Quaternary Newsletter
Report
QRA Quaternary Research Association

2023 QRA ANNUAL DISCUSSION MEETING APPLICATIONS OF QUATERNARY GEOSCIENCE TO ENGINEERING: PROCESS, PROPERTIES & BEHAVIOUR

Joint meeting convened by the QRA Engineering Geology Research Group and the Engineering Group of the Geological Society (EGGS) 5th-6th January 2023

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Following the announcement of a rail strike, the 2023 Quaternary Research Association Annual Discussion Meeting (ADM) was reluctantly held online for the third year running. The event was held on the 5th to 6th January and co-convened by the QRA Engineering Group and Engineering Group of the Geological Society. This year's topic was 'Applications of Quaternary Geoscience to Engineering: Process, Properties and Behaviour', with the following themes addressed over the two days through keynotes, short talks, posters and small group discussion sessions:

- Quaternary geoscience supporting the low carbon economy
- Engineering in glacial and periglacial sequences
- Significance of river terraces and uplift to engineering and geoarchaeology
- Climate change, sea-level and coastal processes.

200 people registered for the event and around 100 attended each session. Around 60% of attendees were from industry, representing engineering geology, engineering geomorphology, ground investigation and nuclear waste management sectors.

The conference opened with a welcome talk by the President of the Geological Society **Ruth Allington**. The first session (Engineering in glacial and periglacial sequences) began with a keynote presentation by **Dame Sarah Springman** (University of Oxford) discussing how geotechnical investigations, analysis and modelling can be used to enhance understanding of alpine rock glaciers, based on work undertaken by her team on three periglacial sites in Switzerland. Following this, **Tom Morgan** (Geotechnical Consulting Group) shared insights into geohazards posed by relict periglacial shears with a case study from HS2. Next, **Benjamin Bellwald** (Norwegian Geotechnical Institute) discussed recent work on the structure of deeply-buried hill-hole pairs in the SW Barents Sea that were imaged using high-resolution 3D seismic data. **Jon Merritt** (British Geological Survey) then presented a paper describing the long history of study of the complex sequence of Quaternary deposits in West Cumbria, and shared insights from his work in the region since the 1990s NIREX study. This was followed by **Mark Coughlan** (University College Dublin), who described the I-MORE project that seeks to map and geotechnically characterise the glacial and post-glacial geomorphological deposits in the North Irish Sea to aid identification of units that may pose geotechnical risk to the development of offshore wind. **Sinead Birks** (Imperial College London) and **Amber Pavey** (Jacobs) continued the West Cumbria theme and co-presented an updated glacial geomorphological map of the region that demonstrates the complexity of this ice-marginal landsystem. Their talk demonstrated how this mapping has been used to support the creation of a 3D geological model of the area, which supports hydrogeological modelling of nuclear sites in the region. To conclude the morning's talks, **Bartosz Kurjanski** (University of Aberdeen/ Atkins) discussed the challenges of interpreting 2D UHR seismic data and ground modelling in glaciogenic ice-marginal settings with examples taken from a recent case study in the Southern Baltic. The session was followed by splitting attendees into four break-out groups led by **John Davis** (Geotechnical Consulting Group) to enable deeper discussion of the opportunities for connection and interaction between academia and industry.

The afternoon session focused on how Quaternary geoscience is critical in supporting the transition to a low carbon economy. The session kicked-off with a keynote talk from **Mads Huuse** (University of Manchester), who shared insights into how Quaternary geoscience is being utilised in low carbon energy generation and storage, with a specific focus on activity in the North Sea. **Simon Hunt** (Jacobs) then discussed how detailed logging and interpretation of Quaternary geology, together with a geochronology supported by amino acid racemisation dating, has been used to develop ground models for the proposed Bradwell B nuclear new build site. **Natasha Barlow** (University of Leeds) highlighted the importance of Quaternary science as the foundation of sustainable offshore wind development and emphasised the benefits of industry-academia collaborations for successful projects. **David Harrison** (Geo-4D Limited) described the development of early-stage desk studies into Quaternary sediments on various engineering projects, emphasizing the geohazard significance of Quaternary sediments.

The break was followed by a short poster session where we viewed glacial-themed posters from **Sinead Birks** (Imperial College London) and **Ben Stoker** (Charles University, Prague) and a sea-level record from Greenland presented by **Hannah Hogan** (Durham University). After the poster session, **Lorraine O'Leary** (Fugro) continued our low-carbon topic by discussing the geohazard challenges that can arise when laying cables across, or trenching into, Quaternary sediments, and at landfalls, using case studies from across northwest Europe. The final talk of the day was given by **Chris Smith** (Arup) who presented the benefits of using geomorphological mapping and sub-surface geophysics data to improve geotechnical understanding of the seafloor for offshore wind farm developments using the Sea of Hebrides, West Scotland, as an example. The day ended with a discussion session led by **Claire Mellett** (Royal Haskoning DHV) identifying key opportunities and challenges in relation to low carbon infrastructure and Quaternary geology.

