NEWSLETTER NO. 144
December 2000

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. Phone (01384) 458070. 7:30 p.m. for 8 o'clock start.

MONDAY 29th JANUARY 2001 "Little Geophysics - looking at the top 100 metres" Dr I A Hill, Department of Geology, University of Leicester. The lecture is concerned with the common ground of engineering, archaeological, environmental and geological geophysics in the depth range 0.5 to 50 metreS.

WEDNESDAY 21st FEBRUARY 2001 Rockwatch Roadshow 10- 4pm at Walsall Town Hall, Lichfield Street. To be held in the February half term, this would appear to be an important venture. Take the children or grandchildren back to the Jurassic with a range of activities: model dinosaur claws, Velociraptor skull, fossil identification, construction of a Jurassic forest and much more.

MONDAY 26th FEBRUARY 2001 "Quaternary Topics" Dr D. H. Keen, Department of Geography ,Coventry University.

MONDAY 26th MARCH Annual General Meetin at 1.30 pm followed by "Bringing Dinosaurs to Life" John Martin, Managing Curator, Leicester City Museum

MONDAY 23rd APRIL "A Walk across the Mid Atlantic Ridge: A geological Guide to Iceland" P F Regan, Division of Earth Sciences, University of Derby.

MONDAY 21st MAY "The Geology of Eastern Europe" Dr Jan Zalasiewicz, Department of Geology, University of Leicester.

BCGS 25th Anniversary Lecture 25th Sentember 2000: 'Birmingham's Aquifers and Sustainability'. Professor Mackay, Head of the School of Earth Sciences and Professor of Hydrogeology, University of Birmingham.

In the course of the evening, Professor Mackay wore both his hats. He opened with a mini-lecture on the trends in the School of Earth Sciences and explained that the School offers six undergraduate degrees, two of which are Applied Geology and three combined degrees. There are three Applied Postgraduate Courses and research is organised into three Groups: Palaeobiology , Hydrogeology, and Tectonics and Basins. The perceived need of Universities to become more independent of State funding has fomented changes: the advent of powerful computers coupled with industrial requirements, for example in the search for petrochemicals, has resulted in a shift in the work of the Tectonics and Basins Group from observational Geology to modelling structures. The Palaeobiology Group has relevance for work in Genetics and the sphere the Hydrogeology Group was clearly demonstrated in the main body of the lecture.

As Professor of Hydrogeology he addressed the formal title of his lecture, changing patterns in the groundwater over the last two hundred years and of recharge over the complexly varying surface of the Birmingham area, substantiated by an exposition of the methodology applied by the School's Hydrogeology Research Group in their current study. Apart from numbers along parameters of graphs shown, Professor Mackay honoured his promise to banish mathematics from his talk.

Groundwater levels are rising in Brum because of decline in both groundwater abstraction and industrial use. An estimated 100 million cubic metres of water per annum could be available for abstraction if the water could be selectively extracted. The surface waters have been degraded by many pollutants including sodium hydroxide, sodium chloride, phosphates, nitrates, oil, wood preservatives, pesticides, detergents, surfactants and dispersants, a "nasty cocktail of chemicals", at greater depths there should be clean water. Unfortunately, extracting and using this clean water might cause the ingress of fouler water from above. Thus it is necessary to understand the vertical exchanges which take place and how different rates of drawing water affect leaching and chemical exchanges between different depths. What has been attempted has been an elucidation of flow pathways in textured porous rocks as well as quantification of micro-scale geo-chemical variations in and between sedimentalogical facies and their impact on the large scale rock/fluid/solute interactions.

Over the last ten years there has been little reduction in pollution levels in boreholes. 40% of identified pollutants still exceed World Health Guidelines for drinking water. In the seventies and eighties increases in the acidity of the groundwater speeded the dissolution of metals. However as the ph becomes more alkaline with time due to calcite dissolution, within fifty metal levels are expected to plummet. (Localised high density pockets are likely to remain in geo-cul-de-sacs by-passed by the main flow.)

The URGENT (Urban regeneration) project being undertaken by the University aims to produce models to simulate the evolution of the complex groundwater system which lies beneath Birmingham. The study investigates the sustainability of using Birmingham *aquifer.*

Modelling requires very detailed surface mapping using all available information sources. Different surfaces have different recharge potentials and chemical environments. Urban recharge systems receive direct precipitation, indirect recharge from rivers, canals, main sewers, septic and storage tanks and also water from deep percolation. Potential Recharge equations have been generated and the drainage characteristics of the soil is investigated with reference to hydrological soil group mapping to estimate the rate of potential recharge that will take place. Variations in drift geology naturally affects rates of recharge. Groundwater flow to the River Tame is very heterogeneous: there are areas of high flow where the system gets flushed out rapidly and areas where flow is very sluggish and where pollutants get trapped.

