The Geologists’ Association
The Association, founded in 1858, exists to foster the progress and diffusion of the science of geology, and to encourage research and the development of new methods. It holds meetings for the reading of papers and the delivery of lectures, organises museum demonstrations, publishes Proceedings and Guides, and conducts field meetings.

Annual Subscription for 2003 are £34.00, Associates £24.00, Joint Members £52.00, Students £14.00.

For forms of Proposal for Membership, and further information apply to the Executive Secretary, The Geologists’ Association, Burlington House, Piccadilly, London W1J 0DU.
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President: William French
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Cover picture: Photograph of a specimen of the internal cast of a high spired gastropod from the Tertiary of Italy—picture by Ross Sandman.

ADVERTISEMENTS
While precautions are taken to ensure the validity of advertisements the Association is not responsible for the items offered, for any loss arising or for their compliance with regulations.

NOTICE CONCERNING FIELD MEETINGS:
The Association now has a mobile phone for emergency communications concerning field meetings (UK only). If you have to cancel on the day, or are lost or late for the start of a field meeting, please call the GA mobile phone (07990 806961). The mobile phone will only be switched on just before and during field meetings.
(For routine enquires, please call the Field Meetings Secretary on the usual number.)

Advertising Rates
Full Page £360
Half Page £190
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REPORT FROM COUNCIL

There are no Council meetings in August or September so the only Council Meeting to report is the October meeting.

The Treasurer reported that the combined effects of a legacy and the refunds due to Gift Aid, means that the current account is much healthier than in the past. In order to encourage all members to gift aid their subscriptions, members who have not Gift Aided their membership will receive an application form in their membership renewal information to encourage them to do so.

There was much discussion in the Publications Committee and in Council on how the GA should financially support its publications. This is an on-going discussion with various models under consideration which will be returned to later. In-house setting of the magazine and guides has provided significant cost-savings and Council officially recorded their thanks to Bill French and Trevor Greensmith for saving the Association a great deal of time and money.

The future of Geology Today in which the GA has considerable interest, both financial and material, seems to be more secure with some interim production changes. In order to really secure its immediate future it would help if illustrated articles can be produced by members, pitched for general readership.

The revision of the rules is progressing. The system for revision involves the Charity Commission approving the recommended changes which then have to be agreed by members at a special Annual General Meeting, hence it is a time consuming process.

The Field Meetings Officer reported that field meetings in the UK have been well supported this year but overseas ones have not. The programme for next year is going well and includes about one UK trip per month. There have been few nominations for the field meetings leaders database. Members are encouraged to suggest names.

COUNCIL WAS REMINDED THAT THE FIELD MEETINGS OFFICER WILL BE RETIRING IN THE END OF THE YEAR. IT IS IMPERATIVE THAT THE ASSOCIATION GETS A REPLACEMENT IF YOU HAVE ANY INTEREST AT ALL PLEASE CONTACT THE OFFICE.

John Crocker
General Secretary

CURRY FUND REPORT

At its September meeting, the Curry Fund had five new applications of which four were funded and one deferred.

Petersborough Museum was granted £2546 towards the cost of its Fossil Fish and Reptile Project. The grant will enable greater access to this internationally important marine collection by putting the documentation onto a database; digitally imaging objects in the collection for education and interpretation, improving the storage conditions of the fossils and producing a web page for publicity and wider access. The Earth Science Education Unit (ESEU) at Keele University was granted £1600 for the purchase of 400 World Geological Maps to be given to participants on the in-service teacher training courses in Earth Science run by ESEU. This project is an important way of supporting Earth Science teachers at all levels in our schools.

The project has also recently asked for feedback on the help that these maps give to teachers in their lessons and look forward to the responses. It was agreed to give the Herefordshire and Worcestershire Earth Heritage Trust £221 towards the printing costs of an information leaflet on the work of the Trust. The GA received a grant of up to £3000 towards the cost of producing and printing the 2nd edition of its Guide No. 49 Geology of Tenbury. A decision on the application from the University of Bristol towards the cost of producing high quality fossil replicas for the Bristol Dinosaur Project was deferred until the Christmas meeting, pending receipt of supplementary information.

The Bristol and Bath Geological Society sent a cheque for £800 being the repayment of an interest-free loan from the Curry Fund to cover cash flow during production of its Guide to the Building Stones of Bath. We are delighted that this publication has been such a success and wish the Society well in its future ventures.

I think now is a good time to inform readers that the Curry Fund Committee has agreed to offer small grants, not exceeding £200, to Local Groups and Affiliated Societies to help with expenditure involved with developing displays and attending the GA Annual Reunion in Cardiff in November 2004. You may remember that, after the success of moving the Reunion to Liverpool in 2001, the GA Council agreed that, every third year, it would be held outside London. It was felt that this would enable groups who found it difficult to come to London to get to the event with their displays and, most importantly, for groups to form new liaisons. I am delighted to report that there are a number of groups who have developed links and run field meetings to each other's areas as a direct result of the Liverpool meeting. Perhaps, after the Cardiff meeting, there will be many more such exchange visits.

The Curry Fund Committee will meet in March 2004 and will consider the applications for further funding. Special Application Forms and Guidelines for the 2004 Reunion are available from the GA office. Applications will be considered at the March and June meetings next year, 2004.

The normal Application Forms can be downloaded from the web site and are also available from Burlington House. We look forward to hearing from you due course.

Susan Brown, Curry Fund Secretary.

LIBRARY NOTES

The move of the earth sciences section of the Library has proceeded apace through the long hot summer (but at least down in this south eastern corner of the UK) and is now almost complete. Final tidying up remains to be done, including the labelling of shelves for example, so that sections are easy to find and boxes will be cleared leaving the tables ready for use. Please bear with the disruption for a little longer.

Now from the present to the past. A query concerning one of our nineteenth century members has led me to investigate how archive records are handled at University College London. UCL is a member of a project called AIM25 funded by the Research Support Libraries Programme to provide a web-accessible database of descriptions of the archives and manuscript collections of the principal colleges and schools of the University of London, of other universities and colleges in London and the surrounding area bounded by the M25 and, of some of the royal colleges and societies of medicine and science based in London. The complete archival holdings of 49 institutions will be covered. Images of the archives are not included. As access conditions differ between institutions application to use the material has to be made to the archivist of the relevant institution itself. This growing database should prove a useful tool for members' researches and can be accessed at www.aim25.ac.uk. This is not just of parochial interest to the south-east of England but is part of a wider initiative as several AIM25 institutions have already contributed to the UK Archives Hub and it is included in the Online Resources for Historians gateway of the Institute of Historical Research.

Elaine Bimpson
Librarian.
THE ASSOCIATION

Following the diverse meetings concerning the structure and management of the Association held over the last few years, a summary of the objectives of the Association has been put together by Jonathan Larwood. This is a document for discussion and it may well be necessary to depart from it to develop new ventures. It is a starting scheme against which progress and performance can be measured.

A STRATEGY

Since 1858, the Geologists’ Association has promoted the study of geology and helped all those interested in geology to widen and deepen their knowledge. Through publication, lectures and field meetings the GA has established a national and international reputation for geological excellence. The Geologists’ Association is about enjoying, understanding, valuing and promoting geology. It exists for all, whatever their level of interest or expertise.

In response to the Way Forward Review the GA’s strengths were confirmed and a number of areas for change and growth identified. This strategy sets out the success of the GA and identifies priorities for the Geologists’ Association to build on this success and to open up geology for all.

Members

The greatest asset of the GA is its membership. With some 2000 members (mainly southern based) and a widespread network of 75 local and affiliated groups the GA is a local organisation with a national voice. Membership has remained stable over the last 50 years but has not grown significantly. It is important to maintain established loyalty whilst also seeking opportunities for growth. To achieve this the GA will seek to:

- Provide and promote the current service and benefits for members and local and affiliated groups including a membership magazine, Proceedings, access to the GA library, lecture and field meetings and group insurance.
- Through consultation with the membership identify and provide new benefits, understand more fully what the membership wants and.

widen access to geological information for the membership.
- Actively promote increased membership through the establishment and delivery of a marketing strategy that raises the profile of the GA and the benefits of membership.
- Strengthen the diversity and geographical spread of membership, targeting other interest groups and societies (such as the National Trust and the Ramblers’ Association) and encourage student membership.

Communication

Communication is essential to the success of the GA - everyone must feel a part of what happens. The GA membership must be kept in touch with what the GA is doing, locally, regionally and nationally. Among some there is the perception of isolation from central activities - the GA should strive to break down these barriers. To achieve this the GA will seek to:

- Maintain and enhance GA membership magazine as a forum for information exchange and debate.
- Develop the GA website to communicate within and outside the GA establishing a network link between the GA membership.
- Explore with the membership the establishment of new discussion groups and networks through the membership magazine and website.
- Learn from each other and establish closer regional links between members and groups.
- Ensure open communication between Council and membership, ensure Council acts as a voice for its membership.

Publication

The GA has a reputation for excellence in publication. The GA Proceedings and guide series are widely valued. The Proceedings, however, does not present a balanced portrayal of geology - to meet the needs of the readership it should reflect the diversity of geological interest. The GA has supported publication and innovation in the promotion of geology and should continue this role keeping pace with the changing needs of the membership and the wider reader. To achieve this the GA will seek to:

- Increase the value placed on the Proceedings (maintaining the profile of a refereed journal) while establishing a more balanced geological, stratigraphical and subject coverage.
- Continue to publish a high quality guide series of our most interesting geology.
- Through the Curry Fund continue to support the design and publishing of leaflets, trails and signs boards, alongside innovation in raising awareness and understanding of geology.
- Look for new style publications to widen our readership and where beneficial, publish electronically.

Action

Experiencing geology is the most important activity of the GA and is why people join. The GA should widen the experience of geology for its members and widen the awareness of geology outside its membership. To achieve this the GA will seek to:

- Organise field visits for its membership encouraging others to participate.
- Host lectures and talks throughout the country on all aspects of geology aimed at all levels of understanding.
- Organise and support events that promote a greater understanding and appreciation of geology.
- Continue to host an Annual Reunion and geology festival.
- As a membership and organisation, and through the Curry Fund, support the promotion and conservation of geology.
- Promote good practice through the GA fieldswork code.

