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Dinosaur Tracks, Myths and Buildings: The Jin Ji (Golden Chicken) Stones from Zizhou Area, Northern Shaanxi, China

Lida Xing¹, Jianping Zhang¹, Hendrik Klein², Adrienne Mayor³, Yu Chen⁴, Hui Dai¹, Michael E. Burns⁵, Junmin Gao⁶, Yonggang Tang⁷ and Shurong Dong⁶

¹School of the Earth Sciences and Resources, China University of Geosciences, Beijing, China

²Saurierwelt Paläontologisches Museum, Neumarkt, Germany

³Classics Department, Stanford University, Stanford, California, USA

⁴Capital Museum, Beijing, China

⁵Department of Biological Sciences, University of Alberta, Edmonton, Alberta, Canada

⁶Yulin Municipal Society for Private Collections Culture, Shaanxi, China

⁷Institute of Geology and Palaeontology, Linyi University, Linyi, China

For centuries, dinosaur footprints have influenced popular legends and myths in the surroundings of important tracksites. In many regions of China, track-bearing slabs were utilized as building materials and integrated in houses, yards, or cave dwellings, often serving as auspicious symbols or aesthetic decorations. Special birds such as the golden pheasant, widely distributed in China, may have inspired people to consider them as mythic trackmakers. The Zizhou area in northern Shaanxi, China, is famous for tracksites in the lower portion of the early Middle Jurassic Yan'an Formation. Sandstones with dinosaur tracks from these localities have been collected since the Ming Dynasty (1368–1644) and are used by villagers as cellar covers, stalls, or millstones. Besides their historical importance, the slabs are a valuable resource for ichnological research. Well-preserved theropod, ornithopod, and stegosaur tracks such as *Kayentapus*, *Eubrontes*, *Anomoepus* and *Deltapodus* incorporated into manmade structures can be seen while simply walking through some small villages of this area.

Keywords Ichnofossils, Dinosaur footprints, Myths, Folklore, Shaanxi Province, China

1. INTRODUCTION

There is a growing body of evidence demonstrating that humans started to observe and record fossilized footprints earlier than previously thought. In one well-known example, priests of the Hopi tribe in the United States wear special aprons with patterns of dinosaur footprints in the Hopi Snake Dance (a traditional ritual dance) (Look, 1981;

Mayor and Sarjeant, 2001). The Fremont people also replicated tridactyl footprints similar to theropod tracks at the Flag Point pictograph-tracksite of the Vermillion Cliffs area in southwestern Utah (Lockley et al., 2006). Iroquois, Delaware, Navajo, and other tribes of North America, as well as the Aztecs and other groups in Mexico, revered dinosaur tracksites in their homelands as footprints made by sacred beings, birds, insects, giants, and monsters (Mayor, 2005). Tridactyl dinosaur footprints and the supposed trackmaker, a large bird, are illustrated in paintings of ancient Bushmen in the Mokhali Cave of Lesotho in southern Africa (Helm et al., 2011).

By examining Chinese dinosaur footprints and local folklore in recent years, evidence is mounting that dinosaur footprints influenced Chinese folk traditions and were interpreted as mythical birds, mammals, plants, gods, and/or heroes (Xing et al., 2011a; Xing et al., 2015a). However, documentation of long-term use of rocks containing footprints by local inhabitants has been lacking.

An assemblage of dinosaur tracks on slabs used as building materials was found in Zizhou County in northern Shaanxi Province in 2011 (Fig. 1). It is composed of footprints and trackways of medium- to large-sized theropods that show similarities with *Kayentapus* isp. and *Eubrontes* isp., and of small bipedal ornithischians that can be referred to *Anomoepus* isp. Additionally tracks of a quadruped are present and assigned here to *Deltapodus* isp., which may be attributed to stegosaurians (Xing et al., 2015b). During investigation, the authors discovered that the use of dinosaur track-bearing stone slabs can be followed traced to the second half of the 15th century (Ming Dynasty, 1368–1644). We here briefly describe the different utilization by the local inhabitants.

