Manchester Geological Association

BCRA

British Cave Research Association

33rd BCRA Cave Science Symposium

hosted jointly with the Manchester Geological Association

Symposium - Saturday 8th October, 2022
Field trip - Sunday 9th October, 2022
Department of Earth and Environmental Science, University of Manchester

Welcome

The British Cave Research Association and Manchester Geological Association are pleased to welcome you to the 33rd Annual Cave Science Symposium and associated fieldtrip. The Symposium is hosted by Prof. Cathy Hollis at the School of Earth and Environment, University of Manchester, on Saturday 8th October, 2022. We have a programme of presentations that will be of interest to anyone wishing to know more about the underground environment.

Symposium Organisers

Please contact Prof Cathy Hollis (cathy.hollis@manchester.ac.uk) for details of the venue and local facilities in Manchester as well as details of the programme and for enquiries concerning oral or poster presentations. For details regarding the field trip, please contact Jo White at: j.white@bcra.org.uk

Registration

Entry is free of charge, however donations towards the cost of room hire and refreshments are welcomed. Donations can be made online at

https://bcra.org.uk/bookshop/donate.html

Registration for the Symposium, evening meal and field trip is online at

https://forms.gle/baVp2KJEcPVjJPWD8

All are welcome, and we look forward to seeing you at the symposium.

Location

The Williamson Building is located in the centre of the University of Manchester campus, on Oxford Road, directly opposite the Manchester Museum (currently closed). It is about 20 minutes walk from Manchester Piccadilly and about 10 minutes walk from Manchester Oxford Road railway station. It is served by several buses. Detailed information on travel to campus is provided here:

https://www.manchester.ac.uk/discover/maps/

Parking is available at the Aquatics Centre and behind the Humanities Building, both less than 5 minutes' walk from the Williamson Building (car parks B & D on the campus map)

A detailed campus map is available here:
https://documents.manchester.ac.uk/display.aspx?DocID=6507

Remote Access

This meeting will be hybrid and streamed via Zoom on the following link:

https://zoom.us/j/98425252220 Meeting ID: 984 2525 2220 Passcode: 731611

Please stay on mute, to prevent incidental noise and echo and turn off your video to ensure optimal connection. Ask questions via the chat function which will be monitored by the session chair. Voting at the AGM will also be via the chat function. Please enter yes or no via direct chat to the meeting host.

Refreshments: Tea, coffee and biscuits will be served during the morning and afternoon coffee breaks. For hot drinks at other times, and for lunch, the following outlets are on campus, a short walk from the Williamson Building:

Café Nero (in Blackwells Bookshop): 11am to 5pm

Navarro Lounge (food, coffee/tea/food): 9am to 12am (https://thelounges.co.uk/navarro/)

BrewDog: 11am – 12am

Co-op supermarket: 6am – 11pm

BCRA Science Symposium, 2022, University of Manchester

Schedule

09.00 Doors open

09.30 Introduction and welcome

09.45 *Fiona Whitaker et al*.: Controls on the distribution of cenote blue holes on Andros Island, North-west Great Bahama Bank

10.10 *Mahjoor Lone et al*.: Indian Summer Monsoon variability through the mid-to-late Holocene

10.35 Break

11.00 *Alessandro Mangione et al*.: Hypogenic cavern characterisation in Mississippian carbonates (UK)

11.25 *Mark Tringham et al*.: Geology and speleogenesis in the UK's longest cave formed in dolomite - Preliminary findings from new work in the Slaughter Cave System, Forest of Dean.

