SEM morphological study of clam shrimp *Ganestheria* (spinicaudatan) from Upper Cretaceous of Jiangxi, southeastern China

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Abstract

Morphological re-examination of the specimen of *Ganestheria longnanensis* Bi and Xie from the Upper Cretaceous Zhoutian Formation in Chenglong Village, Longnan County, Jiangxi Province, southeastern China under a scanning electron microscope (SEM) revealed morphological features on the carapace that had not been recognized previously: widely spaced radial lirae on growth bands intercalate large-sized polygonal reticulation, within which small-sized reticulation also occurs.

Key words: fossil clam shrimp, taxonomy, Upper Cretaceous, Zhoutian Formation, China.

Introduction

Bi and Xie (in Chen and Shen, 1982) described the clam shrimp (spinicaudatan) *Ganestheria* from the Ganzhou Formation, which was uplifted to the Ganzhou Group by the Jiangxi Geological Survey in 1994, and containing two formations, i.e. the lower Maodian Formation and the upper Zhoutian Formation. The Zhoutian Formation is composed mainly of variegated siltstone and claystone, intercalated with thin-bedded sandstone, gypsum, salt and conglomerate. The holotype specimen of the type species *Ganestheria longnanensis* Bi and Xie was collected from the Zhoutian Formation in Chenglong Village, Longnan County, Jiangxi Province of southeastern China. Then later *Ganestheria* became an index genus to correlate the Zhoutian Formation with the upper Huizhou Formation in Shexian County of

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Anhui Province because of the occurrence of the genus in both sequences. In this paper a re-examination of a specimen of *Ganestheira longnanensis* under an SEM revealed important morphological features not previously seen, as recorded below.

Material and methods

The studied specimen is deposited in the collection of the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences (NIGPCAS). It is an external mould of a left valve, and was originally collected from the Upper Cretaceous Zhoutian Formation in Chenglong Village, Longnan County, Jiangxi Province.

Most of the previous studies on the palaeontology of fossil clam shrimps have used a light microscope. This means that some potential characters of taxonomic value were difficult to see clearly (Li, 2004; Li and Batten 2004, 2005; Li et al., 2004, 2006, 2007a, b, 2009, 2010, 2014, 2015; Li and Matsuoka, 2013). Here the authors have relied on examination of the specimen using a LEO 1530 VP SEM and a Zeiss V20 Stereomicroscope.

Systematic palaeontology

Class: Branchiopoda Latreille, 1817
Subclass: Phyllopoda Preuss, 1951
Order: Diplostraca Gerstaecker, 1866
Suborder: Spinicaudata Linder, 1945
Superfamily: Lioestheriacea Raymond, 1946
Family: Sinoestheriidea Chen and Shen, 1982
Genus *Ganestheria* Bi and Xie, in Chen and Shen, 1982, emend.

1982 *Ganestheria* Bi and Xie gen. nov., in Chen and Shen, p. 41.
1985 *Ganestheria* Bi and Xie (in Chen and Shen, 1982), Chen and Shen, p. 81.
2014 *Ganestheria* Bi and Xie (in Chen and Shen, 1982), emend., Chen and Shen, p. 445.

Type species. *Ganestheria longnanensis* Bi and Xie, in Chen and Shen, 1982

Occurrence. Upper Cretaceous Zhoutian Formation, Longnan County, Jiangxi Province; Upper Cretaceous Huizhou Formation, Shexian County, Anhui Province, China.

Emended diagnosis. Carapace very large, elliptical in outline; dorsal margin ridge-like and markedly serrated, with spinous apophyses; umbo located between the anterior and median points of the dorsal margin; growth lines stout and convex, posterodorsal part slightly

