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36th BCRA Annual Cave Science Symposium

University of Bristol, School of Geographical Sciences,
Saturday 11 October 2025

Abstracts of Presentations and Posters

For multi-authored items, names of the presenting authors are underlined.

Session 1: Past climates from speleothems

The application of high-resolution U–Th dating techniques to Assynt speleothems: initial results

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Collection of speleothem samples from caves in Assynt, NW Scotland, in the 1980s and 1990s allowed dating by the uranium-thorium disequilibrium method using the now-outdated alpha spectrometry (AS) technique. 53 dates were obtained in this way, allowing a broad understanding of the chronology of fluctuating glacial-interglacial climatic phases over the last 200,000 years. An initial phase of dating in 1981–82 at SURRC (now SUERC), East Kilbride, produced a suite of dates that – at that time – fitted with the accepted chronology of the Late Pleistocene glacial history of Britain. However, there has been increasing awareness of a growing conflict between the current chronology of the build-up and decay of the northern edge of the last ice sheet based on extensive dating of land surfaces and deposits using TCN and OSL techniques. This has prompted a reappraisal of some of the Assynt specimens using modern, high-resolution dating methods. This has highlighted certain shortcomings in the initial methodology and cast doubt on the veracity of this initial phase of dating. Failed subsequent attempts to replicate the older dates using carefully controlled AS methods have underlined these concerns.

Modern dating methods have the great advantages of dating discrete speleothem growth layers with very small standard errors compared to the 'bulk samples' required for dating 30–40 years ago. We now have 32 high-resolution, MC-IPC-MS dates from Assynt speleothems as part of a wider project hoping to reveal a detailed chronology of all periods when external conditions were conducive to speleothem growth during at least the last 125,000 years in this key area on the NW edge of maritime Europe. In this talk we will concentrate on what this initial batch of dates reveals about the timing of ice sheet initiation, growth and decay. We will offer a brief reassessment of an earlier analysis of the geomorphic evolution of the Allt nan Uamh valley (Hebdon *et al.*, 1997) now that we doubt the reliability of the three oldest dates obtained during the 1980s. A brief mention will also be made of the wider project which intends to look at various proxy indices locked up in the speleothem growth layers and what these may show about changing climatic conditions during the various phases of speleothem growth.

Photograph (above)*: Flowstone sample UEA901120-9 from Uamh an Claonaite, which recently yielded a U/Th date of 63,235 years BP from near its surface.*
[This image relates to the Abstract of the Presentation by Lawson, Atkinson and Breitenbach in the adjacent left-hand column and below.]

Annually-laminated stalagmite in Northwest Yucatán, Mexico, precisely dates and quantifies rainy-season droughts during the Maya civilization decline

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The Maya civilization of Mesoamerica flourished during the Classic Period (*ca*. 250 to 1000 CE) and is noted for its monumental architecture, hieroglyphic writing, and advanced mathematics, astronomy, and calendar system. During the Terminal Classic Period (*ca*. 800 to 1000 CE), the Maya civilization declined dramatically. Population centres shifted to the northern lowlands of the Yucatán peninsula (Mexico) where they underwent a series of boom-bust cycles before eventual depopulation. Several explanations have been put forward to explain this cultural transformation, including natural (deforestation, erosion, soil loss, earthquakes, hurricanes, climate change, disease, insect pests, overpopulation) and socio-political factors (civil unrest, inter-site warfare, invasion from outside cultures, etc.). Regional climate proxy records suggest multiple prolonged drought episodes during the Terminal Classic, however these records are sparse and some contain large chronological uncertainties and poor temporal resolution. To further advance our understanding of climate variability in Mesoamerica during this transition period on a local scale, here I will present a stalagmite from northern Yucatán. The stalagmite is exceptionally laminated through the Terminal Classic period, allowing our group – research led by Daniel H. James – to construct a seasonal climate proxy record based on calcite oxygen isotope variability with ± 6 year age uncertainty. Rainfall interpretation of the stalagmite oxygen isotope record is supported by modern rain and drip water monitoring, as well as a replicated lower-resolution stalagmite oxygen isotope record from the same cave. Despite uncertainties in archaeological chronologies, results suggest political activity at major northern Maya sites, including Chichén Itzá and Uxmal, declined at different times during this period of frequent droughts, implying differential cultural responses to climate stress. This work was recently published in *Science Advances* (James et al., 2025).

Reference

James, D H *et al*., 2025. Classic Maya response to multiyear seasonal droughts in Northwest Yucatán, Mexico. *Science Advances*, Vol.11, Issue 33, eadw7661.
[https://doi.org/10.1126/sciadv.adw766]

A journey into caves along the northern boundary of the Sahara: beautiful caves, speleothems and research into past rainfall

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There is abundant evidence of wetter conditions in the Sahara during the early- to mid-Holocene, but a paucity of high-resolution spatial and temporal rainfall reconstructions, which has impeded the robust understanding of climate and archaeology. North of 28°N there is a particular lack of rainfall records, which limits testing of the processes controlling climate change in the sub-tropics. Cave speleothem records from locations that are arid to hyper-arid in the modern-day are especially helpful. The chronology alone of speleothem growth from these locations informs us of the timing of when climate was wetter in the past. We use additional measurements, for example of oxygen isotopes, that help us to assess the sources of past rainfall. We will present results of stalagmite records from inland, north-west Sahara – south of the Atlas Mountains – which demonstrate peak in increased rainfall between 8.7–4.3 kyr BP (Couper *et al*., 2025). We propose that much of this additional rainfall is caused by 'tropical-plumes' (plumes of rainfall originating from convecting moisture in the tropics). This rainfall supported a significant increase in the region's population during the Neolithic, as suggested by the combined presence of speleothem growth and rich archaeological artefacts in a region that is sparsely populated under modern-day desert conditions. Improved habitability and increased recharge to rivers flowing south through the Sahara will have facilitated connections, during a key period in the development of land use and animal production.

