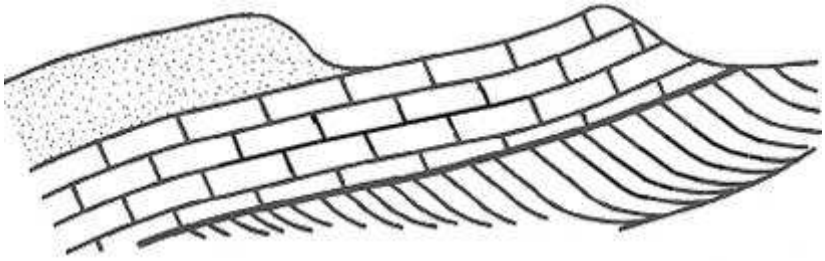
Farnham Geological Society

[www.farnhamgeosoc.org.uk]

Farnhamia farnhamensis



A local group within the GA

Vol. 12 No.3 **Newsletter** October 2009

Editorial

This is my swansong as Editor of the Society's Newsletter. I am retiring from the committee at the AGM in January, having served for 20 years (8 of which as Editor of the Newsletter) all of which I have greatly enjoyed. Thank you, to all the contributors to the Newsletter during my watch and my thanks go in particular to Graham Williams who has provided much input into field trips, and to Janet Catchpole who has arranged not only the fish and chip suppers for our speakers, but also persuaded many of them to summarise their lectures.

This October Newsletter features the trip to the Isle of Man and contributions from no less than six members are included. In my earlier years as Editor I would have tried to re-arrange such individual contributions but there is much to be said for printing these as written; it certainly reduces the likelihood of angst when the editor dares to re-write the text!

Finally, I wish my successor well and hope that he or she will have the continued support of members who are prepared to make their own contributions rather than just enjoy the finished publication. Mike Weaver has been an inestimable strength to me in laying out the Newsletter and arranging for its printing; I am confident he will continue to render his invaluable services to the next editor.

Peter Cotton

Remaining programme of lectures 2009

Date	Speaker	Title
9th October	James Ford	Brick Making and Chalk Mining Hazards in Reading
13th November	Dr Julian Murton Sussex University	Ice Age England
11th December	Paul Olver	The Star of Bethlehem
8th January 2010	tba	tba

Vacancy for Newsletter Editor

As you will all have seen from reading this month's editorial, Peter Cotton, after many years in post, is standing down as editor of the Society's Newsletter. I have received many words of praise from members, visiting lecturers and other Societies on the very high standards that have been consistently achieved by Peter during his reign as Editor. On behalf of the entire membership, I would like to take this opportunity of thanking Peter for the excellent service he has provided during his time as Editor.

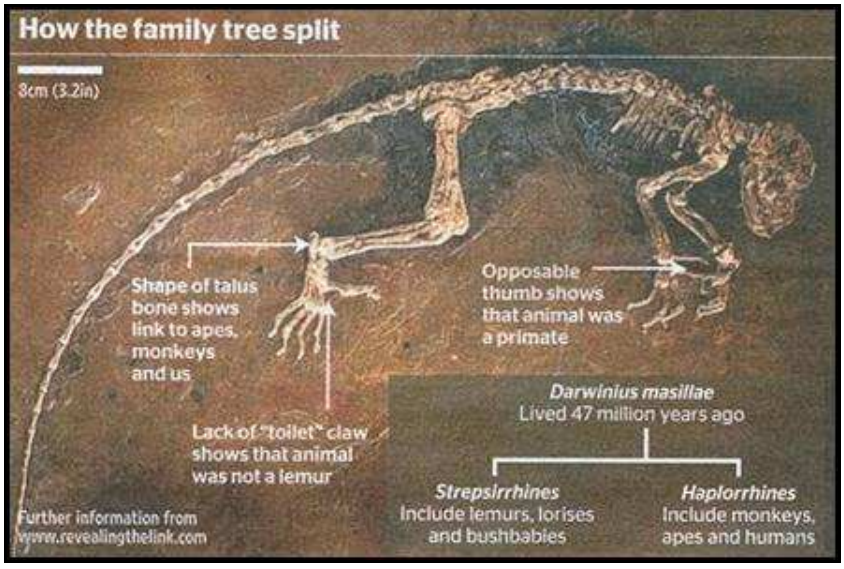
The post of Newsletter Editor is therefore vacant as of now, and the Committee is urgently seeking an immediate replacement. The main role of the Editor is to gather articles of interest for the Newsletter; these can be in the form of articles written by members (geological articles, published papers, field trip reports, etc) or, copyright permitting, articles appearing in other publications (newspapers, magazines etc) thought to be of interest to members. Although the new Editor can if he/she wishes take on the entire task of information gathering and publication, significant help will be provided with the type-setting/computing/printing side of publication if required.

