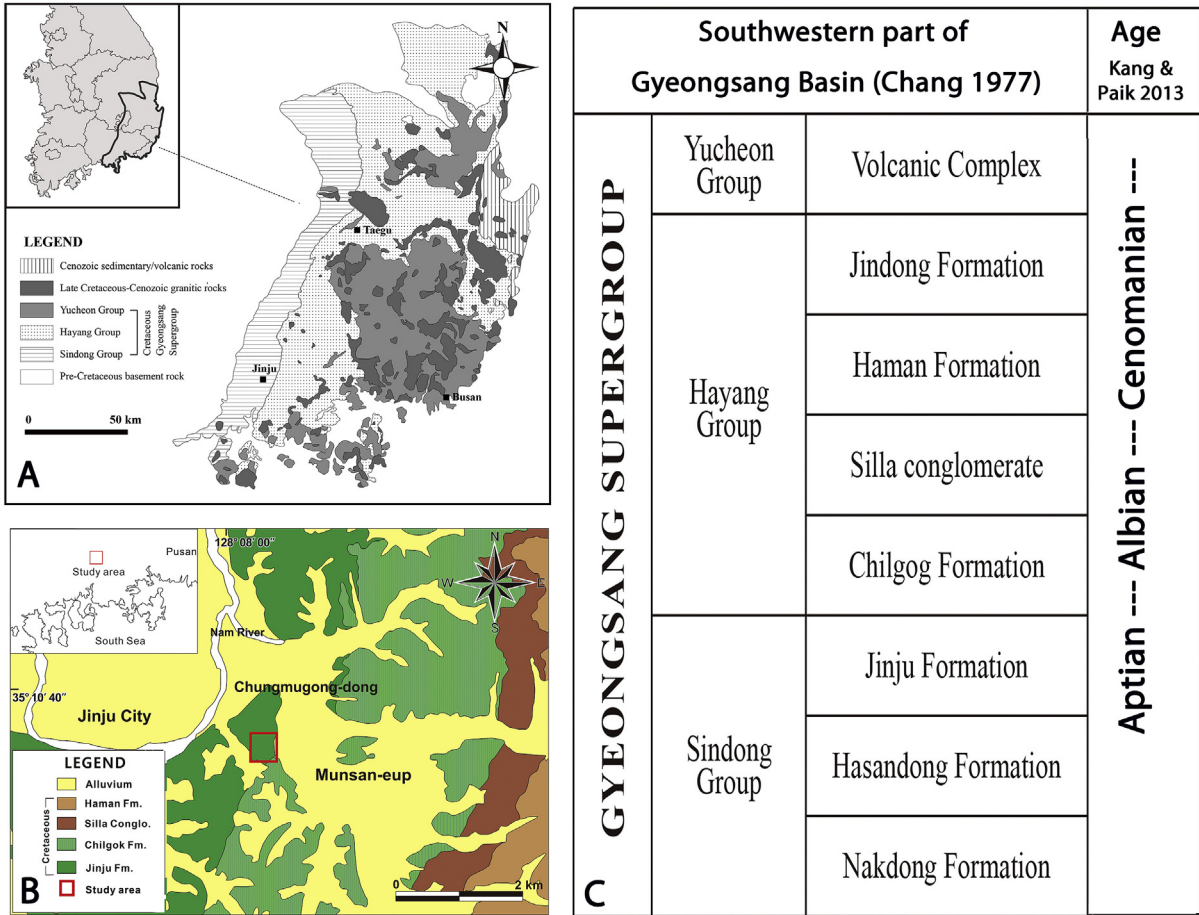


Fig. 1. Location maps and stratigraphy for the Gyeongsang Supergroup. A: location of Gyeongsang Basin in southeast of Korean Peninsula, with Group level geological map. B: Formation level geological map of area around Jinju City, showing study area. C: stratigraphy of southwestern part of the Gyeongsang Basin with inferred age of the formations. See text for details.