Address correspondence to Lida Xing, School of the Earth Sciences and Resources, China University of Geosciences, Beijing 100083, China. E-mail: xinglida@gmail.com

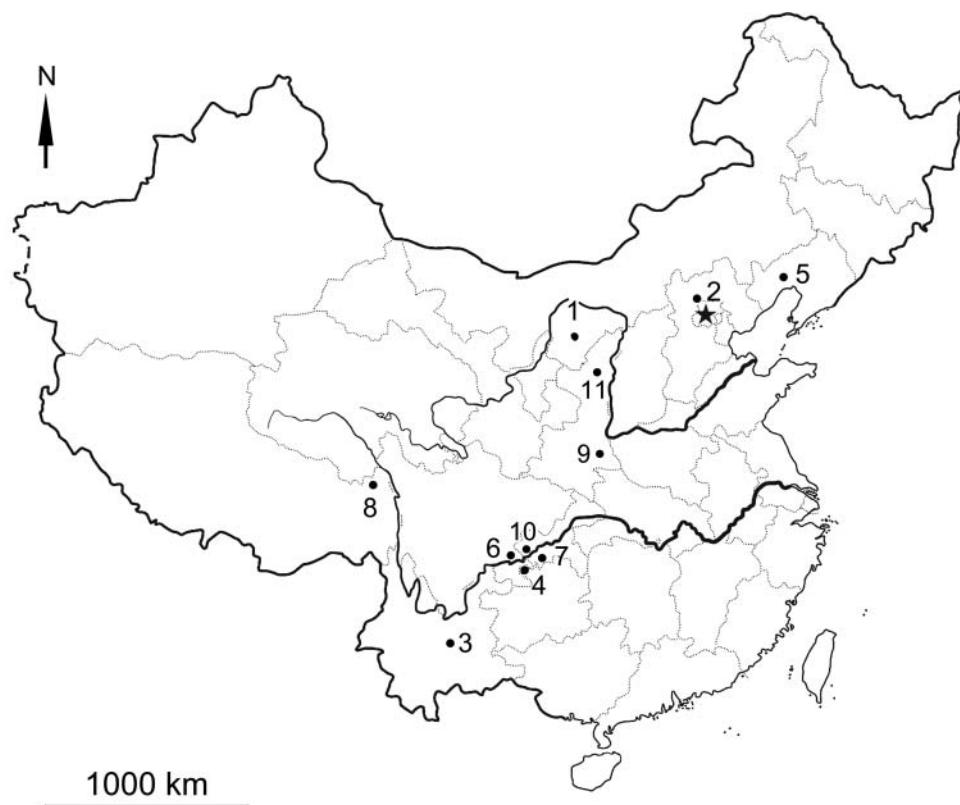


FIG. 1. Locations of tracksites related to Chinese myths. 1, Chabu (Divine Bird); 2, Luofengpo (figurines); 3, Xiaoxiyan (Golden Chicken); 4, Chishui (Heavenly Chicken); 5, Nanbjiazi (Golden Chicken); 6, Luoguan (rhinoceros); 7, Lianhua Baozhai (Lotus); 8, Morong (King Gesar); 9, Shaojian (Golden Chicken; He et al., 2011); 10, Jinji (Golden Chicken; Xing et al., 2013); 11, Zizhou (Golden Chicken; this manuscript). 1–8 based on Xing et al. (2011a).

2. GEOLOGICAL SETTING

The sources of the building stones are the Zizhou tracksites situated between Longweimao Village and Wangzhuang Village, Zizhou County, Shaanxi Province, which is within the range of the eastern Ordos Basin. The tracks are found in several layers of feldspathic quartz sandstone bedrock underlying a layer of red clay that is exposed on both sides of the Wang River. The local Geological Survey (Bureau of Geology and Mineral Resources of Shaanxi Province, 1989) documents that stratigraphically, the tracksite is positioned in the lower portion of the early Middle Jurassic Yan'an Formation (Xing et al., 2015b). Fragmentary fossils of petrified wood are also observed in the track-bearing layer. The tracks are usually preserved together with mud cracks and invertebrate trace fossils.

