CHARNIA

NEWSLETTER

of the

Geology Section

of the

Leicester Literary & Philosophical Society

www.charnia.org

MAY 2015

R I G S

Regionally Important Geological Sites

in Leicestershire & Rutland

Happy Birthday, 'TDF'

The Section's President, Trevor Ford, celebrated his 90th birthday with family and friends on April 18th. Past and present members of our committee were there to join the cake-cutting fun.

Trevor has been the Section's mentor, servant, leader and friend since the 1950s. We wish him all the best, and congratulations.

The cake was made by Trevor's granddaughter, Kirsty, and decorated to be a rock outcrop with a 'fluorspar' geode on top. Note 'TDF', Trevor's career-long informal name.

COVER PICTURE: Forest Rock

This natural outcrop, also the site of a quarry in the nineteenth century, is included in a small public open space in Woodhouse Eaves. The important stratigraphical and lithological transition from Precambrian to Cambrian can be seen here.

It's a perfect candidate for **RIGS** designation - significant for geological research and education, accessible, and valued by local people. *See p. 4*

Editorial May 2015

January's editorial was a 'goodbye' from Andrew Swift, who retired as editor at the March AGM - more on that elsewhere in this *Charnia* - so this is my 'hello'. You won't notice many visible changes, I hope, as Andrew's design doesn't need messing with, and the contents will follow the same kind of pattern as before unless you tell me you'd like something different. And contributions are always welcome!

You'll find a review of this year's Saturday Seminar *'Seven Steps to becoming Human'* on page 10. Everyone I spoke to on the day said it was a great success - thanks to the organisers and especially to Roy Clements for the title and concept - and Roger Latham, under his Treasurer's hat, was also pleased to report that the event was financially successful too.

I was particularly interested in the last talk, by Michael Ellis, Head of Climate Change at BGS. He discussed Paul Crutzen's and Eugene Stoermer's 'Anthropocene', the proposed geological Epoch that is said by some of its proponents to have started when the first atom bomb was tested, and which has been popularised in Britain by Leicester's own Jan Zalasiewicz. Dr Ellis's talk was full of interesting ideas about both the science (climate change, fossilised infrastructure and garbage) and the philosophy (the meaning of being human, and the changes we could make, if we chose to, to make the world better rather than exterminate ourselves).

My question, though, is: can the Anthropocene by classified as an Epoch? An Epoch is the subdivision of the geological timescale longer than an Age but shorter than a Period. Examples are Eocene and Late Cretaceous. How long does a subdivision have to be to count as an Epoch?

It's a bit of a sliding scale (which is interesting in itself, perhaps reflecting both increased resolution (the amount of available preserved evidence) and our feeling that there must be a progress toward 'us'). The Late Triassic lasted 34 million years, the Pleistocene 2.6 million; while the Holocene, the Epoch we thought we were living in, has only run for 10 thousand years so far. Isn't the Anthropocene, if it turns out as badly as some predict, going to more like the event between the Cretaceous and the Tertiary that's marked by the K/T boundary? In other words the Anthropocene is an extinction event, too short to qualify as an Epoch or even an Age, merely a marker horizon, like the iridium spike. It will be the concrete and plastic spike.

Here's a good starting source for information: http://quaternary.stratigraphy.org/workinggroups/anthropocene/ ... and tell me what *you* think. I could start a *letters to the editor* page.

What's left of the ...

Summer Programme 2015

Anglesey, North Wales - Weekend field trip

Friday 19th to Sunday 21st June

Leader: Dr Charles Bendall (Aberystwyth): to study, contrast, and compare the rock strata of Anglesey to those of the Llŷn Peninsular, Gwynedd.

Miller's Dale & Ecton Mine, Derbyshire

25th July (time tbc)

Leader: Albert Benghiat.

Lea Quarry, (B4371) Stretton Westwood, nr Much Wenlock, Shropshire

8th August

Leader: Mike Allen. Fossiliferous Silurian limestone. (The Wrekin & Ercall - lavas - are nearby.)

Leicestershire

September 2015 - details to follow.

Joint meeting with the Natural History Section, LLPS.