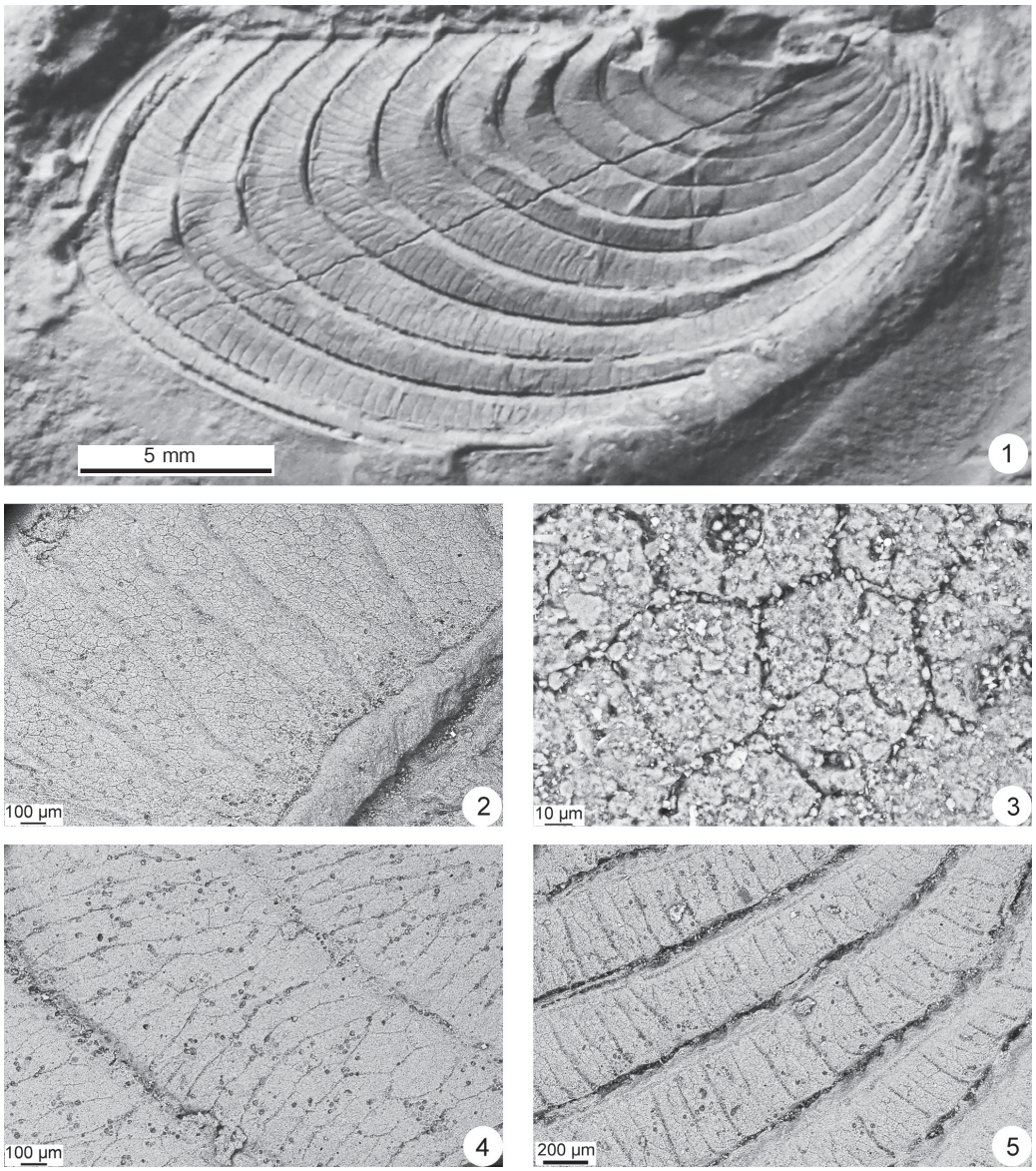


Fig. 1. 1–5, *Ganestheria longnanensis* Bi and Xie, in Chen and Shen, 1982, emend., all, except Fig. 1.1 (a light microscope image), are SEM images of an external mould of a left valve from the Upper Cretaceous Zhoutian Formation, Longnan County, Jiangxi Province. **1,** NIGPCAS 160162. **2,** large-sized reticulation intercalated between widely spaced radial lirae on growth band in the postero-dorsal part of the carapace. **3,** secondary small-sized reticulation occurs within the large-sized polygonal reticulation. **4,** irregular radial lirae on growth bands in the middle part of the specimen. **5,** widely spaced regular radial lirae on growth bands in the antero-ventral part of the specimen.

recurved, with a row of rounded nodes; growth band broad, flattened and few in number, ornamented with widely spaced and regular radial lirae, large-sized polygonal reticulation occurs between radial lirae, secondary small-sized reticulation also occurs within the large-sized reticulation.

Discussion. *Ganestheria* was originally described with radial lirae ornamentation only (Bi and Xie in Chen and Shen, 1982). Chen and Shen (2014) described another specimen and recognized that it has markedly serrated ridge-like dorsal margin with spinous apophyses. Now through an SEM re-examination, we have revealed that reticulation occurs between the widely spaced radial lirae.

Ganestheria longnanensis Bi and Xie, in Chen and Shen, 1982, emend.

Fig. 1.

1982 *Ganestheria longnanensis* Bi and Xie gen. and sp. nov., Chen and Shen, p. 42, pl. 3, fig. 2.
2014 *Ganestheria longnanensis* Bi and Xie in Chen and Shen, 1982, emend., Chen and Shen, p. 449, pl. 1, figs. 6–8.

Material. External mould of a left valve, NIGPCAS 160162, Chenglong, Longnan County, Jiangxi Province, southeastern China.

Emended diagnosis. As the genus.

Description. Carapace very large, elliptical in outline, 22.9 mm long, 11.1 mm high; dorsal margin long and straight, ridge-like and markedly serrated, with spinous apophyses; umbo loacated between the anterior and median points of dorsal margin; anterior height less than the posterior, the greatest height near the median part of the carapace; growth lines stout and convex, slightly recurved at postero-dorsal margin, with a distinct row of rounded nodes, more than 14 in number; growth band broad and flattened, widely spaced radial lirae intercalate large-sized polygonal reticulation, within which small-sized reticulation also occurs.

Discussion. Another species of *Ganestheria* has been described from the Upper Cretaceous Huizhou Formation in Anhui Province, i.e. *G. shexianensis* (Zhang, in Zhang et al., 1976) Chen and Shen, 1982. Although it is very similar in outline with *G. longnanensis*, the rounded nodes on growth lines are not visible because of the poor preservation. It is only possible to make a detailed comparison when better preserved specimens are recovered in the future.

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