11.50 Discussion

12.00 BCRA Annual General Meeting

12.50 Lunch

14.00 *Zahra Malekpour-Fard et al*.: The first record of cave dwelling Opiliones from Iran (online)

14.25 *Keziah Claire Warburton:* Geographical Information System (GIS) Mapping as a Method of Osteoarchaeological and Taphonomic Analysis of Early Neolithic Human Remains from Cave Burials in North-Western England

14.50 *Phil Murphy*: Stoned in Stonelands and Washed up in Wharfedale

15.15 Break

15.45 *Jo White et al*.: Derbyshire Mine Biofilms – Snottites, Slime and Oozes

16.10 *John Gunn et al.:* Spatial variability of limestone permeability in the Dow Low area, Buxton, Derbyshire

16.45 Close

Field Trip

A field trip to Alderley Edge Mines will take place on Sunday 9th October. These are a series of interlinked mines in Triassic sandstones that are owned by the National Trust and have been leased from them by the Derbyshire Caving Club, who maintain access. See

https://www.derbyscc.org.uk/alderley/

Depending on numbers, and the level of expertise of participants, we may run two trips; a short easy trip with time for photographs, and a longer trip to the deeper levels. You will need to bring an over-suit or overalls, helmet & light and boots or wellies.

WELCOME FROM THE BCRA CHAIRMAN

On behalf of the Council and Trustees of the British Cave Research Association (BCRA) I am pleased to welcome members (and those who have not yet joined BCRA but hopefully will do so in the future!), together with members of the Manchester Geological Association, to the 33rd BCRA Cave Science Symposium. I am pleased that this will be our first 'in-person' meeting since 2019 but also welcome those who will be joining us online. A great deal of work is involved in organising conferences and symposia, and hybrid events present their own challenges. Hence, we extend our thanks to Professor Cathy Hollis for acting as the academic organiser of this 33rd Symposium and for putting together an interesting programme of lectures.

The first BCRA Cave Science Symposium was held at the University of Sheffield in 1984 and it was followed by annual meetings until 1987 when it became biannual (1987 and 1991). There was then a four year hiatus before the meetings resumed in 1996 since when they have been held annually. The 30 Symposia up to and including 2019 were held at 14 individual institutions with the Universities of Bristol and Leeds tying for most popular with five meetings at each. A physical meeting was not possible in 2020 due to the global pandemic and instead a virtual meeting making use of the Zoom platform was hosted by Northumbria University and the British Geological Survey. This made it possible for us to welcome speakers and guests who would not otherwise have been able to be present and there were over 100 registered attendees from across the globe making the event our largest ever science symposium. For 2021 BCRA Council decided that a physical meeting was desirable but as most Universities remained unwilling to host outside events due to Covid19 constraints an alternative venue was required and we secured the use of the excellent facilities at the Hulland Ward and District Millennium Village Hall, Derbyshire for a meeting to be hosted by the University of Huddersfield. Sadly, the weather intervened and the meeting had to be abandoned and re-arranged for Saturday 15th January as an online only event, via the British Geological Survey zoom platform.

The objective of the BCRA is "*to promote the study of caves and associated phenomena wherever they may be situated, for the benefit of the public*" and the Annual Symposium is one of the ways that this objective is fulfilled. The *associated phenomena* include karst landforms on the surface, and this aspect is reflected in the title of the Association's scientific journal, *Cave and Karst Science*. The BCRA Cave Science policy focuses on four major themes: speleogenesis, archaeology/palaeontology, biology and technology. Speleogenesis is interpreted broadly, including those aspects of geomorphology, geology and hydrogeology that impinge on the development of conduits and ultimately caves. Studies of present cave climates and reconstruction of paleoclimates and paleoenvironments using cave sediments (speleothems and clastic deposits) are also considered under the speleogenesis heading. This years meeting has a definite dominance of talks under the 'speleogenesis' theme but archaeology and biology themes are also represented.

The BCRA AGM is held during the Symposium. Administrative matters are kept to a minimum, the primary objectives being to provide BCRA members with a succinct summary of Association activity during 2022 and to seek views on what should be done in 2023 (our golden anniversary year) and beyond. Interested non-members are welcome to attend the AGM (in person or online) and to contribute to the discussion but not to vote.

