Newsletter No. 214

August 2012

The Black Country Geological Society

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Copy date for the next Newsletter is

Monday 1st October 2012

The Society provides limited personal accident cover for members attending meetings or field trips. Details can be obtained from the Secretary. Non-members attending society field trips are 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 at Dudley Museum & Art Gallery,
St James's Road, Dudley, DY1 1HU. Tel. 01384 815575.
7.30 for 8 o'clock start unless stated otherwise.**

Those wishing to attend field meetings please contact our Field Secretary, Andy Harrison, telephone: 01384 370 188, mobile: 0797 333 0706 or email: fieldsecretary@bcgs.info

Saturday 18th August *(Field meeting):* Wrens Nest and Dudley Museum, led by Graham Worton. Meet at Mons Hill Car Park, Wrens Hill Road, DY1 3SB at 10.00. Trip to visit the new features installed at the Wren's Nest through the 'Ripples Through Time' project (10.00-12.30). Then meet at Dudley Museum, St. James's Road, DY1 1HU at 1.30 for a guided visit to the geology collections from 1.30 - 3.30. Bring a packed lunch, or there are cafes/pubs in Dudley. This is a joint trip with the Shropshire Geological Society and with the Teme Valley Geological Society.

Saturday 6th October *(Conservation day):* Barrow Hill Local Nature Reserve. Pensnett, Dudley, next to Russells Hall Hospital, DY5 4JH. Mostly vegetation clearance, from 10.30 to 14.30. All welcome. Meet at the entrance on Vicarage Lane near St Marks Church. Bring a packed lunch.

Sunday 14th October *(Field meeting):* Charnwood Forest, led by Mike Allen. Meet at the services off the M1 junction 22/A511 at 10.00. We are going to visit several sites to see the Charnwood succession ending at Bradgate Park where Precambrian fossils may be seen at their best in low light at this time of day/year. Bring a packed lunch. Hi-vis jackets and hard hats **not** needed, but suitable footwear for possibly muddy paths advisable. Expected to end by 5.00pm.

Monday 15th October *(Indoor meeting):* 'The Geological Photo Archive of the Geologists' Association'. Speaker: Dr. Jonathan Larwood, senior palaeontologist, Natural England, Peterborough. The Geologists' Association has a long history stretching back to 1858. Throughout much of that history it has recorded its activities through written documents and captured its field excursions in many photographic formats including glass plates. This talk will delve into a 100 years of geology and geologists captured on film. Photographs of field trips in and around the Black Country will particularly feature, as will the way in which fieldwork has changed - and the fashions in geologists' clothing across the century.

Saturday 3rd November *(Conservation day):* Springvale Park, Wolverhampton. Vegetation and exposure clearance, from 10.30 to 14.30. All welcome. Meet at the end of Ettingshall Park Farm Lane just off A459, WV4 6SP. Bring a packed lunch.

Monday 12th November *(Indoor meeting):* NB Please note change of date. 'Next Steps for the Development of the Lapworth Museum of Geology'. Speaker: Jonathan Clatworthy, Director of the Lapworth Museum of Geology, Birmingham University. Over the last 5 years various ideas and bids have been put forward to develop and extend the Lapworth Museum of Geology. In June 2012 a large Heritage Lottery Fund (HLF) bid was submitted that has the potential to transform the Lapworth Museum and raise the profile of geology in the region, providing a new focus for public earth science in the nation's second city. This talk will show the vision that is hoped for and provide an exciting update on the progress so far.

Car Sharing for Field Trips

If transport is a problem for you or if you intend to drive and are willing to offer lifts, please contact Andy with at least 48 hours notice. We hope that this will encourage members to attend the more distant field visits.

Monday 10th December: ***(Indoor meeting, 7.00 for 7.30 start)*** **BCGS Members' Evening and Christmas Social.** This is our annual chance for members to share their geological experiences in a sociable atmosphere with Christmas buffet provided by the Society. Please get in touch with Graham at the museum (meetingsecretary@bcgs.info tel 01384 815575) if you would like to do a short presentation, or show some of your specimens etc.

Monday 21st January 2013: ***(Indoor meeting):*** **'The Mineralogy of Scotland'. Speaker: Roy Starkey,** President of the Russell Society and founder of the British Micromount Society. Roy writes:- Scotland is a country with diverse geology and scenery. Rocks dating back over 3 billion years are found in some parts of Scotland and these rocks (Lewisian gneiss) were at one time many kilometres deep in the Earth's crust and have subsequently been exposed gradually at the surface. We can recognise five separate and geologically distinct provinces in Scotland - the Lewisian gneiss and Torridonian of the North West; the Moine rocks of the Central and Northern Highlands west of the Great Glen Fault; the Moine and Dalradian of the Central and Grampian Highlands; the Midland Valley, and the Southern Uplands. These areas are separated by large faults - the Moine Thrust in the north-west, the Great Glen Fault, the Highland Boundary Fault and the Southern Upland Fault. A series of glaciations have dramatically shaped the surface rocks, giving rise to spectacularly varied scenery, especially in the Cairngorms and the west and north-west Highlands. The geological variety and vast differences in the age of the various rocks mean that Scotland's mineralogy is both diverse and interesting. This talk will seek to highlight some of the key areas of interest and hopefully provide the impetus for members of the audience to go and explore for themselves.

Red stilbite from Earlston Reservoir, Touch Hills, Stirlingshire

Events at Dudley Museum and Art Gallery

Rock and Fossil identification. Bring your rock and fossil finds along to the Museum and Art Gallery and have them identified by resident experts from **11.00 - 1.00** on **Wednesdays:** 15th, 22nd, and 29th August (Summer holidays), and 31st October (Half term), or the same time on **Saturday:** 24th November.

Saturday 22nd September 10.00 - 4.00: Magical Minerals and Fossil Fair. Admission free. Featuring a host of geological suppliers and rock and fossil dealers as well as the first sight of some of the new exhibitions being put together for the 100th anniversary celebrations on 12th December.

Wednesday 12th December: 100 Years of Geology at Dudley Museum & Art Gallery
Anniversary event celebrating 100 years of geology exhibitions, collections care, conferences and research contributions of Dudley Museum and Art Gallery. The evening will begin with a reception and short presentation, reliving the opening of the original geology gallery by Professor Lapworth in 1912. Then there will be a social gathering and 'conversatzione' to enjoy the new exhibitions and geological reminiscences of this special place, its special geology and those who have cared for it during the past 100 years. A detailed programme will follow in the October newsletter.

