



# The Black Country Geological Society

It is with regret that we have to announce the departure of one of the leading members of the Society. Peter Knight has gone into business on his own - opening a fashion menswear shop in Edgbaston. As the setting up and running of the shop became more than a full-time job, Peter has had to leave the ECGS.

He joined us in 1979 going on his first field trip in the Black Country six years ago. He became progressively more involved by joining the committee and running the book and specimen sales at indoor meetings, where his efforts have greatly helped the Society's finances. Peter is an avid fan of the Jurassic and has become something of an expert in his chosen field. He can be seen in Dorset every year cycling around his favourite county looking up old and new sites, and adding wherever possible to his magnificent collection of fossils and to his already extensive knowledge. On this score we are sure that much more will be heard of Peter Knight in the future.

He was also involved in the first stage of the setting up of the geological trail at Cotwall End but as one door has closed for us another one has opened and we are very lucky to have another young, enthusiastic member in the Society who is taking over where Peter left off. Graham Whorton is a more recent member but is now on the committee and has taken over the sales at indoor meetings. He has also taken over completely the running of the Cotwall End project (which will continue as soon as the winter is over).

Long may Graham be with us, and let us hope that in the not too distant future pressures will ease for Peter thus enabling him to return to us. In the meantime we offer our thanks to both these young men whose enthusiasm and drive help to maintain the vitality of the Society.

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## Forthcoming Meetings:

February 24th - Monday: Talk by Mr. W. G. Hardie on "Geology of Kenya."

March 17th - Monday: A.G.M. plus film "The Earth, our Inheritance."

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Indoor meetings are held at the Saracen's Head, Stone Street, Dudley. 7.30 p.m. for 8 p.m.  
For field meetings, those who would like lifts, please contact Nigel Bradley.

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The Society does not provide personal accident cover for members or visitors on field trips. You are strongly advised to take out your own personal insurance to the level which you feel appropriate. Schools and other bodies should arrange their own insurance as a matter of course.

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*Chairman*  
A. Cutler B.Sc., M.C.A.M.,  
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*Vice Chairman*  
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P. D. Shilston M.A., C.Eng.,  
F.I.E.E., M.I. Mech.E.

*Field Secretary*  
N.G. Bradley

Programme 1985:

February 24th - Monday. Talk by Mr. W.G. Hardie "Geology of Kenya." Bill Hardie has now retired from being Senior Lecturer in geology at Birmingham University. His special interests include petrology and volcanic studies. Members will remember his exciting account of the G.A. trip to western U.S.A. and can look forward to another absorbing evening with this account of the G.A. visit to Kenya.

March 17th - Monday. A.G.M. followed by the B.P. film "The Earth, our Inheritance."

April 20th - Sunday. Field trip to the south Shropshire orefield, led by Mr. Stuart McNicol. Meet 10.30 a.m. at The Bog Field Studies Centre, grid reference SO 355980. This is reached from the A488, two miles E. of Shelve.

May 12th - Monday. "Aspects of Trilobite Geology," talk by Dr. A. Thomas of Aston University.

June 15th - Sunday. Field trip to The Potteries, North Staffs., led by Dr. L. Boardman of the National Coal Board. Meet at 10.30 a.m. at Mow Cop Folly, grid reference SJ857572.

June/July (date to be arranged) Weekend field trip to Llangollen with Birmingham University Extramural Dept. Accommodation in hotel.

September 7th - Sunday. Field trip to Charnwood Forest, led by Dr. T. Pharoah of the British Geological Survey. Dr. Pharoah is currently working on the concealed Precambrian geology of the Midlands.

October 5th - Sunday. Field Trip to Staple Edge, Forest of Dean. Joint trip with the Shropshire Geological Society.

November - Meeting to be arrange.

December 8th - Monday. "New Zealand Geology and Scenery." Illustrated talk by Shiela Pitts, based on a five week tour of North and South Islands.

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Evening Field Trip to Wrens Nest.  
June 17th, 1985. Leader Paul Shilston

Wrens Nest is the most important site in the Society's area and is always worth a visit. It is even more attractive now because of the energetic restoration of the site by the Warden and his helpers, who have cleaned up the area and greatly improved the steps and footpaths.

In addition, an observation platform has been built opposite one of the "Seven Sisters," giving a good view of the face and enabling people to see right into the cavern. Now that the Seven Sisters are dangerous and have been fenced off, this platform offers the best view available.

This evening field trip was just an informal tour round the main geological features of the Wrens Nest. The area is easy to interpret since the physical relief closely matches the geology, and because as an old quarry site there are many extensive exposures.