Finally, and as we have many non-BCRA members attending as Guests, it is important to note that BCRA is a Charity that is run by volunteers and relies on income from membership fees and donations. If you enjoy this meeting and would like to join BCRA we would be pleased to welcome you (go to http://bcra.org.uk/detail/fees.html) and if you are willing to provide a donation to assist us then please do so via http://bcra.org.uk/donate.

Professor John Gunn, BCRA Chairman

ABSTRACTS OF PAPERS

Controls on the distribution of cenote blue holes on Andros Island, North-west Great Bahama Bank

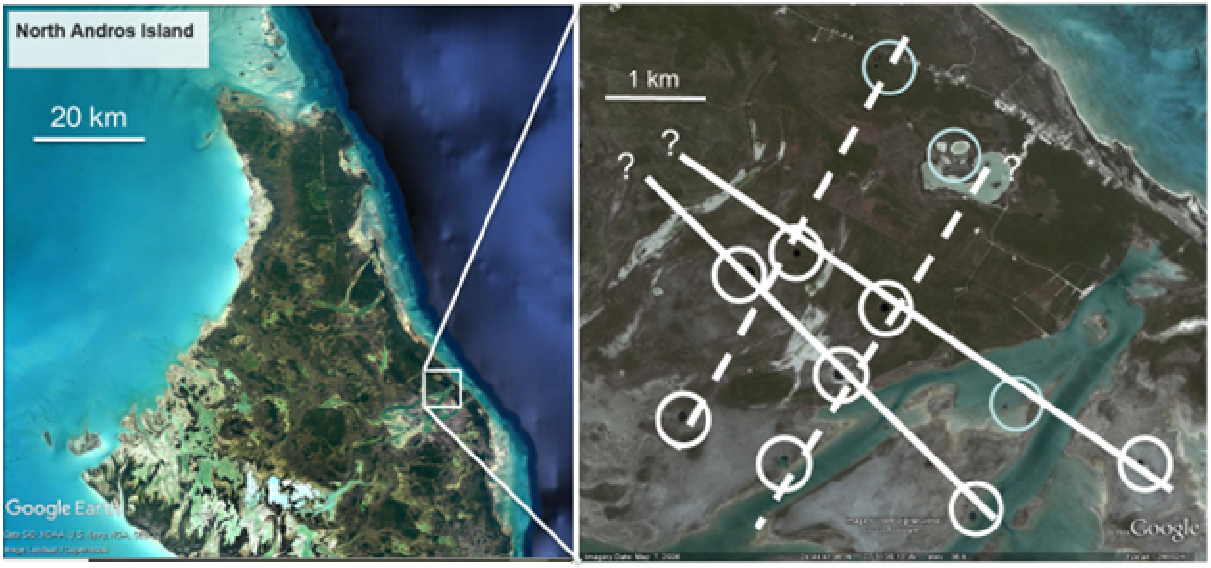
Fiona F. Whitaker[2], Harriet L. Mills[2], David Leslie[1]

[1.] University of Lancaster; [2]. University of Bristol (fiona.whitaker@bristol.ac.uk)

The Bahamas platform is widely recognised as the most stable continental block in the Caribbean. It is underlain by a series of normal and wench faults, which are inherited from an upper Jurassic rifting phase but presumed inactive since. These deep faults appear to control the geometry of the steep platform margins and deep-water re-entrants. At the surface and extending up 40 km, major fracture systems occur parallel to the platform margins and show diagenetic alteration by circulating groundwater. Similar systems are described in ancient platform margins in the Canning Basin and Guadalupe Mountains. Here we present a statistical analysis of the distribution of large scale karst features distributed across Andros island, that provides the first evidence for extensive fracturing up to 35 km from the platform margin.

Some 177 circular collapses ("cenotes") were identified from satellite imagery. At the surface these features have a diameter of 105±60 m, with the largest spanning 370 m. Field survey shows they have a maximum depth of c.110 m, with floors of collapse boulders and soft sediment suggesting active autochthonous infill. Underwater exploration of a subset of cenotes suggest they tend to increase in diameter with depth, possibly due to the effects of mixing-zone dissolution and associated collapse. Only a few of the smaller cenotes are known to connect with lateral cave passage, but this apparent absence may simply reflect dissolution, collapse and infill of the larger features.

