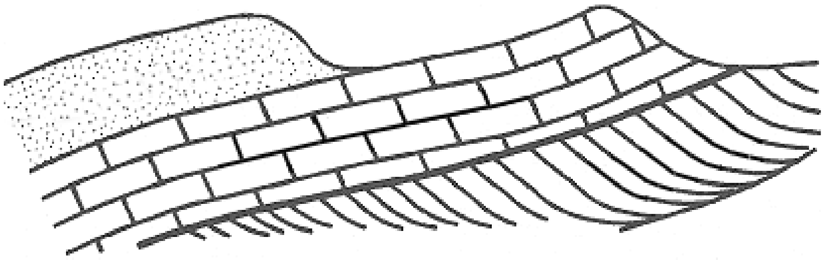
Farnham Geological Society

[**www.farnhamgeosoc.org.uk**]

Farnhamia farnhamensis



A local group within the GA

Vol. 10 No.1 **Newsletter** February 2007

INSIDE THIS ISSUE

A Happy New Year to you all from the Editorial Committee. Since the last newsletter in October we have had our AGM, at which the Society's Committee was re-elected en-bloc, together with the welcome addition of Janet Phillips. I have stood down as Chairman and John Gahan is succeeding me, having handed over his responsibility as Programme Secretary to Janet Catchpole. I shall continue as the Editor of the Newsletter.

Also, since the last Newsletter went to press, there have been two more field trips: one to Dorset in September and the other to Western Normandy in October. Accounts of these two trips appear in this issue.

The Society dinner was held at the Farnham House Hotel in October when 35 people had an enjoyable evening. The Committee is considering changing this annual event to a Sunday lunchtime to enable attendees to drive in daylight rather than on a dark Friday night in October. The actual date has yet to be finalised, but is likely to be at the end of October/early November.

The Society was represented at the Geological Association's *Festival of Geology* held at University College in November. Janet Catchpole, helped by other members, set up a display covering the Society's Sunday field trips in2005/06.

Looking to this year, another exciting series of lectures and field trips have been arranged and it is hoped that more members can be persuaded to come on field trips and that more articles on these are forthcoming for future newsletters.

Peter Cotton

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FGS monthly meetings - 2007

Jan 12th **– 'Geothermal Exploration in the East Africa Rift Valley'** –
DR GEORGE DARLING, BGS, Wallingford, Oxon

Feb 9th – **'Boring old Granites'** –
PROF JOHN CLEMENS, Kingston University, Surrey

Mar 9th - **'Trilobites' –**
PROF RICHARD FORTEY, Natural History Museum, Kensington, London W8

April 13th – **'Hot dates and model behaviour: taking the pulse of a dynamic Earth through thermochronology'** –
Dr GEOFF BATT, Royal Holloway, University of London

May 11th – **'A Field trip to the Mantle'** –
DR HILARY DOWNES, Birkbeck College, London

June 8th – **'Richard Owen and Fossil Vertebrates'**,
DR CHRIS DUFFIN, Deputy Head, Streatham & Clapham High School

July 13th - **Members evening and presentations**.

August - SUMMER BREAK - **no meeting**

Sept 14th – tba

Oct 12th – **'Gold giants of the Great Silk Road – Expedition across the Tienshan'**,
Dr REIMER SELTMANN, Natural History Museum, London

Nov 9th - tba

Dec 14th -.'**Making Gold – Nuclear Alchemy'**
DR PADDY REGAN, University of Surrey

Newspaper snippet-Nasa finds little green gems on red planet

Large outcrops of a gemstone mineral commonly used in jewellery have been found on Mars, scientists said yesterday. On Earth the mineral, olivine, takes the form of the brilliant green gemstone peridot. An instrument aboard a Nasa spacecraft spotted an area of nearly 19,000 square miles rich in olivine in the Nili Fossae region of Mars.

The mineral, detected by the Mars Global Surveyor, was on the surface of the planet. Scientists believe it may have been thrust up from below the ground by faults and fractures. It is thought that the broken nature of the ground at Nili Fossae may be linked to the Isidis impact basin, formed long ago by an asteroid or comet.

On Earth, exposed olivine weathers and breaks down quickly because of the planet's relatively warm, wet weather. Conditions are very different on Mars, which is cold and dry. How much of the unweathered mineral is found on Mars may provide clues about the planet's ancient climate. If the mineral has been there since early in the planet's history, it would mean the planet has been cold and dry for most of its life. But many scientists believe Mars was once much more like the Earth, with running water and a thicker atmosphere.

A team of United States researchers led by Todd Hoefen of the US Geological Survey in Denver, Colorado, reported the findings in the journal *Science*. Nili Fossae is thought to have formed at least 3·6 billion years ago, giving an upper limit for the appearance of olivine on the surface. The scientists wrote: "If the olivine was exposed shortly after the impact event, the martian surface may have been dry and cold for more than three billion years, but if the olivine was recently uncovered ... it could have been cold and dry for as little as a few thousand years."

