MERCIAN Geologist

VOLUME 15 PART 2 JULY 2000

Address for Correspondence
The Secretary, E.M.G.S.
Rose Cottage, Chapel Lane,
Epperstone, Nottingham NG14 6AE
0115 966 3854 alan.filmer@which.net

The Mercian Geologist is published by the East Midlands Geological Society and printed by Norman Printing Ltd (Nottingham and London) on paper made from wood pulp from renewable forests, where replacement exceeds consumption.

Registered Charity No. 503617

ISSN 0025 990X

Cover photograph: The quarried and weathered face of Stanage Edge in the Derbyshire Peak District, with incomplete grindstones left below where they were worked from the massive beds of the Namurian Chatsworth Grit [photo: Tony Waltham].

Contents

MERCIAN NEWS

Lincolnshire glacial erratics

Exotic erratics were carried to Lincolnshire by Pleistocene ice that originated in Northern England, Scotland and Scandinavia, and some of their more distinctive lithologies allow accurate identification of their sources. Last century the Lincolnshire Naturalist Union had a Boulder Committee who started to make a survey of erratic boulders in Lincolnshire. Since those days, deep ploughing and the construction of new buildings and roads has brought to light many more boulders than were known at that time. In the new millennium, and shortly after the centenary of the foundation of the LNU Boulder Committee, now seems to be an appropriate time to update this information.

The Lincolnshire RIGS Group has produced a leaflet, *Gifts from the Ice Ages*, that encourages residents and visitors to report any stones 'foreign' to the county. The response has been encouraging and these initial reports are all investigated by the RIGS team, to compile an updated record of the county's erratics. For copies of the leaflet, or with reports of erratics, contact RIGS on 01507 526667 or at Lincolnshire Wildlife Trust, Banovallum House, Manor House Street, Horncastle LN9 5HF.

Tales from the web site

The EMGS web site, constructed and maintained by Rob Townsend has been operational for a year, hosted by the Natural History Museum, which also hosts other societies and organisations with aims similar to those of the Museum itself. The site contains an invitation to join the Society, current programmes of lectures (together with abstracts) and field trips, details of the Society's publications and links to other geological societies (who also have links back to the EMGS). The site is becoming better known and has also prompted new members to join the Society.

Requests for information are now reaching the secretary through the site. One from the USA was trying to locate a copy of a Mercian Geologist paper by CJ Duffin in 1979. This was provided, and the author was also located through the web so that the Atlantic is now being crossed by e-mails on the finer details of coprolites from Rhaetic bone-beds.

Another request was from someone, also in the USA, researching the life of a child killed in an air raid in 1943 when leaving the shelter of the Broad Marsh caves. A reply outlined the structures that existed prior to building the shopping centre (along with a promotion of the EMGS book on the caves).

Why not visit our site (at www.emgs.org.uk). The more people who do so, the better the site will become known. The secretary welcomes members' suggestions for any material that it should include.

Peterborough Museum

It is well known that Peterborough Museum possesses a collection of Jurassic marine fossils matched only by those at the British Museum of Natural History and the Hunterian Museum in Glasgow. The collection has been augmented and cared for over a period of 18 years by volunteer members of Stamford and District Geological Society, led and inspired by Alan and Pauline Dawn. The conservation laboratory is well established, and this year has been augmented by an airbrasive machine, purchased with contributions from many sources, including a generous grant from the EMGS.

An airbrasive machine is an invaluable tool in fossil treatment. It sends a blast of compressed air and abrasive powder through a very fine jet that is directed to remove rock from around the fossil being prepared. Powders of various grades and hardness can be used, according to the hardness and delicacy of the specimen under treatment. Work with the air jet is slow and tedious, and is sometimes carried out under magnification in a dust cupboard, with an extractor fan to expel surplus dust. It is more gentle and controllable than the normal mechanical methods of fossil preparation.

Demonstrations of the machine in operation can be arranged. Contact the museum at Priestgate, Peterborough PE1 1LF or telephone 01733 343329.

