

Mesoproterozoic Calymmian Tintinnids from Central China

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Abstract: Tintinnids are very common in all marine water and even fresh water. The oldest fossils of Tintinnids are not only appeared in Neoproterozoic Era, but also in Mesoproterozoic Calymmian. Eight species of six genera Tintinnids of Mesoproterozoic Calymmian, from Huangmailing Phosphoric Ore in Hubei Province of Central China, are illustrated in this paper. They are the oldest ancestor of Tintinnids. Tintinnids had about 1600 million years history.

Keywords: Tintinnids, Mesoproterozoic, Calymmian, Central China.

Tintinnids are important members of the plankton in all marine habitats, and some of them also can live in the fresh water nowadays [1-13]. But very few of them had been preserved as fossils in the rocks. The fossils of Tintinnids had been reported by paleontologists that was appeared as early as the Neoproterozoic Era and were very common in Late Jurassic and Early Cretaceous Period [14-17]. In 2006, we reported that *Funnella sinensis* [18], the oldest fossil of Tintinnids in the rocks of the lower part of Huangmailing Formation of Mesoproterozoic (about 1600 million years ago). Here, the aim of this study is to report on the Tintinnids more detail in the metamorphic rocks of Huangmailing Formation from Huangmailing phosphoric Ore in Hubei Province of Central China. Eight species of Tintinnids are illustrated with scanning electron micrographs here. Tintinnids samples for species identification were collected from the metamorphic rocks of the seven Geological Sections of Huangmailing Phosphoric Ore: the fourth bed of granulite and the fifth bed of granulitic apatitole of Section A; the fifth bed of granulite and the sixth bed of granulitic apatitole of Section B; the fourth bed of leucopleptite, the seventh bed of granulite, the ninth bed of granulite and the eleventh bed of gneiss of Section D; the first bed of leucopleptite of Section E; the first bed of granulite, the sixth bed of granulitic apatitole and the seventh bed of leucopleptic apatitole of Section F; the fourth bed of leucopleptite, the sixth bed of leucopleptic apatitole, the eighth bed of leucopleptic apatitole and the ninth bed of granulitic apatitole of Section G; and the third bed of leucopleptite and the fourth bed of leucopleptic apatitole of Section H (Fig. 1).

GEOLOGICAL SECTION OF HUANGMAILING PHOSPHORIC ORE

Huangmailing Formation

Section G

Section G is the main section which yielding a lot of fossils. It is located at Dajian hill.

- | | |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bed 12 | 2.5m. Dark grey granulite, yielding Tubular fossils. |
| Bed 11 | 2.2m. Black granulite, yielding Tintinnids <i>Eutintinnus tubulosus</i> , <i>E. frakmoi</i> and Tubular fossils. |
| Bed 10 | 1.3m. Striped granulite, yielding Tubular fossils. |
| Bed 9 | 2.3m. Dark grey granulitic apatitole, yielding Tintinnids <i>Eutintinnus tubulosus</i> , <i>Funnella sinensis</i> , <i>Salpingella acuminata</i> , <i>Undella bicollaria</i> and Tubular fossils. |
| Bed 8 | 2.1m. Grey leucopleptite, yielding Tubular fossils. |
| Bed 7 | 0.8m. Black grey leucopleptic apatitole, yielding Tubular fossils. |
| Bed 6 | 2.0m. Dark grey granulite, yielding Tubular fossils. |
| Bed 5 | 0.4m. Black stripedgranulitic apatitole, yielding Tintinnids <i>Eutintinnus tubulosus</i> , <i>Salpingella acuminata</i> and Tubular fossils. |
| Bed 4 | 5.1m. Dark grey granulite, yielding Tintinnids <i>Eutintinnus tubulosus</i> , <i>Funnella sinensis</i> , <i>Tintinnopsis coronata</i> , <i>Salpingella acuminata</i> and Tubular fossils. |
| Bed 3 | 0.2m. Striped granulite, yielding Tintinnids <i>Undella bicollaria</i> , <i>Xystonellopsis brandti</i> and Tubular fossils. |

