



WGCG

Warwickshire Geological Conservation Group

Conserving Warwickshire's Geological Heritage



Our Interpretation Board at Ryton Pools Country Park, erected in 2019

Photo credit: Brian Ellis

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Warwickshire Geological Conservation Group

Hidden wonders in the landscape of Warwickshire

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Workshop: Making Sense of Geological Maps

22 February 2020

David Gosling

Many of us can still read road and Ordnance Survey maps as we go about our travels on the surface of our planet, but interpreting geological maps is much more difficult. The online BGS maps are a good example and can be quite challenging with their multiple options of 'Superficial', 'Bedrock', or a blend of both, with the further option of showing our human infrastructure on top. With this in mind, I jumped at the opportunity to register to attend Norman Dutton's workshop '*Understanding Geological Maps*'. This, I thought, would be an informative and relaxing way to spend a February Saturday morning. A few weeks later some doubts crept in when I received an email asking me to bring to the workshop; pencils, an eraser, a ruler and a protractor. A protractor! This was beginning to sound serious. Then I remembered I had a collection of pre-Digitalocene epoch artefacts – including a slide rule, set square, and compasses. The protractor was there too.

We were fortunate to have the day led by Norman, whose experience and resources as a geology teacher and Chief Examiner underpinned the activities which followed. He began the day reviewing the various geological maps available in books, folded, sheet form, and online. He praised the printed BGS maps, described the online BGS Viewer as "unusable", but went on to describe the BGS Map Portal as "excellent". He spent a few minutes showing us how to create a map centred on our home. The review of the maps was followed by a detailed 'What to look for' session covering the surface appearance of eight geological structures, and their likely sub-surface form. Norman covered horizontal, dipping, folded and faulted strata, unconformities, igneous rocks and glacial deposits.





Now it was time to put our pencils, rulers, erasers and protractors to good use, and engage our brains. The practical work began with the first of eight increasingly complex exercises based on mainly fictitious geological maps, from which we had to develop the vertical section from a line X-Y on the map. The first map showed two horizontal strata above five strata dipping at 36° . The vertical section, lower down the page, simply showed the contour and heights above a datum of the surface. We set to work and projected the positions and angles of the strata down from the surface map to develop the vertical section. A fairly high degree of success was clearly achieved around the room. Then the sections became harder and we worked at our own pace, but we had reached a GCSE standard in a couple of hours!

After the lunch break, we began to work through the more challenging exercises based on establishing the successions and geological histories of the areas shown on a variety of maps. He likened the understanding of stratigraphy to a Mary Berry Bakewell tart, with its base layer of pastry followed by jam, sponge and icing sugar and the cutting of a slice post-dating its formation! Again, a reasonable number of successes was achieved with the first map. This introduced igneous rocks, a fault and varying angles of dip. Progressing through the exercises, further complexities such as multiple faults, anticlines, and synclines were included resulting in a falling success rate! Norman did at this point make us feel much better by saying we had in four hours worked through a full year's work to tackle the map set for the 1971 GCE A level Practical Geology examination.

The Workshop ended with some very tired brains. We all agreed we had gained a thoroughly fascinating insight to geological mapping. Thank you, Norman.

Valuing Geology

Julie Harrauld

The Problem

In the last decade the concepts of *'natural capital'* and *'ecosystem services'* have come to dominate environmental policy in England, and yet geology, despite being the foundation of our landscapes and the fundamental control on how they work, has been almost completely written out of the natural environment narrative in government policy. In an attempt to help recover the situation for geological interests, I recently undertook a three-month project funded by Santander (Bank) Universities Scheme, the Open University and several Geology Trusts, including WGCG through a Holloway Bursary award.

Our *'natural capital'* is our entire range of *'natural assets'* including geology (in most definitions of it). *'Ecosystem services'* are those that the assets provide and from which people benefit. A commonly used example that has made it onto political agendas is that a forest is an asset; the trees' roots take up water and the leaves take up carbon dioxide and air pollutants, so people benefit from reduced flooding, carbon sequestration and improved air quality – these are all *'regulating' services* provided by the forest. An alternative use for the trees would be to fell them for timber; this would be termed a *'provisioning' service*. Furthermore, ecosystem services include the *'cultural services'* that we obtain from the natural environment, such as the aesthetic beauty of landscapes, our natural heritage, a sense of place, and recreational and tourism opportunities.



