# Microbial Diversity in Cryoconite Holes and Dispersed Cryoconite Revealed Through Culture-Dependent and Independent Approaches

Lars G. van Dijk, Lea Ellegaard-Jensen, Alexandre M. Anesio, Carsten Suhr Jacobsen

AARHUS UNIVERSITY

## Background & Relevance

- **Cryoconite** are dark organic-inorganic aggregates colonized by microorganisms that lower surface albedo on glaciers and ice sheets and serve as hotspots of microbial diversity and biogeochemical cycling
- Dispersed across the surface, cryoconite causes localized melting that can give rise to water-filled **cryoconite holes**
- **Dispersed cryoconite** acts as both a precursor and transitional phase in the ”life -cycle” of cryoconite holes, which can collapse and reform repeatedly throughout the melt season.
- Cryoconite holes provide stable sheltered habitats for microbial life to thrive, while dispersed cryoconite remains exposed to harsher conditions (high solar irradiance, desiccation, freeze-thaw cycles)

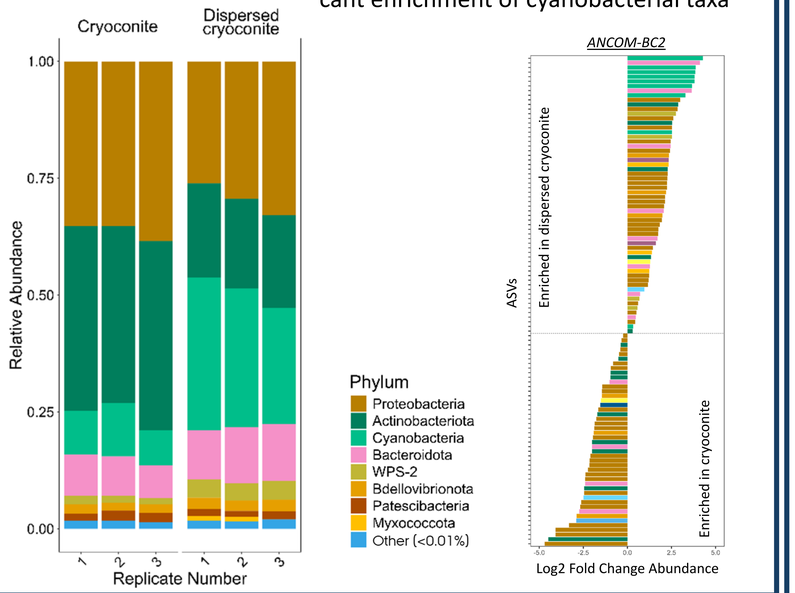
## Research question

*Since dispersed cryoconite is exposed to harsher conditions than material sheltered in holes:*

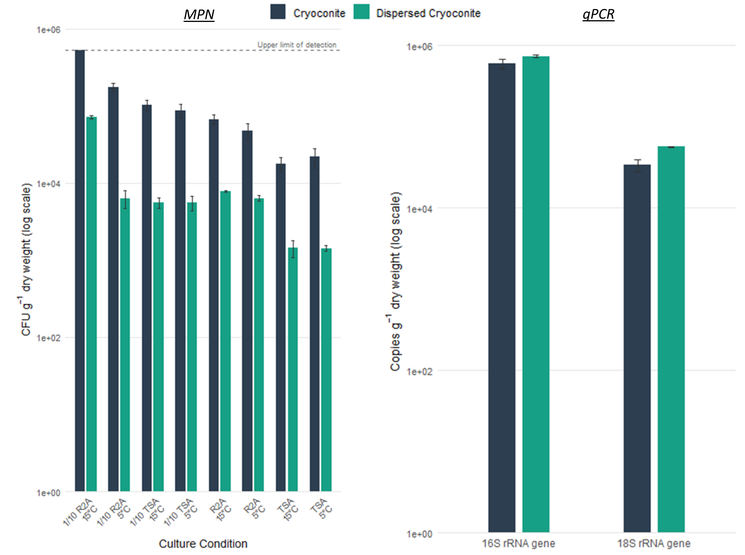
How do bacterial community structure, composition, and culturability differ between cryoconite from cryoconite holes and dispersed cryoconite on the **western margin of the Greenland Ice Sheet**?

