

MERCIAN

Geologist

VOLUME 15 PART 1 JULY 2000

East Midlands Geological Society

President
Tony Morris

Secretary
Alan Filmer

Editorial Board
Dr Tony Waltham
Dr John Carney
Dr Andy Howard

Council

Mrs. Jennifer Anderson
John Aram
Colin Bagshaw
Ben Bentley
Jack Brown

Vice-President
Dr Richard Hamblin

Treasurer
Mrs. Christine Moore

Tony Morris
Mrs. Judy Rigby
Mrs Judy Small

Dr Peter Gutteridge
Mrs. Pauline Jones
Mrs Sue Miles
Dr Philip Small
Dr Ian Sutton

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.

No part of this publication may be reproduced in any printed or electronic medium without the prior written consent of the Society.

Registered Charity No. 503617

© 2000 East Midlands Geological Society
ISSN 0025 990X

Cover photograph: The landslide at Mam Tor, above Castleton in the Derbyshire Peak District, with the old main road that is now permanently closed due to the slide's continuing movement. See report on page 55 [photo: Tony Waltham].

Contents

Profile	2
Tony Morris – President	
Mercian News	3
Geobrowser News from the BGS From the Archives	
John Carney	7
Igneous processes within late Precambrian volcanic centres near Whitwick, NE Charnwood Forest	
Laurance Donnelly	29
Fault reactivation induced by mining in the East Midlands	
Richard Forrest	37
A large rhomaleosaurid pliosaur from the Upper Lias of Rutland	
David Robinson	41
Geomorphology of the Lincolnshire Wolds: an excursion guide	
Landmark of Geology	49
The Holme Post – Tony Waltham	
Reports	52
Morley Quarry – John Carney Mam Tor landslide – Tony Waltham John Muir – Pauline Dawn Titan Shaft, Peak Cavern – Tony Waltham	
Lecture Reports	59
Glacial stratigraphy – Richard Hamblin A dry Mediterranean – Rob Butler Geology in war – Mike Rosenbaum	
Excursion Reports	66
Minerals of the Northern Pennines Ballidon limestone quarry	
The Record – 1999	69
Reviews	70

PROFILE

Tony Morris

With the election of Tony Morris as president of the EMGS in this millennium year, the Society comes very much down to earth! Tony was born in Nottingham during the hostilities of the Second World War. He was brought up and educated locally at Haydn Road Infant and Junior Schools and at Claremont Secondary Boys School. He continued his education at both Peoples College and Nottingham Regional College of Technology (now Nottingham Trent University) where he obtained his ONC and HNC in Building. He was initially employed by Thomas Fish & Sons (Building Contractors) as a Building/Assistant Quantity Surveyor and subsequently he joined the National Coal Board in their Architects and Surveying Department.

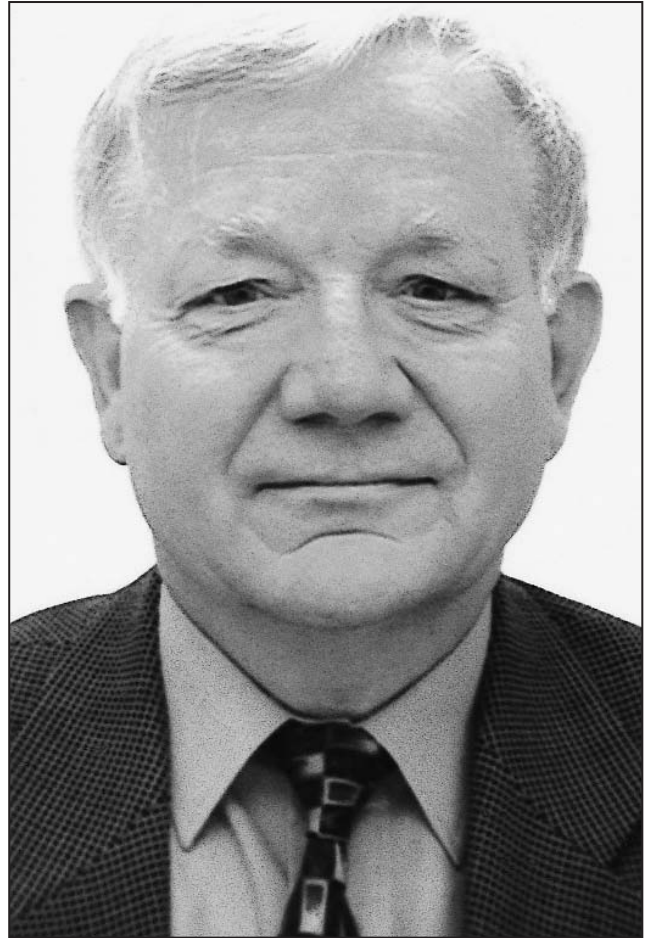
Employment at the Coal Board did not hold sway for long and service to and behalf of others soon beckoned. His interest and involvement in politics and trade union affairs led to him joining the National Union of Public Employees in 1964 as a full-time trade union officer.