The warm-coloured Hornton Stone contributes to the character of local villages



Ryton Pools Country Park occupies a reclaimed sand and gravel quarry, now a popular recreation attraction



Baddesley Clinton is a National Trust property and the character of the house depends on use of Arden Sandstone quarried on-site

Clearly, geology contributes to ecosystem services by providing minerals, fuel and building materials, by underpinning our cherished landscapes and by providing an outstanding range of sites that are part of Britain's globally important scientific heritage. It may also be a controlling factor in other ecosystem services through the role it plays, for example, in hydrological systems by regulating the flow and quality of ground water; and in agriculture by supporting the formation of soils. Nevertheless, geology is almost always excluded from ecosystem services assessments and is only considered as a 'non-renewable resource' (based on the value of minerals production) in natural capital accounts.

The concern for geologists is that we have reached the stage where recognition of geology in policy has been diminished to the point where it is never mentioned in guidance that sets out how planners should approach the natural environment. For example, the 2011 DEFRA White Paper on the environment, *The Natural Choice: securing the value of nature* does not mention geology once and the 2018 update of the *National Planning Policy Framework (NPPF)* retained geology only in a subtitle, and removed all detail from the subsequent paragraphs; geologists then had to work to get it included in the update of supplementary guidance. This low priority accorded to geology in the NPPF may lead to a reduction in protection for Local Geological Sites by local environmental practitioners / planners / land managers / developers, etc.

At an individual level the absence of recognition of the fundamental role geology plays in the landscape, our communities, the economy and our modern way of life is very frustrating.

The Investigation

Natural capital and ecosystem services (NC/EcSv) is a rapidly growing field of work, with assessments taking place all over the country in all types of organisations from big business to National Parks, encouraged by guidance from DEFRA. Large private landowners are also anticipating changes, following Brexit, in the criteria for payments from government for environmental land management and are looking at how ecosystem services and natural capital reports might give them the evidence they need. There is no time to lose in establishing a methodology for including geology in this work.

My short project has allowed an attempt at this. I was able to visit and learn from economists and ecosystem services practitioners and then apply their methods to a few case studies to show how geology could be included. In practice, a further element of the project developed – that of communicating the issue and my work to key players in the field, including relevant government departments. In addition to reviewing the key documents that have driven the rise of the NC/EcSv approach in the UK, and studying guidance on how economic valuation and cost-benefit analysis is carried out and used in natural capital assessments.

The work has included:

1) familiarising myself with current practices through:

- attending conferences held by the Valuing Nature Programme (the body that has driven research into ecosystem services to advise DEFRA) at which I presented a poster,
- communicating with / visiting consultancies and academics who are natural capital practitioners to learn the basics of how the work is done, the concepts used, and what the obstacles are for geology,
- attending an Ecosystems Services Network (a key hub for NC/EcSv news and training) day course on incorporating the NC/EcSv approach into formal Environmental Impact Assessments (EIA) for major development projects.

2) meetings with 'official' bodies including:

- speaking to officials at DEFRA, HM Treasury and ONS to make them aware of the exclusion of geology and offer them the report of my project,
- meetings with Natural England (geologists, ecologists and managers) and British Geological Survey who both have an interest in seeing the project succeed,
- meetings with geologists in Scotland who are working within a different policy framework and are already incorporated in the right networks,
- being ignored or damaged by the biodiversity-led NC/EcSv juggernaut, Historic England has been working since 2015 on developing a parallel approach for the historic environment.

3) communicating with other groups with shared interests including:

- Crown Estates, Duchy of Cornwall, Malvern Hills AONB and the National Trust amongst others, who are all at various stages of engagement in natural capital assessments of their land holdings.