Anyone interested in taking on the role of Newsletter Editor should make this known to me as soon as possible, but in any event, no later than the end of November 2009, as it is hoped that the next Newsletter can be published as planned in February 2010.

John Gahan, Chairman FGS

Fossil find may be missing link in evolution of humans

A missing link in human evolution may have been filled by a remarkable fossil that could be the common ancestor of all apes and monkeys, including our own species. *Darwinius masillae,* a small lemur-like creature that lived 47 million years ago, illuminates a critical chapter in the human story when the primate family tree split into two branches, one of which led ultimately to us. The fossil could even mark the point at which the evolutionary lineage of humans, apes and monkeys diverged from that of more distant primate cousins such as lemurs, lorises and bush babies. Its anatomical features suggest that it lies close to the origin of the human branch and that the creature, or something like it, could be an ancient ancestor of humans.



The almost complete skeleton, which is missing only a part of one leg, was unearthed in 1983, in the Messel Pit near Darmstadt, Germany. Its significance had not been noticed before because the fossil was split into two parts. The pieces have now been reunited by a team led by Jorn Hurum, of the University of Oslo Natural History Museum. The first analysis is published in the journal *Public Library* of *Science One.* As well as the bones, the fossil preserves soft features of the animal such as fur, and even its last meal: it was a herbivore that ate fruit, seeds and leaves. "*This fossil will probably be pictured in all the textbooks for the next 100 years*," Dr Hurum said. "*This is the first link to all humans ... truly a fossil that links world heritage. This fossil is so complete. Everything is there. It is unheard of in the primate record at all. You have to get to human burial to see something that's this complete*."

The ancient remains are those of a young female and the presence· of both adult and baby teeth suggest that she was about nine months old. She was about a metre long and about 60 per cent grown when she died. She has been nicknamed Ida, after Dr Hurum's six-year-old daughter, whose adult teeth were erupting while her father was studying the fossil. The scientific name honours Charles Darwin, as both the bicentenary of his birth and the 150th anniversary of the publication of On *the* Origin of Species fall this year. The second part is taken from the Latin for the Messel Pit.

Ida's importance stems from her anatomical characteristics, which appear to mark her out as a transitional form between two types of primate. Modern primates are divided into two suborders: the strepsirrhines, or "wet-

nosed" primates, include lemurs, bushbabies and lorises; the haplorrhines or "dry-nosed" include monkeys, apes and humans. While some of Ida's features are similar to those of strepsirrhines, she lacks two key characteristics of modern lemurs: a grooming or "toilet claw" on the second digit of her foot, and a fused row of teeth on the lower jaw known as a toothcomb. The absence' of these traits is typical of haplorrhines such as human beings.

Jerry Hooker, a mammalian palaeontologist at the Natural History Museum in London, said: "Importantly, this new fossil lacks a number of key characters of lemurs and lorises, but also has a number of key characters of all other primates. Given that *D. masillae* was at an early stage in haplorrhine evolution, with a mix of primitive and only a few advanced characters, in life it probably looked generally more like a lemur than a monkey, but with a shorter snout and shorter hind limbs."

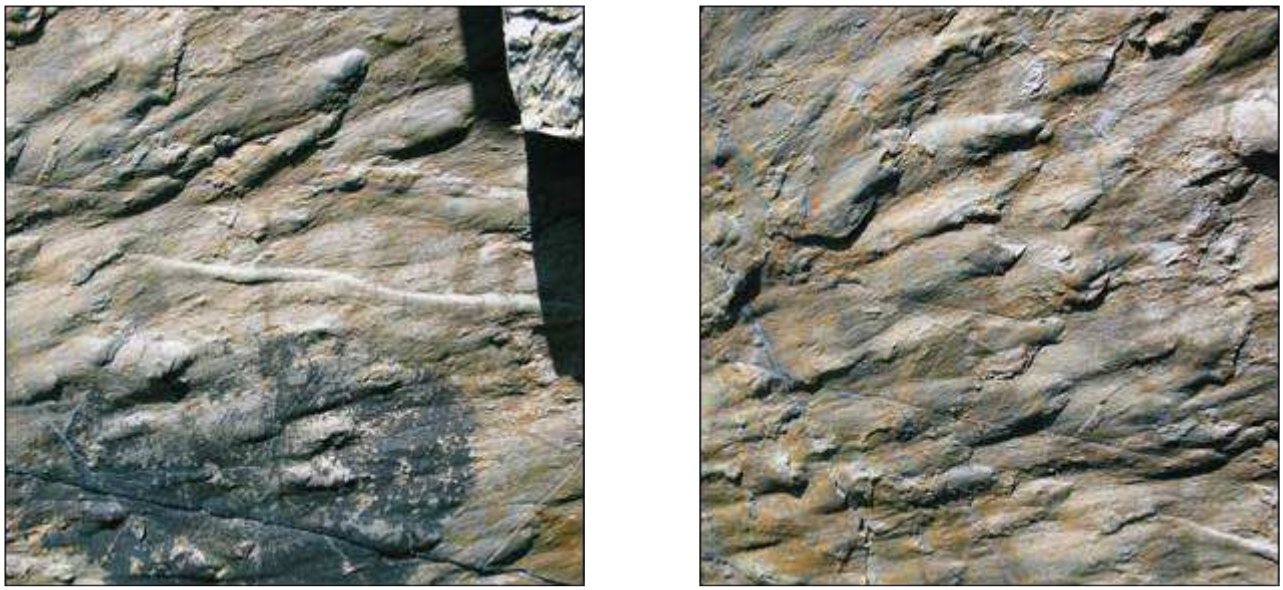
Mark Henderson, Science Editor, The Times, Wednesday 20 May 2009