The Daily Telegraph

A ramble in Argentina – 22 January to 11 February 2004

The great mountain chain of the Andes forms a sort of Chilean/Argentinean backbone, curving south into the Antarctic Ocean, and in January 2004 I was lucky enough to see part of it. I regret that this was not a geological field trip, and I could only call upon my own very limited knowledge to guess at the amazing variety of geological features evident in this landscape. The whole trip was truly memorable, and I count myself lucky to have seen a great deal of Argentina before perhaps the demands of the tourist industry extend to areas which are at present unspoiled.

After two days in Buenos Ayres and a visit to Uruguay across the River Plate estuary, we flew south to Patagonia. After landing at the small airport we drove 200 km through flat, scrubby desert on bumpy, unmade “roads” in a creaking coach, in a temperature of about 35º C. There was a constant rattle as we hit large cobbles in our path. The sky was cloudless but the dust cloud thrown up by us, and rare passing vehicles, was immense. The few signs of life amounted to guanacos (like llamas, only a little smaller and more graceful looking) a rhea, and one or two birds of prey, including a red-backed hawk on its nest in the scrub. We saw no sign of water, except for mud cracks covering the bed of a small, now dried-up lake. The only signs of human interference were a few very small quarries where, it seemed, glacial erratics were being extracted from below the clay/dust sediments.

The surface of the landscape that characterises Patagonia is new in geological terms, but it represents the visible part of the South American Plate which has been moving for the past 125 my. away from its former union with Africa. The submerged part of this plate forms a broad continental shelf under the Atlantic Ocean, and includes the Falkland Islands. The covering sediments have been much altered by countless intrusive and extrusive volcanic events as the Andes were uplifted at the eastern, subducting edge of the Nazca plate, and from the end of the Cretaceous to the present day this great mountain chain has dominated the surface geology. The forests, lakes and glaciers on the lower slopes of the Andes contrast with the extreme aridity of the steppe, which we were traversing. This extends from the foot of the Andes in the west, becoming progressively drier and dropping in altitude to the east as far as the coast of the South Atlantic Ocean. The Patagonian plateau reaches a height of between 1,000 and 1,500 metres OD close to the mountains, and in some places meets the ocean in 750 m. high cliffs. At present, only half a dozen important water courses make their way from the mountains to the Atlantic. Of the many climatic fluctuations, the Pleistocene Ice Age before 10000 BC has most affected the current landscape. At its maximum, ice 2000m deep covered the land, including most of Patagonia. The enormous boulders and roches moutonnées that littered the landscape through which we were travelling indicated the huge mass of ice that had transported and in some cases moved over them.

Patagonia encompasses the most southerly sectors of both Argentina and Chile. In Argentina it extends from the Rio Colorado (36ºS) in the north to Tierra del Fuego in the south. It includes the provinces of La Pampa, Neuquén, Rio Negro, Chubut, Santa Cruz and Tierra del Fuego, plus the south western corner of Buenos Ayres.

The palaeontology on the slopes of the Andes near the northern limit of Patagonia (at around 39ºS) has been found to be extremely interesting, especially near Pino Hachado, in the extensional Neuquén basin. Quite recently some British geologists from the University of Liverpool uncovered many dinosaur fossils there. In fact the relative abundance of fossils near the surface has made Argentina one of the most significant places for the study of dinosaur evolution. Among the examples is the small *Eoraptor lunensis*, 220 mya, considered one of the oldest discovered anywhere in the world.
Cretaceous dinosaur fossils discovered in Neuquén date from the period of separation of the continents of South America and Africa, and provide evidence of the way in which dinosaurs began to evolve in different ways due to their geographical isolation. One example of these is *carnotaurus sastrei,* which has horns and very small “hands.” The topography of Neuquen Province descends from the 12,000ft. cone of Lanin volcano through forested ridges gouged by glaciers. This was once the land of the Mapuche people, and lakes with Mapuche names, tablelands and mesas end in basalt cliffs, where the caves and crevasses contain Mapuche tombs.

Outstanding species of Jurassic dinosaurs have been discovered in other parts of Patagonia. Cerro Condor in Chubut is the only site of Middle Jurassic dinosaurs found in the Americas, and is therefore of great importance in understanding the evolutionary stages between the Upper and Lower Jurassic periods. One of the interesting features is the greater size of Patagonian dinosaurs: the *Argentinosaurus huiculensis* is one of the largest herbivorous dinosaur fossils found on earth, whilst the carnivorous *Gigantosaurus carolinii* was larger than the better known *Tyranosaurus Rex.*

On our sixth day we flew down to Ushaia (**Fig 1**), the most southerly town in the world, located in the Terra del Fuego region. This was our base for four days, starting with a full day’s walk around Lapataia Bay, just off the Beagle Channel (**Fig 2**). It was beautiful, sheltered, and the weather warm and sunny. This more southerly temperature was around 12º C, good for walking. With the help of our guides we identified many wild flowers, and some birds. We stopped for a picnic lunch, and I was able to look briefly at the rocks nearby. Some appeared to be metamorphic; some slate and spotted rock, and there was also a large amount of finely crystalline material which could have been basalt, all very weathered and eroded. I wished for more time and the help of an expert.

