

YORKSHIRE GEOLOGICAL SOCIETY

President: Professor Paul Wignall



EXTREME CLIMATES IN DEEP TIME

14.00 - 17.10 Saturday 24th January 2009

Lecture Theatre CG85, Science Site, Durham University, Durham



EXTREME CLIMATES IN DEEP TIME

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GENERAL MEETING

14.00 - 17.10 Saturday 24th January 2009

TITLE: EXTREME CLIMATES IN DEEP TIME

- 14.00 - 14.05 **Society Business and Introduction**
Paul Wignall, President
- 14.05 - 14.45 **The Precambrian 'Snowball' Earth: Extreme climate change linked to oxygen production and the rise of animal life**
Dr. Simon W. Poulton, School of Civil Engineering and Geosciences
University of Newcastle
- 14.45 - 15.25 **Climate and Environmental Change in the Cretaceous Super-Greenhouse**
Professor Thomas Wagner, School of Civil Engineering and Geosciences
University of Newcastle
- 15.25 - 16.00 **Tea/Coffee/Biscuits**
- 16.00 - 16.40 **Modelling Ancient Earth Climate: Relevance to Future Climate Change**
Dr Alan M. Haywood, School of Earth & Environment
University of Leeds
- 16.40 - 17.00 **Q & A Session with the presenters**
Tom Wagner, Simon Poulton & Alan Haywood
- 17.00 - 17.10 **Closing remarks and thanks**

CONTINUOUS PROFESSIONAL DEVELOPMENT

This meeting counts as 3 hours of Continuous Professional Development under the Geological Society CPD Scheme.

THE PRECAMBRIAN 'SNOWBALL' EARTH: EXTREME CLIMATE CHANGE LINKED TO OXYGEN PRODUCTION AND THE RISE OF ANIMAL LIFE

Dr. Simon W. Poulton, University of Newcastle Upon Tyne

The Precambrian climate record is punctuated by two periods of intense glaciation at the start and end of the Proterozoic Eon (2500 to 542 million years ago). Both periods experienced at least three widespread glaciations, some of which have been proposed as 'Snowball' Earth events. The 'Snowball' Earth model proposes that the entire Earth was covered in ice for prolonged periods of time, due to dramatic decreases in greenhouse gases. These gases were essential to maintain a warm climate due to the lower luminosity of the sun early in Earth's history. Drawdown of atmospheric CO₂ has been suggested as a potential driver of the glaciations; however, it is increasingly apparent that methane (a more efficient greenhouse gas than CO₂) likely played a major role. Recent research ties both glacial periods to major rises in atmospheric oxygen, which would result in oxidation of atmospheric methane to CO₂, potentially initiating the glaciations. In addition to being a consequence of Earth surface oxygenation, it appears that the glaciations further enhanced oxygen production due to a dramatic increase in oceanic productivity as nutrients flooded into the oceans during glacial melting. As a result, the final widescale Precambrian glaciation led to oxygenation of the deep ocean for the first time in Earth's history. This paved the way for the rapid evolution of the first large animals, ultimately leading to the diverse range of life that currently inhabits the planet. This talk will highlight the links between oxygenation, extreme climate change and biological evolution over these crucial periods in Earth history.

