# Newsletter No. 218

# April 2013

The Black Country Geological Society

## Contents:



## Copy date for the next Newsletter is

## Saturday 1st June 2013



The Society provides limited personal accident cover for members attending meetings or field trips. Details can be obtained from the Secretary. Non-members attending society field trips are advised to take out your own personal accident insurance to the level you feel appropriate. Schools and other bodies should arrange their own insurance as a matter of course.

Leaders provide their services on a purely voluntary basis and may not be professionally qualified in this capacity.

The Society does not provide hard hats for use of members or visitors at field meetings. It is your responsibility to provide your own hard hat and other safety equipment (such as safety boots and goggles/glasses) and to use it when you feel it is necessary or when a site owner makes it a condition of entry.

Hammering is seldom necessary. It is the responsibility of the hammerer to ensure that other people are at a safe distance before doing so.

# Future Programme

**Lecture meetings are held at Dudley Museum & Art Gallery, St James's Road, Dudley, DY1 1HU. Tel. 01384 815575. 7.30 for 8 o'clock start unless stated otherwise.**

**Those wishing to attend field meetings please contact our Field Secretary, Andy Harrison, telephone: 01384 370 188, mobile: 07973 330 706 or email: fieldsecretary@bcgs.info**

**Saturday 6th April *(Field meeting):* Around Warwick and Warwick Museum, led by Hugh Jones and Martyn Bradley.** Meet at 10.30 at the Warwickshire Golf Course, Leek Wootton, car park at SP 2889 6834. To visit North Woodloes Quarry (LGS 81). Then move to Warwick. Visit the castle entrance (Bromsgrove Sandstone). Lunch. Walk round Warwick roughly following the WGCG's Warwick Building Stones Trail. Visit the geology gallery of Warwickshire Museum: Plesiosaurs, Rhyncosaurs & other reptile footprints, and our amphibious friend, Dasyceps.

**Sunday 28th April *(Geoconservation day)*: Rubery Cutting.** This session is in conjunction with the Lickey Hills Geo-Champions and directed by Steve Hinton from the Lickey Hills Ranger Service. Meet at the cutting by the junction of the slip road from A38 Bristol Road South, and Leach Green Lane, B45 9XS (SO 993 775). From M5 exit J4 A38. Then 2nd left signed to Frankley & Rubery, turn right on Callowbrook Lane, first R again on Callowbridge Road then L on New Road to get under the flyover. Parking under the flyover. Tools and all equipment will be supplied by the Park Rangers. Bring your own gloves, and hard hats if you wish. Bring a packed lunch. Finish at 14.30. This important geological site in Birmingham is currently benefiting from Natural England's NIA initiative (see: http://www.bbcwildlife.org.uk/NIA). Heavy-duty clearance has already taken place, and this is a chance for us to be involved in more focussed geoconservation, particularly to clean up the contact between the Lickey Quartzite (Ordovician) and the Rubery Sandstone (Silurian, Llandovery).

**Monday 29th April *(Indoor meeting):* 'Sirius Passet and the Cambrian Explosion - insights from the far north'. Speaker: Prof. Paul Smith,** Museum Director, Oxford University Museum of Natural History.

**Saturday 11th May *(Field meeting):* Visit to Geoconservation sites** (Oct 2012 to Mar 2013); **Barrow Hill, Springvale Park, Barr Beacon and Rowley Quarry, led by Andrew Harrison and Paul Stephenson.** Meet on Vicarage Lane, Barrowhill Nature Reserve, NGR SO915894, at 10.30 am. Bring packed lunch and stout footware. At Barrow Hill we will need to get as many people into as few cars as possible, due to restricted parking at Springvale Park and Rowley Quarry. From Barrow Hill we will head to Barr Beacon Quarry first. Please contact the BCGS fieldtrip secretary on 07973 330 706 or email: fieldsecretary@bcgs.info to show your interest in attending.

**Saturday 22nd June *(Field meeting):* The Geology of Dudley and the Black Country from Canal Boat, led by Graham Worton** (Keeper of Geology, Dudley Museum and Art Gallery). Meet at the Canal Trust car park, NGR SO949917 at 10:00 for 10:30. Pub lunch. Canal boat cost £5.65 per person, payable on the day, gift aid optional. Maximum of 48 people, please indicate your interest in attending before 8th June 2013, to Andrew Harrison 07973 330 706 or email: fieldsecretary@bcgs.info

**Saturday 20th July *(Field meeting):* The Building Stones of Worcester.** Details tbc.

# Other Local Events

**Sunday 23rd June, 11.00 - 3.00. Lickey Hills Champions Extended Trail.** Free guided geology walk. Includes visits to Barnt Green Road 'overfold' quarry in the Lickey Quartzite (Ordovician) followed by wider exploration of the Lickey landscape including Beacon Hill (Permian, Clent Breccia) and Lickey Warren (Triassic, Kidderminster Formation). Meet at the Lickey Hills Visitor Centre, Warren Lane, Rednal, Birmingham B45 8ER. No need to book. Suitable for all the family. Approx. 4½ miles. Strong footwear advisable. Light snacks available at the Visitor Centre, or bring a packed lunch.

## Dudley Museum & Art Gallery

**Rock and fossil identification 11.00 - 1.00** by appointment on the following Wednesdays: 10th April, 29th May, 7th, 21st, 28th August and 30th October. Bring along your rock and fossil finds to have them identified by resident experts. Free of charge. Contact details as on p.2.

**Dudley Rock & Fossil Festival: Saturday 28th September 10.00 - 5.00** and **Sunday 29th September 10.00 - 4.00.** More details to follow.