Community

The strength of the GA is in having a local network with a national voice. As the geological community grows so does the need to work in cooperation to ensure a stronger future for geology. To achieve this the GA will seek to:

- Work with other national and local organisations, societies and groups to better promote and protect our geology (including, for example, the Geological Society, Earth Science Teachers Association, UK RIGS, Geological Curators Group and national conservation agencies).
- Act as a national and local voice for geology to ensure good policies for geology and geological conservation are supported and established from national to local levels. Provide an input to national and local consultations and debates relevant to geology, its conservation and understanding.
- Continue to support Rockwatch, the promotion of geology to a younger audience and the inclusion of geology as part of the learning experience.

Management

The GA must remain well managed and operate within its financial means. Growth must be carefully planned and innovation clearly costed and should represent a benefit to the GA membership. To achieve this the GA will seek to:

- Ensure financial security for the day-to-day running and activities of the GA including the GA office, Proceedings, membership magazine, guides and meetings.
- Ensure the financial security of the Curry Fund.
- Establish an overall business plan to ensure best value is achieved for the day-to-day running and activities of the GA.
- Establish a business plan for any new initiative identifying costs and sources of funding.
- Seek opportunities for sponsorship and grant aiding of the GA, its activities and initiatives.

This strategy presents a challenge for the whole of the Geologists’ Association that can only be achieved by the commitment, co-operation and support of its membership. Clear priorities and needs are identified and a lead will be taken by the GA Council in delivering these and encouraging the support of the membership. This will be done through continued consultation with, and involvement of, the membership.

The adoption of this strategy is important as it provides direction for the GA and a means of measuring change and advance. It will provide continuity between Presidents and Councils and a long-term picture which the GA has previously lacked.

Programs will be reviewed annually, the need for new priorities assessed and the strategy fully reviewed every five years.

The Geologists’ Association has an important contribution to make to the future of geology as an advocate for its promotion, enjoyment and conservation. Everyone can contribute, making geology accessible for all.

Jonathan Larwood
December Meeting:

TICKETS NEEDED:
We expect this lecture to be very popular - numbers MUST be limited to 180. Tickets will be needed: obtainable from Sarah Stafford at the GA office, at the October meeting, or at the Reunion. Otherwise, please write with a SAE. There will be a book signing before the lecture with the book being sold at a special reduced price.

MICHAEL BENTON
Department of Geology,
University of Bristol
When Life Nearly Died
5th December 2003
Geological Society, Burlington House,
Piccadilly, W1V 0JU, at 6.00 pm, tea at 5.30

Two hundred and fifty-one million years ago, at the end of the Permian period, life was almost completely wiped out by an environmental catastrophe of huge magnitude. Perhaps only 5% of species survived. The extinction of the dinosaurs 65 million years ago was a minor event by comparison.

At the end of the Permian, complex ecosystems on land and in the sea were picked apart and destroyed. Coral reefs, fishes, shellfish, trilobites, plankton, and many other groups in the sea disappeared. On land, the sabre-toothed gorgonopsian reptiles and their rhinoceros-sized prey, the dinotheriaphians and pareiasaurs, were wiped out. After the event, the Earth was a cold, airless place with only one or two species eking out a poor existence.

What happened, and how did life recover?

This catastrophe was first recognized about 1840 – after all, it is marked by an amazing turnover in the fossil record – but scientists have only begun to tackle it seriously in the past ten or twenty years. Why did it take so long to come to terms with the largest environmental crisis ever? The reasons are buried in a major disagreement among geologists in the 1820s and 1830s, the battle between the catastrophists and the uniformitarians. In the end, the uniformitarians effectively won, and their victory has affected the way earth scientists view the world for 150 years. In a slow process, since 1890, geologists have come to accept that much of what the catastrophists of the 1820s had said is in fact true: the Earth has been subject to huge catastrophes in the past – impacts of meteors small and large, vast and seemingly interminable volcanic eruptions, huge expansions of carbon dioxide from frozen stores deep in the oceans.

In his new book, When Life Nearly Died (Thames & Hudson, 2003, £16.95), Mike Benton documents exactly what happened 251 million years ago, how the astonishing and complex ecosystems on land and in the sea were substantially reduced, perhaps in as little as a few tens of thousands of years. The killing models are controversial – was it all caused by the impact of a huge meteorite or comet over 10 kilometres in diameter, or by prolonged volcanic eruption in Siberia? The evidence has been accumulating through the 1990s and into the new millennium, and it is weighed and dissected in detail.

The lecture is not a distant journalist's account of how our understanding of this worst-of-all environmental catastrophes has developed. It is an insider’s view, from the geologist’s field camp in Greenland and Russia, from the laboratory bench, of how a panoply of scientists are pursuing a major interdisciplinary goal. The story involves geologists, palaeontologists, environmental modelers, geochemists, experts on biodiversity and conservation, even astronomers. Their working methods are dissected and explained, and the current disputes are laid bare. The implications of our understanding of crises in the past for the current biodiversity crisis are also presented in detail: here, the past can truly be a guide to the present and the future of life on Earth.

Michael Benton is Professor of Vertebrate Palaeontology and Head of the Department of Earth Sciences at the University of Bristol. He has written 150 scientific articles, and over forty books, many of them standard technical works and textbooks, as well as popular books about dinosaurs and the history of life.

Both pictures are by John Sibbick.

Charlie Underwood
School of Earth Sciences,
Birkbeck College, University of London

Raiders of the Lost Shark - applying palaeoecology of Mesozoic Sharks
16th January 2004
Geological Society, Burlington House,
Piccadilly, W1V 0JU, at 6.30 pm, Tea at 6.00 pm.

Bulk sampling from a number of Jurassic and Cretaceous sites across Britain has produced a number of large and diverse collections of small to minute shark teeth. These faunas are dominated by remains of Neoselachians, the group that includes all living sharks and rays. Although the Neoselachians only appeared in the Triassic and were of very low diversity until the Early Jurassic, by the Middle Jurassic they were very diverse with many modern groups represented. These Middle Jurassic faunas reveal a very strong palaeoenvironmental preference of species and genera, probably related directly to their rapid radiation. Cretaceous faunas also show palaeoenvironmental specificity, but there is evidence that this is due not only to marine settings but to nutrient flow within different marine basins, with the North Sea Basin being an impoverished and hostile place for large predators.

February Meeting

PETER TURNER
School of Geography, Earth and Environmental Sciences
The University of Birmingham
Birmingham B15 2TT

Red Beds: decoding geomagnetic and astrophysical records
6th February 2004
Geological Society, Burlington House,
Piccadilly, W1V 0JU, at 6.30 pm, Tea at 6.00 pm

Red beds have a special place in the history of geology. They were amongst the first sedimentary facies to be interpreted in terms of depositional environment and palaeogeography and also provided some of the earliest palaeomagnetic data which enabled the development of the theory of continental drift. More recently it has been shown that Red Beds carry detailed records of geomagnetic and astrophysical variations. For parts of the stratigraphic record there are detailed magnetostratigraphies which can be constrained using Milankovitch-type variations giving time scales with resolutions of 100-400kyr. By comparing sedimentary records with such Astrophysical Polarity Time Scales a detailed picture of palaeoclimatic variations can be constructed.

The talk will outline the methodologies employed in this work particularly with respect to the Triassic Period and will be richly illustrated with pictures of red beds from all over the world.
CHERRY LEWIS
(Bristol University)
The Dating Game - One Man's Search for the Age of the Earth
5th March 2004
Geological Society, Burlington House, Piccadilly, W1V 0JU, at 6.30 pm, tea at 6.00 pm

This evening’s talk takes us through Arthur Holmes’ life and his search for the age of the Earth. Like many students, when writing up her PhD Cherry encountered the work of Arthur Holmes, and became captivated by his vision to develop a geological timescale – then a revolutionary idea. Cherry follows the life of Holmes from the terraced house in Gateshead where he grew up, though Gateshead High School and his time studying physics at the Royal College of Science in London. She begins with the work of Kelvin and the discovery of radioactivity that gave the lie to Kelvin’s age for the Earth. Cherry follows Holmes’ pioneering research on the development of dating methods, documenting the setbacks as well as the successes. Through the application of contemporary cutting-edge analytical work he demonstrated the great antiquity of the Earth, providing a basis for the now familiar timescale. She also give us an insight into his personal life and troubles, such as the problems that beset him when prospecting for minerals in Mozambique, the tragedy that befell him in Burma and his long-term relationship with Doris Reynolds, who eventually became his wife.

Cherry studied geology at Bristol University as a mature student, after drama college and running her own business. She worked on Tibetan granites for a PhD and did postdoctoral research at University College, London. A career in the oil industry followed. She now works for Bristol University and is responsible for publicising their research.

REUNION 2004: CARDIFF
5th - 7th November 2004

The Reunion this year was a great success with many excellent exhibits and of course held on the occasion of a major lunar eclipse. It will be described fully in the next issue of the magazine. Next year the Reunion will be in Cardiff hosted by the South Wales Group in the National Museum of Wales and providing the opportunity of diverse field meetings on the Sunday. The illustration of the Jurassic Cliffs of Southerdown makes the point.

Note that we expect to hold a book from signing before and possibly after this talk. Current retail price £11.95
The annual Pot Luck trip, despite the venue being advised with only 10 days’ notice, attracted some 38 members and guests on what was one of the hottest days of the year. Somehow our leader, Mick Oates, had even managed to organise two venues for the day as well as a pub lunch from his current working base in Kazakhstan. First stop (if you could find the site through the country lanes) was a working gravel pit at Linch Hill, near Northmoor/Stanton Harcourt, near Oxford, where around six metres of Thames gravel overlies Upper Oxford Clay.

We were first treated to some specimens in the site office, which included ammonites and plesiosaur and ichthyosaur vertebrae from the Oxford Clay, and woolly elephant and rhinoceros teeth from the Quaternary-age Thames gravel. The walk from the car park at Linch Hill Leisure Park to the pit provided us with our first glimpse of fossils in the field – in fact vast numbers of Gryphaea shells amongst the reject gravel piles at the side of the road. The pit itself revealed a surface of Oxford Clay, cut by drainage ditches and occasional scatters of gravel and shallow ponds with numerous damselflies.

A morning of diligent searching did not provide the quality material showed to us at the start of the day, but numerous small pyritised ammonites, belemnites, abundant Gryphaea and occasional small bivalves were found. Paul Davis, in his usual fashion, managed to find a dinosaur – well, an ichthyosaur vertebra in this instance. The gravel yielded one small tooth (‘horse’), whilst Harriet & Jessica Lubin (aged 10 and 12, respectively, and dad, Jonathan) discovered 4 or 5 teeth, a fragment of jaw and another piece of bone, all probably from the same specimen of a deer (fossil, not modern!).