There must be huge volumes of igneous rock, both intrusive and extrusive in this area. A whole series of active volcanoes lies along the line of the Andes. Large rounded boulders and cobbles littered the shores, evidence of glaciation.

Figure 1: Ushuaia, from the Beagle Channel.

Figure 2: Lapataia Bay

The next day we took a boat trip on the Beagle Channel. Darwin had been here. We felt incredibly excited, just being there. The weather was as one might expect in such a place: cold and very windy. As the storm clouds gathered, we wondered what this could be like on a bad day in winter.

There were many small islands in the channel; rocky outcrops of what looked like extremely weathered granite, which seems likely. The rocks were crowded with an incredible variety of marine wildlife. The boat was manoeuvred as close as was possible, and we identified Southern Elephant seals, Southern sea lions, Magellanic and Rockhopper penguins, Southern Giant petrels, Southern fulmars, several different types of cormorant, Great Skuas and many more. There were many birds we could not identify, but we did see a magnificent Black-Browed albatross on the wing. Sadly these birds are quickly becoming an endangered species due to fishing methods here. We circled the "last lighthouse in the world" and returned to Ushuaia.

Behind Ushuaia a large glacial valley descends towards the town. We ascended this part way by ski lift, and then continued up the steep slope on foot to just beyond the snow line. It was warm and sunny. From the top the scenery was breathtaking as we turned to look over the town towards the complicated curving coastline and snow- capped mountains. The textbook features of a glacial valley were all around us, and the moraines were a treasure-trove of excellent specimens of well polished rock. With no one to contradict me I identified some beautiful banded – and augen gneiss, and much schist. There were granites of many different textures, from granular to porphyritic, some with huge xenoliths. There was also pegmatite - and much more. I needed expert help!

Figure 3: Emerelda Lake.

Figure 4: The beaver lodge, 11pm.

The next day we spent the whole day walking in another glacial valley, northeast of Ushuaia. A feature of this valley was "Emerelda" (Emerald) glacial lake (**Fig 3**), which lives up to its name. The colour was unbelievably intense against the snowy mountain background, and apparently the reason for this phenomenon is that fine particles of glacial sediment form a filter, allowing the penetration of only certain wavelengths of light.

A great deal of edelweiss was growing here. We also saw reindeer moss among many other types growing among stunted trees. A Tyrant bird was also identified. In the lower reaches this was a very boggy valley, with many overturned and uprooted trees, and no path. Quite a difficult walk. There was also much damage to the trees by beavers (**Fig 4**). They gnaw through young saplings with the result that the older trees are more exposed to the legendary Patagonian wind. Even large mature trees are felled in great numbers. The irony is that beavers are not native to Argentina; they were imported from Canada for the fur trade. It was then found that beavers' fur at the Tierra del Fuego latitude is not of the same quality as in the northern hemisphere, so the beavers were set free. The damage they do in places is quite incredible. We were invited to go on a beaver watch the following evening. We did see some beavers, but they were very camera-shy.

The following day we left Ushuaia and flew north to Calafate, and then on to El Chalten by coach. During the four-hour coach trip we were treated to some magnificent views of the Fitzroy mountain range, part of the Andes, and I believe named after the captain of the Beagle. We travelled on yet another unmade "road", partly following the course of one of the few rivers in Patagonia, the Laeona. There was no sign of habitation along the way except one shack, where we stopped for a drink. The inhabitants were apparently quite accustomed to providing refreshments for travellers, and welcomed us with hot chocolate and delicious lemon meringue pie, made with eggs from their very free-range chickens. The walls were lined with old newspaper, and a 1920s radio stood on a shelf. Two young men sat at a table, engrossed in writing. They turned out to be **geologists** from the University of Wisconsin, doing some research on dating local erratics deposited during the last glaciation of the valley. They had collected some very fine specimens, and were now wondering how to get them back to Wisconsin in view of the strict Argentinean airline weight restrictions. Sadly we had little time to chat before we set off again.

From our base at El Chalten we set off the next day for a round walk of 20 km to the glacial lake of Lake Torre (**Fig 5**), formed where glaciers descend between some of the highest pinnacles in the area. Much of the ground was steeply sloping and uneven, with no definite path, and we were very glad to stop at the beautiful lake for a picnic lunch. We drank from a stream, and the water was absolutely clear, cool and tasteless; the purest water in the world, flowing over a variety of rounded, mostly granite pebbles of many different grain sizes.

We saw Magellanic woodpeckers *(carpentero magallánico)*, a Black-throated huet-huet and a carpet of Lady's Slipper orchids growing among trees on the lower slopes. These are rare in Britain. The scenery was magnificent. I found it difficult to believe that the high Andean pinnacles we were looking at were composed of granite, once buried below the surface, and now sliced and carved into these delicate shapes by huge sheets of ice. Many of the peaks are topped with shale. One, called the "Mushroom" is considered by local experts impossible to climb. In fact the faces of some of the granite needles are so sheer that blocks of snow breaking off the summit cornice fall intact for 6,000 ft. before hitting the piedmont below. These mountains have claimed the lives of many mountaineers.