Field trip to the Isle of Man, 10 – 16 May 2009

Day 1 – Monday 11 May (Gordon Freeman).

Our memorable trip to the Isle of Man began on a sunny but chilly Monday morning with a visit to Marine Drive, Douglas, where the roadside exposures at Pigeon Stream enabled us to view and discuss some of the rocks of the Manx Group. Here Bill, our leader, demonstrated his excellent teaching skills and shared with us his wide knowledge and experience of Manx geology

The exposures comprised of metasediments and were the result of low-grade metamorphism. They consisted of grey interbedded mudstones, silkstones and sandstones of Lower Palaeozoic age. They gave us the opportunity to discuss the concept of Bouma sequences, which are used to divide deep water turbidites into intervals (a, b, c, d, e) in which as the current slows the grain size decreases from 'a' to 'e' (sand to silt to mud). Graptolites have been found in these deposits but the only evidence of oxygenation we were able to observe were trace fossils in the form of burrows and trails, and their grey colour The orientation of flute casts seen on some of the sole surfaces in these deposits indicated a north east to south west current direction, and that they were formed in submarine fans which developed along the margins of Avalonia and the Iapetus Ocean.



Trails and burrows, and sole surfaces with flute casts.

Our next stop was Peel on the west coast, where, after taking a short walk through a gap in the wall of Peel Castle, we came to a shallow quarry in the floor of which were folded greywackes of the Niarbyl Formation (Silurian). The greywacke beds are 20 - 30cms thick and are separated by thin pelitic bands. The small folds in these bed are upright and trend north east to south west. The steeply dipping or curved bedding planes of the well-developed syncline seen at this location showed ripples of sand and mud which had been deformed.

The palaeo-flow data from the Niarbyl Formation here suggest that its sediments were derived from the Laurentian Continent on the western side of the Iapetus Ocean. This reversal of the source from Arenig to Wenlock times some 60 million years later, indicates that Avalonia and Laurentia had begun to dock as the Iapetus Ocean closed and its floor was subducted along a suture.

After lunch, in the shadow of Peel Castle, which occupies the important site of St Patrick's Isle, we took the footpath southwards to the viewpoint at Corrins Hill. From here we saw the Antrim Coast and, in the harbour

below, the smokestack of Moore's Kipper Factory, whose products were later to feature at breakfast and as gifts to take home. A steep climb down on the seaward side led to the disused Traie Dullish Quarry.

Here there was a large expanse of grey Manx Slate dipping eastwards into the face of the quarry and thus giving, on the north side of the quarry, an exposure of some 10metres depth. At the lower levels many v-shaped orthocone nautiloids were visible. These vary in size from a few mms to about 50cms. Monograptids and Cyrtograptids have also been reported, but we did not see them. Higher in the sequence there were clearly visible meta-bentonite beds, formed by the breakdown and alteration of volcanic ash giving soft yellowish layers in which there are zircon crystals useful for dating. These rocks are of mid-Silurian age and belong to the Niarbyl Formation. The nearest known Silurian volcanism was probably that in South Wales; a long way for quantities of ash to have travelled. In places it had penetrated into fissures in the rocks.

We followed a path back contouring round the hill and passing another, much smaller quarry, but a quick examination did not suggest that it would give any further information.

Day 2 - Tuesday 12 May (Mary Clarke)

A key event of the Manx field trip was our visit to Niarbyl Point on the south west coast (GR 212777). In plate tectonic terms the Isle of Man was perched at the edge of the Iapetus Ocean from Ordovician into Silurian times - during phases of subduction in a southerly and later in a northerly direction. Here at Niarbyl, it seems, the southerly land of Eastern Avalonia (including England and part of Europe) was over thrust by a slither of the north-westerly continent of Laurentia (comprising most of North America and part of Scotland) as the ocean began to close. The evidence of this event at Niarbyl provides clues to a complex and not yet fully understood story.

Fig 2: Mega-cracks in quartzite

Our leader, Dr W R Fitches, has been and continues to be at the forefront of this research and he discussed with us some of the intriguing problems involved.