Rockhound Challenge 2000

Thirteen-year-old Kirsty Pepper from Spalding, created an imaginative and accurate applique of a Jurassic underwater scene to carry off both the 12-16 Rock Artist Prize and the overall Rockhound Challenge Winner 2000 trophy. Also from the margins of our region, Sean McMahon from Huntingdon shared the first prize in the 12-16 Rockhound collector competition, with his personal account of how, since the age of six, he had gathered his impressive fossil collection. Both received their prizes in December at Somerset House after a tour of the Gilbert Collection, with its truly fantastic pictures, furniture and items made of beautiful and rare, precious stones, gold and silver.

Editorial

Members may be pleased to note that the front cover of the Mercian Geologist has returned to the East Midlands *Geological Society*. The editor can only apologise for the classic typographical error in the previous issue. Now that the journal is back in the geological world, members are invited to contribute to it with any news items, reports, papers or reviews that can bring to life the geology of our home region. Especially welcome would be a member's photograph for the front cover.

GEOBROWSER

Recent geological findings from around the world, selected from the current literature

Message to the burning Bush

The 'global warming' debate reported in our last issue has been given a wide review in the Oklahoma-based *Oil & Gas Journal* (August 28th, 2000; p.58). This even-handed article opined that the Intergovernmental Panel on Climate Change (IPCC) has so far failed to provide 'compelling' evidence about the extent of human influence on global climate, although a re-assessment is due this year. Countries like the UK are nevertheless attempting to reduce greenhouse gas emissions in line with their Kyoto targets, although others will be allowed increases of up to 27%. New Zealand is meanwhile concerned that sheep are emitting methane to the tune of 45% over 1990 levels.

The article's prophecy, that during the first years of the next US administration '.....the Kyoto target will be declared unworkable', was duly fulfilled by incoming President George W. Bush, but the cancellation of the committment was probably down to politics: the growth of US industry is currently outstripping the availability of power supplies and the new President was the governor of oil-rich Texas. The uncompromising nature of the presidential stance may not be universally reflected in US commercial circles, however, as indicated by the *Oil & Gas Journal* article's conclusion that the petroleum industry must have the 'courage to accept the challenge' by actively supporting the development of alternative fuels and research into global climate change. This message carries some weight because the article was written by a former Vice President of Texaco and head of delegation for the International Chamber of Commerce to the UN Framework Convention on Climate Change, although it may be significant that it was written two years after the author's retirement.

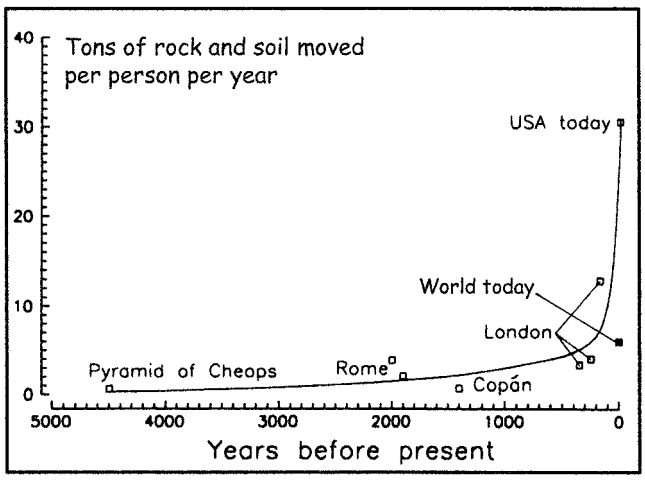
Existential geology: *where do we come from?*

The evolution of primates into *Homo sapiens* is now well documented, but where did Life itself begin? Theories about this were reviewed in the *Journal of the Geological Society* (1997, p.377), starting with the 'warm little pond' of Darwin (1888, p.18) through to the complex experiments of the 1980s that achieved the synthesis of DNA by replication using peptides, in a process called polymerase chain reaction. Those experiments showed that the chain reactions of Life needed water, they needed warmth, and they needed sites to concentrate and combine together the key ingredients and molecular components at an early stage. The crucible of Life, the article argues, could have been provided by a fundamental component of plate tectonics that certainly existed in Archaean times: the mid-ocean ridges, and specifically the mineral-rich and gas-rich hydrothermal systems of the black smoker chimneys. Modern ones are hosts to an abundance of primitive life-forms but it is their structure, consisting of small interlocking compartments with walls of porous, sulphide membranes, that is of particular interest. In identical ancient chimneys, it is suggested, the ingredients for organic synthesis could have diffused into the compartments, generating simple amino acids in concentrations that would favour the development of self-replicating peptides, RNA and DNA. Over billions of years these simple cells could evolve into organisms robust enough to migrate from the oceanic ridge and colonise the shallower seas, some perhaps being forerunners of the *Charnia*-type species that first appeared at around 580 Ma. The discovery (*Geology,* 2000; p.731) of organic material in analogous Early Archaean (3235 Ma) black smoker sulphide deposits may therefore be evidence of our own humble beginnings.