Figure 5: Lake Torre. In the background are the pinnacles of "Torre", "Egger" and "Standhardt."

Figure 6: A view from the Estancia Alice

We travelled back to Calafate across the Patagonian semi-desert. The scenery was all shades of brown; dry and dusty, with classic features of massive glacial erosion. In the semi-distance there were enormous features which I concluded were huge dykes and volcanic plugs, now exposed high above the surrounding softer sediments.

I had never seen a landscape like this! No chance however to take photographs from the juddering interior of the coach. We saw the predatory *Crested Caracara*, known locally as "flying devils".

We flew from Calafate to the Estancia Alice (**Fig 6**), which in the past had been a working farm, and was now a pleasant visitor centre, set in many hundreds of acres bordering Lake Argentina – the largest lake in the country. Beside the lake – which looked like a sea - was an area of wetlands frequented by many birds. A river flowed from the lake past the estancia. The views of the lake set between hills, with snow-capped mountains in the distance, were glorious. Poplar trees helped to shield the buildings from the Patagonian winter winds.

Figure 7: Perito Moreno glacier

Figure 8: Icebergs from the Upsala Glacier

The following day we visited the Perito Moreno glacier (**Fig 7**), now designated as part of the Glacial National Park of Argentina, and part of the Southern Ice Field. This is stunningly impressive. There are board walks and platforms for viewing the glacier. Extremely loud cracking and grinding noises are emitted, both from within the glacier and at the ice front, as great pieces of ice break off and fall with a roar into the water below (called "calving"). The result is a tidal wave, and a new iceberg. We boarded a boat for this incredible view, and were taken as near as possible to the wall of ice. The glacier is 3 miles wide, and 22 miles long. It measures 197 feet above the water at the southern ice front. I have many photographs! This one was taken from the boat:

The next day we visited the Upsala glacier (**Fig 8**), the largest in Argentina. At least thirteen glaciers feed from the Upsala Icefield, and this is the largest of all. Ranges of snow-covered mountains lie behind and at each side of this tremendous glacier, and directional crevasses point to the great cliff of the ice front. Many icebergs of all sizes are created here, and we approached them by trimaran. In the sunshine the colours really are beautiful shades of blue; the dense, compacted ice particles allowing only blue wavelengths through. From Catulate we took a flight back to Buenos Ayres where we had two days of shopping, eating and night-clubbing.

Joan Prosser

Field Trip to Peveril Point, Studland and Brownsea Island - 3rd September 2006

The field trip had two themes: the first was non-marine sediments (surprising given our location) and the second the collision of continents and the effects on the stratigraphic and depositional patterns. It also had 22 people, lots of mud, "sweet smelling" seaweed and one of the best fossilized river beds you are ever likely to see.

Location one: The Purbeck Formation at Peveril Point

Peveril Point during the Jurassic was at the edge of a platform that looked out over a basin. It is now a sea view that has some half submerged rocks with strata that dips in opposite directions, indicating the presence of a syncline. The basin was filled with sediments of mudstone and mainly limestone. This led to the shallowing of the sea that changed the depositional environment from deep marine Kimmeridge Clay through to shallow marine Portland sand into coastal shoal oolites of Portland stone. Eventually the Dorset area became separated creating the lagoon in which the Purbeck sediments were deposited. At this time Peveril Point was at 37 degrees latitude and had a Mediterranean climate with warm wet winters and hot dry summers. This meant that the lagoon dried out periodically and our quest was to find evidence for this and the non-marine environment.

Down on the beach our first stop was to look at a rock that could be limestone. On closer inspection it was packed with lots of tiny gastropod fossils. The snails were identified as a pond variety such as Viviparous our first evidence of the non-marine environment and the possibility of a fresh water lagoon. It quickly became clear that the numbers of species found in the limestone were very restricted indicating a changing environment and possible ephemeral lagoon. The top surface was stained red and was in fact fossilised rust indicating the limestone had been exposed to the air after deposition. Further along the shoreline more evidence of terrestrial activities including possible dinosaur bones. At the far end we found fossilised mud cracks and calcite beef. The fish scale, turtles and crocodiles finds were also all likely to be fresh water varieties.

Location two: Studland – The Cretaceous-Tertiary Unconformity

This area was uplifted during the Palaeocene and the rocks were folded and faulted. It was a period of rapid erosion with the loss of 200 m of rock. The Dorset area became low lying with the deposition of fluvial sands and muds deposited during the late Palaeocene. Although this period of erosion was short it left a time gap in the stratigraphy of more than 20 million years (an unconformity). We therefore needed to find the evidence in the field. At the far end of the beach across the "sweet smelling" seaweed is a chalk cliff with flints. This area in Jurassic times was on a platform. The top of the chalk has an irregular surface with solution hollows which is evidence of erosion and above the chalk is a layer of brown iron stained lumps suggesting it had been exposed to air. Subsidence of the area allowed the incursion of the sea and deposition of a thin layer of clay on to the chalk, filling some of the solution hollows. This was followed by the Reading beds which were deposited by fluvial river systems heading east towards the Bournemouth delta. Another minor marine incursion allowed deposition of London clay, before the river system took over and the Bournemouth delta overwhelmed the area - a case of "too much sediment and too little basin" according to Graham.