Other Local Events

Thursday 6th - Sunday 9th September: Wolverhampton Heritage Open Days. There will be behind the scenes tours of the art stores with the Collections Manager: Thu-Sat: 11am, 1.30pm & 3pm at Wolverhampton Art Gallery, Lichfield Street, Wolverhampton, WV1 1DU. Join the collections assistant to explore the **geology of the Black Country** through the collection. **(Note: Only available Thurs and Fri.)** Download brochure: www.wolverhampton.gov.uk/heritageopendays

Thursday 18th October: New Findings and Developments at the Wren's Nest. Talk by Graham Worton for the Wombourne and District Scientific and Natural History Society. 7.30pm at Wombourne Library and Community Centre, Church Road, Wombourne, WV5 9EZ. NB: BCGS members will be welcome, but there is a charge of £1.00 for visitors.

Saturday 17th November 10.00am - 4.00 pm: Wolverhampton Local History Fair, Molyneux Hotel Building, Whitmore Hill, Wolverhampton, WV1 1SF. BCGS will have at display stand at this event. **Volunteers are needed to help!** If you can spare any time on the day to help at this event, please contact the chairman, Gordon Hensman at: chairman@bcgs.info phone: 01384 256 423.

Other Societies

BCGS members are normally welcome to attend meetings of other societies, but should always check first with the relevant representative. Summarised information for the **next two months** is given in our Newsletter. Further information can be found on individual Society web sites.

Warwickshire Geological Conservation Group

Saturday 11th August - Visit to BGS Keyworth.

Saturday 1st September - Woodlands & Boon's Quarries, Hartshill. Meet 10.30 a.m at Woodlands quarry. Leader: Alan Cook. Joint meeting with NSGGA & Staffs. Geoconservation. At Woodlands, an opportunity to see some of the earliest shelly fossils in the record, followed by a visit to Boons where some of the Precambrian Caldecote Volcanics are exposed.

For details of venues/times contact Ian Fenwick swift@ianfenwick.f2s.com or 01926-512531.The WGCG mobile phone (07527 204184) available on the day from 11.00. There is a charge of £2.00 for non-members. For further information visit: http://www.wgcg.co.uk/

Shropshire Geological Society

Saturday 18th August: Wrens Nest, led by Graham Worton. *(See BCGS programme above.)*

Saturday 15th September (**day meeting): Breidden and Middletown Hills,** led by Andrew Jenkinson and David C Smith. Walking (two miles); some rough ground; bring your own refreshments, if required. Booking to reserve a place and obtain joining instructions from Eva Peringer; e-mail: pertam@evaperinger.plus.com; telephone: 01746 764 189

Anyone wishing to attend should telephone or email the co-ordinator for the meeting at least 48 hours in advance of the activity. A charge of £3.00 is levied for non-members. Further info at: www.shropshiregeology.org.uk/

Stamford and District Geological Society

Wednesday 12th September: Mineral Exploration in Greenland. David Howell - University of Leicester.

Sunday 7th October: Ashover Derbyshire. Leader Dr. Ian Sutton. Meet at 10.30 in the large public car park at Ashover Village Hall grid ref: SK 350 633. We will investigate the geology of the Ashover pericline. Lower & middle Carboniferous limestone & grits and Namurian shales, hydrothermal mineralization and fossils. Moderate amount of walking, mostly on paths also a visit to a disused quarry (take usual safety clothing) Lunch can be had at pubs in area or take packed lunch. Finish about 4.30. For all quarry visits hard hats, reflective jackets and suitable footwear is essential.

Wednesday 10th October: Goldilocks Planet: 4 Billion Years of Climate Change. Mark Williams - University of Leicester.

Meetings are held at Tinwell village hall, at 7.30 pm. Single meetings or visitors £3.00/£5.00
Further information at: www.stamfordgeolsoc.org.uk/

Herefordshire and Worcestershire Earth Heritage Trust

Rock and Fossil Roadshows:
Friday 10th - Sunday 12th August , 11 - 3, Bewdley Museum, Load Street, Bewdley, Worcs. DY12 2AE.

Monday 27th August, 11 - 5, Worcestershire County Museum, Hartlebury Castle, Hartlebury, Kidderminster. DY11 7XZ.

For further information visit their web site: www.earthheritagetrust.org/ or phone: 01905 855184.

North Staffordshire Group of the Geologists' Association

Saturday 1st September: Woodlands Quarry: SP 325 947. This disused quarry exposes a sequence of rocks laid down beneath the during late Precambrian to early Cambrian times, and is of international significance because of the early Cambrian fossils which are found here. Jee's Quarry: SP 333 940. A very large roadstone quarry situated on the B4111 some 3.5 km NW of Nuneaton.

Non-members pay £2 to cover temporary membership giving them insurance cover. A field fee of £2 per head is normally charged for members and non-members to cover leader's expenses. Further information at: www.esci.keele.ac.uk/nsgga/

Woolhope Naturalists' Field Club - Geology Section

Saturday 24th September: Cleeve Hill, Gloucestershire led by Dave Owen. Meet at 10.30am in Car Park Quarry (SO 989 272) on the top of Cleeve Hill. Bring a packed lunch and drink, also suitable clothing and footwear for this area of high ground.

Guests are welcome, but must take day membership of the Club: £2.00. Further information: Sue Hay on 01432 357138, email svh.gabbros@btinternet.com or visit their web site: www.woolhopeclub.org.uk/Geology_Section/default.htm

Manchester Geological Association

Saturday 6th October: 11.00 Pott Shrigley. Leader Paul Aplin. To examine the Lower Coal Measures, evidence of former coal mining and the relation between geology and scenery.

Visitors are always welcome. Please book in with Jane Michael if you intend to come along to any of the field events:- Telephone 07917 434598, email: outdoors@mangeolassoc.org.uk
Further information about meetings at http://www.mangeolassoc.org.uk/

Mid Wales Geology Club

Wednesday 15th August: ***(Evening Field Trip)*** **'Geology in the Park at Powis Castle, Welshpool'.** Meet at 6.30 p.m. in the Castle car park. It will last about one and a half hours.

Indoor meetings are in Newtown, at Plas Dolerw. Meet at 7.15 for 7.30pm. Further information: Tony Thorp (Ed. newsletter & Hon. Sec): Tel. 01686 624820 and 622517 jathorp@uku.co.uk Web site: http://midwalesgeology.org.uk

Have a look at our website at: **www.bcgs.info**

Editorial

This edition reflects the holiday season with two accounts of holiday geology. We hope this will encourage you to report anything with a geological flavour which has cropped up on your travels - anywhere in the world! Reports, short anecdotes, photos, amusing incidents or questions - please send them to the editor (details below). We'd love to hear from you - especially if you haven't previously sent anything for our newsletter. It's excellent news that our current membership figures have now exceeded 100, so there must be at least a few of you out there with an urge to write or share your photos!