After lunch, the group moved on to Hill’s Pit at nearby Tubney Wood, where the Lower Cretaceous Grit (Coralian) is excavated for sand. The promise of bivalves imperfectly preserved in concretions and trace fossils in otherwise barren sands somehow persuaded the group to brave the ever-increasing heat of the day – although there was soon a breakaway group seeking the shade in a remote corner of the site. I must admit to an early departure myself, but not after hearing about the discovery of at least two sharks’ teeth in the relatively unconsolidated sand.

A good day with something for everybody. Our thanks to Mick Oates for the organisation of the trip and we look forward to ‘Pot Luck 2004’, which he has offered to arrange.

David Bone
July 2003

Churches built of GRAVEL??
A Field Meeting to some churches in the Reading/Slough area, 10th May 2003
Leader: John Potter

The GA has had few field meetings in the Reading area in recent years: whereas decades ago there were a number of quarry faces to admire and argue over, the 'progress' of urban environmentalism that regards such places as totally undesirable has reduced these to little more than one exposure. To redress the Association's relative neglect of the area, a Field Meeting was arranged so that over 25 members and friends could examine and enjoy the geological aspects of the churches around Reading. It was led by a man with an irrepressible enthusiasm, and encyclopaedic memory, John Potter, who has visited well over 10,000 churches to study the stone and other materials of which they are built.

Arranging to visit several churches on a Saturday had its problems, not the least of which were weddings - the field meeting had to avoid these or run the risk of members unwittingly becoming matrimonially entangled. So the itinerary was something like the Keystone Kops in its frantic motorway dashes through three or more counties from one end of the district to the other, then back again via country lanes. But the weather held good, there were no traffic jams, and not many members got (temporarily) lost. But throughout the organisation was excellent, the travel instructions faultless and the guidebook very clear and informative.

But what was this about gravel? Why build a church of such insubstantial material? Some monastic foundations could, for significant parts of their buildings, afford to import stone from the Cotswolds as far as France, but village churches could not. Ferruginous gravel cemented mainly by hydrated iron oxides such as goethite is nowadays still encountered in gravel pits, but is treated as waste material - the 'stone rejected by the builders' - but in former times it was, if not commonly used as a cornerstone, at least firm enough to be very practical for wall construction. In the Anglo-Saxon and Saxon-Norman periods, there was not much option in areas where the geology was mainly London Clay overlain by terrace gravels; transporting stone for any distance was expensive.

We were first introduced to this unexpected element in church building at St Peter's Church at Iver, Buckinghamshire (TQ 046 812). Here hard brown gravel is found as smaller blocks in among the ubiquitous flint cladding of the church's exterior, then as larger, more regularly shaped blocks high up in the tower (Figure 1). Our leader then took us round the south side to show us even larger ones, some as foundation blocks, and all of them made of ferruginous gravel showing both angular flint fragments and rounded pebbles, characteristic of the Boyne Hill river terrace of the district. These large blocks over a metre long (Figure 2) must have been carted from pits very close at hand. Such materials are still found in present-day gravel pits, formed as hardpan at the water table, but are discarded or destroyed by modern working methods.

Of great interest were some quoins of Anglo-Saxon date, which included red tiles (Figure 3), and even some Roman roofing tiles ortegulae - evidence of the re-use of material from nearby earlier buildings. Maybe it fell off the back of a car, but in those days it was a practical solution to finding durable building materials.
The Vicar welcomed us to the church and inside we were able to see evidence of former architectural features. It was some surprise to us that John had previously only read about these, never having been able to see inside (we thought he had seen every church, everywhere). This was a good example of a relatively prosperous early medieval church in an area devoid of traditional building stone: for important items such as memorial tablets and the font, the expense of bringing Purbeck limestone (marble) from Dorset was justified, but for bulk materials the source had to be local.

After stopping to admire the quirky features of the small church of St Mary at Wexham (SU 993 815), where we saw that ferruginous sand and gravel could lie interbedded in single blocks and was also used as quoins (Figure 4), we lunched at a suitable hostelr nearby. The party was then shown the next stage of impossibility—a church built almost entirely of gravel. This was St Michael's, Warfield, north of Bracknell (SU 880 723), a substantial church where, apart from mid-Jurassic limestone in the more modern quoins, other stone was mainly restricted to the tower (Figure 5). This stone was sarsen, a hard quartzitic sandstone (silcrete) of early Tertiary age and formerly found as boulders littering the fields around the district. These are, of course, common as the large stones at Avebury and Stonehenge, but at Warfield they had nearly all been broken into blocks small enough to be transported and used in the construction of the tower.

At Heckfield, south of Reading (SU 723 605), the church had been much remodelled in Victorian times, though some ferruginous gravel and a few sarsens remained. Nevertheless an ancient priests' door revealed hinge blocks of "feather bed", possibly Quarz stone from the Isle of Wight, stone packed so tight with bivalve shells that there was hardly room for sand between them. Upper Greensand was used in door frames and arches. Chalk suitable for building had also been sought locally, especially Chalk Marl which is less permeable and thus more resistant to frost action.

John described the manner in which Anglo-Saxon walls at Warfield and Saxo-Norman at Heckfield had been pulled down over the years, and the gravel material re-used to create the present churches.

Then the party moved on to Arborfield south of Reading (SU 750 681), where a ruined church so heavily overgrown with ivy (Figure 6) left us wondering what point there was going there, but at least we could see the construction details of the wall interiors filled with a rubble of flint, chalk and gravel, not visible at other sites. Also, two representatives from the Parish Council concerned with the archaeology of the site arrived with interesting and informative maps and photographs mounted on boards to illustrate the history of the building, and of the adjacent mill and house.

There followed a drive through country lanes, over and under motorways, which led us back to Binfield (SU 845 722), northwest of Bracknell; thankfully, its wedding party had departed, but had left the church locked. Nevertheless, here was another church we could get excited about, built partially of gravel, with Jurassic limestone quoins and window Mullions. Chert from the Hythe Beds of the Weald showed that gravel had been introduced by a proto-Blackwater river which had once drained the Weald. Judging from the size of the pebbles, this river may have been as large as the ancestral Thames then flowing from the Midlands. The lack of quartz and quartzite material from that area led us to draw conclusions about the local river-terrace geology. Arrows waved in various directions emphasised the variety of theories that could be sustained, including whether the material was carried by cart or by pack animals.

Geology of churches is not just about churches: when in the old days it cost more to transport material 12 miles than it did to quarry it, there was a strong incentive to use material from local sources, and we learned the lesson that churches, like some sedimentary deposits, retain evidence of now-vanished river courses.

At each church John had called upon us to scrutinise carefully the pebbles found in the gravels. At Iver and Wexham we had noted the presence of pebbles of quartzite and white vein quartz, sedimentary material derived from sources to the north; but at the other churches white quartz was absent, instead pebbles of chert from the Hythe Beds were present indicating deposition by the early River Blackwater.

Despite the dull weather, the leader kept us interested throughout with his lucid and informative discourse—being based upon such wide experience and long-term study over much of southern England, this was a memorable meeting.

I am very grateful to John Potter for putting me straight about some of the facts in this account. With such fragmentary evidence, so many theories flying around and such fascinating outcrops, it was not possible to take notes comprehensive enough to reflect all the nuances of this fascinating subject.

**Deryck Laming**

Figure 5. St Michael's Church, Warfield, which consists largely of ferruginous gravel, with a tower built of sarsens intermixed with gravel.
Smokejacks & Clockhouse Brickworks – 7th June 2003

Some 40 people assembled at 10.30am in the car park at Smokejacks Brickworks (TQ 116372). This was the first of two working claypits visited that day. Smokejacks is in the lower part of the Upper Weald Clay, and is of early Barremian age (Ross & Cook, 1995). It is best known for the discovery of the carnivorous dinosaur Baryonyx walkeri in 1983 and a well preserved partial skeleton of a juvenile Iguanodon in 2001 (Austen, 2001).

An introductory talk on the geology was given in the car park by Peter Austen. The Weald Clay is considered to represent a low-lying wetland with open water (Agar & Jarzembowski, 2002). A 23m section is exposed here, the bottom 13m of which is thought to represent a shallow lake or lagoon with fluctuating salinity, and the top 10m mudflats and sluggish river channels (Ross & Cook, 1995). The talk was accompanied by a display of specimens and photographs. Richard Agar showed a specimen of a large Lepidotus fish which had been found on the site a few weeks previously. Handouts for identifying finds and copies of published sections were also made available. One of the illustrated insects had been formally described and named recently (Figure 1). Some of the sections had changed, but it was still possible to identify the stratigraphical position of most in situ finds.

Since the previous GA visit, a new cut had been made in the eastern face of the pit which had yielded a rich bed of fossil insects a few weeks previously (correlated with bed 6 in the NW face). Further hand excavations during this visit yielded more insect remains. These included an undescribed scorpionfly. Nearby, a silky lacewing (Figure 2) was found ex situ by Joyce Austen. Other finds on the eastern face, probably all from the equivalent of bed SE21, included a large Goniatophis tooth by Geoff Toye, a well preserved Iguanodon tooth by Ken Cole (recovered by ITV’s Gideon Mantel on Meridian News, 17th July, 2003); and a large broken Unio valve found loose by Joyce Austen. Some enigmatic trace fossils were found at the base of the eastern face by Graham Mayo. They superficially resembled rootlets, but lacked any carbonaceous material and were interpreted as invertebrate burrows or feeding traces. Other ichnofossils found included dimorphed casts from SE18 (Ed Jarzembowski).

After lunch, we regrouped in the car park of Clockhouse Brickworks (TQ 173366) where Richard Agar displayed some local fossils. The pit is in the upper part of the Lower Weald Clay exposing B.G.S. Beds 3a (Oakhurst sand) and 3 (Clockhouse sand) of late Hauterivian age (~135 Ma). The pit is machine excavated biannually to replenish the clay stock pile. The first excavation (in March) had concentrated mainly on the North face and both marker horizons were readily seen. Low-amplitude ripples were observed in Bed 3 by Ed Jarzembowski with trace fossils (Planolites, Beacons) at G.P.S. TQ 176383632. The ripples were slightly sinuous, 7cm apart, striking at S88°E and the bed dipped N. Richard Agar subsequently saw ripples and asymmetric ridges indicating a southeasterly current. Worssam’s Bed 35 (dark grey shaley clay with dark brown iron staining) yielded part of a Lepidotes body (Figure 3) and crystal-filled rootlets / stems. Bed 37 (greenish clay) contained bivalve (Folina) moulds, fish remains including a large shark spine, and carbonised plants including the fern Weichselia, driftwood and possible horsetail remains. The grey siltstones in the East face yielded a selection of insect wings (cockroaches, true flies and leafhoppers) and beetle elytra belonging to various new species (one with a distinct colour pattern preserved). Finally, the Clockhouse rockstore was located amongst vegetation in the adjacent landfill site.