Reference

Couper, H O and eight others, 2025. Evidence for the role of tropical plumes in driving mid-Holocene north-west Sahara rainfall. *Earth and Planetary Science Letters*, Vol.652, 119195.
[https://doi.org/10.1016/j.epsl.2024.119195]

Session 2: Cave fauna, climate and conservation

From Caves to Conservation: the making of the modern fauna in Britain

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Zooarchaeological and fossil collections from caves have traditionally supported research and into a diversity of topics, from palaeoenvironmental reconstruction to the interpretation of early human subsistence practices. However, an area of investigation that has been so far less commonly explored concerns the information that these collections can shed on past climate change and biodiversity for future conservation purposes.

Data from Quaternary palaeoecological studies are increasingly applied to modern conservation challenges via the emerging field of conservation palaeobiology, a new and integrated approach that draws on fossil and historical records to inform the conservation, management and restoration of species, communities and ecosystems beyond the limited time frame of modern ecological observations. This presentation will illustrate ongoing work at the site of Gully Cave in Somerset, a key archive for our understanding of faunal responses to abrupt climate change over the last 70,000 years, before reviewing the potential of collections such as this to provide critical new information for guiding nature restoration..

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A 75,000-y-old Scandinavian Arctic cave deposit reveals past faunal diversity and paleoenvironment

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Northern Europe experienced extreme topographical, environmental and climatic changes during the last interglacial-glacial cycle. High-latitude, fossil faunal records are, however, almost non-existent due to glacial erosion and removal of sediments by flushing meltwater from the glaciers that covered extensive parts of the northern region. The effects of the dramatic Quaternary climatic changes on animal distributions in Fennoscandia therefore remain largely unresolved. The Storsteinhola cave system (68°50′N) in Kjøpsvik, northern Norway, is an exception, with one of the conduits of the cave, known as Arne Qvamgrotta, containing a Pleistocene dated bone horizon. We exploit the exceptional opportunity of this deposit for the comparative, interdisciplinary analyses of a high-latitude faunal record from the Last Glacial period.

The excavations at Arne Qvamgrotta identified a clear sub-fossil horizon, which after extensive dating (including ^{14}C, OSL, $^{230}Th/^{234}U$ and phylogenetic dating) placing the bones in interstadial MIS 5a. To date we have very little knowledge of the fauna from this interstadial other than occasional spot finds. We combine morphological identification with ancient DNA bulk-bone metabarcoding to maximise taxonomic identification of the highly fragmented bone material. With this multi-method approach we identify over 45 different taxa, including a diverse range of mammals (e.g., *Ursus maritimus* and *Balaena mysticetus), birds (e.g., Somateria spectabilis and Uria aalge) and fish (e.g., Sebastes marinus and Salvelinus* sp.). Furthermore, we identify the first collared lemming (*Dicrostonyx torquatus*) in Fennoscandia. Mitogenome analyses of *U. Maritimus*, *D. Torquatus* and *V. lagopus* identify extinct lineages which attest to a lack of habitat tracking and the absence of a local refugium during the subsequent fully glaciated periods. Our results highlight the power of a multi-method approach to broaden taxonomic identification, especially of fragmentary material. The Arne Qvamgrotta excavations and analysis highlight the power of multi-method approaches and the potential of past data to understand risks to Arctic fauna in the face of current warming in the region.

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A new bio-chronology and taphonomic assessment of the mammalian faunal remains from Reindeer Cave, Assynt

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Reindeer Cave (Creag nan Uamh, Assynt) is one of the few sites where faunal remains that pre- and post- date the Last Glacial Maximum (LGM) have been found in Scotland, an area that was fully glaciated by the last ice sheet. Excavated in the 1920s, the radiocarbon dating, taxonomic and taphonomic study of these remains has great potential to inform on palaeoecological and palaeoenvironmental conditions of MIS 2 and 3 in north-west Europe, and regional glacial dynamics. However, some previously-obtained radiocarbon dates from the site appear to contest the latest models of regional glacial advance and retreat in the area. Furthermore, some early dates in the 2m shaft connecting the inner and outer chambers are not consistent with historically-recorded stratigraphic relationships.

