グリーンランド北西部におけるクリオコナイトの形成過程による微生物種の変動

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Microbial composition changes in cryoconite formation process in Northwestern Greenland

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On the glacier surface, psychrophilic microorganisms forms brown-black color small (1mm diameter) granule called cryoconite. From microscopic observation, main structures of cryoconite are formed by filamentous cyanobacteria aggregation and these keep organic material, other microorganisms and mineral particles. Cryoconite are widely distributed on the ablation area of glacier and ice sheet in various parts of the world, and reduce the albedo and accelerate the melting of ice surface. Despite of importance of cryoconite for glacial melting effect, microbiological formation process of cryoconite is not well understand. Therefore, in order to understand microbial diversity changes during formation process, we compared microbial diversities in 8 different size of cryoconite.

In July 2011, on the middle of Qaanaaq Glacier located in Northeastern parts of Greenland, we collected the cryoconite distributed on the surface of glacier. We sorted cryoconite by each sizes (Size 1: 30-100 μm, Size 2: 100-250 μm, Size 3: 250-500 μm, Size 4: 500-750 μm, Size 5: 750-1000 μm, Size 6: over 1000 μm) using niron mesh filter and by tweezers (approximately diameter 1000 μm and 2000 μm). By stereoscopic microscopic observation, all larger diameter cryoconite (Size 3-6) are coated by black organic materials, otherwise half of size 2 and most of size 1 is non-organic attached mineral particles. Therefore, size 1 could be recognized as primary stage of microorganisms growth. Clones of eukaryotic 18S rRNA are classified into algae, cercozoa, fungi, tardingrade. Through all sizes, Raphidonema nivale which snow living green algae and ameba belonging into family: Vampyrellidae are detected. Diversity index increase with cryoconite size increase show that diversified eukaryote live in large sized and mature cryoconite. In lager cryoconite than size 3, many types of ameba and fungi are detected. Usually ameba eat the bacteria and other small microorganisms, and fungi decompose organic materials, therefore larger sized cryoconite become much hetertrophic. Result of bacterial 16S rRNA show that cyanobacteria related to Phormidium pristleyi known as filamentous species are detected in all sizes. Because main structure of cryoconite is composed by filamentous cyanobacteria, this species would be essential for thickening growth around the surface. Otherwise, in lager than size 3, no other bacteria can not be detected due to large amount of cyanobacterial DNA included in samples. In size 1, more than half of total clones are retrieved from glacier environment. Dominant clone is Acidobacterium which reported in Gulkana Glacier in Alaska, however this uncultured clone is genetically far from isolated species and we can not characterize these. Otherwise, one OTU (4 clones) is closely related to genus Deinococcus. Deinococcus is well-known species have tolerance of UV, radioactive ray and desiccation. Because cryoconite are exposed under strong UV and freeze-chew effect, Deinococcus can survive these harsh environment.