Figure 1: Broadstone sand

Figure 2: Base of river channel

At the other end of the beach at Studland is an excellent exposure of the overlying Broadstone Sand with beautiful iron stained cross bedded sands (**Fig 1**). The question on all lips was "where did that colour come from"? The answer lies in the overlying layers of lacustrine muds (Broadstone clay) packed with lignite and plant fossils. Pipes formed by roots go into the top of the sand layer. If these pipes were stuffed with plant rich mud and the root system was sealed by the clay then anoxic conditions would exist and create hydro ferric oxide which on contact with air would oxidize to from iron oxide and the wonderful staining for all to see. Having cleared up that minor geological puzzle we headed for two ferries and Brownsea Island to find the fossilized river bed, the highlight of the day.

Location 3: Brownsea Island

About 100,000 years ago the sea level was lower and Brownsea Island was a hill surrounded by rivers. The flooding of the English Channel due to melting ice formed Poole Harbour 5000 years ago. An island was formed, but the evidence for the original river system is down on the beach if you know where to look. There is the base of the river channel (**Fig 2**) with iron stained cemented sands and conglomerates left behind by the eroding river. There are even wood scrapes and possible evidence for a log jam. This location also offered good views of Graham's oilfield.

It was a great day for building a picture of the past geological events from the evidence surrounding us. The locations were picturesque; the weather was kind and like all good field trips rounded off with tea and cakes. Another fantastic day organised and led by Graham.

Alison Matthews

The rocks and landscape of Northwest Shropshire – FGS field trip June 2006

This week-end field trip, on 3rd and 4th June 2006, was led by the local expert geologist and industrial archaeologist, Gordon Hillier. Seventeen FGS members (**Fig 1**) assembled in the garden of Gordon's house in Maesbrook, south of Oswestry, on the preceding sunny evening to enjoy a buffet supper and to receive field notes, introductory briefing and directions to the food shop and assembly point for both days in Llanymynech [Welsh for Church of the Monk].

On Saturday we made a prompt start for Pant [Valley/Hollow Place] and limited parking at the top of a long, narrow lane. A short walk brought us to the edge of a south-facing Carboniferous Limestone escarpment overlooking Llanymynech and its former quarry, with comprehensive views south to the Severn valley and to Breidden Hill, scarred by quarry working and topped by Rodney's Pillar, and east to Nesscliffe Hill. Back in Llanymynech we proceeded in the 1831 student footsteps of Charles Darwin and viewed steeply dipping Ordovician deep marine mudstones in Pen-y-Foel [Top of Bare Hill] Lane; these lie directly and therefore unconformably below the Carboniferous limestone. From here we walked to the Industrial Heritage Area adjacent to a navigable section of the Montgomery Canal, skirting a huge (disused) conventional lime-kiln en route to a rare example of the later Hoffman Ring Kiln (**Fig 2**). As the name implies this kiln was constructed to provide a circular layout of contiguous chambers which were loaded with limestone and shafts of coal and fired successively to provide continuous production of lime.

Figure 1: The group

Figure 2: Hoffman Ring Kiln

The fourth site was located near Llynclys [Lake of the Hall/Court], back past Pant to the north, where Dolgoch [Red Meadow?] Quarry had been worked extensively as a source of Upper Grey Lower Carboniferous Limestone. Our lunch stop – with full view of the 10m high main exposure – was followed by traverse of a short tunnel whose roof had been a mass grave of Gigantoproductus and coral, to see a second quarry. We then drove further north to the overgrown Bwlch [Pass] Quarry, west of Oswestry and close to Offa's Dyke, for a difficult view of a sequence of Permian sandstones, conglomerates, cherty siltstones and silty clays, which comprise the Cefn-y-Fedw Sandstone formation.

The final location for the day was at Nesscliffe Hill, 18km to the south-east along the A5. Here we climbed through woods to view the mass of Triassic red Sherwood Sandstone and large-scale cross-bedding. Current opinion holds this to be the product of braided river deposits, possibly derived from Aeolian material which had been transported by water subsequently.

Well satisfied with the range and quality of the day's programme we returned to LLanymynech and dispersed to our respective lodgings to shower and dress for a second welcome to Gordon's delightful garden and alfresco supper. We then divided into two teams, one to scour the trees and shrubs for twenty fossil specimens which Gordon had concealed therein, the other team to search for twenty mineral items. Jocular dealings in a fantasy black market were soon audible: "*Pssst, want to swap a mineral for a fossil*?" ….!

Sunday, too, was a day of good weather; our first stop was at Alberbury, 11 km south-east of Llanymynech, to view an outcrop of the eponymous Permian brecchia and its use as a building stone in the village hall. East to and around Shrewsbury and south-east to Much Wenlock brought us within 2 km of Farley/Gleedon Quarry. From the working floor we viewed the abandoned faces of Silurian limestone, mainly bedded but with sections of reef facies discernible, together with folding and minor faulting. The multitude of spoil heaps yielded handsome specimens to even the least competent fossil hunters and the huge site could have engaged our attention for some hours. Another exciting location called, however, and we proceeded some 12km north to The Ercall complex of five quarries adjacent to The Wrekin, just south of Wellington.

