The internal anatomy and the cell movement of Lower Cambrian gastrulas

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The extraordinarily well-preserved fossil embryos recovered from the Lower Cambrian are known from both cleavage and gastrula stages and, consequently, it has the potential to yield vital insights into developmental evolution at that time. However, they are not generally accepted as gastrula fossils because of the gastrulation processes and internal structures in these embryos are poorly characterized. Here we show rare gastrula specimens in which internal anatomical features preserved. All specimens examined under scanning electron microscope (SEM) were mounted on slides using double-sided carbon tape. Internal structures were analyzed with micro-CT at about 5-mm resolution power (TXS225-ACTIS, TESCO at University Museum, The University of Tokyo, Japan)[1] . The yolk consumed in the endoderm formation and the pharynx was appeared after the archenteron formed. Moreover, the stellate ornaments entirely cover the embryos after the epiboly and show no counterpart with any other adults. All lines of evidence so far have supported that our embryo fossils are most probably non-feeding lecithotrophic larvae; although the epibolic gastrulation and radial symmetry suggest a cnidaria Sea anemone affinity, the precise phylogenic position of them is still uncertain because of lacking reliable later stages in development; we also present the cell movement of epibolic gastrulas, the embryonic mechanisms have been compared with modern pattern: enveloping layer extension were observed in our fossils; and similar with purse-string-like contraction of marginal cells, the zigzag margin contraction of the epibolic frontier to reduce their perimeter that push the margin forward, all of which hint that the embryonic mechanisms of the modern embryos had evolved in Lower Cambrian.

Keywords: Lower Cambrian, Kuanchuanpu Formation, Olivooides, epibolic gastrulation, nondestructive internal anatomy by micro-CT