Existential geology: *why are we here?*

Living organisms have made important contributions to the stratigraphical record: witness the shell, coral and algal-rich Carboniferous limestones of the Peak District, and Cretaceous Chalk strata constructed of billions of coccoliths. Humans, on the other hand, stand accused of warming the atmosphere and raising sea-levels to the extent that parts of the landmass will eventually disappear. This negative press is, however, countered by some unusual research (*Geology, 2000*; p. 843), which argues that humans are now the 'premier geomorphic agent sculpting the landscape'.

Our efforts can be quantified in terms of a graph showing tons of earth moved per head of the estimated population, plotted against time. The



Estimates of the amounts of soil and rock moved intentionally by various relatively advanced societies in the past (courtesy of Roger Hooke, Maine University).

figures have been calculated to include the pyramid-building ancient Egyptians, 4500 years ago, although the earth certainly moved for the iron-age Egyptians, who constructed a forerunner to the Suez Canal that by 600 BC was 60 m wide and 13 m deep. The graph of earth movement shows a slight gradual rise until about 1800 AD, when it soars vertically upwards. The advent of the Industrial Revolution is the obvious reason for this, as is the expansion in agriculture, which caused vast amounts of soil to be washed away ('moved unintentionally'). Currently, Americans are shifting about 30 tons of earth per person annually, against the average figure of 6 tons worldwide.

The bottom line is that the total amount of earth moved by our ancestors in the past 5000 years would be sufficient to build a mountain range 4000 m high, 40 km wide and 100 km long. Moreover, it is apparently our destiny to double the length of that hypothetical mountain range within the next 100 years.

Dinosaur theories

Within the science of geology, theories go into dinosaur-like extinction and are replaced by newer ideas avidly researched and supported in band-wagon fashion. But some old theories only fade into the background, and, like the coelacanth, wait for rediscovery. The continuing debate over mass-extinctions at the K-T (Cretaceous-Tertiary) boundary is a case in point. The magnificent Doomsday scenario at the end of BBC's *Walking with Dinosaurs*, showing the fireball and ensuing dust-laden 'winter' that destroyed those creatures, represents the zenith of the meteorite-impact theory of Alvarez et al., (*Science,* 1980; p.1095), but the old ideas of more gradual extinctions are resurfacing.

A review in the *Journal of Earth Sciences* (2001, p.239) has concluded that the extinctions were, as hinted at long ago, part of a 'multicausal event', linked to sea-level fall and global environmental changes brought about by the disruption of oceanic circulation patterns etc. In other words, some biotic populations were under stress before the end of the Cretaceous, but the revised 'gradualist' theories are now suggesting that this stress was exacerbated by superimposed, sudden events. This new stance is necessary because even the most impact-sceptic gradualists would attribute an increment of stress to the Chicxulub meteorite strike 65 million years ago. In addition, however, the end-Cretaceous Deccan basalt eruptions in India are also being implicated in precipitating the mass extinctions. The influence of this event is tangible, for the Deccan ash clouds may be responsible for worldwide layers rich in *volcanic* iridium (Ir), which are only now being distinguished from *cometary-derived* Ir layers and were probably confused with the latter in some earlier papers.

