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Circular 521



YORKSHIRE GEOLOGICAL SOCIETY

President: John Powell Ph.D.

ENGLAND'S NORTH-WEST: NEW VIEWS ON OLD ROCKS



*Skirwith Syncline,
Ingleton Quarry
February 2004
Photo: Fred Dunning*

SPEAKERS: FRED DUNNING OBE, JACK SOPER,
NIGEL WOODCOCK, DICK MERRIMAN
and SIMON KEMP

14.00 to 16.50 SATURDAY 22nd JANUARY 2005

RUPERT BECKETT LECTURE THEATRE, UNIVERSITY OF LEEDS

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YGS 2005

ENGLAND'S NORTH-WEST: NEW VIEWS ON OLD ROCKS

- 1400-1650 **SATURDAY 22nd JANUARY 2005**
- 1400-1410 **Introduction and Society Announcements**
John Powell Ph.D.
- 1410-1440 **Structure and Sequence of the Ingleton Group: Possible Neoproterozoic Basement to the Central Pennines of Northern England**
Fred Dunning OBE (Formerly Geological Museum, South Kensington) and Jack Soper (University of Ireland, Galway)
- 1440 - 1510 **Tectonics of the Caledonian - Variscan Interval on the North of England**
Jack Soper (University of Ireland, Galway) and Nigel Woodcock (University of Cambridge)
- 1510 - 1540 **Tea and Coffee**
- 1540-1610 **Variscan/Acadian Structural Interference Bordering the Dent Fault, NW England**
Nigel Woodcock (University of Cambridge)
- 1610-1640 **The Metamorphism of the Ingleton Supergroup in Relation to Caledonian Basin Thermal History in Northern England and Southern Scotland**
Dick Merriman (British Geological Survey) and Simon Kemp (British Geological Survey)
- 1640 - 1650 **Closing Remarks**

SUBSCRIPTION RENEWALS DUE JANUARY 1st 2005

Subscriptions are due on January 1st and remain as last year i.e:

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If our current records show that we expect you to renew by cheque, then CH will appear on the top line of the address label of this Circular. Please send a cheque for the relevant amount (made payable to YGS) to Ms Chris Jennings-Poole, 6 Wolsey Drive, Stockton on Tees, TS20 1SY.

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The Society would like to thank Independent Paper, Wakefield for sponsoring the paper for this publication, therefore allowing it to be produced in colour at no extra cost to the YGS.

STRUCTURE AND SEQUENCE OF THE INGLETON GROUP: POSSIBLE NEOPROTEROZOIC BASEMENT TO THE CENTRAL PENNINES OF NORTHERN ENGLAND

Fred Dunning OBE, Formerly Geological Museum, South Kensington
and Jack Soper, University of Ireland, Galway

The Ingleton Group, a sequence of steeply dipping turbiditic greywackes that crops out in the two main Craven inliers, has been comprehensively re-surveyed by Jack Soper with special attention to way-up evidence and cleavage/bedding relationships. The established view that the sequence is isoclinally folded throughout is shown to be mistaken: only two large-scale folds dominate the outcrops with a common limb around 3000m thick. In addition, the cleavage/bedding relationships on the limbs of the main fold, the well-established Skirwith Syncline, and in minor fold-pairs, show that the observed cleavage is congruent with the Acadian (post-Silurian) cleavage in the unconformably overlying Windermere Supergroup and is superimposed obliquely across the folds so that it faces down on their inverted limbs. An axial-planar cleavage contemporaneous with the main pre-Ordovician folding of the Ingleton Group is apparently absent.

The age of the Ingleton Group remains controversial. The discovery by BGS of early Ordovician palynomorphs allegedly no older than Arenig in a single sample from the IGS Beckermund Scar borehole in material that is almost certainly Ingleton Group argues for an intense Lower Palaeozoic orogenic episode unknown elsewhere in England and Wales, unless, of course, the folding is demonstrably syn-sedimentary, as much of it is in the Skiddaw Group in the Lake District. However, the scale of the Ingleton folding now revealed is altogether greater than any in the Skiddaw Group. If one chooses to discount the scant fossil evidence until it is confirmed by further work, then the protracted history of major folding, low-grade metamorphism, the intrusion of mafic dykes and the continental volcanic arc provenance



Curving superimposed Arcadian cleavage facing up.