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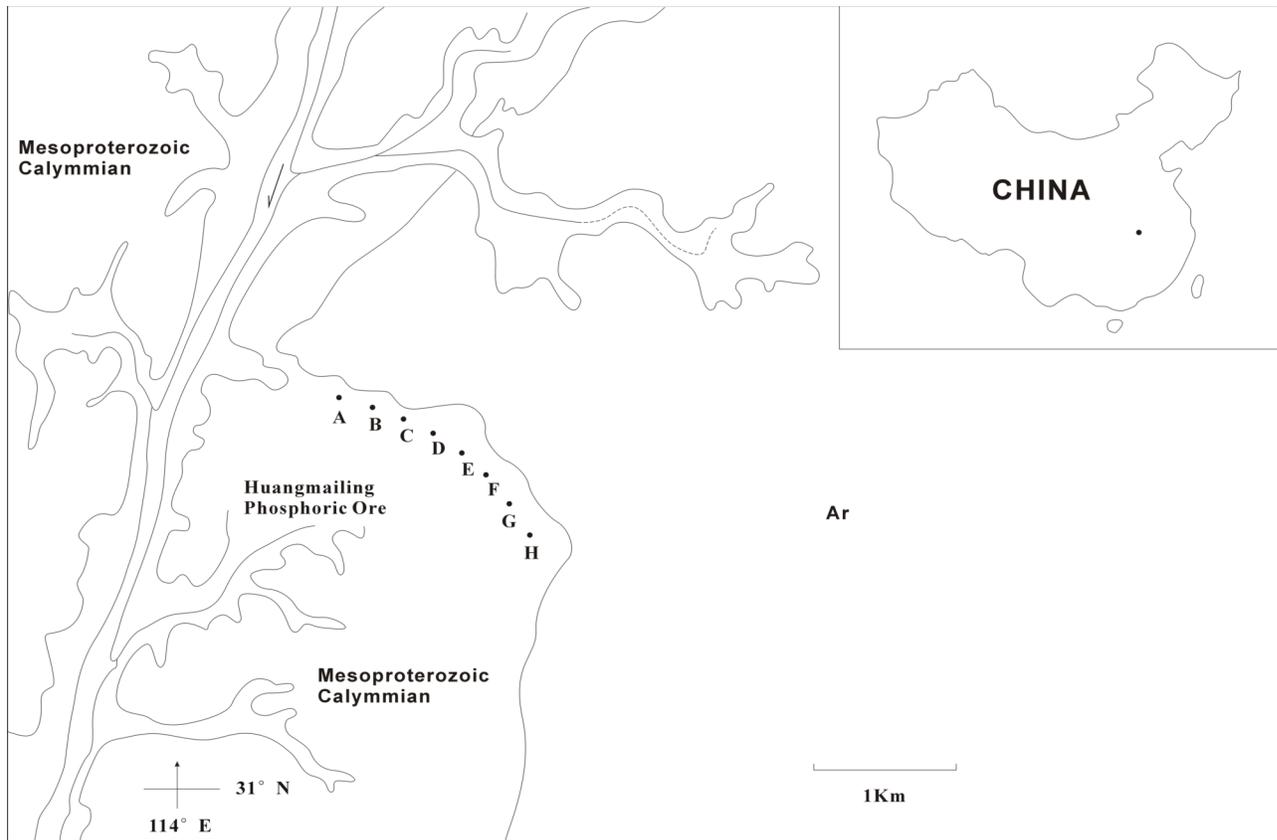


Fig. (1). Map showing location of ailing Phosphoric Ore, and all specimens discussed in this paper were found at localities **A, B, C, D, E, F, G** and **H**.

Bed 2 2.7m. Grey leucoleptic apatitولite, yielding Tintinnids *Eutintinnus fraknoi*, *Tintinnopsis coronata* and Globule *Sinosphaera hubeiensis* and Tubular fossils.