Important changes to Tony's life came in 1966 when he married Jean and his work with N.U.P.E. resulted in a move to Lincoln where they lived for seven years. Promotion in 1973 to Assistant Divisional Officer saw a return to Nottingham. With the creation of a larger public sector trade union, UNISON in 1992/3, Tony was appointed as its East Midlands Regional Head of Health. After more than 30 years as a trade union official Tony took the opportunity for early retirement in 1995, enabling him to expand his interest and involvement with a variety of organisations.

Tony has always taken an active interest in local education affairs. For over twenty years he was the Vice-Chairman of the Basford Hall College of Further Education and he now serves on the Governing Body of New College Nottingham (an amalgamation of several local colleges of further education).

For five years prior to his retirement, Tony was a Director of the North Nottinghamshire Training and Enterprise Council, and he is currently a Non-Executive Director of the Central Nottinghamshire Healthcare N.H.S. Trust, and he serves as an Employment Tribunal panel member.

We would like to think that Tony's first encounter with geology was when, early one Sunday morning, he broke his toe when creating a rockery made of Bulwell Stone! However, in reality, his geological interests stem from his secondary school years with a love of physical geography and summer holidays spent with his aunt and uncle at Great Longstone, Derbyshire, collecting minerals and fossils from the Carboniferous Limestone.



His fascination with geology led him to attend, with his wife Jean, his first geology adult education classes in the 1970s, expertly tutored by Colin Bagshaw. His interest in geology mushroomed with further University and W.E.A. classes, numerous geological excursions and study tours in Britain, North America and Italy and membership of the E.M.G.S. in the late 1970s. Since his retirement he has also found time to serve as a Council member from 1996 to 1998, and he is currently a member of the Editorial Board of the *Mercian Geologist*.

Both he and Jean extended their interests in geology by undertaking a round-the-world trip in 1998 taking in some well known geological sites in Queensland, New Zealand and Hawaii.

His appreciation of geology does not curtail his interest in a variety of other subject areas through adult education classes and interest and involvement in the William Morris Society, the Cromwell Association, the Royal Society for the Protection of Birds, the National Trust and the Nottinghamshire Wildlife Trust. In addition, Tony actively participates in local politics, and has a continuing commitment to the Labour Party.

With the election of Tony Morris as a non-professional geologist, the Society continues to promote the interests of both the professional and amateur geologist.

Andrew and Judy Rigby

MERCIAN NEWS

Wollaton Hall

A new mineral display opens at the Nottingham Natural History Museum at Wollaton Hall, on Friday, July 21st as part of the 'Green Wollaton Trail'. It is in the existing mineral gallery on the first floor of the museum within the Hall.

Featured are two new showcases of the more spectacular minerals, including fluorite, calcite, goethite, rhodochrosite and crocoite, together with a camera microscope and monitor to allow visitors to examine minerals under the microscope for themselves. The new display carries a 'green' message about the environmental impact of mining operations around the world, in particular, the damage being caused by gold mining to the rain forest environment in Brazil.