You will see in this issue that the Society officers have new email addresses. Please use these in future. Emails will automatically be directed to the correct person.

chairman@bcgs.info	Gordon Hensman	secretary@bcgs.info	Linda Tonkin
treasurer@bcgs.info	Mike Williams	fieldsecretary@bcgs.info	Andy Harrison
meetingsecretary@bcgs.info	Graham Worton	newsletter@bcgs.info	Julie Schroder
webmaster@bcgs.info	Graham Hickman		

Please note also that there are **three events requesting volunteers.** Volunteering doesn't require any skill, previous experience or super-fitness - there'll always be someone there to point you in the right direction and make sure that you feel comfortable. We are planning to hold Conservation Days on the first Saturday of each month from October to March. (See p.2 for details of the October and November meetings.) The aim of these days is for our Society to play a part in the ongoing conservation of local geologically significant sites which have in the past been identified and recorded - to take a pride in our local geology and do what we can to keep nature at bay. These are opportunities for us to work together and get to know each other, to learn more about our local geology and to have fun! The first opportunity is at Barrow Hill (our very own volcano!). Although we've had one session there recently, there's still lots of work to do to reveal the geology in all its glory, so I hope that we'll have a good team to complete this work. But if this kind of volunteering doesn't appeal, then why not lend a hand at one of our less energetic events? Your Chairman is asking for assistance to help man the BCGS display stand on 17th November. (See p.4 above for details.) So have a go! If you have any queries about BCGS geo-volunteering, don't hesitate to contact Andy or Gordon for more information. ■

Julie Schroder

Field Meeting Reports

Tuesday 19th June: Dudley Tunnel and Caverns, Led by Graham Worton, Keeper of Geology, Dudley Museum and Art Gallery. This was a joint BCGS/ Geol Soc WMRG trip.

On a warm, cloudy evening members of the West Midlands Regional Group of the Geological Society of London and the Black Country Geological Society, met for an evening boat trip into the limestone caverns beneath Castle Hill, Dudley. The trip was organised through the Dudley Canal Trust and our skipper was Bob.

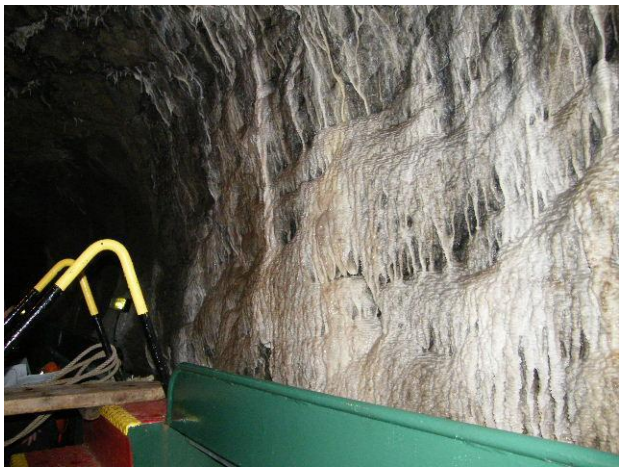
With a few words on health and safety from Bob we launched from the canal side and headed into the dark depths of the Dudley Canal Tunnels. Our route followed the existing tourist route through Lord Ward's Tunnel into the opening of Shirt's Mill Basin before continuing on to the Castle Mill Basin, a junction of canals including the Wren's Nest and the 1989 Tunnels. Continuing along the Dudley Canal Tunnel we entered the Singing Cavern, so called because of its acoustics. From the Singing Cavern we ►

returned via the Rock Tunnel, into the Little Tess junction with its mining exhibit and Blue Peter Plaque, before following the 1989 Tunnel back to the Castle Mill Basin and on to the Dudley Canal Trust Centre.

The Dudley Canal Network has a heritage dating from the Industrial Revolution and was constructed by the Earl of Dudley between 1775 and 1791, to transport raw materials, such as limestone and coal across the Black Country. Manned by a workforce of keepers and leggers, as many as five boats a minute passed through the Dudley Canal Tunnels at their height, the motorway of the day.

In 1849 Sir Roderick Murchison spoke to one hundred members of the British Association for the Advancement of Science and over a thousand locals in the Singing Cavern about the importance of the Dudley area and his new geological period, the Silurian System. The Singing Cavern's acoustic properties have made it a popular venue for weddings, concerts and numerous other events. In 2008 local children put on a geologically themed performance in the Singing Cavern, as part of the WROSNE Project. *(See Newsletter 195 for a retrospective account of this project. Ed.)*

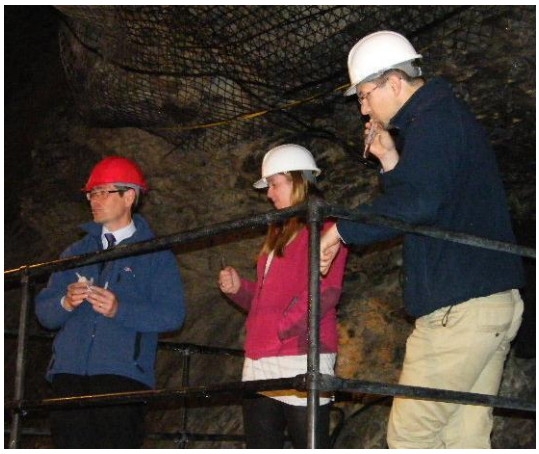
To construct the Dudley Canal Tunnels, vertical shafts were sunk to the water table. Navigators then excavated the tunnels horizontally until they joined up. The early tunnels were dug by hand, using little but shovels, picks and explosives, and the tunnel walls were supported with a lining of handmade bricks, produced by local women and children. Later on, egg-box reinforcing rings and shotcrete replaced the brick linings. In the more open areas of the Singing Cavern and the Castle Hill basin, rock bolts, wire netting and concrete retaining walls have been employed to stabilise weak strata. Vegetation clearance has also been necessary in some of the open air caverns, such as the Castle Hill Basin, which has gained the nick name – 'The Hanging Gardens of Tipton'.