Having viewed the structural features of the coastline from the headland we descended to the beach past a picturesque thatched and whitewashed traditional cottage.

On the foreshore near Niarbyl Point the rocks from opposite sides of the former Iapetus Ocean meet. To the south are the Ordovician sediments of the Manx series that make up the bulk of the island. These were deposited by turbidity currents off eastern Avalonia which at the beginning of this period was not far from the Antarctic Circle. To the north of the beach are rocks of Silurian age, deriving from Laurentia - which in early Ordovician times was near the tropics. The evidence suggests that here in mid Silurian times a bit of Laurentia overthrust Avalonia.

Beneath our feet were the results of this catastrophic event - the highly contorted and convoluted rocks of the Niarbyl Shear Zone. North of the beach, the Dalby (Silurian) group, derived from Laurentia, is faulted against the Manx Group by later earth movements. The junction between the two is clearly visible at the bottom of the cliff, marked by quartz intrusions. The Dalby Group is made up of only one unit, the Niarbyl formation. This extends north east along the Manx coast for about 9km to Peel. Geophysical evidence indicates that the actual line of the Iapetus Suture lies off shore from Man, beneath the Irish Sea.

We went on to visit the strange scenic feature of the Chasms, at the south of the island near Cregneish. This consists of mega cracks in thick bedded quartzites - probably caused by land slippage (Fig 1). Finally we visited an abandoned quarry near Foxdale where a small part of the extensive granite dome beneath the Isle of Man is exposed. This features pegmatite veins and huge quartz crystals.

Day 3 – Wednesday 13 May (Graham Williams-Text & Alan Whitehead-Photos)

The Peel Sandstone Group consists of terrestrial sediments, red sandstone, mudstone and conglomerate beds characteristic of an arid tropical or sub-tropical environment. There are lithofacies characteristic of alluvial fans and of braided river deposits. Interestingly, there are calcretes (also known as caliche, or sometimes as cornstones) which are said to represent palaeosols; where evaporation exceeds precipitation (rainfall) calcareous soils may be formed; they are seen typically in river flood plain sediments, but can develop in aeolian and

lacustrine deposits. Calcretes form just below the surface, and over time they develop from scattered to packed nodules and sometimes to a massive limestone layer.

The Peel Group is in faulted contact with the older Manx Group, so that the direct stratigraphical relationships of the Peel to the Manx are unknown. There is no palaeontological evidence to provide a definitive age, and estimates have ranged from Silurian through Devonian to Permo-Trias. However, there are pebbles which contain Wenlockian (Middle Silurian) fossils which give a maximum age, and recent palaeomagnetic data suggests a latest Silurian to early Devonian age, and this would fit nicely with deposits of a similar nature elsewhere in the UK - the Lower Old Red Sandstone.

Figure 1 shows some of the Society members studying the sandstones at Peel Quarry, which is situated at the Northern end of the promenade at Peel; Figure 2 is a good example of a calcrete, which appears to contain a petrified pigeon with a ball point pen in its beak!.

Fig 1: The FGS group at Peel Quarry

Fig 2: Calcrete

Day 4 - Thursday 14 May (Margaret Richards)

On day 4 of our Isle of Man trip we explored the Carboniferous rocks of the Island, which are found in the south west, around the Castletown area. First we visited Kallow Point where we looked at a bed of Limestone (Fig 1) with a hummocky surface. This 'lumpy' surface (Fig 2) consisted of meter-wide concretions of calcite mudstones overwhelmed by lime grain (sand) with smashed up fossils mainly corals. Stratigraphically higher limestone beds were examined at Standhall Farm where the fossils were much larger. Very large Siphonophyllia were seen (about 35 cms long) plus very clear examples of Megachonetes (Fig 3). (Not seen was the supposedly largest Siphonophyllia in the world, found at this site, at about 1 metre long.) This formation also showed shearing and tension gashes.

Next we moved to Scarlett Point, looking first at limestones cut with numerous dykes, possibly Tertiary but maybe older than this. From here we moved on to the Scarlett Volcanic Formation, which stretches for 1500m along the coast. It consists of Basaltic agglomerates, pillow lavas and other pyroclastics, some highly vesicular. Dykes of basalt were seen cutting the agglomerates as were some poorly defined columnar jointing.