3. JIN JI (GOLDEN CHICKEN) STONES FROM ZIZHOU AREA

Building stones with dinosaur tracks are especially abundant at Wangzhuang Village. The three-toed tracks, called “Jin Ji” (“Golden Chicken”) or “Jin Ji Zhua” (“Golden Chicken’s claw”), are regarded as auspicious symbols. A large number of sandstone slabs containing tracks, petrified wood, mud cracks, and ripple marks are integrated in houses and yards

and serve as rollers, millstones, cellar covers, fences, house pillars, panels of heatable brick beds, eaves of cave dwellings, covers of water cisterns, and even tombstones. Most villagers purposely exhibit surfaces with tracks when manufacturing track-bearing rocks for different constructions, thereby emphasizing their aesthetic features.

Wangzhuang Village was built during the reign of Emperor Kangxi of the Qing Dynasty (1662–1722), and Longweimao Village was built during the reign of Emperor Yongzheng of the Qing Dynasty (1723–1735) (Gao, 2007). These houses were predominantly cave dwellings during Qing Dynasty and are now replaced by modern buildings at or near the original sites. At least 50% of the residents in Wangzhuang Village own fossilized tracks, whereas this percentage decreases over the distance to Longweimao Village.

Humans have been living at both villages from as early as the Neolithic Age (for 4,000–5,000 years, according to local archaeological evidence) as recorded in documentations of later ages; ruins dating to the Ming Dynasty (1368–1644) and Han Dynasty (BC 202–AD 220) have been discovered there (Committee of Zizhou County Annuals, 1993). Scattered among the ruins of Wangzhuang Fortress of the Ming Dynasty (built in the latter half of the 15th century to defend against northern nomadic people; Jiang,

2010) are impressions of petrified wood but no dinosaur tracks, which may have been destroyed by weathering. Such evidence suggests that the villagers most likely began to excavate sandstones from track- and plant-bearing levels since at least the Ming Dynasty.

About 21 tracksites, including 17 dwellings and four quarries, as well as five fossil sites with plant impression fragments (Fig. 2) have been found thus far. The tracksites are distributed close to known archaeological sites. We observed well-preserved tracks in dwellings and recognized that they were morphologically consistent with *Kayentapus* isp., *Eubrontes* isp. and *Anomoepus* isp. assemblages described by

Xing et al. (in press b). Locations are listed and described below.

3.1. Mr. Dengfeng Huo's house, Wangzhuang Village

Two slabs collected around 1880 at the end of the Qing Dynasty served as a millstone and a rolling surface (Fig. 3). The tracks on the millstone are better preserved and constitute a single pace of 27.8 cm length. The left track is 13.6 cm long and 11.7 cm wide with a length/width ratio of 1.2 and an interdigital divarication of 76° for digits II–IV. The claw marks are round and blunt. Morphological features are typical of local *Anomoepus* isp. tracks (Xing et al., 2015b).