# Other Societies

BCGS members are normally welcome to attend meetings of other societies, but should always check first with the relevant representative. Summarised information for the **next two months** is given in our Newsletter. Further information can be found on individual Society web sites.

## Manchester Geological Association

**Saturday 18th May: The Namurian of Dinckley Gorge** (River Ribble, near Ribchester) and the **Quaternary of Brockholes** (LWT reserve adjacent to M6 junction for Preston). Leader: Jennifer Rhodes. For details email Jennifer Rhodes, secretary, Lancashire Group of the Geologists' Association

Further information about outdoor meetings go to: http://www.mangeolassoc.org.uk/ or please contact Jane Michael by email: outdoors@mangeolassoc.org.uk Visitors are always welcome.

## Teme Valley Geological Society

**Monday 29th April 7.30pm: Plates vs Plumes, A Geological Controversy.** Speaker: Prof. Gillian Foulger. Contact Janet 01886 82106.

Meetings are generally held in Martley Memorial Hall, Martley. £3 non-members or join on day. For more details visit: http://www.geo-village.eu/ or contact John Nicklin, 01886 888318, 0774 977 4432

## Woolhope Naturalists' Field Club - Geology Section

**Sunday 21st April: Para-, Peri- or just plain Glacial: What caused the bog at Craig-y-Cilau?** Led by Duncan Hawley.

**Sunday 16th June: Ercall and the Wrekin, Shropshire,** led by Andrew Jenkinson

Guests are welcome, but must take day membership of the Club: £2.00. Further information: Sue Hay on 01432 357138, email svh.gabbros@btinternet.com or visit their web site: www.woolhopeclub.org.uk/Geology_Section/default.htm

## Warwickshire Geological Conservation Group

**Wednesday 15th May: Corley Rocks** (Carboniferous Salop Formation - possible conservation exercise) Leader: Jon Radley Meet: 7pm Rock Lane, Corley.

**Wednesday 19th June: Moreton Morrell Walk.** White Lias scarp & development of the Dene Valley, led by Ian Fenwick & Brian Ellis. Meet: 7pm Black Horse car park, Moreton Morrell.

All meetings will be held in The Lammas Room, Hill Close Gardens, Warwick CV34 6HF and start at 7.00 for 7.30 – coffee beforehand! For more details visit: http://www.wgcg.co.uk/ or contact Ian Fenwick swift@ianfenwick.f2s.com or 01926-512531. There is a charge of £2.00 for non-members.

## Mid Wales Geology Club

**Wednesday 17th April: Early Geological Maps.** Guest speaker: Duncan Hawley.

**Sunday 28th April: Elan Valley, near Rhayader,** led by Colin Humphrey.

**Wednesday 15th May: Geology of Salt in the Cheshire Basin.** Speaker: Kit Moorhouse, and **Practical Geomorphology: How to Interpret the Landscape.** Speaker: Julian Lovell.

**Sunday 19th May: Carn Owen, near Nant y Moch reservoir.** Guest Leader: John Mason.

Indoor meetings are in Newtown, at Plas Dolerw. Meet at 7.15 for 7.30pm. Further information: Tony Thorp (Ed. newsletter & Hon. Sec): Tel. 01686 624820 and 622517 jathorp@uku.co.uk Web site: http://midwalesgeology.org.uk

# Editorial

It has been a very busy and successful winter season of geoconservation days, and there is one more, this time a little further afield, at the Rubery Cutting in Birmingham. This site shows some important geological features which have been obscured by foliage for many years, and this is a chance to get involved in the TLC which it badly needs. There is also a chance to take stock of the year's geoconservation activities in a co-ordinated field trip to visit the four sites which have been the main focus of activity recently. (See p.2 for details of these activities.)

I am pleased to be able to bring you news in this issue that there is a proposal to establish the 'Workshop of the World' Black Country Global Geopark. A Global Geopark is a territory with geological heritage of international significance with a sustainable development strategy and a strong management structure. Stringent criteria apply, and the application process takes a long time. It is early days yet, but we'll attempt to keep you informed as this process proceeds. For more information about Geoparks see:http://www.europeangeoparks.org/ ■

*Julie Schroder*

### The Black Country Mining Heritage Group/Historical Society

It is proposed to establish a group dedicated to the preservation and promotion of the Black Country's mining heritage. After an informal meeting in March, it was agreed that a formally constituted group will form and that the inaugural meeting will be held at the Dudley Rock and Fossil Festival 28th/29th September 2013. The aim of the group will be:

*'To celebrate the mining heritage of the Black Country, to actively research it and share that knowledge as widely as possible through holding talks & lectures, walks, publications, exhibitions and events. Raising awareness of its importance engendering respect for the subject and in so doing engage a wider group of people in caring for, conserving and wisely using it for the benefit of all'.*

Prior to the inaugural meeting an email discussion forum will be set up to direct the detail and establishment of the group. This will initially be facilitated through Graham Worton and Dudley Museum & Art Gallery who will circulate comments and ideas to the group as they come in.

**For more information or to join the discussion forum please contact Graham Worton at Dudley Museum and Art Gallery: Tel: 01384 815575 Email: graham.worton@dudley.gov.uk**

# The Dudley Bug

## Welcome

Following the periglacial conditions this winter, we thought we would introduce you to some of the landforms which may become common once again in Britain. So just 'Chill Out' and bring on the next Ice Age!

*Alison and Chris*

## Periglacial Environments

A periglacial environment is an area where water is frozen as part of a continuous freezing and thawing cycle. The freezing is often intense, therefore leading to periglacial weathering which creates many landforms and features specific to that type of environment.