The Outcomes

Following the learning and outreach part of the work, **four case studies** were identified that could be used to show how geology can be included in NC/EcSv assessments. The locations were Malvern Hills AONB, English Riviera Geopark, Wren's Nest National Nature Reserve and Calke Abbey National Trust property. Meetings were held with relevant contacts at each and limited field work was carried out where necessary.

A **spreadsheet grid** of the type used in most ecosystem services assessments was developed for each location to itemise the assets and services provided by geology. A document was developed with a list of **prompt questions** to enable thinking about geological assets and services in terms of the benefits derived by people from the services and which may be assigned a monetary value.

A report of the project is now being drafted to outline:

- the fundamental influence of geology on the natural environment and its contribution to human development and well-being (i.e. the narrative that needs to be restored)
- the drawbacks of recent policy changes
- the background to how this situation came about
- the basics of how NC/EcSv work is being done
- the obstacles for geology in this
- the spreadsheet grid and prompt questions
- a summary of the case studies
- data sources that can be used in such studies
- recommendations, including a seven-point list for policy makers.

The report has to strike a balance by being understandable to all audiences. Despite a few papers having been written on 'geosystem services' in recent years, there has been, and still is, a big communications gap between geologists, ecologists and environmental economists, with geologists unable to understand why geology is being excluded and ecologists and economists thinking that they already include it! Engagement between these fields has been lacking until now, but I hope this short project will help us to turn the corner.

Holloway Awards: funding new activities **Brian Ellis**

Apart from our work with Primary Schools through leading field work at Burton Dassett Hills and some lessons in school, we have found supporting work directly with pupils difficult to achieve, largely for logistical reasons. Contacts with secondary schools have come to nothing. On the other hand, we have had more success in supporting Professional Development for teachers both in Primary and Secondary schools. We have sought advice about how we might expand this work to encourage bringing more geology into the school curriculum. The current state of play is summarised below.

We have for several years now been supporting the **residential Summer School** led by Professor Chris King at Keele University. The course is for newly qualified or practising teachers who have a Geology or Earth Science background and who wish to teach geology at A level. Currently it is the only route in the UK to equip teachers to be specifically trained to teach (or set up new courses) for A level geology. External industrial funding for the course has recently ceased. The cost to participants is now £1800 and we provide bursaries to cover these costs for two students. WGCG has made a rolling three-year commitment to continue this support. Chris King tells us that this reliable 'core funding' enables him to use it as a lever to try to raise funding from other sources.



Keele Summer School Geological Timescales



Keele Summer School Field work

During 2020 we are involved in two new projects:

1)

Chris King is a leading member of the **Earth Science Teachers Association (ESTA)** and through him we have learnt of a different scheme of Professional Development. This involves day-long workshops for teachers during their initial training. They are aimed at secondary geography and science teachers as well as intending primary teachers, many of whom have limited Geology/Earth Science backgrounds. What Earth Science content remains in the Schools' National Curriculum is taught through science and/or geography classes. The workshops are run mainly in teacher training institutions with a few in schools and at professional conferences using a network of facilitators, trained by ESTA. Participants are provided with classroom resources and are shown how to use them. ESTA has been running workshops for 18 years and has a good track record of their effectiveness. This programme was fully funded by Oil and Gas UK, but this funding has now ceased. WGCG has committed £3000 per year for the next three years to ensure the continuity of the programme and give ESTA time to explore other possible sources of funding. It is anticipated that workshops will be run at about 30 institutions this year and at the time of writing 17 workshops have taken place.

2)

WGCG is also developing a link with the education committee of the **Geological Society of London** for a new scheme badged as **The Geoscience Education Academy** (GEA). The aim of the GEA is to provide a full day course designed to increase teacher knowledge of core geological concepts. Although beneficial for geology teachers, the main audience is secondary geography teachers who do not have a background in geology or the physical sciences. The aim is for teachers to teach topics like plate tectonics with confidence and enthusiasm. Geography is the sixth most popular GCSE subject with 256,420 entries in 2018 (compared to 493 in geology). The geography syllabus contains a wide range of geology-related topics. The GEA has been held at the Society's headquarters in London since 2013, but due to the loss of a major sponsor the Society has had to withdraw the previous support for travel and accommodation which allowed teachers from around the UK to attend. The future of the GEA was then in doubt. In discussions with WGCG a proposal has been developed to run a pilot day school in Birmingham in 2020 for about 30 teachers, thus eliminating the need for funding accommodation and travel. Tuition is free. If the pilot is successful additional GEA courses in other locations may be run in future years. WGCG has accepted GeoSoc's proposed budget and has underwritten this year's pilot scheme with a grant of £3000.