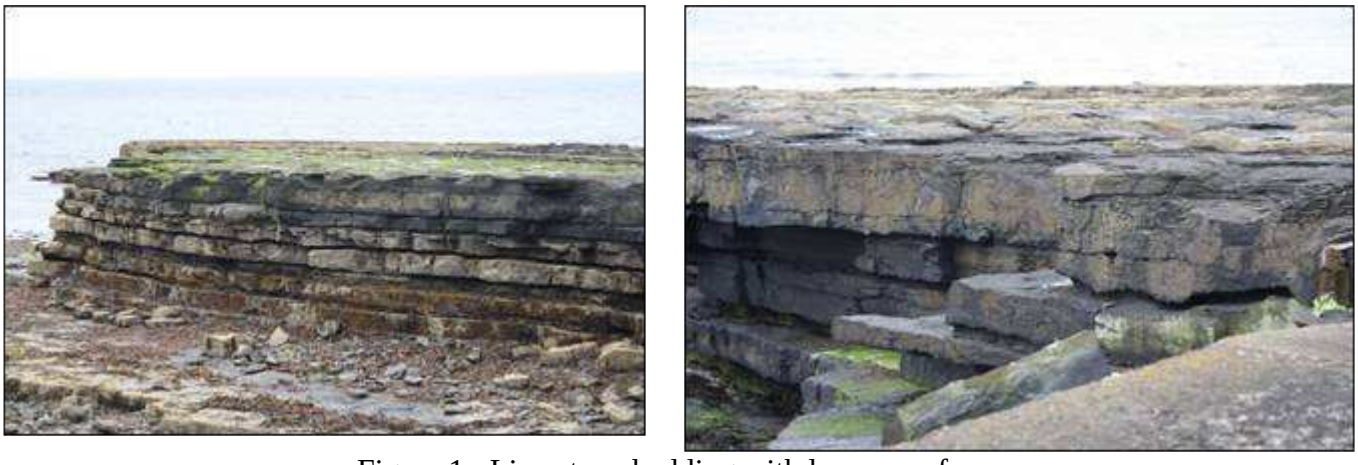


Figure 1: Limestone bedding with lumpy surface

Fig 2: Fossils in lumpy surface

Fig 3: Siphonophyllia and Megachonetes

Day 5: Friday 15 May - Mineralization and Quaternary sediments (Joan Prosser)

After very good weather earlier in the week, Friday dawned both wet and windy. First we were given an excellent recap and explanation by Bill and Graham of the geology we had looked at so far, but it seems there are some formidable questions still to be addressed in connection with the closure of the Iapetus and the formation of the Isle of Man.

The first visit of the day was to the mineral mine at Laxey in the Glen Mooar valley, one of three main mining areas on the island. Ores mined here in the past were sulphides of lead and zinc. The Great Laxey wheel (Fig 1) is a major tourist attraction. It is carefully preserved as the largest surviving working water wheel in the world. It was built in 1854 to pump water from Laxey's mines. In its heyday the wheel was capable of pumping 250 galls of water per minute from the mines 1,500 ft below the ground. (Circumference: 228 ft; diameter: 72.5 ft.) We then visited the beach at Old Laxey where we hunted for mineral samples. We discovered examples of Sphalerite, galena, malachite crystals, ferro dolomite, fibrous quartz, chalcopyrite and an example of vein breccia.

Fig 1: Laxey wheel

Fig 2: Cliff at Dog Mills

The remainder of the day was devoted to Quaternary geology in the north east area of the island, where Pleistocene glacial accumulations conceal Carboniferous and Permo-Triassic deposits. On the way northwards, on the eastern coast the road traversed small valleys which were glacial spillways, part of a large sandur which spreads from east to west almost across the width of the island.

At Dog Mills the low coastal cliff (Fig 2) is composed of outwash deposits of silts and clays. We observed load structures and quicksand features at the margin of the sandur. On the beach were many reworked moraine pebbles including material from elsewhere, riebeckite pebbles from Ailsa Craig among them. A little to the north of this area, at a place called *Phurt,* Neolithic pottery (C. 4000 BC) has been discovered, presumably made from local clay.

At the Point of Ayre, below the raised beach, nesting terns were being given priority over other visitors. Further along however, nearer the lighthouse which marks the most northerly point of the island, we spent some

time collecting beautifully polished and reworked pebbles, many representing places we had visited during the week.

Wildlife on the Isle of Man – Susan Williams

Wildlife flourished in exceptional concentration both on the terrestrial and in the marine environments. The cliff grasslands were interspersed with tufts of brilliant thrift and the pretty pale blue of the sea squill. The hedgerows were a mass of blue bells, white bells and occasional pink bells. The tree lined roads were underlain by drifts of pungent wild garlic. *See Figure 1 Primrose, Squill and Thrift with Peel Sandstone in the background.*

Bird lovers followed the activities of the many species that flew or paddled round the shores. On Langness, Heron, Shell Ducks, Eider Ducks and the Mallard families pottered in the shallows. Choughs, Sand Martins, Kittiwakes and many other sea birds had colonised the cliffs. The Arctic Terns were starting to nest on the shingle banks at the northernmost point, known as the Ayres.

We were rewarded by the sight of a Seal, who though geologist watching was a novelty, and even an Arctic Hare changing into its summer coat; we discovered a flock of the rare 4-horned sheep (Loaghtan) just outside Douglas, but the famous Manx Cat was not to be found except as a Gingerbread !