One of the features of this environment is Permafrost. This is an area of ground that has remained frozen at or below 0°C for more than two years. Today, permafrost can be seen at very high latitudes including much of the Arctic region and also Siberia. Up to 20% of the Earth's surface is covered by permafrost! However, this is reducing at an alarming rate. Permafrost is a store of carbon and methane, and is often seen in videos recorded in Siberia where people ignite the methane locked within bubbles in lake ice as the permafrost beneath melts and releases the gas into the atmosphere.

Periglacial features can vary from place to place, however, they are limited by the type of ground in which they form. The most common periglacial landforms and features are:

- Pingos
- Patterned ground
- Solifluction lobes
- Thermokarst
- Felsenmeer
- Ice wedges

*Pingos near Tuktoyaktuk, Northwest Territories, Canada (Wikipedia)*

**Pingos**

A Pingo is a mound of earth which has a large piece of ice contained within it. Pingos can vary in size, and can often measure up to 600 metres in length and 70 metres in height. Over time a Pingo increases in size, with an average growth rate of 2cm/year through frost heave. Pingos increase in height because there is nowhere for them to move downwards, therefore they expand into vacant space above. The Mackenzie Delta has one of the highest totals of Pingos, with 1350 present across the area. It is believed that there may be up to as many as 11,000 Pingos on the surface of the Earth.

**Patterned ground**

Patterned ground is formed in symmetrical shapes. For many years the formation of this periglacial feature has been unknown, often confusing scientists. Recently one theory for the formation of such patterns is a process known as *frost heave*. Frost heave involves rock fragments within the ground being lifted up onto the surface through continuous freezing and thawing. Frost heave occurs within fine grained, often saturated porous soils. The shape of patterned ground is commonly polygons, circles, steps and stripes. The size of all of these features varies depending on the type of ground in which they are forming. ►

**Solifluction Lobes**

Solifluction lobes form on slopes often covered with grass. The saturated top layer of soil which is continually freezing and thawing, gently slides downhill, forming lobes of ground on the slopes. Examples of this feature can be seen in the UK, particularly in the Cairngorm region of Scotland.

**Thermokarst**

Thermokarst is a land formation made up of irregular marshy hollows and hummocks which are formed by thawing permafrost. As with many other periglacial features, thermokarst landforms are formed by the mounds of earth freezing at the start of the winter; they then melt the following summer leaving small depressions in the land surface. The process is often repeated, creating large depressions in the ground. Quite often these depressions can become very large in size, leading to the formation of thermokarst lakes.

**Felsenmeer**

Felsenmeer form through freeze-thaw weathering of rock. The top layer (typically up to 1m depth) is broken up leaving irregular, jagged rocks on the surface. Felsenmeer don't form on all rock surfaces. They are only found in areas where the rock slope is less than 25°. This type of formation is generally found in high mountainous regions subject to periglacial conditions, for example in Iceland and Norway. *Interesting fact: the name 'Felsenmeer' means 'sea of rock' in German.*

*Melting pingo and polygon wedge ice near Tuktoyaktuk, Northwest Territories, Canada*

**Ice Wedges**

Ice wedges form by water freezing within a crack in the ground. The ice extends downwards in the shape of a wedge. When frozen, the ice causes the crack to expand. As snow and ice melts, water on the surface fills the existing crack and then becomes frozen. The next winter it freezes again causing the wedge to widen. Over time the wedge becomes larger, measuring up to 3-4 metres wide at the surface. ■

# Geoconservation Days, October 2012 - March 2013

The onset of Spring has brought to a close a very successful season of conservation work for the BCGS in the Black Country. Under the direction of Paul Stephenson (Birmingham and Black Country Wildlife Trust) our efforts have concentrated on four local sites which belong to the Wildlife Trust, but are all important geologically. Between October 2012 and March 2013 work was undertaken at Barrow Hill (Dudley), Springvale Park (Wolverhampton), Barr Beacon (Walsall) and Rowley Hill (Sandwell).

Meeting around 10:30 for 11:00, the works have so far mainly involved clearance of scrub, brambles and trees to open up the exposures at each site. Evidence from earlier clearance work shows that once cleared the vegetation is quick to grow back, which not only obscures the exposures, but also damages them. Therefore an on-going programme of annual maintenance work over the autumn and winter months is planned. Weather-wise we were lucky over the season with cold, but sunny days.

## 6th October 2012: Barrow Hill, East Quarry

At Barrow Hill our efforts were confined to clearing one arm of the East Quarry to expose the faces of dolerite and in places the Etruria Marl, into which it has intruded. Clearance work was undertaken in February 2012, however the vegetation had come back with a vengeance. There is still much work to do within the quarry, including vegetation clearance, tidying up exposures, providing some interpretation and on-going maintenance to keep the vegetation in check.

*Barrow Hill before clearance...*

*... and after*

## 3rd November 2012: Springvale Park, Wolverhampton

The exposures at Springvale Park sit at the crest of a high, relatively steep slope. The aims here have been to clear vegetation from the slope to provide a view of the exposures from the park, and to form a level platform at the top of the slope to enable easier access to the exposures of Carboniferous Coal Measures strata. Since BCGS first undertook clearance work on 25th February 2012, little vegetation had grown back. However, there is still much work to do and on-going maintenance is required. ►

*Springvale Park before clearance...*

*... and after*

**1st December 2012 and 2nd March 2013: Barr Beacon Quarry:**

Over the years the Barr Beacon quarry has become choked with low lying vegetation and trees that have completely obscured the exposures of Permo-Triassic Kidderminster Conglomerate and the underlying Bridgnorth Sandstone Formation. A rather magnificent erosion feature of washed out conglomerate can also be seen at the site, but is currently covered in vegetation. We spent two days here undertaking clearance work to open up the exposures and improve their view from the footpath at the bottom of the quarry. There is still a lot of clearance work to be done at the site, which will also require on-going maintenance to keep the vegetation in check.