The second day began with a session on the significance of river terraces and uplift to engineering and geoarchaeology. **Laura Basell** (University of Leicester) gave a keynote talk discussing the relationship between geoarchaeology and engineering in Quaternary deposits, using examples to highlight how geotechnical and geoarchaeological investigations can completement each other. **Michael Grant** (University of Southampton) followed this with a presentation on the use of OSL dating to investigate submerged Quaternary sediments. He highlighted the importance of having a geoarchaeology 'toolbox talk' with geotechnical engineers before coring to ensure that the needs of both disciplines are met from ground investigations. **Andy Howard** (Landscape Research and Management) then explained the development of Pleistocene river terraces in the Trent catchment and described how this understanding is relevant to both geoarchaeologists and engineers. **Rajib Kumar** (Geological Survey of Bangladesh) presented his research on the implications to engineering geology, geohazards and archaeology of the terraces of the Shitalakhya River, Bangladesh. Next, **Cherith Moses** (Edge Hill University) discussed how the meaning of the word 'impact' differs in academic and industrial areas, and how the Quarterly Journal of Engineering Geology and Hydrogeology (QJEGH) is an ideal route for both groups to achieve 'impact' by communicating the benefits of collaboration and applied Quaternary geoscience. **Martin Bates** (University of Wales Trinity Saint David) and **Francis Wenban-Smith** (University of Southampton) then discussed the practical application of Palaeolithic archaeology to major infrastructure development projects, including High Speed 1. The final talk of the session was given by **John Davis** (Geotechnical Consulting Group), who presented his ongoing work reinterpreting the evidence for 'Thorne Island' and the Tyburn 'delta' in Westminster, London, based on ongoing work refurbishing the Houses of Parliament. At the end of the morning we once again split attendees into break-out groups led by **Becky Briant** (Birkbeck) and focusing on opportunities for, and barriers to, collaboration specifically in the context of geoarchaeology.

The 2023 Wiley lecture was given by **David Giles** (Card Geotechnics Ltd). David's talk addressed the question 'Quaternary Engineering Geology – Are we there yet?', and discussed how our understanding of the geological, geomorphological and geotechnical legacy of the Quaternary is being used in the development of ground models and in wider ground engineering practises. David elaborated on how knowledge that is held by the Quaternary geoscience community can be better incorporated in the world of engineering geology and advocated ongoing collaboration through the QRA Engineering Group and EGGS.

The final session of the conference focused on climate change, sea-level and coastal processes and

was kicked off by **Iris Moeller** (Trinity College Dublin), who presented a keynote talk on nature-based adaptations to sea-level rise, with specific focus on how these measures impact our understanding of the 'Anthropocene'. **Daniel Young** (Wessex Archaeology) discussed targeted geoarchaeological investigations that have been undertaken at Lydd Ranges, Dungeness to mitigate the impacts on a SSSI of a coastal flood defence scheme. Following this, **Greg Guthrie** (Royal Haskoning DHV) used his experience as a coastal manager to debate what a 'coast line' is, reflecting on how different Quaternary sediments and landforms can make this a very challenging task. After a short break, we began the second poster session, this time hearing about methodological advances from **James Houghton** (University of Liverpool) and **Thomas Nichols** (University of Liverpool) and a Holocene climate record from Iceland from **Sarah Walton** (Sheffield Hallam). Following this, **Simon Norris** (Nuclear Waste Services) presented the latest plans for storage of high-level nuclear waste in an engineered geological disposal facility and stressed the critical role that Quaternary geoscience has in site characterisation. **Claire Mellett** (Royal Haskoning DHV) brought us back to the topic of low carbon energy and discussed the challenges that geotechnically complex and spatially variable Quaternary deposits pose on horizontal direction drilling at the coast, which is needed to connect offshore power generating facilities to on-shore power grids. The final talk was given by **Alvaro Castilla-Beltrán** (University of La Laguna, Tenerife) who explored coastal landscape changes and abandonment of the first European settlement in the tropics by presenting recent palaeoenvironmental research in Alcatraces Bay (Cape Verde). This year's meeting was concluded with a discussion led by Natasha Barlow and session speakers, drawing the conference themes together. While participants varied over the two days in relation to the content of the talks, key themes were very coherent across all the discussions, providing a platform for future work by the QRA Engineering Group and others. These were:

- The importance of data sharing between industry, government and academia. We know this is possible because our colleagues in the Netherlands provide an excellent example, but UK governance raises some barriers – thoughts were exchanged on how to overcome these, for example on the best place to store Quaternary geological records, especially when archaeological and geological databases are separate. The use of QRA communication channels to encourage sample sharing was also suggested.
- Increasing the accessibility of academic outputs to non-academics. While the move to green open access publication helps with recent research, older work remains behind paywalls. How can we help to make it more visible?
- Talent pipeline into engineering geology and other applied geoscience industries. Two issues were identified here: 1) how can we improve the amount of Quaternary geology in engineering geology courses used for training; 2) how can we encourage students with backgrounds in physical geography (including Quaternary geology and geomorphology) to see engineering geology as a career option?
- Site protocols and sequencing of ground investigation on large projects. How can we ensure geotechnical and (geo)archaeological ground investigations are carried out in a way that avoids duplication of boreholes or use of sampling methods that are suitable for geotechnical work but inadequate for geoarchaeology, and ensures that information can be used for both purposes? This is particularly important given our responsibility to use the earth's resources wisely.

The QRA Engineering Group and Engineering Group of the Geological Society would like to thank the QRA for the opportunity to host this year's ADM. We thank all the presenters for their stimulating talks, and the attendees for their contributions to the conference and the discussion sessions.

Particular thanks are extended to Emelia Spofforth-Jones and her team at the Geological Society in Burlington House for facilitating the last-minute transition to an online format and making the breakout discussion sessions work so smoothly.