

## Research Advances

# First Record of Soft-shelled Turtle (Testudines, Trionychidae) from the Late Pleistocene of Heilongjiang, Northeast China



WU Wenhao<sup>1,\*</sup>, DONG Nan<sup>2</sup>, LI Xiaobo<sup>2,3</sup>, ZHOU Changfu<sup>4</sup>, FENG Nan<sup>5</sup> and Robert R. REISZ<sup>3,6</sup>

<sup>1</sup> Research Center of Palaeontology & Stratigraphy, College of Earth Science, Jilin University, Changchun 130026, China

<sup>2</sup> College of Earth Science, Jilin University, Changchun 130061, China

<sup>3</sup> Dinosaur Evolution Research Centre, College of Earth Science, Jilin University, Changchun 130061, China

<sup>4</sup> College of Earth Science and Engineering, Shandong University of Science and Technology, Qingdao, Shandong 266590, China

<sup>5</sup> Heilongjiang Institute of Geological Sciences, Harbin 150080, China

<sup>6</sup> Department of Biology, University of Toronto Mississauga, Mississauga, ON L5L 1C6, Canada

Citation: Wu et al., 2021. First Record of Soft-shelled Turtle (Testudines, Trionychidae) from the Late Pleistocene of Heilongjiang, Northeast China. Acta Geologica Sinica (English Edition), 95(4): 1409–1410. DOI: 10.1111/1755-6724.14751

## Objective

Numerous vertebrate fossils, dominated by the *Mammuthus–Coelodonta* fauna, have been found from many Late Pleistocene fossil sites in Heilongjiang, northeast China (Jin and Kawamura, 1996). However, fossil turtles have not yet been reported. Recently, two soft-shelled turtle (trionychid) costal plates have been discovered together with other typical *Mammuthus–Coelodonta* fauna fossils.

Soft-shelled turtle fossil remains are scarce in northeast China. To date, only three taxa (*Khunnuchelys erinhotensis*, *Perochelys lamadongensis*, “*Trionyx*” *jixiensis*) have been reported from Cretaceous deposits (Li and Tong, 2017). Cenozoic soft-shelled turtle fossils are extremely rare and have not received any formal description. The specimens we describe in this study fill a noticeable gap in the soft-shelled turtle fossil record of the Cenozoic of northeast China, which provides new fossil data for studying the diversity and stratigraphic distribution of the group.

## Methods

The fossil materials of this study were collected from the Guxiangtun Formation near Yongfeng Town, Qinggang County, Heilongjiang Province. Specimens are housed in the Research Center of Palaeontology and Stratigraphy (RCPS), Jilin University. The specimens were photographed with a Canon 5D III camera, and were identified through morphological comparison from the trionychid literature.

## Results

### Systematic paleontology

Testudines Batsch, 1788

Cryptodira Cope, 1868

Trionychidae Gray, 1825

**Material:** RCPS-0301, a complete costal (Fig. 1a, b); RCPS-0302, a partial costal (Fig. 1c, d).

**Locality and Horizon:** Yongfeng Town, Qinggang County, Heilongjiang Province, northeast China; Guxiangtun Formation, Late Pleistocene.

**Description:** Specimen RCPS-0301 is a left sixth costal, which is 75.5 mm long mediolaterally (without the costal rib) and 22.3 mm cranio-caudally (Fig. 1a, b). The external surface is decorated mainly by thin, vermiform ridges, some being relatively thicker and forming around 13 longitudinal ridges roughly parallel to the midline of the costal. Several thickened tubercles are randomly distributed on the surface. The lateral margin of the costal is 4.5 mm in thickness, almost three times as thick as the medial margin (1.8 mm), with the rib tip extending a short distance (4 mm) beyond the costal lateral margin. This indicates that the specimen likely belonged to a sub-adult or adult individual. In internal view, the rib head is wide and flat, the serrated medial edge of which indicates it was strongly interlocked with the adjacent thoracic vertebrae, as found in other trionychids (Meylan, 1987).

RCPS-0302 is probably a partial right second costal (Fig. 1c, d), based on comparison with other trionychids. Its anteroposterior length is 42.6 mm, and it has a maximum thickness of 9.4 mm. The ventral side of the specimen is smooth, and the flat rib is about 19 mm in width. The exterior surface of the specimen is covered with coarse ridges enclosing small to large reticulate lacunae.

## Discussion

Both studied specimens can be assigned to Trionychidae based on the absence of scute sulci and presence of typical trionychid sculpture patterns (Meylan, 1987). However, due to the scarcity of material, the specimens cannot be identified more precisely below family level. RCPS-0301 represents a small-sized soft-