The Deccan sequence assumes further significance in that its sediments contain terrestrial dinosaur faunas, and accurate radiometric dates obtained on the lava flows constrain the age of these fossils (*Journal of the Geological Society*, 2000; p. 257). A protracted eruptive history has been revealed, lasting from 68.7 to 61 Ma, but with no dinosaur remains above Basalt Flow IV, dated at 65.1 Ma. So the dinosaurs survived the earliest Deccan eruptions, but were they edged into extinction by the cumulative effect of ash clouds from the later outflows, or by an adverse climate created by the Chicxulub impact on the other side of the world, or a combination of the two events? The only certainty is that the critical fossil-bearing exposures will be examined in ever-greater detail as the reconstructed gradualists argue it out with the catastrophists.

NEWS from the BGS

Environmental impact

The winter of 2000-2001 will enter the record books as one of the most miserable ever in terms of environmental crises. Unprecedented levels of rainfall have led to flooding in many parts of the country (see p. 126 of this volume), and saturated soils and bedrock have resulted in a record number of landslips. Many of these have affected transport networks already under stress from flooding and the aftermath of the Hatfield train crash in October 2000. One person died and a second was seriously hurt when their car was overturned and crushed by a coastal landslip at Nefyn in North Wales, and a major tragedy was narrowly avoided on the Isle of Wight when a mudslide crashed through the walls of a packed seaside hotel. Many experts predict that this winter has provided just a foretaste of the perils to come from global warming. Could we have been better prepared to face these events? An All-party Parliamentary Group for Earth Sciences, assisted by BGS and the Geological Society of London, has been attempting to answer this very question by taking a hard look at issues such as availability of strategic data and advice, levels of co-operation between Government agencies and the effectiveness of the planning system. Hopefully, in the future, the nation can avoid such crises before they happen by establishing both improved strategic planning and safer use of land.

Foot and Mouth

At the time of writing, the Foot and Mouth epidemic has brought BGS fieldwork programmes to a standstill. Surveys in rural areas remain

suspended, and mapping in urban areas is only proceeding following rigorous risk analyses on a case by case basis. One of the most serious problems associated with the crisis has been the need to identify safe burial sites for the huge number of livestock carcasses generated by the MAFF slaughter policy for containing the Foot and Mouth virus. BGS has employed the latest digital mapping and Geographic Information Systems technology to help the Environment Agency, MAFF and the Army select the most suitable sites for shallow burial of carcasses. Suitable sites must be easy to excavate and should offer 'natural containment' of any potential contaminants to protect groundwater supplies and surface water courses. GIS has been used at the regional scale to provide the Environment Agency with maps showing areas of suitable geology, allowing the Agency to then import their own environmental protection and planning data to narrow down the range of potential sites. BGS has then followed up with detailed geological assessments to help determine the environmental risk at each potential site. These measures should ensure that the Foot and Mouth crisis does not leave a legacy of environmental contamination long after the end of the virus outbreak.

FROM THE ARCHIVES

An archive photograph of East Midlands geology from the British Geological Survey collection

The plankwalks at Hawton Quarry

Operated by Cafferata and Company of Newark, Hawton Quarry was at its time the largest gypsum quarry in Britain. The quarry face was first loosened by blasting, and the gypsum was then excavated by hand and loaded onto railway wagons hauled by locomotive. By the 1930's, 'electric navvies' and cranes were introduced to extract and load the ore. The very precarious-looking planks were used by the quarrymen to walk barrows of waste 'marl'. This was stripped from benches in the working face, and carted across the planks to backfill the quarry. The site was excavated beneath the Devon valley alluvium and needed steady pumping to keep it dry.

This photograph of the workings was taken on 9 May 1911 by the celebrated Survey photographer, Jack Rhodes (see his short biography on page 6 of the last issue of Mercian Geologist).

The Hawton site exploited mineral from a series of gypsum beds known collectively (and perhaps unsurprisingly) as the Newark Gypsum. This occurs

Hawton Gypsum Mine, Newark. in 1911 (BGS photograph # A1189, © NERC)

within the top part of the Mercia Mudstone immediately below the Blue Anchor Formation, and contains workable mineral in a belt extending from Cropwell Bishop to Newark. The Newark Gypsum consists of up to a dozen individual seams each 0.1 to 0.5 m thick and spanning a stratigraphical interval of up to 20 m. Large gypsum nodules up to 1.5 m thick and 4 m across occur at the top of the series. Each seam was individually named by the quarrymen and is distinctive in terms of features such as thickness, lateral persistence, colour and purity.

