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Università degli Studi di Napoli "Parthenope"
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Topic: Ocean-ice-atmosphere interactions

Natalie Robinson

ABSTRACT Subject :

A novel system for quantitative sampling of sub-ice platelet layers

Abstract 30/01/2023 04:47:16

Hidden beneath the sea ice of Antarctica's coastline exists a fragile, and ephemeral habitat which is thought to play a key role in underpinning the marine food web. Near the front of large ice shelves, outflowing seawater containing meltwater from deep beneath the ice shelf can become 'supercooled' – i.e., colder than the ambient freezing temperature. This supports the development of 'sub-ice platelet layers' (SIPLs) – accumulations of ice discs, each 2-5 mm thick, that buoyantly rise through the water column until they come to rest against the base of the sea ice. The discs coalesce to form an intricate 3-dimensional ice matrix that may extend several metres into the upper ocean, with seawater filling the interstitial spaces. The result is a quiescent and protective marine habitat that harbours some of the highest concentrations of primary productivity on Earth, but whose viability may be threatened by subtle climate shifts. In-situ, and while the interstices remain filled with ocean water, the 3-dimensional SIPL structure can be reasonably robust. However, when samples of the SIPL are extracted, and the interstitial fluid drains away to be replaced by air, the structure becomes very delicate and may disintegrate rapidly. Hence, until very recently, qualitative analysis of the integrated SIPL system – comprising the ice structure itself, the interstitial fluid, and any associated biology – has not been possible. Here we describe the development, testing, and initial deployment of a new, bespoke-engineered system for coring the SIPL. The system sequentially extracts segments of the SIPL without destroying the structure or disassociating the ice from the interstitial fluid or incorporated biology. The samples can then be analysed for ice/water fraction, physical characteristics, or biological assemblage, each of which can be related to the environmental setting. Ultimately, the system will be used to inform assessment of the Ross Sea ecosystem's susceptibility to change as determined by the vulnerability of the unique SIPL habitat.