Bed 1 0.45m. Black manganese apatitولite, yielding Globule *Sinosphaera hubeiensis* and Tubular fossils.

~~~~~ Unconformity ~~~~~

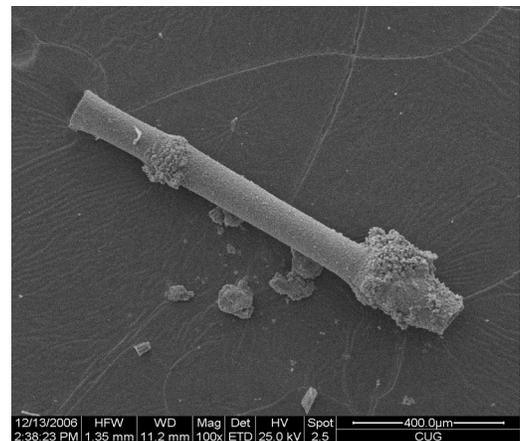
The underlying bed: grey archaeozoic era gneiss.

A total of eight Tintinnid species belong to six genera and four families were identified. They are *Eutintinnus lusus-undae* (Fig. 2), *E. fraknoi* (Fig. 9) and *E. tubulosus* (Fig. 3) of Genus *Eutintinnus* of Family Tintinnidae, and *Funnella sinensis* (Fig. 4) of Genus *Funnella* and *Salpingella acuminata* (Fig. 5) of Genus *Salpingella* of Tintinnidae too; *Xystonellopsis brandti* (Fig. 6) of Genus *Xystonellopsis* of Family Xystonellidae; *Tintinnopsis coronata* (Fig. 7) of Genus *Tintinnopsis* of Family Codonellidae; and *Undella bicollaria* (Fig. 8) of Genus *Undella* of Family Undellidae.

## EOECOLOGY

All Tintinnid fossils are calcareous samples. The size of minerals, in gneiss, leucoleptic apatitولite, granulitite, granulitic apatitولite and leucoleptite of which contain Tintinnids, are from 0.02 mm to 0.3 mm in Huangmailing region. That is belong to the silt range. These rocks also contain the same size of pyrites. Tintinnids *Xystonellopsis*, *Undella* and *Funnella* were lived in Sea Basin or Deep under-

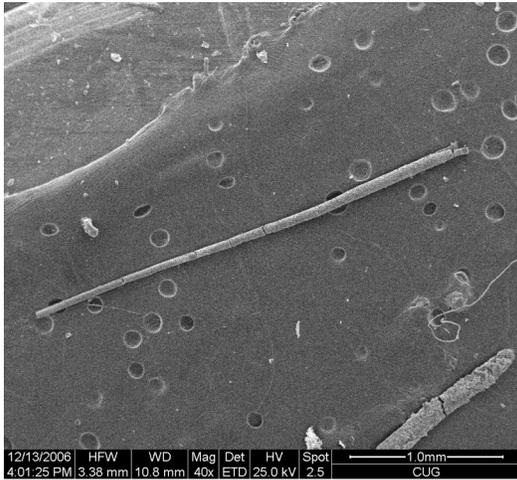
water [4, 19]. According to these above characters, we are sure that Tintinnids, from Huangmailing Phosphoric Ore of Central China, were lived in the sea basin of anoxic environment in Mesoproterozoic Calymmian.



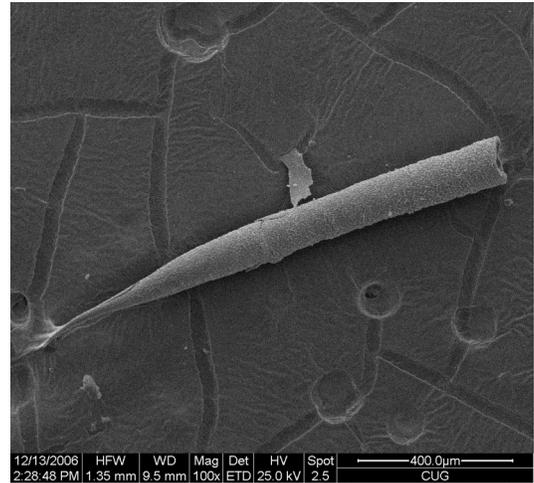