Perpendicular regression reveals the distribution of cenotes is significantly non-random, and identifies many lineations, defined by rows of up to 6 cenotes. The distribution suggests that cenote formation may be focussed at the intersections of lineations. Most lineations within 10 km of the eastern bank margin are oriented parallel to this margin, with a subset perpendicular. However, further inland, the orientation of many lineations echoes that of the N60^{o}W trending Sunniland (Bahamas) Fracture Zone, a long-lived transform feature related to Jurassic rifting that extends across the Floridian Peninsula and crosses the Great Bahama Bank to the north of Andros Island. The vast majority (98%) of identified cenotes occur within 35 km of the western bank margin. The absence of cenotes at greater distances from the margin may reflect increased infill by sediment generated on the shallow modern bank, or alternatively may be controlled by the location of margin of the underlying Cretaceous Andros Bank.


North Andros Island
20 km
Google Earth
1 km
?
?
Google

BCRA Science Symposium, 2022, University of Manchester

Indian Summer Monsoon variability through the mid-to-late Holocene

Mahjoor Ahmad Lone[a,b], Susanne Fietz[c], Joyanto Routhd[d], Carme Huguet[e], Kalpana M. Singamshetty[f], Ravi Rangarajan[g], Prosenjit Ghosh[g], Vikash Kumar[h], Hsun-Ming Hu[b], Chuan-Chou Shen[b], Syed Masood Ahmad[f,i], and Sophie Warken[j]

[a]Department of Geography and Environmental Sciences, Northumbria University, Newcastle upon Tyne, UK; [b]Department of Geosciences, National Taiwan University, Taiwan ROC; [c]Department of Earth Sciences, Stellenbosch University, Stellenbosch, South Africa; [d]Department of Water and Environmental Studies, Linköping University, Linköping, Sweden; [e]Departamento de Geociencias, Universidad de los Andes, Bogotá, Colombia; [f]CSIR-National Geophysical Research Institute, Uppal Road, Hyderabad, India; [g]Center for Earth Sciences, Indian Institute of Sciences, Bangalore, India; [h]National Centre for Antarctic & Ocean Research, Goa, India; [i]Department of Geography, Faculty of Natural Sciences, Jamia Millia Islamia, New Delhi, India; [j]Heidelberg Academy of Sciences, ImNeuenheimer Feld 229, Heidelberg, Germany

mahjoor.lone@northumbria.ac.uk

A stalagmite $\delta^{18}O$ record from the Syndai cave in Meghalaya in northeast India reveals high amplitude mid-to-late Holocene changes in the Indian summer monsoon (ISM) activity on a centennial timescale. Increased $\delta^{18}O$ during 4.6 to 4.1 ka BP points to a multi-centennial weak ISM activity, which is weakest at ~4.2 ka. Notably, this ~500-year-long cold and dry phase does not reveal abrupt hydroclimatic shifts. In contrast, a sharp decrease in ISM precipitation is observed at ~2.8 ka, ~2.4 ka, 2.2 ka, and 1.8 ka BP, whereas ~2.3 ka shows a period of increased ISM precipitation (decreased $\delta^{18}O$). These high magnitude changes in ISM activity are consistent with other established paleoclimatic records from the Northern Hemisphere. Consistent with the $\delta^{18}O$-inferred monsoon activity, the $\delta^{13}C$ time series reveals a sharp decline in vegetation ~2.8 ka and 2.2 ka BP and a corresponding increase at ~2.3 ka BP. The prominent climatic cycles retrieved from spectral analysis of the $\delta^{18}O$ time series reveal that the ISM variability during mid-to-late Holocene is coeval to the variations in solar insolation and or ocean-atmosphere circulation pattern.