Having predicted the average movement of water and pollutants through the system the researchers attempt to refine the model, The Triassic san one is fractured. The chemical environment and exchange capacity within the system and also the extent to which fluid flow is controlled by fracture or by creep through the matrix must be investigated. Effects on flow brought about the frequency of fractures can cause water to by-pass the chemical processes that could occur in the main body of the rock.

The Research Group is a studying the speed and nature of fluid and contaminants movements on a smaller scale. Five boreholes were drilled outside of the School of Earth Sciences Building on the University Campus under whose lawn were placed 250 mo isture electrodes to measure water infiltration, (despite a potentially NIMBY attitude of theUniversity Estates Management!) The chemistry and mineralogy of the rocks in the borehole were logged as was

the distribution of fractures. The low permeability of the beds of mudstone received special consideration in that they influenced the choice of depths at which readings of water pressure were made and 'where discrete water samples were taken in order to make measurements of the tracer compounds which had been injected Tracer tests monitored the horizontal and vertical flows. (Environmental regulations restricted the options of tracer compounds which could be used for flow tracing.) Cases cited were injection at 46 metres with sampling for detection at 52 metres. Surprisingly it was found that flow down through four metres of mudstone was registered after 45 minutes, clearly suggesting the existence of rapid flow through vertical fractures in the mudstone. Most diffusion appears to be fracture to fracture. We were shown printouts of analyses and graphs only a few days old, of readings from the work done at boreholes. Basically the research has shown that even the clay beds in the sandstone aquifer can pass water vertically and quickly. They are not the good 'seals' that they were thought to be.

Today less pollution is getting in to the system as new clean technology replaces the older industries. But the legacy of the past is there. Remediation has not yet had a major effect on contaminant levels in the aquifer. The pollutants have been there for 50 years. They have reached remote crevices and 'will flow back slowly. Restoring to health the Birmingham aquifer is a big job. It took fifty years to get the pollutants in. It will take fifty years to get them out.

CL.F.M, K.MA. & G.W.

23rd October Volcano: "Subaerial and Submarine Volcanic Phenomena"
Dr P. Floyd. Department of Earth Science, Keele University.

To set the scene for this complex topic Dr floyd began by emphasising the significance of impacts in the early generation and storage of thermal energy within accreting planetary bodies, which has been sustained by ongoing radioactive decay, particularly of heavy radionuclides (U & Th). An Important aspect of this heat generation was internal melting, which along with density differentiation gave rise to a layered (core, mantle, crust) structure. Volcanic eruptions provide the only direct knowledge about the chemical nature of the Earth's interior to a depth of up to about 200 km. Greater depths can only be probed using geophysical techniques.

Alter generally reviewing volcanicity ova the Earth's surface (Ring of Fire, Island Arts, etc.), Dr Floyd described the various types of volcanic activity which he then went on to rationalise in terms of relief & fissure type; depth of magma source; lava viscosity, composition & volatile content as well as violence of eruptions: -

1. Shield Volcanoes (e.g. Hawaii) generally erupt vast amounts of low viscosity, fast flowing, basaltic (i.e. low silica) lava mainly from multiple fissures, quietly at 900-1150C. The succession of thin lava flows may cover vast areas up to 100 km. in diameter and often present a stepped profile (Trap basalts,2.. die Treppe=stairs) against the horizon. 'Aa' type lava contains little gas, hence flows relatively sluggishly and cools to firm a sharp, clinker crust beneath which a low density porous, vesicular basalt is often to be found. 'Pahoehoe' lava flows, on the other hand, contain a high % volatiles and therefore have a lower viscosity. These faster flowing lavas usually form a glassy veneer which "freezes" to form characteristic shiny "rope-like" shaped surfaces. In massive flow situations the thick lower, insulated, sections may develop 3D-columnar jointing -sometimes curved due to uneven cooling.
These mafic (basic) basalts probably originate in the upper mantle as deep "mantle plumes" which migrate, if at all, very slowly compared to rates of plate migration. This explains the link in the Hawaii Chain (HC). As the plume source slowly depletes so the chemical composition of the basalt gradually changes - as is also found along the length of the 'HC. When the plate carrying the volcanic vent has migrated well beyond the influence of the essentially static mantle plume so that its supp1y of molten magma has become cut off the area around the central vent then collapses to form a caldera several km. in diameter (e.g. Crater Lake in Oregon).