The tour first visited the old quarry and the Nature Conservancy Council's trench on the eastern side near Wrens Nest Road. This shows the complete sequence from the Wenlock Shales at the bottom, through the limestone horizons to the overlying Ludlow Shales.

Next the party crossed the hill and inspected the Seven Sisters impressive pillar-and-stall workings in the Lower Quarried Limestone with the roof formed of a massive limestone band, now badly weathered and unsafe.

Moving southwards we went to the southern limit of Wrens Nest Hill, which gives an extensive view of the area and of Dudley Castle in particular. The return route down the eastern side of the hill, along the line of the Lower Quarried Limestone, has been greatly improved by the Warden and his team, with new steps and renovated pathways. This provides an interesting walk and passes a number of scree sites with the possibility of finding in-

teresting fossils.  
And so back to the starting point -  
an interesting trip around one of  
Britain's classic geological sites.

Paul Shilston:

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Several members have asked me  
whether Margaret Oliver would be  
giving any account of her Ph.D  
research, so I asked her to write  
a summary for us. She has kindly  
tried to squeeze several years  
effort into an account suitable  
for the newsletter. Her notes on  
the talk she gave to the Society  
in November will follow in a later  
issue. - Sheila:

The Analysis of Spatial Variation  
of Soil in the Wyre Forest.

The earlier part of my project was  
concerned with examining different  
approaches to classification using  
statistical methods. A non-  
hierarchical optimising clas-  
sification was the most successful  
and divided the 201 soil profile  
into six groups. The second part  
of the work focused on the spatial  
aspect of soil variation. Tradition-  
ally this has been analysed and  
represented by spatial classifica-  
tion in which the mapping unit  
represents a particular type of  
soil. The variation of individual  
properties of the soil can be  
determined by interpolation, and  
this can be mapped by isorhythms,  
which are lines joining places of  
equal value.  
Spatial mapping by classification  
or interpolation depends upon the  
ability to predict the soil type  
or individual values at unsampled  
sites from those at sampling points.  
This reflects a characteristic of  
most spatial variables known as  
spatial dependence, whereby nearby  
points are more likely to be similar  
than those further away. For sound  
prediction sampling points should  
be spatially dependent, and sampling  
intensity should correspond with the  
degree of spatial variation at the  
level of the investigation. The

relationships are usually defined in-  
tuitively by an appraisal of the  
complexity of the relief and  
vegetation.  
My initial sampling was not specific-  
ally directed towards mapping, but I  
used the information to experiment  
with a statistical method of spatial  
classification. The non-hierarchical  
classification was modified to take  
the spatial position of the sampling  
sites into account and to apply  
contiguity constraints so that nearby  
sites were more likely to be similarly  
grouped so that the groups covered  
reasonably-sized areas as an aid to  
mapping. A large spatial weighting was  
needed to improve the spatial coherence  
of the groups, but the degree of  
variation within the groups was so  
great that the result was a poor  
classification in terms of prediction.  
It was concluded that the sampling in-  
terval, on average 165m. was too large  
for the sites to be spatially dependent  
and thus for spatial classification.  
This sampling intensity is similar to  
that normally used in soil survey for  
general-purpose mapping.  
At this stage the emphasis of the pro-  
ject changed to determining the scale  
of spatial variation and an appropriate  
sampling intensity to map it. The  
methods embraced in Regionalised  
Variable Theory, developed by Matheron  
at the French School of Mines,  
Fontainebleu, can quantify precisely  
the scale of spatial variation. They  
were just becoming known in Britain at  
this time and were suitable for solving  
the problem in the Wyre Forest. It is  
necessary to know the approximate scale  
of variation to apply these methods suc-  
cessfully, therefore a two-phase  
procedure was needed. The first phase  
identified the approximate scale and the  
second phase the precise scale of  
spatial variation.  
I used a nested survey and analysis for  
the first phase. Nested or multi-stage  
sampling enables the variation at  
several scales to be examined  
simultaneously. Each stage in the  
survey represented a particular sampling  
interval. The underlying theory of the  
procedure is that the total variance of  
the sample incorporates some variation  
from each stage, represented by the  
components of variance. These can be