Here we took lunch in contemplation of the former working face of Quarry 1; this consists of Precambrian flow-banded rhyolite, in which some of us duly sought and found jasper; with a weathered dolerite dyke cutting the eastern extremity beneath masking undergrowth. Quarries 2 and 3 formed a huge and fascinating exhibition of geological features which occupied the remainder of our field study. The northern backdrop to Quarry 2 is a vast cliff of granophyre which fronts the residue of a massive near-contemporaneous intrusion into the rhyolites seen in Quarry 1. The steeply sloping eastern edge of the granophyre is overlain unconformably by shallow Cambrian quartzite conglomerate which in turn is overlain in Quarry 3 by substantial deposits of quartzite with clear ripple-marking on an exposed bedding plane. On returning to the amphitheatre of Quarry 2 we learned that its western face replicates the conglomerate-and-quartzite assemblage in Quarry 3 whose location is, in fact, the result of a 110m dextral tear fault. Finally, we turned to study the quartzite cliff which forms the southern boundary of Quarry 2: those of us with sufficiently sensitive touch were able to interpret the slickensides thereon as evidence of a sinistral tear fault. A conceptual tour de force, indeed, whose effect combined with the physical exertions of the day to render the return to our cars less than brisk.

Graham Williams' vote of thanks, to Gordon for his excellent planning and leadership of the study days and to Marion for her comprehensive and unruffled organisation in catering for our incursions at Maesbrook (not to mention safeguarding our access to and egress from the car-park above Pant), was firmly endorsed and Graham himself was applauded for the unfailing efficiency of his preliminary organisation at Farnham.

David Martin

Field trip to West Normandy – 6 to 9 October 2006

Twenty-seven of us enjoyed this long weekend field trip superbly led by our own Graham Williams. It met up to all expectations which were advertised as SUPER sediments, structures, wine, food and company! Our trip focused on the geology of the west coast of the Cotentin Peninsula, western Normandy, between Cherbourg in the north and Avranches in the south.

Group at Baie d'Ecalgrain

Leader Graham

Normandy has a particularly complex 3 billion year geological history. We investigated very old Archaean metamorphic rocks, the Pentevrian sequence (-2800ma) from the continental basement and learned how they started as sediments. Next came the Brioverian sequence, dating around 900-570, which was more complex being composed of lava, limestone, mudstone and turbidite sequences with granite intrusions. We also looked at the Flamanville granodiorite and then to Carteret to see a huge, spectacular section of early Cambrian sediments.

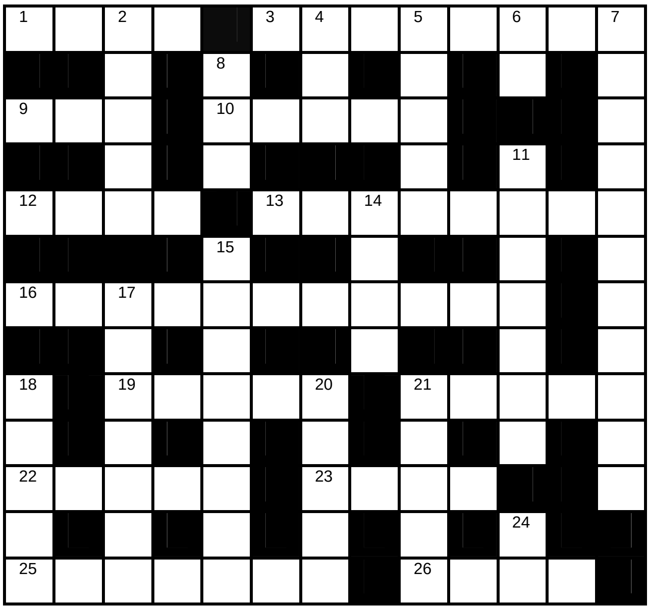
We spent a lot of time on the beaches during our 3 days in the field observing spectacular formations and studying rocks and structures. The weather was quite agreeable and mild except for the ferry crossing from Portsmouth on Friday when it teemed with rain. Our fast ferry was cancelled and we wound up in Caen late at night instead of Cherbourg which would have been early evening. Unfortunately we arrived too late for dinner at the Chateau Briquebec but more than made up for it the following 2 nights. The Chateau dated from the 11th century but fortunately had 21st century amenities. The town itself was lovely and we had a chance to visit the street market before leaving on Monday for a day in the field and the trip home in the evening.