Photo: Fred Dunning

of the Ingleton Group invite comparison with the end-Proterozoic sequences of central England and the Welsh borders, a correlation suggested many times in the past two centuries. This would infer an Ediacaran age of around 560 Ma for the deposition of the Ingleton Group and a latest Precambrian-earliest Cambrian date (543 Ma) for its pre-Ordovician deformation.

TECTONICS OF THE CALEDONIAN - VARISCAN INTERVAL IN THE NORTH OF ENGLAND

Jack Soper, University of Ireland, Galway and Nigel Woodcock, University of Cambridge

The Iapetus Suture is arguably the most important tectonic feature in the British Isles, marking as it does the site of an ancient ocean. The Lake District, located in the footwall of the suture, records an almost complete Ordovician-Silurian record of its closure. Resurvey of the Lake District by BGS commenced in 1982 and involved collaboration by university-based geologists, the present authors among them. As the project nears completion a start has been made on synthesis of the data, most notably on the volcanicity and magmatism in two Presidential Addresses to this Society. The present talk is based on a tectonostratigraphical synthesis recently published by the authors.

The plate tectonic setting of a region controls patterns of sedimentation, magmatism and deformation. A geotectonic model made from a Southern Uplands viewpoint, that of 'flexural progradation', has been a dominating influence during the Lake District resurvey. It proposed that during Iapetus convergence in the Silurian, a flexural basin developed in the Avalonian footwall and migrated south-eastwards, followed by a wave of inversion that culminated in the Early Devonian (Acadian) deformation of the English and Welsh slate belts.

The model successfully accounted for Silurian depositional patterns in the Lake District and North Wales, and like all useful hypotheses, made predictions that can be tested. Two of these relate to the Lake District and prove critical. One is that the deformation and metamorphism of the Skiddaw Group were of Ludlow age; yet relationships in the aureole of the Skiddaw Granite show them to be late Lower Devonian. The Windermere flexural basin was thought to have inverted at the end of the

Silurian, forming the Westmorland Monocline; instead, a substantial cover of Lower Old Red Sandstone must have been deposited, to account for the anchimetamorphic grade of Silurian slates. Regionally, isotopic dating of cleavage-parallel illite has confirmed the stratigraphical evidence that the Acadian deformation did not prograde southwards through England and Wales: it was confined to the period 400-390 Ma (end-Lower Devonian), significantly later than the end of Iapetus convergence at about 420 Ma (end-Silurian).

A new geotectonic model emerges. It has recently been shown that throughout the North Atlantic Caledonides the Early Devonian was a period of sinistral transtension. Over Southern Britain and Ireland a vast spread of Lower ORS was deposited at this time in coalescing transtensional basins; a post-compaction thickness of some 3.5 km is estimated for the southern Lake District, which was eroded and recycled southwards during the Acadian. Another consequence was lamprophyric magmatism in the Lake District and Southern Uplands, due to decompression melting of hydrated Iapetan lower lithosphere. Heat advected into the upper crust transformed the Windermere low heat-flow basin into a hot extensional basin that was subsequently deformed in thick-skinned style.

This period of Early Devonian transtension marks a transition from late Caledonian tectonics (associated with Iapetus closure and generally sinistral) to the Variscan-Alleghenian regime (related to Rheic convergence and generally dextral).

