NEWSLETTER NO. 115

FEBRUARY 1996

The Black Country Geological Society

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 accident insurance to the level you feel appropriate. Schools and other bodies should arrange their own insurance as a matter of course.

Leaders provide their services on a purely voluntary basis and may not be professionally qualified in this capacity.

The Society does not provide hard hats for use of members or visitors at field meetings. It is your responsibility to provide your own hard hat and other safety equipment (such as safety boots and goggles/glasses) and to use it when you feel it is necessary or when a site owner makes it a condition of entry.

Hammering is seldom necessary. It is the responsibility of the hammerer to ensure that other people are at a safe distance before doing so.

FUTURE PROGRAMME

Lecture meetings are held in the Banquet Room (Dudley Suite) at the Ward Arms Hotel, Birmingham Road, Dudley. Phone: (01384) 458070. 7.30 p.m. for 8 o'clock start.

MONDAY 19th FEBRUARY. 7.45 p.m. ANNUAL GENERAL MEETING (see notice in the December newsletter). All posts of officials and committee members are up for annual election. Any nominations for election should be given to the Secretary or can be declared at the AGM.

Followed at 8.00 p.m. (approx) by a lecture "Tales of a travelling geologist" by Graham Hickman (Society member/British Petroleum).

We are delighted to welcome as our speaker GRAHAM HICKMAN who is one of our long standing members, joining as a junior in 1978 and keeping up his membership ever since, even when living abroad. In his work for British Petroleum he has lived, among other places, in Egypt and Houston, Texas, and has travelled to Kenya, India, Japan, Gulf of Mexico, Alaska ....., and now living near London he is coming up specially to speak to us. In the lecture Graham will describe some of his experiences as a geologist and will also cover some of the techniques used in the search for oil.

MONDAY 18th MARCH. Lecture: Mass earth movements, climatic changes and civil engineering: recent catastrophic mass earth movements in North Wales. By Dr. Ken Addison (Wolverhampton University/St. Peters College Oxford).

Ken Addison writes: " In North Wales in June 1993 heavy rainfall on the plateau surfaces, limestone cliffs and steep slopes of the Great Orme near Llandudno triggered slope failures at 30 sites. Overland water flow and eruption of new springs initiated debris flow, debris slides, rockfalls and mudslides. This led to a complex pattern of failure which severely damaged Marine Drive, closing it for 9 months with a loss of toll revenue and involving costly repair.

Erosion of the slopes revealed a complex and highly variable assemblage of angular limestone rubble, glacial sediments, tufa, buried soils and slopewash, indicating a series of mass earth movements over a long period of time during and since the Late Devensian cold stage.

In this lecture I will investigate the geotechnical aspects of the slope failures and propose an environmental reconstruction of the 1993 (and earlier) mass earth movements here and in Snowdonia. They have implications for future engineering and landscape management of the Great Orme, Marine Drive and A5 reads, and other British montane slopes.".

KEN ADDISON is Senior Lecturer, School of Applied Sciences, University of Wolverhampton, and Supernumerary Fellow & Tutor in Physical Geography, St. Peter's College, Oxford. He has made a special study of North Wales geology and in particular its glacial history, and has written several guides and booklets. A selection of these will be on sale at the meeting.

APRIL - DATE TO BE ADVISED. Weekday visit to Winsford Salt Mine, Cheshire.

THURSDAY (note THURSDAY) 25th APRIL. Lecture: "Monitoring active volcanoes: procedures and prospects". By Dr. W. McGuire (Centre for Volcanic Research Cheltenham & Dept of Geological Sciences UCL). Members of the Geological Society of London (West Midlands Regional Group) will be joining us for this meeting.

Bill McGuire writes: The importance of reliable volcano monitoring is illustrated by the number of deaths caused by eruptions in recent times; over 28,000 in the last decade and some 260,000 since 1700 AD. Population growth in underdeveloped countries, where most hazardous volcanoes are located, results in a dramatic rise in the numbers of people occupying danger zones. To counteract this threat monitoring programmes are being developed for previously unmonitored high-risk volcanoes, and the effectiveness of existing programmes is being increased.

