Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

BPO003-03 会場:201B 時間:5 月 26 日 09:00-09:15

石灰質有孔虫の殻内タンパク質の解析
Characterization of the shell matrix proteins of calcareous foraminifera

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Foraminifera are unicellular marine organism. Many of them have calcitic shells and are among the major calcium carbonate producers in the oceans. Their calcareous shells are widely used for stratigraphic and paleoenvironmental analyses. Like the case of skeletons of many other organisms, foraminiferan shell formation is thought to be controlled to a large extent by organic macromolecules such as proteins. But none of them have been identified so far.

Baculogypsina sphaerulata and Calcarina gaudichaud are common calcareous foraminiferan species, and were collected from Okinawa, Japan.

Both of the soluble and insoluble organic shell materials of B. sphaerulata and C. gaudichaudii were separated by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE). For the soluble shell materials of the two foraminifera, no signal was detected when stained with Coomassie Brilliant Blue (CBB), but strong smear bands were seen when stained with silver. CBB is known to stain most proteins, but it does not usually stain very acidic proteins. Thus we also stained the soluble shell materials with Stains-all which stains cation-binding proteins blue and the other proteins pink. When stained with Stains-all, the soluble shell material of B. sphaerulata appeared as a blue smear, and that of C. gaudichaudii showed a blue protein band of 66kDa as well as a blue smear along the lane. These results suggest that the shells of both B. sphaerulata and C. gaudichaudii contain soluble acidic proteins.

For the insoluble shell materials of the two foraminifera, no signal was detected when stained with CBB. But blue smears were seen for both species when stained with Stains-all. The signals did not appear so blue as that of soluble materials. Thus, insoluble materials are unlikely to be so very acidic, and perhaps they play a different role from that of the soluble materials.

In order to clarify the process and the underlying mechanism of foraminiferan shell formation, it is necessary to understand the function of shell matrix proteins. The results of this study provide a basis for those experiments in future.