Our thanks to The Brick Business and Hanson Brick for continuing access to Smokejacks and Clockhouse brickworks respectively.

References
The National Rockwatch programme of Summer Events has been a huge success. We have had a wonderful group of volunteer leaders who have taken Rockwatchers and their parents to the most amazing places in many parts of the country.

Safety First

It's perhaps a useful reminder to say that a given, on ALL Rockwatch events, is that safety is paramount. Prior to each event a thorough "Hazard and Risk Assessment" of the site is carried out by the event leader, usually accompanied by a Rockwatch representative. At the start of each event, Rockwatch members and their parents are always given a specific safety talk by the leader and any safety equipment deemed to be needed, such as hard hats and goggles, are always provided.

Rockwatch Nationwide Field Events

Our field trips this summer have taken us to Yorkshire, Derbyshire, Dorset, Essex, Somerset, Oxfordshire and North Wales - quite a circuit!

I reported in the last issue of the GA Magazine on our activities early in the summer in Yorkshire and Derbyshire, but we also had a later visit to the National Stone Centre (NSC) in Wirksworth, Derbyshire. This was the second annual field trip to the centre and was run jointly with the Earth Science Teachers Association (ESTA) and the NSC. We are grateful for the support of these two organisations. We had wonderful weather and lots of enthusiastic Rockwatchers and their parents joined in the fun. We panned for precious gems - and found them in abundance; we knocked down a typical Derbyshire drystone wall and then learnt how to re-build it; sight of huge fossil crinoids in the Carboniferous limestones drew gasps of amazement and then we made our own using plaster of Paris in lifelike moulds. There were wonderful fossil corals hiding on the limestone reef that the youngsters had great fun spotting and bright shiny mineral deposits, too - these challenged their knowledge identifying them! Once identified, we learnt about their physical properties and some of the uses of the most common minerals found at the site. We walked the trail and along the way, saw many examples of different styles of drystone walls (one of which was supported by the GA Curry Fund) and finally spent some time collecting our own fossils - always a favourite activity with Rockwatch members!

Dorset Coast – Isle of Purbeck

The second Rockwatch Annual Residential Field Trip to study the Jurassic Coast World Heritage Site, was centred this year at the Dorset County Council Field Studies Centre, Leeson House, on the Isle of Purbeck, during the first week of August. We were again fortunate to have Richard Edmonds, the World Heritage Site Education Officer with us and were joined by Barry Cullimore, Director of the Leeson House Field Studies Centre and a number of his staff, all of whom worked so hard to ensure that, once again, this was to be a memorable Rockwatch field trip. There is always so much more scope to develop activities and skills and encourage the youngsters to see the wider geological picture on a residential trip, and this visit was no exception. Parents and children voted this a "brilliant event" and can't wait 'til next year!

Left: Richard Edmonds explaining the formation of the fossil forest on the cliffs east of Lulworth cove

Rockwatchers building a drystone wall at the National Stone Centre
The geology was stunning: we saw dinosaur footprints in sandstone blocks recently excavated from a local quarry and left there with wonderful samples of "Parbeck Marble" thanks to Trevor Haynes, the quarry owner. We followed Jurassic rocks through Kimmeridge Bay and did fossil rubbings of beautiful ammonites in situ found in the hard bands of rocky limestone ledges on the beach. This is a strictly "no hammering" area so only a very few fossils lay loose on the beach found their way into the youngsters' collections. We were most privileged to visit Steve Elrach's private museum in Kimmeridge - a world-renowned collection of fossils from the local area. The Rockwatchers were spellbound at the exquisite specimens Steve has collected and prepared over many years and I'm sure that he will have inspired some of them to learn more about the skills needed for good fossil collecting. Watch this space!

We explored Jurassic and Cretaceous rocks from lulworth Cove to Mupe Bay. The Army Ranges were open so we were able to walk over the cliffs with spectacular views east and west and climb down the cliffs steps to see the fossil forest perched on a wide ridge midway between Lulworth and Mupe. We learnt how Lulworth Cove was formed and saw a similar cove in the making; how the palaeoenvironment had changed towards the end of the Jurassic, and how the fossils evidence for sea level falls. The youngers were amazed to see fossil remnants of some of the giant trees that grew in the forest and fossil soils that had formed. At Mupe Bay, we had a wonderful time collecting fossils - fish scales and (possibly) turtle skin were found by some of them - rare finds indeed. We had evening debriefing sessions; a visit to the planetary show and slide show and talk on the entire World Heritage Coast which greatly helped the youngers' understanding of the area. The visit finished with a tour of a wonderful, small, local private museum in Langton Matravers and a group activity "on the ropes" at the Dorset Field Centre in Wareham.

Walton-on-the-Naze

The half-day field trip to Walton-on-the-Naze in late August was a great success and yet again we had wonderful weather. Our thanks are due to Wendy Hamilton who led the trip and gave the Rockwatchers and their parents a useful and interesting talk about the geology of the area. Wendy is a local resident and an O.U. graduate, so we knew that we had gone far for a great time.

The rocks at Walton were the youngest that we have explored on our field events this year - London Clay aged between 50 - 35 million years and the Red Crag at 2.5 million years old. Although the cliffs along this part of the Essex coastline are relatively low and unstable, there were a number of interesting features to see such as thin bands of ash in the London Clay - evidence of long ago volcanic activity, land slips, jointing, cross-bedding and parallel bedding. A major feature was the unconformity, representing some 30 odd million years, the time gap between the end of the Tertiary, after deposition of the London Clay, to the formation of the Red Crag during the Pleistocene, some 2.5 million years ago. We learnt that the palaeoenvironment during the deposition of the London Clay was similar to that of Malaysia today; trees and ferns grew in abundance and we found some evidence of this in the fossils we collected - lots of amazing pieces of petrified wood on the beach and in the pools left by the receding tide. The sharp-eyed amongst the group were delighted to find shrews' teeth on the beach, quite large. In the London Clay deposits in the cliffs were many discrete patches of carbonaceous material (lignite) from ancient trees and plants. The Red Crag - very red and loosely consolidated at this exposure - yielded a variety of gastropods and bivalves including Neptunia contraria and Glycymeris glycymeris. All told, there were lots of fossils at this site and everyone found enough to keep them happy!

The Mendips

At the end of August, Rockwatchers and their parents were thrilled by a visit to Whately Quarry in Somerset, the largest limestone quarry in the country, producing some 4.5 million tonnes per year of Carboniferous limestone for roads. This quarry is owned by Hanson and the company has invested a large amount of money to improve the quarry and lessen the noise and dust. The visit took place on the day of the grand opening of the new storage area and the guests were treated to a guided tour of the quarry and the history of the company. We then made our way to the top of the mountain where we were greeted by the Education Officer at the Centre. After an introductory talk by the geology of the site, types of limestone quarried in the Mendips and its varied uses, the party went off in the minibuses to the quarry. It is huge! We all felt very insignificant inside this enormous hole in the ground, but it gave us ample opportunity to see the geology of the area, some marvellous rock structures, dipping beds and wonderful mineral deposits. Some of the children found beautiful specimens of "dog tooth" spar calcite and a few small fossils. The photograph show just how huge some of the machines used for earth moving were.

In the afternoon, we were joined by the President of ESTA, Martin Whiteley, at Tedbury Camp, who showed the youngsters how to work out the geology of an area from first principles using observational skills in the field - most useful and important skill for geologists! Tedbury Camp beautifully illustrates a major angular unconformity between the Carboniferous and the Jurassic Periods - a time gap of some 150 million years. In fact, not far away from Tedbury is the classic site where Henry de la Beche (who founded the British Geological Survey in 1835) worked out this famous unconformity. The fossil records in the Carboniferous limestone are virtually impossible to extract, but interesting to spot, including the amazing fossil worm casts, bored into the limestone surface at the unconformity junction just where the Jurassic seas began to flow over the Carboniferous limestone surface and an invaluable marker of this event.

As has become the pattern for Rockwatch field trips, fossil hunting occupied the rest of the afternoon making the visit a valuable learning experience for all the young geologists. We have already put our visit to the quarry for next year into our diary!

Below: Even Rockwatchers seem insignificant by the side of this monster earth mover in Whately quarry.
Ardley Quarry

On a bright, sunny, Saturday in September, Rockwatchers and their parents met Michael Oates and Nick Pierpoint, exploration geologists with bg-group, in Ardley Quarry, Oxfordshire, to explore a fantastic set of dinosaur footprints. There were tracks from both sauropod and theropod dinosaurs and we were kept busy measuring and tracking these footprints along the quarry base to determine the speeds of these ancient creatures. The tracks are in the middle Jurassic “White Limestone Formation” and it is estimated that they are some 168 million years old. The palaeoenvironment of the area was probably poorly drained tropical mudflats along a coast line, backed by lush vegetation — the perfect habitat for huge, herbivorous, sauropods and for carnivorous theropods. The distance measured between each sauropod footprint was 4 metres and after some tricky calculations (done with the help of a laptop computer) we estimated that this creature was about 15 metres long and moving at a speed of 4.8 miles per hour. The theropod tracks were most interesting — the tracks started with this three-toed (tridactyl) creature moving fairly slowly. The footprints were some 75 cms. long with the toes pointing outwards and a stride length of some 2 metres, which, after our tricky calculations, gave a speed of 4.2 miles per hour. But, after a short way, the footprints became shorter, the stride length changed, the toes pointed slightly inwards and the speed was calculated to be 9.6 miles per hour. We think this meat-eating dinosaur had seen his lunch and was making his attack! After such excitement, we settled down to collecting fossils from some of the quarry spoil heaps, avoiding the hiding holes for the Great Crested Newt, of which there are many at this site. The Rockwatchers managed to find lots of Jurassic fossils, although most were broken pieces rather than fine specimens, but good to add to existing collections and a useful learning tool. Everyone agreed it was a brilliant trip and expressed their thanks to Mick Oates and Nick Pierpoint.