Here we report on our new analyses of the faunal remains from the shaft and the outer chamber of Reindeer Cave. Our results indicate reindeer and bears predominate, although new examples of hare, wild pig, and small carnivores have been tentatively identified. The remains appear to have been accumulated mainly via natural means with minor carnivore modifications, although differences between bear bones and reindeer antlers are evident. New radiocarbon dating on bones and antlers from the shaft align with recorded excavation depths and suggest that deposition began before ~45 ka cal BP. This was followed by at least two further phases of deposition, including a final event pre-LGM at ~34 ka cal BP. The earliest post-LGM dates in the outer chamber place bears back in the region ~14.5 ka BP, with later Holocene dates from the outer cave suggesting some post-depositional disturbance of materials. Further dating and multidisciplinary analyses of materials from the outer chamber will enhance our understanding of ecosystem dynamics into the Late Glacial and early Holocene, and the potential for human presence in the region.

***Photograph (above)**:*
Creag nan Uamh (Reindeer Cave) from the valley floor. The famous 'bone caves' can be seen at the junction between the cliff base and the vegetated talus slope below. [Photo: Ivan Young.]

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Session 3: Karst hydrology and hydrochemistry

Caving with Caustic Orphans

Mike Rogerson*[1], *John Gunn*[2], *Adam Hartland*[3], *Sebastian Breitenbach*[1] *and staff at the Buxton Civic Association.

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Hyperalkaline leachate is created when rain or surface water penetrates piles of waste from lime making, iron or steel making, aluminium or chromium refining or ash from combustion processes. This bleach-like (caustic) leachate can flow into surface water systems, causing significant ecological harm. A curious side effect when the source is rich in calcium (normally from lime, steel or iron making) is that the solution (which is dominantly $Ca(OH)_2(aq)$) reacts rapidly with $CO_2(g)$ in the air, depositing large amounts of calcite ($CaCO_3(s)$). Some of these deposits can be truly dramatic, with the best examples being at Brook Bottom near Buxton and near Consett. However, such rapid and voluminous mineral deposition causes additional problems for aquatic life, chokes stream beds and drainage culverts and can cause severe flooding. As the majority of caustic waste sites in Britain affected by this kind of leachate were made by companies no longer in operation, the "polluter pays" principle cannot be utilised to remediate or manage the site, which essentially becomes an 'orphan'.

Although neglected compared to acid mine drainage, research into understanding the surface impact and remediation of caustic orphan sites is developing. However, little is known about the behaviour of these leachates in the subsurface. How they affect water quality, how reactive species like $Ca_{2+}(aq)$ and $OH^-(aq)$ behave during subsurface transport and the fate of ecologically harmful materials such as Al or Cr carried in them, are all poorly known.

Caves provide a unique window to resolve those problems, especially as lime production requires the same thick, pure limestones as caves do, increasing their co-occurrence. By great fortune, one cave receiving caustic leachate from an overlying orphan site is Poole's Cavern, where the *British Cave Science Centre* has been established. With the assistance of staff at the showcave, we have been able to produce three years of nearly continuous monthly average drip-rate measurements and nine months of continuous pH and conductivity measurements at 15-minute intervals for one drip that is hyperalkaline, and one that has never been observed to show caustic characteristics. In addition we are in the process of producing daily water chemistry measurements. From these we can now show that the leachate production process interacts with surface weather, so that in normal conditions leachate only enters the cave in the winter. High rain events also cause changes in infiltration, showing the close coupling of groundwater contamination and surface water surplus. Because the drips are growing stalagmites, we are exploiting three samples that grew between 1927 and 2025 to reveal the long story of how this waste, which accumulated from the 17th to the early 19th centuries when the hillside above Poole's Cavern was dotted with independently operated lime kilns, is slowly being removed by weathering.

***Photograph (above)**:*
Stalagmite that has grown beneath a hyperalkaline drip on the tourist path through Poole's Cavern. [Photo: Sam Wilks, Poole's Cavern.]

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Conditioning of flood pulses produced by intense or prolonged rainfall events during transfer through phreatic and vadose conduits

John Gunn.

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Springs in Castleton, Derbyshire, UK, drain a mixed allogenic-autogenic karst catchment of *c*. 13.5 km^2 within which there are some 30km of explored conduit (caves) and a much greater length of smaller tributary conduits. As part of a long-term study, hydraulic head is measured at five underground sites and water depth is measured at three springs fed by the conduits, and in a river fed by the springs. To accurately represent the hydrological complexity measurements are made at short intervals (2–4 minutes). In October 2023 Storm Babet brought heavy and persistent rain (80–100mm) to the English Peak District and there was widespread surface and underground flooding, including property in Castleton. As expected, the conduits fed by sinking streams from the allogenic catchment responded rapidly to recharge but there was also a rapid response from the autogenic catchment where there are no surface streams and only a small number of dolines. Underground there were large increases in hydraulic head (up to 35m) that resulted in two types of flow switching. Firstly, the increased head at the input end of one phreatic conduit system removed an underwater permeability barrier in a relatively low elevation conduit resulting in a dramatic increase in flow out of the conduit and a corresponding decrease in flow from a linked higher elevation conduit that had dominated before the storm. Secondly, increased head upstream of two conduits with limited hydraulic conductivity allowed water to spill over into conduits that were inactive prior to the storm. The flow switching is less evident in the spring hydrographs, and hence the flood pulse in the spring-fed river, than it is underground and this is thought to be at least in part a result of conditioning by the final section of phreas which also: (1) softens the complex signals measured underground and (2) produces a longer but lower magnitude pulse than would be expected in a surface stream. It is suggested that as intense/prolonged rainfall events become more common, changes within conduits may make the spring response (and hence flood risk) harder to predict.

