Maps to Apps

Lecture by Wayne Shelley, Geological Information System (GIS) Application Developer of British Geological Survey at their Keyworth Headquarters on 12th December, 2013

The majority of people of discernment, whether involved with geology in their work or not, have a curiosity about the rocks beneath their feet, but most are short on knowledge of the subject. Imagine, while travelling anywhere in these islands, having an expert at one's elbow to consult.

In the dozen or so generations since pioneers like James Hutton and William Smith kicked off our geoscience, Britain's geological archive has grown to its present vast treasure house, the graphic part of which is portrayed on 500 maps. The idea that these could be condensed into a pocketbook would have been absurd until very recently; but now, thanks to the GIS application developers at BGS, anyone with a smartphone or tablet can gain all this at the touch of a fingertip.

This astonishing power is an App named iGeology which may be downloaded free from the BGS web site. Our speaker, lead GIS application developer Wayne Shelley, described how this App was produced and went on to give a clear demonstration.

With iGeology installed, the GPS on a smart device will recognise your position and present the relevant maps of superficial and bedrock systems. Not only that, but the user may call up a large chunk of multilayered information upon which the maps are based. iGeology then goes into the marvellous realm of augmented reality allowing the user to see the geology maps draped over the landscape that surrounds them. In the future, iGeology will be extended to allow access to vertical sections, cross sections and fence diagrams placed wherever the user wishes.

iGeology was voted best Community Favourite Mobile App at the ESRI International User Conference in July 2011,.the award being presented to Wayne by Jack Dangermond, CEO and founder of ESRI, in recognition of the innovative approach used in the design of this App. Unsurprisingly, iGeology had already been downloaded 160,000 times at the last count.

To call up this app, enter
http://www.bgs.ac.uk/iGeology/

Helen Burke spoke to thank Wayne for his fascinating lecture and demonstration.

Gypsum Geohazards and Road Construction

Lecture by Dr. A H (Tony) Cooper of British Geological Survey, held at their Keyworth Headquarters on 18th November, 2013

Report by Geoffrey Jago

Gypsum evolves on a human timescale - this crisp statement was the key to Dr. Tony Cooper's compelling presentation.

The general concept of time in respect to geology is one of extremely slow change

occasionally shaken by sudden phenomena such as earthquakes, eruptions, floods and landslides but at our November meeting we learnt of gradual but speedier geological changes caused by gypsum dissolving that span only a few years, and of the problems that they can present.

Tony's lecture was based on his wide experience of gypsum a mineral responsible for unexpected subsidence and in some places chemical reactions causing heave. In particular, gypsum's quirky behaviour presents a nightmare to those constructing roads and buildings. Tony described in particular the hazards encountered in building the A50 Southern Derby Bypass, the widening of the A453 main road south of Nottingham and bridge and road construction at Ripon, Yorkshire. In addition he described the investigation procedures and the mitigation measures undertaken.

In the UK, mainly in Triassic and Permian rocks, thick secondary gypsum deposits occur and their dissolution causes most of the problems. In the hand specimen gypsum (in all its forms including alabaster), although soft, does not look as if it would dissolve in water but it is surprisingly soluble, Its solubility lying between limestone and halite (common salt). We were shown photos of a pristine block about 3 metres across, which had fallen out of a cliff near Ripon into a river and had largely been dissolved within eighteen months.

Gypsum originally forms as CaSO4 2H2O commonly in a sabkha (salt flat) environment. On burial to around 1000m dehydration to anhydrite causes considerable shrinkage. Subsequent rehydration forms crystals of secondary gypsum such as satin spar with a 42% expansion which can cause buckling, easily mistaken for tectonic folding.

Dissolution of gypsum often forms cave systems that follow the rock jointing, the water passing through the cracks creates a maze of cavities, illustrated in an example from the Ukraine. Building projects often cannot fill cavities, which would merely divert water. The engineering response must involve extra measures to increase strength and hazard avoidance where possible. The use of geomembranes was described, as was the sacrificial pier principle in bridges. Pressure sensors can provide early warning but their monitoring is a long term commitment. A guiding principle of sustainable drainage is "pipe away, not soak away".

If dissolution is rapid, the attendant chemistry has a similar tempo. Sulphate-rich water (which may have up to 2400 ppm) gives problems for concrete. A slide illustrated a horror list of attack reactions, products including Thaumasite Ca(Si(OH)6(CO3)(SO4) 12 H2O.

Ripon featured extensively in his talk - however unpopular with builders and developers, a geologist's advice is vitally important in such an area where sinkholes are unfortunately often encountered.