Lyn Linse

Peter's puzzle – No. 3

B	I	V	A	L	V	E		W	A	L	E	S
A		O		O				E		O		E
S	I	L	I	C	A		B	A	N	D	E	D
A		C		H		M		L		E		I
L	I	A	S		K	I	N	D				M
		N		O		C			C	O	R	E
P	H	O	S	P	H	A	T	E		I		N
O				A				A		L		T
R	I	P	P	L	E	M	A	R	K	S		A
O		E			R			T		H		T
U	P	T	H	R	O	W		H		A		I
S		E			D					L		O
	G	R	A	B	E	N		G	R	E	E	N

Solution to puzzle 2



Grid for puzzle 3

Across:

1 Compressed vegetation (4)
3 Usually white but can be red (3,5)
9 Covers 2/3 Earth's surface (3)
10 Striding Edge, Helvellyn is one (5)
12 - point (4)
13 Lava is its guest (4,4)
16 St. Pierre overwhelmed by one (4,7)
19 Sub-section of geological era (5)
21 Glauconite colouring (5)
22 - assemblage of fossils (5)
23 Uranium descendant (4)
25 Formed in arid conditions (3,4)
26 Egg shaped (4)

Down:

2 Banded chalcedony (5)
4 Finish of a period of time (3)
5 Flint is a variety of this (5)
6 Blocky lava flow (2)
7 Occur in rejuvenated river (5,6)
8 Minerals are worked from it (3)
11 Containing rich fossil seams (4,3)
14 look for something (4)
15 Ropey relative of 6 Down (8)
17 Gemstone for month of May (7)
18 Rocks are - in centre of Weald (5)
20 Alive with *The Sound of Music* (5)
21 Bird droppings (5)
24 Repeat of 6 Down

Newspaper snippet - Odd rocks are fossils from 3·4bn years ago

A series of strange rock formations, known as the stromatolites of Western Australia, are the earliest fossil evidence of life on Earth, scientists have concluded. A study of the layered carbonate rocks in the Pilbara region suggests that microbes were living in tidal reefs some 3·4 billion years ago.

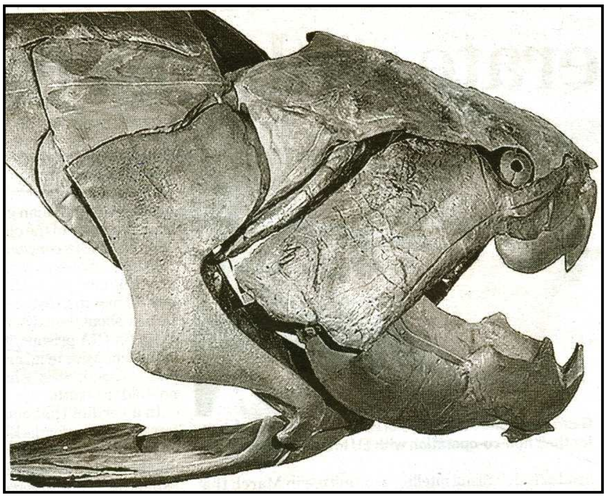
The study, published in Nature, supports Charles Darwin's view that life first emerged in something like a "warm little pond" rather than much hotter and mineral rich undersea volcanic conditions. The stromatolites, first described almost three decades ago, are a source of much spirited debate. Some claimed they were formed from the remains of primitive microbes, while others believed that they were created from mineral-laden waters that surged from undersea volcanoes.

In an attempt to resolve the dispute, Abigail Allwood, her husband Ian Burch, and colleagues from Canada, the Macquarie University, Sydney, and the University of Sydney, studied a stretch of stromatolite-rich rock more than six miles long, part of a formation called the Strelley Pool Chert.

"We mapped that section in detail and realised that there was not just one type of stromatolite [as previously thought] but seven distinct types," said Miss Allwood. Their diversity of the structures and other features make it implausible that this resulted from only chemical processes, the team argues. "This is the first discovery of a complex, ecosystem-scale remnant of the early biosphere," said Miss Allwood. "It is difficult not to believe that life was well established by 3.43 billion years ago."

The Daily Telegraph, 8 June 2006

Newspaper snippet - Prehistoric fish with bite stronger than T-rex



It swam in a primordial ocean 400 million years ago and could deliver a more powerful bite than any living fish, including the biggest sharks of today. Scientists have discovered that the vice-like grip of its jaws enabled *Dunkleosteus terrelli* to exert a force of 11,000 pounds on its prey, enough to bite the toughest into two.

The extinct creature, which grew 33ft long and weighed up to four tons, was armed with a formidable array of bladed teeth which exerted a pressure of 80,000 pounds per square inch at the tip of its fangs. A study of the fossilised skull of the fish also revealed that it could open its jaws in a one-fiftieth of a second, creating such a strong suction that it would have quickly pulled prey to its mouth.

D. terrelli lived during the period known as the Devonian, before the advent of the dinosaurs, and it probably fed on other armour plated fish, including sharks, as well as tough invertebrates protected by shells and other types of body armour.

Steve Connor, Science Editor, The Independent, 29 November 2006

FGS field trip programme for 2007 / 08

April 1st **Pleistocene sequences in Sussex** led by **Dr Martin Bates.**

Martin is a geologist and an archaeologist; he is interested in sediments, and the archaeology of the Palaeolithic period (the last ½ million years or so). Martin will demonstrate the ancient river system that is now the Solent and a number of related raised beach features, all of which reflect the major changes in sea level that we have experienced in the last couple of million years. We intend to visit Solent Breezes to see river deposits laid down by the Solent River, Chichester and Selsey to see raised beaches, and foreshore channels rich in plant and animal remains, and Chichester harbour to see how this harbour formed during the Pleistocene. Martin is a well respected expert in his field, and I look forward to hearing his story.