*Barr Beacon Quarry before clearance...*

*... and after*

**1st February 2013: Rowley Quarry, Rowley:**

Rowley Quarry is one of few locations where easily accessible exposures of the Rowley Dolerite, or Rowley Rag, can be seen. The Rowley Hills quarries are now all pretty much in-filled, but have left their legacy in paving much of Birmingham. The quarry is an important site to the Wildlife Trust for its abundance of gorse, which provides a habitat for the rare Green Streak Butterfly. Consequently vegetation clearance here has to be carefully managed. The dolerite exposures in the quarry show excellent examples of spheroidal weathering and also what appear to be two distinct horizontal layers of dolerite, which would suggest two separate intrusion events. Paul told us of Wildlife Trust plans for a Toposcope on an area above the quarry, which will be built from the Rowley dolerite.

*Rowley Quarry before clearance...*

*... and after*

The next season of conservation work will commence in October 2013. In the meantime, a day of clearance work at the Rubery Cutting will take place on 28th April. *(See p.2 for full details. Ed.)*

I would like to thank Paul Stephenson for these opportunities over the past six months and also the BCGS volunteers for their time and effort. For all involved these days have proved to be very satisfactory as well as a chance to have a good chat. Please join us on the 11th May to look around each site covered by clearance work over this last season, and do feel free to join us once the next season starts again in October. ■

*Andy Harrison*

# Annual General Meeting Report

The AGM was held on Monday 18th March at 7.30pm followed by another enjoyable and informative talk on the 'Permafrost' theme by Dr. Richard Waller of Keele University. This time his subject was the ice-marginal environment of the Skeiðarárjökull glacier in south Iceland, focussing on the jökulhlaups and ice surges connected with this glacier. The following is a summary of the AGM reports.

**Treasurer's Report**

The Honorary Treasurer, Mike Williams, thanked the auditor for auditing the accounts. The accounts summary balance showed a loss of £618.40, the overspend due to costs incurred to support the drive to increase membership. A total of £1072.58 was spent on publicity leaflets and a 'pull-up' stand. Membership renewals are encouraging. From 2011 to 2012 there was an overall increase in membership in each category - individual, family and student. It is important now to maintain that impetus and Mike asked members to circulate the Society's leaflets as widely as possible.

**Chairman's Report**

The Chairman, Gordon Hensman, reported that it had been another busy year. He thanked all the Committee for their dedicated hard work, with special thanks to Barbara Russell for organising and providing refreshments for all the indoor meetings. As well as the indoor meetings and field trips, several successful conservation days took place in conjunction with the Wildlife Trust for Birmingham and the Black Country. The Chairman stressed the importance of maintaining geoconservation sites within the Black Country. Responding to a query about sending photos of geoconservation days to the local papers, the Chairman agreed that this would provide welcome publicity for the Society, and invited anyone prepared to take on a 'publicity' role to contact him.

The BCGS was represented at two events - the Lime Burning Weekend at the Black Country Museum in May 2012, and the Wolverhampton Local History Fair at Wolverhampton City Archives in November.

**Election of Officers**

All members of the Committee offered themselves for re-election, with the exception of the Vice-Chairman, Alan Cutler; the Meetings Secretary, Graham Worton; and Committee Member, Chris Broughton, who were standing down. The Chairman thanked them all for their contribution to the Committee and the Society. Alan Cutler, as a founder member, was instrumental in setting up the Society. Alan Clewlow was nominated and duly elected to serve as a Committee Member. There were no nominations for the posts of Vice-Chairman or Meetings Secretary. ■

*Linda Tonkin, Julie Schroder*

# British Carboniferous Magmatism

Over the last couple of years I have spent some time looking at the volcanic rocks associated with the Carboniferous Limestones in my own back yard in the Derbyshire Peak District. Coupled with participating in some of the 'clean-up' operations of the Society in the Birmingham district at Barrow Hill and Rowley Regis, and other geological visits to Cornwall and the Edinburgh area, it has become evident that the Carboniferous period in Britain was quite a fiery one, certainly more than the quiet accumulation of limestones, grits and coal measures that we usually associate with this part of our geological past.

*Calton Hill Quarry in the Peak District, near Buxton, showing columnar jointing in a sill injected into tuffs and lavas*

This prompted me to read some of the relevant literature to see how much more there is to the igneous record of our Carboniferous geology. And, like so many subjects, when you look into them it's surprising how much you never knew! ►

Firstly, it becomes apparent that one can readily divide things into two separate strands of enquiry, exemplified by the two separate volumes in the Geological Conservation Review series discussing just this subject. One is devoted to that part of Britain south of the Variscan Front, the other to the area to the north. (The Variscan Front is the line that marks the approximate limit of deformation associated with the Variscan orogeny, also known as the Hercynian or Armorican orogeny, which affected Britain during the Carboniferous and Permian periods).

In the south west of Britain the best known igneous rocks are the various granites, which are all 'post-orogenic', emplaced during the lower Permian between 290-270Ma. Earlier intrusive rocks include Tournaisian dolerite sills. Most of the volcanics of the area are older (Devonian), but some are early Carboniferous, as at Tintagel, Meldon and Brent Tor. They include pillow lavas (now deformed somewhat) and Brent Tor near Tavistock forms a conspicuous landmark with its agglomerate peak surmounted by a small chapel. Some minor tuffs are inter-bedded within the Namurian Crackington Formation (part of the 'Culm' sequence, so very different from the grits which we are accustomed to in the Midlands). Finally, there are the more widespread 'Exeter Traps', a series of lamprophyric lavas, and minor intrusives that extend from late Carboniferous well into the Permian.