**Fig. (2).** *Eutintinnus lusus-undae* Entz, 1885. Fossil was collected from the ninth bed of granulitite of Section **D**.

## CONCLUSION

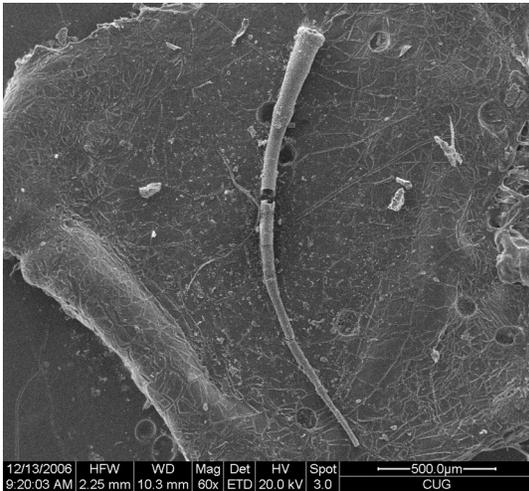
These six genera, *Funnella*, *Eutintinnus*, *Salpingella*, *Xystonellopsis*, *Tintinnopsis* and *Undella*, are the oldest ancestor of Tintinnids. They were lived in sea basin in Mesoproterozoic Calymmian at Huangmailing region of Hubei Province of Central China. Tintinnids had near 1600 million years history.



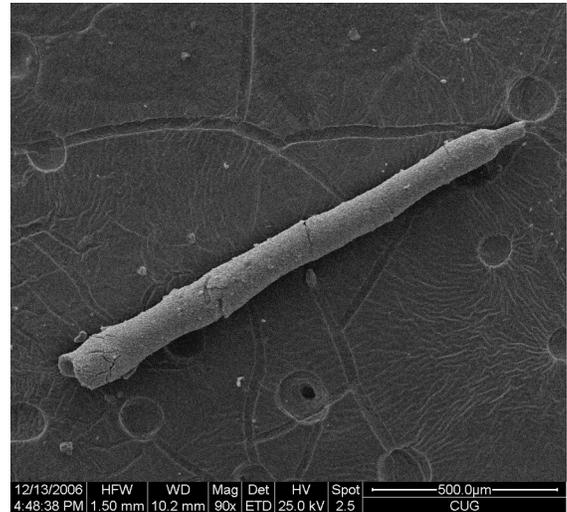
**Fig. (3).** *Eutintinnus tubulosus* (Ostenfeld) Kofoid & Campbell 1939. Fossil was collected from the fourth bed of leucoleptite of Section G.



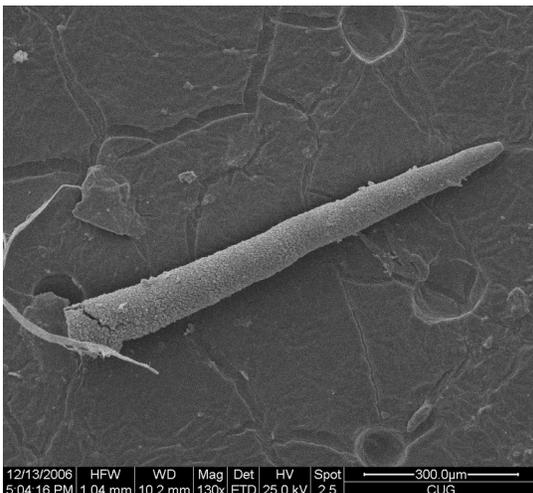
**Fig. (6).** *Xystonellopsis brandti* (Laackmann) Jörgensen, 1924. Fossil was collected from the fourth bed of leucoleptic apatitilite of Section H.



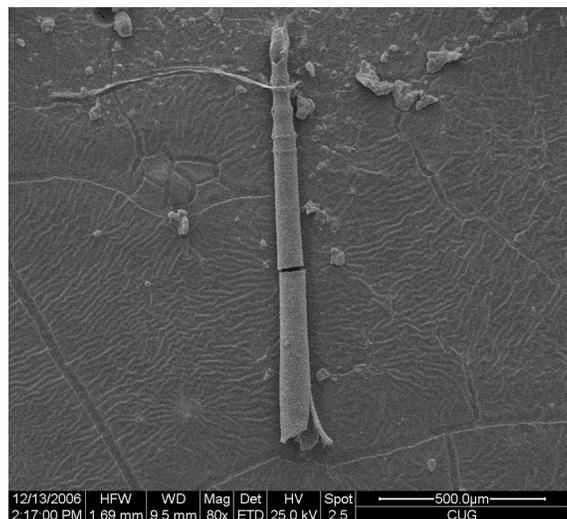
**Fig. (4).** *Funnella sinensis* Li & Zhang, 2006. Fossil was collected from the ninth bed of granulitic apatitilite of Section G.



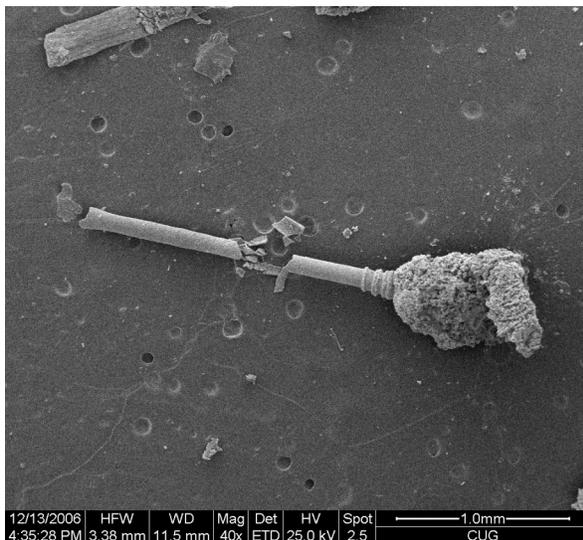
**Fig. (7).** *Tintinnopsis coronata* Kofoid & Campbell, 1929. Fossil was collected from the fourth bed of leucoleptic apatitilite of Section H.



**Fig. (5).** *Salpingella acuminata* Kofoid & Campbell, 1929. Fossil was collected from the fourth bed of leucoleptite of Section G.



**Fig. (8).** *Undella bicollaria* Brandt, 1906. Fossil was collected from the ninth bed of granulitic apatitilite of Section G.



**Fig. (9).** *Eutintinnus frakmoi* (Daday) Kofoid & Campbell, 1939. Fossil was collected from the ninth bed of granulite of Section D.

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