Farnham Geological Society

[www.farnhamgeosoc.org.uk]

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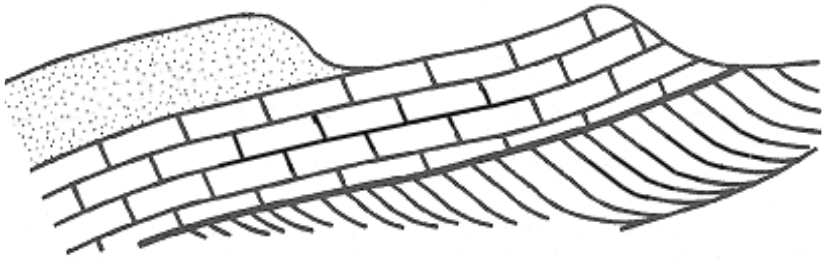

A local group within the GA

Vol. 6 No.1 **Newsletter** February 2003

INSIDE THIS ISSUE

The first issue for 2003 is a 16-page issue in order to clear a backlog of articles. It is probable that the other two Newsletters in this year will revert to the normal length of 12 pages but, if your contributions continue to flow in, then we shall be delighted to have a bigger issue.

It is with great regret that I have to announce the death of Eve Lord in the Phyllis Tuckwell Hospice last October. Eve joined the Society in 1993 and has been a very active member, being among the first to sign-up for field trips and mineral fairs with her husband Ken. Her house was an Aladdin's cave, such a collection of rocks and minerals. As an amateur geologist her enquiring mind and willingness to help will be greatly missed. On behalf of the Society, I send our condolences to Ken, son Roger and all her family.

I am happy to report that Jill Brash is now back at home and continuing her recovery. Also, David Caddy is mobile again; a remarkable recovery from his tumble in Portugal.

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The sharp-eyed amongst you will have noticed that the address of the Society's web-page, given at the head of recent Newsletters, has changed! The old web-site was located on space provided by my e-mail provider - *ntl.* This arrangement had a number of disadvantages: the address not only had to be lengthy, and therefore difficult to remember (*http://homepage.ntlworld.com/mjweaver/fgs.html*), but also gave little indication as to the ownership of the site. By purchasing our own web domain, we have been able to choose an address that reflects the Society's name and also removes the dependency of me having *ntl* as my internet service provider. I do hope all with access to the internet will find time to look and use the site at its new address: ***www.farnhamgeosoc.org.uk***.

Michael Weaver

James Hutton's unconformity

Last August on our way to Aberdeen we stopped for a few days near Coldstream in order to see the coast at St Abbs Head and also to revisit some of the border abbeys that we had not seen since we lived in the North over thirty years ago.

Having walked the Jedburgh Town Trail we read in the Guide –"*An Extended Walk – by walking along the Newcastle Road or through Lothian Park, you arrive at a place called Inchbonny where you will find Hutton's Unconformity. This is one of the most important geological sites in the world*."

We were intrigued but there was no map reference and the girls in the shop by the car park had heard nothing about the place. I suggested to them that it would possibly be a cleared cliff face on the bank of the river. A local getting out of his car seemed to remember something about it but had not investigated it!

Undaunted we persevered and walked through the park and along the riverside until we came to the garden of a house called *Inchbonny*. No doubt we were trespassing but we went through the gate and proceeded to move branches and growth away, in order to see the far bank of the River Jed and after a while we could see the exposure opposite quite clearly though it was difficult to take a photo due to the many branches around.

However we were delighted to find James Hutton's unconformity – "*the horizontal bands of red sandstone lying unconformably on top of near vertical and folded bands of rock*," described in the Town Trail Guide. Since then I have been even more delighted to read about the exposure in an article entitled An Appreciation by Vic Parsons in the GA Magazine Vol. 1 No. 1. I now know that this was James Hutton's second unconformity found in 1787 and that it shows the plane of unconformity separating the Silurian greywackes from the basal breccias and sandstones of the Old Red Sandstone.

200 years ago he challenged the establishment when he "*looked through the abyss of time and found no vestige of a beginning and no prospect of an end*," continues the Town Trail Guide.

Hutton died in 1797 and was buried in Greyfriars Churchyard in Edinburgh. In 1947, on the 150th anniversary of his death, a plaque was placed describing him as the "Founder of Modern Geology." For the Bicentenary of his death in 1997 a bronze plaque was unveiled, near the site of his house, by the Royal Society of Edinburgh and the Edinburgh Geological Society. Since then a new Hutton Memorial Garden has been formed incorporating large interesting boulders from various locations in Scotland where he studied the rocks.

Shirley Stephens

The Malvern hills - a journey through time

One of the many benefits of membership of Farnham Geological Society is its status as a group within the GA (Geological Association). Having often been tempted by an intriguing variety of field trips listed in the GA journal - I finally took the plunge by booking for a one-day excursion - "*The Malvern Hills*" - led by E P Bailey, BSc, C. Geol, FGS - fee £2.00!

Happily back in the country of my youth in my camper van, I joined the party below the Herefordshire Beacon (also known as the British Camp). Members included a contingent from Hampshire, others from the Bath area, plus the leader's mother and young son.

E P Bailey, a geologist with Tarmac, grew up in the Malvern area. The books of T R Owen ('*Geology Explained in South Wales'*, etc), with their vivid sketches, fired his imagination and inspired his choice of career. Their influence could be seen in our leaders excellent 35 page handout: '*The Malvern Hills - A Geological Viewpoint*' - profusely illustrated with photographs, maps and his own explanatory sketches - see Figure 1.

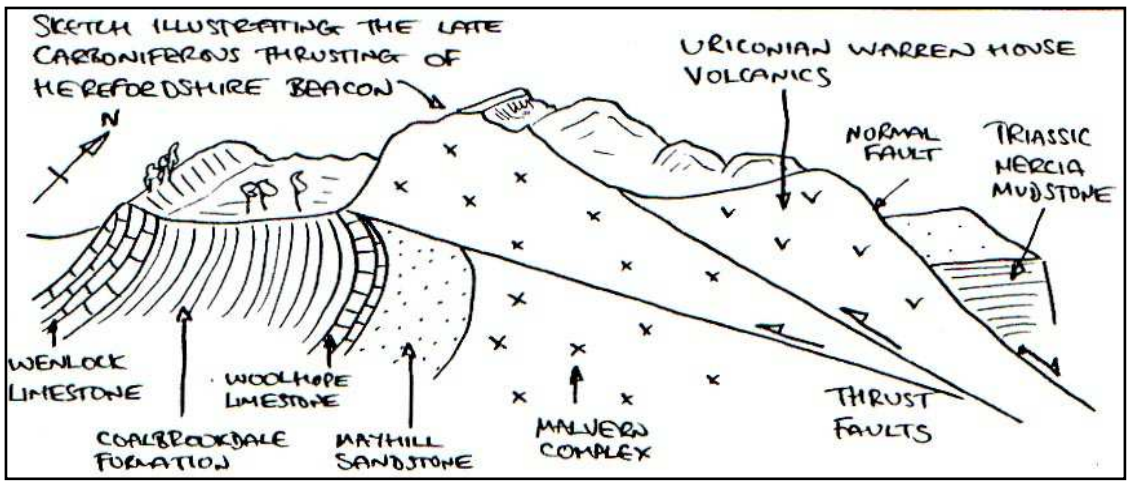


Figure 1: Geology of the Malvern hills

On our walk along the southern section of the Malvern ridge, E P Bailey demonstrated how the succession of rocks related to the enormous and complex forces and movements which have shaped and re-shaped the landscape from Pre-Cambrian to Quaternary times.

