Geophysical characterisation of Subglacial Lake Ellsworth, West Antarctica

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Subglacial Lake Ellsworth (SLE) is believed to represent the most appropriate target for direct sampling of a subglacial lake in West Antarctica. A comprehensive geophysical characterisation of SLE and its surrounding subglacial environments has recently been undertaken, with a core objective identifying the best location for direct measurement and sampling of the lake waters and underlying sediments.

Radar-derived basal topographic data show that SLE is located within one of a series of deep, fjord-like valleys at the margin of the Ellsworth Subglacial Highlands. At 3-3.25 km beneath the ice surface, SLE is 11.9 km long, is 3 km wide at its maximum point and has a surface area of approximately 21.5 m^2. A potential overspill channel for water draining from the downstream end of SLE has been identified in one radar profile. This low-lying gap in the topography may provide a subglacial hydrological pathway from SLE to a second lake downstream.

The geometry of the SLE water cavity has been established from five seismic reflection profiles, all orientated perpendicular to the long axis of the lake. The aims of the seismic surveys were to determine the lake bathymetry and to give some indication of both the physical conditions within the lake, and the nature and structure of any sediments at the lake floor. The seismic data confirm that SLE is a substantial water-body, with a maximum water column thickness of 155 m. These data have been combined with radar measurements of ice thickness and used to constrain 3D models of the lake's ice-water interface and the bed of the lake. Analysis of the seismic data suggests that the lake floor is characterised by high-porosity, low-density sediments indicative of accumulation in a low-energy depositional setting. The evidence for a deep water-body, underlain by a sedimentary package, confirms that SLE is an ideal candidate for direct measurement and sampling.