Leader: Dr Anthony Fletcher. To study the relationship between various rock types and associating lichens.

MORE DETAILS from Robert Tripp, Field Secretary
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CONSERVING OUR GEOLOGICAL HERITAGE

Regionally Important Geological Sites (and others) in Leicestershire and Rutland

Geology has long been the poor relation in the UK's environmental conservation family. Here in Leicestershire and Rutland, a consortium of the Wildlife Trust, County Council, University and Museum, all working through a volunteer steering group, has kept the flame of geology conservation burning for almost 45 years. Now, at last, changes in national Planning regulations might make it possible to protect more of our precious sites of geological importance.

Geology is actually lucky in Leicestershire and Rutland. Back in the 1970s we had a great university geology department, a world-leading university department of museum studies, and an innovative museum service with a thriving geology section, all within a mile of one another. Synergy happened – by which I mean people talked, schemed and collaborated. Mike Jones, Andy Mathieson, Roy Clements and others started a number of things here, making Leicester a real leader internationally: museum galleries using design to communicate with their audiences; museum collection databases; and, most significant for this article, an inventory of all the sites of geological interest in the two counties.

Brown's Hill Quarry, Holwell. Protected, but only as a LRWT Reserve; its SSSI status was lost in 1977. Now also designated as a RIGS for its multiple paleontological, stratigraphic and historical interests. *Photo LRWT*

There were three kinds of sites in the new system. The top-level ones were geological SSSIs – about 30, and they had statutory protection. Next were the other extant sites, places where people could study the geology and collect specimens; there were about 70 of these, some protected as nature reserves, but most either working, or recently-closed, quarries,

railway cuttings, etc. The rest were sites of mainly historic interest, which were identified by searching the collections records for locality data, the local geological literature for references, and early large-scale Ordnance Survey maps for places like 'old clay pits'. The whole inventory of almost 1000 sites – a paper file for every one – was digitised in 1976 by an MSc student called Dave Gittins, who also wrote the program (there being not much on the market in the way of databases in 1976). It was called GSIS (Geological Sites Information System) – and the whole paper version has survived to the present, at County Hall, although the database files can no longer be read.

Forest Rock, Woodhouse Eaves, is a public open space, a rock-climbing venue, and a site of at least regional geological importance. It meets many criteria for designation as a RIGS

By now on a mission, the team, with the support of the Geological Society of London, the Geologists Association, the Nature Conservancy Council (NCC, now Natural England) and the Geological Curators Group, among others, promoted the Leicester approach across the UK, and many museums and similar organisations adopted the recording standards developed in Leicester.

Then, in 1977, NCC (as a Government agency) was 'encouraged' to reduce the number of geological SSSIs. The massive *Geological Conservation Review* was undertaken: a nation-wide survey, one of whose consequencies was restricting SSSI status to only the unique site of national importance for each of a number of themes (rock types; major fossil taxa; major stratigraphic units, etc.). Being a great place to see lots of interesting geology didn't count – SSSIs had to be nationally important *single-interest sites*.

Pickworth limekiln, Rutland A small quarry into Lincolnshire Limestone, and the place where the poet John Clare was employed as a lime burner in 1817. It was on the list of potential RIGS both for its geology and this significant cultural interest, but sadly before it could be designated its ownership changed. It is now inaccessible behind 'no trespassing' signs.

The GCR introduced a significant difference between geological and biological SSSIs, which continues today – ecological sites have only to be of regional significance and can represent multiple interests.

It also left all the erstwhile but now downgraded geological SSSIs suddenly with no statutory protection. Once again, Leicester (Museum and University), with the Geological Curators' Group, took a lead. The concept of RIGS (Regionally Important Geological Sites) was born, and gradually became a national scheme. Many counties now have a RIGS Group – ours is part of the Leicestershire & Rutland Wildlife Trust, but it is also supported, financially and logistically, by Leicestershire County Council. From the 25 or so original downgraded SSSIs we have increased the number to almost 100 RIGS in the two counties, and, thanks to being notified to the Planning Authorities, all of them have some protection – planning applications on RIGS are subject to review, and possible objection, by the LCC environment team.

