This year's meeting is being held to celebrate the contributions made to our field by Professor Barry Thomas. For well over 50 years, Barry has been one of Britain's leading palaeobotanists, and has published numerous books and over 100 papers on the subject (this is not counting his many books and papers on living plants and geoconservation). His main specialism is the Paleozoic lycopsids, especially their taxonomy, floristics, and taphonomy, and he was a pioneer in the use of cuticles to study these fossils. He has also been active in promoting a wider public understanding of palaeobotany, especially during his time as Keeper of Botany at National Museum Wales (Cardiff).

10.00-10.05	Welcome
10.05-10.20	Christine Strullu-Derrien* (Natural History Museum, London, UK; Muséum national d'Histoire naturelle, France; Sorbonne University, France), Alan Spencer, Ester Gaya, Paul Kenrick, & David Hawksworth THE EARLIEST FUNGAL PLANT PATHOGEN DISCOVERED IN THE RHYNIE CHERT
10.20-10.35	Laura Cooper* (University of Edinburgh, UK) & Alexander Hetherington USING HIGH-RESOLUTION IMAGING TECHNIQUES TO STUDY THE PHLOEM-LIKE TISSUE OF RHYNIE CHERT PLANTS
10.35-10.50	Eliott Capel* (University of Lille, France), Cyrille Prestianni, & Borja Cascales-Miñana REVISITING THE EARLY DEVONIAN MATRINGHEM FLORA FROM NORTHERN FRANCE
10.50-11.10	Harufumi Nishida* (Chuo University, Japan), Aya Kubota, Nao Kawagoe, Yusuke Takeda, Mehmet Oguz Derin, & Yasuhiro Iba VOYAGE INTO THE DEVONIAN RHYNIE CHERT ECOSYSTEM USING A NEW HIGH-RESOLUTION IMAGING TECHNIQUE, MULPIS
11.10-11.40	Tea/Coffee in the Council Rooms
11.40-11.50	Peta Hayes & Christopher Cleal CELEBRATION: THE CAREER OF PROFESSOR BARRY THOMAS
11.50-12.10	Christopher Cleal (University of Bristol, UK) WHERE DID THE PALAEOZOIC COAL SWAMPS COME FROM?
12.10-12.25	Azucena Molina-Solís, Christopher Cleal, Claude Monnet, & Borja Cascales-Miñana* (University of Lille, France) DISENTANGLING THE VEGETATION EVOLUTION OF THE NORD-PAS-DE-CALAIS COALFIELD, FRANCE
12.25-12.40	Sirush Khachatryan* (Institute of Geological Sciences of the National Academy of Sciences of the Republic of Armenia, Armenia; University of Lille, France), Vahram Serobyan, Borja Cascales-Miñana, Taniel Danelian, Araik Grigoryan, Vachik Hairapetian, Pierre Breuer, & Philippe Steemans RECONSTRUCTING NORTH GONDWANAN VEGETATION FROM THE MIDDLE DEVONIAN DEPOSITS OF ARMENIA
12.40-13.00	Andrew Scott (Royal Holloway University of London, UK) THE RISE OF ARBORESCENT LYCOPHYTES AS KEYSTONE SPECIES
13.00-14.00	Lunch (at venues outside the society)
14.00-14.20	Geoffrey Warrington (University of Leicester, UK) *P*ALYNOLOGY *P*ROVES *P*ERMIAN IN DEVON
14.20-14.40	Charles Wellman* (University of Sheffield, UK), Cameron Penn-Clarke, & Claire Browning EARLY LAND PLANT REMAINS FROM THE UPPERMOST ORDOVICIAN-?LOWERMOST SILURIAN CEDARBERG FORMATION OF SOUTH AFRICA