Llangollen

The final outdoor event for this year was to Llangollen in North Wales in late September. The trip was led by Hilary Davies of Liverpool University and Cynthia Burek of University College Chester and to whom we are most grateful for an interesting and rewarding trip. The morning was spent exploring the area’s geomorphological landforms — the result of glacial activity on ancient Carboniferous limestones. It’s amazing to see just how powerful an erosive force glacial activity is and its dramatic effect on the landscape in the Llangollen area is witness to this. We then spent some time spotting the fantastic Carboniferous fossils — there were a few crinoids but it was the really spectacular corals and brilliant brachiopods that left us gasping, as did the marvellous views of this wonderful landscape. The morning was steeped in brilliant sunshine, but by the afternoon light drizzle had descended, though it did not dampen our spirits and we concluded the trip with a walk around the geological building stones trail in the town, following the trail booklet produced by NEWRIGS. As in many towns these days, there are still some buildings of local stones, but also many from around the world — for instance in the butcher’s we saw marble from Italy and larrvikite from Norway — a good lesson in international geology! The Rockwatchers and their parents were then given copies of the Geology from the Train leaflet, also produced by NEWRIGS, for those who wished to take a train trip and follow the geology from the train windows!

Indoor events

September was a really busy month for indoor activities as well as field events for Rockwatch. We joined in Family Fun Days at the Oceanography Department at the University of Southampton, SciTec in the Peak at Buxton, an Open Day at the British Geological Survey in Edinburgh and a visit to a home school group in Chelmsford. We gave visitors the chance to make fossil replicas from plaster of Paris; develop their artistic skills making fantastic Jurassic or Carboniferous dioramas; discovering the beauty of fossils doing fossil rubbings and demonstrating their geological knowledge answering our quizzes. The people we meet at these events, adults and youngsters alike, are always amazed to see at first hand just how interesting geology can be and we have lots of feedback about how enjoyable the events have been.

I hope that these brief accounts of Rockwatch events during the summer give some indication of just how much real geology our members are exposed to. We all know that there’s no substitute for seeing things first-hand in the field and learning to understand and, later, to interpret, what is seen. We are so fortunate in Rockwatch that there are so many people who are willing to share their expertise with our members. The youngsters learn in a supportive and relaxed environment and gradually build up their geological knowledge and skills and even though most of them are unlikely to become professional geologists, the knowledge and understanding they develop of the natural world will always be useful on their journey through life.

So, on behalf of Rockwatch, I would like to express our enormous gratitude to everyone mentioned in this article for their help and support, and apologise if I have omitted mention of others who have also willingly helped Rockwatch. We have enjoyed a very successful programme of events throughout the summer and now look forward to our winter programme. I shall report on this in future issues of the magazine.

If anyone reading this article would like to run a Rockwatch event, please contact me through Rockwatch, at Burlington House.

Susan Brown,
October 2003.
Rockwatch Chairman.
One privilege of being retired is that my wife and I can take our holiday in the lovely month of September and there is nowhere better than Anglesey. It is reasonably accessible, the roads are good and the traffic light. One can quickly move from one part to the other island to another. There are broad sandy bays virtually empty apart from a few hardy individuals on surfboards towed by kites. There are plenty of good B and Bs and restaurants once you have winkled them out. Ancient churches, castles and National Trust properties and nature reserves provide well-balanced fare for the tourist. What about the geology? What does the casual visitor look for and what is there to see? Are there any published guides?

Luckily I had a copy of the Geologists’ Association (GA) Guide No. 40 Anglesey dated 1981. Neither rocks nor the Guide are for the faint-hearted: Precambrian Gwna Group, Skerries Group, New Harbour Group, Holy Island Group and so forth. Then there are serpentinites, greisses, granites, schists, chlorite slivers, multiple tectonic events; rough ground for anyone muddled on the Jurassic! But does the casual visitor really want to grapple with the intricacies and interrelations? Rather all that we wanted was a selection of accessible locations of general interest.

We descended the 400 steps at South Stack on Holy Island (park at 206822) to see the spectacular folded greywackes in the cliffs; the ‘part of Anglesey most visited by geologists’. It is so impressive that it is recommended in the non-geological visitor guides. This was followed by a visit to the very attractive National Nature Reserve at Cemlyn Bay (331938) famous for its dunes, shingle ridge and birdlife. For the geologist there are shoreline exposures of Precambrian gneisses and shales backed by low cliffs of partly bedded glacial till. Regrettably, the authors of the GA Guide virtually ignore glacial deposits. Anglesey was overidden by ice sheets.

To the east of Cemlyn is Llandanwg (park 376936) with its famous ancient church (locked). The Guide cites the Gwna Melange and quotes Greenly: ‘a many coloured melange that is really indescribable’. Exactly! It was once thought to be a tectonic breccia but revised opinion claims that it is a submarine gravity slide. It is worth a visit.

Further round the coast is Amlwch which featured in the recent TV restoration series - a haven for industrial archaeologists. Copper was brought down from nearby Parrys Mountain and exported from the harbour. There is a nice tearoom with memorabilia but downstairs is one of the best small geological exhibitions that we have come across. It explains the origin of the copper ores, associated geology plus the processing. Three km to the south lies the enormous openpit mine where the copper ores. This was once Europe’s largest copper mine. There is an extensive network of footpaths for viewing the site. Two heritage trail leaflets are available from the Amlwch Industrial Heritage Trust (01407 832255).

Anglesey is not all Precambrian. The Lower Carboniferous on the south side of Treath Lligwy provides an opportunity to try and interpret the geology for oneself although it is described in the Guide (park at 497871 and go at low tide). Is the conglomerate marine or fluvial? What do you make of the Lligwy Bay disturbance? And what of the vertical beds and chaotic blocks of limestone? Do we sometimes miss a lot of the intellectual fun if we trail round after a party leader or bury our nose in a field guide? But then, a good guide and teacher will try to get a group to describe what they can see and then attempt some explanations. However, this requires time and patience. Do leaders attempt to cover too many locations?

Anglesey is reminiscent of the west of Ireland. Nowhere more so than the peninsula of Llandwyn Island SSW of Newborough (Park at 406634): a rocky coast plus vast sand dunes and sandy beaches. Explore the Gwna Melange, basic dykes, agglomerate spilitic tuffs plus sandstones containing volcanic debris. Perhaps the most striking feature is the pile of pillow lavas looking as if they formed yesterday. These also feature in the popular tourist literature and are explained on an excellent interpretation board. And all of this volcanic activity is food for thought with regard to palaeo-plate tectonics.

Beaumaris is a pleasant town with a famous castle built in 1295 in the care of Cadw, the Welsh equivalent of English Heritage. A good series of display panels illuminates many aspects of Beaumaris and castles in general including a map to show where the many masons came from. An enormous amount of stone was used to build the castle. However, we searched the panels in vain for any mention of the nature of the stone, where it was quarried and how, and by which route, it was transported. The very fabric of the building was ignored! Surely Cadw could find a geologist willing to advise on rocks? Are there no historical documents that could be quoted? Regrettably, in general, English Heritage and the National Trust both fail in a similar way. Ten shops shut at 4.30 pm in Beaumaris.

Sadly Oriel Yny Môn, (the Anglesey Heritage Centre and Art Gallery) at Llangefni (Tel. 01248 722193) had more to offer on mythology than on geology. There was a small exhibition about copper mining with some indistinguishable lumps of rock in the shadows on the floor. But no matter. They have a superb exhibition of original paintings, sketches and notebooks by the wildlife artist Tunnichie who spent many years in Anglesey. Do visit the exhibition.

Some 4 km NE of Llangefni on the B5109 is Stone Science (01248 450310). This is a brave private venture attracting many visitors during the summer months. There is vast range of real and model exhibits including fossils, minerals, rocks, dioramas all in a friendly family atmosphere. The exhibition includes a section on labelled Anglesey Rocks linked to a geological map showing where the rocks occur. The adjoining shop has an unusual range of geological items and a selection of books. There is little of a geological nature in print about Anglesey but the New Natural History of Anglesey does include a chapter. Henslow’s 1822 Geology of Anglesey has just been re-printed, as has Copper Mountain. These are all available here. The adjoining shop has the usual range of items but does include the local geological map.

We had a long chat with Dave Wilson the proprietor. Dave is clearly doing a good job, if not always easy, job in bringing geology to the general public. We mulled over the ins and outs of the UKRIGS Association and problems of funding. The local RIGS group had met there the previous evening.

The GA Guide was very helpful but clearly intended for serious students. We would have appreciated some annotated line drawings to help with interpretation in the field plus a select list of accessible sites of general interest designed for the short stay casual visitor. But nowhere did we see it on sale. Surely the GA guides are the one product that should be marketed?

On a wider perspective we would like to see more provision for casual visitors: concise, cheap and cheerful, selective guides to places of general geological interest. We are well-supplied by directory-style lists of gardens, industrial sites, tea shops, pubs, restaurants, historic buildings, preserved railways, and nature reserves to list but a few. Why do geologists alone hold back from compiling this kind of publication? Geology is fun. Let us share it. For tourist information and list of B and Bs contact 01248 713177 or www.anglesey.gov.uk.

Hugh Prudden
Somerset Geology Group
Cro-Magnon Paradise

With partially closed eyes looking southwards into the sun, a rugged heavily-jawed face with slight browridges and a solid body worthy of an Olympics weightlifter, the massive statue of Cro-Magnon Man, about three times original life-size, dominates the village of Les Eyzies-de-Tayac from its lofty ledge halfway up the cliff. Les Eyzies is in the Dordogne department of Aquitaine in southwest France and is situated in the Vézère valley cut into sandy limestones of Upper Creteaceous age. In effect the statue marks the scientific centre of an area, Perigord, of international importance for the study of Middle (Neanderthal) and Upper Palaeolithic (Cro-Magnon) man. In 1979 the whole complex of caves and ancient habitations at this and adjacent localities was designated as an UNESCO World Heritage Site.

Cro-Magnon Man (Homo sapiens sapiens) is an early representative of modern man and existed from about 40,000 to about 10,000 years ago in several European regions, though possibly originating in western Asia. He was far from being a brutish beast dressed in animal skins and had a brain capacity of about 1,600 cubic centimetres, very similar to ours, within a long and narrow skull. His average height, as deduced from skeletons, was 1.8m (5ft 11in), which was relatively tall compared with earlier, partially overlapping, groups, such as the Neanderthals. The Neanderthals (H. sapiens neanderthalensis) seem to have disappeared around 35,000 years ago though the Cro-Magnons are considered unlikely to be direct descendants. The people seem to have been long-term settlers as suggested by the concentration of occupation sites (caves, beneath overhangs and riverside) in and adjacent to the Vézère valley. The National Prehistory Museum at Les Eyzies, adjacent to the statue, opened in 1918 and built on the ruins of an old mediaeval castle, houses around one million artefacts associated with Cro-Magnon Man, the hunter, and Middle Palaeolithic (Mousterian, Neanderthal) life. The predominantly Aurignacian artefacts of Cro-Magnon times include carved missagenquettes of women and the burin, a stout, narrow-bladed, chisel-like flint scraper used for working large pieces of reindeer antlers, bone and ivory into pointed hooks and projectiles, and indicating a marked step forward in tool and weapon-making capability. The stone industry was very sophisticated for the times but above all was the vast step forward in fine art, more especially wall-paintings.