Croft Quarry This is still a geological SSSI. It is a truly spectacular multiple-interest site, with Caledonian igneous rocks, buried Triassic landscape with basal conglomerates and bedded valley infills, and Quaternary tills at the top. It also has important mineralogy, and it is for this alone that the site is scheduled. This is why it has also been given RIGS status, to maintain awareness of the geodiversity to be seen here. *Photo LCC*

There has been just one more, recent, development and it could be good news for geology conservation. The 2011 Localism Act delegated significant Planning powers to the residents of parishes and towns. This was followed by the 2012 National Planning Policy Framework, which for the first time explicitly added geodiversity and geology conservation to the list of environmental factors to be considered for protection in Planning. Localism has introduced Neighbourhood Plans into the planning process. Neighbourhood Plans will bring a big potential benefit for geology; local people will have a real say in how their communities develop – where housing will be permitted, how a green wedge will separate one community from another, and which sites are of ecological, historical, cultural and

Kilby Bridge pit, February 2015 This important site is the last remaining place where the characteristic Leicestershire facies of the old 'Blue Lias' can be seen; this is the same part of the Jurassic from which the Barrow-upon-Soar marine vertebrate fossils came. Unfortunately the rock is inaccessible, the pit is flooded, and the quarry sides are heavily degraded - and a new housing development is planned for the field next door. Can RIGS status be awarded in time to protect it, perhaps with partial restoration to make the site safe and the exposures accessible?

geological significance at the local level. Sites which meet certain criteria, including geodiversity, and which can be shown to be valued by local people, can be designated as Local Green Spaces in Neighbourhood Plans. And these LGSs, once approved, will be protected against damaging development.

At last! But it won't happen unless communities – actually the Steering Groups who will be drafting Neighbourhood Plans – know about the geological sites in their parishes. This is where we Leicestershire geologists come in. Is your community doing a Neighbourhood Plan? Get involved; find out about the sites (don't forget the old GSIS database at County Hall) and make sure your fellow citizens understand that having a site of geological significance is useful to them, not just to a few slightly odd fossil collectors, as a way of controlling the numbers and locations of new houses and other developments in their parish.

There are over 300 parishes in the two counties; of them, 40 responded to an email sent, on the recommendation of the Leicestershire & Rutland RIGS Group, by the LCC Environment Team inviting requests for information. Those parishes now know about their RIGS and other geological sites, but that leaves a lot more which don't. Can you help spread the word?

John Martin, Chair, Leicestershire & Rutland RIGS Group

Ketton Quarry

Section field visit,14th April 2015

Robert Tripp

Our Section usually has an escort into the Grange Top Quarry at Ketton, which is a facility of the Heidelberg Group, run by Hanson Cement. On this day, our usual minder John, was apparently already booked, and so Tracie, the Coordinator, liaised with the Quarry Team Leader, Roy Dumford, to enable our unfettered access.

A round dozen of us met at 10.00, and after a brief negotiation, drove to the quarry buildings where Roy ascertained that we were of sound mind,

Ketton Quarry: general view, showing the scale of the operation. It's like a whole secret world in there

and knew our way around the quarry, before despatching us northwards. Many of you know the Grange Top, and will appreciate that we walked the one and a half kilometres across the quarry floor to the graben. The day stayed fair, but with a stiff breeze that helped the climb up the fault scarp to the top of the Upper Cornbrash. A happy hour or two passed collecting the usual *Pleuromya*, many *Lopha* clams, a few *Gryphaea sp*. and other bivalves, some brachiopods, and some corals.