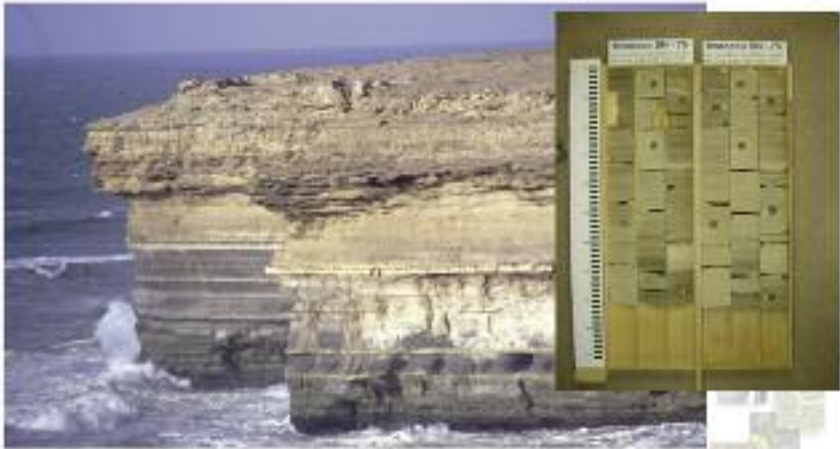


The Precambrian 'Snowball' Earth. © Dr. Simon W. Poulton

Sediments from the Cretaceous ocean provide compelling evidence for intrinsic relationships between extreme greenhouse conditions and the repeated, short term development of oxygen-free (anoxic) conditions in the ocean. Because of the lack or absence of oxygen peculiar organic carbon-rich deposits were formed, black shale or hydrocarbon source rocks. These rocks, deposited during the so called 'Oceanic Anoxic Events' (OAE), not only generated a third of the oil we know today but also provide a spectacular archive of climate and environmental change during past periods of extreme warmth. Continuing investigations of the nature of the marine black shale and the processes leading to their formation have placed black shale research into the centre of today's debate on global warming and rapid climate change. As such current research into the Cretaceous OAEs serves as a focal point for research into extreme climate in a broader sense.

The presentation explores the underlying trigger mechanisms, feedbacks, thresholds and time relationships of the Cretaceous climate-ocean system by looking at high time resolution geochemical records from the Cretaceous deep sea and combining this information with results from computer simulations. This combined approach reveals some fundamental interactions between the atmosphere and the ocean, with the land surface acting as a dynamic interface.

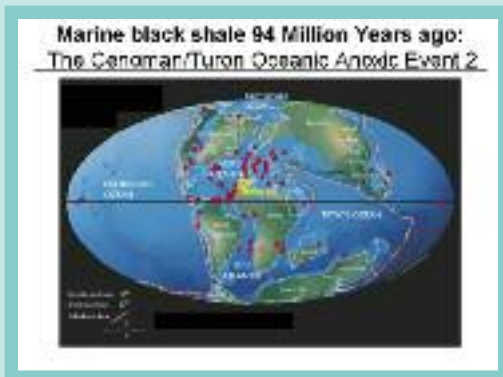
The Study Object: Marine Oil/Gas source rocks (black shale)



CLIMATE AND ENVIRONMENTAL CHANGE IN THE CRETACEOUS SUPER-GREENHOUSE

Professor Thomas Wagner, University of Newcastle Upon Tyne

To explore these relationships in more detail, case studies from the low latitude Atlantic will be discussed. The results explore the linkage between the water cycle in tropical Africa and South America, the establishment of anoxic conditions in the Equatorial Atlantic leading to black shale formation, and the underlying relationship with the Earth's orbit around the sun.



MODELLING ANCIENT EARTH CLIMATE: RELEVANCE TO FUTURE CLIMATE CHANGE

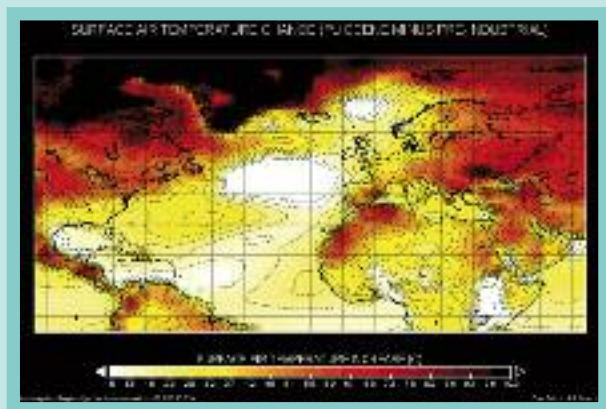
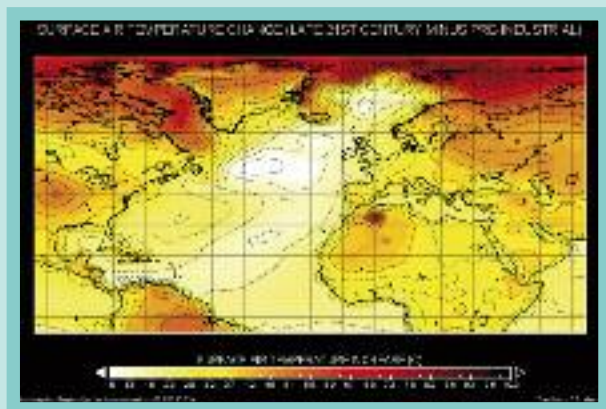
Dr Alan M. Haywood, University of Leeds