Dripstone curtains

Castle Hill, Wren's Nest Hill and Hursts Hill are each periclinal, single fold, structures crossing Dudley. The Dudley Canal Tunnels are sunk through 400 feet of Wenlock Series strata beneath Castle Hill. Through Lord Ward's Tunnel, Castle Hill Basin and part way along the 1989 Tunnel the age of the strata increases through the Upper Elton Formation, Upper Quarried Limestone Member, Nodular Member and Lower Quarried Limestone Member to the Coalbrookdale Formation. The Shirt's Mill and Castle Mill Basins are cut into the Upper Quarried Limestone and the Lower Quarried Limestone Members respectively. Partway along the 1989 Tunnel, an illuminated area defines Castle Hill axial fault zone, beyond which the age of the rock strata becomes younger. Coating the tunnel walls and ceiling are white stalactites and curtains of calcitic dripstone where percolating water has breached the brick/shotcrete tunnel lining.

The singing cavern is cut from the Upper Quarried Limestone Member, a very pure bioclastic limestone rich in crinoids, or sea-lilies that formed within the active wave zone of a shallow tropical sea. In the Singing Cavern we were able to leave the boat and walk around. Graham demonstrated the chemical reactions involved during the dissolution of limestone and its reforming into calcite to form the stalactites and dripstone.



Graham's demonstration

Stratigraphically, below the Upper Quarried Limestone Member and forming the roof of the Singing Cavern, is the Nodular Member. This stratum comprises thin beds of limestone and mudstone, deposited in deeper lower energy conditions than the Upper Quarried Limestone. The small rounded limestone masses of patch reefs have been found in this stratum. ►

Greenish grey clay layers, or bentonite, within the Wenlock Series represent ashfall deposits from ancient volcanic eruptions. Such a layer sits between the Upper Quarried Limestone Member and overlying Lower Elton Formation, which belong to the Ludlow Series. Recent radiometric work on this bentonite layer has dated it to around 427.77 Ma. This is older than previously believed by a margin of 3 to 4 million years and has been confirmed through similar work in Norway.

Murchison stratigraphically described every fossil within the Wenlock Series strata and his work led to the discovery of 600 to 700 different types. These have been divided into more than sixty taxanomic groups and Dudley is the type locality for 186 species, of which 63 are found nowhere else.

From his discussions with local mine operators Murchison managed to assemble a collection of local fossils. After many years moving around and being left in dark rooms the collection finally found a home in the Dudley Museum and Art Gallery where it can be seen today.

The mineralogical wealth of Dudley and the surrounding Black Country cannot be underestimated. As well as limestone, sources of coal, ironstone, clay, seatearth and sand can all be found here. No glaciers were here during the last Ice Age and this resulted in the local geology not being covered in layers of glacial drift, making resources close to the surface and easy to reach. As a result, the area became a very important centre for industry and manufacturing, especially of iron goods.

Graham maintains that the area and caverns should be declared a World Heritage Site. Not only for its geological and industrial heritage, but because in principle it was the world's first industrial area.

Upon leaving the caverns and canal boat, the evening was finished in true geologist's fashion: beers and a buffet dinner laid on at The Park Inn pub.

Saturday 30th June: Haughmond Hill and the Ercall Quarries, Shropshire, Led by Bob Bucki (BCGS).

Haughmond Hill

Haughmond Hill quarry and transport

We met very early, 08:40, at Haughmond Hill Quarry car park on a cool morning with broken cloud, a light wind and showers all day. Since this is a working quarry, we had limited access to its southern end until 11:00 am. A fire engine, used for carrying people and equipment, transported us into the quarry where we were able to spend a couple of hours looking at various exposures.

The rocks of Haughmond Hill Quarry belong to the Longmyndian Supergroup, which comprise the Western Longmyndian - Wentnor Group and the Eastern Longmyndian - Stretton Group that were deposited at the end of the Precambrian around 565 Ma to 568 Ma. Regionally these rocks sit between two major NNE to SSW trending faults; the Church Stretton and the Pontesford-Linley Faults; and are well exposed to the north and west of Church Stretton. They generally comprise green, grey, purple and red sandstone, shale and conglomerate arranged in a large syncline.

The Wentnor Group is sub-divided into the Bridges Formation (purple sandstone), and the Bayston-Oakwood Formation (purple sandstone and conglomerates). The Stretton Group comprises the Portway Formation (green and purple sandstone and conglomerate), Lightspout Formation (grey and green sandstone and siltstone), the Synalds Formation (purple shales and sandstone), the Burway Formation (greenish-grey sandstone and shale) and the Stretton Shale Formation (greenish-grey shale).

At Haughmond Hill Quarry these Groups are only partly represented. We observed the Bayston Oakwood Formation and its basal conglomerate sitting unconformably over sub-vertical beds of the Synalds Formation. Missing from between these two Groups was the Lightspout and Portway Formations, which it is expected were removed during a period of uplift and erosion. The Bayston ►

Oakwood Formation comprises a thick layer of hard grey greywacke, quarried for roadstone, and separating two conglomerate layers. Black pitch, from later overlying coal measures strata, and skeletohedral crystals of calcite formed from carbonate rich fluids line the walls of fractures and joints that cut through the Bayston Oakwood Formation and the unconformity.

Skeletohedral calcite

Several theories surround the formation of the Longmyndian Supergroup. All appear to be centred on the idea of braided river systems eroding an ancient landscape and feeding into shallow water deltas and mudflats, possibly on the edge of a subsiding fore-arc basin close to a volcanic island arc. Later uplift and deformation resulted in the folding, faulting and calcite mineralisation that we saw within Bayston Oakwood Formation.

The Ercall Quarries, Lawrence's Hill Quarry, and Maddocks (Maddox) Hill Quarry

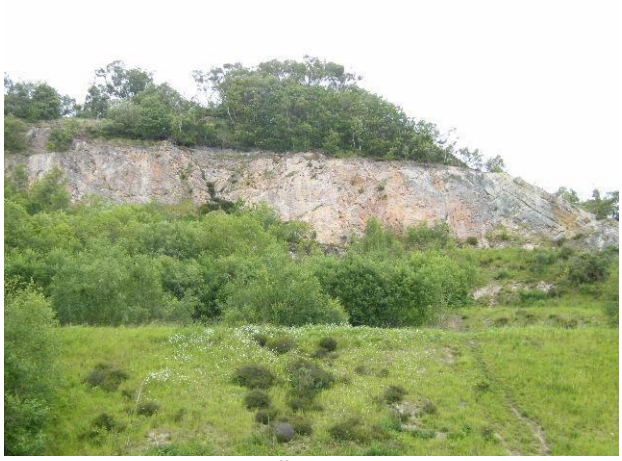
Upon leaving Haughmond Hill Quarry we stopped for a quick cup of tea at an adjacent picnic area before heading to Lawrence's Hill and the Ercall, situated approximately 1km south of the M54 Junction 7 in the shadow of the Wrekin. Parking at Forest Glen car park, we had lunch, before first visiting Lawrence's Hill Quarry, which is managed by the Shropshire Wildlife Trust. Next we headed northeast up the road where we got to see three of the five wooded Ercall Quarries, which twenty years ago were quite devoid of trees. Rock exposures within these quarries include Uriconican Volcanics and Wrekin Quartzite, which give a picture of events and environmental conditions across the Late Precambrian/Early Cambrian boundary, between approximately 566 Ma and 540 Ma. After the Ercall Quarries we made an unscheduled visit to Maddocks (or Maddox) Hill Quarry, situated to the east of the Forest Glen car park.

