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The Ecology of Antarctic Blue Ice: The BIOICE Project

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This poster describes new studies into the microbial ecosystems found in Blue Ice Areas (BIA) around the periphery of the Antarctic Ice Sheet. These habitats are located on the Antarctic fringe, often at high elevation, and therefore represent the first opportunity for cells entombed in old glacier ice advected from Antarctic interior, to be revived by the increased availability of solar radiation (blue ice) and water (subsurface melt).

Our study is the first to consider how two different types of BIA host two different habitats; those associated with nunataks or mountain ranges, and those associated with ice surfaces only. The difference between them is the availability of debris and water for microbial processes. In the former scenario, debris is blown onto the blue ice from local sources to provide a source of both microorganisms and energy. In the latter case, the lack of an external debris source is compensated by the possibility subsurface melting due to the optical properties of blue ice. In these systems a far greater proportion of the cells are liberated from ancient glacier ice.

To explore these overlooked ecosystems, we visited high elevation (c.1200m) BIAs in Dronning Maud Land, near Troll Research Station. Our expedition during Antarctic summer season 2019-2020 yielded microbial and biogeochemical data from both debris-free and debris-rich BIAs, as well as shallow glacier ice cores of different ages. In addition, we explored a variety of cryoconite holes entombed within the above BIAs.

Our results show that BIA ecosystems are characterized by tremendous heterogeneity between their cryoconite holes. While some show signs of photosynthesis, others are dominated by bacterial production. Furthermore, optical properties of the BIA and physical properties of the ice itself (fracturing) control subsurface meltwater production and water movement, influencing the sub-ice ecosystems and their biogeochemistry. The poster will present how we are exploring the revival of these ice bound organisms on their way from the Antarctic Ice Sheet interior towards the coast.