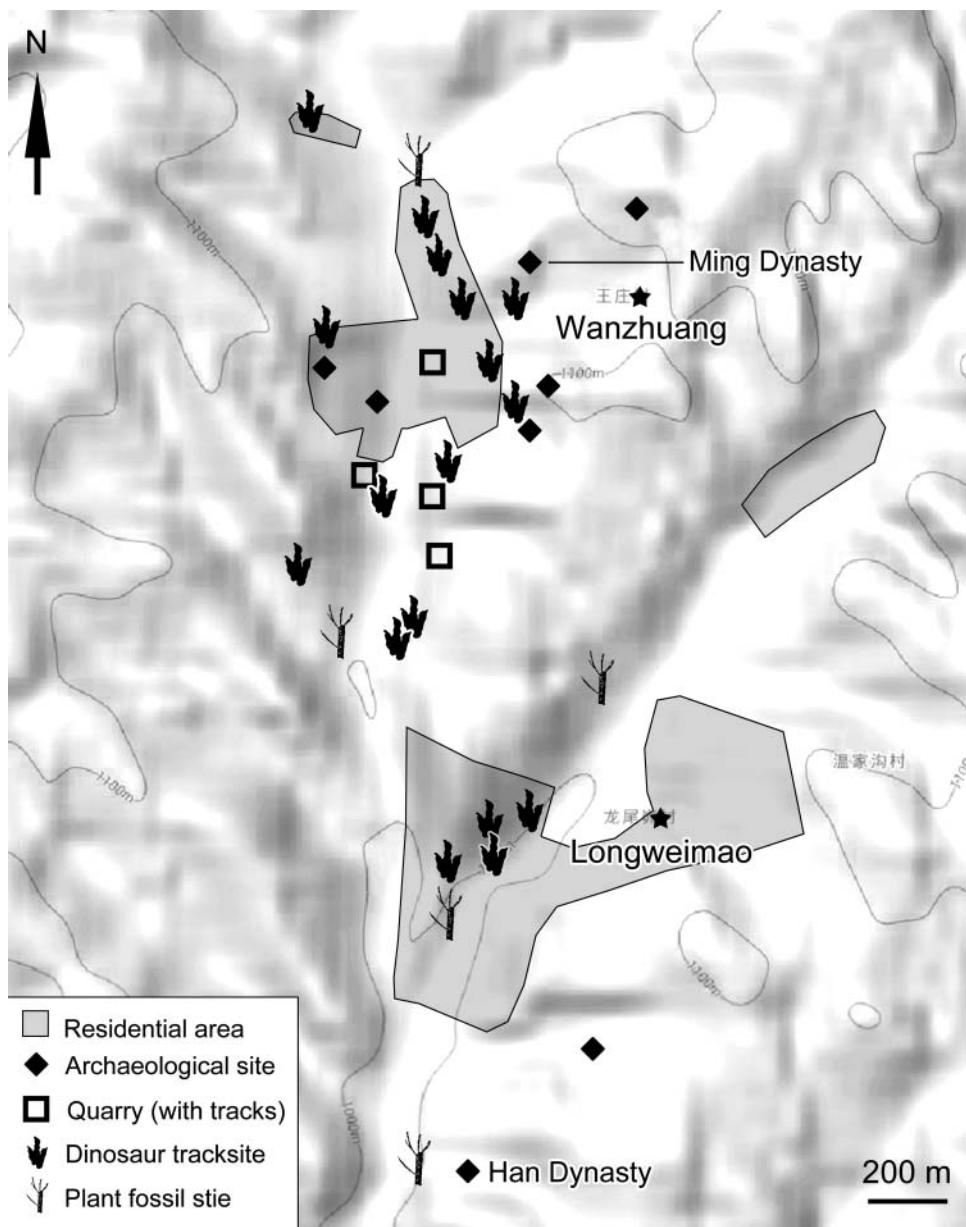


FIG. 2. Tracksite distribution in Wangzhuang Village and Longweimao Village, Zizhou area, China.