VARISCAN/ACADIAN STRUCTURAL INTERFERENCE BORDERING THE DENT FAULT, NW ENGLAND

Nigel Woodcock, University of Cambridge

The Acadian (mid-Devonian, 400-390 Ma) and Variscan (late Carboniferous to early Permian, 300-290 Ma) deformation events had approximately the same NNW-SSE regional shortening direction, but produced strongly contrasting structural geometries in northwest England. Acadian structure is dominated by southwest to west trending upright folds and an axial planar to weakly-transecting cleavage, formed beneath at least 5 km of overburden. This metamorphosed and now cool upper crust responded in a more brittle way to remote Variscan shortening: a grid of faults, often NNE-striking, typically forced monoclinical folds in the thin (~2 km) post-Acadian cover.

The Dent Fault is the best known example of the Variscan NNE-striking faults. Along much of its length its main strands dip steeply north-northwestward and cut the steep limb of its matching monocline, the sense of which is in sympathy with the reverse fault displacements. The footwall preserves the simple synclinal element of the monocline in Carboniferous rocks. More complex domal outcrop patterns occur in the hangingwall, due to interference of the anticlinal element of the monocline with pre-existing east-west Acadian folds. The hangingwall is also cut by steep faults forming a duplex geometry in map view. These duplex faults took up much of the Variscan strike-slip, whilst most of the dip-slip was partitioned on to the main Dent faults.

The high-angle interference of Variscan and Acadian structures might be taken to imply no mutual mechanical control. However, a number of lines of evidence suggest that the Dent and parallel faults were reactivating NNE-striking Acadian or earlier structures. These reasons are:

- 1 Oblique slip on faults so strongly misoriented with respect to Variscan shortening.
- 1 Compartmentalizing of Acadian fold patterns by NNE-striking faults further west.
- 1 Strong local perturbation of Acadian structural trends and transection relations near the Dent Fault in ways that are kinematically unrelated to Variscan displacements.
- 1 Swings of Ludlow (late Silurian) palaeoflows to parallel Dent Fault.
- 1 Possible role of NNE-striking faults in accommodating Early Devonian crustal transtension.

The evidence suggests that the NNE-striking elements of the Variscan fault network of NW-England are inherited not just from Acadian structures but from Silurian or older basement faults.

THE METAMORPHISM OF THE INGLETON SUPERGROUP IN RELATION TO CALEDONIAN BASIN THERMAL HISTORY IN NORTHERN ENGLAND AND SOUTHERN SCOTLAND

Dick Merriman and Simon Kemp

British Geological Survey, Keyworth, Nottingham

A series of boreholes in Horton Quarry (Horton-in-Ribblesdale) penetrated mudstones and slates belonging to the Windermere Supergroup (WSG) overlying laminated mudstones of the Ingleton Group. Illite crystallinity (IC) measurements indicate a metamorphic inversion between the two groups of mudrocks. The WSG mudrocks are mostly in the high anchizone or epizone, whereas the Ingletonian samples are lower grade in terms of IC, and are mostly late diagenetic zone or low anchizone. Hence younger strata at higher grades rest on older strata at lower grades, creating an inversion. Ingletonian slates from Pecca Falls show epizonal and anchizonal IC values, and greywacke samples from Ingleton Quarry, contain pumpellyite. This suggests that grade in the Ingletonian may increase north-westwards from Horton to Ingleton.

The K-white mica b cell dimensions show further differences between the Ingleton Group and WSG. The Ingletonian samples are characterized by low b cell values in the range 9.001-9.014, whereas the WSG have higher values in the range 9.014-9.022. The latter values are similar to those recorded from the WSG of the southern Lake District, and Lower Palaeozoic mudrocks in the Scottish Southern Uplands, and are consistent with metamorphism in a low heat flow, convergent geotectonic setting.

The Ingletonian b cell values suggest metamorphism in a higher heat flow setting, most likely an extensional basin. The metamorphic inversion at Horton and differences in K-white mica b cell dimensions suggest that the Ingleton Group and WSG strata evolved in different geotectonic settings and record two separate metamorphic events.