[See also the photograph on the following page...]

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The photograph to the right relates to the Abstract of the presentation by John Gunn on the previous page:

The combined discharge from the Castleton springs flowing over the Goosehill Bridge weir during Storm Babet.
[Photo:Anthony Marsden.]

Strange stories from Stump Cross Caverns – is the answer from below?

Phil Murphy.

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The Stump Cross Caverns cave system is a network of more than 6 kilometres of passages positioned beneath the interfluve between Wharfedale and Nidderdale, the two most easterly glaciated valleys of the Yorkshire Dales. It is formed in folded and faulted limestone strata situated in the Craven Fault Zone, the transition zone between the Askrigg Block high and the Craven Basin. The form of the cave system is unlike that of most caves in the Yorkshire Dales karst because it is formed within relatively steeply dipping limestone beds (15–30°). The cave consists of large tubular passages connected by smaller passages or rifts, and has a distinctive multi-level maze-like plan. The highest (show cave) level contains large volumes of clastic sediment overlain by extensive speleothem deposits. 68 U-series dates have been obtained from the site, making it one of the most comprehensively dated sites in the UK. It also a significant Pleistocene vertebrate palaeontological site. Despite this intensive study, little consideration has been given to the origins of the cave system. A re-evaluation of the cave morphology on a range of scales, hydrological setting and a review of the previous studies undertaken in and around the cave system suggest a possible origin, at least in part, as a result of hypogenic karstification.

Session 4: Further cave science

Cave invertebrate assemblage monitoring in Ogof Ffynnon Ddu (OFD) and Ogof Draenen

Lee Knight.

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The designation of caves as SSSIs has historically relied on geological and palaeontological features and their importance as bat roosts, with their ecology often being neglected. To address this shortcoming Natural Resources Wales initiated base-line surveys of the cave invertebrate assemblages within two major cave systems, to trial the methods required at the study sites and other potential designated cave sites across Wales. Both caves have been the subject of biological investigations in the past, allowing the results of the survey, undertaken in summer 2023 and winter 2024, to be critically evaluated against historical data.

The survey encompassed five stream sites and four lentic habitats in each cave, sampled by netting. Terrestrial invertebrate assemblages were investigated within the threshold zone of the cave entrances and at four sites within the deep cave environment, the former by manual searching and the latter using a combination of three methods, manual searching, the placement of scouring pads as artificial refugia, and baited pitfall trapping.

The survey in OFD recorded a total of 84 invertebrate taxa, including 30 previously recorded from the cave. This now makes the total number of invertebrate taxa known from the cave 123, including 9 troglobionts, 36 eutroglophiles and 7 subtroglophiles.

The survey in Draenen recorded a total of 84 invertebrate taxa, including 34 previously recorded from the cave. This now makes the total number of invertebrate taxa documented from the cave 124, including 12 troglobionts, 21 eutroglophiles and 7 subtroglophiles.

The results of the base-line survey, coupled with an examination of the historical data have enabled the compilation of a set of target invertebrate species and communities that form the basis of conservation objectives for both caves, against which future condition monitoring can be assessed.

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Fifty years of Mulu cave science

Andrew R Farrant.

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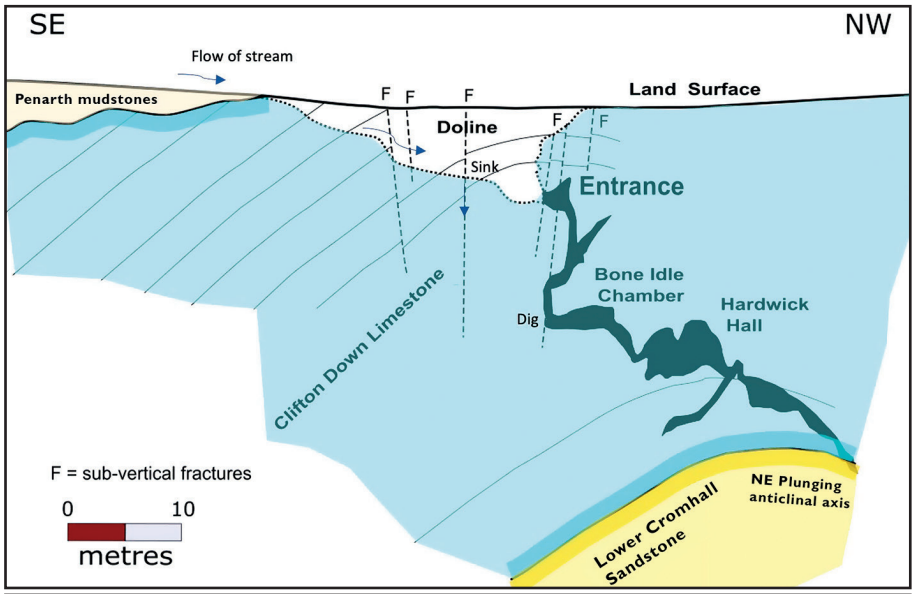
Back in April 2025, the Royal Geographical Society celebrated the (almost) 50th anniversary of the 1978 RGS expedition to the Gunung Mulu National Park. The main focus of this RGS expedition was forest ecosystems. Over a period of 15 months, 115 scientists spent 10,000 days-equivalent in this wonderfully rich tropical forest. The research involved 50 separate projects within five programmes: forest ecology and nutrient cycling, geomorphology/hydrology and cave surveying, botanical and zoological inventories, vegetation surveys and management plan studies.