Monitoring seismic activity and ground deformation continues to form the mainstay of volcano surveillance programmes, but increasing use is made of new techniques involving the measurement of gravity and magnetic variations, and the changing compositions of volcanic gases and ground waters. Earth observation satellites play an increasing role, gathering data on a number of topics including the composition, growth and evolution of gas and ash plumes, the detection of thermal changes which might indicate future activity, and the remote measurement of ground deformation.

DR. McGUIRE is probably this country's foremost volcanologist. He is Visiting Professor of Volcanology at University College, London, Head of the Centre for Volcanic Research at Cheltenham, Chairman of the Volcanic Studies Group of the Geological Society, and UK

Representative of IAVCEI (International Association of Vulcanology and Chemistry of the Earth's Interior).

His research interests are ground deformation and magnetic monitoring of volcanoes; volcano instability; volcanic hazards and their mitigation; volcanics and climate change. He has worked on Mount Etna for 19 years and also has research programmes in the Canary Islands and on Piton de la Fournaise volcano (Reunion Island, Pacific Ocean).

SUNDAY 19th MAY. Field meeting to Wirksworth, Derbyshire. Leader: Kate Ashcroft (Society member).
Meet at 10.15 a.m. at the National Stone Centre (grid ref: 284553) situated on the B5035 Ashbourne to Wirksworth road, just east of its intersection with the B5023. The Centre has a large car park on the south side of the road, i.e. the right hand side if approaching from Ashbourne.

There is access to some spectacular quarries which enable one to study Carboniferous shelf limestones and to compare sedimentation features inside a lagoon, on the reef and from deeper water beyond the reefs. The overlying Grits can be studied at Black Rocks.

HARD HATS ARE REQUIRED FOR THIS FIELD MEETING.
Members must provide their own.

Hammering is restricted to loose material. All attending will be required to sign an indemnity form on the day.

MONDAY 17th JUNE. Evening field meeting to Saltwells Nature Reserve. Leader: Alan Cutler (Society Chairman).

MONDAY 1st JULY. Evening field meeting to Kinver. Leader: Alan Cutler (Society Chairman).

SUNDAY 14th JULY. Field meeting to The Roaches, north Staffordshire. Leader: Don Steward (Stoke-on-Trent Museum).

SATURDAY 7th - FRIDAY 13th SEPTEMBER. British Association Annual Festival. Held for 1996 in Birmingham. Details available from BAAS Office:

Fortress House
23 Saville Row
London W1X 1AB
phone: 0171 494 3326

SUNDAY 29th SEPTEMBER. Field meeting to Alderley Edge, Cheshire, for Triassic strata and an underground visit to one of the copper mines. Leader: Tony Browne (Manchester Geological Association).

MONDAY 7th OCTOBER. Lecture: Underground limestone mining in Shropshire by Dr. Ivor Brown (Consultant).

Editorial

Pondering how to get more people to contribute to the newsletter so that it will retain its freshness I was grateful for a new puzzle from 'Tamia'. It's a very good crossword but somewhat easier than most we've published. Do try to solve it if you have time. (I do appreciate that most of you are very busy!) But what a wealth of talent we have among our membership. Thank you to all who have contributed in the past year.

Scottish poet Hugh MacDiarmid frequently used geological imagery in his poetry for example read 'Crystals like Blood', 'On a raised beach' and 'The North Face of Liathach.' I'm intrigued by the ideas and imagery in his poems, as in this very short one:

On the Ocean Floor

Now more and more on my concern with the lifted waves of genius gaining
I am aware of the lightless depths that beneath them lie;
And as one who hears their tiny shells incessantly raining
On the ocean floor as the foraminifera die.

Reports

Thrust tectonics and piggyback basins in the Western Spanish Pyrenees by Dr. Jonathan Turner (Birmingham University), 27th November 1995.

A topographical map of the western Mediterranean reveals a string of mountains from North Africa through Spain to Italy, with the Pyrenees forming on of the components of the Spanish sector. In his lecture Dr. Turner outlined the tectonic movements relating to the Pyrenees, reminding us of the basic principles of mountain building, and explaining in detail some of the structures resulting from the various thrust sheets including the formation of piggyback basins at their top levels.

