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CONSTRAINING THE TIMING OF FENNOSCANDIAN ICE SHEET GLACIATION(S) ON THE KOLA PENINSULA, NORTHWEST ARCTIC RUSSIA

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Background and Rationale

A key unresolved question is the timing of Fennoscandian Ice Sheet (FIS) glaciation on the Kola Peninsula, northwest Arctic Russia (Figure 1) during the Late Weichselian (c. 40-10 ka). Sedimentary exposures in the study area reveal glaciotectonised glaciofluvial sediments, some of which are overlain by till deposits (Lavrova, 1960; Svendsen *et al.*, 2004; Boyes *et al.*, 2021). This documents either (i) initial ice sheet advance or (ii) sustained readvances of the ice margin during deglaciation on the peninsula. Current chronological evidence of these ice sheet advance/readvance events is scarce (Boyes *et al.*, 2021; Boyes *et al.*, 2023a), leading to uncertainty and variability in previous reconstructions (Hughes *et al.*, 2016; Stroeven *et al.*, 2016; Boyes *et al.*, 2021; Boyes *et al.*, 2023a).

In summer 2019, we visited 10 sedimentary exposures along two west-east transects on the Kola Peninsula (Figure 1) to scrutinise glacial sediments and collect samples for optically stimulated luminescence (OSL) dating. We hypothesise that the glacial sediments examined in this study document initial ice sheet advance on the Kola Peninsula and subsequent retreat/readvance phases of the last FIS. The aim of this work was to establish the timing of deposition of the sampled lithofacies to better constrain the timing of ice sheet advance and readvance phases in the study area.

