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Glaciohydraulic supercooling is an important glaciological process which potentially has significant implications for ice sheet dynamics and geomorphology. It occurs as basal water ascends from an overdeepening at/or below the pressure melting point and consequently freezes. The extent to which supercooling has contributed to basal ice formation has been debated for over 20-years, with some glaciologists suggesting it is the primary mechanism for basal ice formation, whilst others have argued it is only one of several mechanisms.

Past research has suggested that supercooled glacial ice plays an important role in both ancient and modern glacier dynamics, having been associated with the entrainment of subglacial debris, as shown during Heinrich Events. Recent research suggests that supercooling may have been responsible for basal freeze-on, and has been associated with the slowdown of ice streams, namely Kamb Ice Stream, Antarctica. However, a definitive isotopic signature to identify supercooled glacial ice and the extent to which the isotopic composition differs when compared to the parent water source, remains unknown. This project aims to determine whether ice formed from supercooling has variable water isotope signatures when sampled at micro and macro scales.

Here we will present new results of laboratory experiments where ice formed from supercooling is grown under ideal conditions, and analysed in detail for variations in δ18O and δD across its distinctive herringbone crystal structure. We will also identify whether there is a significant amount of isotopic enrichment, as suggested by previous work. Thin sections of ice formed from supercooling will be created to identify the crystallographic structure, whilst bulk and micro samples will be taken to identify possible isotopic discrepancies at a finer resolution, an aspect which could have been overlooked in large-scale sampling. This will demonstrate whether different scales have contrasting isotopic signatures and will assist glaciologists to identify supercooling and the geomorphological significance can be quantified.