Closing his interesting and informative presentation with the solicitous words: "I hope none of this happens to you", Tony put up a final slide of a cavity containing, positioned almost vertically, a bus.

John Black gave the speech of thanks.

A Walk on the Geological Side.

Held at British Geological Survey, Keyworth, 10th September, 2013

Report by Geoffrey Jago

To its enduring credit BGS has produced, as part of the 2012 enhancement of its Keyworth headquarters, an immortal monument which must take a proud place with the most important items of British heritage.
On 10th September, 2013 we were privileged to be introduced to it by Dr. Stephen Parry, Higher Scientific Officer at BGS, who, with the co-operation of many of those that quarry UK stone, took on the impressive responsibility for its creation.

Entitled The Geological Walk, this comprises a carefully chosen collection of over forty rocks laid mostly as flagstones but accompanied at intervals by menhirs, each weighing several tonnes, all selected as representatives of principal rock types in England, Scotland, Wales and Northern Ireland.

Approaching Reception

Of these leviathans, by way of introduction five of them guard the broad path from the car park to Reception which is also paved with selected stones. The mighty five have been carefully chosen both to represent the main rock classifications and to be sourced from the the four countries that comprise the UK. To the fore, Scotland provided the most ancient, the 3 billion year old gneiss from Lewis (metamorphic). Next, a large chunk of chalk from Northern Ireland (sedimentary) is followed by two from England: Bardon andesite breccia (volcanic) and Charnian pyroclastic (extrusive igneous). Finally Wales contributed a fine grained granite from Anglesea (intrusive igneous).

Walking the Timeline

And so to the main feature nearby. Lying between two new buildings dedicated to the two giants of geology William Smith and James Hutton, the Timeline extends on a straight west to east line for 3 billion years by geology and for 130 metres by foot. Flagstones and massive specimens, the largest weighing over 22 tonnes, are positioned in chronological order each described in a very informative leaflet.Most of the rocks are of hard quarryable stone but no examples could be found that were sufficiently durable to represent the youthful Quaternary at the far end. However the processes of their deposition are displayed, represented by paviors taken from its harder senior brothers.

James Hutton Building Facade

Part way along the Walk an impressive facade on the James Hutton Building commemorates his innovative work by a stylised representation of his 1788 diagram of Siccar Point on the Berwickshire coast. At Siccar two ages of Devonian Old Red Sandstone lie on an unconformity with Silurian wacke sandstone, the latter’s beds lying almost vertically. The facade uses lateral equivalents of these very rocks to emulate the diagram on an immense scale.

Web Information

BGS merits another feather in its cap for the section of its web page it devotes to the Walk. The leaflet is downloadable in PDF form and a further cornucopia of detail is accessible by those who call

up: http://www.bgs.ac.uk/contacts/sites/keyworth/geologicalWalk/home.html Or, for those familiar with the art, by scanning the QR code.

Here each stone may be viewed either wet or dry together with details of its name, age and place of origin.

Public Access

The Walk is open to the public at BGS Keyworth between 9 and 4.30, Monday to Friday, excluding public holidays and other office closures. Parking is free, while leaflets, books and specimens of fossils and minerals are for sale in the Reception and Exhibition Area.

Endpiece

Arguably more interesting than Stonehenge, at Keyworth you do not need to wait for a solstice to actually touch the stones.Perhaps in millions of years to come new intelligent life, if it has evolved sufficiently to understand geology, will gaze at this everlasting pavement and marvel at the erudition achieved by the human race in its day.

Helen Burke, who convened the meeting, thanked Dr. Parry for this very interesting evening.

"Cold Winters in a Warmer World"

Held at British Geological Survey, Keyworth, 16 July 2013

Report by Geoffrey Jago

As Sellar and Yeatman, authors of "1066 and All That" and "And Now All This" might have written, Geology is the Science of Long Words. We have a new one in sclerochronology.

Dr Andrew Johnson of the University of Derby, our speaker at our July meeting described the study that he and his colleagues have undertaken whereby the way the weather behaved in Pliocene times, 2.5 to 3.8 million years ago, may be deduced from the shells that lived in those seas, and may usefully be compared with the weather of today.

The technique has resemblances both to carbon dating and tree ring dating, in this case studying annual growth rings in the calcium carbonate of fossil shells. The proportion of oxygen isotopes in the lime gives the pointers to the nature of climate at the time. While oxygen exists in the atmosphere it is constantly updated by radiation, but this process halts once it is entombed in a shell and it begins to undergo a slow process of nuclear decay. The rate of this process provides an accurate time clock while rates of growth provides further information.