There is such a lot to see at Les Eyzies and in the vicinity, such as numerous, often extensive decorated caves at Font de Gaume, and rock shelters, the latter commonly located beneath towering water-worn overhangs of the limestone cliffs. Unfortunately certain of the caves at Les Eyzies with their multi-coloured wall-drawings are closed because of algal and bacterial growth, which, in conjunction with electric lighting, has caused the pictures to degrade. Nonetheless, of the known 150 archaeological sites in the area, of which about 20 are open to the public — the Cave of the Hundred Mammoths — exhibits about half of all known depictions of mammoths plus drawings of horses, bison and ibex. Perhaps the most famous wall-paintings are those associated with Lascaux Grotto, a few kilometres upstream from Les Eyzies. Lascaux was discovered in 1940 by four boys and opened to the public in 1948. It was found to contain 600 wall-paintings and 1500 engravings of horses, red deer, bison, bulls, cows and other creatures which, collectively, might indicate that the site had some religious significance. They date from round about 15,000 B.C. to 9,000 B.C. (Magdalenian) and utilised manganese dioxide for black colours and iron oxides in the form of red and yellow ochres mixed for varying shades. Affected by degradation the main caverns were closed in 1963 but an amazing replica of the wall-paintings was opened nearby for public viewing in 1983 (Lascaux II), defying all but experts in knowing that they are not the real thing.

These few examples of prime Palaeolithic sites should give you a flavour of the importance of the area in human evolutionary terms but before leaving it is worthwhile pointing out that there are caves open to the public which show less evidence of the activities of Cro-Magnon Man but are nonetheless very interesting to visit. Such are the Grottes de Lascaux in Jurassic limestones forming part of the deeply incised Causses du Quercy (limestone plateau), near the ancient pilgrimage site of Rocamadour, where 1.6km of galleries exhibit a magnificent range of stalactites, stalagmites and other exotic dripstone features, generally better developed than in most of the other grottos and caves. On the other hand you can visit the Grotte des Mervilles at Rocamadour or, much further south, about 18km east of Cahors, the Grotte de Pech Merle where again Palaeolithic wall-paintings can be seen.

The dating of the complete demise of Cro-Magnon Man is somewhat obscure but it is curious that certain relatively modern groups, such as the now extinct Guanches of the Canary Islands, showed cranial morphology similar to Cro-Magnon.

The final point to make is that if you are tempted, as you should be, to visit many of these fascinating pre-historical sites, all situated in beautiful craggy and wooded countryside replete with chateaux and ancient castles (some associated with Richard Coeur de Lion), it is essential to have the use a car. Road maps and pamphlets detailing specific sites are freely available at Information Offices. The roads are nowhere near as busy as in Britain even in the high season and access to the area via the newly improved motorway system south of Limoges and Brive is good.

Trevor Greensmith
The Abberley and Malvern Hills Geopark

The Abberley and Malvern Hills has now been accepted as a European Geopark and there is recognition of the huge infrastructure that exists to help residents and visitors realise what is a very special area they are in. The Partnership that put together the application and now takes the project forward is made up of the Abberley Hills Preservation Society, English Nature, the Forestry Commission, Gloucestershire Geocuration Trust, Herefordshire and Worcestershire Earth Heritage Trust, Scenescapes and University College Worcester.

It is one of the classic areas of British geology and parts are of international importance. Research has been undertaken in the area for over 150 years and has culminated in recent times with detailed geological mapping, geochemical basement studies, seismic reflection traverses, aeromagnetic and gravity analyses, geothermal assessments and the drilling of deep boreholes.

The complex geological history is summarised in the Preface to the British Geological Survey Worcester Memoir. "The detailed lithostratigraphy and chronostratigraphy chronicle the district’s geological history, from the Proterozoic accretion on the southern margin of the southern hemisphere continent of Gondwana, the rifting and northward drift of the East Avalonian plate through the Cambrian, Ordovician and Silurian, its collision and docking with the North American Laurasian and European Baltoscandian plates during the Acadian Orogeny, tectonic inversion of the region during the Variscan Orogeny, and finally, Permo-Triassic rifting and the formation of the Worcester Basin. Superimposed on these tectonic events, the Quaternary glaciation in the Abberley Hills and the Pembrokian/Silurian unconformity on the western side of the Malvern Hills.

There are substantial trails programme in place in the counties of Gloucestershire, Herefordshire, Shropshire and Worcestershire. The number of these trails fall into the Geopark area. The geology and landscape and building stones trails explain and illustrate many aspects of geology and geomorphology. They tell the story of the evolution of the landscape that we live with and the backdrop to our daily lives as well as describing the rocks and fossils seen in the buildings of our towns and cities. The trails series raises public awareness of geology and landscape in the area and encourages a long-term environmental awareness and appreciation.

The trails provide high quality information about Earth Heritage in the form of trail guides, interpretation panels and leaflets. The guides contain supplements with information about archaeology and biodiversity along the trails. Sites with safe and easy public access are used. The trails and sites can be used by school-children as part of their work in the national curriculum. They have also been used in undergraduate degree courses at University College Worcester. One of the successes has been the use of one existing guide by the Severn Valley Railway Education Department. This vintage steam railway company is now producing a guide for the Severn Valley for schools using the guide, which explains geology and landscape along the route. The geology is explained as the train travels along and at various stations in the Wyre Forest coalfield and along the gorge-like River Severn.

There are many other attractions within the Geopark showing myriad possibilities for and links e.g. Stratford Canal Basin, Diglis Canal Basin and the River Severn itself. All have transport links with locally derived raw materials. The public open spaces such as Broomyard Downs, Castlemorton Common or Hartlebury Common have survived as areas of poor agricultural land because of their underlying geology. The buildings from Worcester Cathedral and parish churches to Elgar's Birth-place all have a story in their building materials. Mambient Craft Centre already has close links with, and actively promotes literature related to the Mambient collections, as does Severn Valley Country Park in respect of the Aycleby and Highley Collieries. The vineyards, hop fields and apple cider orchards are all available for creating that link with geology for the tourists and customers. There is greater scope in the walking guides of long distance routes such as the Severn Way, Gloucestershire Way or the Worcestershire Way to comment on the geology along the route. Thus the aim is to ensure that there is the widest possible range of media, through the active co-operation of many different partners, taking parts of the story with which different people can emphasise their own level of interest. This will bring home to people the reasons for establishing a Geopark in an area which most would not immediately see at first sight as primarily a geological attraction, whilst encouraging a greater awareness of the significance of our Earth heritage in evolution of the natural and human landscapes.

The Abberley and Malvern Hills Geopark has a considerable number of museums and heritage centres within and around its borders. They vary from public authority museum services with branch museums, large collections and a professional staff to small heritage centres run by volunteers. The majority of these museums have geological collections or some geological association. This is not surprising, as the region is one of Britain's most important classic geological areas. Its variety of rocks and splendid array of geological features have attracted geologists since the early 19th century and over years they have used and deposited specimens in the local museums. Museums have an active role to play in the development of a good Geopark system. Their work and aims are entirely complementary. Both are concerned with the preservation, protection and promotion of our invaluable geological heritage. Already co-operation is in place with Herefordshire Heritage Services, Worcester Museum, Stratford Museum and Severn Valley Country Park. The two systems fit well together and further development of the interactive partnership provides outstanding opportunities and benefits to both systems as well as the local community for many reasons.

The potential for raising awareness of Earth heritage is illustrated by the proposals currently being developed in conjunction with the hotel and self-catering industry based on thematic investigation. This approach is self-guided in general but with an important element of organised group courses. The geological themes that lead themselves to popular discovery in the Geopark are palaeontology, orogenesis, floral geomorphology, igneous and metamorphic petrology, Silurian stratigraphy, Triassic stratigraphy, geocuration and hydrogeology. To this list can then be added the cross-discipline approach where additional non-geological expertise is used to establish the link between geology and other areas of study: archaeology, wildlife, wine production, spa towns, music and churches.

The official launch of the Geopark will take place in April 2004 and will be followed by International Geopark week in June when UCW will play an important part in a coordinated programme from 17 geoparks across Europe.

Peter Oliver
Geopark Manager and Director of Worcestershire Earth Heritage Trust.
English Nature Research Report 505
Proceedings of a one day conference in Salford, 16th April 2003.

The conflict in collecting is easy to understand. Rock and mineral samples are needed for research, for teaching, for the record and for display. Researching on rocks and minerals requires collection for laboratory analysis and proper description. The samples can then be available for others to study and appreciate in perpetuity. They are also effectively conserved - preserved against weathering and erosion.

Conversely, we need to see rocks and minerals in situ again for research, mapping, and teaching, and for aesthetic appreciation. Some years ago a student field trip to Arran visited one particularly impressive exposure of sandstone with diverse sedimentary structures. Some two years later on a second visit the site was found to be totally demolished by crowbar and sledge-hammer.

Because resources are finite they must be conserved but in practice they can be destroyed by erosion and weathering as well as by over aggressive collecting. Collectors can be conservers and protectors or destroyers of the finite sources.

These various themes are discussed repeatedly through the papers at this conference. The themes include the finite nature of the resource, the long term value of the collections, the role of collectors and dealers in providing stable collections for museums, and the wild, unacceptable behaviour of some collectors with their saws and explosives. Difficulties also derive from Health and Safety considerations that make it difficult to gain access to sites.

Another central issue is the proper recording and storage of collections so that they are truly conserved and do not end up in diverse dumps. Samples like those illustrated here are perhaps typical of the range of collections that need to be logged and stored in an independent record.

Report 505 is available from English Nature - telephone 01733 455100.

Below: Exceptionally fine calcite crystals with haematite from a cavity in the Carboniferous limestone of Frizington Cumberland. View represents a width of 20 cm.

Above: Spectacular ripple marks in fissile sandstone from the New Red Sandstone of Scrabo Hill, Newtonards, Co. Down.

Above: An aplite vein cutting porphyritic Shap Granite - width of picture represents 10 cm.