Fig 1: *Primrose, Squill and Thrift with Peel Sandstone in the background*

A community adventure in Chile

This tour, organised by Journey Latin America, took 12 intrepid travellers (three from the society) from the Atacama Desert in the north to Patagonia in the south via the Lake District and Chiloe Island. The Andes providing an ever-present eastern boundary.

The Atacama visit included salt lakes covered with Flamingos; a pre dawn visit to the Tatio geyser field where some of the hot springs were ice covered; some very spectacular gypsum deposits and young cross-bedded sands & gravels through which we trekked. We experienced picturesque sunsets and the nights provided a panorama of stars and planets with no intervening pollution.

Exposures were of folded Cretaceous – Miocene continental sediments covered by Neogene evaporites deposited in an alluvial fan to playa lake environment with a background of volcanoes, some active.

The Lake district consists of lakes and volcanoes one of which was active, Chaiten. We flew near it and saw the plume of gas and cloud rising well above the level of the surrounding clouds. A river running through basalt flows in the lee of Volcano Orsono allowed close inspection of the hexagonal jointing and erosion patterns.

We visited the Island of Chiloe which consists of schist, tertiary sediments, fluvioglacial deposits and volcanics. It also provided evidence of the 1960 (mag 9.5) earthquake and subsequent tsunami. We participated in local activities including milking a cow; eating in private houses; viewing cheese making, weaving, salmon smoking and joining in a communal feast, Curanto, with local entertainment.

The tour finished in Patagonia where we stayed in a lakeshore refuge in the lee of the Cuernos del Paine (the horns) consisting of a granite laccolith intruded into black shale originally part of the Antarctic oceanic plate crust.

Atacama desert

Osomo foothills

Torres del Paine

John Williams

Building a granite church in The Highlands

In a unique project currently being undertaken by a local architect, Robert Trembath from Churt, a church is being built on a private estate in the Scottish Grampians on the shores of Loch Ericht. It is called the Chapel of Ben Alder, overlooked by the mountain of that name (3,766 feet).

Ben Alder Lodge with mountains behind

From a geological viewpoint the fascination of this project is the sourcing of the granite blocks being used in the construction. Historic buildings in the Grampian region were largely built in local granite obtained from nine large quarries in the area. However, the Scottish granite industry no longer produces stone for building in any significant quantity; but there is a quarry at Alvie which has been able to cut large stones of a warm pink colour for carved features and ornaments.

Against this background of shortage of suitable granite blocks, it was fortunate that Robert heard about an old quarry near Aberdeen that had been used as a dump some years ago for granite stones taken from old historic buildings in Aberdeen.

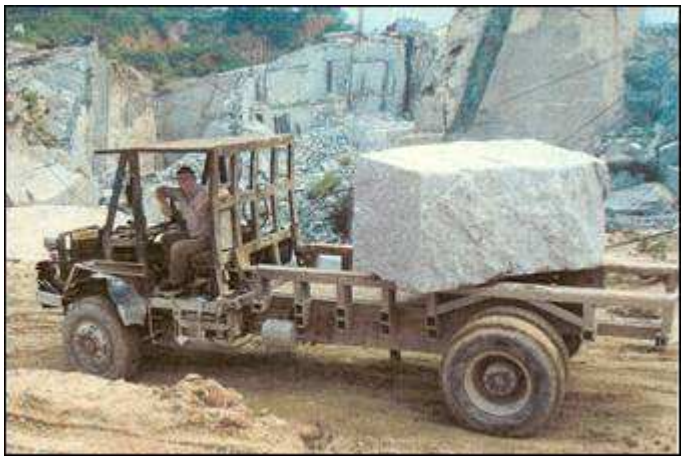
The quarry at Alvie

Granite at the quarry in Aberdeen

Permission was obtained from the owners, Aberdeen City Council, to remove this stone for use in the building of Ben Alder Chapel. The significant point about the use of this discarded stone was that it comprised a

whole variety of colours since, when originally quarried centuries earlier, several quarries would have been needed to provide the volume of stone required, each having its distinctive colours.

The stone from the quarry dump has been used for the main walls of the chapel but good quality granite blocks were needed for the key features such as windows and arches. Although Alvie quarry, already referred to, was able to supply some of this better quality stone, an extensive search was mounted to find granite closely matching the colour and texture of the stone local to Ben Alder. The successful supplier was found in a small town in the Fujian province of South East China. The quarry there is 200 metres deep and a quarter of a mile across and most people of the town work with the granite and have achieved a high level of expertise.