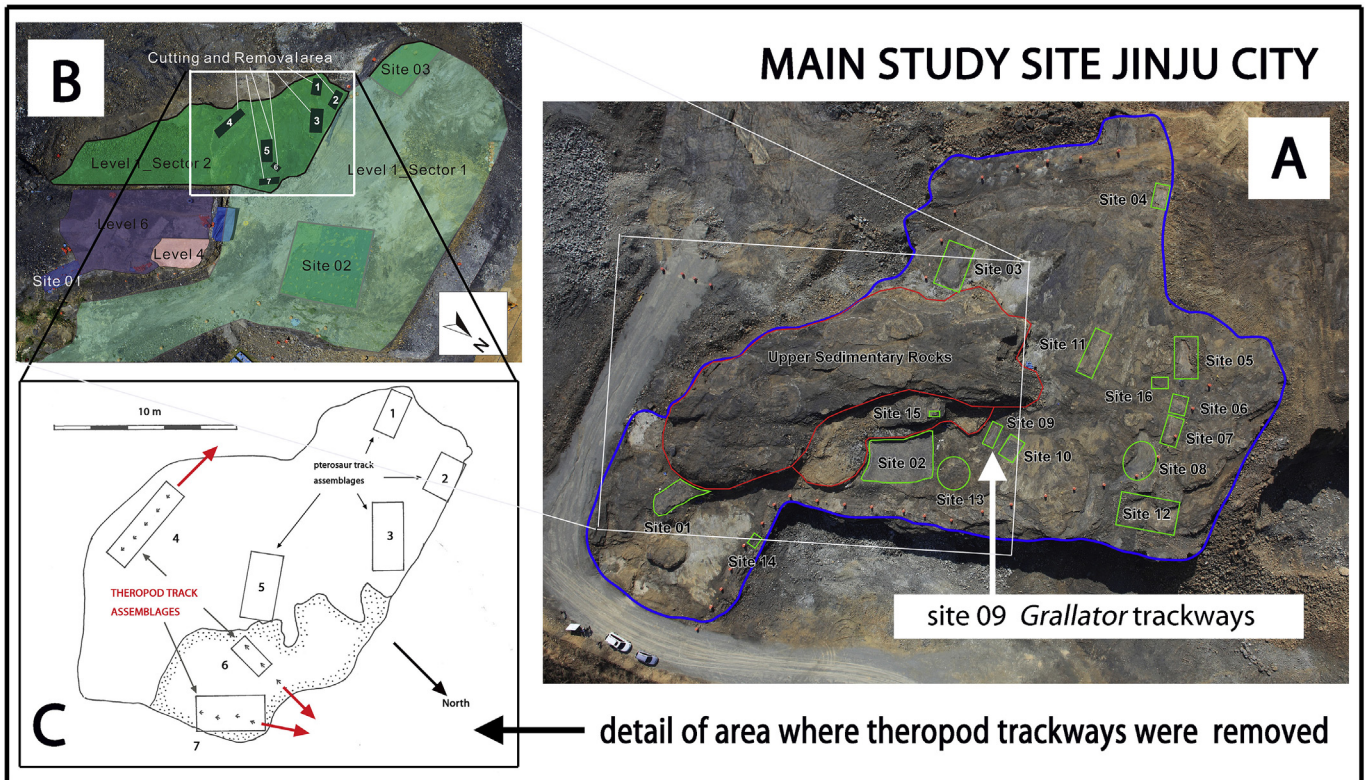


Fig. 2. Aerial views and maps of the Jinju Innovation City outcrops during excavation. A: shows area about  $\sim 160 \times 115$  m ( $\sim 18,400$  m<sup>2</sup>) with multiple tracksites at multiple levels, including site 09 from which *Gallator* trackways were excavated. B: shows main level 1 excavation areas (corresponding to white rectangle in A), with detail of cutting and removal area (white rectangle) in Sector 2 of Level 1. C: detail of cutting and removal area including sites 1–7. Sites 5–7 produced theropod trackway segments described here. See text for details.

Download English Version:

<https://daneshyari.com/en/article/5787893>

Download Persian Version:

<https://daneshyari.com/article/5787893>

[Daneshyari.com](https://daneshyari.com)