BCRA Science Symposium, 2022, University of Manchester

Hypogenic cavern characterisation in Mississippian carbonates (UK)

Alessandro Mangione, Cathy Hollis, Corinna Abesser, Vanessa Banks, Andrew Farrant, Andre Gonzalez-Quiros, John Gunn, Richard Shaw, Wenwen Wei and Fiona Whitaker

Alessandro.Mangione@manchester.ac.uk

Hypogenic caverns typically comprise non-stratabound conduits (pipes) and complex maze systems that display a "morphologic suite of rising flow". They are thought to form from upward-flowing fluids, with dissolution attributable to fluid cooling, fluid mixing, changes in redox and/or pH due to injection of CO_2 or H_2S-rich water and pressure. However, despite an increasing number of studies of hypogenic caverns, they are still less well characterised than epigenic conduit systems that are formed by direct surface recharge. In part, this is because, commonly hypogenic caverns have no surface expression and hence their presence in the subsurface is often difficult to detect. Although their occurrence and distribution can significantly impact subsurface fluid-flow, prediction of this is far from straightforward.

Non-stratabound caverns of possible hypogenic origin intercepted within epigenic caverns and mines, and sometimes exhumed within outcrops, have been recognised in Mississippian carbonates on the Derbyshire Platform, northern England (UK). These caverns include: 1) open vertical and sub-vertical caverns; 2) partly mineralised and sediment filled caverns; 3) calcite-lined caverns. Some of the calcite-lined caverns are associated with calcite veins. These often contain very coarsely crystalline calcite cement, with well-formed crystals commonly >5 cm diameter, that represent the last cementation event on the platform.

This study aims to understand the relationships between cavern occurrence, morphology, size, location and geological context and the timing of cavern development to assess the degree to which hypogenic processes contributed to their formation. Fieldwork involves mapping the location, size and shape of the caverns, and their association with faults, stratal architecture, and rock type (e.g., limestone, dolomite). The geological and geochemical analysis carried out in this study, will then be used as constraints for numerical models that aim to better understand processes of genesis and evolution of hypogene caverns.

BCRA Science Symposium, 2022, University of Manchester

Geology and speleogenesis in the UK's longest cave formed in dolomite - Preliminary findings from new work in the Slaughter Cave System, Forest of Dean.

Mark Tringham, Cathy Hollis[1] & Xiya Zheng[1]

mtringham@btinternet.com [1]University of Manchester, UK

Re-surveying and research has been underway in the Slaughter Cave System since late 2018. So far this has included water tracing, re-surveying of much of the 14km long Slaughter Stream Cave, geological observations, rock sampling and analysis, and photography.

Petrographical analysis performed at University of Manchester indicates that the cave is likely all formed in dolomite, but with a widely varying silica content and porosity. Passage plans, profiles and cross-sections are strongly influenced by stratigraphy and geological structure, including shelly and more porous horizons alternating with harder dolomite-rich layers, stylolites, wrench faults, fault breccias, iron ore veins and some local changes in structural dip.

The re-surveying has given a clearer idea on active and relict passage elevations, morphology and genesis, with three main levels of development identified. Paleo-water flow indications from wall scallops are uncommon, but nevertheless sufficient to define the main relict epigenic drainage routes and relate them to progressive down-cutting and lateral migration of 'base level' water table and springs in the nearby Wye Valley. In some remote parts of the cave more complex speleogenetic features are present, likely related to the combined effects of early hypogenic cave formation, iron mineralisation and later epigenesis. Some faults are seen to be recently dilated with dm scale tectonic void rift spaces that seem to post-date much of the solutional cave formation.

Cave sediments include large volumes of quartz sand and allogenic sandstone pebbles together with boulder breakdown and rare cryogenic calcite, all of which point to a long cave history sometimes with permafrost and flash-flooding in peri-glacial environments. Calcite spelothems are rare, likely due to lack of permeability in a shaley cap-rock which is present above most of the cave. Manganese (?) and hydrated iron minerals coat many cave walls in the active streamway and are preferentially deposited over protruding coral and brachiopod fossils.