Massive granite block weighing ~15 tonnes

The work shops

Carved granite packed in special crates prior to shipping

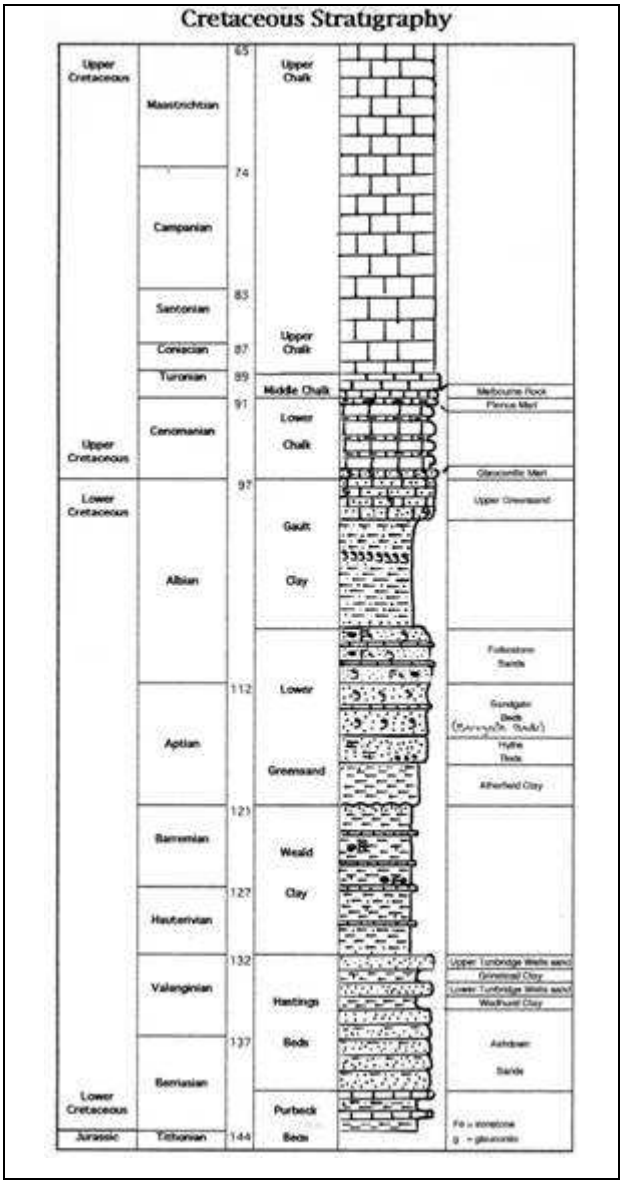
Sculptor at work

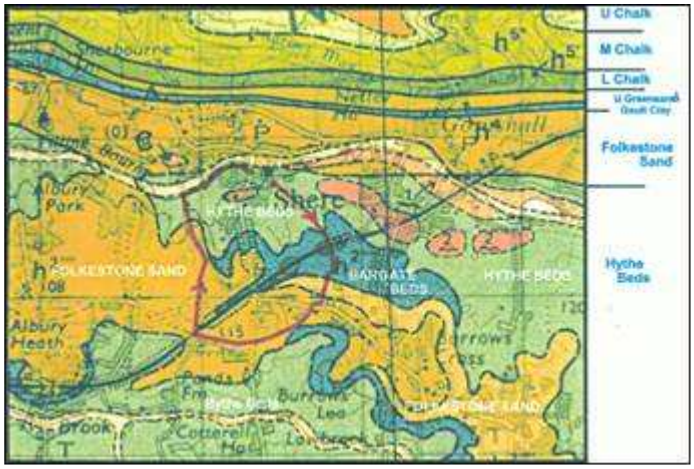
The final photograph shows a sculptor at work in the chapel – the craftsmen have been recruited from all over Britain – which is due to be completed this year.

Peter Cotton

FGS field trip to Shere, June 2009 – the Leader's field notes

We explored how the underlying Cretaceous geology was reflected in the landscape around Shere, from the Chalk of the North Downs to the Atherfield Clay and Lower Greensand of Holmbury Vale. We saw some of Shere's 15th to 18th centuries buildings, terminating in the White Horse two bay timber framed open hall house, circa 1450, to examine some important ales!!





The soft Cretaceous rocks provided few outcrops; but the different Formations form distinctive landscapes which helped us to create geological maps. Most people can distinguish Chalk Downland, and perhaps the Gault Clay Vales; it is much more difficult to distinguish the various Greensand Formations (Fm) in the countryside. The relevant succession of rocks is given in the attached stratigraphical column and described immediately below.

