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 Funnela 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 granulitite and the fifth bed of granulitic apatitolite of Section A; the fifth bed of granulitite and the sixth bed of granulitic apatitolite of Section B; the fourth bed of leucoleptite, the seventh bed of granulite, the ninth bed of granulitic apatitolite and the eleventh bed of gneiss of Section D; the first bed of leucoleptite of Section E; the first bed of granulitite, the sixth bed of granulitic apatitolite and the seventh bed of granulitic apatitolite of Section G; and the third bed of leucoleptite and the fourth bed of leucoleptic apatitolite of Section H (Fig. 1).

GEOPHYSICAL 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 granulitite, yielding Tubular fossils.
Bed 11 2.2m. Black granulitite, yielding Tintinnids Eutintinnus tubulosus, E. frakmoi and Tubular fossils.
Bed 10 1.3m. Striped granulitite, yielding Tubular fossils.
Bed 9 2.3m. Dark grey granulitic apatitolite, yielding Tintinnids Eutintinnus tubulosus, Funnela sinensis, Salpingella acuminata, Undella bicollaria and Tubular fossils.
Bed 8 2.1m. Grey leucoleptite, yielding Tubular fossils.
Bed 7 0.8m. Black leucoleptic apatitolite, yielding Tubular fossils.
Bed 6 2.0m. Dark grey granulitite, yielding Tubular fossils.
Bed 5 0.4m. Black striped granulitic apatitolite, yielding Tintinnids Eutintinnus tubulosus, Salpingella acuminata and Tubular fossils.
Bed 4 5.1m. Dark grey granulitite, yielding Tintinnids Eutintinnus tubulosus, Funnela sinensis, Tintinnopsis coronata, Salpingella acuminata and Tubular fossils.
Bed 3 0.2m. Striped granulitite, yielding Tintinnids Undella bicollaria, Xystonellopsis brandti and Tubular fossils.

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Bed 2 2.7m. Grey leucoleptic apatitolite, yielding Tintinnids *Eutintinnus frakmoi*, *Tintinnopsis coronata* and Globule *Sinospaera hubeiensis* and Tubular fossils.

Bed 1 0.45m. Black manganese apatitolite, yielding Globule *Sinospaera hubeiensis* and Tubular fossils.

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. frakmoi* (Fig. 9) and *E. tubulosus* (Fig. 3) of Genus *Eutintinnus* of Family Tintinnidae, and *Funnela sinensis* (Fig. 4) of Genus *Funnela* 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 apatitolite, granulite, granulitic apatitolite and leuco leptite 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 Funnela* 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.

**CONCLUSION**

These six genera, *Funnela, 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. (4). *Funnela sinensis* Li & Zhang, 2006. Fossil was collected from the ninth bed of granulitic apatitolite of Section G.

Fig. (5). *Salpingella acuminata* Kofoid & Campbell, 1929. 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 apatitolite of Section H.

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

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