## Results

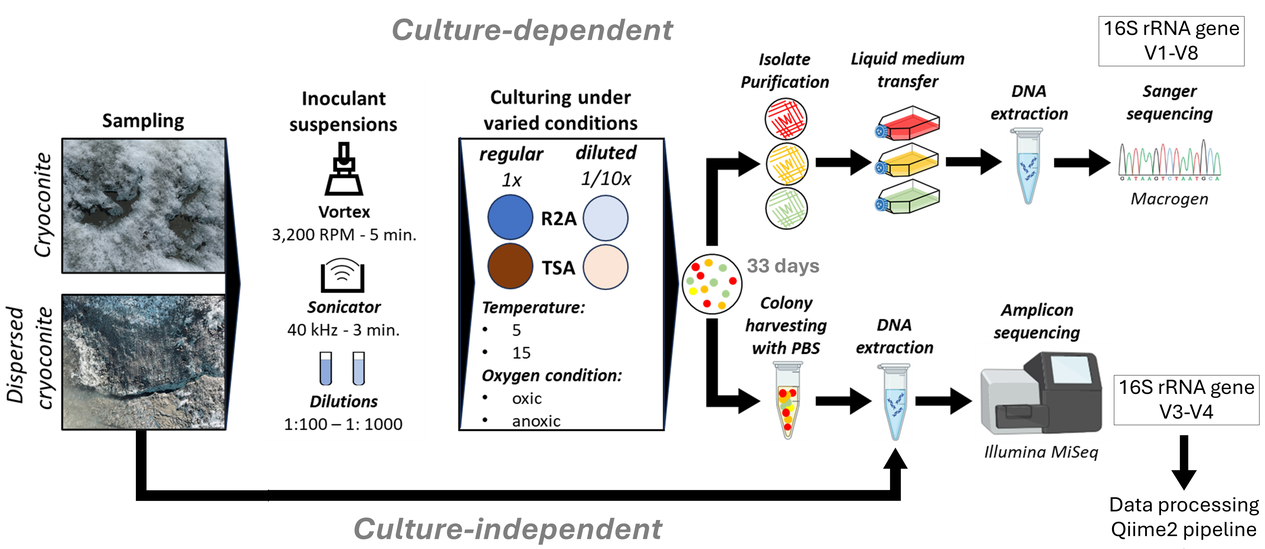
**Box 1)** Dispersed cryoconite shows higher bacterial diversity and significant enrichment of cyanobacterial taxa




**Box 2)** Dispersed cryoconite harbors significantly fewer viable heterotrophs despite similar 16S rRNA gene abundances

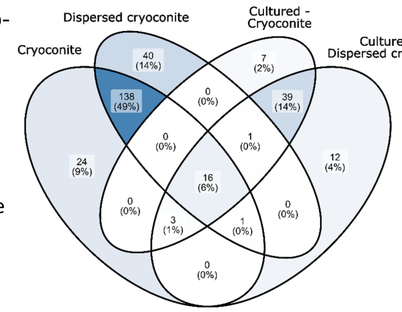



## Methods




**Box 3)** Cultivation recovers a largely shared ASV pool from both cryoconite holes and dispersed cryoconite, with only a few unique taxa

- Richness captured: cryoconite cultures = 12.3 %; dispersed cryoconite cultures = 10.1 %
- Community coverage: cultured ASVs account for 40.9 ± 2.6 % of 16S sequence reads in cryoconite and 20.1 ± 2.4 % in dispersed cryoconite




## Future outlook

- **Pollutant-carbon utilization assays:** Use heterotrophic bacterial isolates obtained in this study to assess how anthropogenic pollutants affect their carbon utilization patterns
- **Pesticide exposure microcosms:** Evaluate mineralization potential and community-level responses to pesticide exposures in cryoconite from the remote western Greenland Ice Sheet versus the more anthropogenically influenced Forni Glacier (Italian Alps).

Contact information:
*Lars Gerrie van Dijk* lvd@envs.au.dk
*Carsten Suhr Jacobsen* csj@envs.au.dk
*Alexandre M. Anesio* ama@envs.au.dk

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