***Photograph (above)**: Christos Pennos examining directed phytokarst in the entrance of Clearwater Cave, Gunung Mulu National Park, Sarawak. First identified on the 1978 Royal Geographical Society Expedition to Gunung Mulu, directed phytokarst consists of rock spikes or cones oriented towards the incident sunlight. It is attributed to the action of photosynthetic organisms such as blue-green algae, mosses, and lichens. The shape of the features varies, depending on the angle of the incident light, with cones forming when light is perpendicular and ribs forming when it is parallel to the rock surface. [Photo: Andrew Farrant.]*



The cave science during the 1978 expedition comprised cave surveying and limited geomorphological and hydrological studies. In the intervening 47 years, however, there has been comparatively little research done on the rainforest ecosystems in the National Park, but a huge amount has been done in the caves: Mulu science has literally gone underground. This talk will summarize a variety of work that has yielded insights into the age and formation of the caves; past climates based on the chronology of speleothem growth; nutrient cycling and ecosystems within the caves; and the role of bats and birds in making the caves bigger. What discoveries will the next 50 years bring?

Fishing for answers at Fishmonger's Swallet

***David Hardwick*[1,2], *Adelle Bricking*[3], *Linda Wilson*[1,4].**

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Fishmonger's Swallet in Alveston, South Gloucestershire, just a few miles north of Bristol, is a small stream-sink that appears to have had a relatively constrained use as an ossuary, as demonstrated by radiocarbon dates on human and animal (dog) bones from the site that suggest a period of deposition in the late Iron Age. This talk will present a brief overview of the site and the insights it has provided into the health of the individuals concerned and the post-mortem treatment of their remains and will also touch on the latest excavations at the site and plans for future work on the wealth of material it continues to provide.

Figure (above/left):
Interpretive geological cross section through Fishmonger's Swallet, showing also the location of the dig site where late Iron-age remains have been found.

[Adapted from Figure 3 in:
Tringham, M, 2022. Geological setting of Fishmongers Swallet. Proceedings of the University of Bristol Spelaeological Society, *Vol.29(1), 19–22.*

***Photograph (left)**:*
Brighid Black, preparing to exit Bone Idle Chamber in Fishmonger's Swallet, with the dig site in the background. Taken on the post BCRA symposium field trip led by David Hardwick and Adelle Bricking. [Photo: David Cooke.]

Posters

Stalagmite-based palaeoclimate reconstruction from West and Central African karst regions: Insights from the 2023–2024 National Geographic Society Speleological Expeditions

Ilesanmi, F A [1*], ***Baldini, L M*** [2], ***Egesi, N*** [3], ***Ndongo, A*** [4], ***Mvoubou, M*** [4], ***Agbebia, M*** [5], ***Retonda-Kondja, S*** [4], ***Kwankam, F N*** [6], ***Bisse, S B*** [7], ***Baldini, J U L*** [2], ***Bokanda, E E*** [8], ***Okon, E E*** [9], ***Rogerson, M*** [10], ***Odelugo, L*** [2] ***Ait Brahim, Y*** [11], ***Taylor, G*** [1], ***and Akinlabi, E T*** [12].

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The karst regions of West and Central Africa remain among the least explored globally, with limited palaeoclimate records hindering understanding of long-term climate variability in the tropics. Despite extensive limestone terrains, stalagmite-based climate reconstructions are notably absent due to challenges, including inaccessibility, dense vegetation, limited funding, and insufficient collaboration between regional and international research institutions. This study presents results from the 2023–2024 National Geographic Society-funded speleological expeditions across these karst landscapes, aimed at documenting cave systems and collecting speleothems for palaeoclimate reconstruction. Explorations led to the successful sampling of stalagmites exclusively in Gabon, where 15 specimens underwent preliminary analysis, including Uranium-Thorium (U–Th) dating and FTIR analysis; isotopic analysis is ongoing at Northumbria University, and lamina counts on two specimens provide initial chronological constraints. The selected Gabonese caves contained well-preserved speleothems, offering high-resolution geochemical archives of past climate variability. This research underscores the untapped potential of Central and West African karst systems as key palaeoclimate archives, while highlighting spatial heterogeneity in stalagmite suitability. The findings contribute to the growing body of tropical African palaeoclimate research and support improved calibration and validation of climate models. Integration of these records into modelling frameworks will enhance reconstructions of regional hydroclimatic variability and inform resilience strategies in the face of ongoing global climate change.

A palaeoclimate record for the Western Mediterranean from Gibraltar speleothems

Dirk Hoffmann [1], ***Dave Mattey*** [2], ***Meighan Boyd*** [2], ***Tim Atkinson*** [3] ***and "Team Gib"*** [4].

