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The diversity and systematics of early Cambrian lophotrochozoans (the Chengjiang Lagerstätte, China): discoveries and new progress

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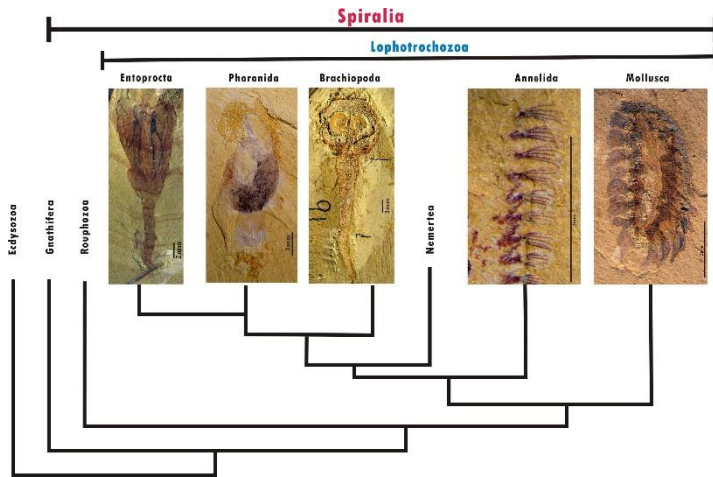
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All Lophotrochozoa (sometimes equated with Spiralian), a clade of non-ecdysozoan protostomes, mainly comprises the two phyla of Annelida and Mollusca within Trochozoa and the lophophorata [1]. Until now, only a few of specimens of polychaete worm and *Wiwaxia* bring insights into the evolution of character states of annelids and mollusks [2]. The Lophophorata (Bryozoa, Entoprocta, Phoronida and Brachiopoda) are united by the presence of a fan of ciliated tentacles surrounding the mouth, and so were treated together as the lophophorates [1]. Although considerable advance have recently been made in unveiling the Cambrian morphology and diversity of brachiopods [3, 4], and the pivotal lophophorate animals recently including bryozoans and entoprocts, the most conspicuous phylogenetic gap in the fossil records is for Phoronida. *Iotuba* (an early synonym of *Eophoronis* Chen 2004) was proposed as a phoronid candidate, but actually of a species of sipunculids.

Here we describe abundant well preserved material of *Archisaccophyllia kunmingensis* Hou et al., 2005, from the Cambrian (Series 2) Chengjiang deposits, reinterpreted here as a stem-group phoronid with actinotroch-like larval characters. The phoronid affinity is supported by the sessile body plan and interior soft anatomy. The body consists of an upper agglutinated calyx and a lower stout stalk with a distal holdfast. The soft anatomy includes a U-shaped gut with a mouth surrounded by a fan of flexible tentacles. *Archisaccophyllia kunmingensis* differs from extant phoronid actinotroch larvae in being much larger with a sessile lifestyles, as well as in having the calyx covered by agglutinated quartz grains that is reminiscent of the agglutination that is known both in extant adult phoronids as well as from the enigmatic lophophorate *Yuanotheca*, recently described from the Chengjiang fauna. The occurrence of an actinotroch-like phoronid from the Chengjiang biota traces the ancestry of yet another lophotrochozoan phylum back to the Cambrian radiation, and has important implications for the earliest evolution of lophotrochozoans, and shows that an agglutinated lophotrochozoan body plan may have evolved earlier or commener than previously suspected.

Figure 1: The diversity and systematic framework of early Cambrian lophotrochozoans (Brachiopoda, phoronida, entoprocta, Mollusca, Annelida and Sipuncula)



References:

- [1] Zhang Z et al., (2013) Sci. Rep. 3: 1066
- [2] Zhang Z et al., (2015) Sci. Rep. 5:14810
- [3] Zhang Z et al., (2014) Sci. Rep. 4: 4682
- [4] Zhang & Holmer, (2013) Sci. Found. China 21: 66-80