2. Acidic (silica rich) Volcanoes produce slow flowing viscous Al/Si rich lavas which give rise to high steep sided (strato) volcanoes (e.g. Mt Fuji.) which comprise alternating layers of tephra (solid ejecta) and solidified lava usually with the well defined vents close to the summit. They occur where ocean crust is being subducted under continental crust into which the Al/Si rich solidifying magma rises, cooling slowly, to produce porphyritic granite plutons to be eventually uncovered by later erosion and weathering processes (e.g.. Cornwall & Devon Tors). These eruptions tend to be explosive due to rapid early escape of volatiles (Mt. St. Helens) partly because of the sudden drop in external pressure. Vast quantities of particulate material may be ejected into the atmosphere and even into the stratosphere (e.g. Toba, Krakatoa) to cause short term global cooling.

3. Intermediate (lsland Arc) Volcanism occurs when ocean crust is subducted under another, colliding oceanic crustal plate, producing a mid-ocean arc of islands (e.g. Caribbean, Indonesia etc.) which may develop and eventually merge to produce a mountain chain like the Andes. The intermediate andesitic lava which is produced often contains Na-rich plagioclase and Mg-rich pyroxene phenocrysts but no quartz.

4. Mid Ocean Ridge Volcanism occurs what plates are moving apart. Ocean crust is stretched, uplifted and is consequentially thinned. Hot, molten material from the mantle wells up to fill this growing shallow "dome" and creates new lithosphere by squeezing red-hot basaltic magma directly into the seawater (rather like toothpaste!). A glass skin forms immediately around the still molten basalt to form a pillow lava pile (e.g.. Anglesey) which defines a constructive plate margin. Iceland is unique in being a section of MOR which just happens to coincide with a mantle plume and consequently is above sea-level.

5. Black Smokers are probably not true volcanoes. They represent networks of ocean floor water conduits through which hot (<300C) saline water continuously circulates scavenging heavy metals from within the ocean bed. The Cu/Zn/etc. metal rich concentrate is ejected into very cold sea bottom water where the metals slowly accumulate as insoluble sulphide deposits. Black Smokers also represent a curious biological niche in which novel lifeforms can exist which do not seem to depend at all upon standard photosynthetic processes.

6. Continental Volcanism Hot spots (see 1) can occur under continental crustal regions, causing uplift and "doming" (e.g. Afar Triangle). Eventually this distortion leads to cracking of surface rocks and the formation of rift valleys which might become embryonic spreading zones if accompanied by the extrusion of basaltic magma. When a spreading centre passes beneath a continent, a similar situation obtains. Again, if great volumes of molten basalt flood lowland regions, followed by uplift, Plateau Basalts are formed (e.g.. the Deccan)

Deep Ocean Floor Drilling Project
Looking for magma/mineral sources in the oldest, (>200 Ma) known surviving section of ocean floor produced Cretaceous into Jurassic cores. One borehole entered a sea-mount containing pillows with associated glass shards, floor vesicular basalts as well as sane goethite which suggests the presence of "cold" smokers from Jurassic times.

Volcanic Activity in The Planets
Finally Dr Floyd described sane examples of extraterrestrial volcanism. Olympus Mons on Mars is the largest known shield volcano with a diameter >700 km. with the caldera rim rising to a height of 23 km. above the surrounding plains This indicates a very thick (c. 400 km.) & strong lithosphere able to support such vast structures - originally overlying a huge molten source. This suggests Mars was a "one plate planet" with a mantle plume piercing a fairly immobile lithosphere. Venus on the other hand displays lower relief with evidence for lava flows and "raft"-like features in what seems to be a young structure. Venus has no impact craters which suggests the surface has probably been turned over many times during the last 4 Ga. Io, one of Jupiter's moons, about the same size as Mercury & Moon, manifests an active geology at low temperatures based largely on a covalent geochemistry. Io is dominated by many volcanic features including shield volcanoes with calderas which are also eruption centres with debris reaching >250 km., and what appear to be dark red lava flows of molten sulphur (melting point 1l5C) over a pale surface of volcanic ash. This "cool" volcanic activity is possibly derived from heat generated by gravity-induced internal friction by the huge mass of Jupiter.