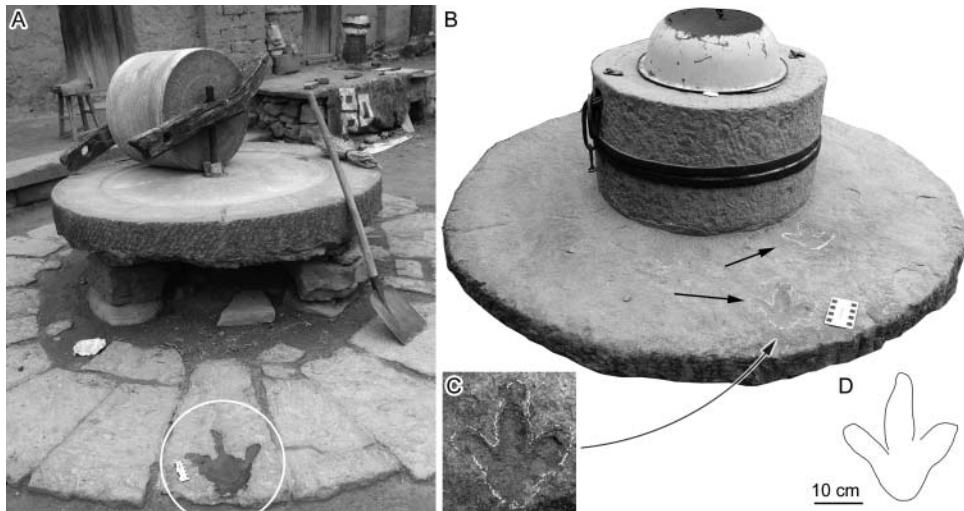


FIG. 3. Photograph of ornithopod tracks (*Anomoepus*) from the walking surface (A) and millstone (B) at Mr. Dengfeng Huo's house, Wangzhuang Village. C is a close-up of the track in the millstone. D is an interpretative outline drawing of C. The circle and arrow point out the track.

3.2. Mr. Funian Wang's house, Wangzhuang Village

Three slabs preserving tracks collected in the early 1980s serve as a baffle plate on a donkey stall, a wall of a garden, and a cover of a cellar (Fig. 4). The best specimen at the donkey stall is preserved as a natural mold. It is 22.5 cm in length

and 17.5 cm in width with a length/width ratio of 1.3 and shows an interdigital divarication of 71° for digits II–IV. Digits display sharp claw marks and indistinct pads. The imprint is morphologically consistent with typical *Kayentapus* isp. tracks (Lockley et al., 2011).

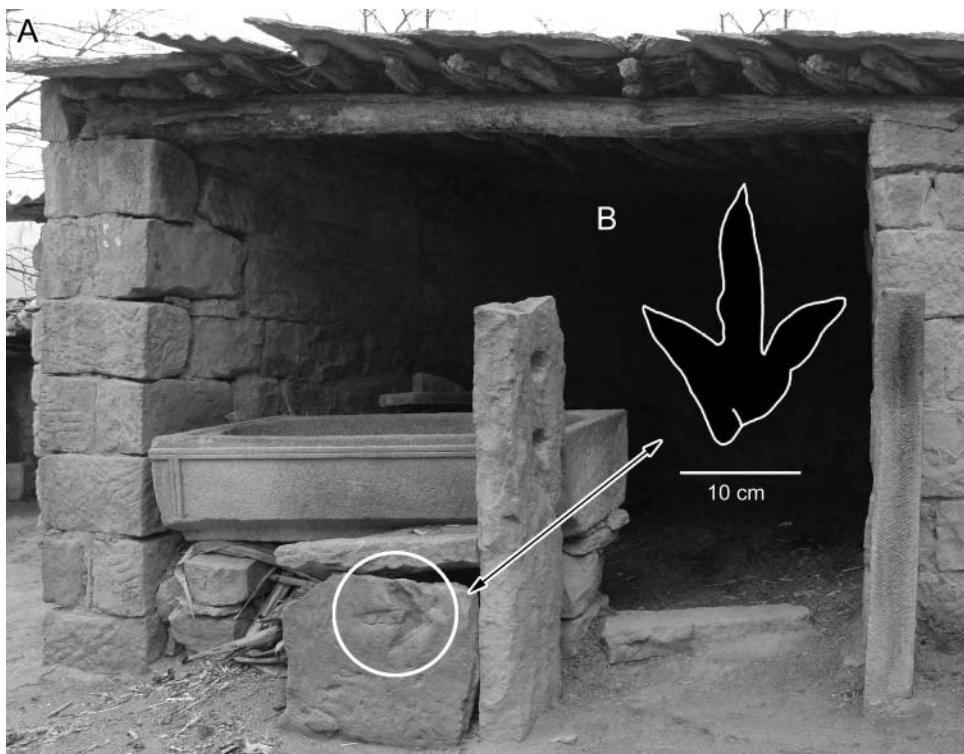


FIG. 4. Photograph (A) and interpretative outline drawing (B) of theropod track (*Kayentapus*) from the baffle plate of a donkey stall at Funian Wang's house, Wangzhuang Village.