The Uriconian Volcanics are also of Precambrian age, pre-dating the Longmyndian Supergroup, and they form the Wrekin and Caer Caradoc. These rocks comprise a mixture of acid and basic volcaniclastic deposits that include rhyolitic lavas, ash fall deposits and tuffs. It is believed that they represent aerial fall deposits and flows that accumulated on the flanks of ancient volcanoes, within the same island arc setting where the Longmyndian Supergroup was deposited. The volcanoes resulted from one piece of oceanic crust being subducted beneath and overridden by another. The accumulated Uriconian Volcanic deposits were later transported down slope and fragments of rocks have been found within the Longmyndian Supergroup suggesting their earlier age relationship.

The sequence of Uriconian Volcanics exposured in **Lawrence's Hill Quarry** comprise lapilli tuffs at the base, overlain by a succession of volcanic breccia, flow banded rhyolite and amygdaloidal basalt. At the north-western margin of the quarry three dolerite dykes, discoloured from weathering to limonite, cut these strata. The lapilli tuffs at the base of the sequence comprised thickly bedded steeply dipping blue-grey and fine grained rock containing rounded clasts, or lapilli, of molten material.

An exposure of Uriconian Volcanics in **Ercall Quarry 1** comprised a grey and purple-brown flow banded rhyolite believed to have formed from sticky viscous lava or a nuée ardent-type high temperature ash flow. In places, devitrified spherical silica geodes gave the lava a spherulitic texture. These geodes resulted from rapid cooling and degassing, which produced gas bubbles near the surface of the flow. Secondary siliceous mineralisation later infilled the remaining cavity, from the outer edge inwards, leaving some of the geodes hollow.

Fine grained granophyres (granite plutons) later intruded the Uriconian Volcanic rocks. In **Ercall Quarry 2** we saw an exposure of orange-pink Ercall Granophyre that has been radiometrically dated at approximately 560 ±1 Ma providing a maximum age for the Precambrian-Cambrian boundary. Grey Cambrian Wrekin Quartzite unconformably overlies the granophyre and exhibits ripple marks on bedding surfaces that are indicative of a shallow marine environment during the early Cambrian. Fault plains, etched with slickensides, through the Wrekin Quartzite in Quarry 2 show dextral strike-slip movements of approximately 150m. The unconformity between the Ercall Granophyre and the Wrekin Quartzite comprised approximately 7m of yellow and grey basal conglomerate. Green-grey bands ►



Ercall Quarry 2

of clay, possibly weathered ash layers, approximately 6m above the unconformity have yielded acritarchs, which have been used to cross correlate the age of the basal Cambrian to approximately 543 Ma.

More ripples and faulting of the Wrekin Quartzite could be seen in **Ercall Quarry 3** where the quartzite grades into a darker grey. On the far side of the quarry was an exposure of the Comley Sandstone, which overlies the Wrekin Quartzite and contains fossils of sparse brachiopods and worm burrows.

Maddocks (or Maddox) Hill Quarry was situated at the end of a wooded track. The quarry is now disused and the quarry floor covered in trees, shrubs and open grassy areas, which included many unusual wild flowers such as bee and marsh orchids.

We saw two outcrops in the quarry. One outcrop was sub-vertical green-grey and dark red shale showing purple manganese weathering along cleavage and fracture plains. This outcrop was an exposure of Shineton Shales, which are of Ordovician age. It contains fossils of dendritic graptolites, a testimony to the deep marine origins of this stratum.

The other exposure we saw comprised red and black lamprophyre, which is an igneous rock containing no essential quartz or feldspar (plagioclase) and mostly comprising biotite, amphibole and opaque minerals like pyrite. The lamprophyre was later intruded concordantly along the bedding plains of the Shineton Shales.

The heavens opened around mid-afternoon when we returned to our cars. I would like to thank Bob for a very interesting fieldtrip. We will be visiting the Cambrian again during our early August visit to Caer Caradoc and Comley Quarry. ■

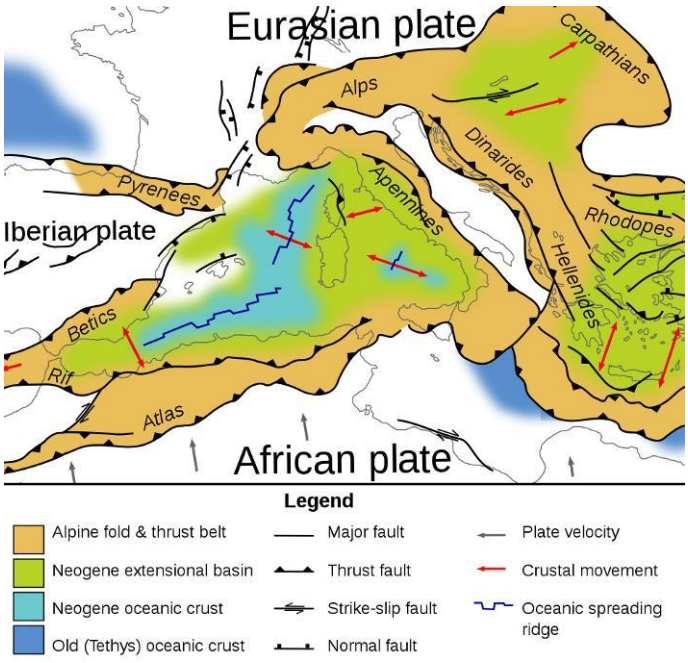
Andy Harrison

Volcano Adventure in Weather-beaten Italy

Part 1. The Bay of Naples and the Campanian Volcanic Province.