The museum is open every day from 11am to 5pm in summer, and daily except Fridays from 11am to 4pm in winter. Admission is free during the week, but there is a small charge at weekends.

Editorial

Items from Society members are always welcome for the Mercian News and for the Geobrowser column. All material, and any longer reports or full papers, should be sent to the editor, who will pass them on to the appropriate section sub-editor. The editor will also value any member's feedback or suggestions on the content of *Mercian Geologist*.

Archaeologists from the NHAS at work in the western caves under the Broad Marsh Centre. They are digging beneath missing parts of the old brick floor to expose the original rock floor and any early artefacts.

EMGS at Earth Alert

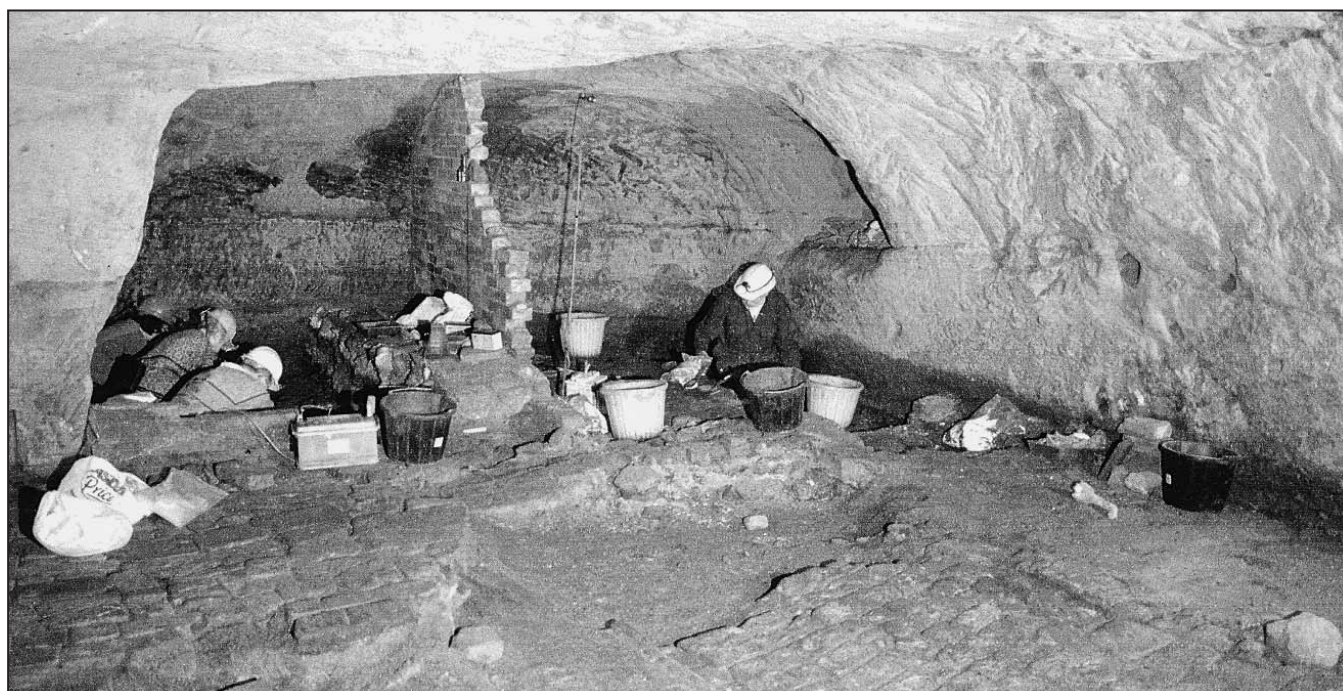
Earth Alert was a successful four-day Millennium Festival of Geology hosted by the Geologists' Association at Brighton in May 2000. The EMGS display stand was one among a hundred at the event, and was manned by Ben Bentley.