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A twenty-year effort of cave monitoring, geochemical analysis and dating of speleothems from caves in Gibraltar has culminated in completion of an extremely detailed and well-dated "Reference Record" of West Mediterranean palaeoclimate covering the past two glacial-interglacial cycles. This poster presents the record of stable isotopes of oxygen and briefly compares it with another long record from the Eastern Mediterranean, highlighting the changing east-west gradients in oxygen isotopes as climate changed through the last glacial cycle. Together with that record and the ice core records from Greenland, the extremely well-dated Gibraltar record forms a "reference framework" within which to fit shorter speleothem records and elucidate the patterns of climate change across Europe during the last 200 thousand years.

North–south gradients of oxygen isotopes in precipitation between Greenland and Gibraltar during the Last Glacial

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The changing climate during the Last Glacial is recorded in the oxygen isotope composition of ice (meteoric precipitation) in long cores drilled through the Greenland ice sheet. The glacial period as a whole is punctuated by shorter episodes termed Dansgaard–Oeschger (or DO) Events, each lasting a few thousand years, during which $\delta^{18}O$ (a measure of the ratio of the heavy oxygen isotope concentration in the ice) first increased sharply, then declined slowly. Local temperatures followed the same trends. Speleothem records suggest that DO events affected climate all over the northern hemisphere, but unlike ice they do not directly record the oxygen isotopes in precipitation, but present a mixed signal affected by oxygen isotopes in drip water (reflecting local rain), cave temperature, and chemical kinetic factors during the formation of calcite. Our record in Gibraltar shows a remarkably close, parallel trend to Greenland. In this poster we present a first attempt to decode and separate the mixed signals and to isolate the $\delta^{18}O$ of palaeo-rainfall in the Western Mediterranean. The results suggest that it varied very little between the warm and cold phases of DO Events, whereas much larger changes occurred in Greenland. However a 1‰ uncertainty remains in the absolute value of $\delta^{18}O$ in Gibraltar's palaeo-rainfall because of chemical kinetic factors. The main part of $\delta^{18}O$ variation in Gibraltar speleothem during DO Events is due to changes in local temperature, measured independently via geochemical records of sea surface temperatures encoded in sediments in the Alboran Sea, adjacent to Gibraltar.

***The photograph to the left complements the Abstract of the Poster below by Panitz, S and 12 others**:*

U-series dating of stalagmite WICC 009 from Water Icicle Close Cavern (Derbyshire, UK) demonstrates a record of speleothem growth in the 96–49ka interval interrupted by a speleothem breakage event between 87 and 83ka. This is interpreted as being related to in-cave ice growth that was associated with wet periglacial conditions.

[Reproduced from Fig.6 in: Gunn, J and 6 others, 2020. Palaeoenvironments in the central White Peak District (Derbyshire, UK): evidence from Water Icicle Close Cavern. Cave and Karst Science*, Vol.47(3), 153–168).]*

[Photo: John Gunn.]

Spatio-temporal dynamics of speleothem growth and glaciation in the British Isles

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Reconstructing the spatio-temporal dynamics of glaciations and permafrost relies largely on surface deposits and is therefore a challenge for every glacial period older than the last due to erosion. Consequently, glaciations and permafrost remain poorly constrained worldwide before *ca.* 30ka. Since speleothems (carbonate cave deposits) form from drip water and generally indicate the absence of an ice sheet and permafrost, we evaluate how speleothem growth phases defined by U-series dates align with past glacial–interglacial cycles. Further, we make the first systematic comparison of the spatial distribution of speleothem dates with independent reconstructions of the history of the British–Irish Ice Sheet (BIIS) to test how well geomorphological ice reconstructions are replicated in the cave record. The frequency distribution of 1020 U-series dates based on three different dating methods between 300 and 5ka shows statistically significant periods of speleothem growth during the last interglacial and several interstadials during the last glacial. A pronounced decline in speleothem growth coincides with the Last Glacial Maximum before broad reactivation during deglaciation and into the Holocene. Spatio-temporal patterns in speleothem growth between 31 and 15ka agree well with the surface-deposit-based reconstruction of the last BIIS. In data-rich regions, such as northern England, ice dynamics are well replicated in the cave record, which provides additional evidence about the spatio-temporal distribution of permafrost dynamics. Beyond the Last Glacial Maximum, the distribution of speleothem dates across the British Isles offers the opportunity to improve chronological constraints on past ice sheet variability, with evidence for a highly dynamic Scottish ice sheet during the last glacial. The results provide independent evidence of ice distribution complementary to studies of surface geomorphology and geology, and the potential to extend reconstructions into permafrost and earlier glacial cycles. Whilst undersampling is currently the main limitation for speleothem-based ice and permafrost reconstruction even in relatively well-sampled parts of the British Isles, we show that speleothem dates obtained using modern mass spectrometry techniques reveal a higher spatio-temporal resolution of glacial–interglacial cycles and glacial extent than previously possible. Further study of leads and lags in speleothem growth compared to surface deposition may provide new insights into landscape-scale dynamics during ice sheet growth and retreat.