Geologically speaking Italy is dangerously unstable. It sits astride a tectonic collision zone within the Alpine orogenic belt, with intense activity occurring on all sides: to the west, small platelets jostle for position, while from the south the main African plate is moving northwards on its collision course with the Eurasian plate. To the south of Sicily, subduction of the last remaining fragments of Tethys ocean crust has given rise to the Aeolian volcanic chain north of Sicily. To the east of Italy, running from NW to SE and then through the southern end of its spine, a major collision front has created the Apennine range of mountains. And in addition to this, the entire Italian peninsula is rotating in an anti-clockwise direction.

All this - and a great deal more - I learned during the Geological Association's study tour in April to include Italy's five active ►



From a diagram by Woudloper, Wikimedia Commons

volcanoes: Somma-Vesuvius, Solfatara, Etna, Stromboli and Vulcan. The tour was based in three centres: Sorrento to study the volcanism around the Bay of Naples; Giardini Naxos on the east coast of Sicily near Mount Etna, and Lipari in the Aeolian Island arc, our base for visits to the islands of Vulcano and Stromboli. My husband, John and I met the other members of our group of 32 plus our leader, Paul Olver, at Gatwick airport. With the GA behind the arrangements, an experienced leader at the helm, plus a detailed schedule and study guide, all was set for a fortnight's action packed, hassle free enjoyment of Italy's geology, with generous helpings of archaeology and history thrown in for good measure. What could possibly go wrong? A major eruption? An earthquake? Well, nothing to do with Italy's turbulent tectonics as it happened, but a mixture of turbulent weather and local social unrest made for some serious creative thinking on Paul's part: plan 'B' and even 'C' strategies had to be employed on several occasions.

Oplontis - boundary between ash and pyroclastic flow

Naples greeted us with torrential rain, and the well-known majestic cone of Vesuvius was conspicuously absent. Paul gave us our first overview of the local geology as we negotiated the tortuous route to Sorrento. The Sorrento peninsula consists mainly of Triassic limestones, and we could see how these dip to the north, forming the southern end of a huge synclinal structure which underlies the Bay of Naples. We learned that Italy's volcanoes can be divided into 3 distinct regions: those of the Roman province to the north are now inactive; those around the Bay of Naples belong to the still active Campanian volcanic province, and the third province comprises Etna and the Aeolian islands.

The cloud level had risen to the level of a small cap on the summit as we approached Vesuvius for our scheduled visit the next day, but the darker clouds of social unrest confronted us as we made our way up the Torre del Greco. Here a police road block heralded the news that officials at the summit were on strike. There would be no access for visitors, and that was that. Plan B came into force: we would continue round to the northern side of the Bay of Naples and bring forward the next day's scheduled visit to the crater of Solfatara in the Campi Flegrei volcanic area. Soon thwarted again by a monumental traffic jam, Paul's quick thinking led to 'plan C', an unscheduled visit to the Roman Villa of Poppaea at Oplontis, which proved to be a highlight of our trip. Lying between Herculaneum and Pompeii, it is notable for the quality and extent of its surviving frescoes, but the excavation which brought it to light in the 1960's also reveals in spectacular cross-section the sequence of events which buried it in volcanic deposits during the Plinian eruption of 79AD. Before that most famous of all eruptions, Monte Somma dominated the skyline of the Bay of Naples, and was not thought at the time to be a active volcano. What remains today is the outer rim of Somma to the north east, with the new cone of Vesuvius (properly named Somma-Vesuvius) rising out of the old crater and dominating the view from the west. At Oplontis we could see in cross section the pumice and ash which fell during the first phase of the eruption, followed by the wave formations left by a highly energetic pyroclastic surge, then a great depth of subsequent pyroclastic flow deposits.

Amygdales of leucite

Our scheduled afternoon visit to Pompeii was made all the more meaningful as a result of our visit to Oplontis. During the eruption of 79AD it suffered a similar sequence of events to those at Oplontis, but this is better exposed at Oplontis. In Pompeii we examined the stones used in the Roman walls and roadway. Many of these are hewn from the lava of earlier eruptions, and frequently contain amygdales of the locally common mineral, leucite. Paul explained that this is a feldspathic mineral which occurs here as a result of the complex composition of the local magmas: they are unusually rich in potassium resulting in part from the alkaline composition of the basement rocks. Illustrating this point, a lava building block containing a limestone zenolith from this basement was conveniently visible within a nearby wall. The sun shone at last, and Vesuvius was revealed in its entirety, towering over the town which it destroyed but which, perversely, lives on as a result of that destruction. ►

A limestone zenolith

The rain came down in ceaseless torrents the next day and Vesuvius was still strike-bound, but our exploration of the Bay of Naples continued with the long drive round to the Campi Flegrei (Phlegraean Fields), the site of some monumental eruptions in the past. Pozzuoli harbour roughly outlines the northern section of a massive caldera formed during a catastrophic eruption about 12,000 years ago which produced the widespread Neapolitan Yellow Tuff (NYT) deposits. At Cuma on the coast to the west of the Campi Flegrei we saw the NYT formation dramatically exposured in and around the Caves of the Sibyl, which cut deeply into it. Prior to this eruption, around 39,000 years ago an even more massive eruption produced the Campanian Ignimbrite which showered pyroclastic fall deposits over a huge area of the eastern Mediterranean; these can be seen in the cliffs across the bay at Sorrento.

Somma-Vesuvius from Pompeii

Solfatara crater - note buildings on the rim!

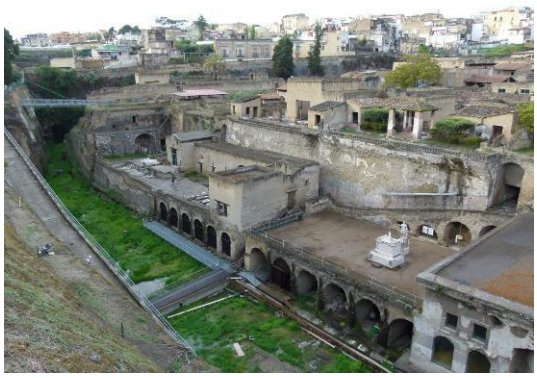
Today, the Campi Flegrei is pock-marked with numerous small craters marking a series of relatively small eruptions in recent times. The last substantial eruption occurred in 1537, creating the cone of Monte Nuovo, and since then the nearby crater of Solfatara has become the most active in the area. It is a scene of boiling mud pools on the crater floor, with fumaroles at the eastern end belching out a cocktail of noxious gases whilst beautiful yellow and orange sulphur deposits build up around the vents. But most amazing of all was the sight of buildings along the western edge of the crater! These are people's homes on the edge of a volcano that is very far from extinct! We'd already noted with some amazement that communities are thriving within the walls of seemingly inactive craters, and the main autostrada threads them together - tunnelling through the crater walls and across the crater floors with apparent indifference to the magma chamber seething below. Although activity in the Solfatara crater is closely monitored, such reckless building and complacency will surely lead ultimately to a human catastrophe of breathtaking proportions.

