

Morphological observation of cytoplasm with acidic and alkaline vesicles in large foraminifera cell by confocal imaging

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Algal symbiont-bearing large benthic foraminifers are primary and carbonate producers as well as paleoenvironmental indicators in tropical and subtropical reef environments. Despite their importance, their cellular physiology is not well known. In the present study, we have developed methods to observe in vivo images of a living symbiotic porcelaneous large foraminifer, *Amphisorus kudakajimensis*. The Nikon A1 confocal laser scanning microscope with Calcein-AM was used as a fluorescent indicator for visualizing the morphology and streaming of cytoplasm in living *A. kudakajimensis*. The observations indicated that the cytoplasmic density decreased and reticulopodia were formed at the aperture in the marginal part of intrashell cytoplasm. We also observed vesicles with elevated pH (pH 9.0) and lowered pH (pH 6.0) in reticulopodia-like cytoplasm using a pH-sensitive probe molecule, 8-hydroxypyrene-1,3,6-trisulfonic acid (HPTS). The present study demonstrates the use of confocal microscopy in studying cytoplasmic dynamics and the initial calcification processes such as seawater endocytosis and alkalization of seawater vacuoles.

Keywords: Large foraminifera, Confocal imaging, Live imaging, pH, Calcification