



# A new trionychid turtle from the Early Cretaceous of Heilongjiang Province, Northeastern China



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## ABSTRACT

A new soft-shelled turtle (*Trionyx jixiensis* sp. nov.) from the Lower Cretaceous Chengzihe Formation, Jixi city, Heilongjiang Province, China is described on the basis of a nearly complete carapace. The new species is diagnosed by the absence of suprascapular fontanelles and absence of a preneural; eight neurals, tetragonal fifth neural; and eight pairs of costals, with the large eighth costals meeting after the eighth neural. Due to the incompleteness of the specimen and confused classification of the genera of trionychids, the new species cannot be included in any genus of Trionychinae and is temporarily assigned to *Trionyx* (*sensu lato*). *Trionyx jixiensis* is one of the earliest trionychids, its discovery indicates that the family was already diversified during the Early Cretaceous in Asia.

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## 1. Introduction

In the crown group of turtles, the Trionychidae is the most ancient family (Krenz et al., 2005; Near, Meylan & Shaffer, 2005; Lourenço et al., 2012; Joyce et al., 2013), with the oldest record from the Early Cretaceous (Hirayama, 2005; Hirayama et al., 2013). The Early Cretaceous trionychid turtle record is scarce, all soft-shelled turtles from that epoch are known only from Asia, but often with poorly preserved material, so their exact systematic position is not well resolved (Danilov et al., 2014). A total of four species of Trionychidae are known from the Early Cretaceous of Asia. These include *Sinamyda fuchienensis* (Yeh, 1974) from the Early Cretaceous of Fujian, southern China; *Trionyx kyrgyzensis* Nessov, 1995 from the late Early Cretaceous of Kyrgyzstan; and the very fragmentary *Kappachelys okurai* Hirayama, Isaji and Hibino, 2013 from the Lower Cretaceous Akaiwa Formation of Japan (Yeh, 1974; Nessov, 1995; Hirayama et al., 2013). The fourth taxon, *Perochelys lamadongensis* Li et al., 2015 has been described recently from the late Early Cretaceous of Liaoning, northeastern China (Li et al., 2015).

Here we present the systematic study of a new trionychid turtle collected recently from the Lower Cretaceous of Heilongjiang

Province, northeastern China. Although the specimen only consists of a carapace, it preserves enough characters to distinguish it from all known trionychids. Our study provides new insights into the early diversification of trionychids.

## 2. Geological setting

The specimen was collected from the Lower Cretaceous Chengzihe Formation, Jixi Group; Yufeng Village, Liumao County, Hengshan District, Jixi City, Heilongjiang Province, China (45° 18'20"N; 130° 51'7"E; Fig. 1).

The Jixi Group consists of (from the bottom to the top) the Didao Formation, the Chengzihe Formation, and the Muling Formation (Yu, 2000). The Chengzihe Formation is an important coal-bearing formation in eastern Heilongjiang Province. It is located within the Jixi Basin, Boli Basin, Shuanghua Basin and adjacent areas. The formation is composed of mudstones, siltstones and coarse sandstones, mainly non-marine in origin; while its lower part consists of paralic deposits. It overlies unconformably the volcanic layers of the Didao Formation; and underlies conformably the Muling Formation. In the Jixi Basin, the Chengzihe Formation reaches 700–1437 m in thickness (Jiang et al., 2010). In addition to the trionychid turtle described in the present paper, a macrobaenid turtle shell has been reported from the same horizon of the Donghai coalmine (Ma, 1986; Brinkman et al., 2008).

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Fig. 1. Map showing the location of Jixi, Heilongjiang Province, China.