In the early 20th century, gypsum was put to a variety of uses. It was principally employed in plaster and cement manufacture, as a filler in various substances, notably paper and paint, and as a 'finisher' in the manufacture of cotton and lace goods. It was also used in brewing and as a fertiliser, particularly by hop growers in Sussex and Kent. The pink varieties were sold as an ornamental stone for use in grottoes. Gypsum continues to be an essential raw material for most of these uses today, although its use as a fertiliser has substantially declined. Other more specialist uses of gypsum include ceramics, dentistry, food additives and surgical plaster (perhaps handy to mend the fractured limbs of fallen quarrymen!).

The Newark Gypsum has been mined, usually by surface quarrying, at several places in south Nottinghamshire, including the Balderton and Hawton areas to the south of Newark, and at Staunton in the Vale, Orston and Cropwell Bishop. Other mines southwest along the outcrop, at Gotham, East Leake and Barrow on Soar, exploit the Tutbury Gypsum at a slightly lower stratigraphical level. This occurs as a single seam up to 5 m thick, which is usually mined underground by the pillar-and-stall method.

Total gypsum production in Nottinghamshire was around 100,000 tons annually at the time of the photograph. By comparison, current annual production of gypsum in Britain is about two million tons, of which Nottinghamshire contributes about one half. Much of the demand for plaster, plasterboard and cement-making are now satisfied by DeSulphoGypsum, a by-product of Flue Gas Desulphurisation plants at coal-fired power stations. The FGD plant at Ratcliffe-on-Soar produces about 250,000 tons of gypsum per year. Demand for natural gypsum will continue for the more specialist uses, and can only be satisfied by the higher purity mineral yielded by the Newark Gypsum. The seams are currently quarried at Kilvington, mid-way between Bingham and Newark. That quarry will probably be exhausted in 2003, after which production is planned to return 'home' to Newark - with the re-opening of the currently mothballed mine at Bantycock, south of Balderton.

Andy Howard and Paul Tod
British Geological Survey; kwphoto@bgs.ac.uk

THE RECORD

The Society has welcomed 28 new members, and membership numbered 384 at the end of 2000.

Field meetings

In May 2000, Ian Chisholm led a day trip to Stanton Moor, Derbyshire, to examine landforms on contrasting facies within the Namurian gritstone.

In June, Andy Howard led an evening trip around the University campus to look at the Nottingham Castle Sandstone sequence.

In July, Albert Horton and Keith Ambrose led a visit to Upper Broughton Church and the nearby Marlstone in Leicestershire.

Also in July, Neil Aitkenhead led an excursion to Carsington reservoir and the dolomitised limestone in the slopes up to Harboro' Rocks.

In September, Dave Elford led a visit to the quarries in Scunthorpe Ironstone.

In October, Alan Dawn led a day excursion round three quarries in the Lincolnshire Limestone between Wansford and Duddington.

In February 2001, Tony Waltham led two evening visits to the sandstone caves under the Broad Marsh Centre, including some that are not normally accessible.

The indoor meetings

In March 2000 after the AGM, Dr Martin Whyte related experiences chasing dinosaurs across China.

In April, Prof. Mike Rosenbaum talked about the role of geology for the military in wartime.

In May, as part of Derby Environmental Week, Dr Trevor Ford delivered his authoritative lecture on the history and geology of Blue John fluorspar.

In October, Dr Tony Waltham described the geology and volcanoes of Kamkatka at a meeting attended by 130 people.

In November, Prof. Dick Aldridge gave a most lucid talk to bring us up to date on the progress of his research on conodonts.

In December, Trevor Bridges explained how the form of minerals reveals something of their history.

In January 2001, Dr Tony Reedman talked about the BGS activities in the developing world.

In February, Dr Chris Lavers gave a fascinating talk on past extinctions and drew parallels with man's activities today.

Events

The Society was represented at the Geologists' Association's Earth Alert in Brighton, at the Cresswell Crags road show day on Archaeology and Geology, at the Millennium Wall event at the National Stone Centre, at the Derbyshire Country Capers and at the British Sedimentological Research Group meeting at Loughborough.

Alan Filmer, Secretary