

A study of irregular shaped tests formation of planktonic foraminifera

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Planktonic foraminifera are protist forming carbonate tests. They are used as useful index fossils, and moreover, the oxygen isotopic and trace element compositions in their calcite tests are recognized as a promised archive representing paleo-ocean environments. Foraminifera generally consist of multipul chambers, and each chamber forms spirally for the center of the first chamber. Culturing observations have contributed for understanding relationships between trace elements and isotopic indices, and environmental factors. However, the transfer of elements and trigger of test formation are poorly understood. Cultured specimens sometimes show irregular-shaped tests, which are unlikely formed under natural condition in the ocean.

In this study, we focused the test formation of planktonic foraminifera, and cultured two species (*Globigerina bulloides*, *Globigerinoides ruber*) collected at Sagami bay. Culturing temperature was controlled at 19, 21, 23 and 25 °C. Calcium isotopic reagents were added to the culturing seawater to mark the timing of test formation. Moreover, we also investigated the other specimens cultured with seawater, whose calcium concentration was raised for 10% respective to the original concentration. In those cases, the pH of calcium reagents were adjusted to appropriate pH, and therefore, the seawater pH was kept at constant during the observation.

As a result, three of ten specimens of *G. ruber* have newly formed a regular test at 19, 21 and 23 °C. On the other hand, 5 of 7 specimens of *G. bulloides* have formed new tests, three of which have formed irregular shaped tests. These three specimens are ones survived more than a couple of weeks after sampling. The water temperature of irregular test formation was 21 or 25 °C, suggesting that the temperature was not a direct controlling factor of irregular test formation. Potential factors are concentrations of dissolved oxygen or dissolved organic matters. Foraminifera first forms organic layer called POM at the beginning of test formation. Anomalously high organic concentration in crystallization liquid may impede the regular formation of POM, consequently resulting in the formation of irregular-shaped tests.

For the specimens with increasing calcium concentration of seawater, the spines fell out within 12 hours. Because calcium is an essential element not only for test formation but also various biological reactions, rapid increase of calcium concentration might disturb the biofunction of planktonic foraminifera.

Keywords: planktonic foraminifera, laboratory culture