Locomotion and move tracking of "*Calytogena*" clams *in situ* and in patented H_2S controlling tanks

*Miku Ohta[1], Takami Nobuhara[1], Yuta Doi[1], Mana Hayase[1], Makoto Sugimura[2], Yukiko Nagai[3,4], Takashi Toyofuku[3], Ryoichi Iwase[3]

1. Faculty of education, Shizuoka University, 2. Enoshima Aquarium, 3. Japan Agency for Marine-Earth Science and Technology, 4. Yokohama National University

Vesicomyid clams are one of the representative chemosynthetic animals, which have flourished in seep and vent sites during the Cenozoic. We report locomotion and behavior patterns of “*Calytogena*” clams to examine their adaptability to fluctuation of seep activity and disturbance of rapid burial. We analyzed time-lapse image data of *in situ* Real-time Deep Seafloor Observatory off Hatsushima Island in Sagami Bay, 1174 m in depth (3 min. interval) and patented H_2S controlling tanks in JAMSTEC (30 sec. interval) and Enoshima Aquarium (3 min. interval).

The “*Calytogena*” clams usually show semi-infaunal standing position with anterior side down and foot penetrating into underground sulfide layer, but sometimes crawl laying their shells with ventral side down. In standing position, the clams rearrange their postures swaying and obliquely rotating shells with foot as an axis. The clams sometimes push one another maybe quarreling over their favorite seep spots.

In crawling mode, they move forward by repeating the following steps: 1) laying shell down, 2) extending and penetrating foot in anterior direction, 3) maybe forming an anchor by foot expansion, and 4) pulling shell forward by foot contraction. In cases, the clams gathered into one spot and stranded one another, but could restore their postures into normal semi-infaunal position by extending and bending foot, which has wide movable range and high flexibility. During foot re-penetrating into the sediment, we observed that mass of sediment particles travels on whole surface of foot from its tip to root. Our SEM observation confirmed that the foot surface is densely covered by mucous cilia. The ciliary movement maybe enables the sediment conveying backward, which helps foot penetration.

In patented H_2S controlling tanks of Enoshima Aquarium, the “*Calytogena*” clams migrated keeping their track along the outer margin of bacteria mat. The average time and distance of one move action is about 15 min and 3.22 cm, so the average speed is about 0.38 cm/min. “*Calyptogena*” clams have been reported to form a ring colony surrounding bacteria mat, and this ring colony is a result guided by best condition of chemical subbottom profile. The positions and areas of bacteria mats in the Enoshima Aquarium tank have been rather stable but the margin fluctuated. The Enoshima clam tracks seem to be a result of tracing the best spot for getting subbottom hydrogen sulfide. In contrast, the “*Calyptogena*” clams of *in situ* the Hatsushima observation seem to move breaking bacteria mats, which were newly formed just after turbiditic rapid burial. In emergency where they lost their favorite seep spots just after such physical disturbance, the clams also repeated round trips from one position, back and forth in various directions, with maximum speed about 12 to 14 cm/min.

“*Calytogena*” clams have high ability of moving and restoring of their postures, as noted above. This ability is one of the keys of their adaptability to fluctuation of seep activity and disturbance of rapid burial, leading to their flourishing since the Cenozic.

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