

QRA UNDERGRADUATE DISSERTATION PRIZE 2023

It is our great pleasure to announce that the joint winners of this year's QRA Dissertation Prize are Jemima Lane (University of Oxford) for her dissertation on "*Insights into the luminescence chronology of a linear dune from the Thar Desert, India, and its implications for regional paleoenvironmental reconstructions*", and William Spicer (University of St. Andrews) for his dissertation on "*Reconstruction and palaeoclimatic implications of Younger Dryas glaciation in the Southeast Grampians, Scotland*".

The judges commend the very impressive quality of work. It was a pleasure to read all the dissertations that were submitted for the award and the broad scope of the topics and skills employed indicate the health of Quaternary research in Britain. Topics included glaciology, palaeoecology, palaeolimnology and geochemistry. With such high-quality work, it proved impossible to identify a single winner, so we are pleased to award the QRA dissertation prize jointly to Jemima and William.

Jemima Lane's dissertation, entitled *Insights into the luminescence chronology of a linear dune from the Thar Desert, India, and its implications for regional paleoenvironmental reconstructions*, demonstrated a comprehensive grasp of analytical techniques and sedimentary processes, presented using a fluent, concise and mature writing style. The critical evaluation of chronology, synthesis of sedimentation rates and effort to integrate complementary evidence from other proxies indicate her understanding of the evidence and its contribution to existing knowledge. The work was all the more impressive in that Jemima was working on material collected by others and she therefore did not have a chance to observe firsthand the context or wider desert mosaic that she has very ably written about.

William Spicer's dissertation, on *Reconstruction and palaeoclimatic implications of Younger Dryas glaciation in the Southeast Grampians, Scotland*, demonstrated a strong ability to connect local evidence to broader processes and models, using an impressive combination of detailed mapping, modelling and

palaeoclimate inference. The mapping (based on remote sensing and fieldwork) and the writing were clear and succinct, presented in a manner that explained the details very effectively for an informed but non-expert audience. William used these lines of evidence alongside other published proxies to reconstruct potential precipitation gradients across Scotland, thus demonstrating his ability to not only generate and present new evidence to a high standard, but to also use this to extend our understanding of palaeoclimate variability.

Judges:

Althea Davies

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Insights into the luminescence chronology of a linear dune from the Thar Desert, India, and its implications for regional paleoenvironmental reconstructions

Arid landscapes constitute a dominant proportion of Earth's landmass and support an increasingly large population. Understanding how these drylands interact with both anthropogenic forces and environmental fluctuations is necessary to explain how such landscapes form and how they may change in the future. We can understand the relationship between arid landscapes and climatic conditions through paleo-reconstructions that link environmental fluctuations with geomorphological responses. The Thar desert in northwest India is a rich repository of paleoclimatic information in the form of proxy records which can be interpreted through sedimentological and statistical analysis. One such form of analysis is luminescence dating, which can be used to date sediment deposition in sand dunes. Luminescence chronologies reveal limited contextual information but can be incorporated within multi-proxy frameworks of paleoenvironmental change to evidence linkages between desert morphology and climatic forcing. This project carried out sedimentological analysis and optically stimulated luminescence (OSL) dating on a linear dune in the northeastern Thar desert (adjacent to the city of Lunkaransar) to produce a robust and repeatable chronology. This chronology was then compared with nearby dune records and accumulation intensity models to clarify and verify the linear dune's accumulation history. This history was considered alongside multi-proxy records of Thar climatic change to investigate Holocene conditions in the desert. OSL ages reveal five distinct points of accumulation throughout the Holocene which are aligned with early Holocene and late Holocene accumulation phases and a weakening in accumulation in the middle Holocene. This timeline corresponds with the sediment record at the adjacent Lunkaransar paleolake and reinforces multi-proxy evidence of a relationship between the Indian Summer Monsoon (ISM), aridity, and Holocene dune accumulation in the Thar desert.

Jemima Lane
University of Oxford

Reconstruction and palaeoclimatic implications of Younger Dryas glaciation in the Southeast Grampians, Scotland

Glacial landform evidence provides an excellent opportunity to reconstruct past glaciers and climates. Scotland's distinct and well-preserved geomorphological signature associated with Younger Dryas (12.9-11.7 ka BP) glaciers has received considerable research attention and provided detailed reconstructions of glaciers and climate. However, several areas remain where glaciation remains speculative or poorly constrained. The southeast Grampians is one area largely absent from recent research and has benefitted from a much-needed re-evaluation in this study.

This dissertation presents the results of a highly detailed geomorphological assessment of the southeast Grampians. The detail of the mapping effort, combined with ice surface profile modelling, provides evidence for the reconstruction of a ~55 km² plateau icefield and surrounding valley and corrie glaciers. The findings contest the previous understanding of an alpine style of glaciation and present evidence for a polythermal icefield centred on the Mounth Plateau. Given the change in the style of glaciation, palaeoclimatic variables are updated using the reconstructed Mounth Icefield. An equilibrium line altitude of 738 m and a precipitation value at sea-level of 845 ± 150 mm a⁻¹ are calculated here to suggest that the climate of the southeast Grampians was ~21% drier than present. Palaeoclimatic variables are used to re-evaluate previously inferred climatic gradients across Scotland and support a strong west-east precipitation gradient during the Younger Dryas.

Overall, the study has thoroughly re-assessed the geomorphological evidence in the southeast Grampians and produced results more consistent with our current understandings of glaciation and climate in Britain during the Younger Dryas.

William Spicer
University of St Andrews