Alf Cole

'Dudley Gathering' Joint meeting between the History Of Geology Group (HOGG) of the Geological Society of London and theBCGS. 13th to 15th October 2000, held at Dudley Museum

About thirty society members and HOGG delegates gathered at Dudley Museum and Art Gallery in a convivial atmosphere on the evening of Friday 13th October 2000. This was a night of informal introductions over a glass of wine and a chance to see the trilobites on display and other exhibitions at the museum that was hosted by the society as part of our 25th year celebrations. A similar number gathered at the museum for the conference on the following morning to hear a varied programme of talks reflecting the great importance of the Black Country area in the development of the science of geology. Eminent speakers including Gordon Herries Davies, Hugh Torrens, John Fuller, Cohn Knipe and Michael Roberts were complemented by Alan Cutler and Graham Worton of the Society.

A very broad range of subject matter was presented. Among the topics discussed were; the histories of the Midland's geological societies, fortunes of Midland geological collections, journeys of discovery of geological greats like Adam Sedgwick and J Beete Jukes, and acknowledgement of the massive contribution of practical men such as Dud Dudley, James Ryan and Henry Johnson to the understanding of the Earth. This was a truly fascinating and inspiring meeting that pulled together the labours of workers in this area over a time span of more than 300 years. It was a humbling experience that testified to achievement in the face of great difficulties and often heavy human tragedy.

Personally I felt that one of the most intriguing questions of the day was posed by John Fuller's paper. He showed that Dud Dudley bad published the first tangible geological map of the area around Dudley Castle in 1665 in his famous work on iron smelting Metallum Martis. John went on to ask the question, 'What was the Royal Society's demonstrator and an engineer with expertise in hydraulics doing down a hole on the edge of Dudley in 1712, forty seven years after the publication of Dud's work?' He proposed that they had been addressing a hypothesis that had been put forward to explain the structure of the Earth in 1695 by John Woodward. Woodward's theory was that the primaeval Earth had a solid surface and that within it was an abyss, which contained the ocean waters. These waters burst forth in an event he called the universal deluge where upon 'the earth was taken all to pieces and dissolved'. He further postulated that when it settled down again, the heaviest parts sank to the centre of the earth and the lightest parts settled lastly and were therefore on top. John suggested that the reason that these two men were down a hole in Dudley, logging a coal mine for the densities of the different beds of rock was to test Woodward's hypothesis. He believed that they had read Dud's work and selected the site because there was no better place available to test it!

A buffet lunch was provided by the society, and at the end of the lectures the group braved the rains and headed down to the Black Country Museum to be taken into the Singing Cavern by the Dudley Canal Trust to hear further recollections of Black Country geology.

Sunday 15th saw a field excursion to Wrens Nest to round off what was a wonderful weekend of events that will be long remembered. Many thanks are due to all those involved in the weekend and especially to Alan Cutler for organising the conference programme, displays and liaison with HOGG.

It is intended that the papers presented at the Dudley Gathering will be published as an millennium/anniversary commemorative volume in the near future. Work has already begun and it is hoped that this will be ready for publication in 2001.

Graham Worton.

(I am told that many letters have been received complimenting members of the society, and Alan Cutler and Graham Worton in particular, on the arrangements for and the success of the HOGG meeting.)

EDITORIAL

In a few months time I shall have completed ten years as newsletter editor and feel that it is time someone else had the fun of the job. Yes, it really has been fun! Also I feel sure that many of us in time will receive our newsletter by e-mail. Perhaps the work of newsletter editor and website manager should be combined? Do any of our members have web-skills? Are any of our members willing to run our website? Amir Kanwar is asking this question. Also we shall need a new Field Meetings organiser at the AGM. Are there vacancies on the committee that you could fill? Please think about these matters and see if you can contribute.

CONSERVATION COLUMN

Update on The Black Country Geological Society Collection
About 350 specimens have now been given to the museum as part of the growing BCGS collection. The vast majority of this is from four engineering projects from which we were able to record and collect prior to loss of the sites. These are:-

Dibdale/Burton Road land reclamation site, Dudley which exposed a 20-40m section of the Middle Coal Measures strata of the area and yielded superb fish remains, plant and bivalve fossils of about 310 million years in age.
Bowmans Harbour land reclamation site, Wolverhampton, which exposed a slightly younger Coal Measures sequence and also yielded fish remains, plain and bivalve fossils.
Step-pit excavations, East Wrens Nest, Dudley. During engineering works to re-open this mineshaft to the caverns Silurian shales of the Lower Elton Formation (formally the Ludlow Shales, circa 415 million years) was removed and has yielded a very diverse shelly marine fauna including trilobites.
Dudley College excavations at the centre of Wrens Nest Hill, Dudley. Shales from the Coalbrookdale Formation (formerly the Wenlock Shales~ circa 425 million years) were recorded and sampled yielding a rich fossil fauna particularly rich in corals.

