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A short-lived aeolian event during the Early Holocene in southern Norway

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The Starmoen dune field in southern Norway was formed during a single, brief phase of aeolian activity right after the last deglaciation, ~11-10 ka ago, as shown by tightly clustered quartz OSL ages and non-migrating dunes with few discordances. Luminescence characteristics depend on sediment type, and incomplete bleaching causes age overestimation for glacifluvial deposits.

Geology

Crescentic dunes and dune heaps at Starmoen on the Jømna valley for most of one of Norway’s largest dune fields. The dunes overlie glacifluvial sediments, deposited during the last deglaciation.

Successively steeper beds indicates in-place build-up from a low heap to a dune, rather than a dune that has migrated to its present position, as seen in this example of a ground penetrating radar (GPR) profile across a dune at Starmoen 3. This suggests that the dune-forming phase was short and did not allow for much migration.

Few discordances are found in both GPR profiles and open sections, as shown above and right. This supports a single aeolian episode with minor reworking.

Aeolian and glacifluvial sediments may be sedimentologically very similar, but are distinctly different in their luminescence characteristics. Below are examples of finely laminated aeolian and glacifluvial deposits from Starmoen 3 and Hornmoen bruk, respectively.

IR-tests and preheat plateau tests show that the aeolian samples have no feldspar contamination (mean IR/Bl ratio 2%) and could be analysed with preheat cut at 20°C/160°C, while most glacifluvial samples suffered from feldspar contamination (IR/Bl 10-34%) and needed preheat cut at 22°C/200°C or 180°C/160°C.

Chronology

Quartz OSL ages were determined from the 180-250 μm fraction of 14 samples at the Lund Luminescence Labaratory, Sweden. Both large and small aliquots were measured, using sample-adapted SAR-protocols on a Risø TL/OSL reader DA-20.

A modern analogue, a small dune forming at a sand pit, shows that the aeolian sand is bleached and can give accurate ages.

A fast component dominates the signal, as shown above in comparison with Risø calibration quartz, although the Starmoen quartz is not very bright. The luminescence response to dose continues to grow until ~200 Gy (D ~55 Gy).

Small aliquots show that aeolian samples from Jømna have broad dose distributions and apparent age overestimations, while samples from Starmoen have the expected narrow dose distributions and stratigraphically consistent ages.

Incomplete bleaching of glacifluvial sediments is suggested by broad and skewed small-aliquot dose distributions. Minimum age model (MAM-3) ages yield younger ages than the mean, but still older than expected from the regional deglaciation history and are based on very few aliquots (low p-value).