14.40-15.00	Christopher Berry* (Cardiff University, UK), Neil Davies, & William McMahon WHEN SOMERSET WAS DEVONIAN, AND DEVON WAS IN BELGIUM: TALL TALES OF VERY OLD TREES
15.00-15.15	Hugh Pearson (EDF, Sizewell, UK) PALAEOBOTANICAL JIGSAW PUZZLES
15.15-15.45	Tea/Coffee in the Council Rooms
15.45-16.00	Luke Mander* (The Open University, UK), Andres Baresch, & Hywel Williams THE ORIGIN OF LOOPY LEAF VENATION NETWORKS: A CONSEQUENCE OF HERBIVORY?
16.00-16.20	Alexander Hetherington (University of Edinburgh, UK) NEW PERSPECTIVES ON THE EVOLUTION OF PHYLLOTAXIS AND RHIZOTAXY IN FOSSILS
16.20-16.45	Peter Crane (Oak Spring Garden Foundation, Virginia, USA) AN UPDATE ON THE FOSSIL RECORD OF GNETALES
16.45-17.10	Carlos Góis-Marques* (University of Madeira, Portugal; University of the Azores, Portugal; University of Lisbon, Portugal), Célia Bairos, José Madeira, & Miguel Menezes de Sequeira INVESTIGATING THE PALAEOBOTANICAL RECORD FROM THE VOLCANIC MACARONESIAN ARCHIPELAGOS: FROM HISTORICAL COLLECTIONS TO RECENT DISCOVERIES
17.10-17.20	Jiří Kvaček (Národní Muzeum, Prague, Czechia) ANNOUNCEMENTS
17.20	Meeting close

Attendance is free and open to anyone interested in palaeobotany and related fields. Please contact Dr Peta Hayes to confirm attendance.

Meeting supported by the Linnean Society of London.

A social gathering has been arranged for after the meeting at a nearby pub - a private room is reserved at The Goat Tavern, 3 Stafford Street, Mayfair, London, W1S 4RP.

For further information, please contact Dr Peta Hayes, Natural History Museum, Cromwell Road, London, SW7 5BD, UK; p.hayes@nhm.ac.uk; X @NHMPalaeobotany

Abstracts:

When Somerset was Devonian, and Devon was in Belgium: tall tales of very old trees

Christopher M. Berry*[1], Neil S. Davies[2], & William J. McMahon[2]

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Recent exploration of the coast of North Devon and West Somerset have demonstrated that the Middle Devonian terrestrial sediments of the area are far from devoid of fossils as previously believed. Amongst abundant plant debris, trunks and branches of the pseudosporochnalean *Calamophyton* are the most recognisable, and various sedimentary phenomena can be attributed to standing and fallen *in situ* trees of *Calamophyton* with varying degrees of confidence. Recent theories suggest the plants grew far from their present place in the British Isles. Given an Eifelian (early Mid Devonian) age, are these the oldest fossil forests?

Revisiting the Early Devonian Matringhem flora from northern France

Eliott Capel*[1], Cyrille Prestianni[2,3], & Borja Cascales-Miñana[4]

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The late Early Devonian was a period of significant morphological and anatomical diversification among various early land plant groups. Nonetheless, evidence documenting this remarkable event remains limited, especially given the scarcity of permineralized material. Here, we reinvestigate an Emsian flora from Matringhem (northern France), to both revise the originally described adpression assemblage and examine the permineralized content. Additionally, a newly sampled nearby locality yielded plant micro- and macrofossils, providing further material to document plant diversity in this region. The adpression assemblages demonstrated the predominance of basal euphyllophytes, with interestingly, vegetative and isolated fertile remains attributed to *Psilophyton burnotense*. This contrasts with the permineralized flora found to be entirely composed of axes with anatomical characteristics encountered among zosterophylls. A discrepancy between both types of fossil records is common in Early Devonian plant assemblages and might reflect a sampling/identification bias or divergent taphonomic pathways. Nevertheless, a comparison between several other permineralized floras showed that zosterophyll-dominated records are indeed more reminiscent of Pragian to early Emsian assemblages, in contrast to euphyllophyte-dominated middle to late Emsian floras.

Acknowledgments: This project is funded by EARTHGREEN project (ANR-20-CE01-0002-01).

Where did the Palaeozoic Coal Swamps come from?

Christopher J. Cleal

University of Bristol, Bristol, UK

The coal swamp biome dominated the tropical lowlands of Pangaea during much of late Carboniferous (Pennsylvanian) times. However, there were also coal swamps in the early Carboniferous (Mississippian), notably during the Serpukhovian – early Namurian in southern Scotland, the Lower Loire and Upper Silesia. Like the Pennsylvanian swamps, these proto coal swamps produced significant deposits of peat, now represented as coal. The vegetation was also broadly similar, being dominated by arborescent lycopsids, sphenopsids and ferns, but with a lower diversity of seed-plants, with few medullosaleans and no cordaitaleans. There was a clear but indirect correlation between the development of the coal swamps and climatic fluctuations during the Late Palaeozoic Ice Age. This was not because of changing climatic conditions in the tropical belt, but because fluctuations in the size of the ice-sheet in high latitude Gondwana was affecting sea-levels: during glacial phases, lower sea-levels exposed larger areas of tropical Pangaea for the swamps to expand, which would then be flooded by rising sea-levels during the interglacials.