Hugely as human understanding of these events has expanded in recent years, mysteries remain. For example - in the Gullet Quarry we were shown what is 'probably the most important Silurian - Pre-Cambrian contact in the British Isles'. Most workers believe it to be a sedimentary basal conglomerate. Others argue that the conglomerate is tectonic. See E P Bailey's treatise for further consideration of this and other Malvern mysteries.

Mary E Clarke

FGS field trip to the Western Algarve, Portugal - September/October 2002

The autumn field trip to the Western Algarve was a new type of venture for the Society. Lyn and John Linse organised and led three groups of FGS members on a study tour over a period of three weeks. Each group numbering, four to six people, spent one week with us at an astronomical observatory, Centro de Observacao Astronomica no Algarve (COAA), sited in the hills near Portimao,. The area is not heavily frequented by tourists so there were opportunities to sample real Portuguese life.

Logistics worked like clockwork. Lyn and John flew in with the first group on 21st September and left with the third group on 10th October. Flights were back-to-back and the changeovers were spot on. An air-conditioned minibus with a driver was hired for the full three weeks. Mark White, the driver, was excellent, both friendly and reliable. He spoke both English and Portuguese.

It was three weeks of fun and adventure except for one disaster. Unfortunately, on the second day of week 2, David Caddy fell and broke his hip. Ten minutes later he was rushed to hospital by ambulance and three hours later had a hip replacement operation. By the end of the week he was able to fly home with the rest of his group.

Most of the days were spent doing geology at a leisurely pace. The minibus was always within a short walking distance of the sites studied. Great scenery and rocks, especially on the coast. Also on the agenda was bird watching (Ornithology) and a half-day was spent at a bird sanctuary. The groups saw how birds were caught in nets, weighed, inspected and ringed. After that we went spotting at the Alvor Estuary and saw groups of Flamingos, probably on their way to Africa.

There were plenty of sites of archaeological interest and museums to visit. During clear evenings the groups had an opportunity to view the heavens in all their splendour through the powerful telescopes at COAA under the expert guidance of Dr Bev Ewen-Smith, the owner. He and his wife Jan run the observatory with B & B accommodation. Arrangements were made to have dinners there for five evenings per week. It was very much family style and everybody loved it. Jan is an excellent cook and we all gained weight, especially from her desserts. Other times

Sandstone and limestone cliffs between Lagos and Luz. Dark outcrop is basalt and explosion breccia volcanic neck and dolerite dyke.

we ate at local restaurants. One was up-market, noted for it's fish and meat dishes. Another was a local hole-in-the-wall cafe specialising in chicken piri-piri (hot chilli) grilled over an open log fire. Also fun was lunch at a dockside marquee restaurant in Portimao serving mountains of all sorts of charcoal grilled fish and seafood.

The tour also included interesting towns, visits to potteries, drinks at pavement cafes or just taking in the sun on the patio or beach. Some people took the opportunity to fly over the area in a light plane piloted by Bev. The holiday was so successful that plans are underway to repeat it in the near future for people who missed out this time around.

Lyn Linse

Caen stone - its history and use

Summary of Society's September lecture given by Richard Butler, President of the Mole Valley Society

Caen Stone is a cream coloured oolitic limestone from the Mid-Jurassic 220 ma. It has been used as a building stone since Roman times and was exported in huge quantities to England after the Norman Conquest to build castles, abbeys and houses. As its name implies, it has been mined around the city of Caen near the estuary of the River Orne which was conveniently used for the transport of the stone in barges.

Its character as a building material is based on its homogeneous structure which means that it can readily be shaped and dressed. It contains few flaws or fossil inclusions and provides almost perfect bedding planes. As a building stone therefore it is superior to Reigate Stone that for a long time been used in England. (See Editor's note at the end, however).

Such was the popularity of Caen Stone with the Norman masons employed in the construction of both civic and religious buildings that it is recorded that a 'Society of Carvers' was established which could be employed to dress and carve the stone to individual specifications. The existence of such a Society of Norman masons has not been verified but there is a common signature of workmanship in masonry works carried out on both sides of the English Channel.

Throughout the middle-ages huge quantities of Caen Stone were exported to England, even during centuries of hostilities with France when special dispensations between the two powers allowed exports to continue without hindrance. Canterbury Cathedral is built entirely of the stone and it took 15 boatloads (apart from 14 that were somehow sunk en route) to build Westminster Palace. Chichester Cathedral built in 1501 and the Tower of London constructed in 1096 are all entirely constructed from the Normandy stone, although evidence of some repairs shows the use of Reigate Stone and its typical flaky weathering to be used as an expedient from time-to-time. Arundle Castle, Boxgrove Abbey and Winchester Cathedral all owe their existence to Caen Stone from which they are all constructed. In the 11th century the elaborate walls of the high alter screen at Durham Cathedral was especially ordered because of its beautiful texture, even though the local coal measures' sandstone completes the remainder of the cathedral. Falaise Castle just outside Caen, the birthplace of William the Conqueror, is completely built of the local limestone, but surprisingly not his tomb in Caen Cathedral where he is now buried.

Mr Butler estimated that three quarters of a million cubic meters of Caen Stone has been exported from Normandy and used world-wide. For example, as recently as 1952 the new cathedral in Bermuda was entirely constructed of Caen Stone. Caen Stone has been overtaken as a building stone in recent years due to the use of modern aggregates and the cost of transportation. Although it is still very much in use for essential repairs to ancient buildings and special construction projects world-wide, it is now in decline as a major building material.

A strange swansong for the Caen Stone mines themselves is that they were so vast in and around the Orne estuary and along that part of the Channel coastline, that during the D Day landings in June 1944 (Omaha Beach) they helped to save some 40,000 French lives. The mines were extremely dry and strong shelters and very little damaged during the ferocious bombardments that lasted several days.

John Gahan

Editors Note: Sir Christopher Wren is recorded as saying that the Reigate stone used for Westminster Abbey was an 'unhappy choice, no better than the Caen stone used by the Normans for which Reigate stone was substituted because of its lower cost'.

FGS trip to Italy: 'The five volcanoes tour' - Part 2 - Sicily & the Aeolian islands

The journal editor originally asked me to write a social report on the society's trip to the volcanoes of southern Italy, the Aeolian Islands and Sicily. There were, as I then understood it, to be two separate geological reports on the trip. The first, covering the first week when the party was visiting Vesuvius and the Phlegrean Fields, written by John Gahan, was included in the October Newsletter. Very foolishly I volunteered to extend my brief to cover the geology of the remainder of the trip, that is the Aeolian Islands and Mount Etna. As John has largely covered all aspects, including the non-geological, of the first week, my report has little to add to his.

The article that follows is in three parts. The first is a footnote to John's report and is intentionally limited to the non-geological excursions and visits with hardly a mention of volcanoes, lavas, brecias and suchlike. The second part is a short digression on the vulcanology of southern Italy. The third part is a diary and commentary on the second week during which we visited Vulcano, Lipari and Mount Etna.

1 Social report on the first week

Thirty four of us, including three Herefordians, gathered at what seemed to be an empty Gatwick on the afternoon of Wednesday 10th April. Here Paul (Olver) distributed "Song sheets" and Dorcas (Cresswell) handed out flight tickets. Hugh Agnew was there both to see us off and to wave an advertisement for a far cheaper flight to Sorrento! When Dorcas started to distribute the tickets, in alphabetical order, Hugh stepped forward with "Agnew" - for a brief moment Dorcas's face was a picture. We left him behind still chuckling.

