

【Grant-in-Aid for Scientific Research(S)】
Biological Sciences (Agricultural sciences)



Title of Project : Elucidation of regulation mechanism of calcification in marine organisms toward preservation of global environment

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Research Area : Boundary agriculture

Keyword : Environmental analysis

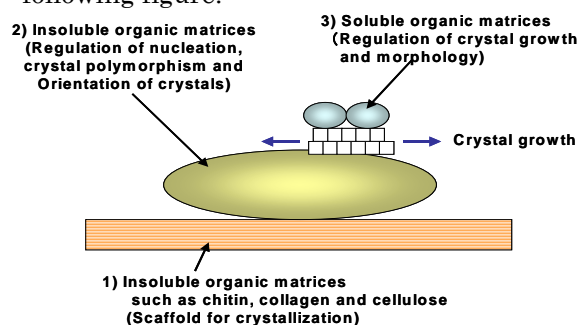
【Purpose and Background of the Research】

Fixation of carbon dioxide is classified into two groups, photosynthesis and calcification. Although the fixed amount of carbon dioxide by calcification is about 30-fold less than that by photosynthesis, the product, calcium carbonate, is put into a long-term global carbon cycle, thereby calcification being more important than photosynthesis. Calcification by marine organisms has been performed for more than 500 million years and has contributed to the dramatic decrease of carbon dioxide content (0.04%) in the atmosphere by depositing calcium carbonate of their remains. The amount of calcium carbonate deposits reaches almost 90% of the total carbon on the earth. However, the mechanism of calcification by marine organisms remains unclear. This research aims at clarifying the mechanism of calcification in marine organisms to preserve global environment.

【Research Methods】

In general, calcification is presumably regulated by organic matrices in calcified tissues. To clarify the mechanism of calcification, we will determine the structure and function of important organic matrices in calcified tissues derived from various marine organisms including coccolithophores, corals, mollusks and crustaceans, which are major calcifying organisms, using combined techniques of bioorganic chemistry, molecular biology and mineralogy. Concerning coccoliths, we will focus on characterization of proteins on the base plate on which coccolith is formed. Since coral calcification has not been studied extensively from the standpoint of mechanism of calcification, we will search for novel matrix proteins responsible for calcification. We have been identifying organic matrices in both nacreous and prismatic layers of the Japanese pearl oyster. In this study, we will continue to find novel matrix proteins from the shell together with clarification of the structure-function relationship. Since crustaceans have a characteristic of carrying amorphous calcium carbonate in the calcified tissues, we will identify organic matrices

inducing amorphous calcium carbonate. Though these studies, we will clarify the common mechanism underlying calcification in various marine organisms. The possible model for the roles of organic matrices is shown in the following figure.



【Expected Research Achievements and Scientific Significance】

The common mechanism of calcification among various calcareous marine organisms is expected to be clarified, and important organic matrices associated with calcification are identified.

【Publications Relevant to the Project】

1. L. Addadi & S. Weiner: Proc. Natl. Acad. Sci. USA, 82, 4110 (1985).
2. H. A. Lowenstam & S. Weiner: On Biomineralization, Oxford Univ. Press (1989).
3. K. Simkiss & K. M. Wilbur: Biomineralization- cell biology and mineral deposition, Academic Press (1989)
4. N. Tsutsui et al.: Zool. Sci., 16, 619 (1999).
5. H. Inoue et al.: Biosci. Biotechnol. Biochem., 65, 1840 (2001).
6. M. Suzuki et al.: Biochem. J., 382, 205 (2004).
7. N. Ozaki et al.: Biochem. Biophys. Res. Commun., 357, 1172 (2007).
8. M. Suzuki et al.: Science, 325, 1388 (2009).

【Term of Project】 FY2010-2012

【Budget Allocation】 117,500 Thousand Yen

【Homepage Address and Other Contact Information】

Under construction

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