On the fringe of the Variscan Front we come across small outcrops of volcanic rock around Weston-super-Mare; specifically the (Courceyan) Middle Hope volcanics (lavas and calcareous ashes) and the slightly later (Arundian) Spring Cove pillow lava and agglomerate interbedded with limestones containing the well known large 'Caninia'-type solitary corals. There are other small patches of lava at Uphill, Tickenham and Goblin Combe between Weston and Bristol. These are of olivine-basalt type and are also Courceyan in age.

*Arthur's Seat, Edinburgh - Wikimedia*

Leaping to the north of the country, I won't enumerate the many volcanic extrusions and intrusions within the Scottish Midland Valley. I will just observe that most of these are of Viséan age, though of course the host rocks in this part of the country are quite unlike the familiar 'mountain limestone' of the Midlands, and more like the Yoredales of northern England. I was particularly taken by the character of the Chadian volcanic rocks on the Forth coast near Edinburgh, equivalent in time to the better known Arthur's Seat and Salisbury Crags of the city itself. If you are in this area and looking for some colourful geology, take a walk along the coast west of North Berwick to Weaklaw Rocks, noting also the intrusive rocks forming various offshore islets; you won't be disappointed!

Activity seems to have persisted longer in Ayrshire and Fife, continuing into Westphalian times. Several intrusive swarms from the alkaline sills of Fife and Lothian through to the dykes of Orkney date from the late Upper Carboniferous to the late Permian. I will mention just one in particular to illustrate their interest - the Craighead essexite dyke, well exposed in a small quarry above the Southern Upland Fault where it crosses the M74 above Abington. Essexite is a distinctively porphyritic rock with lovely black augite phenocrysts, and is a type of gabbro used for curling stones.

North of the Highland Boundary Fault there are further volcanics through the Upper Carboniferous and into the early Permian, notably on Kintyre (associated with the oft forgotten Machrihanish coalfield!) and Arran, and even a somewhat mysterious outcrop of lavas at Glas Eilean in the straits between Jura and Islay.

Returning in a 'homeward' direction, we find further basal Carboniferous (Courceyan) lavas straddling various parts of the 'Iapetus suture line'. These mark a relatively extensive outburst of volcanic activity marking the Devonian/Carboniferous boundary and recurring locally in middle Viséan (Holkerian) times. They include the Birrenswark and Kelso lavas, which are mainly flows with some subsidiary tuffs, associated vents and small intrusions. As time went by volcanic outbursts appear to have migrated southwards with the Holkerian Cockermouth Lavas in Cumbria (though an older age is also reported... ?late Courceyan) and the Brigantian Scarlett Volcanics on the Isle of Man.

Whilst still in the north of the country, I should also mention the best known of all English minor intrusions, the Whin Sill. This is large by the standards of 'minor' intrusions in the present context, and of course underlies much of the north-east of England. It is confidently dated as late Carboniferous ►

(Stephanian), approximately the same as the Scottish Midland Valley tholeiitic sill and dyke complex.

Moving further south we reach the Midlands where the most concentrated magmatism was the late 'limestone-times' (Asbian-Brigantian) activity of the Peak District. This consisted of a large number of lavas with lesser pyroclastics, several associated vents, and 8 or 9 separate younger sills ranging through the Upper Carboniferous. Four 'volcanic centres' have been suggested in this area with by far the thickest development appearing to centre on the eastern inlier at Ashover. They have been named the 'Fallgate' Volcanics after a location in this village. Brigantian and Namurian tuffs and lavas have also been recorded in several boreholes further east in Nottinghamshire.

More recently, a substantial volcanic pile was discovered in the Vale of Belvoir during exploration for an eastward extension of the South Nottinghamshire coalfield. This is most fully developed near Grantham, and mostly of Westphalian 'A' (Lower Coal Measures) age, although weathered thin tuff bands known as tonsteins are present at higher horizons over a wider area.

*Golden Hill Quarry near Usk*

Similar Westphalian volcanics are also known at depth beneath the South Midland coalfield and even beyond into Oxfordshire and Berkshire. These are of some interest as they occur either side of the so-called St. George's Land 'Midland Barrier' shown on all the reconstructed geographies of the time.

An isolated lava of late Viséan (Brigantian) age occurs at Little Wenlock near Telford, and an extraordinary occurrence of a vent of uncertain (but ?Dinantian) age may be seen in the form of agglomerate and associated monchiquite dykes in two localities near Usk. One, named 'Golden Hill quarry' is more green than golden (ie. well overgrown), but the owner very obligingly cut a swathe through for my benefit on an impromptu visit, fetching a chain saw for the job there and then!

And so we finally return to our familiar starting point around Birmingham where we come across various patches of igneous rock in the form of the ?lopolith/ laccolith of the 'Rowley Rag' (late Westphalian), the even smaller basalt sills at Pouk Hill and Wednesfield (early Westphalian), and the volcanic complex at Barrow Hill whose age is Westphalian... or possibly late Namurian... Perhaps it was long-lived and both these dates are correct? These are similar in age to other scattered intrusions in the West Midlands: sills at Clee Hills, Kinlet, Shatterford and Dosthill, and dykes at Brockhill and further afield at Bartestree near Hereford.

*Rowley Rag at the quarry cleaned up recently by BCGS (off St. Brades Close). It shows spheroidal weathering of the basalt.*

So what are we to make of all this? It's a lot to take in, and doesn't look much clearer in chart or diagram form. In the first instance, we can see the context of our 'local contributions' on a much broader canvas. We might note that apart from the granites of the south-west (which are anyway of Permian age), magmatism was exclusively of a volcanic (i.e. extrusive) nature, albeit with minor associated shallow intrusions. Interestingly, we might also note that prior to all this in the Devonian there was also much emplacement of granite across northern Britain (Lake District, Isle of Man, beneath Weardale, the Cheviot, the Southern Uplands) as well as elsewhere in Scotland.