On arrival in Naples we were met by our coach and our bubbly guide Wendy Viney. She comes from the Lake District and has been living in the Naples area for more than twelve years. She gave us a running commentary most of the way to Sorrento.

The next morning we set off in our coach for a 2 hour visit to Pompeii, where we met our guide Hugo. The excavated site is huge (with still more to uncover) so we could only see some of it. Despite most of the finds being in the Archaeological Museum in Naples the site is fascinating. Much has been restored so one can begin to visualise what it must have been like. Some of the wall paintings are still in place and the plaster casts of the voids where the bodies were drowned in ash are far too lifelike for comfort. We do not even have to imagine what the eruption must have been like as Pliny the Younger sent two letters to Tacitus giving an eyewitness account of the catastrophe. After lunch, at a restaurant high on the slopes of Vesuvius, we climbed to the rim of the volcano.

Friday was given over to sightseeing. The coach, with Wendy in attendance, took us on a tour of the Amalfi peninsular. We stopped at Positano, Amalfi and Ravello where we saw the Villa Rufolo Gardens, all as described in John's report. Wendy is an amusing guide, not least when describing the strained relationships in her Italian partner's family.

Saturday, off again in our coach to the Phlegrean Fields. Most of the day was serious geology but we started in Cumae where, in Roman times, the Sybil resided. The Sybil was a "Wise Woman" who acted as a soothsayer. Pauline instantly volunteered being sure she was wise enough – *voice from the back row "Not another Sybil Servant!"*. We finished the day with a visit to the Roman amphitheatre at Pozzuoli.

Sunday morning by coach again, this time to the Vesuvius Observatory which is now a Museum both of Vesuvian history and of the equipment used to study tremors. It is only open to the public on Sunday afternoons. The Museum contains a fascinating collection of seismographs. After lunch we visited the archaeological site at Herculaneum. As much of the ancient site is underneath modern Ercolano, only a small fraction can be excavated.

This is very sad as Herculaneum was far better preserved by the pyroclastic flow than Pompeii, where the initial ash deposits collapsed the roofs. At Herculaneum the pyroclastic flow completely filled the houses so the roofs did not collapse; it did however char the woodwork.

Monday began with an early start down to the port in Sorrento to take the hydrofoil to Capri where we were met by Gino, our guide for the day. He took us to visit the villa San Michele, the idyllic home of Axel Munthe, after which we had free time to look round Anacapri and find some lunch. During the lunch break some of us were lucky enough to find the church of San Michele with its magnificent mosaic majolica tile floor depicting Adam and Eve in the Garden of Eden with its wonderful wild animals and then their expulsion. After lunch Gino took us on a boat trip round the east end of the island.

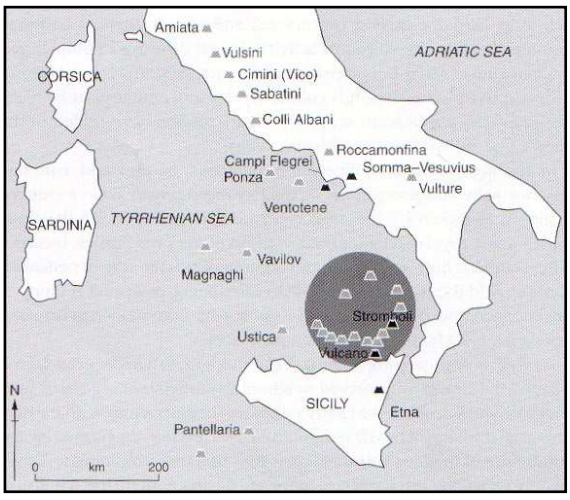
Tuesday was a day of travel, first by coach south along the all but deserted autostrada to Villa S. Giovanni (about 5 miles north of Reggio) where we left the coach to walk on to the ferry to Messina in Sicily. Here we met our new guide Cinzia Maiorana. Then on in a new coach to Milazzo and dinner in the hotel.

2 Vulcanology of southern Italy

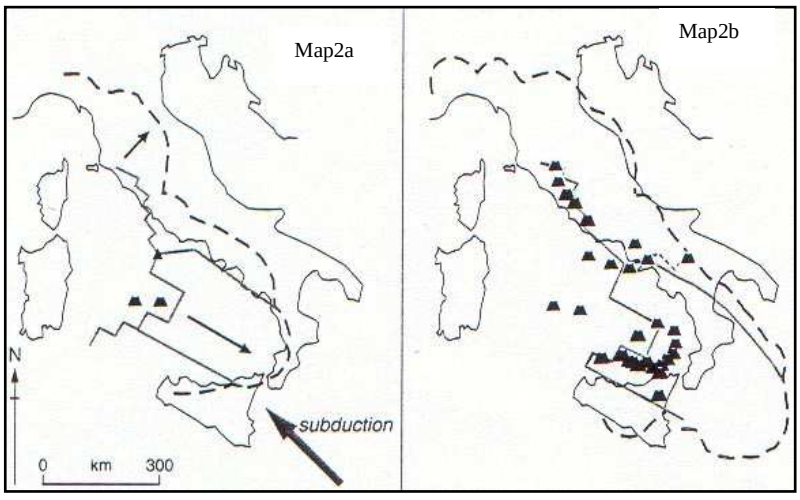
Before detailing our visits to Vulcano, Lipari and Etna it seems sensible to say something about the overall vulcanology of the whole trip. Paul's excellent "Song Sheet" gave an overview of the whole area before launching into fine detail. Five interrelated questions intrigue me.

1. Why are these volcanoes where they are?
2. When did they first appear?
3. Why are the effusion products so variable ?
4. Why are their eruptions so variable? (from just seeping to Strombolian, Vulcanian or even Plinian - there are other named types which are not found for the Italian volcanoes)
5. When will the next eruption be? If anyone could answer this even the politicians might say thank you - without of course providing any further grants!

If you know the answers to these questions please skip the rest of this Section.



Map 1: Quaternary volcanoes in Italy



Maps 2a & 2b: Crustal movement in the Italian region from 5 million years ago (2a) to the present (2b). The main collision front (dashed line) has rotated anticlockwise and extended to the south east. Crustal failure (full lines) around the triple junction (little black triangle in 2a) has allowed different preferred movements in the north and in the south (thin arrows in 2a). Volcanoes shown in map 1 lie along the migrating fault systems. North west subduction of the African plate (large arrow in 2a) continues to feed magma to the Aeolian Islands.

The maps and diagrams are taken (with the kind permission of the Publishers Terra Publishing, PO Box 315, Harpenden, Herts, AL5 2ZD) from "*Italian Volcanoes*" by Chris Kilburn and Bill McGuire. These maps go a long way to answer question 1. The volcanoes lie along the collision line between the African plate and the European plate and this line has been moving eastward and extending both northwards and southwards during the last 5 million years. These changes with time are the first important point explaining why some are now extinct. The second point is less immediately obvious but equally

important. It is that the relative movement between the plates varies along the contact line. At some places the plates (eg currently under the Aeolian Islands) are colliding almost at right angles to the line of contact leading to subduction, in other places the plates are sliding past each other leading to shear stresses. It is this variation that holds one of the keys to the answer to question 3.

The book also includes a table of starting dates for the various Italian volcanoes. These are, for the volcanoes we planned to visit: 0.5-0.3 million years ago for the Neopolitan volcanoes, 0.5 million years for Etna and 1.3 million years for the Aeolian Island volcanoes.