3.3. Mr. Dengcheng Huo's house, Wangzhuang Village

A slab with two tracks preserved as natural casts and collected around 2000 is used as a baffle plate on a sheepfold (Fig. 5). A second slab on the bottom of a trough shows the impression of petrified wood (Fig. 6). The better-preserved track is 24.5 cm in length and 19.0 cm in width with a length/width ratio of 1.3, and an interdigital divarication of 64° for digits II–IV. At the proximal end of digit IV a possible metatarsal pad, which is 5 cm in length, is visible. Digits show sharp claw marks, typical of *Kayentapus* isp. (Lockley et al., 2011).

3.4. Mr. Qilai Huo's house, Longweimao Village

A slab collected around 2000 and containing several tracks and mud cracks was used to cover a cellar (Fig. 7). A complete tridactyl track on the cover is 11.4 cm in length and 11.8 cm in width with a length/width ratio of 1.0 and an interdigital divarication of 89° for digits II–IV. Digit II, as preserved, is separated from the other two digits. Sharp claw marks partially cross-cut and overprint the mud cracks. The general morphology is similar to the specimen at Dengfeng Huo's house and is identified as a small *Kayentapus* isp. track (Lockley et al., 2011).

4. DISCUSSION

Besides the Zizhou area, there are legends about finding Jin Ji, or Jin Ji claws impressed in solid rock in other parts of China. Such tales are likely linked to the findings of dinosaur tracks at different locations that are listed in the following:

- The Xiaoxiyang tracksite (Lower Jurassic Fengjiahe Formation) of Kunming City, Yunnan Province, preserves more than 600 tracks, ranging from 8–50 cm in length, with distinct claw marks. Zhen et al. (1986) described these tridactyl tracks and referred them to the *Grallator–Eubrontes–Kayentapus* assemblage (Lockley et al., 2013).
- The Nabajiazi Tracksite (Jurassic-Cretaceous Boundary, Tuchengzi Formation) of Beipiao City, Liaoning Province, preserves tracks that range from 4.5–16.7 cm in length. Fujita et al. (2007) referred them to *Grallator* isp.
- The Shaojian Tracksite (Lower Cretaceous, Donghe Group) of Shangluo City, Shaanxi Province includes two tracks, each 57.5 cm in length. Hu et al. (2011) referred them to *Megalosauripus* isp.
- The Jinji Tracksite (Lower Jurassic, Shangshaximiao Formation) of Yongchuan District, Chongqing Municipality includes tridactyl theropod tracks that are 25 cm in length. Xing et al. (2013) referred these to cf. *Therangospodus* isp.

Xing et al. (2011a) considered a relationship between Jin Ji legends and their distribution in the surrounding area of sites (1), (3) and (4) and the golden pheasant (*Chrysolophus pictus*) (Fig. 8). Another Jin Ji legend common in the region around site (2) is possibly connected to the presence of three-toed birds including chickens and hawks (Xing et al., 2011a). The hypotheses were based specifically on the historical geographical distribution of golden pheasants that are unique to China. These colorful, regal-looking birds can be found in Middle and West China, including Gansu, Guangzhou, Guizhou, Hubei, Hunan, southwest Qinghai, south Shaanxi, Sichuan,

