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Fennoscandian Ice Sheet glaciation in northwest Arctic Russia during the Last Glacial-Interglacial Transition

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Previous attempts to reconstruct the glacial history of the last Fennoscandian Ice sheet (FIS) in northwest Arctic Russia have resulted in various Last Glacial-Interglacial Transition (c. 20-10 ka) scenarios, suggesting that the Kola Peninsula was glaciated by the FIS, the Ponoy Ice Cap, or the Kara Sea Ice Sheet. The conflicting glacial interpretations have stemmed, in part, from the use of low-resolution geomorphological and geological maps. The advent of high-resolution remotely-sensed imagery warrants a new glacial reconstruction of ice sheet dynamics in northwest Arctic Russia: we therefore present initial glacial interpretations based on new high-resolution geomorphological mapping.

Geomorphological mapping using high-resolution ArcticDEM and PlanetScope imagery has identified >245,000 glacial landforms, significantly increasing the volume and detail of geomorphological data in the region. Over 66,000 subglacial bedforms (subglacial lineations and subglacial ribs) are used to construct flowsets, which demonstrate that ice flowed from the Scandinavian mountains in the west and across the shield terrain of the Kola Peninsula. Moreover, four possible palaeo-ice streams are identified in the region. Mapping individual moraine hummocks, rather than hummocky moraine spreads as in previous mapping attempts, reveals multiple ice margins across the Kola Peninsula. A noteworthy ~25 km wide belt of hummocky moraines aligned north-south across the Kola Peninsula is tentatively attributed to the Younger Dryas (c. 12.8-11.9 ka) ice marginal zone. The so-called “ring-and-ridge” hummock moraines that are predominantly observed within this ice marginal zone suggest down-wasting and stagnant ice margins. The meltwater landform record also reveals subglacial channel networks along the northern coastline that suggest warm-based conditions of the ice sheet may have been induced by warm currents in the Barents Sea during the last glacial-interglacial transition.

This research will provide crucial empirical data for validating numerical model simulations of the FIS, which in turn will further our understanding of ice sheet dynamics in other Arctic, Antarctic, and Alpine regions.