The Pyrenees were formed in the Miocene/Pliocene as the Spanish plate first pivoted with the opening of the Bay of Biscay and then was pushed under Europe by the northwards advance of the African plate. There were substantial sedimentary deposits on the sea-floor before the collision of the plates and it is these rocks which now form much of the Pyrenees. They include thick shelf carbonates, corals, marine clastics and marine/alluvial fan deposits. It is estimated that 150km of the Spanish plate is under Europe with consequent thickening of the crust in this area.

We were reminded of the principles of isostasy whereby a continental mass of low density material floats on the higher density lithosphere. Where there are high mountains on the continental surface there is a corresponding thickening of the underside to provide the necessary increased buoyancy, and similarly as a mountain is reduced by erosion there is a corresponding uplift due to isostatic action. Because of the continuous processes of erosion and uplift, older rocks in the core of a mountain are gradually exposed, and the sequence of strata that composed the mountain is shown in the adjacent sediments; this sequence is often the best evidence of the original structure of a mountain rather than studying the core itself.

During mountain building as a result of plate collision, thrust sheets can develop as older and younger strata are thrust above/below each other, and this occurred during uplift of the

Pyrenees. The behaviour of a thrust belt can be likened to a wedge of snow in a shovel pushed on a garden path, the angle of taper of the deformed edge is critical, and as pressure continues it collapses on itself. The subsequent uplift and the folding caused by the various thrust forces in different directions with resultant major faults has produced some very complicated structures.

Basins can form and then fill whilst being carried on top of active thrust sheets (*thrust-top or 'piggyback' basins*) and their development depends on the evolution of the thrust system. Basically the shape of a basin depends on the degree of flexure of the underlying crust or base, a stiff base produces a shallow spreading basin whilst a flexible base produces a deeper narrower basin. During its development a basin normally commences as relatively wide and shallow, then as the thrust action causes shortening of the strata it will become narrower and deeper in its upper section, so giving a characteristic profile. In the Pyrenees thrusting and folding has produced such basins - Dr. Turner cited in particular the East and West Jaca Basins (see fig. 1) - and these have then been filled with sediments from erosion as the thrust and folding continues.