Using high-resolution imaging techniques to study the phloem-like tissue of Rhynie chert plants

Laura Cooper* & Alexander J. Hetherington

Institute of Molecular Plant Sciences, School of Biological Sciences, University of Edinburgh, Max Born Crescent, Edinburgh, Scotland, EH9 3BF, UK

The Rhynie chert is an Early Devonian Lagerstätte renowned for exceptional cellular, three-dimensional preservation of an early terrestrial ecosystem. The lycopsid *Asteroxylon mackiei* is the most morphologically complex plant of the Rhynie chert, exhibiting rooting axes and leaves. By combining exceptional preservation, occurrence at a key time in terrestrial plant evolution and a phylogenetic position within the extant lycopsids, *A. mackiei* can provide unparalleled insight into the origin and evolution of key plant tissues. Phloem is the specialised sugar-conducting tissue of vascular plants. As the origin of phloem is associated with increased size and complexity, phloem can be considered a major innovation in plant evolution. Phloem is defined by the presence of sieve pores, often <1μm pores connecting cells enabling efficient transport through the phloem. Though *A. mackiei* exhibits a tissue similar to phloem, the presence of sieve pores in this tissue has not been confirmed - in part due to the resolution limit of light microscopy. In this talk I will demonstrate how I have developed two high-resolution microscopy techniques - Airyscan Confocal Laser Scanning Microscopy (CLSM) and Scanning Electron Microscopy (SEM) – to search for potentially <1μm sieve pores in *A. mackiei*.

An Update on the Fossil Record of Gnetales

Peter Crane

Oak Spring Garden Foundation, Virginia, USA

Interest in the evolutionary history of Gnetales has increased significantly over the last 40 years, in part because of the importance of the group for a deeper understanding of seed plant phylogenetics and angiosperm relationships. The rapid subsequent expansion in the informative macrofossil and mesofossil record of Gnetales has been an area of significant paleobotanical progress and now provides a useful complement to the record based on dispersed pollen. In this paper I will review new records from the Late Jurassic and mid-Cretaceous that are attributable to Gnetales or their close relatives and that expand what is known about the diversity and distribution of Gnetales in the past.

Investigating the palaeobotanical record from the volcanic Macaronesian archipelagos: from historical collections to recent discoveries

Carlos A. Góis-Marques*[1,2,3]; Célia Bairos[1], José Madeira[3,4], & Miguel Menezes de Sequeira[1]

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The Macaronesian archipelagos (i.e., Azores, Madeira, Canary, and Cabo Verde archipelagos) palaeobotanical record has been overlooked due to the belief that oceanic islands, volcanic in origin, lack well-preserved and palaeobiologically informative plant fossils. However, bibliographical, collection-based, and fieldwork evidence clearly demonstrates that plant fossils can be common, abundant, and well-preserved. Yet, both the number and quality of these records can vary due to historical/current exploration and geological/taphonomical settings. The first historical record is known from the 16th century for the Azores archipelago, the late 18th to early 19th century for the Canary and Madeira archipelagos, and the mid -19th century for the Cabo Verde archipelago. Overall, bibliographical/field evidence shows that a palaeobotanical record is found on most of the islands, ranging from 13 Ma to the present. Somatofossils such as logs, stems, leaves, flowers, fruits, seeds, pollen, spores, and phytoliths are found within sedimentary and volcanic rocks, and preserved as impressions, compressions, adpressions, permineralizations, lava tree casts, and mummifications/unaltered. Ichnofossils are usually rhizoliths associated with Quaternary fossil dunes. Taphonomically, the fossil assemblages are allochthonous to autochthonous with cases of *in situ* (T0) assemblages, especially related to explosive volcanism. Plant fossils from oceanic islands are valuable, as they can provide minimum ages for phylogeny calibration, clues on the evolution of insular syndromes, allow the reconstruction of the palaeovegetation, detecting plant extinctions, and allow the inference of the anthropic impact on once pristine insular vegetation.

