Methane-seep molluscan community controlled by subbotom structure in the Middle Miocene Bessho Formation, central Japan

Takami Nobuhara[1]; Yuki Ohtori[1]

[1] Education, Shizuoka Univ.

Subbotom structure at methane-seepage sites is essential to understanding seep system, but has not yet been made clear from viewpoints of diagenetic heterogeneity of subbottom sediments. The lower Middle Miocene Bessho Formation consists of siltstone deposited on slope, and intercalates large seep carbonate blocks (the Akanuda and Anazawa Limestones). This study presents anatomical views of the seep carbonates, and shows relation between ecology of seep community and subbottom structure.

Lithological succession can be well observed on the outcrop of the Anazawa Limestone. The lower horizon consists of siltstone including minute carbonate blebs and/or muddy micritic nodules irregular in shape, over 10 cm in diameter (scattering concretion phase). The micritic nodules increase upward in size and density, and unite each other to form large blocks (amalgamated concretion phase), but siltstone patches remains between the carbonate blocks and connect each other. The upper horizon is characterized by dominance of black calcite veinlets and white calcite veins (blowout phase). The black vienlets, composed mainly of granular sparite, not only fill interspaces of muddy breccias, but also contain mud-balls and silt grains in their sparitic cement. These textures suggest that the veinlets were formed by focused flows penetrating semi-consolidated to soft muddy layers. In contrast, white veins mainly consist of fibrous crystals along the substrate margin and blocky sparite in the core. They contain micrite breccias and fragments of black-veinlet, but littel rounded mud-balls and silt grains. The white veins are judged to be final filling of druses in carbonate blocks.

Mode of fossil occurrence is closely related with the lithological succession mentioned above. At the first two phases (scattering concretion and amalgamated concretion phases), vesicomyid *Adulomya* shells are sporadically disseminated in the muddy micrite. In contrast, at the blowout phase, *Adulomya* conjoined valves are densely concentrated, frequently associated with *Bathymodiolus* shell patches, in muddy micrite close to the veinlet-dominant facies. Especially in narrow micrite zone sandwiched between veinlet-dominant facies, *Bathymodiolus* conjoined shells are exclusively concentrated. Same correlation between lithological phases and modes of fossil occurrence is also confirmed at the Akanuda Limestone.

The correlation pattern indicates that the chemosynthetic communities were strongly influenced by subbotom structure. At the scattering concretion phase, seepage is diffusive through pore spaces of silt sediments. Such habitat condition is utilized only by vesicomyid clams, which can trail and trace temporal and wandering seepage. Next, at the amalgamated concretion phase, the seepage passage is gradually restricted and confined into silt-network between impermeable concretion blocks. The narrow and cramped passage leads to high pore-water pressure, which finally brecciated semi-consolidated silt and fluidizing the above soft sediments (the blow-out phase). Such focused flow condition is suitable for colonial aggregations of sessile bivalves *Bathymodiolus* as well as *Adulomya*.

A boring core sample, vertical to the bedding of the Anazawa Limestone, shows that the three lithological phases cyclically repeat at 2 to 5 m intervals from the outcrop surface to 20.8 m in core depth. The Mid-Miocene seepage had continued during the long intervals, repeating occlusion and breakage modes. Deep-sea muddy sediments are generally homogeneous in original, but diffusive seepage can change the subbotom heterogeneous during differential concretion processes. If the seepage continues during long duration, various modes of seepage recur and lead to increase of niches and diversity of chemosynthetic communities.