The four days had a continuous programme of lectures, there was a Rock, Mineral and Fossil Show, and two festival exhibitions occupied side halls. A big attraction for the younger visitors was a hands-on fossil programme run by Rockwatch, the Natural History Museum and the Open University. This included a race between radio-controlled trilobites of Paradoxidian dimensions (about 30 cm long) that had to be seen to be believed, and attracted more than a share of the older visitors

More and less caves

Excavations for the foundations of Nottingham's new ice stadium revealed twenty caves, of which only two had been previously recorded. Most had been cellars beneath houses, but there was also a cave malt kiln complex. Many of the caves had already been unroofed or damaged, and they are now all filled with concrete. At least their temporary exposure did add to the sparse cave records for the eastern end of the old town.

On a brighter note, a new cave has been found and preserved under the Broad Marsh Centre. Its entrance was exposed during excavation of the debris in the western caves. Ongoing work by archaeologists of the Nottingham Historical and Archaeological Society has exposed two splendid brick floors in caves that were once used as stables. The clearance effort is in preparation for extending the system of caves that is accessible to visitors.



GEOBROWSER

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

Global spin

The debate about global warming, and mankind's part in it, has been re-ignited following the Sir Peter Kent Lecture given by the Environment Minister, the Rt. Hon Michael Meacher, to the Geological Society and reported in the January *Geoscientist*. The Minister quoted figures, from British Government-funded research, showing that global temperatures have risen by 0.6°C over the last 140 years, and that man-made greenhouse gas emissions have made a quantifiable contribution to this increase within the last 50 years alone. The reported reluctance of some developed countries to implement certain of the Kyoto targets probably has nothing to do with the substance of a subsequent letter published in the March edition of *Geoscientist*. A mining exploration consultant based in Canada suggested that the Minister's speech was an example of 'non-science', and blamed the situation on sunspot cycles, which could promote warming by releasing large amounts of water vapour to the atmosphere. Meacher's stance was supported, however, by two communications originating from this side of the pond, in the May *Geoscientist*. These emphasised that current climate models have failed to explain global warming simply in terms of water vapour content or sunspots, indeed no model has been able to replicate the planet's warming over the last century - without taking into account the rising concentrations of greenhouse gases.

Global impact

It is difficult to pick up a modern popular geological publication that does not refer to a catastrophe, and it is equally difficult to deny that such articles make compelling reading. One of the remaining lines of research into the Chicxulub impact structure in Mexico, was to determine its third dimension. In 1996 this was finally accomplished following the acquisition of marine seismic deep-reflection profiles, coupled with onshore wide-angle seismic profiles. The results are spectacular (*Geology*, 1999; p.407). The impact structure appears to have consisted of a three-ring 'excavation cavity', of about 100 km diameter, beneath which there is a whole-crust deformation zone that includes significant offsets to the Moho at depths down to 55 km.

Apart from ridding this planet of dinosaurs, the Chicxulub impact has benefited us in other, more material ways (*Geology*, 2000, p.307). It effectively created the preconditions for the south-eastern Mexico oil fields, currently producing 1.3 million barrels per day. Firstly, the seismic impact loosened the substrate by shattering the platform limestone

sequence that had been quietly accumulating at the end of the Cretaceous; this produced limestone-breccias, up to 300 metres thick, now constituting the principal oil reservoir. Next came the accumulation of a 30 m-thick layer of impact material, consisting of bentonitic clays with conglomeratic lenses representing the ejecta reworked by tsunamis. This upper layer effectively sealed the limestone-breccia reservoir from later diagenetic fluids, and prevented any possibility of hydrocarbon migration when eventually the oil was generated.