Lunch became a staggered event. Some had eaten before, and some ate

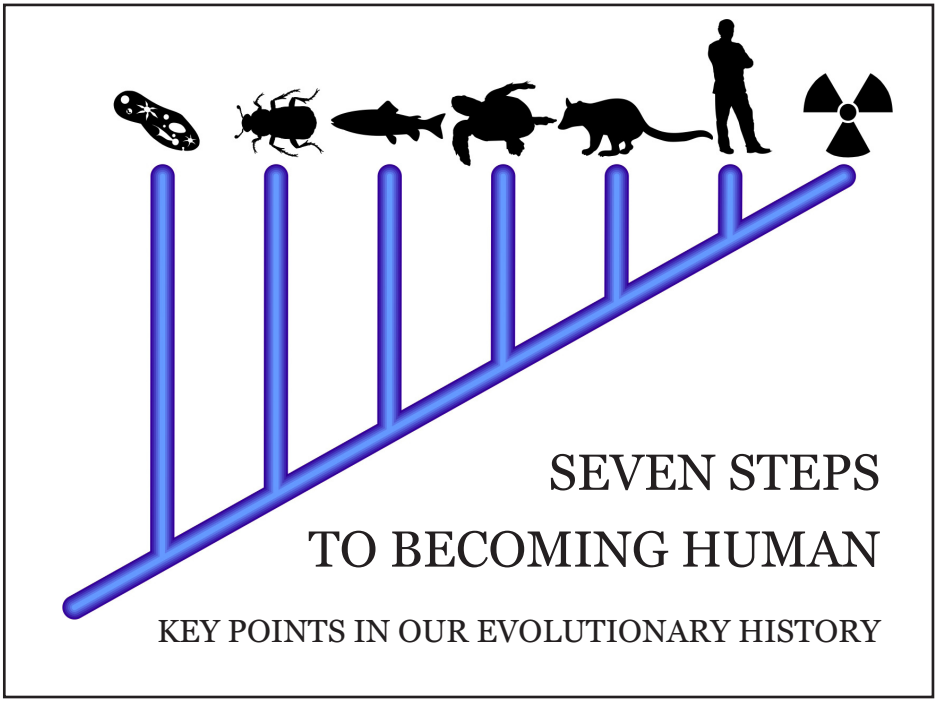
after, we visited the Lincolnshire Limestone of the Inferior Oolite Group. Here the eagle-eyed Chairman gleaned his dino tooth. A few Members now began to drift homewards - hopefully tired but happy. The lack of a chaperone, on this day, allowed the Group to linger long into the afternoon, and we went south to the stock pile of the Blisworth Limestone of the Great Oolite Group. One might remember from previous ramblings on the subject of cement manufacture, that the Blisworth is not favoured as source rock for the kiln because of the chemistry. However, it is very fossiliferous. In the hope that some perfect specimens might have been weathered out of the pile, it was swarmed over. *Clypeus*, usually in abundance, was not so much in evidence this time; but, again, the eagle-eyed Chairman found a tooth of some reptile, probably a pterosaur ... we await identification (see left).

Collecting in the Upper Cornbrash and drift

A reptile tooth found in the Blisworth Limestone by Mark Evans, who writes: *I favour a pterosaur for the reptile as it is pretty slender, the transition from enamel to the root is curved and there is a wear facet on one side of the tip, all of which are seen on pterosaur teeth from the Stonesfield Slate*

The stalwarts were dragged away kicking and screaming long after 17.00…. with the usual stretching supermarket bags, and straining backpack!

We are so grateful that Roy Dumford placed his trust in us to behave, and to not get ourselves into trouble. He gave us his cellphone number to make contact, should the worst occur. A casual peek at my 'phone during the morning showed there to be 'No Signal'!



SATURDAY SEMINAR 2015

STEP 1. Evidence for **early life** in the Eo- and Paleoarchean

STEP 2. **Animals** and the invention of the Phanerozoic Earth system

STEP 3. The origin of **vertebrates** and your fishy ancestors

STEP 4. New **tetrapods** from Romer's Gap: unrecorded diversity that laid the foundations of the modern fauna

STEP 5. Coming out of the shadow of the dinosaurs: a new look at the first **mammals**

STEP 6. Being **human**

STEP 7. The **Anthropogene**: geology and the human process

Saturday Seminars are an opportunity for the Section to raise money to enable us to fund our regular lectures, and particularly to attract the best speakers in their fields. Over 70 people attended the 2015 meeting, and our Treasurer was very happy, because this year's seminar made a comfortable profit.

