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Fluorescent observations of calcium ion activity in living benthic foraminifera

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Foraminifera are one of the main sources of marine biogenic carbonate and are commonly used to reconstruct paleoenvironments. However, little is known about the intracellular control on elements. In particular, knowledge on calcium ion activities in living foraminiferal cells is of great interest, since it may have implications for many studies in paleoceanography. Recently, fluorescent calcium indicators have been developed that can be used to observe calcium ion activities within a living foraminiferal cell directly. In this study, we applied the fluorescent calcium indicator Fluo-3 AM to observe intracellular calcium ion mobility within one species of a shallow water benthic foraminifers. We show that with this fluorescent calcium indicator is possible to 1) perform real time calcium observations, and 2) study intracellular calcium ion distribution of foraminifera during calcification.
We incubate living foraminiferal specimens under two conditions, one under Fluo-3 AM solution in normal filtrated seawater and the other Fluo-3 AM solution in calcium-free artificial seawater. Fluorescence was seen all over foraminiferal cell in specimens incubated in Fluo-3 AM/normal seawater, while there are no fluorescence was observed in individuals that were incubated with Fluo-3 AM in calcium-free artificial seawater, though the specimens extend their pseudopodia actively under both conditions. Therefore the observed fluorescence should be indicated the calcium ion existence. This method may allow us detailed real-time observation of in-vivo calcium activities in foraminiferal cell. It may be over the many limitations of the existing methods to trace calcium uptake of foraminifera.