A WORD FROM THE PRESIDENT

It is a great honour to take on the Presidency at an exciting time of review and change. The Council, under Pete Rawson's leadership, has recently initiated a new 5-year Plan that, I am sure, will provide more for our members, both professional and amateur. With sales income from recent publications such as the Northumbrian field guide, we will be able to publish new outputs highlighting the magnificent geology of our region and, in turn, attract new members, thereby ensuring that the Society is on a sound financial footing. But above all, we aim to promote geoscience in northern England. With your enthusiasm and your support, I know we can succeed.

Those of you who were able to attend the AGM in York were treated to Professor Pete Rawson's fascinating and beautifully illustrated Presidential Address (part II) on the global setting of the Speeton Clay ammonite faunas. Taking us across the globe during the Early Cretaceous, Pete touched on the palaeogeography of the Early Cretaceous seaways, migration of Tethyan (mid-latitude), Boreal (northern) ammonite faunas, and even a few South American migrants (all making their way, sensibly, to Yorkshire!). Major faunal migrations were associated with high sea-level stands, possibly linked, controversially, to the waning of small polar ice caps during this time of supposed 'greenhouse' climate. Earlier, the Society's Moore Medal was presented to Ian Kane for his excellent BSc thesis (University of Derby) on the Rough Rock. This was followed by presentation of the John Phillips Medal to Professor John Catt in recognition of his outstanding research on the Quaternary, including his work on the Pleistocene glaciations of eastern Yorkshire, a summary of which he presented at our recent Glacial Landforms meeting held jointly with the Hull Geological Society. Later that evening we enjoyed a convivial evening at the Annual Dinner, in the splendid surroundings of the King's Manor – thanks are due to Trevor Morse for the arrangements. Finally, I would like to thank Pete Rawson for his excellent and forward-looking Presidency – he has steered us successfully through a period of change and, with the enthusiastic backing of the Council, has laid the cornerstone for the success of the Society over the coming years.

I look forward to seeing you at our meetings in the coming months.

John Powell

YGS COUNCIL PROFILES

Dr John Powell, President

With our widely dispersed membership, I thought it would be useful for you to know a little about the Officers and Members of Council who run the Society on your behalf. Last year we introduced badges for Council members so that you could know whom to approach at meetings with ideas and suggestions on ways to improve the YGS. I hope the new profiles of Council will spark some common interest and encourage you to approach us at meetings with your ideas. To 'start the ball rolling' I have included my profile in this Circular:



I graduated from the University of Newcastle upon Tyne in 1974 and was awarded a PhD for my research on the tabulate corals and the palaeoecology of Silurian patch reefs in the Welsh Borderlands, supervised by former President, Colin Scrutton. I joined the Yorkshire and East Midlands Unit of the Geological Survey's Leeds Office in 1978, where I worked on the Jurassic rocks and Quaternary deposits of the North York Moors and Vale of York. In 1984 I was posted to Jordan where I spent nearly four years training counterparts in mapping and sedimentology on rocks ranging in age from the Precambrian to the Quaternary, especially Cretaceous carbonate platform sequences. Returning to Keyworth in 1989, I led the Black Country Applied Geological Mapping Project. During the 90's I combined overseas training/mapping assignments in Botswana, Syria and Jordan with the Birmingham Mapping Project. After a two-year spell as Regional Geologist, Middle East and Africa, I took up my current post at BGS as Head of Discipline, Geology, Geotechnics and Palaeontology. More recently my fieldwork has taken me to Morocco and Mauritania, but nothing beats the Yorkshire coast on a sunny day! I joined the YGS in 1979, and have served periods on Council during the 80's, 90's and more recently since 2001.

YORKSHIRE GEOLOGY MONTH - MAY 2005

The simple aim of this 'Yorkshire Geology Month' is to ask geologists, geology groups and people with interests related to geology to run one or more local geological events for the public in Yorkshire and the surrounding areas in May (or early June) 2005. If you or your organisation/company are interested in taking part please contact Mike Horne initially or visit www.horne28.freeserve.co.uk/ygm.htm for further details. It is also hoped that as a result of the month's activities an informal network of Yorkshire geologists will be created and those taking part will be invited to a 'gathering' during July 2005.

e-mail - m.j.horne@hull.ac.uk or write to 28 Salisbury Street, Hull, HU5 3HA.