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Current research on groundwater habitats in Scotland and recent records of several stygobitic crustacea

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Current research on stygobitic fauna (i.e living exclusively in groundwater settings including caves, aquifers) in Scotland. Two ostracod species are presented, new to Britain and only currently known from two Scottish sites, Smoo Cave and a spring catch pit on the Isle of Lismore. Also revealed is a recent record of the syncarid *Antrobathynella stammeri* at just its second Scottish location – Jeannie Barrie's Cave in the Pentland Hills south of Edinburgh.

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Entering a Plea of "Sanity"...

[on the basis of undiminished responsibility?]

Hopefully, our readership includes many who find themselves habitually reading the ***Forum*** *section of* ***Cave and Karst Science*** *and also reading the thoughts provided in our* ***Editorial*** *sections. Those who do, whether from genuine interest or because it ensures that maximum "value" is wrung from their subscription, must be aware that we have kept one kite flying from Day 1 of our Editorship in 1994. It is surely a common-sense notion that those who (one way or another) invest part of their life – amounting to "years of dedicated effort" – in pursuit of the award of a degree, a higher degree or a still-higher degree, ought to feel driven, if not actually obliged, to* ***raise awareness*** *of the light that they have laboured to perceive and to formalize.*

Currently we live in a world where support for research projects linked to myriad aspects of the cave- and karst-related sciences is at a level that could not even have been fantasized as recently as 50 years ago. Presumably, most such projects bear fruit? Why then do so many successful degree candidates choose not to advertise their success, let alone their ideas? A rhetorical question perhaps? Surely it is not a sane choice to keep the dazzling light of a "great leap forward" obscure in the gloom beneath that proverbial bushel or, belabouring another proverb, to spoil their well-founded ship for a ha'p'orth of tar?

In this Issue we are pleased to publish an Abstract describing the completion and outcomes of a study that led to the recent award of a Doctorate to Jo White. We congratulate Jo on her achievement – because it is a fact that gaining such recognition really ***is*** *an achievement worthy of approbation. But, in* ***Cave and Karst Science*** *terms, we also thank Jo for being aware of our long-uttered plea, and submitting the Abstract for publication. It is difficult to credit that this is the only abstract received since December 2022.*

So, our oft-repeated plea returns. No matter where you are in the World, if you are, or have been, sufficiently dedicated to invest ***years*** *in collecting and analysing data, followed by racking your brain to derive results that merit the recognition manifest in the award of a degree, please take those few extra* ***minutes*** *to send your Abstract to* ***Cave and Karst Science*** *[addresses are on the Contents page or on-line]. Raise awareness of your contribution and widen recognition of your efforts. "You know it makes (common) sense!"*

David Lowe and John Gunn

Doctoral Thesis Abstract

Biofilms, including Snottites, from Caves and Mines in Northern England

Joanne WHITE

A thesis submitted to the University of Huddersfield, UK,
in the partial fulfilment of the requirements for the degree of Doctor of Philosophy.
Main Supervisor: Dr Bethany Fox
Date of Award: June 2025

Abstract

Underground environments are inhospitable habitats for microbial life. However, many studies have unearthed a diverse variety of microbial life in underground environments. The microbial communities of underground environments in the UK have been little studied. Here, we examine the microbial life of biofilms, including snottites, from six cave and mine sough sites in northern England.

Microorganisms living in underground environments must protect themselves from the extreme conditions encountered there and may form biofilms as one method of protection. One specialised type of biofilm is known as a snottite. These are jelly-like, pendulous biofilms which hang from the roof of caves and mines. Snottites are often found in hypogenic sulphur-acid caves and acid mine environments, where they are described as being extremely acidic (pH 0–2).

Samples of water, rock, sediment and speleothem were collected and analysed to determine the geochemical influences on microbial life. Biofilm samples were collected and analysed using culture-dependant and culture-independent methods, and the metabolic pathways of the resulting metagenomic sequences were examined. Using these, we create suggested metabolic cycles for each site, showing how bacteria might be utilising elements from the environment and potential interactions between bacterial species.

We show that each underground site contains micro-environments, each of which harbours its own distinct microbial population. The elemental influences in these micro-environments can vary considerably across small distances. A variety of bacterial strains were identified and were compared to bacteria found in studies of bacterial communities from similar sites in the literature. Unlike previously described extremely acidic snottites, biofilms from the mine soughs we studied, including snottites, are neutral or weakly acidic (pH 4–7). This is due to the influence of calcium carbonate buffering the internal acidity of the snottites.

Despite their differing pH, the snottites we studied shared several of the same species of bacteria and metabolic processes with their more acidic counterparts. We hypothesise from these discoveries that the energy source of an environment has more influence over the microbial population than the pH. We have used these findings to propose three models of snottite formation for snottites found in hypogenic caves, acid mine environments, and neutral mine environments. We also found evidence of other organisms, including mites, living in snottites, and thus consider the role of bacteria as the base of snottite ecosystems.

Notes for Authors

A Reviewer Complains

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Abstract: I recently reviewed a paper, and identified a series of simple errors that all authors should recognise and avoid. Key words are additional to the title, not just repetition. The word 'very' is an overused modifier; do not use it. A single sentence is not a paragraph. All the references in the text must appear in the reference list; all the those in the reference list must appear in the text.