A common feature of all these programmes is that funding sources have been difficult to find or have indeed died up, putting training for teaching geology topics somewhere in the school curriculum at risk. As far as I have been able to ascertain WGCG is the only body now supporting externally funded Professional Development in geology teaching in the UK. WGCG is investing £9600 this year in these programmes. This is only possible through Rob Holloway's generous bequest. I hope to be able to report on the outcomes at the 2020 AGM.

Postscript

The implementation of the activities in the Summer Term of 2020 depends on the availability of host institutions and locations and the requirements for public health separation which in the current virus - related situation may still be in place.

Vancouver Island

Peter Band

As my son and family live in Vancouver, I have spent several holidays in the area, including Christmas at Tofino in 2019. Vancouver Island lies off the coast of British Columbia, Canada. It is a delightful holiday destination for those who enjoy an outdoor life. The island is about half the size of England, has less than one million population, enjoys a temperate climate (albeit rather wet), mountains, forests and wildlife that includes bears, cougar, lynx, with bald eagles in the sky and orcas in the ocean. The restaurants are pretty good too; and so is the geology.



The Tofino Inlet
within the Pacific Rim
Park near Tofino,
Vancouver Island

The island is part of a terrane (*see footnote*), known as Wrangellia, one of a series of terranes that collided and accreted to the western margin of the North American Plate. Wrangellia is believed to have docked about 100 million years ago. The terrane was constructed during three periods of vulcanism, with intervening periods of erosion and sedimentation. Its origin may have been as an island arc, created by the subduction of an ancient Pacific plate, followed by shallow sea sedimentation and a cover of basaltic flood lavas. Paleomagnetic studies show that it originated in more southerly latitudes and was subsequently carried to its collision with North America by plate tectonic processes. The collision with North America resulted in much of the island being uplifted and eroded to expose granitic plutons, limestones and basalt lavas. Glaciers have since carved the western river valleys into fiords.

Though the island is heavily forested and much is essentially inaccessible to the visitor, the island's geological history can be viewed by taking a road trip along the Trans-Canada Highway from the capital, Victoria, and continuing on Highway 4 to the headlands and beaches of the Pacific Rim National Park. This route and its many side roads into the wilderness enables the visitor to explore the geology of Vancouver Island. I recommend *The Geology of Southern Vancouver Island* by Chris Yorath, either as a travel guide or for fireside

reading for those who wish to learn more. The book is available on Amazon. You may need several days to explore this region, possibly using Port Alberni or the capital, Victoria, as a base and enjoying a visit to the centre of Canadian surfing at Tofino, where the temperate rain forest reaches down to the broad beaches.



Cascade Volcanic Arc

About 200kms off the coast of Vancouver Island lies the Juan de Fuca ridge; a divergent plate boundary that is adding fresh ocean floor to the Juan de Fuca plate, driving it eastwards to subduct below the westward moving North Atlantic Plate and creating the Cascade Volcano range of Oregon, Washington and British Columbia. The Cascade subduction fault is locked and may not have moved since a giant earthquake unleashed a tsunami in January 1700. The forces building up are anticipated to unlock eventually precipitating another major earthquake expected at some unknown time in the future.

Editor's Footnote.

Terrane (rhyming with 'barn') may be an unfamiliar term to some. It is a term which has become used as part of plate tectonic theory. The Oxford Dictionary of Geology and Earth Sciences defines 'Terrane' as a "fault bounded area or region which is characterised by a stratigraphy, structure and geologic history distinct from those of adjacent areas and which is not related to those areas by unconformable contact. Terranes can have origins as accretionary wedges, island arcs and microplates." You might think of them as bits of old geology assembled and incorporated into unrelated new - geological sore thumbs.