Much future multi-disciplinary work remains to be done before arriving at a comprehensive analysis and understanding in this fascinating major cave system, which has not received much scientific attention before. The scientific results from this unusual cave environment will also help reinforce the case for improved conservation and pollution avoidance in the active stream-way, which is a significant on-going concern.

BCRA Science Symposium, 2022, University of Manchester

The first record of cave dwelling Opiliones from Iran

Zahra Malekpour-Fard[1], Sharareh Shafiei[2], Helaleh Nategheh[3], Majid Tajvar[4]

[1,2] Razi University, Kermanshah, Iran; [3] Sabzkaran-e Balan NGO; [4] Guilan Mountaineering Council

zahramalekpourfard@gmail.com

Study on Opiliones in Iran dates back to the 19th century when Thorrell (1876) discovered two species from the country. After that, a few studies have slightly upgraded the information on the Iranian harvestmen fauna in a long period. Snegovaya et al. (2018) listed all records on Iran Opiliones including 22 species from four families, along with the description of one genus and two species. Perhaps, the most remarkable work is reporting the family Biantidae for the first from Iran and Palearctic. Recently, five further species have been added to the harvestmen fauna of the country from which two are new to science. They also reported the family Trogulidae for the first time from the country. Collectively, 28 species from six families including Biantidae, Dicranolasmatidae, Nemastomatidae, Phalangiidae, Sclerosomatidae and, Trogulidae have been reported from Iran territories so far. With at least 16 discovered species, Alborz Mountain Ranges have the richest harvestman diversity in Iran followed by the west and northwest parts of the country, along Zagros Mountain Ranges. There are no reports on Opiliones from other regions of Iran except one from central and three records from southern parts. From 6650 globally described species, more than 130 use caves as permanent or temporary habitats. Cavernicolous harvestmen exit the cave at night to forage and then return to the cave before dawn for a daily rest where they may themselves be preyed by other cave inhabitants. In Iran, harvestmen have been reported from various habitats including near human settlements at high elevations, bush-covered mountains, rocky arid plains and parks. Although no detailed description has been given about their habitats. The Hyrcanian vegetation zone is an 800 Km long area which is surrounded by Caspian Sea from the north, and Alborz Mountain Ranges from the south. Alborz Mountain Ranges act as a barrier to trap the evaporations arising from the Caspian Sea above the Hyrcanian region, and the consequent humidity and rainfall make it a unique and rich ecosystem in terms of habitats, fauna and flora. There is no record of the observation of harvestmen in caves of Iran so far. In this study, we reported one species of Phalangiidae family from a cave for the first time from the country.

Cokendolpher, J.C., Zamani, A. & Snegovaya, N.Y. (2019) Overview of arachnids and arachnology in Iran. Journal of Insect Biodiversity and Systematics, 5 (4), 301–367; Snegovaya, N.Y., Cokendolpher, J.C. & Mozaffarian, F. (2018) The Opiliones of Iran with a description of a new genus and two new species. The Journal of Arachnology, 46 (1), 69–80; Snegovaya, N. Y., Cokendolpher, J. C., & Zamani, A. (2021). Further studies on harvestmen (Arachnida: Opiliones) from Iran, with the descriptions of two new species. *Zootaxa*, *4984*(1), 7386; Thorell, T. 1876. Sopra alcuni Opilioni (Phalangidea) d'Europe e dell' Asia occidentale, con un quadro dei generi europei di quest' Ordine. Annali del Museo Civico di Storia Naturelle di Genova 8:452–508.

