氷河生態系における窒素循環に関わる微生物の生態解析

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The nitrogen cycle in cryoconites: naturally occurring nitrification-denitrification granules on a glacier

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Cryoconites are microbial aggregates commonly found on glacier surfaces, where they tend to take spherical, granular forms. While it has been postulated that the microbes in cryoconite granules play an important role in glacier ecosystems, information on their community structure is still limited and their functions remain unclear. Here, we present evidence for the occurrence of nitrogen cycling in cryoconite granules on a glacier in Central Asia. We detected marker genes for nitrogen fixation, nitrification, and denitrification in cryoconite granules by digital PCR, while digital RT-PCR analysis revealed that only marker genes for nitrification and denitrification were abundantly transcribed. Analysis of isotope ratios also indicated the occurrence of nitrification; nitrate in the meltwater on the glacier surface was of biological origin, while nitrate in the snow was of atmospheric origin. The predominant nitrifiers on this glacier belonged to the order *Nitrosomonadales*, as suggested by *amoA* sequences and 16S rRNA pyrosequencing analysis. Our results suggest that the intense carbon and nitrogen cycles by nitrifiers, denitrifiers, and cyanobacteria support abundant and active microbes on the Asian glacier (Fig.1).

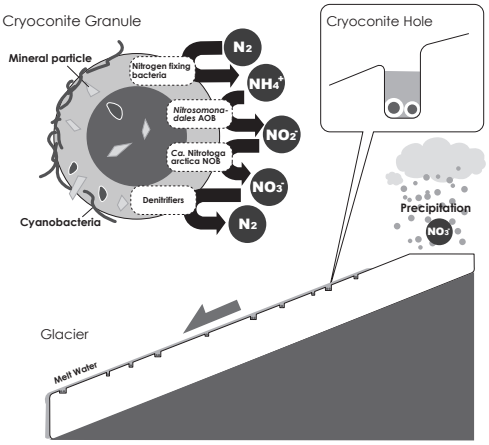

Figure 1.　Schematic diagram of the nitrogen cycle in supraglacial cryoconite granules as inferred by gene potential.
Nitrogen compounds supplied chiefly by snow precipitation and wind are metabolized to nitrite, nitrate, NO, N_2O, or N_2, by nitrification and denitrification that occurs in the supraglacial cryoconite granules.