The age of the Chengzihe Formation was long considered to be Late Jurassic or latest Jurassic to Early Cretaceous (Sha, 1991). Based on the discovery of the marine bivalve *Aucellina* in its lower part, the Chengzihe Formation was later attributed to the upper Lower Cretaceous (Sha, 1990). Although a slightly older age has been proposed based on the dinoflagellates and angiosperms by some authors (Valanginian–Hauterivian, possibly extending into the early Barremian; Sun et al., 1999), an Aptian–Albian age for the Chengzihe Formation is supported by the following evidence (Jiang and Feng, 2000; Jiang et al., 2010): the bivalve *Arguniella-Sphaerium* Fauna present in the Chengzihe Formation is widely distributed in northern and eastern China, Mongolia and the Far East of Russia, especially in the Jehol Group; the plant fossils of the Chengzihe Formation and the Fuxin Formation of the Jehol Group are referred to the same flora, and some angiosperms, such as *Asiatifolium elegans*, *Chengzihella oborate*, *Jixia pinnatipartita*, *Shenkuaa caloneura*, *Rogersia lanceolata* which first appeared in the Aptian, are common in the early Albian in the Amur region, Russia; the angiosperm pollen types *Tricolpopollenites* and *Tricolpites* in the upper part of the Chengzihe Formation first appeared in the late Aptian to early Albian. The marine bivalves, such as *Aucellina caucasia*, *Aguilerella shuguangensis*, *Camptonectes shuguangensis*, found in the lower part

of the Chengzihe Formation, indicate an Aptian–Albian, mainly Aptian age.

Institutional abbreviations: GMH, Geological Museum of Heilongjiang, Harbin, China; IVPP, Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences, Beijing, China.

### 3. Systematic paleontology

Testudines Batsch 1788  
Cryptodira Cope 1868  
Trionychidae Gray 1825  
Trionychinae Gray 1825  
*Trionyx* Geoffroy 1809 *sensu lato*  
“*Trionyx*” *jixiensis* sp. nov.

Fig. 2

**Holotype** GMH H2008J120, a carapace.

**Etymology** The specific name is derived from “Jixi”, the city where the specimen comes from.

**Type locality and Stratigraphic horizon** Yufeng Village, Jixi County, Heilongjiang Province, China. Chengzihe Formation, Lower Cretaceous.

**Diagnosis** A trionychine of moderate size, with a bony carapace length of 216 mm. Characterized by the following combination of features: 1) nuchal emargination weak; 2) width of the nuchal about 3.5 times of its length; 3) suprascapular fontanelles absent; 4) preneural absent; 5) eight neurals, 6) fifth neural tetragonal; 7) eight pairs of costals, 8) first costals with parallel anterior and posterior borders; 9) eighth pair of costals large and 10) meeting at the midline posterior to the eighth neural. Differs from all other Cretaceous trionychines by character 2. Additionally differs from *Perochelys lamadongensis* by characters 3, 9–10; differs from “*Trionyx*” *kansaiensis* by character 1; differs from *Gobiapalone* spp. by characters 3, 8–9; differs from “*T.*” *dissolutus* and “*Aspideretes*” *maortuensis* by character 3, 6 and 9; differs from “*T.*” *shiluutulensis* by characters 4, 6, 8–9 and differs from *Aspideretoides riabinini* by characters 3–5 and 9. See Table 2 for further differences between “*Trionyx*” *jixiensis* and other Cretaceous trionychids.

**Measurements:** see Table 1.

**Description** GMH H2008J120 is a nearly complete carapace exposed in dorsal view. Some fragments are lost, but the impression of the external surface of two-thirds of the carapace is preserved intact. The left part shows a slight distortion (Fig. 2).

**Carapace.** The carapace is medium-sized and subcircular in outline. The width is greater than the length. The suprascapular fontanelles are absent. Two sculpturing patterns are distributed on the whole carapace surface. Small and subcircular pits cover most of the carapace surface while wormlike ridges parallel to the carapace margin are located on the distal part of the costals.

Table 1

Measurements of the holotype (GMH H2008J120) of “*Trionyx*” *jixiensis* n. sp. (in mm).

	Carapace	Nuchal	Neural I	Neural II	Neural III	Neural IV	Neural V	Neural VI	Neural VII	Neural VIII
Length	216.0	27.5	37.4	24.7	23.1	21.9	17.6	16.9	15.2	10.4
Width	246.6	96.8	22.1	21.4	19.6	17.6	14.6	15.8	13.1	12.3
	Right costal	Costal I	Costal II	Costal III	Costal IV	Costal V	Costal VI	Costal VII	Costal VIII	Costal VIII
Length–medial/lateral		30.2/43.2	25.7/45.0	21.6/33.5	21.4/37.9	22.8/36.7	17.9/41.3	16.3/43.2	8.1/37.1	
Width		86.5	107.6	121.1	122.5	115.0	101.4	78.5	46.1	

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