To Dr. Johnson and his colleagues, differences between each band of a shell as it grows season by season leaves valuable evidence of the nature of the environment at the time.

Our speaker's synopsis gives the clear picture:

"The warm world of the Pliocene has been extensively used as a test bed for numerical climate models. Discrepancies exist between model outputs and some proxy estimates of

Pliocene sea-surface temperature (SST), particularly in the North Atlantic region. These can be resolved using chemical and physical records in the shells of bivalves, the study of which (sclerochronology) now partners the study of records from trees (dendrochronology) as a means of obtaining high-precision climate data. Sclerochronological data from the Pliocene of the southern North Sea Basin are consistent with other proxy evidence of high summer SSTs but provide a radically new insight into winter temperatures, which were seemingly often little different from now.

The revised values for Pliocene winter temperature lead to a lower estimate of annual mean temperature: only a few degrees above present, in agreement with model outputs. There are some indications from sclerochronological data that cold winter conditions resulted from the incursion of frigid 'continental' air. Whatever the cause, Pliocene climate data show that marked seasonality may exist in a warm world. Winter clothing will be as essential to future Britons as now!"

During the evening Dr. Johnson gave well illustrated details with many examples of research and the conclusions which may be drawn from such work.

Predictions of adverse changes of climate, a favourite topic in the more serious sections of the media, are of ongoing general concern and, as ever, the past is the key to the present as well as to the future. Once again geoscience has stepped in.

More information at http://www.derby.ac.uk/search/?q=sclerochronology/

At the end of the meeting the speaker was thanked by our chairman Dr. John Black.

Petroleum Geoscience Research at Derby University

Held at Derby University, 14 May 2013

Our May meeting at Derby University featured presentations by three MSc students nearing the end of their three-month independent research projects.

Senior Lecturers in Petroleum Geology and Geoscience Dr. Dorothy Satterfield and Dr. Martin Whitely opened the evening by describing the work of their department and the effort that Derby University devotes to petroleum research. Projects in recent years have centred on a number of oil and gas fields including the North Sea, the Niger Delta, North Thailand and, nearer to home, Eakring in Nottinghamshire and various British potential shale gas reserves. Having access to abundant onshore well and seismic data from home sources including British Geological Survey, Derby's studies span most aspects of the energy production scene and they underline the importance of teaching a high standard of formal written reports and presentation. They recognise emerging themes such as the current industry focus on enhancing production, while new technologies, basin and reservoir modelling and synergy with environmental assessment also feature in the vanguard of their work.

Monib Nazir was the first student to make his presentation on potential hydrocarbon reserves in the light of an interpretation of Jurassic to Paleogene earth movement in the Afghan-Tajik basin.

Roshni Varia next described her work on the interpretation of seismic sections and the

geological structure in the North Sea oil and gas fields to the west of Norway.

Isong Assiak completed the evening with an account of his research into rock structure and reservoir modelling in the Dutch sector of the North Sea.

Collections, Digitisation and GB3D Fossil Types Online

Held at British Geological Survey, Keyworth, on 30 April 2013

On 30 April 2013 on his home ground at British Geological Survey, Keyworth, Dr. Mike Howe, Chief Curator of BGS spoke of the BGS Museum's current work.

Practical Demonstration

The evening began with two practical demonstrations. First, a NextEngine scanner, twirling a fossil shell on a turntable, plotted its surface by laser scan, and took white-light colour photos. The second equally impressive demonstration was of a MakerBot 3D printer building up a model of a fossil, layer by layer, in extruded thermoplastic.

JISC Project

In updating and improving their recorded information,In association with JISC (originally the Joint Information Systems Committee, now a registered charity named JISC), the National Museum Cardiff, the Sedgwick Museum of Earth Sciences (Cambridge University), the Oxford University Museum of Natural History, and the Geological Curators' Group, the BGS museum is keeping step with the huge strides that computer imaging technology has taken in the last few years by using the latest techniques to reproduce their vast collections in digital graphic form.

Photographing and Scanning

BGS is rephotographing all fossils in 2D (simple pictures) and 3D stereo pairs which can be viewed as anaglyphs (stereoscopic images seen through red/cyan spectacles). The digital files use the JP2 format, an upgrade of JPG, which saves download time while preserving acute detail. Laser scanners generate the 3D images via a network of points called a pointcloud which is then computed, using polygons, into a contour net to form the basis of the stored 3D image. Colour information is then "draped over" it. The 3D images thus created have many advantages. They can be archived, measured, duplicated, communicated to others and subjected to finite element analysis. Sectional diagrams can be drawn and solid models made by 3D Printing.