In rather broad-brush terms, Carboniferous magmatism was sandwiched between two periods, and two foci, of subduction-related plutonic emplacement. It was preceded by the final closure of the Iapetus Ocean in the north (Caledonian event) and followed by the closure of the Rheic Ocean in the south (Variscan event). The interval between was when the Pangaean supercontinent was consolidating. The area occupied by Britain was between the clashing rocks of Laurentia, Baltica and Gondwana where the crust was subjected to stretching and thinning, associated with the formation of 'blocks' and 'basins' due to uplift and subsidence (i.e. vertical movements) as much as the horizontal motions associated with drifting landmasses. The one exception was in the south, where remnants ►

of island-arc associated subduction was still lingering. I have in my mind's eye here a situation not unlike the present day eastern Mediterranean, in which Laurentia = Europe, Baltica = Middle East and where Gondwana = Africa. Puffs of subductive volcanism continue today mainly in southern Italy, though they have been more widespread in the past. (Santorini comes to mind. Quite a puff, that was.)

This lithospheric stretching gave rise to areas of increased heat-flow causing partial melting that generated, on the whole, tiny volumes of magma released as local areas of 'within-plate' type volcanic products. These are characterised by being undifferentiated (chemically fairly uniform), such that most of these volcanic products are of olivine-basalt type, at least to begin with. Through time some chemical variation did occur leading to more alkaline types and, where larger volumes of magma were involved as in Scotland's Midland Valley, even some more acidic differentiates such as trachytes and andesites. Most of the volcanism took place at the margins of the stable blocks or on the edges of the basins (but this is yet another generalisation), whereas the intrusive activity was often more widespread. To pursue my present day analogy we can see recent evidence of 'within-plate' type volcanism in places like Egypt, the Auvergne, Bohemia, northern Hungary and Transylvania, though in most of these places the gas is presently on a back-burner, if it hasn't gone out altogether.

Basically, then, we can blame it all on Pangaea. So, next time you visit your local igneous outcrop, it is worth remembering it is part of a much greater magmatic province, but certainly no less interesting for being so. This wider context also gives one something to ponder when clearing away the modern day 'botany' that has such a bad habit of repeatedly concealing the underlying geology. ■

| | | | | | | |
|---|---|---|---|---|---|---|
| [Permian] | | | | | [base at] | 299Ma |
| Carboniferous | Upper | Stephanian | | | | 306Ma |
| Chronology: | | Westphalian (D,C,B,A in descending order) | | | | |
| (as used above) | | ('coal measures') | | | | 315Ma |
| | Middle | Namurian | | | | |
| | | ('grits') | | | | 326Ma |
| | Lower | Dinantian | Viséan | Brigantian | | |
| | | ('limestones') | | Asbian | | |
| | | | | Holkerian | | |
| | | | | Arundian | | |
| | | | | Chadian | | 345Ma |
| | | | Tournaisian | Courceyan | | 360Ma |

*Mike Allen*

# New Zealand Volcanoes - White Island and Tongariro

All of New Zealand's currently active volcanoes lie on or close to the North Island, in the area called the Taupo Volcanic Zone, a 150 mile belt stretching in a NE-SW direction from White Island, (30 miles off the coast of the North Island in the Bay of Plenty), through the area of Rotorua and Taupo, to the three active volcanoes in the centre of the North Island in Tongariro National Park; Tongariro, Ngauruhoe, and Ruapehu.

The Volcanic Experiences trip in November 2012 was fortunate to visit the volcanoes at a time when alert levels had been raised, following minor eruptions from two of these volcanoes in the preceding few months.

*White Island*

**White Island**

The trip to White Island was quite an experience. After an early morning drive from our base at Rotorua, our group of 23 boarded the excursion boat at Whakatane for the one and a half hour journey to the island. It could just be seen in the distance from the harbour at Whakatane, but as the boat got ever closer, the features of its dark edifice with clouds of steam rising high above it became much clearer. Eventually, our boat dropped anchor in a sheltered cove on the southern side. Everyone had to climb down into an inflatable 12-person rig for the short trip to a concrete jetty - almost all that remains of a sulphur mining operation abandoned many years ago. ►

*White Island main crater*

Our guide and all visitors were equipped with gas masks and hard helmets. Some had questioned the need for these, but it soon became obvious that they were a necessity. No climbing was involved, as the volcano had in the past blasted out one side of the crater rim, and we were able to follow a path past bubbling mudpools, steaming vents and fumaroles right up to a spot where we could look down into the currently active crater. By the shore close to where we landed, there was a strong smell of sulphur, but this became more intense the closer we got to the crater. The cocktail of gases emerging from sites all around included a percentage of sulphur dioxide, which caused a smarting of the eyes, coughing, and a distinct worry about the possibility of asphyxiation.

After a safety briefing by our guide (what to do in the event of an eruption!), we set off past the helicopter landing area, following a path to the main area of fumaroles. I had seen steaming sulphurous vents in many places, from Vulcano to Hawaii, but nothing on the scale witnessed here. The sheer volume, noise and pressure of the emissions, and the brilliance of the dazzling yellow sulphur deposits really had to be witnessed to fully comprehend.