New perspectives on the evolution of phyllotaxis and rhizotaxy in fossils

Alexander J. Hetherington

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Lateral plant organs, including leaves and reproductive structures, are arranged on stems in distinct patterns termed phyllotaxis. Despite phyllotaxis being a key characteristic of land plants it remains unclear when phyllotaxis evolved and what phyllotactic types were present in early vascular plants. Fossils hold a key line of evidence for investigating the evolution of phyllotaxis but in many cases the mode of preservation limits our ability to quantify phyllotaxis, especially in compression fossils. In contrast to compressions, 3D permineralised fossils offer a unique window to study the evolution of phyllotaxis in the past. Here I describe how phyllotaxis can be investigated in fossils from 3D digital reconstructions using the leaves and sporangia of the lycopsids *Asteroxylon mackiei* as a case study. Our initial studies have focussed on phyllotaxis in leaves and sporangia, however these same techniques offer a promising approach to study an analogous patterning mechanism in rooting systems termed rhizotaxy.

Reconstructing North Gondwanan vegetation from the Middle Devonian deposits of Armenia

Sirush Khachatryan*[1,2], Vahram Serobyan[1], Borja Cascales-Miñana[2], Taniel Danelian[2], Araik Grigoryan[1], Vachik Hairapetian[3], Pierre Breuer[4], & Philippe Steemans[5]

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Armenia offers exceptional Devonian outcrops consisting of shallow-water mixed carbonate-siliciclastic deposits, which yield abundant and diverse faunas of brachiopods, bryozoans, conodonts, and ostracods. However, in terms of plant remains, they are widely unexplored. Here we show, for the first time, highly diverse fossil records from both plants and dispersed spores of such deposits. New evidence comes from 37 miospores, belonging to 24 genera, recently discovered from the Middle-Upper Devonian Ertych section of Central Armenia. This rich palynoflora includes, but it is not restricted to, *Acinosporites lindlarensis*, *Aneurospora greggsii*, *Apiculiretusisporites brandtii*, *Chelinospora concinna*, *Cymbosporites catillus*, *Emphanisporites rotatus*, *Geminospora lemurata*, *Kraeuselisporites ollii*, *Samarisporites triangulatus*, and *Verrucosisporites nitidus*, which represents an important morphological disparity. Spore distribution indicates a Givetian-age to sampled levels. Interestingly, the presence of *K. ollii*, only known on the Baltica outcrops, would imply a proximity of Armenia to this palaeocontinent. Recovered dispersed spores further allow reconstructing the vegetation of these early land ecosystems. According to the affinities of potential parent plants, the Ertych flora would be mainly characterised by a significant abundance of lycopsids, such as *Leclercqia* and *Bisporangiostrobus*, as well as progymnosperms, such as *Archaeopteris*. Moreover, some plant megafossils have been also found. Preliminary results suggest the presence of an *Aneurophyton*-like plant. Obtained material further suggests the presence of a plant morphology linked to the early fern-like groups, closely resembling *Eocladoxylon*. This scenario would be in agreement with the heyday stages of the Eophytic phase of evolutionary floras, implying the presence of a well-structured vegetation on these North Gondwanan environments.

Keywords: Armenia, Ertych section, Givetian, Palynoflora, Plant megafossil, Eophytic flora.

Acknowledgements: SK thanks the support provided by the Eiffel PhD program (2023/ n°P853628G). BC-M thanks EARTHGREEN funding (ANR-20-CE01-0002-01). Research financed by the Committee of Science of the Ministry of ESCS of the Armenian republic (Project No: 22RL-016).

The origin of loopy leaf venation networks: a consequence of herbivory?

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Networks vary widely in their architecture and functional properties. Modelling work has shown that networks optimized for transportation efficiency are branching trees, while networks optimized for resistance to damage are characterized by loops. Illustrations of these two architectures are found in leaf venation networks, and branching networks are found in ferns as well as the seed plant *Ginkgo*, while networks with loops are typical of flowering plants and some ferns. The first evolutionary transition from branched to loopy venation is recorded by leaf fossils in the Westphalian of the Carboniferous, but there is currently a lack of data on the effects of damage in extinct leaf venation networks. Consequently, it is unclear whether loopy leaf venation networks could be a possible outcome of selection for resistance to damage. We address this issue here with a computational analysis of venation network robustness that is focused on fossil leaves from the Westphalian. We compare the responses of real-world fossil leaf venation networks to simulated damage and interpret the results in the context of the Carboniferous record of herbivory. We suggest that herbivory may have played a role in driving the evolution of loopy architectures in Carboniferous leaf venation networks.