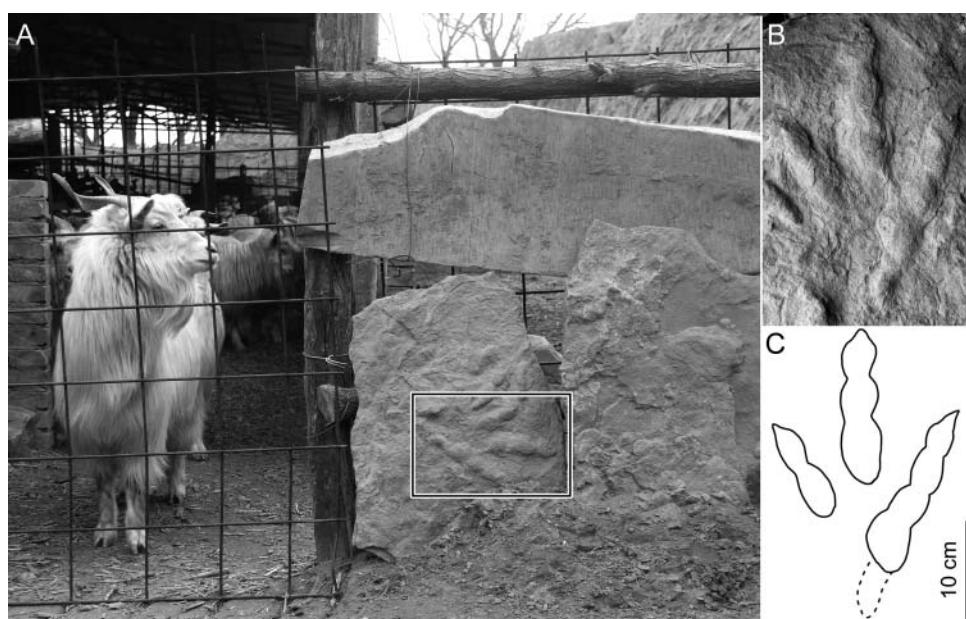


FIG. 5. Photograph (A), close-up (B) and interpretative outline drawing (C) of theropod track (*Kayentapus*) from the baffle plate of a sheepfold at Mr. Dengcheng Huo's house, Wangzhuang Village.



FIG. 6. Photograph of the trough at Mr. Dengcheng Huo' house, Wangzhuang Village. A. upper surface, B. bottom surface with visible petrified wood impression.

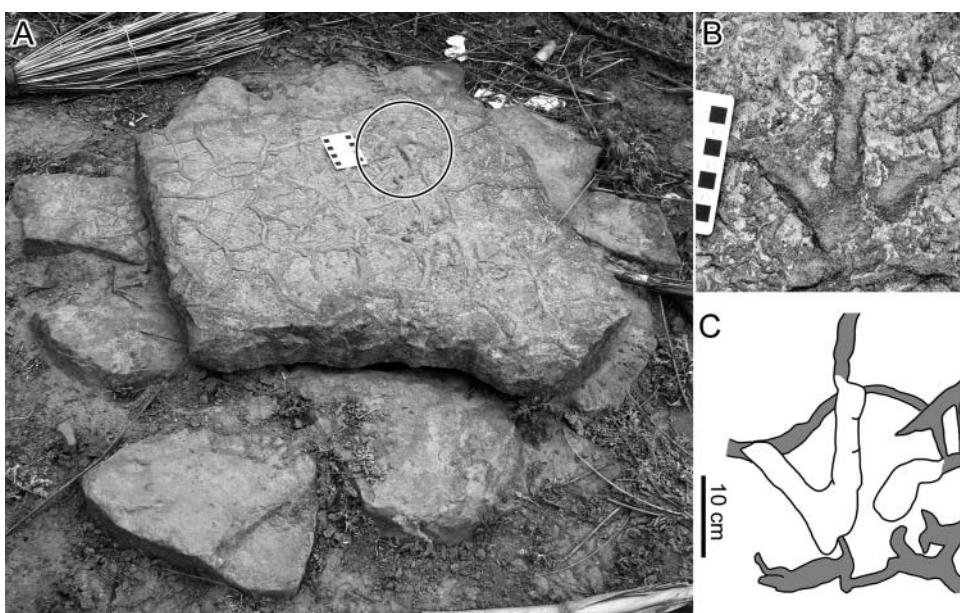


FIG. 7. Photograph (A), close-up (B) and interpretative outline drawing (C) of theropod track (*Kayentapus*) from the cover of a cellar at Mr. Qilai Huo's house, Longweimao Village.