Models are the foundation of many scientific endeavours. The centrality of models such as the Lorenz model of the atmosphere, the Lotka-Volterra model of predator-prey interaction, the double helix model of DNA are cases in point. Scientists spend a great deal of time building, testing, comparing and revising models. In short, models are one of the principle instruments of modern science, but they are by definition simplifications of reality and can be considered a tool to help us understand complex natural systems (e.g. the climate system). Numerical models of climate, often referred to as General Circulation Models (GCMs), are being increasingly used to simulate how Earth's climate and environments have changed over geological time. There are many reasons for this but arguably two of the most important reasons include (a) the evolution of Earth Sciences as a whole into a modelling as well as observationally based science and (b) the clear scientific and political requirement, in light of anthropogenic modification of climate, to evaluate the performance of GCMs over a diverse range of past climate scenarios.

MODELLING ANCIENT EARTH CLIMATE: RELEVANCE TO FUTURE CLIMATE CHANGE

Dr Alan M. Haywood, University of Leeds

This talk will provide a brief summary of climate change during the Cenozoic and review the rationale for palaeoclimate modelling. Three case studies are presented which 1) investigate the assertion that the Pliocene epoch was characterised by a permanent El Niño state, 2) explore the role of polar ocean gateways in the initiation of the East Antarctic Ice Sheet and development of Antarctic Circumpolar Current at the Eocene/Oligocene boundary and 3) study the greenhouse climate states of the Eocene/Cretaceous and how well models reproduce such conditions. Finally the usefulness of palaeoclimatology, specifically palaeoclimate modelling, to future climate change will be examined by an attempt to use past climates to calculate climate and Earth System sensitivity to a doubling of atmospheric carbon dioxide.



PRESIDENT PROFILE

Paul Wignall



I was born in West Yorkshire, but mostly grew up in Lancashire giving me an unusual perspective on the Lancashire/Yorkshire divide. I did my first degree at Oxford University and then went to Birmingham where, under the supervision of Professor Tony Hallam, I studied the palaeoecology of the Kimmeridge Clay. After a short stay, as a postdoctoral fellow, at Leicester University I moved to Leeds University at the end of the 1980s and I have been here ever since. On completing my PhD 20 years ago I would have called myself a palaeontologist, but my subsequent research interests have encompassed sedimentology, stratigraphy, geochemistry and, most recently, volcanology and so today I find it best to simply call myself a geologist. However, if I find myself wandering out of my depth in a new field of research it is always useful to say "well actually I'm a palaeontologist but I'm interested in this field".

For most of my time at Leeds I've been interested in the causes of mass extinctions, particularly the greatest of them all at the end of the Permian. This research has taken me to many splendid places around the world, including Greenland, China, Pakistan and Japan. If there were any good outcrops to study in England then I would study them, but needs must, and so I've found myself passing through Schiphol Airport on many occasions. In the past 10 years I have also become interested in other extinction events, including the Early Jurassic crisis. Fortunately (for my carbon footprint) this is best studied in the wonderful sections on the North Yorkshire Coast which are only a short car drive away. The linking theme with most of this is the role of major volcanism and it is this that has seen my research interests drift into this field.

Despite my far-flung research interests, I first cut my research teeth on the marine bands in the Upper Carboniferous of the Pennines and I still like to do fieldwork in this area and the very similar Pennines-on-Sea localities seen on the west coast of Ireland.