CALENDARS

A big thank you for all your support on the production and sale of the calendars. The print run sold out except for the two I had for demonstration purposes, so would appear to have been a success.

KDP

MEMBERSHIP SECRETARY - NEW DETAILS

Please note that Chris has a new e-mail address, which is: chrisjpoole@hotmail.co.uk

Should you need to contact her by e-mail please use this address and not the old one. Chris' other details remain the same and can be found on the back page of this circular.

EARTH SCIENCE TEACHERS ASSOCIATION

Following last month's review of the Earth Science Teachers Association Journal I received the following correspondence from Peter Kennett, which I thought you might like to see. If you can help or would like more details I have included the association's contact details for members to use.

KDP

I was delighted to see such a helpful review of the Association's journal, Teaching Earth Sciences in Circular 520, concluding with the suggestion that the YGS could collaborate in helping "the hard-pressed teachers of Earth science in our schools".

Members may not be aware of the existence of the Earth Science Education Unit (ESEU), set up with the moral support of ESTA and the financial backing of the UK Offshore Operators' Association. The ESEU is administered from Keele University, but now has a team of 48 local facilitators able to cover the country, with particular strengths in Yorkshire. The Unit is able to deliver In-Service Training to teachers of secondary science, at their own school, for no charge other than travel. It also leads workshops for PGCE students at their own institutions. The main aim of our sponsors is to enhance good Earth science in our schools, and there is no pressure whatever to "sell" oil!

How can YGS members help? The main way is to help promote the ESEU by informing any contacts that members may have in the school education system. This could be via their children, or even grandchildren; by telling a friendly teacher along the road; writing to the governors of their nearest school etc. At the same time, a school may welcome a local geologist who can help them to identify the rocks in the collection (quite often in a muddle!), or by riding shotgun on a trip to the local churchyard, when children are investigating rock types and weathering etc. (In this case a CRB check would probably be asked for by the school).

For further information, contact the ESEU Administrator at Keele on 01782 584437, or email at eseu@keele.ac.uk ESEU's website is www.earthscienceeducation.com and ESTA's is www.ESTA-uk.org

Peter Kennett

FORTHCOMING YGS MEETINGS: 167th SESSION

- | | |
|--|--|
| Sheffield, Saturday 19th February 2005 | Joint meeting with the Sorby Society,
Red-bed sediments |
| BGS Keyworth, Saturday 19th March 2005 | Joint meeting with the
East Midlands Geological Society.
Recent BGS Research |

CORRESPONDING SOCIETIES

Contact society representatives for the latest information.

CRAVEN & PENDLE GEOLOGICAL SOCIETY

Yvonne James. Tel: 01282 813 772 or www.cpgs.org.uk

Jurassic Geology of Tibet

Speaker: Paul Wignall Ph.D., University of Leeds

Friday, 14th January

The Norber Erratics

Brian Parry BSc.; Limestone Research Group, Huddersfield University

Friday, 11th February

CUMBERLAND GEOLOGICAL SOCIETY

Nigel Courtman. Tel: 01229 861 478 or www.cumberland-geol-soc.org.uk

Cumbria Rigs Sites, An Interactive Evening

Speaker: Dr. Gordon Taylor (Chairman, Cumbria Rigs)

Newton Rigg Campus, Penrith

Wednesday, 19th January

AGM & "Presidential Address"

Angela Marchant - Title to be announced

The Friends Meeting House, COCKERMOUTH

Wednesday, 23rd February

EAST MIDLANDS GEOLOGICAL SOCIETY

John Wolf e-mail: sec@cmgs.org.uk or www.emgs.org.uk.

Presidential Address - Talking Rocks

Saturday, 5th February

Speaker: Ian Thomas (National Stone Centre)

Start: 6.30pm.

