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New Morphological Structures Revealing the Phylogenetic Affinity of Problematic Fossil Chuarids from the Early Ediacaran Lantian Biota

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Abstract: The Lantian biota, hosted in the lower black shale of the Ediacaran Lantian Formation of South China, provides a unique window revealing the complex multicellular life in early Ediacaran Period. As the most abundant taxon of the Lantian biota, the problematic fossil chuarids have two different preservational modes that most of the specimens are preserved as discoid carbonaceous compressions while rare specimens preserved as three-dimensionally pyritized internal molds. Although the pyritized chuarids had ever been interpreted as eukaryotic megacysts based on the medial split excystment structures (Yuan et al., 2001), the carbonaceously compressed chuarids are still ambiguous in their phylogenetic affinity, which hampers our ability to fully evaluate their paleobiological and paleoecological significance. Here we report some new morphological structures of the carbonaceously compressed chuarids in the Lantian biota, which could provide new insight into their phylogenetic affinity. Most of the carbonaceously compressed

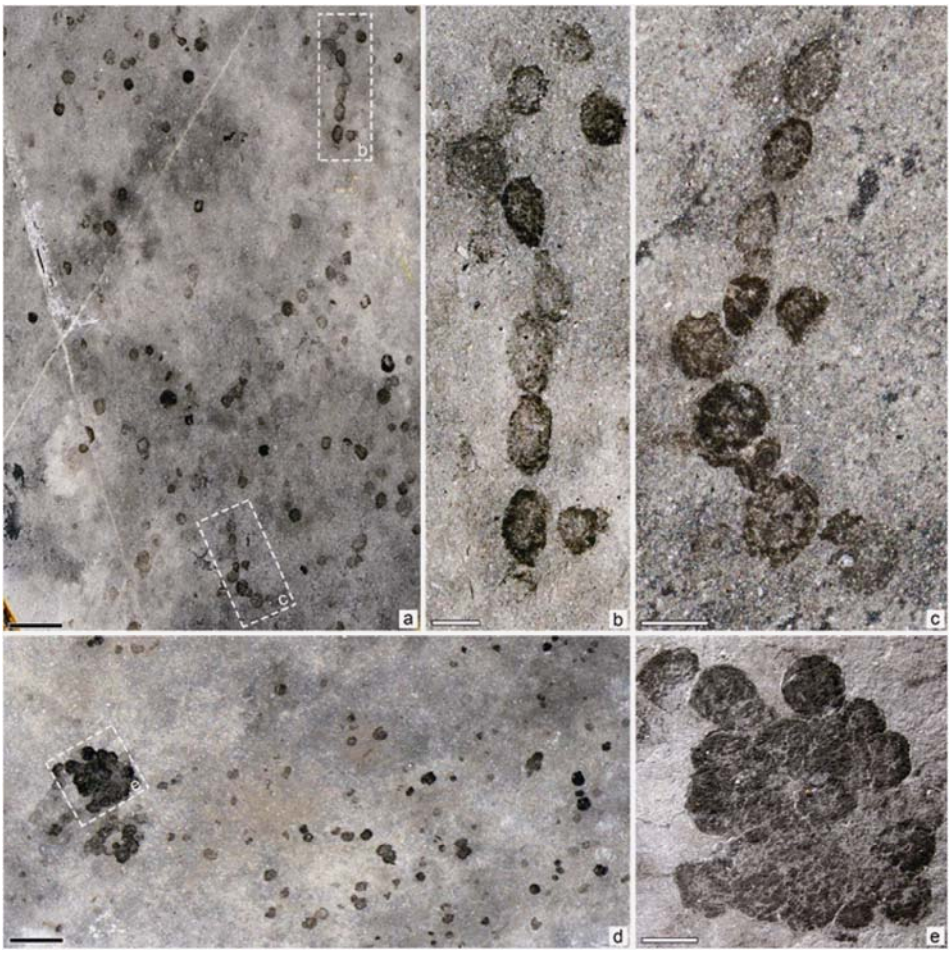

Fig.1. Carbonaceously compressed chuarids from the early Ediacaran Lantian biota.
(a–c) Chain-like clusters formed by chuarid discoidals, note the slight separation between discoidals caused by the degradation of the gelatinous covering; (d–e) Agglomerate clusters formed by chuarid discoidals, note the discoidals closely connected and never overlapped implying spherical shells originally. Black scale bars are 5 mm, and white scale bars are 1 mm.

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chuarids are preserved as millimeter-sized discoidals, and distributed individually (Fig.1a, d). In contrast, several chuarid discoidals could form regular chain-like (Fig.1a–c) or irregular agglomerate (Fig.1d–e) clusters. The chuarid discoidals are always connected or separated slightly in the chain-like clusters (Fig.1b–c), and connected closely but never overlapped in the agglomerate clusters (Fig.1e). We inferred that the chuarid discoidals were spherical shells originally, and have outer gelatinous covering. Thus, the discoidals were connected by the gelatinous covering to form the chain-like or agglomerate clusters, and the slight separations between discoidals could be caused by the degradation of gelatinous covering. These morphological structures of the chain-like and agglomerate chuarid clusters resemble some typical Nostoc or Chroococcus of cyanobacteria (Castenholz, 2001; Lee, 2008). Thus, the chuarid fossils in the Lantain biota may therefore represent a polyphyletic group of diverse floating eukaryotic and prokaryotic organisms, which are different from the typical Precambrian *Chuaria–Tawuia* assemblages (Steiner, 1996; Sharma et al., 2009; Tang et al., 2017) in both phylogenetic affinity and stratigraphic range.

Key words: *Chuaria*, early Ediacaran, Lantian biota, cyanobacteria

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