Now to the much more difficult questions 3 and 4 whose answers are closely interlinked. Even in the simplest of terms the products erupted and the violence of a eruption depend on many, far from independent, variables. These include: the amount of magma available, how far the magma chamber is from the surface, how long it has been there, its temperature and how this has varied over time, its pressure, its composition and the presence of water either in the magma, in the native rock or free ground or sea water. The magma composition depends on where it originated. Some comes from within the Earth's mantle, but for the volcanoes we were visiting most, if not all, was formed by the melting of crustal rock either as a result of subduction or plate collision. And as if that were not imprecise (sic) enough, when the magma rises to the magma chamber it can break off and dissolve chunks of the native rock lining the passage to the magma chamber (to appear later after an eruption as xenoliths).. Also during a series of eruptions parts of the rim of the previous volcano can collapse into the crater/caldera and then be expelled with erupting material (more and different xenoliths). Note the continuous repetition of the word magma which we as geologists can never examine. All we can examine are the erupted products, classifying them by particle/ lump size, colour, density and chemical analysis, etc., etc,. These classifications have produced a bewildering catalogue of names and much heat under the collar. I will attempt no detailed guide to this catalogue.

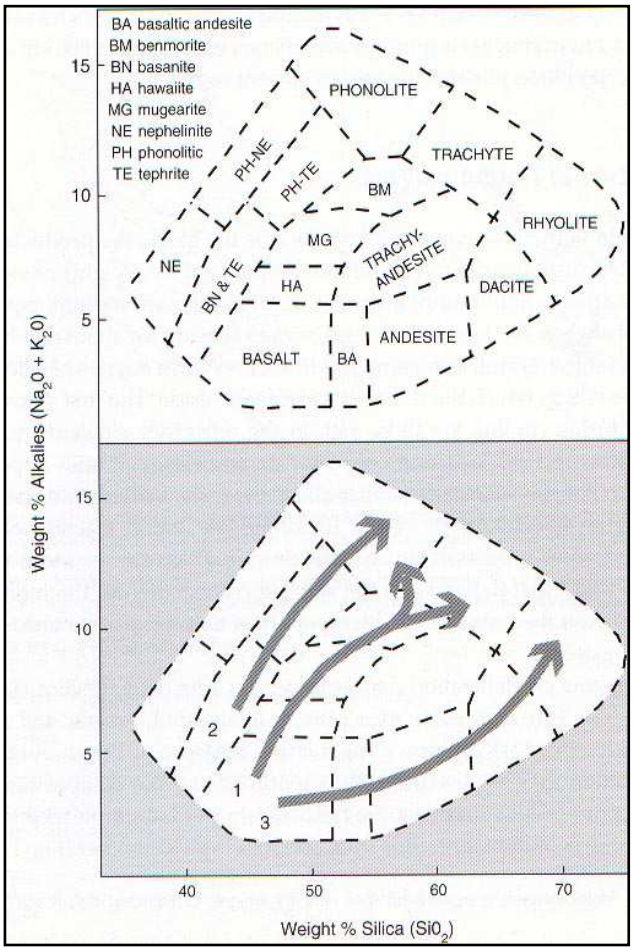


Figure1: Standard classification (top) of volcanic rocks according to their total alkali(Na2O + K2O) and silica contents. Trachybasalts are divided into three fields for hawaiite, mugearite and benmoreite. Common evolutionary trends (bottom) among Italian magmas are; (1) K-basalt to K-trachyte or K-phonolite, (2) K-tephrite to K-phonolite, and (3) K-basalt to K- rhyolite

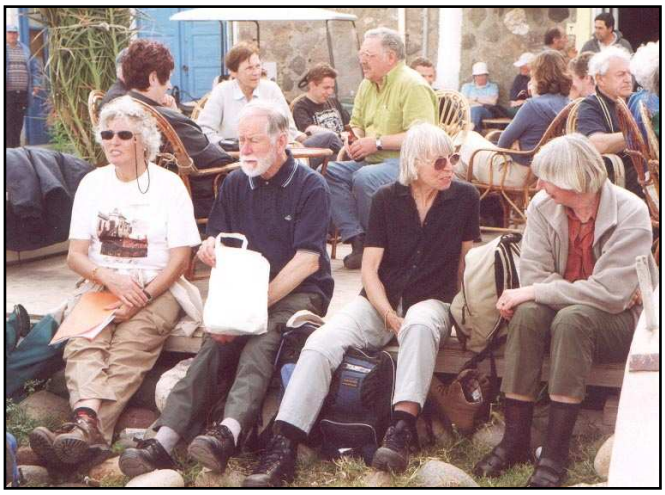
There is however a well understood and documented chemical analysis cataloguing system which makes it easier find one's way. Here I precis from Kilburn and McGuire. 'Italian magma consists mainly (99% by wt) of eight elements: silicon, aluminium, magnesium, iron, calcium, sodium, potassium and oxygen. Of these silicon and oxygen account for 50% or more of the total mix and, as the magma solidifies, they form a series of silicate structures in which the remaining elements reside. The first silicates to form on cooling are rich in magnesium, iron and calcium. It is only later in the cooling that the silicates take up the potassium and sodium. Or put another way , after some solidification the remaining liquid becomes increasingly richer in potassium and sodium. The exact proportions and absolute amounts of these two elements depend on the analysis of the original magma and any subsequent additions. Plotting total alkali silica against the alkalis potassium and sodium (both expressed as their oxides) provides a crude measure of the amount of crystallisation that has occurred. Now superimpose the key rock names on the plot and it becomes clear how magma, cooling over time in the magma chamber, becomes richer in potassium and sodium. This is shown on the diagram [Note to those who went on the tour: this diagram is a mirror image of Paul's diagram in the song sheet, numbers on the x axis being reversed]. Some eruptions will throw out only the remaining liquid to cool and solidify, others will throw out both the already solidified silicates (eg augite and pyroxene crystals) within and beside the liquid. There is a further sub-classification to assist our identification of the type and source of magna present. This is the ratio of

potassium oxide to sodium oxide in the liquid fraction. This is normally less than about 0.6, however for both the Campanian and Aeolian volcano magmas the ratio is much higher. This is interpreted as confirming that the bulk if not all of these magmas have originated from melted crustal (rather than mantle) rock following subduction, faulting or foundering.

The question of the level of violence of eruption is no less complicated than the question of the composition of the magma. Again, grossly simplifying, two variables are critical: (1) the fluidity of the magma and (2) the concentration of bubbles. Magma can have between 1 and 4 % water dissolved in it. As the magma rises the pressure falls and the water turns to steam bubbles. The more fluid the magma is the easier it is for these bubbles to migrate to the surface. The result being either a lava flow or a lava fountain. If the magma is less fluid (eg basaltic, trachybasaltic, trachyandesitic) eruption will be Strombolian. If the magma is even less fluid (eg andesitic and trachytic) eruption will Vulcanian. Finally if the magma is still less fluid (eg dacitic, phonolitic) or there is a major blockage allowing the pressure rise to beyond bursting point the eruption will be Plinian. If there is little or no water in the magma there will be no more than a lava flow regardless of how fluid or otherwise the magma is.

3 Diary of the second week

Wednesday morning we left the hotel early to catch the 7.25am hydrofoil to Lipari where we checked into the hotel and immediately returned the few hundred yards on foot down to the port to catch a ferry to Vulcano. On arrival we set off to walk up to the rim of the crater looking for spindle shaped breadcrust bombs on the way. The fine black ash from the 1888-90 eruptions gave way near the top of the crater edge to pink compacted very fine ash from old material also thrown out during 1888-90. Walking round the rim to the north west we found the fumaroles (see photograph) gently blowing with their rims of reduced sulphur. We returned down to the port for lunch at one of the local hostelries. Some of the party inspected the warm mud pool just behind the jetty. Then back to Lipari which we immediately toured by coach. The real highlight of this tour for me was the large obsidian outflow on the north side of the island close to the large pumice quarries. The pumice is chuted down to a jetty (much as coal is on the banks of the Yangtze gorges in China) to be taken away by boat. Further round on the north west overlooking the island of Salina we stopped to examine some basaltic-andesite pyroclastics (Brown Tuff). The car park also had a group of stalls selling almonds, honey and the local brand of firewater rather like sweet Madeira. Our hotel in Lipari was excellent and the island is so beautiful that I plan to go back for a longer stay.