The path led on to the rim of the inner crater, much of its surface covered in mud-cracks as the periodic small crater lake had been boiled away, though there was still a huge amount of steam issuing from within. There had been an eruption from the crater on August 5th. This later caused the formation of a lava spine which became visible, causing raised eruption alert levels in early December, a few weeks after our visit. Our circular route then led us past the foundations of the old sulphur processing factory back to the point where we first disembarked, all of us grateful that the 'what to do in the event of' advice had not needed to be put into practice.

The island was discovered and named by Captain James Cook, in 1769. He did not link the swirling white clouds with volcanic activity, and did not land there, but it was claimed by the Crown soon after the Rev. Henry Williams landed in 1826 and stated that the whole island was composed of sulphur. The island was sold into private ownership in the 1830s and then passed through various owners, with mining taking place periodically, but never for very long. In February 1914 a new operation started, but within a few months, a major disaster occurred. The south western rim of the crater collapsed, causing a lahar which swept down over the area of the mining operation, killing all ten miners on the island and burying them. In 1925, mining started again but efforts to make the operation profitable were to no avail, and all mining ceased in 1933. Since 1953, it has been a private scenic reserve, allowing visitors in limited numbers, weather and volcanic activity conditions permitting.

The island is the tip of a typical andesitic strato-volcano, thought to be 150,000 to 200,000 years old. Like other volcanoes in the Taupo Volcanic Zone, it has formed due to the Pacific Plate moving north-westward and being subducted beneath the Indo-Australian plate. Continuing along the line of the Taupo Volcanic zone north-eastwards from White Island, there is a chain of volcanic sea-mounts, all running parallel to the plate boundary.

**Tongariro**

*The Steaming Te Mari Crater at Tongariro*

The New Zealand volcano making the most news in 2012 was Tongariro, another andesitic strato-volcano. It is thought to date back 300,000 years, though older layers are buried and the rocks exposed at the surface are much younger. Tongariro erupted twice in the space of three months in 2012, though each eruption lasted only a few minutes. The volcano hit the headlines on 6th August, when it produced a short-lived explosive eruption from the Te Mari crater, which had not erupted since 1897. The eruption produced a 6km high ash-cloud which spread fine material over a wide area, reaching as far as Napier, around 140km to the east. Local roads were given a 3mm ash covering. The eruption also hurled one-metre blocks up to 2 km from the crater. The world-famous 'Tongariro Alpine Crossing' hiking trail passes close by the craters. It is walked by many thousands of people every year, but as the August eruption occurred ►

just before midnight at the height of the New Zealand winter, no-one was on the trail and there were no injuries or fatalities.

*Lahar damage showing mud coating and stripped bark on the lower slopes of Tongariro*

One of the main concerns was the lahar (mudflow) which raced down the mountain, carrying blocks and finer material. It passed through thin forest on the lower slopes. Our visit in November saw evidence of the damage caused and the depth of the flow. A main concern for the National Park Authorities was that a repeat during the summer months could overwhelm one of the camp sites, with possible multiple casualties.

On the day of our visit, weather conditions varied from bright sunshine to heavy showers of rain and sleet. Due to the low cloud-base we were only able to cover part of the Tongariro crossing, but we were fortunate to get a good view, from distance, of the steaming Te Mari crater, a subsidiary cone on the northern flank of Tongariro.

Just a few days later, on November 21st around the middle of the day, the Te Mari crater erupted again. This was less intense than the August event, but still produced an ash plume 2km high. The event was witnessed by many visitors, including two local school groups on field outings - one being only 1km from the crater at the time of the eruption. The authorities immediately evacuated between 60 and 80 people from the Tongariro Crossing trail, closing it to the public. Air traffic covering much of the eastern side of the North Island was suspended, with cancellations and delays persisting for several days.

Alert levels have since been reduced, and though the volcano is still being very carefully monitored, public access is again allowed and the area is now receiving its normal volume of visitors. Indeed, the publicity gained by the eruptions may well have benefited the local tourist industry in recent months! ■

*Alan Clewlow*

# Geobabble

I was recently with a group of geologists, in a pub, talking rocks and places, and one of our party would periodically get up to take a call on his mobile and then consult his iPad. He explained that his son was on his field mapping as part of his geology degree course. He was in a fairly remote part of Cyprus and he had this arrangement with his Dad; he would text or phone and ask him to look at his locality using Google Earth or some other programme and advise him about structure or a particular feature. This sent the rest of us into a Monty Python type conversation with most sentences starting along the line of; “When I did my field mapping I had to walk to the next village to get to a phone box”. “You had a phone box! I had to walk 6 miles to a post box and send a card”. It did however remind us of how rapidly we can distribute geological information and data.

The International Space Station (ISS) is no longer news, unless something goes wrong, but Commander Chris Hadfield is about to end his tour of duty in charge of this mission, his third and the thirty fifth for the ISS. He is the first Canadian to be in this position but he has caused much interest for me, as a geologist, by taking lots of photographs of the Earth’s surface from his spacecraft and beaming them back to Earth. They include images of cities and agriculture, weather systems, but for me the most interesting are related to the geology, major fault lines, fold systems and volcanoes. The clarity and detail is similar to flying on a commercial flight at 35,000ft, and looking out of the window. He comments on each picture he takes, about a dozen a day, and recently he pointed out a small dark circle in a photograph of part of Somalia and said that he did not know what it was. Within minutes someone had looked at a map online, using the given coordinates, and come up with a photograph showing that it was a caldera now filled with water, similar in many ways to the student phoning his Dad. ►

I have seen these pictures because of social media, in this case Twitter. Most of my friends will have nothing to do with Twitter or Facebook, but if you 'follow' or choose your 'friends' sensibly it is a terrific way to share information. I had to 'follow' Cdr Hadfield on Twitter, and each day his photographs appear on my laptop.