The Temple of Serapis (actually a Roman market place) in Pozzuoli harbour brought us face to face with the three columns famously illustrated in Charles Lyell's 'Principles of Geology' which provide vivid evidence for the phenomenon of 'bradyseism'. At about 3 metres above the current high water level, holes made by the rock-boring marine bivalve 'lithodomus lithophagus' extend upwards to the same level on each pillar. This means that the pillars have at some time been submerged to at least that level, with the lower portions protected from attack by accumulations of sediment. This uplift and descent of the land (bradyseism) is caused by the emptying and re-filling of magma chambers, and is a useful indicator for an imminent eruption. A period of uplift prompted an evacuation of Pozzuoli in 1984, but it proved to be a false alarm.

Above: Temple of Serapis in Pozzuoli
Right: Holes made by lithodomus lithophagus

More rain and strong winds the following day caused the closure of the hydrofoil service, and abandonment of our planned visit to the island of Ischia. Though disappointing, 'plan B' took us back around the rather depressing suburbs of Naples to Campi Flegrei for another chance to get to grips with the geology, and 'plan C' was an almost impromptu visit to Herculaneum on our return journey to Sorrento. This made good sense: originally scheduled for the day of our return to Naples later in the tour, that time could now be 'freed up' for Vesuvius, strikers permitting.

The excavated area of Herculaneum is much smaller than Pompeii, and more intimate - perhaps giving a better picture of ordinary life in a Roman port. We were now familiar with the sequence of ►



Herculaneum, beneath modern Ercolano

events in the 79AD eruption, but it became clear that there was a difference here: ash and pumice deposits are largely absent, although there is a greater overall depth of pyroclastic flow deposits. This was because Pompeii and Oplontis, lying to the south east of Somma, were down-wind of the eruption, but Herculaneum on the coast to the west was much less affected by air-borne deposits. However, it lay closer to the centre of the volcano and was overwhelmed by the full force of the subsequent pyroclastic surge and flow deposits. The terrified people sheltering in the warehouses on the sea front didn't stand a chance.

By now the rain had stopped, giving us a chance to survey the scene from the high ground above the excavations. It is a sobering thought that the modern Naples suburb of Ercolano sits on top of the unexcavated part of this disaster area, and the coast is now several hundred metres to the west. Lying close to Campi Flegrei and sprawling all around Somma-Vesuvius, could modern Naples be destined to join its subterranean neighbours as a buried relic of a past civilisation?

We'd been battered by appalling weather and thwarted by strikes, but with characteristic calmness and patience Paul had turned adversity to advantage on many occasions, and we left the Bay of Naples the next day very much the wiser, and with much to think about. But our thoughts were now turning excitedly to the prospects of a close encounter with Etna and we couldn't help hoping that the weather would be kinder to us on the next chapter of our volcano adventure... ■

The concluding instalment will appear in the October issue. *Julie Schroder*

Parque Ardales and El Chorro Reservoir

For anyone taking a vacation on the Costa del Sol or visiting Malaga, then a very different possibility from the 'fleshpots' of Torremolinos or Marbella is offered by the Ardales National Park.

Photo 1

Situated just one hour by car to the north of Malaga and connected by the new A359 trunk road, this national park offers stunning limestone scenery, wind sculptured sandstones and massive conglomerates (Photo 1).

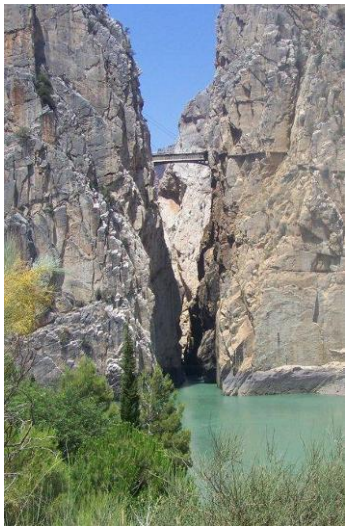


Photo 2

The park, also known as 'Los Tres Lagos' (the Spanish 'Lake District'), comprises the reservoirs 'El Conde de Guadalhorce' (constructed 1914-1921 and fed by the River Turan), 'El Guadalteba' and 'El Guadalhorce' (constructed 1970), fed respectively by rivers of the same names. All three reservoirs then flow out through the Desfiladero de Los Gaitanes (Photo 2), a magnificent gorge which cuts through Jurassic Limestones, 3 kilometres in length and in places 400m in height, but only 10m wide. The waters flowing through this gorge are the main sources of drinking water and irrigation for the province of Malaga as well as providing hydro-electric power at the El Chorro pump storage facility.

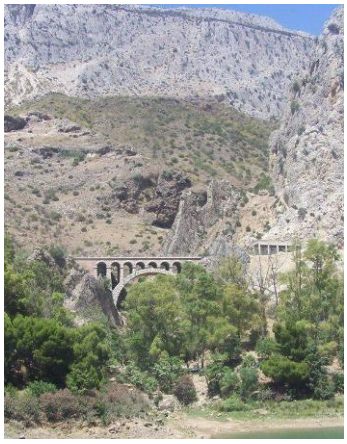


Photo 3

The narrow gorge contains the main railway line linking Malaga with Granada and Seville; tunnels and hanging bridges abound (Photo 3). There is even an old service road running above the river at a height of some ►

Photo 4

Photo 5

100m and known as the 'Caminito de Rey' which just seems to hang off the sheer cliff face. (Photo 4. Note high-speed train crossing bridge, top right.)

Well illustrated information boards give excellent insight into the geological background to the park. However, the spectacular outcrops of conglomerates which just seem to flow out of the rock faces and the magnificent wind eroded landscape (Photo 5) just speak for themselves.

Finally as every good geologist knows a hard morning in the field deserves a nice lunch before resuming the afternoon's observations (see below). ■

Mike Williams

Geobabble

Margaret Atwood is a wonderful novelist. Amongst her works are *The Handmaid's Tale* written in 1983, studied by many A-level English students, and a disturbing description of a totalitarian society. *The Blind Assassin* won the 2000 Booker prize, and one of her most praised novels is *Oryx and Crake* which appeared in 2003. Atwood is Canadian, and in the summer of last year took a holiday in a cruise ship to the Canadian Arctic, specifically to Nunavut, an Inuit province and the largest territory in Canada. Until 1999 it was part of the Northwest Territories, and to find it on a map, it is west of Greenland, across Baffin Bay at about 70° N. It consists mostly of islands around what was once called the Northwest Passage. Global warming means that many of the inlets are more readily available to shipping. This barren, huge area has a population of just 32,000 Inuit.