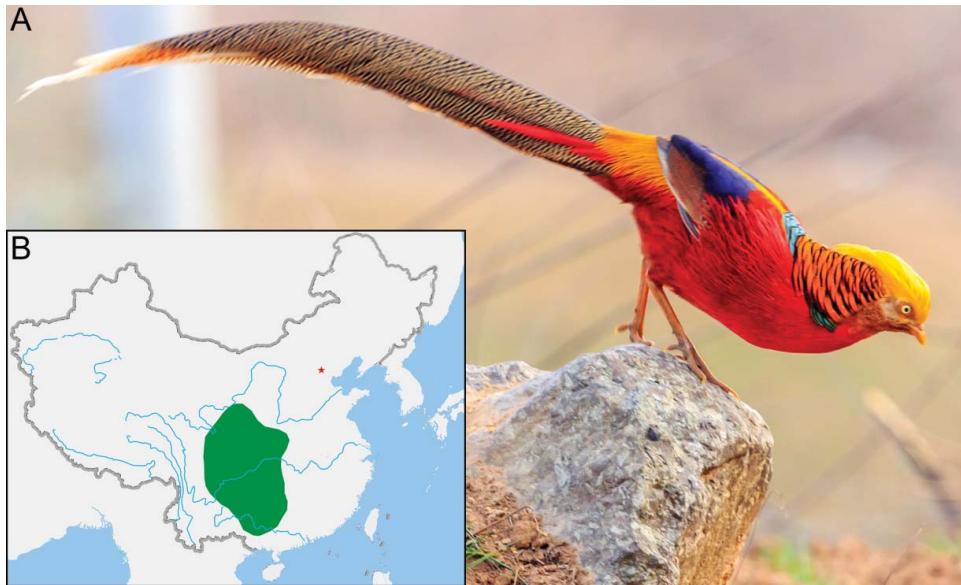


FIG. 8. Photograph (A) of *Chrysolophus pictus* (photo by Cong Fu), and the present geographic distribution of *Chrysolophus pictus* (modified by MacKinnon and Phillipps, 2000). (See Color Plate VIII.)

and Yunnan Provinces, among which the Gansu and the Qinling Mountains in South Shaanxi are the most important regions (Lu et al., 1991). Although the Zizhou area is in north Shaanxi where no golden pheasants are found today, it was formerly densely covered by hill forests at least at the time of the Song Dynasty (960–1276), providing a suitable environment for terrestrial and arboreal birds. But periodic regional climate change and the profound influence of continuous human activities resulted gradually in drought conditions leading to vegetation degradation (Zhang and Zhang, 2010).

The ancient Chinese people were quite familiar with golden pheasants and mentioned them in many records, for example in the *Compendium of Materia Medic* of the Ming Dynasty, *Erya* and *Hanshu* of the Han Dynasty, and *Guanghai Yuhengzhi* of the Song Dynasty. Golden pheasants are large (up to 1 m in length) with brightly colored feathers, thus liable to be worshipped and deified by local residents as forest spirit or incarnations of a god (Sun, 2003; Jin, 2004). Other bright-colored phasianid birds are also likely to be deified, such as *Gallus gallus*, which is closely related to Feng Huang, mythological birds analogous to the fantastic Phoenix of Greek mythology (Feng et al., 2006). According to archaeological evidence, *Gallus gallus* had been domesticated by the Late Neolithic Age (Yan and Yin, 1992). In addition, in ancient China, a lack of modern palaeontological and geological knowledge led to the idea that the tracks must have been directly imprinted in stone, reinforcing the divinity of the trackmaker. Therefore, with the physical evidence (track fossils) supporting the existence of mythical creatures, regional belief was intensified.

Residents of Zizhou County have been excavating and using slabs with tracks at least since the end of the Ming Dynasty for more than 600 years. In view of more ancient Jin

Ji (Golden Chicken) records from north Shaanxi, this use might possibly be traced back to the Song Dynasty (960–1276), more than 1000 years ago. Overall, the tracksites of Zizhou County form the oldest recorded example that human observed dinosaur tracks, assimilated them into myths, and incorporated them into buildings. Similarly, the Lotus Fortress tracksite of Chongqing, which was built in the Southern Song Dynasty, demonstrates that ancient Chinese had been living on tracksites for about 700 years (Xing et al., 2011b). However, residents there do not use sandstone containing tracks as building materials.

Xing et al. (2015a) were able to successfully identify a sauropod trackway in Zhaojue County, Sichuan Province, by utilizing the folklore traditions of the Yi people. This methodology was also applicable in Zizhou County, where many tracks have been found on the advice of local residents, demonstrating the possibility of finding tracks using the knowledge of the local folklore (Xing et al., 2011a).

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