BCRA Science Symposium, 2022, University of Manchester

The Descent: Geographical Information System (GIS) Mapping as a Method of Osteoarchaeological and Taphonomic Analysis of Early Neolithic Human Remains from Cave Burials in North-Western England

Keziah Warburton, The University of Central Lancashire

kcwarburton1@uclan.ac.uk

Caves have long been recognised as an important aspect of Neolithic burial practice and our understanding around such practices has been supported by taphonomic analysis and re-analysis of original excavations. Almost two decades ago Leach (2006) did a comprehensive review of 21 assemblages from subterranean sites in Yorkshire, resulting in the re-dating of several burials to the Early Neolithic. Building on her work, this research aims to assess whether Geographic Information Systems (GIS) can be used as a tool for exploring taphonomy, currently under researched in human assemblages. Through our understanding of taphonomic patterns at an element, body and stratigraphic level, site specific inferences of burial practices can be constructed and patterns across cave burials assessed.

Two main sites were selected for analysis, Cave Ha 3 (Yorkshire) and Heaning Wood (Ulverston). Two further sites, Lesser Kelco and Sewell's Cave (Yorkshire), were brought in as supporting assemblages. Bone fragments were assessed for twelve taphonomic characteristics, split into 42 subcategories. The taphonomy was mapped onto anterior and posterior templates of bones in QGIS, creating visual representations of changes. Additionally, archive material was examined for spatial information relating to find locations. Cave Ha 3 offered the most comprehensive data and the taphonomy data was geographically referenced in QGIS. This provided stratigraphic distribution of changes. Tertiary excavations were conducted at Cave Ha 3 during July 2022, further improving mapping. Spatial data for Heaning Wood is less detailed and mapping is currently in progress.

Initial results suggest that QGIS can provide excellent visualisation of taphonomic modifications, regardless of whether a site has spatial legacy data. It has allowed analysis of intra and inter-body taphonomic changes. For sites that do have context data, QGIS provides a more traditional use, mapping where these modifications have occurred within the cave. This has implications for understanding original deposition, geological processes and the relationship between the buried bodies and cave.

BCRA Science Symposium, 2022, University of Manchester

Stoned in Stonelands and Washed up in Wharfedale: Paleoclimate and archaeological studies in the caves of Littondale and Wharfedale.

Phil Murphy , School of Earth and Environment, University of Leeds.

p.j.murphy@leeds.ac.uk

The caves in the eastern valleys of the Yorkshire Dales karst have been subject to relatively little archaeological and scientific study in recent years. Such work, like cave exploration in the area, being undertaken by a few dedicated individuals. Stonelands Cave, situated beneath the north eastern flank of Littondale, appears an obvious site for human use during but no previous reference to any archaeological evidence from the site was known. Materials recovered from sedimentary deposits in the large entrance chamber produced evidence of Roman occupation. A study of speleothem deposits in the cave suggest the possible presence of an ice body within the cave during Late Pleistocene times. Archaeological materials recovered and preserved by the local caving community during the 1960s have been accessed as part of this study and radiometric dating of such materials has provided further supporting evidence of a breeding population of bears in the area during late glacial times and evidence of flooding in now dry surface features during the Roman occupation.

This study shows the area is a potential treasure trove for future cave archaeological and paleoclimate studies and illustrates the importance of cultivating relationships with the caving community. The work was undertaken in partnership with David Hodgson, a leading figure in karst science in the area and a true Dalesman, who sadly passed away during 2021. The project was funded by a grant from the BCRA Cave Science and Technology Research Initiative.

Murphy P J and Chamberlain A T 2021. The Elbolton Pot Bear – a further late glacial bear occurrence in the south eastern Yorkshire Dales. *Cave & Karst Science* **48**(1) pp17 & 18; Murphy P J Chamberlain A T and Hodgson D. 2021. Stonelands Cave, Littondale, North Yorkshire: A newly identified Roman cave site in the south eastern Yorkshire Dales. *Yorkshire Archaeological Journal* ***93*** pp166 – 169; Murphy, Phillip J and Andrew T Chamberlain 2020. A Roman dog from Conistone Dib, Upper Wharfedale, UK, and its palaeohydrological significance. *Cave and Karst Science* **47**(1), pp39-40; Murphy, P. 2020. Cavers, Caves and Corpses: how caving has contributed to our understanding of the archaeology and palaeontology of the Yorkshire Dales. In *"Pennine Perspectives"* edited by R.D. Martlew, 45-50. Kettlewell: Yorkshire Dales Landscape Research Trust; Murphy P J, Hodgson D, Richards D and Nita D C 2019. Stonelands Cave, Littondale, North Yorkshire, UK: evidence for ice caves in the Yorkshire Dales? *Cave and Karst Science* **46**(3) 111-114; Murphy P J, Hodgson D, Richards D & Standish C 2014. Boreham Cave, Littondale, North Yorkshire – some geomorphological observations. *Cave and Karst Science* **40**(3)109-13