Sun, sea and slides

Reports of instantaneous events, such as comet strikes and the eruptions of 'supervolcanoes', seldom fail to enliven the popular media. Understandably less obvious are the major submarine 'catastrophes', involving single large debris flows that have run out across the sea floor for distances of up to 400 kilometres. These are presently being discovered and investigated off the African continental margin, opposite the Saharan coast and Canary Islands (*Sedimentology*, 1999; p.317). The Canaries are steep-sided volcanic islands that built up fairly rapidly from the sea floor, and in consequence they have experienced their own, equally spectacular flank collapses. The example discussed in *Geology* (1999, p.739) should be of particular interest to those intending to visit the resorts of western Tenerife. It appears that the steep seaward slopes mantled by deposits from the intermittently active Teide Volcano are actually founded on much older breccias. These were formed over the past six million years, by several episodes of debris flowage. The origin of these debris flow events is linked to the genesis of the horseshoe-shaped wall of Las Canadas, which partly encircles Teide to the south-east. Rather than simply being the side of a caldera, this feature is primarily a type of composite, mega-landslide scar, formed by repeated lateral collapses of the pre-Teide volcanic edifice. The submarine continuations of the debris flow breccias have been detected by offshore sonar investigations, but the scale of their size in relation to the continental margin examples was not mentioned.

Minoan disaster?

The repercussions of sudden volcano-collapse events were drastically illustrated by the loss of life, and collateral damage, caused by the tsunamis generated when Krakatau exploded in 1883. But what sort of role has been played by similar catastrophes in the more distant past? It has long been known that the islands and coastlines of the Aegean Sea are fringed by tsunami-like deposits, and the temptation was to associate such tidal wave activity with the violent eruption of Thera, on Santorini, between 3000 and 4000 years ago. A

major displacement of seawater, during the massive collapse that terminated this eruption, could easily have generated the tsunamis, but the linkage between these events had always been based on circumstantial evidence. Support for such a connection is now forthcoming, however, through work that has combined geology with archaeology and computer modelling of the eruption (*Geology*, 2000, p.59). Trenches dug in the Minoan ruins on the Turkish and Cretan coasts have revealed a two-layer stratigraphic record of the catastrophe, that begins with a thin tsunami deposit, identified by its fossils that include life-forms normally found far offshore. Directly overlying this comes the new find of a tephra layer, the ejecta of which matches material known to have come from the Plinian phase of the Thera eruption. In real-time, these Plinian eruptions actually preceded the volcano collapse that generated the tsunamis. However, the tephra had to be carried by eruption clouds, and these probably took 2 to 3 days to reach the shores of Turkey. The tsunami travelled faster; it overtook the eruption column, and according to the computer simulation arrived on the Turkish coast only about 2.5 hours after it was generated. The demise of the entire Minoan civilisation has commonly been attributed to these events, but other studies are showing that although the Thera eruption was severe, Minoan life continued for some time afterwards.

NEWS from the BGS

Geoscience takes guts

Geochemists at the British Geological Survey are currently using synthetic stomachs to assist them with their work. This is not to provide a remedy for 'over-indulgence' during fieldwork, but to determine the risks to humans and animals from the ingestion of soils contaminated with metals.

Impending legislation will require local authorities to take responsibility for contaminated land within their boundaries and to assess the risks associated with the contamination. Current guidelines stipulate that risk assessments should be based on the total concentration of toxic substances in soils, although it is known that only a fraction of metal contaminants in soils is actually absorbed – or 'bioavailable' – via plants or animals. BGS is using synthetic stomach solutions at 37°C to determine the percentage of soil contaminants that are 'bioavailable' via uptake through the human gut. Using soils containing arsenic exceeding the recommended limit of 10 milligrams per kilogram, BGS tests have indicated that, in some cases, less than 1% of the arsenic is extracted from the soil by the stomach solution and would hence be absorbed following ingestion.

Research is continuing with other contaminants, and will lead to a better understanding of the toxicity of soils on contaminated sites. As pressure continues to mount on land use in the UK, this research will ultimately assist with assessing the health risks associated with contaminated land and will encourage its effective re-use with appropriate types of development.

Tsunami catastrophes

Britain's coastline may be at risk from tsunamis, giant waves that can have devastating effects on communities in low-lying coastal areas. Marine geologists at the BGS are currently determining which areas could be threatened, quantifying the extent of the hazard and developing strategies for reducing the risks.