Disentangling the vegetation evolution of the Nord-Pas-de-Calais Coalfield, France

Azucena Molina-Solís[1], Christopher J. Cleal[2], Claude Monnet[1], Borja Cascales-Miñana*[1]

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In this communication, we provide new insights into the plant diversity and biostratigraphy of the Nord-Pas-de-Calais Coalfield. This coalfield is formed by an almost continuous series of Namurian–Westphalian deposits, from which has been historically described an extremely diverse macrofossil flora. Recent evidence has highlighted a clear palaeofloristic pattern for this coalfield that can be compared with evidence from other coeval Variscan environments. Here, we further study this macroflora focusing on the biostratigraphical changes through a series of multivariate data analyses. Obtained cluster I-VIII model allows deeper comparisons with coeval vegetation. But most importantly, this new model elucidates up to six major phases in the evolution of coal swamp vegetation in the Nord-Pas-de-Calais Coalfield: (1) an initial invasion of peat substrate vegetation in the earliest Langsettian; (2) a rapid diversification of the clastic substrate vegetation in the early-middle Langsettian; (3) a more gradual diversification of the vegetation of both clastic and peat substrates during the late Langsettian to middle Duckmantian; (4) the appearance of more characteristically late Westphalian, but less diverse floras during the late Duckmantian to early Bolsovian; (5) a marked increase in species diversity in the middle-late Bolsovian; and (6) a marked reduction in species diversity during the Asturian. Evidence further shows how this dynamics of swamp vegetation was responding to both climate change, notably the major phases of the so-called Late Palaeozoic Ice Age, and the orogenic landscape changes during Westphalian times.

Keywords: Biozone, Carboniferous, coal swamp, Nord-Pas-de-Calais, palaeotropics, vegetation evolution.

Acknowledgements: We thank Jessie Cuvelier for her technical assistance during the study of palaeobotanical collections of the University of Lille. Research supported by EARTHGREEN project (ANR-20-CE01-0002-01).

Voyage into the Devonian Rhynie Chert ecosystem using a new high-resolution imaging technique, MULPIS

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Here we invite you to a virtual voyage into a petrified ecosystem preserved in the Devonian Rhynie Chert. The 3D image inside the solid rock is obtained using a new method that we named 'Hyper-resolution Multi-dimensional Petrographic Imaging System (MULPIS)'. In the MULPIS, each entire concretion is serially ground at extremely thin intervals, allowing each surface to be photographed at high resolution. The obtained serial image data are rendered to reconstruct complete internal structure of the chert, including the rock matrix and embedded organic/inorganic materials. The new method dramatically raised the probability of new fossil encounters from mere coincidence to inevitable. It should be noted that the MULPIS is totally destructive. However, the method is still useful in combination with other traditional methods as well as 3D printed modelling techniques.

One block of the Rhynie Chert stored in the National Science Museum of Natural History and Technology, Tokyo, was used for preliminary study. The rock was ground down automatically at 2 µm intervals or less (e.g., 0.5) in case we needed higher resolution images, such as of sporomorphs. Each surface was photographed with high-resolution digital cameras and an entire imaginary space was 3-dimensionally rendered from obtained image data using Amira (ver. 2021.1) and ImageJ (2.0.0). The ground area is ca. 5 x 6 cm square, and we gained a continuous virtual-space image of 1.5 cm thick in the first trial. We continued the same procedure and started to obtain more specimens for various purposes of scientific analyses in collaboration with colleagues in the University of Edinburgh.

More than 140 plant fragments have now been detected manually within the rendered space. The tissues of plants and associated fungi are well-preserved with high anatomical resolution. Other organisms such as arthropods are not found yet but are expected to be encountered in further investigations. Most plants are composed of protostelic round axes of varying size and preservational conditions; some have suffered fungal decay of different degrees. Some axes have undulating outlines, others are flat, and the total classification and taxonomic studies are in progress. The potostele has elongated but non-tracheal elements suggesting possible affinies to Protracheophytes, such as *Aglaophyton* and *Horneophyton*. Several types of sporangia are found, some terminate on protostelic axis, some are detached. We made 3D reconstructions of selected axes and sporangia, including some 3D printed models.

The MULPIS can provide us with not only anatomical details of Rhynie organisms, but with keys for understanding various interests such as life cycles, ecological details, depositional as well as seasonal/chronological sequences.