Thursday - planned trip to Panarea and Stromboli. We set off again down to the port to purchase a picnic and board the boat to Panarea. The sea was fairly rough so, on arrival, there was a discussion with the ship's captain on the inadvisability of going on to Stromboli. We used the time to eat our picnic on the foreshore behind the port area (see photograph). With the cancellation of the trip to Stromboli, Paul took us to see the 14^{th}-13^{th} century BC archaeological site of a bronze age settlement at the south end of the island. This was on the flat top of a high rock that was all but disconnected from the rest of the island, a perfect defensible site. We then returned to Lipari with time to visit the Cathedral and the Archaeological Museum. Paul took a few people round the "Closed for Restoration" Geological Museum. That evening we split up to eat out in various restaurants round the town.

Friday, another early start to take the 7.50 hydrofoil back to Milazzo and board our coach for the journey to Giardini Naxos and book into the hotel Kalos. We left the hotel immediately for Aci Castello with our new guide Guiseppe. After visiting the Norman Castle (c1076) - see photograph below- perched on a huge basalt rock (made

up of vertical pillow lava) sticking out to sea on another very fine defensive site, we went down onto the volcanic foreshore to eat a picnic lunch. Then, still on the foreshore, we studied a lava outcrop overlaying clay and a fault with dyke before returning to the hotel for dinner.

Saturday, a day given over to visiting the splendid 6th –5th century BC Greek temples at Agrigentum and the superb Roman villa at Piazza Armerina. However there was some geology out of the coach windows on the way. Tertiary yellow clays underlying massive tertiary limestones with extensive erosion. The coach kindly dropped us at the top of the ridge, strangely called the Valle di Templi, and left us to walk up to the first temple and then down past the others to be picked up at the far end. Then on to see the late 2nd –early 3rd century AD villa/palace (the experts are not in full agreement over the exact date or the original occupant). Here are some wonderful mosaics, the well known bikini ladies and I think even better the long 'Ambulatory of the great hunt' illustrating the loading of African and Indian wild animals into and out of their naval transports, a Roman Noah's Ark. There are many more mosaics almost any one of which alone would justify a visit.

Sunday by coach up to the bottom of the now defunct funicular on Etna at about 2000 metres. Here Guiseppe took us for a walk to look more closely at the various lavas and to show us a cavern in the lava where ice was stored in winter and then used in summer to freeze lemon water ice. It is claimed that this lemon ice was invented in Catania at the foot of Etna, no doubt using ice from this cavern. Guiseppi was also exceedingly knowledgeable about the flora. The party then split, Paul taking some for a local cinder cone walk, while the rest took a ride in a massive four-wheel bus further up to look at a fumarole and see the smashed remains of the top funicular station half buried in a lava flow. It is difficult to describe the sheer size of Etna, even at 2000 metres one is still a long way from the top (over 3300 metres) not just vertically, but much much further horizontally (see photograph). By the time we had returned to the hotel the top of Etna was covered with snow and during a brief glimpse looked very beautiful.

Monday and the start of our journey home. We visited Taormina with its fine amphitheatre almost hanging off the steep slope above the town. After time to wander in the old town we set off for Palermo where we had a few hours to enjoy the city before catching the overnight ferry to Naples and dinner on the boat.

Tuesday we arrived very early in Naples harbour where Wendy was waiting to take us to find breakfast from a range of cafe stalls behind the fishing port. After this she took us on a short coach tour above Naples before dropping us in the middle for few minutes final shopping. And so to the airport and home to Gatwick. Overall it was a superb trip thanks to the excellent planning of both Paul and Dorcas. Thank you both very much

Geoffrey Levett

Tanzanite - a twentieth century discovery

Tanzanite is a relatively new addition to the gemstone market, having been discovered in 1967 in Tanzania, after which country it was named. That first discovery is the only known source of the gemstone which is found at 200 feet below the surface. It is carefully mined by hand to avoid damage to the precious small supply that is so far available. Tanzanite exhibits a remarkable range of colours between lilacs and blues and, being strongly trichroic, presents different colourations when viewed from different angles. The value of the gemstone increases with the saturation of the colour, with the deep blues and deep violet blues being the most treasured and highly sought after.

An exclusive range of Tanzanite jewellery is offered for sale by The Gold and Silver Bureau at Ilford, ranging from earrings with small Tanzanite stones in 14 carat gold settings at just over £2,000 to a ring with a large Tanzanite surrounded by cut diamonds at almost £5,000. They state that "only the very privileged few will ever possess this valuable and exciting discovery of the Twentieth Century."

It is apparently possible to purchase Tanzanite stones more cheaply in the Bahamas. By extraordinary coincidence, as I was typing this article during my lunch break at work, a colleague passed my desk and said "My daughter has some of that." She brought in the ring to show me the delicate blue stones which, although quite small, had a depth and beauty all their own. Perhaps I should save up for a holiday out there and become one of the "privileged few" !

Ann Bower

Proposed field trips - 2003

May 2 -18	Aegean islands -	leader: John Williams
tba	Welsh Marches -	leader: Paul Olver
Jun 7	Lulworth Cove -	leader: John Gahan
Jul 7	Western Weald -	leader: John Gahan
Sep 18 - 28	Brittany & Channel Islands -	leader: Paul Olver

For further details or expression of interest please contact the Field Secretary - Dorcas Cresswell
Tel: 01497 - 847262 or e-mail: *dorcas.cresswell@dial.pipex.com*

Search for Gold at Selsey

When we first came to live in the area of Hindhead I read somewhere about finding gold coins on the beach at Selsey Bill. We made quite a few visits to that area, principally centred on Bracklesham Bay, but gold coins have kept very well hidden! It has always puzzled me as to where these coins had come from but I found the answer whilst looking at Barry Cuncliffe's book on "Iron Age Communities in Britain."

On page 52, whilst mentioning the Gate of Hill forts in the 1st century AD, one of the paragraphs reads: "*The Atrebatic Kingdom contained three urban centres; Calleva (Silchester) in the North, Selsey in the South with Venta (Winchester) lying between. The nature of the Selsey centre is a matter of some speculation but the nucleus of the settlement lies in the region of Selsey Bill where extensive coastal erosion has removed most of the evidence apart from large quantities of coins and fragments of gold washed up on the shore*."

There is quite a lot of information on the lost defences of this area and if you are interested in hill forts this is the book to read. I now know the actual source of the supposed treasure, as I had imagined, it was at the very least a Spanish galleon brought to grief on our shores!

Mary Darling

Newspaper snippet: Jade trove in jungle and a mystery solved

American scientists have discovered what could be the world's largest deposit of jade, in central Guatemala. The deposit had been hidden for centuries below volcanic ash and jungle until 1988 when hurricane Mitch ripped away the forest covering and caused landslides in the mountainous region. Olmecs, a pre-Columbian Mesoamerican people, once mined the vast deposit. It was when they started seeing jade appearing in markets that

scientists from the American Museum of Natural History in Texas started wondering where it was coming from and began making expeditions to find the source two years ago. The team found veins of jadeite two metres thick and up to 50 metres long, rivalling the size of deposits in Burma, previously the leading source.

