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EVOLUTIONARY MORPHOMETRICS OF THE FORAMINIFERAL TEST IN TIME AND SPACE

Chaired by Norman Macleod

The vast majority of foraminiferal taxa are defined according to morphological concepts in which patterns of variation (*e.g.*, morphological discontinuities, subspecific morphoclines) have often been assumed or anecdotally illustrated rather than demonstrated quantitatively. While this practice is not different in principal from that used in many other fossil and Recent groups, the unique attributes of the foraminiferal fossil record make it a natural laboratory where fundamental questions regarding the nature quantitative patterns of morphological variation can be assessed at unprecedented levels of detail. Issues that can be addressed under this research programme, at least in principle, include patterns of intraspecific variation, patterns of interspecific variation, automated object recognition, morphological paleobiogeography, correlation of morphological variation with a variety of physical and biological factors, theoretical morphology, and consequences of combining this information with phylogenetic data for understanding the evolutionary history of this group (e.g., morphological disparity, comparative method studies). This open technical session addresses itself to the presentation of new methods whereby such studies can be undertaken and surveying a range of results achieved thus far. Particular emphasis will be placed on what such investigations can tell us about general nature of evolutionary-ecological processes operating in foraminifera (and marine settings in general), and how such data can be used in taxonomic, systematic, stratigraphic, biogeographic and phylogenetic contexts.

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Biometrical study of the benthic foraminifera *Cribroelphidium oregonense* and morphological features of its deformed individuals

Kohei Abe[1] & Shiro Hasegawa[2]

[1]Graduate School of Life and Environmental Sciences, University of Tsukuba, 1-1-1 Tennodai, Tsukuba 305-8572, Japan - abekohei@arsia.geo.tsukuba.ac.jp
[2]Graduate School of Science and Technology, Kumamoto University, 2-39-1 Kurokami, Kumamoto 860-8555, Japan

Intra-specific variations of morphology of foraminiferal tests are considered valuable tools for the environmental understandings. However, the relationships between test morphology and environments do not detected clearly for many species. On the other hand, morphological deformation is considered to occur in more or less stressed environment for a species, but it is not clear to distinguish the deformation from the intra-specific variation of test morphology. In this study, we examine 1) variation of test morphology for a benthic species; *Cribroelphidium oregonense* (Cushman & Grant) that include a lot of "deformed" specimens in its populations, 2) relationships between test morphology and some environmental factors. In the case of this species, deformation mainly consists of reduced chamber-size (Abe & Hasegawa, 2002).

Observed specimens were collected from the Pacific Ocean, coastal area off eastern Hokkaido, during the cruises of GH02 (August, 2002) and GT03 (December, 2003). They are cut at equatorial plane for several specimens and observed using a low vacuum SEM, or directly pictured using a microfocus X-ray system. We measure the areas of each chamber on the photographs of cross section, as a representative of three-dimensional volume of chamber that is fundamentally analogues in shape during its ontogeny. Biometrical analysis of *C. oregonense* has represented the following results:

1) The chamber size of this species increases throughout its ontogeny, and the slope of regression line is consistently 0.003 for every specimen. Therefore this growth ratio of chambers is a peculiar feature for *C. oregonense*.
2) The growth rate of chamber by chamber varies regularly. The timing of increasing and decreasing peaks are correlative quite easily in a living population from a station, and also possible among the populations at different the living assemblage from other stations. Such a periodicity of this species indicates that the origins of reducing or increasing chamber-size are not the ecological factors within the specimens but an external factor, such as seasonal oceanographic environmental changes.
3) The fluctuated growth line of chambers are found not only in "deformed" specimens but also for each normal ones. When the chamber sizes increase or decrease, the chamber sizes are recovered about the size on the regression line within a few chambers. We considered the chamber sizes on the regression line are the "ideal chamber size" for the specimen and the "deformed" specimens are considered nothing but the specimens that the ratio of decreased or increased chamber sizes

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become larger. This supposed to indicate the events that lead to change the chamber sizes are not continuous things, but occurred relatively short scale in time.