Right: Impure halite crystals in argillaceous sediments of the New Red Sandstone, from a salt mine at Winsford, Cheshire. The photograph represents 8 cm in width.

Left: Middle Acheulian hand axe from gravels on Taplow terrace of the river Lea at West Ham and collected about 1900.
Amateur Field Clubs in Britain – The Cotteswold Club

The Cotteswold Naturalists’ Field Club, is 154 years old and arguably the oldest club of its kind in England. It was inspired by, and took much of its rules of conduct from, the Berwickshire Naturalists’ Club, the members of which were drawn from both England and Scotland. They in turn had grown out of the Pinnian Society of Edinburgh, founded in 1823. Prideaux John Selby, a prime mover in the Berwickshire club, was no stranger to Gloucestershire, and his youngest daughter married Thomas (later Sir Thomas) Troward, our Club’s first Honorary Secretary. Charles, the son of the Rev. James Daubeny of Stratton, Cirencester, became Professor of Chemistry at Oxford, and had known all the contemporary scientists of note and brought the Club to their attention.

The early field meetings were very energetic, as were many of their type in Victorian England. As a result the early Proceedings are a mine of geological research, and for many years were one of the most prestigious journals for geological papers. Regular authors included Prof. James Bucker, Dr. John Lycurgus, Rev. P.B. Brodie, Rev. W.S. Symonds, Robert Etheridge, Dr. T. Wright, Lansdell Richardson and Hugh Strickland to mention but a few.

In the later part of the 19th century the club’s focus shifted away from the Earth Sciences and the content of the Journal reflected this. In the mid 19th century the club made a conscious decision to rediscover its former status in the Geoscience world and has made big strides to improve its lecture programme, its field meetings and its publishing. With the appointment of Dr Adrian Parker (Oxford) as the Journal’s editor in 1996 there has been a rapid move back to the balance that formerly existed. The last six volumes of the Proceedings have reflected this and the Club now publishes annually. The proceedings have been published annually since 1846 and have produced some 600 geology papers over the last 150 years from in and around Gloucestershire, a tradition that is now very much alive again.

The recent Proceedings have contained about half a dozen geology related papers per volume from sources such as the BGS (following their recent re-mapping programme) and academic researchers working in the area.

In the most recent volume several important new sections were described that have been exposed in the Inferior Oolite. Papers by Tolland and others are developing a new understanding and architecture for the Inferior Oolite sequences in the Cotswolds that will allow a better understanding of this important and now much neglected sequence of limestones. This winter’s proceedings will focus on S. S. Buckman with an important paper covering his life by H. Torens.

The club is always keen to find new members and to stimulate further papers for publication and there is an active programme of events and meetings to meet members’ needs. The Club sees itself as the natural home for all earth scientists in the region, both amateur and professional.

One of the recent traditions of the Club has been the Annual Lansdell Richardson lecture. Recently it has been held at the University of Gloucestershire, St. Paul’s campus, Cirencester in March of each year. Recent speakers have included Prof. H. Torens and Prof. Gondek speaking on Cotswold topics.

The club has an average of some 250 members who mostly reside in Gloucestershire. However a growing number have been attracted from outside the county who join the field meetings and enjoy the annual journal. In recent years there has been a move towards mid-week evening field trips at the expense of the longer weekend affairs. This perhaps reflects the time available to the modern geologist/naturalist! This year the club has visited the Westmoreland valley where the old mansion was built from local Inferior Oolite quarries, The Old Town looking at the orchidology and Middle Jurassic exposures in “Laurie Lee Country” and the Forest of Dean, Carboniferous sequence in the Soudley Valley. These trips always finish at a pub with fine local ales in the best traditions of field geology.

Persons interested in joining should contact Mrs S. Gage, Starter Ct Cottage, Coaley, Nr. Dursley, Glos GL11 5AT (current fee is £15/annum). In addition any institutions or libraries interested in taking the Proceedings should contact Mr. H. Harris, Yew Tree House, Church Road, Leonard Stanley, Glos GL10 3NU (current fee is £15/annum).

Mark Campbell

Left: A recent Club trip to the new sections at Leckhampton Hill.
Below: Rock cliffs scene of many succesful club excursions.
In the following paragraphs, the Editor reviews the forthcoming articles in the Proceedings of the Geologist’s Association vol. 114 part 4 (2003)

Information for Authors, by myself, provides advice on how the Ordnance Survey now requires authors to acknowledge the use of National Grid coordinates when these are cited in their publications; introduces the use of key words in manuscripts from the beginning of 2004, to assist location and retrieval of papers by electronic search; and discusses what factors contribute to the overall publication time for manuscripts in the Proceedings (for manuscripts submitted during 2001-02, the mean submission-to-publication time is 9.7 months for papers and 4.9 months for other types of contribution).

The Westphalian succession of the Glynneath area, South Wales is important because this is the only area in the whole of Europe in which an almost continuous section through the lower and middle Westphalian (Pennsylvanian, Upper Carboniferous) is revealed in a succession of natural exposures. These lie along the Cwm Gwrelych - Nant Llyn Fach streams, on the southern side of the Vale of Neath, between the flanks of the mountain of Craig-y-Llyn and the A465 trunk road which runs along the floor of the valley. The area has been designated as a Site of Special Scientific Interest and is currently under consideration for the IUGS World Geosites inventory. In this paper, Benjamin Evans, Christopher Cleal, Barry Thomas and William Wimbledon give a detailed account of the localities, their geological setting and interpretation. The succession represents the closest analogue for the icehouse conditions of today, when there was both extensive polar ice and tropical forestation. The succession reveals the change from the littoral and lower delta plain deposits of the early Westphalian through the development of the fluvial-lacustrine, coal-bearing deposits (Productive Coal Formation), into coarse alluvial clastic sediments (South Wales Pennant Formation). The Glynneath exposures provide a unique resource for study of economic coal deposits and their setting in the context of the Variscan evolution of Europe.

In Fossil echinoderms from the Carboniferous Limestone sea defence blocks at Barton-on-Sea, Hampshire. David Lewis, Stephen Donovan and Paul Sanford demonstrate the utility of such sources of material where the provenance is known (in this case, the Clifton Down Limestone Formation of the Foster Yeoman Torr Works quarry at Merehead, East Cranmore, near Stepton Mallet, Somerset) but the source material is unavailable for study purposes - access to working quarries is hazardous and consequently is frequently prevented for safety reasons. The authors describe a diverse, well-preserved, echinoderm fauna obtained from the blocks, where they are sufficiently weathered (corals, bryozoans, trilobites, brachiopods and gastropods can also be found), and show the utility of such secondary sources of material for collectors.

Darren Naish describes A definitive allosaurid (Dinosauria: Theropoda) from the Lower Cretaceous of East Sussex - a proximal partial tibia has been discovered in the Samuel Beckles (1840-1890) collection of Hastings Museum and Art Gallery. It was probably collected from the Hastings Group (Berriasian-Valanginian) and in the Hastings area, but its precise origin remains unknown. The author concludes that it is an allosaurid more closely related to Allosaurus and Neovenator salerii than to sinraptorids and other basal allosaurids. However, its morphology suggests that it is not referable to N. salerii and that it probably represents a different form of derived allosaurid with more robust limb bones, possibly Becklespinax altispinus, but as this taxon is based only on dorsal vertebrae, this hypothesis is presently untestable.

Proceedings of the GA and History of Geology Group (Geological Society) joint meeting on “The Amateur in British Geology” (2002) provides four more papers in this issue:

In Henry Hugh Higgins and Frederick Price Murrat: the reluctant paleobotanists and the Ravenhead collection. Alan Bowden and Wendy Simkiss introduce us to the work of two non-professional paleobotanists. The educator and natural historian, Rev. H.H. Higgins (1814-1893), instituted a ‘rescue’ collection of material from the Ravenhead Railway Cutting, near the village of Thatto Heath, Lancashire, during its construction in 1869-70. The site transected two coal seams, the upper of which (Upper Ravenhead Coal) contains what is now known to be a Westphalian A flora. At the time of collection, however, the taxonomic classification of fossil plants had not been fully established, and the site provided valuable new material (e.g. linking for the first time the Calamites stem with its root stucture, previously named Pinnularia on the basis of isolated specimens).

F.P. Murrat (1820-1904), a conchologist and former bryologist, extended Higgins’ work to describe and identify many new genera of plants with fern-like leaves, a task made complicated by the fact that many specimens from the cutting occurred as detached leaves. The material (now in National Museums Liverpool) represents one of the best collections of fossil plants to have been discovered in Lancashire.

Bryozoans and corsetry: the palaeontological work of George Robert Vine (1825-1893) of Sheffield by Patrick Wyse-Jackson, Caroline Butler and Tom Sharpe, introduces us to the work of G.R. Vine, by profession a corset- or stay-maker but also keen naturalist who, from the late 1870s, specialised in the study of Carboniferous foraminifera and fossil and Recent bryozoans. With his son, he sold micropalaeontological specimens to augment his income. His name is today principally linked with the stenolaemate Order Cryptostomatata, which he erected in 1884.
Stephen Donovan describes the work of Charles Taylor Trechmann and the development of Caribbean geology between the wars. Trechmann (1884-1964) is best known to British geologists for his studies of the Permian (Zechstein) and Pleistocene of northeast England, carried out in the summers during the 1920s-30s, but he spent the winters in the Antilles (West Indies) islands, particularly Jamaica, and wrote many papers on the palaeontology, biostratigraphy, tectonics, metamorphism and volcanism of the islands. His studies of their Cretaceous and Cenozoic benthic mollusc faunas are still standard references for many areas and stratigraphic units. However, some of his ideas, e.g. the proposition that tidal action could be an important tectonic force in mountain uplift, were regarded as eccentric. In an interesting aside, Donovan informs us that Trechmann was a considerable geological philanthropist – many of his gifts now reside in the Natural History Museum, London, but next time you attend a GA meeting in Burlington House, recall that it was Trechmann who donated John Cook’s famous painting ‘Discussion of the Piltdown skull’, which hangs above the east staircase, to the Geological Society.

In The amateur in Lake District geology, Alan Smith recalls the contributions made by Johnathan Otley (1766-1856), John Boulton (1790-1873), John Ruthven (1793-1868), John Postlethwaite (1840-1925), Charles Edmonds (1885-1964) and Edgar Shackleton (1903-1991) to unravelling the complex history of this area. His paper provides a most useful precursor to David Oldroyd’s book-length study of geological research in the Lake District (Geological Society memoir 25) published this year, despite its 2002 date.