\* Corresponding author. E-mail: wenhao.wu@foxmail.com

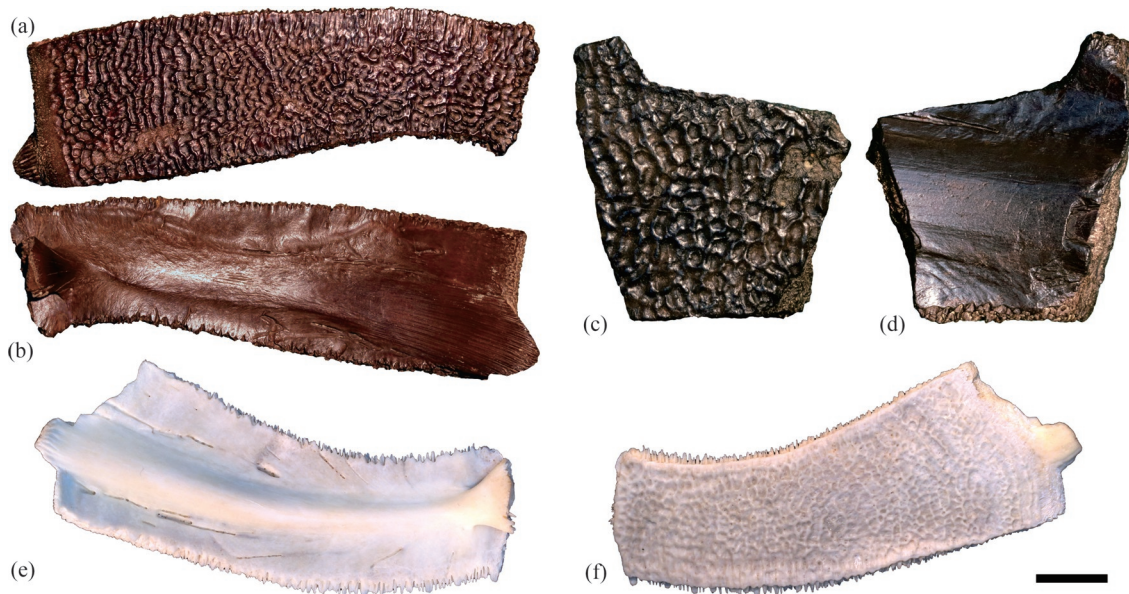


Fig. 1. Trionychid costal plates discovered in the Upper Pleistocene Guxiangtun Formation in Heilongjiang Province, Northeast China. (a, b) RCPS-0301 in dorsal and ventral views; (c, d) RCPS-0302 in dorsal and ventral views; (e, f) an adult right second costal of *Pelodiscus sinensis* in ventral and dorsal views, which is morphologically similar to *Pelodiscus maackii*. Scale bar = 1 cm.

shelled turtle with an estimated carapace length between 16 and 20 cm, while RCPS-0302 represents a relatively larger taxon probably more than twice the size of RCPS-0301. The two were discovered associated with *Mammuthus primigenius*, *Equus hemionus*, *Coelodonta antiquitatis*, *Megaloceros ordosianus*, etc., from the upper part of the Upper Pleistocene Guxiangtun Formation in the Qinggang area (Jiang et al., 2019), a fauna that was living in an average annual temperature of 6.9°C–7.6°C lower than today in the study area (Wang, 1987). This indicates that they are the most cold-tolerant soft-shelled turtles found in northeast Asia. *Pelodiscus maackii* is the only cold climate-adapted soft-shelled turtle distributed as far north as southeastern Siberia today (Fritz et al., 2010), where there is a similar average annual temperature range as our study area during the Late Pleistocene. RCPS-0301 has similar morphological characters in the sculpture pattern with that of *Pelodiscus maackii*, but has a relatively smaller carapace size and more platted costal rib. RCPS-0302 can be distinguished from *Pelodiscus maackii* by its relatively coarser sculpture and more platted costal rib (Fig. 1).

## Conclusions

Two unidentified taxa of trionychid turtles have been discovered in the Late Pleistocene of Heilongjiang Province. They represent the first record of trionychids in this area and are the most cold-tolerant soft-shelled turtles ever found in NE Asia. With dozens of Late Pleistocene *Mammuthus*–*Coelodonta* fauna fossil localities having been discovered, further work in this area may provide information on the distribution, diversity, and evolution of trionychids in the Late Pleistocene of northeast China.

## Acknowledgments

This study was supported by the National Science

Foundation of China (Grant No. 31670215), Special Program of Key Lab for Evolution of Past Life and Environment in Northeast Asia (Jilin University), Ministry of Education, China (Grant No. 201801).

## References

- Batsch, A.J.G.C., 1788. Versuch einer Anleitung, zur Kenntniß und Geschichte der Thiere und Mineralien. Akademische Buchhandlung, Jena, 1–528.
- Cope, E.D., 1868. On the origin of genera. Proceedings of the Academy of Natural Sciences of Philadelphia, 20: 242–300.
- Fritz, U., Gong, S., Auer M., Kuchling, G., Schneeweiß, N., and Hundsdoerfer, A.K., 2010. The world's economically most important chelonians represent a diverse species complex (Testudines: Trionychidae: *Pelodiscus*). Organisms Diversity and Evolution, 10: 227–242.
- Gray, J.E., 1825. A synopsis of the genera of reptiles and amphibia, with a description of some new species. Annals of Philosophy, 10: 193–217.
- Jiang, H.T., Zhao, K.L., Wang, Y., Zhou, X.Y., Li, X.Q., Ding, J.Y., and Yang, S., 2019. The survival environment of *Mammuthus*–*Coelodonta* Fauna in Qinggang, Heilongjiang Province, northeast China. Acta Anthropologica Sinica, 38(1): 148–156 (in Chinese with English abstract).
- Jin, C.Z., and Kawamura, Y., 1996. Late Pleistocene mammal fauna in northeast China: Mammal fauna including woolly mammoth and woolly rhinoceros in association with Paleolithic tools. Earth Science, 50: 315–330 (in Japanese with English summary).
- Li, J.L., and Tong, H.Y., 2017. Parareptilians, Captorhines, and Testudines. In: Li, J.L., and Zhou, Z.H. (eds.), Amphibians, Reptilians, and Avians, Palaeovertebrata Sinica Volume II, Serial 6. Beijing: Science Press, 92–369 (in Chinese).
- Meylan, P.A., 1987. The phylogenetic relationships of soft-shelled turtles (Family Trionychidae). Bulletin of the American Museum of Natural History, 186(1): 1–101.
- Wang, M.H., 1987. Preliminary study of palaeovegetation and palaeoclimatic index in the late period of the Late Pleistocene in Northeast Plain of China. Journal of Glaciology and Geocryology, 9(3): 229–238 (in Chinese with English abstract).