May 4th - 6th **Anglesey** led by **Dr Denis Bates** (Martin Bates' dad!!).

Denis is a well respected palaeontologist who has worked in Anglesey for 40+ years. He wrote the geological field guide for the island. We intend to see a suite of metamorphosed Pre-Cambrian rocks including the amazing Gwna Melange, Spilitic Pillow lavas at Rhoscolyn and the Holyhead Quartzite, South Stack and new Harbour Group proximal and distal turbidites, metamorphosed to schists and full of beautiful fold, fault and cleavage systems - enough to please the most ardent structural geologist. We will visit Parys Mountain copper mine to see mineralised Silurian volcanics, and Lligwy Bay to see Carboniferous Limestone and Old Red Sandstone sediments. Finally we will see a massive Tertiary igneous dyke intruded when the North Atlantic opened, and perhaps the Peregrines will be nesting again. Denis is an old friend, a fun leader, with a host of stories.

June 10th-17th **Cork and the Ring of Kerry** led by **Dr Denis Bates**

Denis will take us to the Dingle and Iveragh Peninsulas to see spectacular folded Devonian and Carboniferous rocks; on Valencia Island (a tropical paradise) we will see the oldest tetrapod (4 footed animal) tracks in the world. Weather permitting we hope to take a boat trip out to Skellig Michael - a magical bird colony with Puffins and Gannets. Then down to the Old Head of Kinsale to study the Armorican Fold Belt, and on to Waterford to see some classic Ordovician volcanic sequences. Interspersed, we will visit old Celtic structures including Beehive Monasteries and the Gallarus (drystone) Oratory. Together with the spectacular countryside and seascapes, and friendly Irish folk, this promises to have something for everyone.

July 1st **Burton Bradstock and Chesil Beach** led by **Dr Graham Williams**

We visit the cliff sections at Burton Bradstock to see a sequence of Lower and Middle Jurassic rocks including the Bridport Sand, Inferior Oolite limestone and Fullers Earth. The Bridport is one of the reservoirs of the Wytch Farm oil field, so there are bound to be oil related comments from Graham!! Then we visit parts of Chesil Beach, beach combing to understand the development of this feature during the last ½ million or so years. Finally we go to the Swannery at Abbotsbury to examine the lagoon behind Chesil Beach, to see the birds, and to have a cream tea!

August 4th - 5th **South Wales** led by **Dr Graham Williams**

I hope to visit the coast near Bridgend where we can see a variety of limestone sequences and rocks of Devonian, Carboniferous, Triassic and Lower Jurassic age, with spectacular fossils, particularly corals. An impressive unconformity is visible - it shows an ancient desert land surface, eroded into Carboniferous Limestone, with hollows and wadis filled with Triassic desert sands and conglomerates. This visit has to be confirmed, and I am looking for a knowledgeable leader to help us.

September 2nd **Hengistbury Head, Hordle and Hurst** led by **Dr Graham Williams**

The coast between Bournemouth and the New Forest consists of soft Eocene sediments. First, we will see some marine sediments at Hengistbury Head which contain Nummulites (shells about 1cm across made by a gigantic single celled creature), and some lagoonal sediments at Hordle in which the famous Hampshire crocodile was discovered. Second, we will see Holocene cliff erosion and sedimentary features (beaches, bars and spits) to see how a reasonably stable coastline has reacted to rising sea level and man's sea defence systems; we will speculate on the future for this coastline.

October 7th **Carboniferous Limestone of the Avon Gorge and the Old Red Sandstone of Portishead** led by **Dr Tony Kirkham**

Tony is a well respected Petroleum Geologist who is unusual in that he has also published a whole library (it seems) of papers, including on his beloved Carboniferous Limestone (his PhD topic); this old friend is an enthusiast and one of the nicest people I have ever met. Tony will show us classic sections of the Carboniferous Limestone in the Avon gorge, and will tell us his tantalising "Microtektite" story, published recently; at Portishead we will see ORS exposures with, among other features, wonderfully preserved palaeosols.

I hope this programme will provide something of interest for everybody - interesting places, beautiful countryside and seascapes, wild life and plants, ancient and modern rocks, and a touch of archaeology.

Graham Williams, FGS Field Secretary

Date	Days	Venue
2007 April 1	1	Beach sequences in Sussex
May 4 - 6	3	Anglesey
June 10 - 17	8	SW Ireland - Ring of Kerry
July 1	1	Burton Bradstock & Chesil Beach
August 4 - 5	2	South Wales
September 2	1	Hengistbury Head
October 7	1	Bristol - Carboniferous limestone
2008 April 4 - 6	3	Lizard Peninsular
Early May	8	Majorca
June 2	1	Osmington to Overton
July 2 - 4	3	Cardigan Bay