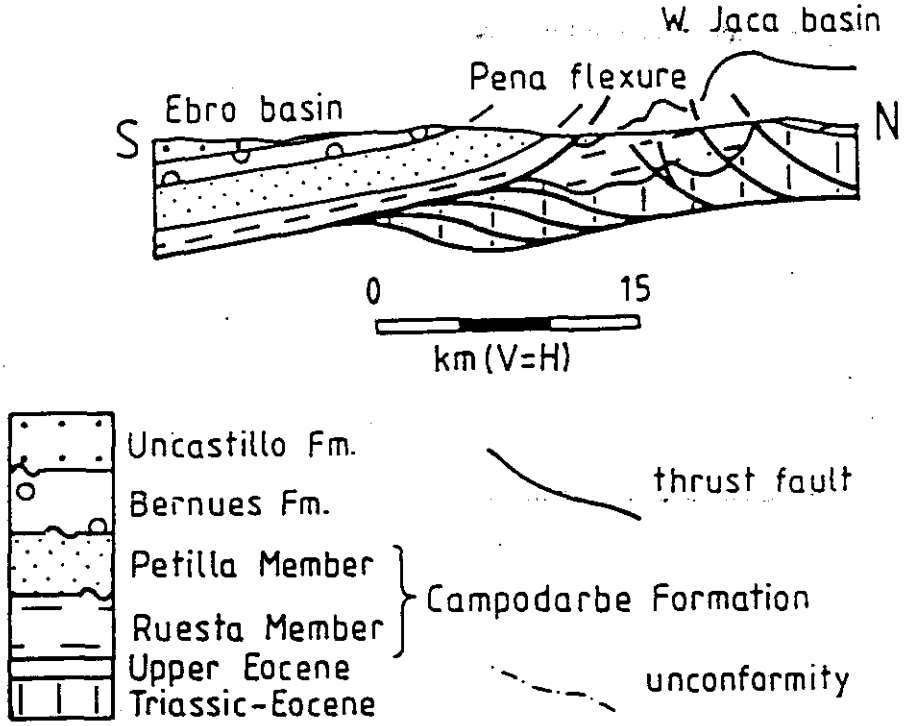


Fig. 1 section showing thrust faults in West Jaca Basin

The Ebro basin, to the south of the Pyrenees, was relatively undeformed but the tectonic movement caused it to become a continental landlocked area. At that time its drainage was internal to lakes while the River Ebro now drains into the Mediterranean having cut a channel through the coastal mountains. The area has many braided streams full of rounded conglomerates which could not possible have been transported by the existing river and the inference is that these rocks were deposited by a fast flowing river prior to the collision of the plates, and that erosion since the collision has removed the overlying cover.

The lecture was a very interesting exposition of an area which had not previously featured in our programme and we are grateful that Dr. Turner was able to speak to us.

Dennis Wood

The Great Dyke of Zimbabwe by Dr. J.I. Langford (Reader in Crystallography in the School of Physics and Space Research at Birmingham University). 15th January 1996.

Much of Zimbabwe is high veld country, at an altitude of 3000-5000 ft. It is generally rather flat but is crossed from north to south by the Great Dyke, a low ridge up to 300 ft above the surrounding country extending 320 miles in length and 2-7 miles in width. The Dyke, along with the Great Wall of China, was visible to the first Lunar landing team and the Landsat satellite pictures show it clearly.

The high veld generally consists of Archaean granites and schists of 3500-2700 My age. It is well mineralized with about 40 minerals identified. The Great Dyke is strictly speaking not a true dyke but a "linear series of differentiated mafic and ultra-mafic lopoliths" that is, saucer shaped intrusions largely of ferro-magnesium-silicate minerals. The intrusions were emplaced 2600 My ago. There are at least 4 centres of magma along the line of the dyke, the magma spreading in a long line of fissures. Bore holes drilled 10,000 ft into the lopoliths show 12 cycles of cooling with no chill zones between, so the intrusion stayed hot and plastic between cycles. As each intrusion cooled, olivine crystallised first, then pyroxenes with gabbros at the end of each cycle. This results in sequences of 1) Serpentinite, pale green olivine-rich soft rocks based on sheet silicates together with chromium and <5% of accessory minerals; 2) Pyroxenite, darker, harder rocks having chain silicates units and 3) Gabbros derived from olivine-basalt. The large weight of plastic intrusion caused the layers to slump towards the source as they solidified forming saucer-like synclines which, as they cooled, were faulted longitudinally and transversely to form a graben structure. The mineral sequences are exposed at the sides of the graben.

Chromite, $FeCr_2O_4$, a dense mineral having spinel structure, is found at the base of the serpentinite layers 10-20cm thick, the serpentinite layers usually being about 1.6-1.7m thick. The whole body of chromite is the world's largest deposit and is mined for use in stainless steel. Chromite is probably the largest export of Zimbabwe.

The various rock layers in the line of low hills of the dyke can be readily seen since little vegetation grows on the serpentinite due to trace elements such as nickel, but the pyroxenite supports lush vegetation.