A WORD FROM THE PRESIDENT

Paul Wignall

It's a great honour to become the new president of my favourite geological society. I first joined 20 years ago as a postgraduate student when all I wanted was to get the *Proceedings*. However, once I moved to Leeds I began to attend the indoor and field meetings and got to appreciate what an active society it was (and still is!). Martin has left the society in continuing, fine health and it's up to me to make sure it stays that way. One of the new variations to the Society's events that Martin and the Council instituted this year was to change the format of the AGM in York to a more informal, buffet-style meal after the Presidential Address. I like to think that this was a success, despite the rather chilly room, and I hope that everyone who attended enjoyed this gathering. However, there's always room for improvement and we will soon have to decide if we use a similar format next year, so watch this space. If you have any feedback then please let the secretary know, we are always keen to hear from our members.

The New Year begins with a topical theme looking at ancient climates at the University of Durham. As you might expect climate research is at the top of the scientific agenda these days and there is a vast amount of new research being undertaken on our current climate state. However, understanding future changes of climate are a lot easier if we know how climate has changed in the past, this is where earth scientists come in. Our knowledge of ancient climates has improved dramatically in the past 10 years both from use of increasingly sophisticated computer modelling and also from direct study of the geological record. Our meeting at Durham will give a flavour of some of this new research and I hope to see you there.



SORBY MEDAL PRESENTATION



Outgoing President Martin Whyte presents the Sorby medal to Professor DA Spears.



NEW MEMBERS

New Members

Mr K Dorning

Mr A Triffit

Mr J F Miller

Sheffield

Easingwold, York

Rotherham

Ordinary membership

Ordinary membership

Student membership



BRITISH CAVE RESEARCH ASSOCIATION CAVE SCIENCE FIELD MEETING

Sunday 8th March 2009

CRESWELL CRAGS, NOTTINGHAMSHIRE

A Cave Science Field Meeting is to be held from 10.30am on Sunday 8th March 2009 at Creswell Crags Museum and Archaeology Park, near Worksop, Nottinghamshire.

The meeting will follow the 20th BCRA Cave Science Symposium at the University of Sheffield on Saturday 7th March and will be hosted by Professor Andrew Chamberlain and the Creswell Heritage Trust.

Please contact the lecture secretary: Dr.Trevor Faulkner, by email: t.faulkner@bcra.org.uk or, for initial queries, by telephone at: **+44 (0)1625 531558**.



FOSSIL PLANTS IN SOUTH BAY, SCARBOROUGH

Stuart Swann and Jim Middleton

South Bay in Scarborough is well known to geologists the world over and has been visited by members of the YGS for many years. Most of the interest in South Bay has been directed towards the Scarborough Formation which makes up the wave cut platform around and beyond the Holbeck landslip to White Nab, the best part of a kilometre further south. Parsons (1977) and Gowland and Riding (1991) for example are the major workers on this formation recently. The cliff is made up of the Scalby Formation comprising the Moor Grit Member succeeded by the Long Nab Member. The sedimentary structures have been well mapped and good explanations of the environments represented have been given (Rawson & Wright G.A. Guide No 34, 2000 for example).

Dinosaur footprints have been recorded from this area but the most prolific type of fossil seems to have been ignored for at least 100 years. At least we cannot find any recent references that go into any detail.

Recently we have done a preliminary survey of the plant fossil remains in the section from Holbeck Land Slip to White Nab and, from the fallen blocks at beach level, have recovered the remains of fifteen species (morpho-species, some of which are fairly tentative). These have been found in two brief excursions and more work is planned as we consider this to be a very interesting site.



FOSSIL PLANTS IN SOUTH BAY, SCARBOROUGH

Stuart Swann and Jim Middleton

Bennettiales make up the majority of the species found but Conifers, Ginkgoales and Pteridophytes are also represented. We think that further surveying of the area will provide some interesting additions to our knowledge of the environment in this part of the Jurassic succession on the Yorkshire coast. But even if it only confirms the findings of previous workers it still a very interesting piece of coastline.

So take a look at the specimens in the attached photographs and see if you agree.