In addition to the fossil material, a small but significant reference collection of local rocks collected during conservation work (site recording) carried out for Dudley MBC during 1998/9 is now held at the museum. This is by no means a comprehensive collection and any additional specimens of typical rock types from any locations across the Black Country would be very welcome.

Another particular collection that The BCGS membership could help with is that of building and monumental stones. If you have any samples of rough or polished stones commonly found in buildings around the area that you could bear to part with I'd love to hear from you. So if you have any good material that you think might be suitable for the BCGS collection please consider bringing it to one of our meetings or to the museum.

West Midlands Regional Planning Guidance: Geological Conservation Policy West Midlands Regional planning guidance, which must be used by all Local Authorities when drafting planning policy for their particular areas, is under review. Changes to this guidance will be made in the next 18 months. These changes will include (for the first time) consideration of geological sites across the region. The region includes the counties of the West Midlands, Shropshire, Staffordshire; Warwickshire and Hereford & Worcester. Geological sites are being considered under the policy concerned with regional environmental assets.

We have been providing information together with our neighbouring counties and English Nature to ensure that the great importance of this region's geology is properly considered. This is a very significant development for protecting and promoting our geological heritage to planning professionals (who often have little or no interest or knowledge in geology) and marks a real change in the thinking of those responsible for nature conservation through the planning system.

RIGS Handbook Update
Two revised chapters of this have now been received from the Royal Society for Nature Conservation (RSNC). These update the list of contacts of RIGS bodies and also explain the planning process for those involved in trying to conserve geological sites. Eight more chapters are in their final draft and will be issued shortly. This is now a very comprehensive and useful document and a copy can be viewed at indoor meetings or at Dudley Museum. Copies are available from Ruth Capper at RSNC at £20.
Until next time... Graham W

NEWS IN BRIEF

New Members
King Edward VI College Stourlridge.

University of Nottingham School of Continuing Education Residential Field Courses:
Geology of the Three Peaks of the South Pennines (Kirkby Lonadale) 27-29 April & 29 April - 1 May2001
Landscape Evolution in Norfolk 8-10 June 2001
Geology and Flora of Western Ireland (S. Mayo, Connemara and the Burren) 19-25 May & 26-1 June2001
Geology in Fife and Angus 7- 12 September & 13- 18 September 2001
Study Tour of New Zealand February 2002
Details of all the above from Kathy Flewitt, Special Programmes, School of Continuing Education, University of Nottingham, Jubilee Campus Nottingham, NG8 IBB

Volunteers wanted
Paul Smith is asking for volunteers to help him open the Lapworth Museum at Birmingham University on Saturdays. Volunteers would be required to help for one Saturday per month. Contact Paul Smith on 0121 41444173

Editor K. M. Ashcroft
Hon. Secretary Dr Sarah Worton,

BLACK COUNTRY SITES No 8: Holloway Street, Lower Gornal, West Midlands

Situated approximately 2 km to the west of Dudley town centre is a large shallow abandoned sand pit with remnant long rockfaces scattered among the greenary and ponds of a park. The rockfaces are of Upper Silurian/ Lower Devonian deltaic cross-bedded sandstones of the Downton Castle Sandstone Formation (known locally as the Gornal Grit). The junction between the Downton Castle Sandstone and the underlying Turners Hill beds of slightly younger age is exposed behind factories on the opposite side of Holloway Street and also at the opening of a storm water pipe in the main quarry area. The Turners Hill beds are shales containing much primitive plant material and show that a quieter, less energetic sedimentary palaeogeographic environment existed immediately before the onset of Downton Castle Sandstone deltas. The best exposure is approximately l00m in length and can be found at National Grid Reference SO 9175 9195. (National Grid Reference SO 39175 29195) It is the best and only known example of the junction between the two geological units in the area and is in distinct contrast with the junction of the Downton Castle Sandstone at other nearby localities such as The Hayes Cutting at Lye or at Saltwells Local Nature reserve. This makes this exposure particularly important for understanding how changes occurred in this area at the onset of the Caledonian mountain building period. There is open access to the exposures from footpaths leading from Holloway Street and associated estate roads onto the green area. There is currently no open access to the exposure at the rear of the factory units and permission must be obtained from the occupiers to see these exposures. Some faces are now quite overgrown.