

Abstract

Weng'an biota found in Doushantou formation in Weng'an, Guizhou Province, south China possesses perfectly preserved fossil records. The Weng'an biota is different from others in that they are phosphatized and soft-bodied fossils. This research tries to confer how the environmental conditions lead to the phosphatized fossils.

In my experiments, I use the anemone, as my material. My major topic is how the calcium phosphates preserve the details of the cell structure by infiltrating into the cells first and following mineralize on the structure inside the cells with environmentally conditional variations.

Two approaches were reported in experimental simulations of calcium phosphates mineralization of soft-bodied fossils. In previous studies, most of the results emphasized the role of microorganism-induced mineralization of calcium phosphate, a taphonomic process known as authigenic mineralization. In their results, the calcium phosphates only mineralized outside the cells but never found inside the cells. The other taphonomic process is called permineralization that the calcium phosphates enter cells by chemical infiltrating and following mineralize the cell organelles, such as nucleus and chloroplasts to preserve the details of the cell structure. In our process, we conducted the study in sterilized condition to simulate the second hypothesis. As a result, we observe huge amount of calcium phosphates deposit inside the cells in our experiments, which is different from previous studies. Based on the results, we think that permineralization is the favored mechanism for calcium phosphates to mineralize on the structure inside the cells.

摘要

在中國南方貴州省瓮安縣的陡山沱地層中發現了許多保存精美的磷酸鈣化石，這些化石為距今 5 億八千萬年前的前寒武紀時代的生物所形成的，被命名為瓮安生物群。有別於大多數化石紀錄，瓮安生物群化石的主要成份為磷酸鈣，而且大都是由軟組織所形成的化石。而本論文的研究目的是想探討是什麼獨特的地理環境所導致這些化石的形成。

實驗中我選用了海葵，一種腔腸動物作為實驗材料，研究的方向主要在於磷酸及鈣如何進入到海葵的細胞中，然後隨著環境 pH 值的變化沈積在細胞內部，將細胞的形狀和輪廓給保存下來。

磷酸鈣沈積在細胞內部的機制有兩種，舊有的文獻中都傾向於微生物的作用所導致磷酸鈣的沈積。從實驗的結果來看，磷酸鈣僅沈積於細胞膜外，但在化石紀錄中我們甚至可以看到細胞核、葉綠體等構造被沈積的磷酸鈣礦化保存下來。因此我的實驗方法轉向第二種機制來設計，即經由非生物性的化學滲透作用進入細胞內，然後因 pH 值的變化導致溶解度的改變而沈積於細胞內。從實驗結果來看，我們在細胞內部發現了大量的磷酸鈣礦物顆粒沈積。突破了只能在細胞外部沈積的研究結果，因此我們認為非生物性的滲透作用機制可能是當時瓮安生物磷酸礦化形成化石的主要原因。