Sthbay1 Bennettitale *Otozamites graphicus*

SthBay2 Pteridophyte *Coniopteris hymenophylloides*

SthBay3 Still to be worked on but could be a Ginkgoale genus *Sphenobaiera* and the clusters of thin leaflets could be a genus of Czekanowskiale called *Solenites*.

Sthbay4 Coniferale *Elatides williamsoni*

We are enjoying exploring the palaeo-flora of Scarborough enormously. Any information on work that we may have missed in our admittedly cursory review of the literature would be appreciated. An e-mail to stuart@neyorksgeologytrust.com will reach us.



Sthbay1 Bennettitale *Otozamites graphicus*



SthBay2 Pteridophyte *Coniopteris hymenophylloides*



SthBay3 Still to be worked on but could be a Ginkgoale genus *Sphenobaiera* and the clusters of thin leaflets could be a genus of Czekanowskiale called *Solenites*.



Sthbay4 Coniferale *Elatides williamsoni*

All pictures © Stuart Swann



CORRESPONDING SOCIETIES

Contact society representatives for the latest information

CRAVEN & PENDLE GEOLOGICAL SOCIETY

Contact: Paul Kabrna, tel: 01282 813772; e-mail: paul_kabrna@msn.com or www.cpgs.org.uk/
Venue: Rainhall Centre, Barnoldswick.

Witnessing the birth of a new ocean in Afar, Ethiopia?

Tim Wright Ph.D., University of Leeds

Friday 13th February

Living with a lava dome: Mt Unzen, Japan

Hugh Tuffen Ph.D., University of Lancaster

Friday 13th March

CUMBERLAND GEOLOGICAL SOCIETY

Contact: Nigel Courtman, tel. 01229 861 478 or www.cumberland-geol-soc.org.uk

**Conserving and Celebrating Geology, Landscape
and Wildlife in the North Pennine AONB**

Cliff Woodley Stewart, AONB Officer and Geopark Manager

Wednesday 18th February

EAST MIDLANDS GEOLOGICAL SOCIETY

Janet Slatter, tel. 01509-843.297; e-mail: sec@emgs.org.uk or www.emgs.org.uk

Venue: Lecture Theatre B3, Biological Sciences Building, University of Nottingham

Foundation Lecture:

**When Antarctica was green: fossil plants reveal Antarctica's
climate history**

Professor Jane Francis

Lecture followed by our annual dinner

Saturday 21st February

HUDDERSFIELD GEOLOGY GROUP

Julie Earnshaw (Secretary). Telephone: 01484 311 662 or e-mail: earniehome@ntlworld.com

**Dropstones and Drumlins: The last ice sheet in the
North of England**

Catherine Delaney

Monday 9th January

Plate tectonics in New Zealand

Ailsa Burrows

Monday 9th March



CORRESPONDING SOCIETIES

Contact society representatives for the latest information

HULL GEOLOGICAL SOCIETY

Mike Home. Tel: 01482 346 784 or e-mail: m.j.horne@hull.ac.uk or www.go.to/hullgeolsoc
Venue: Department of Geography, University of Hull, at 7.30pm.

The Lynden Emery Memorial Lecture - "The Speeton Clay"
Professor Pete Rawson

Thursday 12th February

**"Rotunda, the William Smith Museum of Geology,
its history and redevelopment" and the Annual General Meeting.**
Will Watts

Thursday 19th March

LEEDS GEOLOGICAL ASSOCIATION

Anthea Brigstocke (General Secretary). Tel: 01904 626 013; E-mail: abrigstocke@hotmail.com or www.leedsgeolassoc.freereserve.co.uk Venue: Mathematics & Earth Sciences, University of Leeds)

LEICESTER LITERARY & PHILOSOPHICAL SOCIETY SECTION C (GEOLOGY)

Chairman: Dr Joanne Norris. Tel: 0116 283 3127, e-mail: j.e.norris@ntlworld.com, www.charnia.org.uk/
Venue: Ken Edwards Building, University of Leicester

**The geological record of massive volcanism and large
meteorite impacts: a view from the British Isles.**

Wednesday 28th January

Professor Stephen Hesselbo (Department of Earth Sciences, University of Oxford)