Terrane is not to be confused with the more common and older term 'Terrain' which is defined as "an area of ground with a particular character." It encompasses topography and landforms and is descriptive rather than explanatory. Unfortunately American usage of this concept is now being spelt as 'terrane' which rather confuses things!

Introducing our new Honorary Secretary: Ray Pratt

Our Honorary Secretaries have always been well established and well-known members of the Group. This is not the case with Ray Pratt who has only recently joined us. Colin Frodsham and Brian Ellis met Ray when they put on a WGCG publicity display at a Geological Association day conference at Birmingham University. Ray became interested in our activities and started attending some of our meetings. When we announced that we were looking for a new secretary, Ray asked what it involved and offered to take on the job. To say the Trustees were pleased is an understatement. It is also good to welcome a qualified geologist to the group.

Ray was involved in oil and gas exploration and production for 37 years prior to retiring. A geology graduate of Kings College London, Ray has worked as a mudlogger, pore pressure engineer, wellsite geologist, operations geologist and petrophysicist. In 1995 Ray completed an MSc in Management with a thesis on Self Directed Teams in Oil and Gas. Soft skills learned from his research thesis have been successfully practised in his roles as Operations Geologist and Petrophysicist with a number of client companies.

Ray's career has taken him around the world working in some exotic locations as well as some of the harshest environments on the planet. Since retiring in 2016, Ray has pursued active roles in learned and professional societies, attending and giving talks, participating and leading field trips as well as promoting geoscience to young students and the general public. Ray is a director of Geostart (UK) Ltd with interests in farming and tourism, as well as geological consulting. Amongst his many connections in the geology world are membership of the American Association of Petroleum Geologists, the Black Country Geological Society, the Geologists Association, the London Petrophysics Society, the Open University Geological Society - Northern branch and he is an Honorary member of the Norwegian Formation Evaluation Society.

Through his roles as the Geological Society of London West Midlands Regional Group Chairman and Professional Committee member, he is already integrating us more into the geological community of the West Midlands.



Chairman's Message

John Crossling

"Just a simple wish that you keep well, and I look forward to seeing you in better times"



We had planned to repeat last year's successful tours around of Upton House (National Trust) on Sat 16th, run a day or evening session at Ryton Pools and an urban event, possibly Warwick. In line with government guidance and common sense, WGCG will be withdrawing from GeoWeek this year.

Hazel Colliver

Just as we were finalising the newsletter, we learnt that Hazel has died. Long-time members will remember her. She was an active member and played an important role in the running of WGCG. She acted as membership Secretary for some time. Hazel and Allan regularly came on field trips. They cut quite a dash in their open-top sports car on the Peak District field trip in September 2009. A service of celebration for Hazel will be held at St. Martins-in-the Fields, Finham, when restraints on social gatherings have been lifted. Allan would be pleased to see WGCG members there to, as Allan says, "give Hazel the send-off she deserves." We send Allan our best wishes.



WGCG on the field trip to the Peak District in 2009

WGCG Summer Field Excursions 2020

RESIDENTIAL TRIPS:

Fri.-Mon. May 8-11th	North Lincolnshire	CANCELLED
Fri.-Sun. August 21-23rd (max. 16)	Mendips <i>(based in Brent Knoll)</i>	leader: Martin Whiteley
Local travel in the field area will be by minibus		

DAY TRIPS:

Sunday March 29th	Nottingham Caves *, Castle Rock & Park Tunnel	CANCELLED
Saturday April 25th	Wren's Nest, Dudley Museum & Archives	CANCELLED
Saturday June 6th (Joint with BCGS)	Blockley Brickpit (Northcot Brick Co.)	leader: Jon Radley & Mike Allen
Saturday July 11th (max. 16)	Apedale Heritage Museum / Biddulph Grange * <i>(* entry charge for non-NT members)</i>	leader: site guides

Members will be informed by email whether the remaining 2020 field excursions will still run.