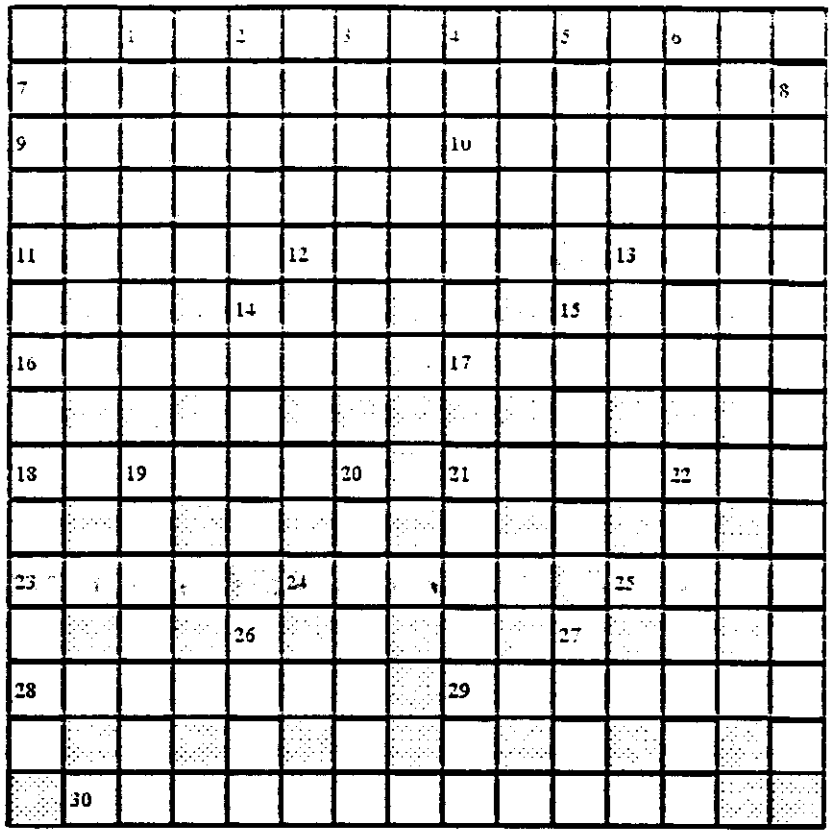
The larger mines are owned by Anglo-America or Union Carbide. The method of mining is simple, the outcrops of Serpentinite are located near the magma origin. The layers dip down the syncline at about 30^0. The soft serpentinite is mined out exposing the chromite layer underneath. Various levels are mined 15m apart, the lowest being 180m deep. Ore and waste are put in separate cars, the ore being brought to the surface for transport to a central crushing and treatment plant. The waste is used for back-fill and the excess tipped at the surface. Much of the mining is done manually, labour being plentiful.

Smaller mines are locally owned and run as co-operatives, mining is primitive with even less mechanisation.

One large mine visited by Dr. Langford was producing 6000 tonnes/month, about half of its capacity since sales had declined due to recession. There were 3 such mines and an unspecified number of smaller mines.

The Dyke is also rich in platinum minerals, but these have not yet been fully exploited.

A MAINLY GEOLOGICAL CROSSWORD compiled by 'Tamia'



ACROSS

1. A metamorphic rock of elongated and granular minerals. (6,6)
9. To reduce, possibly to a spray. (7)
10. Breccia is composed of these fragments (7)
11. The Geologists' Association joins in with benefit (4)
12. An activity to be listened to (5)
13. To use 26 down in an art form (4)
16. Acicular crystals developed this habit (7)
17. A soil subjected to the depletion of soluble minerals (7)
18. A spherical or elongated opening (7)
21. To combine with oxygen (7)
23. Glacial debris rejigged to form a rhythmic cadence (4)
24. One of these may be of special scientific interest (1,4)
25. A compound of other elements with hydrogen (4)
28. Pistachio coloured mineral; secondary product in igneous rocks (7)
29. He may live in 27 down or could be found in Europe (7)
30. Transport for sleeping equipment? (7,5)

DOWN

1. Black shiny mineral found in acid igneous rocks (7)
2. Lain badly on a sharp point (4)
3. Removal of an article from earl made a precious stone (7)
4. Drumlins are one of these deposits (7)
5. Ooliths are made of these? (4)
6. Brackish (7)
7. Suspended over a trough (7,6)
8. Sleeping gear laid out with the heavy items underneath (6,7)
14. Glaciers do this bravely (5)
15. A fundamental rock type (5)
19. This evaporite is a significant source of potassium for fertiliser (7)
20. These potentates used 26 down for decoration (7)
21. Scenic feature, partly formed without cropping, now has scanty vegetation (7)
22. Lean in towards the slope (7)
26. Not all that glitters (4)
27. A prolific non-metallic element combines with the indefinite articles to form a large continent (4)