[JJ] Evening Poster | B (Biogeosciences) | B-BG Biogeosciences & Geosphere-Biosphere Interactions

[B-BG03]Microbial ecology in earth and planetary sciences

convener:Michinari Sunamura(University of Tokyo Dept. of Earth &Planetary Science), Natsuko Hamamura(Kyushu University), Keisuke Koba(京都大学生態学研究センター, 共同), Yuki Morono(Kochi Institute for Core Sample Research, Japan Agency for Marine-Earth Science and Technology)
Wed. May 23, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)
Microbes have exerted the great influences on earth environments through the history of earth. Microbial ecology is a study of interaction between microbes and surrounding environments. Research target of Microbial ecology covers most of environments on the earth and planet, e.g. soil, subsurface, subseafloor, ocean, river, lake, air, space, volcano, fault and earthquake, minerals, and more. In this session , we aim to exchange informations of microbial distribution, population dynamics, function, effect on material cycles between microbial ecologist and earth&planetary scientist. We hope effective discussion from interdisciplinary approaches in this session.

[BBG03-P01]Traces of microorganisms in reefal microbial crusts discovered in a Holocene reef sediment core from the Ryukyu Archipelago

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Keywords:Reefal microbial crust, Holocene, Microbioerosion

The Reefal Microbial Crust (RMC) is a microbial carbonate formed by benthic microorganisms which cover the surfaces and cavities of dead coral skeletons and induce the precipitation of carbonate crystals. There are still many questions on their formation processes and controlling factors. Several centimeters-thick carbonate crusts similar to the RMC were found on the surfaces and cavities of fossil corals from a Holocene reef sediment core drilled on an offshore coral reef of Okinawa Island, the Ryukyu Archipelago (Ryukyus). The RMC-like crusts found in the Ryukyus mainly consist of high-Mg calcite, and contain bioclasts and siliciclastics, but traces of microorganisms that are likely involved in the formation have not yet been observed. Therefore, we aim to observe the microstructure, to find the traces of microorganisms in the RMC-like crusts, and to elucidate their formation processes.

Samples containing the RMC-like crusts were obtained from a Holocene reef sediments core (total length: 8.0 m) drilled at the Naha new port pier (Okinawa, Japan). The depositional age of the core is ca. 7540 to 7350 cal yr BP for fossil corals at a core depth of 7.5 to 6.5 m, and ca. 7000 to 6760 cal yr BP for fossil corals at a core depth of 4.0 m. Five slab samples, in which the RMC-like crusts were observed, were selected from the core, and two cuboid samples (long axis: 25 to 30 mm, short axis: 5 mm) were cut from each slab. The cuboid samples were immersed in 5% H_2O_2 and cleaned ultrasonically in Milli-Q water (a cross-section surface sample). In addition, the surface was impregnated with epoxy resin under a vacuum condition, polished and etched superficially in 5% HCl for 30 seconds (an etched surface sample). Surface microstructure and traces of microorganisms in the RMC-like crusts were observed on both cross-section and etched surface samples using scanning electron microscope (SEM). Element composition analysis (qualitative spot analysis) was carried out using energy dispersive X-ray spectroscopy (EDX) to examine elemental components of crystals and particles.

Observations of the cross-section surfaces confirmed aggregates of aligned and lumpy pores on the surfaces of RMC-like crusts. Peloidal microcrystalline aggregates with a diameter of approximately 20 to 100 μm were observed in the pores of RMC-like crusts and fossil corals. Bioclasts (e.g. coral and shell fragments) and siliciclastics (e.g. quartz and potassium feldspar) were observed in the peloidal microcrystalline aggregates. The following four kinds of carbonate crystals were observed in the aggregates: high-Mg calcite of braded and “rice-grain” shapes, high-Mg calcite with Al and Si in “ash-like” appearance, and acicular aragonite. Observations of the etched surfaces also confirmed laminated and clotted casts of pores in RMC-like crusts, and clotted masses developed in the cavities of coral skeletons. Casts of bioclasts and remnants of siliciclastics were observed in the laminated and clotted casts. Tubular microbioerosion traces with a diameter of about 2 to 5 μm were also observed in the laminated and clotted casts.

These observations showed the presence of both laminated stromatolite-like parts and a clotted thrombolite-like parts in the RMC-like crusts from the Ryukyus. In addition, peloidal microcrystalline aggregates and microbioerosion traces similar to those produced by cyanobacteria were observed in the interior and in the vicinity of RMC-like crusts. Therefore, we confirmed that carbonate crusts found in the Ryukyus are RMCs. RMCs from the Ryukyus are likely formed by irregular accumulations of two parts: a dense part where bioclasts and siliciclastics has been trapped by high-Mg calcite cements induced by microbial community, and a pore part where bioclasts associated with microbioerosion and peloidal microcrystalline aggregates are observed.