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Basal melting over Subglacial Lake Ellsworth and its catchment: insights from englacial layering

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Deep-water 'stable' subglacial lakes likely contain microbial life adapted in isolation to extreme environmental conditions. How water is supplied into a subglacial lake, and how water outflows, is important for understanding these conditions. Isochronal radio-echo layers have been used to infer where melting occurs above Lake Vostok and Lake Concordia in East Antarctica but have not been used more widely. We examine englacial layers above and around Lake Ellsworth, West Antarctica, to establish where the ice sheet is 'drawn down' towards the bed and, thus, experiences melting. Layer drawdown is focused over and around the NW parts of the lake as ice, flowing obliquely to the lake axis, becomes afloat. Drawdown can be explained by a combination of basal melting and the Weertman effect, at the transition from grounded to floating ice. We evaluate the importance of these processes on englacial layering over Lake Ellsworth and discuss implications for water circulation and sediment deposition. We report evidence of a second subglacial lake near the head of the hydrological catchment and present a new high-resolution bed DEM and hydropotential model of the lake outlet zone. These observations provide insight into the connectivity between Lake Ellsworth and the wider subglacial hydrological system.