

DISSOLUTION PROCESS OF GLOBIGERINA BULLOIDES
SHELL (PLANKTIC FORAMINIFERA) OBSERVED BY X-RAY
MICRO CT BASED ON DISSOLUTION EXPERIMENT AND
DEEP-SEA SEDIMENT SAMPLES

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<https://doi.org/10.15017/1441030>

出版情報 : 九州大学, 2013, 博士 (理学), 課程博士
バージョン :
権利関係 : 全文ファイル公表済

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by

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SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE
DEGREE OF DOCTOR OF PHILOSOPHY

at the

DEPARTMENT OF EARTH AND PLANETARY SCIENCES GRADUATE
SCHOOL OF SCIENCES KYUSHU UNIVERSITY

FEBRUARY, 2014

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Submitted to the Graduate School of Science, Kyushu University in February, 2014, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

ABSTRACT

Dissolution process of planktic foraminiferal shell is clarified based on the observation of internal shell structure and density distribution by X-ray micro CT scanner. 3D graphics of internal shell structure is constructed and density (porosity) of shell can be estimated by CT numbers. In this study, X-ray micro CT observations of planktic foraminiferal shells (*Globigerina bulloides*) were performed by following two approaches: (1) laboratory experiment for *G. bulloides* shell dissolution to understand the dissolution process; (2) evaluation for dissolution/preservation status of *G. bulloides* shells in marine sediments.

Dissolution experiment of *G. bulloides* shells in pH controlled under-saturated water (pH: 6.7 ± 0.1) were performed for nine days. Based on X-ray micro CT

observation, shell structure of *G. bulloides* shells were divided into three types of calcite: early developed calcite, inner calcite and outer calcite. The early developed and inner calcites with low CT numbers (low density) are sensitive to dissolution whereas outer calcite with high CT numbers (high density) is resistant to dissolution. CT number histogram of *G. bulloides* shell changed with dissolutions, decreasing both mode and frequency of CT numbers. Linear correlation ($R^2 = 0.62$) between volume ratio of low-density calcite and shell weight loss indicates that shell weight loss can be estimated by CT number distribution regardless of initial shell condition (shell size or thickness). A novel proxy for CaCO_3 dissolution is proposed based on volume ratio of low-density calcite estimated from CT number histogram of planktic foraminiferal shell.

Knowledge on foraminiferal shells dissolution obtained by the laboratory experiment was applied to foraminiferal shells in marine sediment samples. *Globigerina bulloides* shells were obtained from eight sea-surface sediment samples in the western North Pacific ranging from 969 to 3135 m water depths. Dissolution of *G. bulloides* shells progresses as water depth deeps based on shell weights and CT numbers. Foraminiferal shell dissolution in the sediment samples occurred in the early developed and inner calcites with low CT numbers. On the other hand, the outer calcite is well preserved. The dissolution process of foraminiferal shell in marine sediment samples is consistent with the results of dissolution experiment.

Observation of dissolution process of planktic foraminiferal shell from the view

points of internal structure and shell density distribution by X-ray micro CT indicates that X-ray micro CT method is useful to estimate the extent of dissolution of planktic foraminiferal shell.

ACKNOWLEDGEMENTS

I express my hearty thanks to my thesis advisor Associate professor Yusuke Okazaki for his continuous and invaluable support to complete this study. He gave me countless opportunities for participating papers. I am appreciate for his great effort to improving my manuscript. I sincerely appreciate my thesis advisory committee members including Associate professor Yusuke Okazaki and Professor Tasuku Akagi of the Graduate School of Science, Kyushu University, and Dr. Katsunori Kimoto of JAMSTEC for their constructive reviews and suggestions for improving the manuscript. Also I truly thank Emeritus Professor Kozo Takahashi of Kyushu University, currently Professor of Hokusei Gakuen University for opening door to studying paleoceanography.

I am grateful to Dr. Katsunori Kimoto of JAMSTEC. He gave me an opportunity to meet the subject of this study and countless suggestions for my study. He taught me many things about planktic foraminifera in detail. They were greatly helpful for my study. I also appreciate him for improving my manuscript and providing constructive opinions. The dissolution experiment of this study was performed at JAMSTEC under the support of Dr. Katsunori Kimoto. Most devices in this experiment were provided by him.

The observation of foraminiferal shell by X-ray micro CT scanner was performed at Tohoku University Museum under the support of Associate Professor

Osamu Sasaki of Tohoku University Museum. Method for observing foraminiferal shell by X-ray micro CT was established by his effort. This is essential method for my study. Also, he gave me helpful advices and suggestions for my study and manuscript. Dr. Harumasa Kano of Tohoku University Museum gave me technical support in utilization of X-ray micro CT scanner. I owe them for their effort in spending their valuable time on my study.

I would like to gratefully acknowledge the captains crew, and the scientists on board Research Vessel Mirai of JAMSTEC during the cruise in 2010, for their effort in assisting the sediment trap experiment. This study is based on the samples, which have been obtained during this cruise. In this, study, I used multiple core samples, which have been obtained during the cruise of MR97-02, MR98-05, MR01-K03, MR05-04 and MR98-02 by Research Vessel Mirai of JAMSTEC. Therefore, I am also grateful to captains, crew on scientists of these cruises.

I am grateful to the members of the Plaeoenvironmental Science Laboratory at the Graduate School of Kyushu University for their assistance and numerous discussions in many phases. Particularly, helpful support for utilization of SEM was provided by Dr. Susumu Konno. On the other hand, Dr. Takuya Sagawa gave me various advice and information on technical knowledge about planktic foraminifera. I acknowledge Professor Haruyoshi Maeda, Associate Professor Kaoru Kashima and Dr. Shoichi Shimoyama for their encouragement and useful suggestions. My appreciation

goes to Ms's Tomoko Koga, and Fukumi Watanabe who have done substantial amount of office work for our laboratory.

Finally, I deeply appreciate my family for their understanding and encouragement. My study is supported by their cooperation.

This research was partially supported by JSPS Research Fellows Grant Number 25-5427.

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