They also found an ancient jade road running across the forest and to their surprise, as well as the more common green and red jade, they found rare blue jade which was the favourite gemstone of the Olmec civilisation which inhabited the coastal plain of the Gulf of Mexico from 1200-300BC and who were great sculptures. "The mystery has now been unravelled," says George Harlow, as to where the Olmecs managed to find so much jade.

The Times, 25 August 2002

Communicating to Members by e-mail

Members have been asked to provide their e-mail address when renewing annual subscriptions. E-mail is a quick, cheap and efficient way of conveying up to the minute information (eg: a very late change in the advertised speaker) as well as being a means of sending reminders of forthcoming meetings and other events where the timing and/or expense of a global mail-shot would not be practical. Members who are not on e-mail need have no worries about being overlooked, as "snail-mail" will continue to be used for all standard communications regarding AGM, Membership etc. Anyone who missed the opportunity to let me have their address should e-mail it to me at: *mjweaver@ntlworld.com*

Michael Weaver

FGS monthly meetings - 2003

Jan 10	AGM followed by Dr John Linse, Astronomical Association: *The sun - our nearest star*
Feb 14	Dr Richard Fox, Richard Fox & Associates: *Landfill & waste disposal*
Mar 7 ##	Prof. Richard Moody, Kingston University: *Petroleum geology of North Africa*
Apr 11	Dr Chris Edlers, Royal Holloway College: *Using 3-D seismic data to understand the North Sea*
May 9	Dr Adrian Rundle, Geological Society: *Introduction to microfossils*
June 13	Kevin Attree, University of Surrey: *Meteorites - their origin & significance*
July 11	*Members evening & presentations*
Aug 8	*Summer break - no meeting*
Sept 12	Prof Roy White, Birkbeck College: *Geophysics without equations*
Oct 10	Dr Derek Rust, Brunel University: *Palaeoseismology of the 'big-bend' of the San Andreas*
Oct 17	**Society dinner**
Nov 14	Dr Alan Jobbings: *A gemological journey from the Alps to Vesuvius*
Dec 12	Dr Tony Hall: *The granites of Cornwall*
Jan 9	AGM 2004
##	Note: the meeting in March is on the **First** Friday of the month

Looking through amber

Summary of October 2002 lecture given by John Cooper, Booth Museum of Natural History, Brighton

The Society's October lecture, 'Amber - a window on the past', was by John Cooper chairman of the Brighton and Hove Geological Society and very closely associated with the Booth Museum of Natural History which has the 13th largest geological collection in the country, with 50,000 items. John started his lecture by telling us about the Museum which was founded by Edward Thomas Booth, to house his collection of British birds, for study, in 1874. At his death in 1890, his collection was left to the people of Brighton and now houses over half a million specimens from the local natural environment, being in the care of Brighton Borough Council.

Since its founding the Museum has expanded its displays to include many objects from the local area such as fossils of sea urchins, dinosaur and other bones, insects, etc., and many other zoological and geological items. It has published much literature about its collections including one on insects by Ed. Jarzembowski, who has lectured to our Society. One of the museum's important tasks is to identify items brought in by the general public.

John then introduced us his main subject amber which is derived from resin in certain trees and has modern usage in oil paints, varnishes, lacquer and medicine, as well as for preservation. In 1770, it was known to have been used by a John Cook, for the relief of catarrhs, headaches, etc. as a tar water. There are several areas around the world well known for deposits of amber such as Japan, Lebanon, Burma (which are of Mesozoic Age), the Isle of Wight (Cretaceous Age), West Indies, Germany, Mexico, Scotland, Eastern England and the Baltic (30 – 40 ma Tertiary Age). The oldest yet found is 320 ma. In New Zealand amber is called Kopal and comes from the Kouri Trees, which between 1853 and 1971 produced 460,000 tons.

90 per cent of European amber is from the Baltic coast which was found in 1850. It was 16 feet below the sea bed and in 1868 yielded 185, 000 lbs. It was extracted by open cast mining in 1870
and by 1930 over 1.2 million lbs. had been removed, the vast majority for chemical processes. The colour varies from Lemon Yellow, Orange, Red etc. as well as cloudy or clear and these properties can be used to define the origin of the amber. Although it can be preserved in water, it eventually crumbles.

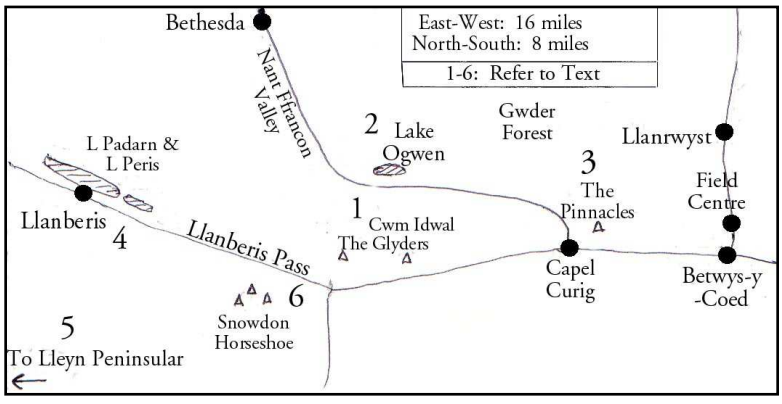
Most fossils entrapped in amber are mainly insects such as butterflies, moths, spiders, flies, etc. although one lizard has been found . Since man discovered amber he has made decorative pieces such as necklaces, carved figures, amulets, etc., although other articles have been made such as a red amber cup which was found in a grave at Hove, Sussex by the Rev. Skinner while excavating a 20ft mound in 1821. A Bronze dagger, found with the cup, in the 6ft 7in coffin was dated to 1280 – 1193 BC. Caskets (from Russia) and cruets (from Germany) have featured in amber as well as wall panels made around 1707 – 1712 which were presented to Russia and appeared in an amber room in Stalingrad.

When Jill and I went to New Zealand, a few years ago, we visited the Kouri Museum at Matakohe, between Whangarei and Dargaville in North Island, which had a magnificent amber room stuffed full of all things amber, including Victorian false teeth ! The whole museum was devoted to the Kouri tree and the associated resin industry of gum digging (amber) in the forest floor . It was a fascinating talk by John with splendid pictures, enjoyed by all.

Colin Brash

FGS field trip to North Wales, August 2002

A group of 17 members of the society spent a week during August in North Wales, staying at the Drapers' Field Centre north of Betwys-y-Coed.. David Cronshaw, who has led a Farnham group on four previous occasions from various field centres around the country, had planned six full-day excursions. Five of these were in the Snowdonia National park and the sixth necessitated a long drive westwards in the two minibuses to the end of the Lleyn peninsula.



For the most part, the rocks in this area to the west of the Conway valley are pre-Cambrian, Cambrian and Ordovician. To the east of the Conway Valley Fault the rocks are mostly Silurian but those were only studied as we passed through in the bus from Farnham. Because of the extreme age of the rocks being studied - back to over 600 ma - they have undergone many periods of folding, uplift and erosion which has resulted in the present day complicated mixture of rock types and geological structures. The group found the Ordovician rocks particularly difficult to interpret and Dave needed all of his deep knowledge – his PhD thesis was on regional metamorphism in North Wales – and his great reserves of patience in dealing with a group whose

enthusiasm was somewhat greater than its knowledge. When scientific analysis became mentally overwhelming there was, however, the magnificent scenery to be seen all around, a product of the geological complexity. Also there was an entirely different diversion on most days when the RAF were using the valleys and surrounding hilltops as ideal training ground for low-flying jets – noisy but exciting!