We also prepare some optional tours to the virtual MULPIS world of different time and space. One is the Late Permian silicified chert from the Bowen Basin of Australia, containing *Glossopteris* (*Homevaleia* H. Nishda *et al*. 2007) ovules. Next is inside the calcium carbonate concretions from the Late Cretaceous Yezo Group of Hokkaido, Japan, in which we already found a pseudo-angiospermic fructification of possible new order of extinct Gymnosperms (Nishida *et al*. EPPC 2018, APC II 2023) and an array of mesofossil flowers (Kubota *et al*. APCII 2023). The final tour is to the silicified paleosol from the Late Cretaceous Williams Point Formation of the Livingstone Island, Antarctica, preserving a conifer root system with associated mutualistic root nodules attributable to the Arbuscular Mycorrhizae.

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Palaeobotanical jigsaw puzzles

Hugh L. Pearson

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Chaloner (1986) suggested "Most palaeobotanists would rate the reassembly of whole plants…as one of the prime goals in fossil plant research." He listed six documented instances where evidence allows the conceptual linking of detached organs of fossil plants, but he made no claim that this list was exhaustive.

Sales of jigsaws mushroomed during the periods of lockdown in the COVID pandemic. Some strategies used to complete these puzzles may find their parallels in the task of reassembling whole fossil plants. This talk explores how such a trivial pursuit may stimulate further attempts to reconstruct more complete bodies of prehistoric plants and perhaps add to Chaloner's list.

Reference:

Chaloner, W.G. (1986). Reassembling the whole fossil plant, and naming it. In: Spicer, R.A. & Thomas, B.A. (eds) *Systematic and Taxonomic Approaches in Palaeobotany*, Systematic Association, Special Volume No.31; Clarendon Press, Oxford, p. 67-78.

The rise of arborescent lycophytes as keystone species

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The diversification and spread of arborescent lycophytes in the Mississippian had a major impact for the Earth System. Initially in the Tournaisian and early Viséan these plants played a minor role in a range of lowland ecosystems from lowland floodplains to disturbed volcanogenic settings. As such they may be considered keystone species (Power *et al*., 1996) in that their impact upon communities or ecosystems is large. In particular several factors potentially led to these plants becoming dominant in wetland ecosystems and hence provided a major impact upon the Earth System as a whole. The first was the development of a stigmarian rooting system that allowed the plants to live in wetland setting where their fast determinate growth and cheap construction allowed rapid drawdown of carbon dioxide from the atmosphere. The burial of the resulting organic sediments – peats, further influenced this atmospheric change. At the same time extensive development of lycophyte dominated peats in the mid to late Mississippian allowed for an increase in atmospheric oxygen levels. This in turn would have led to increased wildfire activity. The ability for arborescent lycophyte vegetation to survive fire may be the result of continuous leaf abscission from the trunk and the ability of the plant to photosynthesise through stomata on the trunks thereby reducing the ladder fuels and preventing crown fire development. This set the scene for the dominance of these plants in the following Pennsylvanian.

Power, M.E. *et al*., 1996. Challenges in the quest for keystones. *BioScience*, 46: 609-620.

The earliest fungal plant pathogen discovered in the Rhynie Chert

Christine Strullu-Derrien*[1,2], Alan R.T. Spencer[1,3], Ester Gaya[4], Paul Kenrick[1], & David Hawksworth[1,4]

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The Rhynie Chert is one of paleobotany's most iconic deposits with its exceptionally preserved fossils providing a uniquely clear view of the early development of life on land. The deposit includes plants, animals (mostly arthropods) and various microscopic organisms including different fungal groups. Associations between plants and fungi are a significant feature of the chert, involving symbiotic, saprophytic as well as parasitic fungi. Fossil fungi have received an increasing interest over the past decades and the advent of Confocal Laser Scanning Microscopy (CLSM) provides an important new tool for imaging minute organisms.

Through the combined use of brightfield microscopy and CLSM we describe an exceptionally well-preserved and enigmatic fungus from the Rhynie Chert. The fungus forms a stroma-like structure with conidiophores arising in tufts outside the cuticle on aerial axes and leaf-like appendages of the plant *Asteroxylon mackiei*. It causes a reaction in the plant that gives rise to dome-shaped surface projections. Together, these observations provide evidence of it being a pathogenic fungus, i.e., a disease-causing parasite.