determined by a nested analysis of variance and they indicate which sampling interval or intervals account for most of the variation. My sampling design incorporated five stages covering sampling intervals of 6m, 19m, 60m, 190m and 600m. At stage one, nine sampling points were located at the nodes of a 600m grid. From each of these points nine more points were located 190m away in a random direction. From each of these 18 points a site was located 60m away randomly, and from the now 36 points a point located 19m away. At stage five only half the 72 points were replicated to reduce the sampling effort. At each sampling point a pit was dug and properties of the soil recorded at 0-5cm, 10-15cm, 25-30cm, and 50-55cm. The components of variance for each variable were determined and they showed clearly that over 80% of the spatial variation occurred over distances less than 60m. This is approximately the upper limit of spatial dependence. Thus the sampling sites of the first survey were well beyond the range of spatial dependence. A much smaller sampling interval than anticipated and than is normal in soil survey would be needed to ensure that the data were suitable for mapping. A substantial proportion of the variation also occurred within 6m and would be difficult to resolve. This survey identified the range of distances within which to concentrate a detailed spatial analysis using transect sampling and the analytical tools of Regionalised Variable Theory. The semi-variogram is the central tool of these procedures. It is a measure of how a property varies with distance and can be plotted as a graph against sampling interval. It was estimated from data recorded at 5m intervals along 500m long transects in three directions. The same set of properties were recorded as for the nested survey. Each property was examined individually, but their graphs have many similar characteristics. They

generally rise from the origin, more steeply for properties in the subsoil indicating more intense variation, and eventually flatten when the sampling sites are no longer spatially dependent. These graphs identified the average range of spatial dependents as 40m. This correlates fairly closely with the average spacing between the lithological units of around 50m. Thus the geology exerts a fairly strong control on the pattern of soil variation in the Wyre Forest in terms of the soil morphological characteristics. The semi-variograms were used to assess the optimal sampling intensity for interpolation; for precise estimation it would need to be 20m. Thus to map individual soil properties in the Wyre Forest would require an enormous sampling effort. The shape of the semi-variograms suggested that the variation is composed of transition features, i.e. areas of different types of soil, and that the soil changes more rapidly in some places than others so that soil boundaries could probably be identified. Therefore, spatial classification seemed likely to be worthwhile and might require less sampling effort. Two approaches to spatial classification were examined along one 500m long transect, the spatially weighted procedure mentioned earlier and statistical segmentation, which identifies the most significant changes in soil type. Thirteen boundaries seemed to subdivide the transect optimally, but there was still considerable variation within some of the segments. Although the soil varied more rapidly in some places than others the pattern that emerges was that the variation from place to place was fairly continuous. It is possible to relate sampling intensity to the risk of missing a boundary so that sampling can be optimised. For a risk of missing one boundary in ten in the Wyre Forest it would be necessary to sample every 20m. Hence using spatial classification to represent the variation would not result in any saving in sampling effort. The soil of the Wyre Forest is extremely variable both spatially and in terms of its properties. It is far more variable than seemed likely from examining the

landscape and vegetation at the outset. It would require an enormous sampling effort to resolve the spatial variation for precise mapping. In areas such as the Wyre Forest a conventional sampling intensity would be inadequate and it might be more sensible to map a small part of it accurately to show what is happening elsewhere, rather than the sort of approximation that would be inevitable otherwise. This study has shown clearly the importance of determining the scale of spatial variation before planning a sampling strategy for general mapping.

Margaret Oliver:

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Lickey Hills Field Trip:  
November 17th 1985:

The leader was Dr. Richard Hamblin of the British Geological Survey. Although currently surveying the continental shelf around St.Kilda, Dr. Hamblin has spent some years mapping in the Midlands, including the Lickey Hills area.

We met at Warren House Car Park, and commenced by walking SSE along the western fault defining the Lickey horst. The fault was apparent from its effect on topography and vegetation. The first exposure was in Barnt Green Volcanics, of assumed Precambrian age. These are much altered, steeply dipping tuffs and shales, in which trace fossils have been found. Next, at Reservoir Road Quarry, we were able to see the lowermost Lickey Quartzite, here very purple due to its volcanic ash content. This is assumed to be Cambrian, but contains no fossils. The folding and fracturing seen here may be related to the nearby Rednal Fault. A more typical exposure of Middle Lickey Quartzite was seen in the Rednal Gorge.

Climbing Beacon Hill, we found exposures of Keele Beds (Upper Carboniferous) and Clent Breccia (?Permian). The Breccia consists of fragments eroded from Precambrian volcanic rocks. This material caps

many local hills, and is resistant by virtue of its permeability rather than its hardness.

After lunch the party drove to Rubery to see an unconformity between the Lickey Quartzite and Silurian Rubery Sandstone. The basal sandstone consists of rounded quartzite grains, and passes upwards into shales. Fragments containing Llandovery fossils were found in the scree. Our final site was at Wildmoor, the type area for the Wildmoor and Bromsgrove formations (both Triassic and perhaps better known as the 'Upper Bunter' and 'Lower Keuper' respectively). A discussion followed of the characteristics of braided river deposits. The two formations are brought together by a fault which has only recently been revealed by quarrying. The fault is therefore not shown on published 1/50,000 maps, but appears on the new 1/10,000 maps, copies of which we were able to inspect. We are grateful to Dr. Hamblin for an absorbing day's geology, enjoyed in bright November sunshine.