Indeed, like previous Saturday Seminars, 'Seven Steps' was an opportunity for members and guests to listen to some of the UK's leading scientists working on the topic. And what a great seven talks they were. Every speaker gave double value:

giving a summary of their special area of research in the wider context of each of the seven steps.

There is a slight risk when doing 'steps to being human' that such an arrangement of topics might be interpreted as a mistaken attempt at reviving the pre-Darwinian 'Great Chain of Being', in which a sequence of ever more perfect beings led to us. Evolution is, of course, now known to be directionless. At every one of the seven steps a different path could have been taken; it's only when looking back that we can say, for example, that the appearance of the first tetrapods turned out to be a step on the way to humans.

STEP 1 Dominic Pepinau reminded us of what is already known, from microfossils, about early life – the bacteria, Archaea and stromatolites from 2.7 billion years ago. But his work is on finding *biosignatures* in rocks even older than this; basically traces of possibly biotic carbon in ancient sedimentary and metamorphic rocks. This method is suggesting that the *earliest* evidence of life on Earth could be as much as 3.83 billion years old.

Canadian Shield: 3.75 billion years-old ?biotic carbon
Image: Science/AAAS

STEP 2 Nick Butterfield pondered why it took so long to get from Archaea to animals. The favoured theory is that multicellular life – the first metazoans of the Neoproterozoic – couldn't get started until the abiotic environment was right: atmospheric oxygen at the right concentration is the main contender. But Nick reminded us of the effects of animals themselves, even the simplest, on the environment. Cyanobacteria are probably responsible for a lot of the oxygen, after all. So it seems possible that it was simply (or perhaps complicatedly) just that it took that long to sort out the gene regulatory networks required to build animals.

STEP 3 Making a metazoan animal was one giant step. So was the step – actually a series of leaps – that made the first vertebrate animals; again, it was overhauls of the genome that made this possible. Robert Sansom took us through the steps to the mineralised vertebral column, and especially to the ones that feel so significant to us – the acquisitions of paired eyes and nostrils, brains, limbs, teeth and immune system during the Devonian 'age of fishes'.

STEP 4 Al Romer (1894-1973) was the first, great, American all-round vertebrate palaeontologist. Your reporter (how old must he be?) remembers Romer with a still-sharp mind, in a cloud of cigarette smoke and with fag-ash down his tie, visiting the VP lab at Bristol University. Romer's *Vertebrate Palaeontology* traced the evolution of the complete lineage, except for a frustrating gap in the record at just the time (lower Carboniferous) when vertebrates made the transition from water to land. Romer's Gap has now been filled, in Nova Scotia and in Scotland, where Tim

Smithson has worked extensively. We now have a much clearer picture of the first terrestrial tetrapods.

Digital reconstruction of *Morganucodon* lower jaw, from Gill et al. (2014)

STEP 5 Darwin never mentioned dinosaurs, and neither did they feature at the meeting. They are not one of the seven steps, having evolved after the appearance of our direct ancestors, from a different tetrapod lineage. The sequence of innovations defining mammals – warm-blooded, large-brained, agile, high-frequency-hearing – is another of those big steps representing big genetic shifts. Pam Gill showed the sequence, but was also able, thanks to new finds and new techniques, to show (contrary to what has been suggested by the apparently dominant dinosaur fossil record) how diverse early mammals actually were in the Mesozoic.

STEP 6 The last two speakers asked the same question: what does it mean to be human? Fiona Coward took step six, but instead of showing a series of skulls and jaws – the standard 'becoming human' talk, which demonstrates our descent from a common Bonobo/*Homo* ancestor through lots of African hominins – she wondered which, if any, of the characters that are supposed to 'make us human' are truly unique. It turns out that almost eveything we thought was unique to humans is just a more-developed character or trait invented by one of our non-human ancestors.