Tsunamis have been responsible for some of the most notorious catastrophes in history. Those following the eruption of Krakatoa in 1883 killed 30,000 people in the coastal zones of Java and Sumatra, and tsunamis devastated shores of the Mediterranean when Santorini exploded (see the note in Geobrowser). The most destructive tsunamis have been associated with earthquakes or island volcano eruptions, but recent research indicates that powerful tsunamis may also be caused by submarine landslides. These can occur along continental margins in many parts of the world, outside the earthquake and volcano zones. Large concentrations of the world's population live on coastal lowlands just a few metres above sea level and are therefore potentially at risk.

Submarine landslides result from failure of large volumes of sediment on continental slopes. They can be triggered by minor seismicity, by the release of shallow gas or the melting of gas hydrates (gas locked into ice molecules). Such landslides are known to have occurred along the continental margins of Northwest Europe. About 7000 years ago, a gigantic slide occurred at the northern end of the North Sea, displacing about 5500 cubic kilometres of sediments. This caused a tidal wave up to 5m high, inundating the coast as far south as Northumbria and depositing a layer of marine sediments that can be traced for up to a kilometre inland. The effects were even greater along the Norwegian coast. Other submarine landslides have been identified to the west of the island of Barra and along the Atlantic margin.

BGS has been investigating whether future landslides could pose a risk in coastal zones in the UK. The project is looking into the causes of submarine landslides and their frequency, calculating the possible heights of tsunamis and examining how the shape of the coastline may focus the wave effects. This will highlight vulnerable areas and provide planners and insurers with the information they need for risk assessment and management.

Publications go online

BGS is following the trend by offering its services and products online. The new e-commerce site at www.british-geological-survey.co.uk is designed for customers with credit cards to browse and buy online from the Survey's range of printed maps, books and guides. Selected photographic images and some key digital information such as the World Mineral Statistics can also be purchased.

Future development of the site will provide BGS customers with an ever-expanding range of geoscience services and information. More advanced products, such as digital map data, are planned for the near future, and in a third phase of development the site will offer interactive services for delivery of site-specific information.

Back in the land of paper, BGS is about to publish a new book in its *Earthwise* series entitled *Catastrophes – Time's trail of destruction*. Written by Susanna Van Rose and lavishly illustrated, the book investigates the origins of famous catastrophes since the dawn of creation.

FROM THE ARCHIVES

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

Druids' Stone at Blidworth

This particular Druids' Stone stands on a sandstone slope (at NGR SK579558), just west of Blidworth in Nottinghamshire; it lies close to a footpath that heads west from near the old village

church. Though marked on old maps as *Druidical Remains*, its name is hardly appropriate. The Stone is a calcreted mass of glacio-fluvial gravel, left behind after the surrounding uncemented gravels were quarried away. These gravels of the Blidworth area are remnants of a formerly more extensive sheet, that was deposited by meltwaters towards the end of the Anglian glaciation about 450,000 years ago. The pebbles are mostly sourced from local Triassic sandstones, but include erratics originating from the Lake District and from Jurassic and Cretaceous rocks of north-east England and the southern North Sea.

The image was taken on 24 April 1911 by Jack Rhodes, photographer for the Geological Survey of Great Britain, during survey of the Ollerton geological map. Jack Rhodes joined the survey as a young man in 1910, and soon became involved in geological photography, a job he held until his retirement in 1956. By this time he had taken over nine thousand photographs. In the early days he carried his equipment into the field using a horse or donkey, for which he received a hay allowance. He was later supplied with a motor cycle and sidecar, finally graduating to a motor car in 1945. Many of his early photographs used long exposure times which, along with lens aperture, location and weather conditions, were recorded in meticulous detail. The figure on the right of the Druids' Stone, while apparently hammering with gusto, must in fact have been holding his breath and standing still (or 'petrified' perhaps), as the exposure time for the photo was two seconds.

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



The Druids' Stone at Blidworth, as viewed from the west in 1911. Short of checking for individual missing pebbles, the rock looks exactly the same today (BGS photograph #A1175, © NERC).