The geology and evolution of Mars

Wednesday 25th February

Dr John Bridges (Department of Physics and Astronomy, University of Leicester)

MANCHESTER GEOLOGICAL ASSOCIATION

Jane Michael. Tel: 0161 366 0595, e-mail: outdoor@mangeolassoc.org.uk or www.mangeolassoc.org.uk
Venue: Williamson Building, Department of Geology, University of Manchester

Mam Tor: A landslide still on the move
Annual General Meeting followed by Presidential Address
Dr Christine Arkwright, University of Manchester

Wednesday 18th February

**"Magnetic Lakes and Trees:
What Environmental Magnetism can tell us**
Professor Barbara Maher, University of Lancaster

Wednesday 18th March

NORTH EASTERN GEOLOGICAL SOCIETY

Frank Trowbridge. Tel: 01642 582 786, e-mail: frank.trowbridge@care4free.net or www.northeast-geolsoc.50megs.com



CORRESPONDING SOCIETIES

Contact society representatives for the latest information

ROTUNDA GEOLOGY GROUP

Sue Rawson. Tel: 01723 506502, e-mail: suerawson@yahoo.co.uk

Venue: Room CG7, Scarborough Campus of the University of Hull, Filey Road, Scarborough. 7.30pm

Open Evening and first AGM

Thursday 5th February

NORTH STAFFORDSHIRE GROUP OF THE GEOLOGISTS' ASSOCIATION

Eileen Fraser. Tel: 01260 271505 email: fraser@fraserco.co.uk or www.esci.keele.ac.uk/nsgga/

Venue: School of Earth Sciences and Geography, University of Keele

**Silurian soft-bodied sensations:
a unique window on the evolution of life**

Thursday 5th February

Professor David Siveter, University of Leicester

AGM and Chairman's Address

Thursday 5th March

Shark Bay to Wave Rock

Elizabeth Hallam

WESTMORLAND GEOLOGICAL SOCIETY

E-mail: mail@westmorlandgeolsoc.org.uk , westmorlandgeolsoc.org.uk/

Venue: Shakespeare Centre, Kendal

Shetland Geology

Wednesday 21st January

Jean Slee-Smith - Westmorland Geol. Soc.

AGM and Presidential Address

Wednesday 18th February

Prof. Euan Clarkson F.R.S.E., University of Edinburgh

Start: 7.45pm

OTHER SOCIETIES OF INTEREST

EAST MIDLANDS REGIONAL GROUP OF THE GEOLOGICAL SOCIETY

Ed Hough e-mail: eh@bgs.ac.uk

SORBY NATURAL HISTORY SOCIETY

Sorby Geological Group Secretary Ken J. Dorning: geology@sorby.org.uk

www.sorby.org.uk/grpgeo.shtml www.sorby.org.uk

YORKSHIRE REGIONAL GROUP OF THE GEOLOGICAL SOCIETY

Isla Smail. Tel: 0113 242 8498 or e-mail: isla.smail@arup.com



SUBMISSION OF PAPERS

Manuscripts for publication in the Proceedings should be submitted to 'The Editors, Proceedings of the Yorkshire Geological Society, Geological Society Publishing House, Unit 7, Brassmill Lane Enterprise Centre, Brassmill Lane, BATH, BA1 3JN'. Typescripts should be prepared using the updated instructions for authors given on the inside back cover of the latest issue (Volume 57 Part 1, November 2008).

Publication of manuscripts may be expected in the next, or next but one part, following acceptance. The Proceedings will be abstracted and/or indexed in, GeoArchive, GeoRef, Geobase, Geological Abstracts and Mineralogical Abstracts, Research Alert and Science Citation Index Expanded (SCIE).

COPY FOR CIRCULAR

Copy deadline for Circular 551 is the 26th January 2009

Copy deadline for Circular 552 is the 27th February 2009

NEXT YGS MEETINGS

The next Indoor Meetings

28th February 2009 - The Carboniferous World: Millstone Grit/Namurian.

University of Leeds.

21st March 2009 - The Permian of the North Sea. BGS, Keyworth.

CONTACTS

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