To some it may be barren, but to the geologist it is a treasure trove, and part of Atwood's cruise was a series of lectures and field visits on shore led by a government geologist, Marc St-Onge. Many of us can remember that time when we were first introduced to the fascination of geology and just had to know more, and see more. This happened to Margaret Atwood at the Port Epworth fossil site, on mainland Nunavut in Coronation Gulf, where she was shown a huge area covered in Precambrian Stromatolites, 1.9 billion years old; she was hooked. The details of preservation at this site were described by St-Onge as 'mind blowing' and 'amazing'.

Stromatolites in the Hoyt Limestone (Cambrian) Lester Park, near Saratoga Springs, New York, note the 3 cm scale in the left foreground Photo by Rygel, M.C., Wikimedia Commons

This whole experience inspired the author to write a short story, with a significant geological component based on her field visit. She wrote it on board and read it to her fellow passengers. The title is *Stone Mattress,* and the first line is: 'At the outset Verna had not intended to kill anyone', ►

which tells you of the flavour of the plot. I am saying no more because the whole eight page story is free for all to read online. If you Google 'Stone Mattress' it will lead to the site of The New Yorker, and the edition of 19th December 2011, and there is the story; the fossil plays a dark part. If you had not worked it out, the word Stromatolite comes from Latin roots, and the words for stone and mattress.

The initial information I used is from the Vancouver Sun; an article by Randy Boswell entitled 'Meet the Canadian geologist behind Atwood's latest short story', dated 16th December 2011.

http://www.newyorker.com/fiction/features/2011/12/19/111219fi_fiction_atwood ■

Bill Groves

The Dudley Earthquake, 22nd September 2002

Did the Earth move for You?

Saturday 22nd September marks the 10th anniversary of the Dudley Earthquake. **Where were you when it happened?** Please send your recollections of the event to Andy Harrison at fieldsecretary@bcgs.info for a Newsletter item to mark this significant anniversary in the history of the Black Country. (Or post to Andy at 15 Dove Ridge, Amblecote, Stourbridge, West Midlands, DY8 4LE.)

Members' Forum

Solutions to a rocky puzzle from the Torridon Mountains

This puzzle has sparked your interest, and I've received three different suggestions to solve the mystery... (Ed.) Here's a reminder of the problem posed by my nephew, Mark in the previous issue:

"What is the explanation for these rocky nodules found on the slopes of Beinn Eighe above Loch Coire Mich Fhearchair, grid reference roughly NG946603. There was a small area covered in large sandstone blocks and many of them had these formations on them".

From Jim Spencer of the MGA (Manchester Geological Society):

Your photo of the Torridonian rocks reminded me of a Permian outcrop on Arran, where the feature has been interpreted as a palaeofulgarite.

When lightning strikes in a desert the intense heat of the electric discharge causes the sand to fuse in a dendritic (sort of tree-root) pattern, called a fulgarite. The Arran one is just a single circular mark, so this may not tie up with the description of many of them on adjacent blocks. At first sight they look almost like ammonites - but not in the Torridonian of course!

From BCGS member Peter Twigg:

We walked the Beinn Eighe mountain track about 10 years ago and came across what I think your nephew saw. There was an information board nearby, which explained it was so-called 'Pipe Rock'. The specimens I photographed were the inverse of your nephew's but I am sure it is the same thing. (Sorry it is not a good photo.) To be specific, the BGS book for the area describes it as the 'Pipe Rock Member of the Eribol Sandstone Formation in the Comley epoch of the Cambrian. It is coarse grained and recrystallised, bioturbated with abundant pipe-like and funnel shaped burrows perpendicular to the bedding'. ►

Reported by your editor after a phone call from BCGS member Spencer Mather:

Spencer lived near Beinn Eighe for a while some time ago, and knew about this exposure and a couple of other similar exposures in NW Scotland. He said that these nodules belong to a particularly coarse sandstone horizon containing small pebbles, often of a fairly similar size within a particular zone. Under certain conditions of great pressure, and with the right mineral solutions as the rock is forming, the small pebbles get a coating of the sand around them, and for obscure reasons (which even Spencer couldn't explain), the sand and silicate matrix around the pebble can end up being a lot harder than the surrounding sandstone. Thus the coated pebbles are left standing proud, but eventually erosion will take its course and the pebbles will fall out.

What do you think? Please let me know, and please send more puzzles for our readers to solve (Ed.)

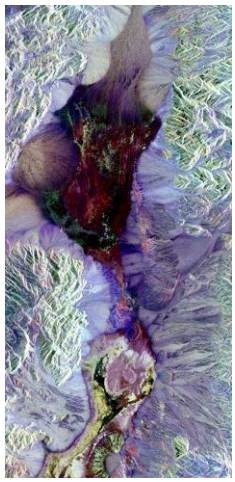
The Dudley Bug

Hello. We are sorry for the lack of a Dudley Bug in the June 2012 Newsletter, things are very hectic at the present time with us both having busy work commitments and one of us in the process of a final research project for a masters degree. But we have managed to put a little 'Mini Dudley Bug' together for you this month. So enjoy!

Chris and Alison

Remote Sensing and Geology

Remote sensing is a method of collecting physical data about a particular object or a phenomenon such as a volcanic eruption. This is done using sensor satellites; therefore contact with the given subject is not required. Remote sensing allows the oceans, land and atmosphere to be monitored from a chosen distance, which makes monitoring inaccessible areas easy.



In order to collect remote data, sensors within a satellite are used. These detect the radiation which is reflected back from the given subject. Two popular forms of Remote Sensing are LiDAR and RADAR surveys. Sensors may also be fitted to ground based equipment, boats and helicopters.

Remote Sensing is very useful within a geological context. This is because it enables us to look at what is present beneath vegetation as this can be removed. Different rock types and features will reflect different types of radiation. Features including faults can be seen very clearly with Remote Sensing. Different sensor combinations will show up different features more clearly.

Remote Sensing is not only used for geological purposes but is also very useful in environmental sciences. In the environmental sector, land uses can be monitored.

Remote sensing image showing how it can be used to interpret the geology of an area, in this case Death Valley (Image from Wikipedia http://en.wikipedia.org/wiki/File:Death-valley-sar.jpg)

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