And so to **STEP 7**. Is it a step, or is the Anthropocene, rather than a geological epoch, more like a powerful scientific hook on which to hang the political, economic and philosophical decisions we must take in the 21st century? Michael Ellis is Head of Climate Change at BGS, so it's his job to take this debate seriously. We humans are without doubt leaving a district marker horizon in the geological record (concrete, biological extinctions, radioactive isotopes, etc.), and this is undoubtedly because of our ability to influence the environment – but this itself is not a unique ability, as earlier speakers noted. The only real difference between step seven and the others is that we humans, uniquely, are able to defy our genes: we can rationalise, and choose how to behave. I can't improve on Dr Ellis's own words:

"*… the Anthropocene goes beyond geology. It is an idea that speaks to the meaning of being human, to the way we regard nature, to the role of law as a natural process, and to the state of the future Earth. Some have suggested that the Anthropocene portends the end of us … I suggest that it opens up a new … path into a future that we make for ourselves."*

JM 20-5-15

Andrew Swift steps down from Committee after 19 years

At this year's Annual General Meeting, former *Charnia* editor Andrew Swift stood down from the committee after almost twenty years' service to the Section. In preparation for my Chairman's Report, I went searching through the Society's Transactions to trace Andrew's Committee career. He first joined the Committee in 1996 as Vice Chairman, becoming Chairman in 1998 for two years. Following a year of serving as a co-opted member, Andrew started his second stint as Chairman in 2001, a role he filled for the next four years. Following two years as an ordinary member of Committee, he took over the role of *Charnia* editor in 2007, only standing down, finally, eight years later.

As Chairman, Andrew oversaw among other things the first weekend excursion (to Watchet) in 1998, the development of our website www.Charnia.org.uk, and the transfer of the Saturday Seminar from Vaughan College to the University. He has continued to assist the succeeding Chairmen, both myself and Joanne, organised and led field excursions, and as Editor developed *Charnia* into the glossy publication you hold today. The health and vigour of the Section today is a legacy of which he can be proud.

Mark Evans, May 2015

Section visit to *Ediacaran Enigmas* at the Sedgwick Museum

The Sedgwick Museum in Cambridge has been hosting a temporary display of Ediacaran biota during this past year. Its curator was Dr Alex Liu, who, last year, moved to Bristol University. He had been instrumental in bringing together casts, and data, of biota from some of the major sites around the world, of which there are over 50. Eastern Newfoundland has over 100 fossil-bearing beds, in continuous section, approaching 4000 metres thick, and of course, Charnwood Forest, Leicestershire, was contiguous before the opening of the Atlantic Ocean.

Rangeomorhps in the field in Newfoundand
Image: Sedgwick Museum, Cambridge University

On our visit, on March 27, we looked, in particular, at a specific group of organisms, the mysterious, and controversial, fossils - the Rangeomorphs. The Ediacaran Period of 635 to 541 million years ago saw major evolutionary advances in the radiation of animal life. Not all Ediacaran fossils are identified as animals; but in the earlier times, evidence of burrowing, locomotion, predation, and mineralization of structures is evident. The Rangeomorphs occupied the last 40 million years of the Ediacaran, before their extinction at the base of the Cambrian Period. Work being done by palaeobiologist, Dr Jennifer Hoyal Cuthill, using computer modelling, is testing hypotheses of the Rangeomorphs' growth patterns. Statistical analysis of spatial distributions (up to 50 individuals can occur per square metre) by Dr Emily Mitchell has found evidence for competition for resources between organisms. Dr Liu has been testing the relationships between the organisms; and how they may have related to the rest of the Tree of Life.

Our party of nine was welcomed by Nicola Skipper, the Museum Education Coordinator, who outlined the plan of the Museum, before introducing us to Charlotte Kenchington, a doctoral student at Cambridge. Charlotte is investigating the possible environmental and ecological reasons for the distribution of taxa, as, of the 22 or more documented species of these macro-organisms, some are found in both Newfoundland and Charnwood, while others occur in only one or other of the localities.

Our thanks to the Museum staff had to be heavily weighted toward Charlotte, who, knowing of our visit, had voluntarily returned to the Museum on her day off to discuss the Ediacaran biota with us.

Following our couple of hours engaged in absorbing the display, our Members then scattered throughout the Museum, and into other Institutions, in search of Knowledge.

Rob Tripp, May 2014

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