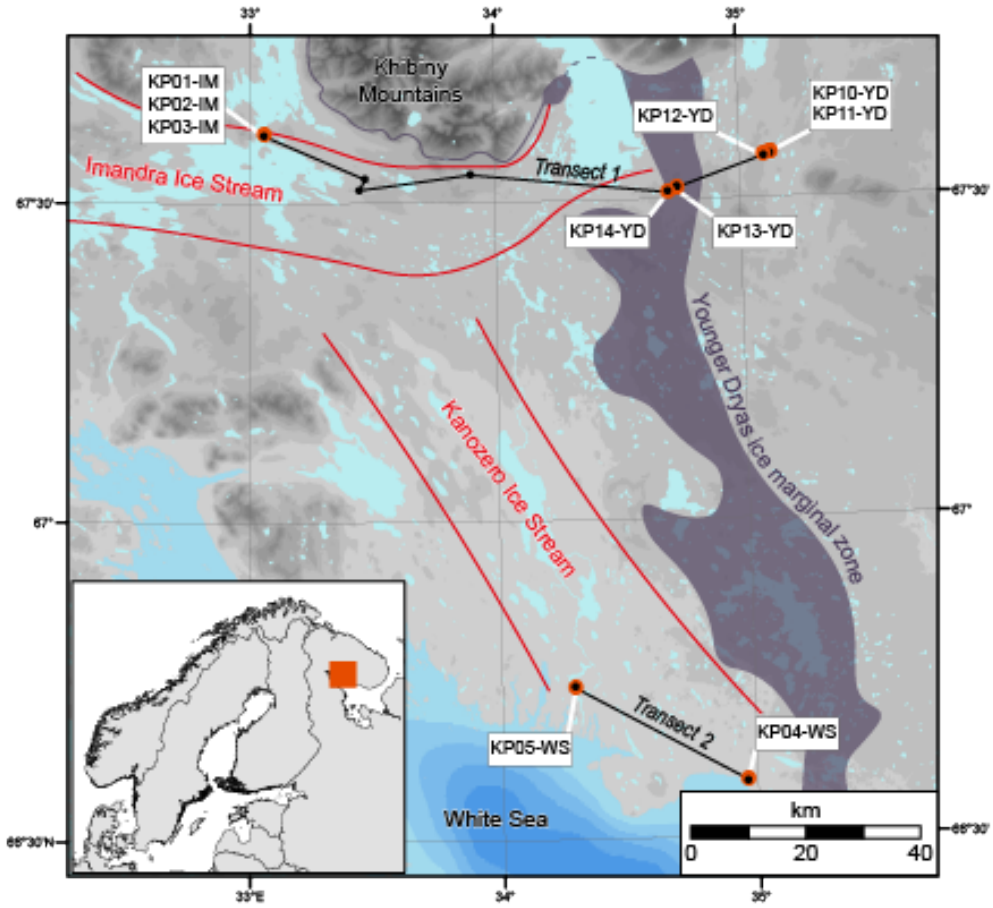

Figure 1. Location of the OSL samples on the Kola Peninsula, northwest Arctic Russia. The last FIS advanced west-east across the Kola Peninsula: the positions of the Imandra and Kanozero Ice Streams (Boyes *et al.*, 2023b) and the Younger Dryas ice marginal zone (Boyes *et al.*, 2023a) are shown. Sedimentary exposures and OSL samples were recorded and collected along two transects in the study area that aimed to capture the timing of ice sheet advance and/or readvance in this palaeo-glaciologically complex region.

Preliminary results and significance

For the purpose of this short summary, we focus on reporting the OSL dates returned from samples collected from the Kola Peninsula during fieldwork in summer 2019. The study area (Figure 1) is palaeo-glaciologically complex (Boyes *et al.*, 2023a,b), with sedimentary and geomorphological evidence of (i) west-east ice sheet advance across the peninsula, (ii) ice streaming and ice stream reconfiguration during deglaciation, and (iii) readvance and/or standstill of the ice margin during the Younger Dryas stadial (c. 12 ka). Transect 1 follows the flow direction of the Imandra Ice Stream and crosses the Younger Dryas ice marginal zone, with the aim of understanding glaciodynamics of these palaeo-glaciological events. Transect 2 is parallel to the White Sea coastline, where the Kanozero Ice Stream is thought to have interacted with the White Sea Ice Stream.

The key messages from these OSL ages are:

- Along Transect 1, OSL dates of glaciotectonised glaciofluvial outwash sediments situated directly beneath glacial diamicton (interpreted as subglacial traction tills) from three sites (KP03-IM, KP13-YD, and KP14-YD) indicate ice sheet advance c. 30-23 ka.
- On the White Sea coastline (Transect 2), OSL ages (KP04-WS and KP05-WS) of glaciofluvial outwash sediments situated directly beneath glacial diamicton (likely melt-out or glaciolacustrine till) are indicative of ice sheet advance c. 30-26 ka on the southern Kola Peninsula.
- Other OSL dates from the region do not correspond to the last glaciation and instead may be used to constrain past glaciations. Ages (KP01-IM and KP02-IM) from a 10 m section of interbedded glaciofluvial outwash sediments indicate deposition c. 96 ka and c. 74 ka, suggesting there may have been glacial activity in the region during MIS-5 and MIS-4. Similarly, OSL dates (KP10-YD and KP11-YD) of glaciotectonised glaciofluvial outwash sediments within a morainic ridge indicate deposition of the lithofacies c. 133-115 ka. Although this would suggest glacial activity during MIS-5, the relative age of the morainic ridge is more likely the last deglaciation. Finally, an OSL age (KP12-YD) of a glaciotectonised glaciofluvial outwash lithofacies situated between two glacial diamicton lithofacies suggests deposition c. 70 ka, suggesting that the lower till deposit may be associated with MIS-4 glaciation.

The preliminary results presented here provide an insight into the complex glacial history of the Kola Peninsula during the Quaternary. Significantly, OSL dating does not only provide constraints on the timing of initial ice sheet advance during the last glaciation but also during previous glaciations. This is perhaps not unexpected; the Kola Peninsula has been glaciated by successive glaciations during the Quaternary. Therefore, the OSL dates returned in this study will have implications for constraining the timing and ice sheet dynamics of multiple Quaternary glaciations on the Kola Peninsula.

Acknowledgements

The author would like to thank the QRA not only for provision of the New Research Workers' Award, but also for their flexibility in redirecting funds to an alternative research focus that was necessitated by COVID-19 pandemic restrictions. Thanks must also go to the British Society for Geomorphology for their provision of the University of Liverpool-BSG Luminescence Dating Award, which supported the costs of the OSL dating, and to INTERACT (grant numbers 262693 and 730938) for fieldwork support. Special thanks are given to Andrey Vashkov, Olga Nosova, Vasili Kolka, and many other colleagues at the Kola Science Centre of the Russian Academy of Sciences, without whom collection of these samples would not have been possible. This work was undertaken while BMB was in receipt of a University of Brighton PhD Studentship.

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