BCRA Science Symposium, 2022, University of Manchester

Derbyshire Mine Biofilms – Snottites, Slime and Oozes

Jo White[1] , Simon Rout[1] , Bethany Fox[1] and John Gunn[2]

[1].Department of Biological and Geographical Sciences, University of Huddersfield
[2.] School of Geography, Earth & Environmental Sciences, University of Birmingham, Birmingham B15 2TT, United Kingdom

joanne.white@hud.ac.uk

Jelly-like pendulous 'snottites', gelatinous oozes and mucoidal slimes, while sounding like something from a low-budget alien horror film, are descriptions of some of the biofilms found in Derbyshire mine environments.

We have studied three soughs that drain former lead mines in Derbyshire through collection of samples of the biofilms present. Within the project we have analysed the bacterial composition of these samples using metagenomic analyses and 16S rDNA sequencing coupled with analysis of the water chemistry to understand the relationship between the environment and biofilms present. Cultivation techniques have also been employed to try to isolate individual organisms to study their role within the environment. The results obtained to date provide an insight into the metabolic pathways and processes occurring in these biofilms, including sulphur cycling and iron oxidation.

BCRA Science Symposium, 2022, University of Manchester

Spatial variability of limestone permeability in the Dow Low area, Buxton, Derbyshire

John Gunn[1], Tenant Sibanda[2] & Lawrence Brown[3]

[1] School of Geography, Earth & Environmental Sciences, University of Birmingham, Birmingham, B15 2TT, UK. (j.gunn.1@bham.ac.uk)

[2] Breedon Group, Pinnacle House, Breedon on the Hill, Derby, DE73 8AP, UK

[3] Hafren Water, Barkers Chambers, Barker Street, Shrewsbury, SY1 1SB, UK

As part of hydrogeological investigations at Dowlow Quarry, Buxton, Derbyshire, groundwater tracing experiments using sodium fluorescein dye were undertaken from three locations: Borehole H2 in the quarry and two dolines, DOL1 to the north and DOL6 to the northeast. There were two injections into H2, one using 3.68kg and a second using 24kg. In both experiments dye was flushed in using a bowser. Springs and soughs (lead mine drainage levels) at distances ranging from 0.9km to 25.35km from the site were monitored for 215 days but no tracer was recovered. Spot samples collected from H2 over a period of 1163 days following tracer injection all contained dye demonstrating a low rock permeability. In contrast, dye injected into DOL1 was detected at four spatially separated sites demonstrating divergent flow. Based on the first dye emergence at the closest monitored spring the velocity was >2600 m/d and the velocity towards the most distant recovery point was 550-1250 m/d. Two tracer tests were undertaken at DOL6, one under low groundwater elevations and a second at higher elevations. During the first experiment there was a slight increase in dye concentrations in borehole H2 (velocity 90m/d) and poor dye recovery from a single spring, the tracer having moved at a velocity of 60-80m/d. In contrast, the second experiment demonstrated that there is divergent flow and that DOL6 is in the groundwater catchments of two rivers. The velocity towards the spring where tracer emerged under low groundwater conditions was 165m/d and the velocity towards a spring in a different drainage basin was 490m/d. Dye was also recovered from a monitoring borehole in the quarry (velocity 190m/d) and from a more distant spring (velocity 75-90m/d). These results demonstrate the marked heterogeneity of limestone permeability and the importance of repeated groundwater tracing experiments under different groundwater elevations.