Another big piece of Earth Science news recently concerns the thickness of the ice covering Antarctica. Over 25 million measurements were taken, mostly satellite data using a wide range of geophysics including seismic and gravity measurements, airborne radar, glaciological modelling and geological mapping. The idea is to measure the altitude of the ice surface, and also the ice rock interface and so calculate the thickness of the ice. In fact there are 27 million $km^3$ of ice, and if it all melted, global sea levels would rise by 58m. One of the best places to read about this and look at the maps is at www.bbc.co.uk/news/science-environment-21692423 or for a more detailed look at the science behind the research, go to www.the-cryosphere.net

*Mawson (far right), one of a party to the S. Magnetic Pole, 1909*

Thus far I have spoken of the advanced communication techniques of the 21st century. We often hear of very hazardous expeditions undertaken by explorers today, usually connected to a cause or attempting to be the first person to do some feat, and when something does go wrong we are able to airlift people out and they are recovering within days if not hours. If only the great Antarctic explorers of the 20th century had had this luxury. While I was researching this article I came across a book review in the Observer newspaper of 27th January 2013. The book is *Alone on the Ice* by David Roberts and is a biography of the great Australian geologist and explorer Sir Douglas Mawson. He was Professor of geology at the University of Adelaide, and he studied the Antarctic and the rocks of the Flinders Range, particularly the Precambrian glacial deposits. He died in 1958, but in the early part of the century was one of the greatest Antarctic explorers. He is relatively unknown in this country; probably because he was only interested in the science rather than glorious achievements.

Mawson set up the Australasian Antarctic Expedition from 1911 to 1914. He approached Scott to get a 'lift' on the Terra Nova for his party but he was refused, but then Scott invited him to join his party with the possibility of being one of those to reach the South Pole. Mawson turned down this offer as this appeared to have little scientific value; he always thought that the magnetic pole was of greater scientific interest. Mawson's expedition was to establish three permanent bases from which teams of explorers would go out to record the unknown territory. Mawson led one of these parties and in November 1912 set out with Belgrave Ninnis, an Army officer and Xavier Mertz, a Swiss cross country skier.

*Mawson resting at the start of his epic journey, late 1912*

It is difficult to put their epic journey into a few lines, but in December Ninnis, together with his sledge and dog team fell down a very deep crevasse and was never seen again. His sledge was carrying the tent and the bulk of the food. Mawson and Mertz now made a dash back to the base camp. Their food had to be supplemented by eating the dogs. This diet caused all sorts of horrific ailments such as their skin peeling. Mertz became delirious and on the morning of January 8th he died. With over 100 miles to reach the base, a very ill Mawson struggled on with the remaining sledge and a makeshift shelter until he also fell down a crevasse. Fortunately his sledge wedged itself on the surface leaving him dangling on a rope. Eventually he managed to climb out. On February 8th he reached the base camp just in time to see the expedition's ship leaving for Australia. He joined the small party left at base camp and overwintered there. ►

*D M recuperating, 1913*

He always said that the thought of meeting his fiancée again kept him going, and when he reached the base he sent her a radio message that began: "Deeply regret delay only just managed to reach hut". I feel quite inadequate in doing justice to Mawson's life and exploits but I admire that he was not doing it for Australia or the Empire; he was doing it for science, and his fiancée. You may wish to follow up the sources I have used in addition to the book review already mentioned. Mawson can be found in the *Australian Dictionary of Biography,* and also a blog from the Smithsonian: blogs.smithsonianmag.com/history/2012/01/ ■

*Bill Groves*

# Members' Forum

## 'Clever Dick' is wrong!

Following from my article on Global Warming in the last Newsletter Martin Normanton, our Honorary Auditor and Walsall Eco-Warrior, has commented that 'Clever Dick' *(Matt Ridley: see Mike's article, Issue 217, p.15 Ed.)* is wrong'. In a natural forest trees die and are consumed by fungi et al, in a process which converts nearly all the carbon in the tree into $CO_2$. Meanwhile the growth of replacement trees absorbs a similar amount of $CO_2$. When we harvest and burn the timber this is bad news for fungi, but no difference for the planet as the $CO_2$ is being given off just the same through a different route and the growth of new trees offsets the emissions. So the process is carbon neutral over the 10 to 12 years that it would take the timber to rot. Yes, some fossil fuels are used to transport the timber (but small beer), and fertilisers can be a problem, as nitrogen fertiliser manufacture uses a lot of energy, but nowhere near the emissions from burning fossil fuels instead of wood.

When we harvest the timber to make buildings etc. the carbon is locked up until the structure is demolished (or rots away) so in a short term sense we have removed the carbon from the atmosphere. We could do even better if, when burning the wood in a large plant, we capture and store the $CO_2$.

The statement that timber used to generate power or heat is more carbon rich than coal is nonsense. Further, it does not require 200 years for the breakdown point between releasing the carbon atoms by burning and the planting of new trees as these new trees will do most of their growth in a few decades. Biomass burning emits about the same as oil burning but then it is absorbed by the new trees over this shorter time frame. So far no $CO_2$ from fossil fuel burning has been deliberately absorbed, except that there is evidence that plants grow more quickly at higher $CO_2$ levels and temperatures, so do absorb a little fossil fuel $CO_2$.

Thanks go to Martin for his contribution to this debate which has become very relevant in view of the recent announcement that Britain's largest power generating unit, the Drax power station near Selby, responsible for generating about 7% of Britain's electricity, is to convert to burning millions of tonnes of wood each year. In a £700 million plan, huge quantities of wood will be imported from North America, Europe and Africa. The irony here is that by burning biomass, at treble the cost of coal, Drax will qualify for generous subsidies funded by levies on our electricity bills. ■

*Mike Williams*

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