1: Cwm Idwal

This cwm (corrie) is situated south of Lake Ogwen and north of the central peaks of Snowdon. It is ideal for studying landform and the complex geology of the Ordovician rocks referred to earlier. Landform is dominated by the effect of mountain glaciation carving out these huge corries and leaving moraines on the valley sides.

During the climb up into the Cwm Idwal syncline it was surprising to find in these folded, compressed rocks which had been subjected to volcanic ash bombardment during Ordovician times, small exposures of sedimentary rocks showing minor folds and cross-bedding. In a narrow gully left by the removal of slate one could see the cleavage planes of the slate where mudstones laid down in the Ordovician Sea had been heated and compressed during the folding of the Idwal syncline. Further evidence of this intense compression was the sequence of quartz veins squeezed out of the original sediments. But the rock that was to become the best known by name, although not always readily recognised, was Rhyolitic Tuff which is a lithified deposit of airfall volcanic ash sometimes mixing with original mudstones to form tuffites. Another type of tuff was the Pitts Head Tuff which is derived from volcanic ash flow and here produces a hard ridge standing above the Nant Ffrancon valley which Telford used for relocating the route of the A5.

A lunch stop at Llyn Idwal before climbing up to the massive, steeply dipping Idwal Slabs of rhyolitic tuff used for practising rock climbing. As an example of the complexity of the rocks of this region Dave Cronshaw pointed out some breccias comprising blocks of acid tuff, vesicular basalt and sandstone in a matrix of fine debris – phew!

2: Lake Ogwen and the Nant Ffrancon Valley

At the foot of Cwm Idwal alongside the A5 road is Lake Ogwen which we walked round clambering over boulders of rhyolitic tuff fallen from the adjoining mountain ridge. This arduous scramble was relieved from time to time by the discovery of a variety of rock types such as microgranite, lapilli tuffs and cross-bedded sandstone. Our leader attempted to explain the presence of these exposures but admitted that there is a major problem in the interpretation of volcanic rocks in the Snowdonia area because of the uncertainty about the location of the eruptions 500 ma. It has been established that a series of volcanoes was involved but with no clear idea of their location. However, it is fairly clear that there were two distinct groups of volcanoes, those around the central volcanic group of the Snowdon area and those to the north east of the area called the Crafnant Volcanics.

Lunch was taken this day on the eastern slopes of the magnificent mountain called Tryfan and afterwards, the party set off down the old road over the ridge west of Lake Ogwen into the Nant Ffrancon valley. This valley had been seen from above previously when climbing into Cwn Idwal and it presents a marvellous example of a U-shaped glacial valley running down towards the slate mining area of Bethesda. Its wide flat bottom, covered by deep deposits of glacial melt material from 10-12 thousand years ago, supports small-scale farming activity. On the south western side of the valley could be observed a line of corries in which the ice had accumulated as part of the mountain glaciation in this area which was distinct from the major ice sheet moving from the north west.

Walking along the valley in bright sunshine one could see the spoil heaps from Bethesda's old slate industry which were deemed to be too unsightly by the planners of the Snowdonia National Park so its boundary was drawn to exclude them!. Before climbing out of the valley to rejoin the minibuses we saw a huge roche moutonniere standing by the path which was climbed to examine its quartz porphyry composition.

3: Capel Curig and the Gwder Forest

The village of Capel Curig is sited where the A5 ,heading westwards from Betwys-y-Coed to Bethesda, junctions with the road heading up through the Llanberis Pass. From the car park a steady climb was needed to reach several important geological features and also the classic view of the Snowdon Horseshoe to the south west. The first feature was an outcrop of fine grained porcelanic tuffs demonstrating a feature called "slump bedding" where the ash beds have been distorted by subaqueous sliding of unconsolidated material Next was a further climb to a well-known feature of Capel Curig hill called "The Pinnacles", consisting of bedded coarse grained basic tuffs which weather into these crags.. More detailed examination in the area of the Pinnacles has produced an interpretation that a small volcanic vent existed here. Descending from the crags other features .inspected were chloritised dolerite, a tuff with orthoclase crystals and other distinctive aspects of the Lower Crafnant Volcanic formation which, as already mentioned, have a provenance different from the Snowdon Volcanics.

At the furthest point eastwards in the walk at the site of a dried up lake, Dave pointed out that the afternoon visit was to the forested area clearly visible to the east but even he, with his mountain hare attributes, would not attempt to reach it from there. So into the minibuses and back through Betwys-y Coed to a forest road leading south west from Llanwryst. The drive northwards from Betwys-y-Coed along the Conway Valley clearly demonstrated how different the Silurian landscape was to the east. At Sarnau, another dried up lake, the group set off to inspect several old mines in this Llanwryst mining district where lead and zinc ores were extracted in the C19th. This whole area lies within the Middle and Upper Crafnant Volcanic Formations. An important feature of these formations is the admixture of components ranging from blocky tuffs to bonded mudstones and tuffites containing feldspar crystals, coarse shards in a matrix of fine greenish mica flakes and chlorite. The interpretation of these features is that they have developed from the incorporation of unlithified mud into a large ash flow.

4: Around Llanberis – a day's walk through 100 million years.

Sunday was the only wet day for this traverse from the head of Llyn Padarn to the south east of Llanberis. Along this four mile section pre-Cambrian gave way to Cambrian followed by Ordovician. The pre- Cambrian was the Padarn Tuff Formation which is the oldest exposed rock in northern Snowdonia. An Ordovician period dolerite dyke was seen intruded into the tuff and a little further along was to be seen illustrated in a roadside wall two different types of rocks where the pre-Cambrian gave way to Cambrian in the shape of a basal conglomerate together with green coloured mudstones and sandstones. Although this differential layering was a little contrived in a man-made wall Dave assured the group that across the busy road was a rock face of the same constituents!

In Llanberis the minibuses parked in the slate museum car park and the group made its way to the old Vivian slate quarry now flooded and used by divers for honing their underwater skills. The sides of the quarry showed huge cleavage planes of purple and green slates with some bedding planes discernible with the "eye of faith".. Dave described how selective the slate miners had been in extracting only the best slate and pointed out that a large dolerite intrusion jutting out into the water had been left untouched. The quarry museum records the history of the mining activities in the major Cambrian slate belt between Bethesda, Llanberis and Nantile.

Having emerged from the quarry and re-crossed the bridge between Llyn Padarn and Llyn Reis we noted three excellent examples of "reduction spots" which had been elongated by compressed forces and are in fact used to calculate the degree of compression experienced. Following the A4086 road to the outskirts of the town a series of exposures can be seen recording cycles of deposition of fine and coarse sediments, the latter produced by turbidite flows into the Welsh Basin.

5: Lleyn Peninsula

A 50 mile drive from the Field Centre takes you to the western coastline of the Lleyn Peninsula. The first stop was at Aberdaron for a walk along the beach with its crumbling cliffs of glacial till overlain by soft sand sediments. Whilst it was very pleasant to sample the atmosphere of a holiday beach for a brief time, the object of the walk to the far end of the strand was a much more serious matter. It was here that pre-Cambrian rocks of the Mona Complex were to be seen in the cliffs side by side with rocks of the Ordovician period, a major unconformity leaving out the whole of the Cambrian succession. Since lunch was taken at this spot far from "the madding crowd" there was plenty of opportunity to study these exposures. The pre-Cambrian rocks revealed examples of ancient schists and pillow lavas. (On the northern side of the peninsula at Nefyn there can be seen classic pillow lavas along with their associated jaspers.) The Ordovician rocks had clearly been subjected to low level metamorphism. Some basalt columns could also be seen in the cliffs.