Nigel Bradley:

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Exhibition:

The Human Story: At the Commonwealth Institute, Kensington High Street, London, until Feb 23rd. An unusual exhibition with many special events. From early man to the far future. School parties, 10p. each to adult price £1.00. Daily 10.00 a.m. to 5.30 p.m. Sunday 2.00pm to 5.00 p.m.

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Staffordshire Nature Conservation Trust:

Brown End Quarry, Waterhouses, was visited by the BCGS in May 1985 on the North Staffs. trip. The trust are appealing for funds for its purchase. Donations please to Alan Dean, Campanula, St. Michaels Road, Penkridge, Staffs.

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Independent Broadcasting Authority:

Plans for local radio are being considered, and views are welcomed. Paul Shilston has application forms for tickets for the meeting on 11th February at Wulfrun Hall, Mitrefold, Wolverhampton at 7.30 p.m.

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Record of the Rocks:

The FCGS is a recording unit for the National Scheme for Geological Site Documentation. Members are encouraged to remember how useful it is if they can provide information about new exposures, changes in old ones, or other information about geology. Apart from teaching use, national organisations such as the National Coal Board, Gas Board, and airport enquiries use the information.

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For Sale:

Roy Prigg has a number of items for sale. These include laboratory and field equipment and geological specimens and slides, glassware and chemicals.

Apply:- The Lodge, Pitmaston Court, Goodby Road, Moseley, Birmingham B13 8RJ.  
Tel: 021-449-3492.

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University of Bristol Courses:

1. Brittany-Normandy, C85 K001 SJR  
March 21st/25th. St. Malo region.
2. Cretaceous of S.E. England,  
C85 K001 SJ. May 24-26th.
3. Dorset Coast, S85 D013 SJ. One  
day based at Lulworth, 22nd June.
4. Pembrokeshire, C85 G001 SJ. Long  
weekend 7th/9th March.
5. Isle of Purbeck, D85 G001 SJ.  
Long weekend 28 Feb./2nd March.
6. North Somerset Coast,  
S85 D001 SJ. One day 1st June.
7. Hebrides and N.W. Scotland, two  
weeks in early June.

8. Iceland. 12 day field trip, by  
minibus. Approx. £700.

9. Paris. November weekend.  
Mineralogy specimens. Ask Anne  
Harrison!

Details of all these from Department  
of Extramural Studies, Wills  
Memorial Building, Queen's Road,  
Bristol BS8 1HR.

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Geologists' Association Excursions:

Arran, April 7-14th.  
Seychelles, August 8-28th.  
India, December.  
Details from Secretary, Geologists'  
Association, Burlington House,  
Piccadilly, London W1V 9AG.

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Field Secretary:

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Tel: 27-4916.

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University of London Excursions:

Isle of Wight, April 18-20th: St.  
Davids, Pembrokeshire, May 2-5th:  
Ashford, Kent, July 19-26th:  
Details from University of London,  
Extramural Department, 26 Russel  
Square, London WC1E 5DQ.

BLACK COUNTRY GEOLOGICAL SOCIETY.

Notice is hereby given that the eleventh annual general meeting will be held on Monday 17th March 1986 at 8pm at Saracens Head, Stone Street, Dudley.

AGENDA.

1. Apologies for absence.
2. Minutes of the AGM held on 18th March 1985.
3. Statement of accounts and Treasurer's report.
4. Chairman's annual report.
5. Election of officers and committee.
  - (a) Chairman
  - (b) Vice-chairman
  - (c) Hon.secretary
  - (d) Hon.Treasurer
  - (e) Conservation secretary.
  - (f) Field secretary.
  - (g) Three committee members.
  - (h) Hon.Auditor.
6. Annual subscription rate for 1987.
7. Any other business.

The retiring officers and committee are :

Chairman	A.Cutler
Vice-chairman	Dr.P.G.Oliver
Hon.Secretary	P.D.Shilston
Hon.Treasurer	Mrs.A.Harrison
Field Secretary	N.G.Bradley
Committee members	J.Easter      Mrs.H.Logan S.Hughes      P.Knight

## SUBSCRIPTIONS 1986

Membership subscriptions are now due, and should be paid to the Hon.Treasurer :

Mrs.A.Harrison  
15 Duncombe Grove  
Harborne, Birmingham B16.

Subscriptions can also be paid at any meeting.

**SUBSCRIPTION RATES ARE AS FOLLOWS :**

Individual membership	£6 per annum.
Family membership	£8 per annum.
Student membership	£2.50 per annum.
Associate/group membership	£15 per annum.