We also show that the fungus belongs to an extinct lineage of ascomycetes. Along with some other Ascomycota previously documented in the Rhynie Chert, these could serve as a minimum node age calibration point for the Ascomycota as a whole, or even the Dikarya (the subkingdom of Fungi that includes the phyla Ascomycota and Basidiomycota) crown group.

Palynology **P**roves **P**ermian in Devon

Geoff Warrington DSc., CGeol., FGS (Snr)

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On the basis of vertebrate remains from the 'Otter Sandstone' the upper part of the red-bed succession on the south Devon coast has long been known to be Triassic; the underlying 'Budleigh Salterton Pebble Beds' are also regarded as Triassic but only have derived Palaeozoic fossils. West of Budleigh Salterton the succession now comprises formations of the Aylesbeare Mudstone Group (AMG) and the underlying, largely arenaceous, Exeter Group (EXG). These are generally considered to be Permian though some workers regarded the EXG as partly Carboniferous and others the AMG as partly Triassic.

In April 1987 Permian miospores were recovered from the lowest (Whipton) formation in the upper part of the EXG. In 1989 more specimens were obtained from beds between that formation and the highest (Exe Breccia) in the EXG, but none have yet been recovered from lower in the EXG or from the AMG. The miospores include *Lueckisporites virkkiae* and provided the first biostratigraphical evidence of a Permian age in the Devon succession. On the basis of the then-known range of *L. virkkiae* the assemblages were interpreted as 'Kazazian to Tatarian' (Mid- to Late Permian) in age; this is now Roadian (early Guadalupian, Mid-Permian) to end-Changhsingian (late Lopingian, Late Permian). The taxon has recently been reported from pre-Roadian (Kungurian, late Cisuralian, Early Permian) deposits in South America.

The Exeter occurrences are below the Exe Breccia which postdates the start of the Illawara Superchron, close above the Roadian-Wordian boundary at a magnetostratigraphical reversal at c. 266.8 Ma. Beds with the Exeter occurrences are separated from the lower part of the EXG by a major unconformity and all or most of the Kungurian (late Cisuralian, Early Permian) is unrepresented. Therefore the Exeter occurrences are now interpreted as Roadian to possibly earliest Wordian (early Guadalupian (Mid-Permian) in age.

Early land plant remains from the uppermost Ordovician-?lowermost Silurian Cedarberg Formation of South Africa

