Simulation experimental taphonomy of modern fish embryos —Enlightenment for the early fossil embryos

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Abstract

Phosphate fossil embryos were found in the Ediacaran Doushantuo Formation and Early Cambrian Kuanchuanpu Formation in the Guizhou and Shaanxi provinces of South China respectively. The structure of the fossils is delicate and artistic. Although there has been some work done to date to identify the nature of these fossil embryos, their identification and characterization still are controversial. Therefore, we used experimental taphonomy approach to provide insight into the origin of these structures. Previous studies confirmed that delicate, perishable structures could be retained by mineralization, but the experiments about the early morphological changes are few. Research about the sequencing of embryonic structure during the mineralization process is an important direction.

Instruction

The experimental taphonomy in this study simulated the chemical conditions (pH and Eh) of the sediment environment to observe the morphological changes of Bluntnose black bream embryos (Megalobrama amblycephala). We assume that silicate mineralization is similar to phosphate mineralization, and that silicified fossil embryos are comparable to fossil embryos preserved by phosphate. In the experiment, a silicate solution was used instead of a phosphate solution. The result shows that the preservation of the embryos is affected by the environment. Silicification is a very rapid process, taking place over 15 days. Different forms and part of embryos are preserved entirely. The results also show that the substitution reaction occurs within the structure of embryo rather than just as a coating. Experimental taphonomy provides a good way to explore the origin and preservation of Early Cambrian fossil embryos.

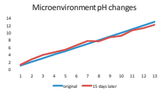
Method

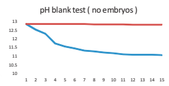
1.Putting the bluntnose black bream embryos in jars which are aseptic condition.
2. Pouring Na_2SiO_3 solution into jars.
3.Dropping hydrochloric acid(HCl) solution into jars to regulate pH.
4.Then, jars are sealed and removed to shade place.
5.15 days later, taking out samples, solidifying embryos in biochemistry method.
6.Testing samples by energy disperse spectroscopy(EDS) and observing samples by scanning electron microscopy(SEM).

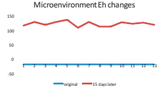
Results

62 bottles embryos

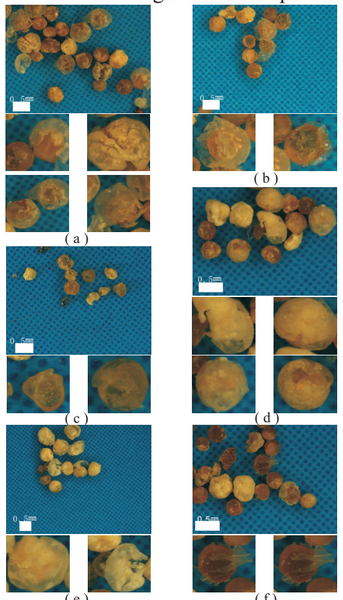
78 boxes solidified embryos

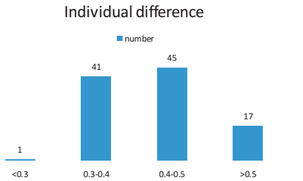




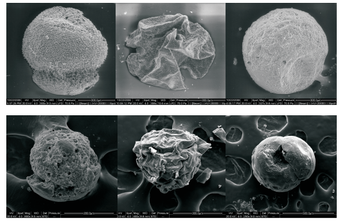


Reflected-light microscope

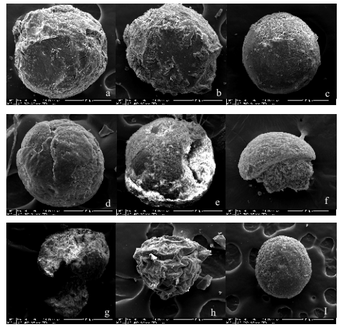


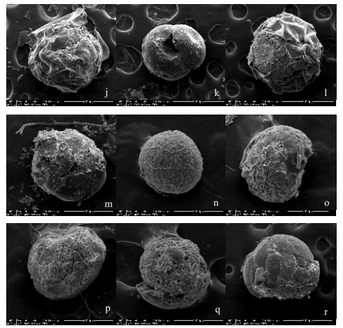


Fossils and embryos

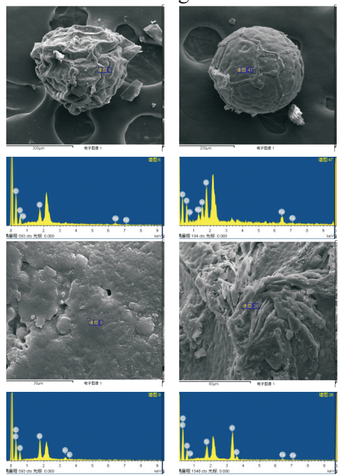


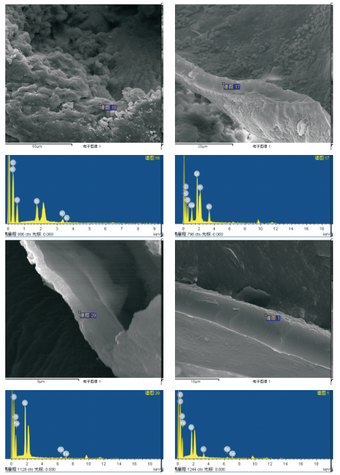
SEM figures



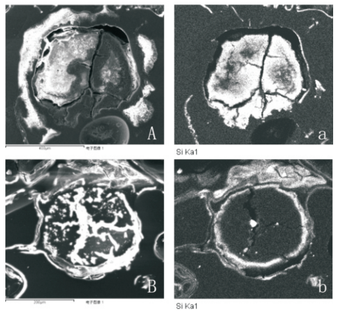


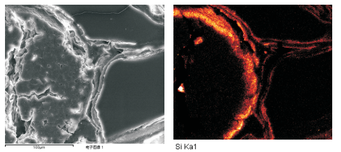
EDS figures



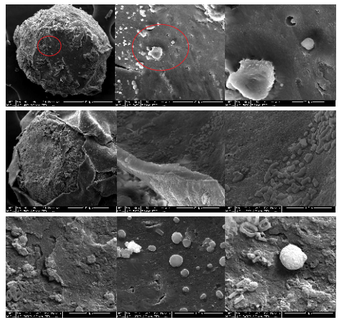


Surface analysis by SEM





Minerals on embryo surface



Conclusion

1.During buried stage, some physical and chemical reactions occur between biological and microenvironment.
2.Acidic medium and reducing environment are requirements for fossil preservation.
3.Embryo oolemma and ovokaryon can be saved in a short time. Some time they are saved differentiate.
4.Different shapes and sizes can be saved at same time.
5.Embryo is mineralized in two ways, one is metasomatism, the other one is coating

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