Professor William Antony Swithin

Sarjeant (1935-2002) is an obituary written by myself. It was a fascinating task to record the life and work of a colourful, and often controversial, figure whose geological interests embraced palynology, palaeoichnology and the history of geology, but who was also a field naturalist, archaeologist, bibliophile, local historian, folk-singer, musician, Sherlonian scholar and novelist.

The issue closes with a short note by Richard Forrest recording Evidence for scavenging by the marine crocodile Metriorhynchus on the carcass of a plesiosaur and a report by Eric Robinson, Field meeting: winter on the Somerset coast, 14-16 February 2003.

Richard J. Howarth

The Earth: A Very Short Introduction,
by Martin Redfern
141 pp, paperback, £6.99,
ISBN 0-19-280307-7,
published by Oxford University Press in their Very Short Introduction series (more details from www.oup.co.uk/vsi)

"This is not a guide to rocks and minerals and geological map-making," the author makes clear at the beginning. "It is a portrait of a planet." And a very clear portrait it is too. The first chapter introduces us to the solar system and the natural processes and cycles of rocks, gases, climate, currents, earth, and weather.

It is a pity we have to wait till Chapter 2 to read about the scale of geological time, because this is what to me, as a non-scientist, is really mind-boggling. The chapter covers the dating of Earth, the geological column, mass extinctions, the relationship between climate change & Earth, and the start of life. It is followed by chapters on deep Earth (more amazing statistics!) and the sea: the ocean ridge system, mantle plumes, the sea bed, ocean movements and more. This leads to sections on drifting continents, plate tectonics (some particularly spectacular facts here), volcanoes, and finally earthquakes.

The book contains line drawings, diagrams, charts, photographs, statistics and suggestions for further reading. There are some colourful metaphors to help us understand geological processes (most of them connected with cooking). There are also some fascinating deductions - like how the Earth's temperature is calculated.

The book's sober cover does not do justice to the exciting content, the drama of the geological processes, the scale of geological time, and the amazing facts quoted. I had no idea that there are fossilized imprints of raindrops in 3-billion-year-old sediments in India, for instance; nor that, if the Straits of Gibraltar were sealed off, the Mediterranean would evaporate in about 1000 years; or that there are bacteria living under the sea floor in rocks over a hundred million years old ("they don't exactly lead exciting lives..."). We end with the reassuring fact that a major earthquake in Tokyo could cause enough damage to cause the collapse of the global economy. (Never mind: in 5 billion years' time the sun will expand so much that the world will become uninhabitable anyway.)

There are some wonderful descriptions: how diamonds are formed by material travelling through the lithosphere at 70 kph; how the Alexander Terrane split from Australia 375 million years ago and made its way to Alaska, possibly via California; and how a 40-metre tsunami stranded a steamship deep in the jungle. But by far the most graphic description is a simple statement of the geological processes ("The most ancient continental rocks have been reworked, folded, fractured, buried, partially melted, folded and fractured again, and shot through by younger intrusions, that it is hard to make sense of them.")

Martin Redfern produces programmes for the BBC Radio Science Unit, and is clearly used to making science accessible to the public. The book is lucid, literate & very readable, with a beautiful clear layout. The facts and figures quoted are, as I have said, stunning - but the style remains factual and dispassionate. (Are professional scientists so accustomed to things on this scale that they are no longer amazed? If so, it's we amateurs who are the fortunate ones.)

That apart, some attention to terminology would be good - subduction is mentioned on page 41, but not explained for another 30 pages - and a glossary would be helpful, given that this is a book for beginners. But that is a detail. This is a super book which makes you want to know more.

Julia Spencer
ENCyclopedia of sEdImENTS anD sEDIMENtARY ROCKS

Edited by Gerard V. Middleton

Well, how does one set about reviewing a thick and heavy tome comprising over 253 articles compiled by 193 authors? Perhaps a good starting-off point might be to select those articles on topics with which one has become familiar over the passage of time and see if they stand up and have been given reasonable treatment. But firstly, we need to determine what is the target audience for the book and then see if the quality of the articles is appropriate for the designated readers. According to the dust covers, the encyclopedia provides a comprehensive reference work on most aspects of sedimentary rocks for students of Earth Sciences, academics, and professionals, as well as informed lay readers. I certainly would have welcomed such assistance in compiling student essays long ago, especially with the up-to-date bibliographies. As far as lay readers are concerned I am not so sure, informed or not. The 'going' is hard technically.

Three main themes are covered — Geochemistry, mineralogy, and petrology; sedimentary environments and facies; and sedimentary processes, though in several of the articles aspects of all three are discussed. The sequence of topics is strictly alphabetical, commencing with 'Algal and Bacterial Carbonate Sediments through to Zeolites in Sedimentary Rocks and usually each is admirably cross-referenced to related fields of knowledge. For example, the first article is cross-referenced to 'Bacteria in Sediments', 'Microbiologically Induced Sedimentary Structures', 'Reefs' and 'Stromatolites'. The last article has six such, but there can be as many as sixteen, thus helping any prospective user to widen his understanding of a particular aspect of sedimentology. Generally the articles are of good quality though I must admit that the ones on Chalk and Lacustrine Sedimentation were a bit disappointing, in not being comprehensive enough. I was surprised that the text or bibliography of the latter did not mention Lacustrine Petroleum Source Rocks, a Geological Society Special Publication (1988) comprising a compendium of some 26 papers. An even bigger surprise is the absence of an article on coal. Coal Balls are discussed but not coal. Possibly coal petrology and sedimentation are out of fashion at the moment. While mentioning this it is curious that oil-shales, an economically valuable resource if only of yesteryear, merely get a four-line mention in an article on Kerogen. The Eocene Green River Formation of the Mid-West states gets the briefest of nods elsewhere. So, there are, inevitably I suppose, omissions but which only slightly detract from the designated comprehensiveness of the encyclopedia. These omissions, incidentally, also include the almost non-appearance of cheniers and chenier plain deposition with just nine lines in 'Coastal Sedimentary Facies'. Considering that the author is U.S.-based (more than half of the authors are located in North America) this seems barely adequate for a major sedimentation feature of the Louisiana coastal zone. But all these are very minor nit-picking points in a splendid volume that has much to offer even to hardened professionals in the academic and commercial spheres. Everyone needs to polish up occasionally their knowledge of sediments and sedimentary processes. How about Clathrates, Extraterrestrial Materials in Sediments, 'Features indicating Impact and Shock Metamorphism', 'Glaucopy and Verdin' and 'Goethemrite Characteristics of Sediments' for starters?

Very occasionally, a bit of light relief appears amidst the scientific somberness of the articles. In 'Forensic Sedimentology' a police officer looking at a suspect's clothes observed 'that is the worst case of dandruff I have ever seen'. It proved not to be dandruff but diatomaceous earth essentially identical to the insulating material of a safe ripped open the previous day (by our captive friend)!

I think most people are interested in biographies of distinguished scientists who have helped to shape the subject over the decades, so a section dealing with a certain number of such makes good reading. Henry Clifton Sorby, Ralph A. Bagnold and Robin G.C. Bathurst are the British representatives, though a case could be made for John Murray of Challenger fame, who moved to Scotland in 1858 at the age of 27, and Philip H. Kuenen of turbidity current fame, who was born in Scotland and lived there for five years. Maybe that is stretching it a bit.

So, what overall conclusion is arrived at with regard to this new book? I believe that it has been a worthwhile enterprise, a worthy companion to the several other encyclopedias emanating from the same source. Well-Illustrated throughout, though no colour, well-written by the numerous authors and certainly authoritative in style and content. The editing and pulling together of the various articles from so many sources must have been a major headache at times, so congratulations to everyone involved. The price may well be beyond the means of students, especially in Britain, but Earth-Science Libraries should order it now, assuming they can afford it too!

Trevor Greensmith
NEW TENERIFE GUIDE

Tenerife, a mecca for sun-loving tourists, is by far the largest of the Canary Islands and is of outstanding interest in being dominated by the world's third largest oceanic-island volcano Teide, which rises some 3718 m above sea-level and more than 7.5 km above the adjacent ocean floor. To visit the sulphurous summit of the stratovolcano, Pico del Teide, via cable-car and preferably on a clear day, is an unforgettable experience with magnificent views not only of the flanking and massive collapse walls of the Caldera de las Cañadas and the relatively young lava flows, sands and gravels occupying much of the caldera floor but also, some 90 km away to the southeast, the prominent volcanic island of Gran Canaria. Structural collapse of volcanic edifices is no stranger to the Canaries archipelago and there are several prime examples of these in Tenerife, also evidence of massive avalanche deposits which are now known to extend for several kilometres off-shore and have been produced at intervals during the geological history of the island.

The oldest volcanic rocks of the island are predominantly varieties of basalt intruded by dykes and phonolitic plugs about 12 to 4 million years old outcropping at the western and northeastern ends. Originally the three main outcrops were probably separate islands but, about 3 million years ago, they became progressively linked by a prolonged major phase of volcanism during which the Caldera and ultimately Teide were formed. The later rocks are much more varied in composition and structure and include a range of ashes, lapilli tuffs, pumice, basalts, trachytes and phonolites laid down by a range of processes including airfalls, ash-flows and lava flows. The whole of the central part of the island became in effect a veritable infernal of all aspects of volcanic activity and all these are examined in the course of 8 days' worth of visitor-friendly itineraries. The 107-page Guide, a completely revised second edition now in colour, has been compiled by Robin Gill and Matthew Thirlwall and is an absolute must for anyone even remotely interested in volcanoes.

Geologists' Association Guide
No. 49: Tenerife Canary Islands.
ISBN 0-900717-50-5; £11 for Members; £15 for non-Members

Trevor Greensmith

This guide is illustrated in colour throughout and shows the spectacular coloured features of the volcanic rocks. The picture to the right is only part of one illustration and shows a section of a scoria cone with a weathered top overwhelmed by basaltic lavas of the Old Basalt Series of the Anaga Massif, at the southwest end of the Playa de Anaga, northwest of Santa Cruz. The figures to the bottom left give the scale.

GEOLOGISTS’ ASSOCIATION GUIDES

All the following guides are available in person or by post from the Geologists’ Association Office at Burlington House, Piccadilly, London W1J 0GU.

All the prices shown include post and packing (Overseas add £1).

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6 Liverpool (1982)
Above: Overturned limestones, shales and bentonite within the Aymestry Limestone Formation in the Abberley Hills with the youngest beds to the left.

Above: Dingle Quarry (a RIGS) in the Precambrian of the Malverns showing a dolerite dyke below cutting diorites and granite with pegmatite veins.