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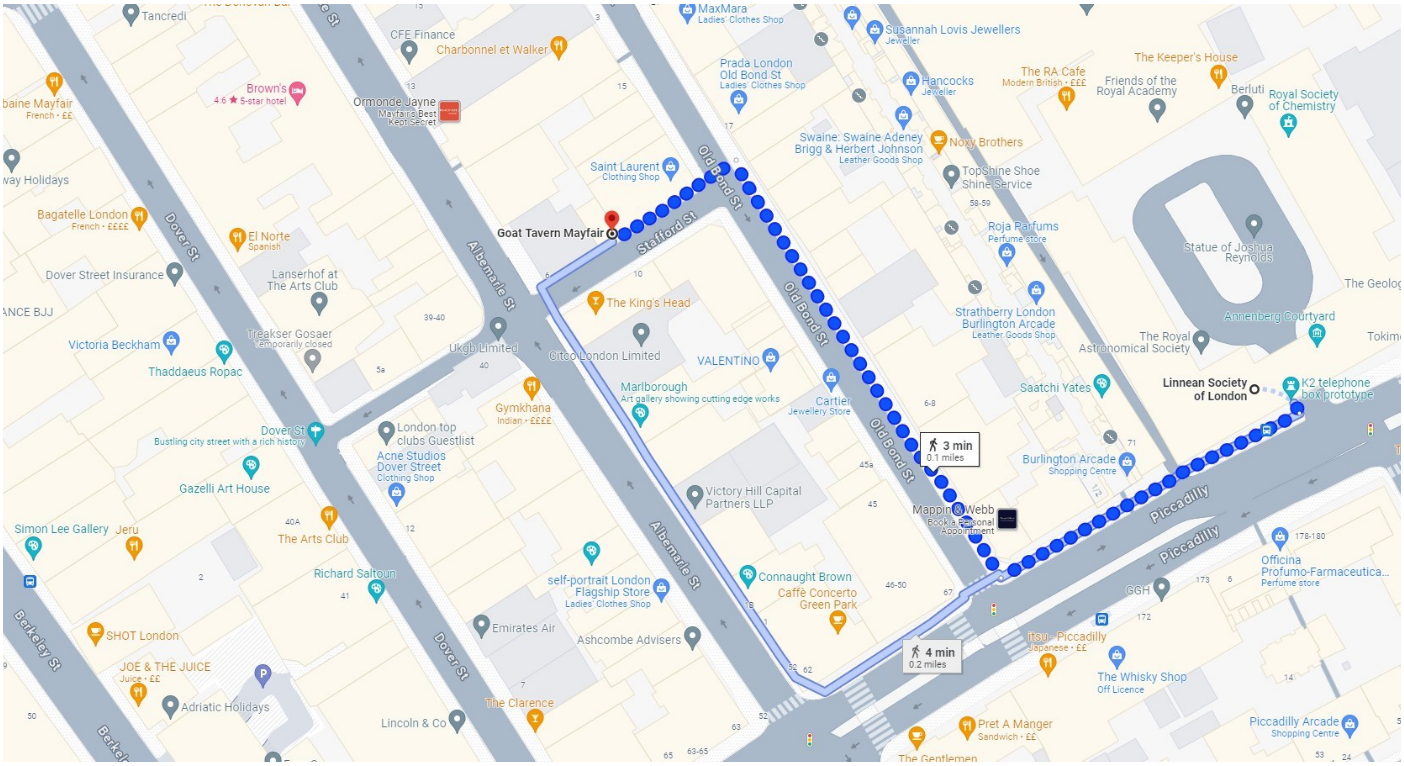
The Cape Supergoup forms a regionally extensive and extremely thick Ordovician to Carboniferous succession of sedimentary rocks in southwestern South Africa. It includes the Lower-Middle Ordovician-lowermost Devonian Table Mountain Group, which incorporates the uppermost Ordovician Soom Shale Lagerstätte (within the Cedarberg Formation). The Soom Shale Lagerstätte accumulated in an unusual cold-water setting, associated with the decaying South Africa ice sheet, towards the end of the Hirnantian Glaciation. The deposits of this glacial marine environment, characterised by anoxic bottom waters, preserve a highly unusual marine biota. It includes specimens exhibiting exceptional preservation of their soft tissues in clay minerals. Overlying deposits of the Soom Shale are shales and thin sandstones ascribed to the Disa member that accumulated in a shoreface-shelf setting. Associated with these deposits are relict Soom taxa in addition to a handful of *Clarkeia* type brachiopod faunas suggesting a probable earliest Silurian age for the upper part of the Cedarberg Formation.

Previous palynological investigations of the Soom Shale have yielded typical marine elements, including chitinozoans, scolecodonts and rare acritarchs, but also common terrestrial elements in the form of dispersed spore tetrads. The latter are historically important as they represent an early report, by Jane Gray and colleagues, of dispersed cryptospore tetrads and were the first evidence for early land plants from Africa south of the Sahara (Ordovician eastern Gondwana at 30˚ S).

Herein we report on a palynological investigation of an exposure of the Cederberg Formation from the northernmost outcrops of the Cape Supergroup at Matjiesgoedkloof, Western Cape Province. Recently the sedimentology and ichnology of the underlying ice-marginal shallow-marine deposits of the Pakhuis Formation were described. Although macrofossils have not been recovered from these strata, they yield a fascinating ichnofauna that is diverse and disparate and comprises trackways and burrows. These show colonisation of glacial deposits by makers of burrows and trackways that lived in brackish water conditions as ice sheets retreated.

Our palynological investigation yielded assemblages of abundant and well-preserved palynomorphs. They are of moderate thermal maturity and are much less coalified than palynomorphs from the more southerly exposures. Surprisingly the assemblages are dominated by land plant spores with extremely rare marine palynomorphs (chitinozoans and scolecodonts but not acritarchs). This may be a consequence of high freshwater influx from the decaying ice sheet-glaciers excluding normal marine biota (although the ichnological evidence demonstrates the presence of at least some organisms). The dispersed spore assemblage is somewhat unusual in that it is dominated by tetrads with monads and dyads rare. Coeval assemblages from similar palaeolatitudes in Gondwana (e.g. from the Arabian Plate) are far more diverse. This possibly reflects the close proximity of the vegetation to the ice sheet.

A social gathering has been arranged for after the meeting at a nearby pub - a private room is reserved at The Goat Tavern, 3 Stafford Street, Mayfair, London, W1S 4RP.



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