Databases Project

The International Code on Zoological Nomenclature and the International Code of Nomenclature for algae, fungi and plants require that every species or subspecies of organism, whether living or fossil, should have a type or reference specimen to define its characteristic features. BGS takes part in the Databases Project linking data from over seventeen national museums which classifies their fossils into type materials such as holotype, syntype, lectotype and so on.

Question and Answer

An enthusiastic Q & A session discussed the projects' untapped potential in research. Dr Howe anticipated progress in educational packages for which a proof project is keenly sought.

Committee member Helen Burke who convened and chaired the meeting thanked Dr. Howe for this very instructive presentation.

Readers are enjoined to read more at www.3D-Fossils.ac.uk

Chartership Workshop

Held at Leicester University on 12 March 2013

On 12 March, 2013 at Leicester University the Society's Chartership Officer, Bill Gaskarth, held a Chartership Workshop attended by University students.

Dual Evening Meeting

Held at British Geological Survey, Keyworth, on 26 February 2013

Report by Geoffrey Jago

1. Early Careers Geoscientists Award
2. Radioactive Waste Repositories in Finland and Sweden

Early Careers Geoscientists Presentations

The meeting began with four 15-minute presentations by young graduates, competing for our Group's nomination to the National Final for the Early Career Geoscientist Award, which will be held at Burlington House later in the year.

Charlotte Murray spoke on "The premise behind Ground Investigation and their impact on developments progression"; and she was followed by Adam Garbutt, who described British Gypsum's operation of their Bantycock Quarry near Newark. Next was Huw Clarke of Cuadrilla Resources who presented the case for Shale Gas Fracking, then Penny Jenkins of Envireau Water described water quality Investigations and improvements at the Maltings site in Scotland.

All presentations attained a thoroughly clear and professional standard. In handing our Group's award to Adam Garbutt, our Chairman John Black said that the judging panel's votes had been very close and he praised all the speakers for the high standard of their work.

Radioactive Waste Repositories in Finland and Sweden

The main lecture was then given by Dr. Adrian Bath, of Intellisci, Notts (www.Intellisci.co.uk) on his work as consultant to regulators of the nuclear industry in both Sweden and Finland. The low-lying islands of Forsmark in Sweden and Olkiluoto in Finland

face each other separated by 200km of the Gulf of Bothnia, and both have been deemed suitable sites for potential deep repositories of radioactive waste. Sweden has ten nuclear reactors to Finland's four and both countries have been working on the selection processes and construction work since the mid 1980s.

The geology of both sites is similar: crystalline granitic rocks with pegmatites and gneisses, overlain by glacial deposits. Diagrams illustrated complex patterns of fracturing.in the deep rocks.

Dr. Bath detailed the comprehensive ongoing geoscientific study, based on an extensive programme of drilling and testing. Three scientific models, geochemical, hydrogeological and rock mechanical, have been integrated in the process of obtaining the best information possible on the site conditions, and steady progress has been maintained.

The planned method for containing the radioactive waste is to case it in steel and copper cylindrical canisters, which will be placed in rock sockets surrounded with bentonite clay. Tunnelling work follows a not dissimilar pattern in both countries. The Onkalo tunnelling on the Finnish side extends for 5.5 Km spiralling at a slope of 1 in 10 around a central canister shaft, with total tunnelling extending to 8.3 Km.

A speech of thanks was given by John Black.

Annual General Meeting and Presentation

Held at British Geological Survey, Keyworth on 22 January 2013

On 22 January, 2013 the East Midlands Regional Group held their Annual General Meeting at BGS.

Professor David Siveter (University of Leicester) then gave a presentation on "Cambrian Fossils of the Chengjiang Lagerstätte, China: The Flowering of Early Animal Life" of which the following is a synopsis:

The discovery of the Chengjiang biota, in early Cambrian rocks in China, was one of the most significant palaeontological finds of the 20th century. The fossils are abundant and exquisitely preserved, beautifully showing fine details of the hard parts and soft tissues of invertebrate and vertebrate species. They are vital keys in helping to unravel the evolution of multicellular organisms during the "Cambrian Explosion". The Chengjiang biota provides direct evidence for the roots of animal biodiversity. Over 200 species have been recorded, with arthropods being the most abundant group. The biota presents the most complete evidence of an early Cambrian marine community, and a record of the early establishment of a complex marine ecosystem, with food webs capped by predators. The majority of forms were bottom-dwellers. Not least, the fossils of Chengjiang bear upon fundamental questions regarding animal body plans and the genetic generation of evolutionary novelty. The universal value of the Chengjiang fossil site is acknowledged with its recent inscription to the list of UNESCO World Heritage sites.