It is fair to say that if I am not reviewing a paper, then I have just finished reviewing one. In retirement, I have more time for reviewing and take a relaxed view of it. Reading an emerging research paper should be a pleasure, but the poor writing skills of some authors can make it a curse. I know that author X is a talented scientist, but why do they write with their brain in neutral? It is a good job that what I write in my review reports is a calmer version of some of this reviewer's thoughts. I can be tactful, even if an author has failed to fulfil their end of the bargain with due attention to detail. There are many texts that aim to help the struggling academic author (e.g., Day, 1998; Silvia, 2007; Hartley, 2008; Donovan, 2017); more of this target audience should read them.

Earlier this week I reviewed a paper for a high-profile geological journal. It was a short paper, two of the co-authors were well-known to me and have a high profile internationally, and yet in places the paper was sloppy, not to put too fine a point on it. Why? Such poor writing must be corrected before publication, placing an unnecessary burden on the shoulders of the reviewer(s) and editor(s). A sensible author wants the reviewers on their side, but sloppy writing makes them critical enemies.

A scientific research paper is comprised of two overlapping components, the science and the writing itself – the style, for want of a better word. I will not presume to tell you how to do your science. I do presume that you do it to the best of your ability and that it is essentially correct. Having taken such care to ensure your learning is correct, why be lax in presenting your findings?

If I was author of such an untidy submission I would be distressed; may I never submit a paper in such a sorry state. What went wrong? Is it a fashion to submit poorly authored/edited papers? I do see rather a lot of them. So, I am moved to put pen to paper. If you are writing a paper, then take care; the following points are common areas where authors fail. They are as easy to get right as to get wrong. Get them right. They are common errors made by authors and all are annoying to the reviewer whose remit is not to provide remedial writing tuition.

Key words have long been a bone of contention for me (Donovan, 2017, pp.59–61). Ideally, key words add to the title and support the abstract. They require careful thought by the author. But sadly, many authors are lazy, and they neglect to think. The paper that I recently reviewed had ten key words, seven of which were repeated from the title. No, wrong! Key words should be additional to those in the title, not just mindless – the correct word, sadly – repetition. Of the four authors, did nobody consider the key words worthy of some expenditure of intellect?

Shy away from using the word 'very'. Geologists love it, but it is an overused modifier (Kracht, 2020, p.136; Donovan, 2017, p.25) that is commonly inserted without sufficient thought. Once I reviewed a paper where the author had used 'very' eight times in one paragraph. To give a real example amongst many, a fine-grained sandstone is defined precisely, with grains 1/16 – ¼ (0.6–0.25) mm maximum dimension (Donovan, 2021, Table 7.1). But what is a very fine-grained sandstone, which, over the years, I have seen in more than one paper received for review? It is not defined, and I doubt that the author has counted sufficient grains to demonstrate that they all lie at the lower end of the fine-grained sandstone spectrum. In the paper that I just reviewed, I read of 'very rare', 'very few', 'very clear' and 'very weak'. I deleted every 'very'. The prose was in no way injured; rather, focus was improved.

Some authors struggle to group their thoughts together into paragraphs and, indeed, may compose them of just a single sentence. Single sentence paragraphs are a feature of the lowbrow tabloid press – you know which newspapers I mean – and not the academic literature. If you have written a paragraph consisting of only one sentence, then your brain is not being applied to the job at hand. Your ignorance and lack of thought will be displayed for all to see. Read the sentence/paragraph; does it relate more closely to the previous or succeeding paragraph? Whichever, move it accordingly.

Sloppy reference lists fill me with angst. It is so easy to ensure that your references are accurate. All the references in the text must appear in the reference list; all those in the reference list must appear in the text (Donovan, 2017, pp.77–78). Note must; not if or maybe or if the stars are in the correct alignment, but must. The easiest way to ensure such a concurrence is to print a hard copy of the paper, separate the text, captions and appendices from the reference list, and place them side-by-side on a desk. Relate the text to the reference list. If "Anauthor, 2026" appears in the text and reference list, then tick it off using a pencil in both places (pencil marks are less conspicuous when you read through the text for a last time). After the text, check the reference list; have you ticked them all? If not, either delete all those that have not been ticked in the reference list or add them to the text. I generally favour the former as it is a little late in the day to be chopping and changing to alter the text, but that is a personal preference. In the paper recently reviewed, a paper by one of the co-authors was referenced multiple times in the text, but was omitted from the reference list. If people can miss their own papers, what chance do other authors have?

In short, I suggest four simple take-home messages for the responsible author of academic papers. Act on these simple suggestions and your reviewers will be rewarded with a paper more readable and will, in consequence, find your submission more worthy of approval.

1. Make your key words additional to the title, not just repetition. Mere repetition is superfluous.
2. Don't use very to excess. Treat is like a curse on your paper's message (Kracht, 2020, pp.134–136). At most, use one very to every 10,000–15,000 words. It will then be sufficiently dilute actually to mean something.
3. Paragraphs should never, ever, be comprised of less than two sentences. A single sentence is not a paragraph.
4. All the references in the text must also appear in the reference list.
   All the references in the reference list must appear in the text.
   There are no exceptions.

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