EAST MIDLANDS REGIONAL GROUP OF THE GEOLOGICAL SOCIETY

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

HUDDERSFIELD GEOLOGY GROUP

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

Folly Dolly Falls, nr. Meltham

Sunday, 16th January

Alison Quaterman

11.30am - 1.00pm. Meet in Safeways Car Park in Meltham (SE 100108)

Short Walk to spectacular waterfall with fault and two rock types.

Wellies definitely needed for best view.

HULL GEOLOGICAL SOCIETY

Mike Horne. Tel: 01482 346 784 (after 7.30 pm)

or e-mail: m.j.horne@hull.ac.uk or www.go.to/hullgeolsoc

Geological adventures in Malaya

Thursday, 20th January

Speaker: Dr. Derek Gobbett

(Evening lecture)

Subject to be confirmed

Thursday, 17th February

Speaker: Dr. Jane Bunting

(Evening lecture)

LANCASHIRE GROUP OF THE GEOLOGISTS' ASSOCIATION

Norman Catlow. Tel: 01772 727 577 or e-mail: norman@catlow4736.freeserve.co.uk

LEEDS GEOLOGICAL ASSOCIATION - 130th ANNIVERSARY PROGRAMME 2004

Anthea Brigstocke (General Secretary). Tel: 01904 626 013.

E-mail: abrigstocke@hotmail.com or www.leedsgeolassoc.freeserve.co.uk

LEICESTER LITERARY & PHILOSOPHICAL SOCIETY

Chairman: Andrew Swift. Tel: 0116 252 3646 or e-mail: as48@le.ac.uk

The role of clay minerals in recycling crustal rocks

Wednesday, 26th January

Speaker: Professor Dick Merriman (BGS, Keyworth)

Members Evening

Wednesday, 9th February

To be held at New Walk Museum Leicester

MANCHESTER GEOLOGICAL ASSOCIATION

Jane Michael. Tel: 0161 366 0595, e-mail: jammyjane@aol.com or www.mangeolassoc.org.uk

Afternoon Seminar - Evolution of the Cheshire Basin

Saturday, 22nd January

Sherwood Sandstones - Dr. Geoff Warrington, formerly British Geological Survey

Mercia Mudstones - Dr. Albert Wilson, formerly British Geological Survey

NORTH EASTERN GEOLOGICAL SOCIETY

Frank Trowbridge. Tel: 01642 582 786, e-mail: frank.trowbridge@care4free.net

or www.northeast-geolsoc.50megs.com

NORTH EAST YORKSHIRE GEOLOGY TRUST

Mike Windle. Tel: 01947 881000, e-mail: contact@neyorksgeologytrust.com

SORBY NATURAL HISTORY SOCIETY

Ken J Dorning.

www.shu.ac.uk/city/community/sorby/secgeo.shtml

WESTMORLAND GEOLOGICAL SOCIETY

Mrs P. M. Wilson. Tel: 01539 533 198 or www.wgso.fsnet.co.uk

**Cretaceous Lagerstätten including feathered dinosaurs from China
and fossil fish from Brazil**

Speaker: Dr. John Nudds, Manchester Museum

Wednesday, 19th January

AGM & Presidential Address

Speaker: Dr. Stuart K. Munro

Start: 7.45pm

Wednesday, 16th March

YORKSHIRE REGIONAL GROUP OF THE GEOLOGICAL SOCIETY

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

Deformation of Ultra-Soft Soil

Speaker: Dr. M W Bo, Bullen Consultants Ltd

The Adelphi Hotel, Hunslet Road, Leeds

6.30 pm for 7.00pm

Wednesday, 26th January

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 55 Part 2, November 2004).

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 522 is the 22nd January. The next indoor meeting will be a joint meeting with the Sorby Society held on the 19th February 2005 at Sheffield. Title: Red-bed sediments.

Copy deadline for Circular 523 is the 19th February 2005.

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