Returning to the minibuses the group headed towards the very tip of the peninsula in order to visit the site of the late pre-Cambrian subduction zone. On the hillsides there was a breathtaking display of heather and Atlantic gorse, their purple and yellow blooms glistening in the sunlight. There were several pre-Cambrian boulders to study on the way up, some consisting of porcellanous tuffs. There was also a unique feature on the headland called a melange comprising dolomitised limestone blocks and pillow lavas with low grade metamorphism..

6: Snowdon

For the last full day in Snowdonia what more appropriate than a climb to the summit of Snowdon. It is possible that some of the younger members of the party, ie those below 60, would have willingly climbed on foot, but in deference to group solidarity, everyone used the Snowdon Mountain Railway for the ascent but assuaged their consciences by walking down – including some not so young!

The train journey is an exciting experience and the views are superb all the way up to the summit at 3560 feet. It is actually more relevant to talk about the Snowdon Horseshoe because, viewed from the south by Llyn Llydam, there are 3 peaks forming a narrow arc with Snowdon (3560 ft), Crib y Dolysgl (3493 ft) and Crib Goch (3027 ft). Looking westwards from the train on its descent and studied at closer quarters by those walking down is the dramatic north-facing corrie of Clogwyn Du'r Arddu. This is one of several corries on the northern edge of Snowdon which are witness to the major glaciation in this area. The highest cwm is Glaslyn near to the summit which is bounded by steep ice-scarred crags and occupied by a lake that drains into Llyn Llydaw. In these crags one can determine the contact between the Lower Rhyolitic Tuff which comprises much of Snowdon and the Bedded Pyroclastic formations which are at the peak of Snowdon and consist of basic tuffs, tuffites, thin basaltic lavas and tuffaceous sediments.

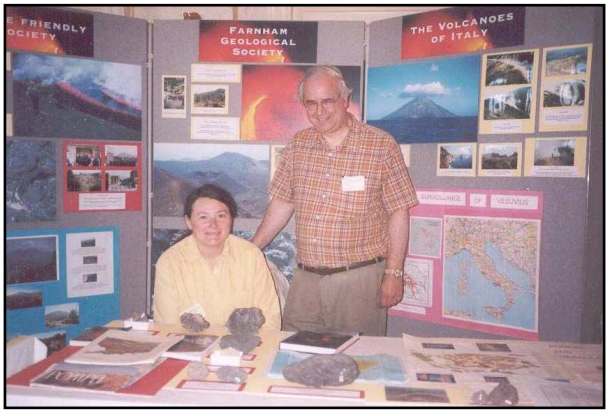
At the evening "talk through" with Dave Cronshaw there was heated discussion about the rock face of Clogwyn Du'r Arddu and the Snowdon syncline. For those of us who had taken the train back down, the complexities of this cwm were not obvious but the outline sketch drawn by Dave convinced us that this exposure was indeed a very good example of the mysteries of Ordovician Volcanics.

A marvellous week with a first-class leader. And so back to Farnham.

Peter Cotton

Earth Alert 2, Scarborough: 24-27th August 2002

Seven members of our Farnham Society attended the GA Earth Alert 2 Conference in Scarborough over the August Bank Holiday weekend. Paul and Sue Olver put on an excellent display based on the May 2002 trip to the Italian Volcanoes and the Aeolian Islands.



The conference was held in the Spa Centre, a large Victorian entertainment complex in South Bay. There was a programme of lectures in the theatre; on the Saturday the subjects were aspects of the geology of Yorkshire, on the Sunday on the North Sea oil exploration; and on the Monday about natural and man-made hazards and global climate change.

There were the usual mineral, fossil and second-hand book dealers and displays by organisations with geological connections –Tarmac for example. Local groups put on displays based on their activities or interests.

Members of the public were encouraged to attend, with Tannoy announcements to those on the beach, plus dinosaur

sculptures on the sand, and the information that there was much more to see at the Spa Centre. The Discovery room, with activities for children, was particularly popular. There were public lectures each day and geologically based local walks, some for delegates only and some open to the public.

We were blessed with good weather, if a little cloudy and windy on the Monday. The views along the coast were spectacular, to the left towards Castle Hill and to the right towards grass covered cliffs with some evidence of landslips. It was worth the effort of going that distance and I hope it was considered a success.

Cath Clemesha

At the Annual GA Reunion at University College, London on November 2nd, Paul and Sue Olver travelled all the way from Hereford by train for the day, with part of their excellent Italian display, and we included ours on the Snowdonia Field Trip which 18 of us went on in August. So we produced a joint effort, giving the whole display the title: '*Volcanoes - ancient and modern'*. The reunion was not so well attended as it usually is but the ten of us who went from Farnham enjoyed the day. For the first time there was a Rockwatch Club section for the youngsters in a separate room and the children were having a great time. The GA has now taken over the running of the club and produces four magazines a year.

Shirley Stephens

Reigate stone - quarrying and use

Summary of Society's November 2002 lecture given by Paul Sowan

Paul Sowan had stepped in to replace the scheduled lecture by Paul Rust about the San Andreas fault. He gave a fascinating talk about the quarries in the Reigate-Merstham area in which Reigate Stone had been excavated by miners for use in the construction of famous London buildings and elsewhere for Royal Palaces. Indeed much of the funding for the project Paul is currently engaged in, that is sampling stone from the quarries and relating it to the buildings in the care of the Historic Royal Palaces Agency, is being provided by that body.

The chemical composition of samples taken from some 17 buildings shows a wide variety, particularly in the quartz and calcite content. Reigate Stone has a very complex composition and there is still much to learn about why this should be so. It is part of the Upper Greensand succession that together with Gault Clays, form a single sequence of deposition after the Lower Greensands and before the Chalk.

The interest of the Historic Royal Palaces Agency is primarily to discover whether anything can be done to help them in their restoration work of badly eroded stone in buildings such as the Tower of London. Paul made an interesting reference to a non-scientific approach in their investigations when he said that the cleaners employed in the Tower had been asked to collect all the material that fell off the walls so that the rate of decay could be measured! Although the general observation is that Reigate Stone is very subject to weathering, there are examples as in Merstham Church where the stone has stood up remarkably well. Christopher Wren made uncomplimentary remarks about the stonework of Westminster Abbey but still used it in St Paul’s, albeit inside the walls round the apse and similar passageways.

Another interesting point related to the cost of transport of the stone for use in London where the cost ex-quarry was almost doubled on delivery. Indeed one of the reasons why Caen Stone was used as an alternative was because loaded on the barges in France, it could be taken to London by sea at almost the same delivered cost as Reigate Stone.

Concerning the techniques used by the old quarrymen for mining the stone, Paul said that the height of the seams they worked was less than 2 metres and they gained access to the good quality stone by cutting a “picking bed” at the top and then removed relatively small blocks for hauling up the slope to load on to horse-drawn wagons. A great amount of low quality stone was left behind in the process that has had to be cleared out in modern times before using the old quarries for mushroom cultivation.

Scientific tests of the stone by sampling cores from different levels in the rock face revealed little difference in the composition so the quarrymen’s knowledge of what was good quality stone was based on practical experience. Although the talk was primarily concerned with the use of Reigate Stone for building purposes reference was made to its use as a refractory material – the miners were known as “firestone miners” –and at a later date it was used for making step whitening products marketed under names such as Snowdrift and Osowhite Step Powder.

Peter Cotton