Chalk:

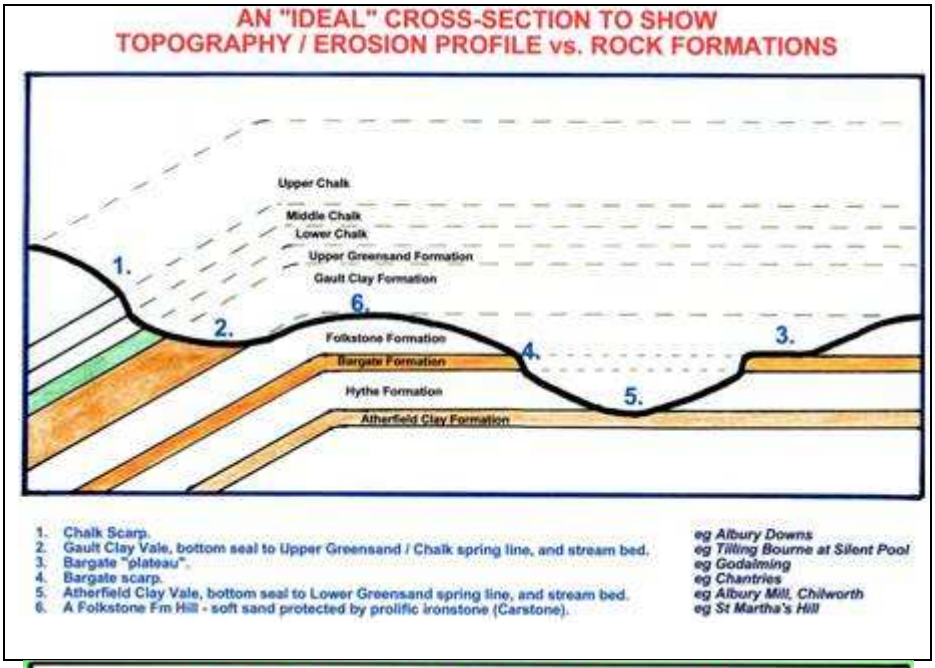
- *Upper Chalk* - hard, white chalk with flints
- *Middle Chalk* - hard (harder than U Chalk), white chalk, no flints
- *Lower Chalk* - soft, very pale greyish-brown chalk inter-beds of argillaceous and clean limestone

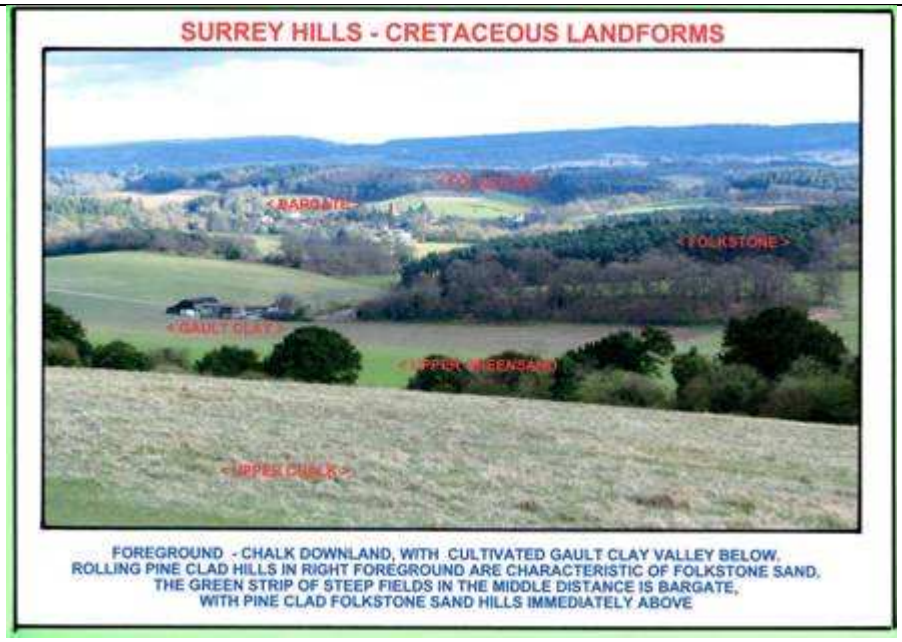
Upper Greensand Fm: - about 25m of soft, very pale greyish brown, "chalky" silt with glauconite

Gault Clay Fm: - up to 75m of grey-brown argillaceous silt

Lower Greensand :-

- *Folkestone Fm* - 32 to 60m of glauconitic, ferruginous medium-grained poorly consolidated quartz sand, green-grey, weathering to iron-stained rusty brown at the surface. Irregular veins and seams of iron oxide cemented sandstone (Carstone) are common near the surface.
- *Sandgate Fm* - up to 45m of grey, fine to coarse-grained, argillaceous, poorly sorted, glauconitic, ferruginous, quartz sand and sandstone. In the Guildford-Godalming area, the Sandgate Fm is almost entirely replaced by the Bargate Fm.
- *Bargate Fm* - 10 to 14m of brown, coarse-grained quartz sandstone, with some grey calcareous beds containing reworked Jurassic ooliths, limestone grains and fossils. Some beds have a calcareous cement. This calcareous sandstone provides a distinctive marker between the Hythe and Folkestone Fms.





• *Hythe Fm* - 30 to 80m of pale grey well sorted fine to medium-grained quartz sand, and weakly cemented sandstone, glauconitic towards the top.

• *Atherfield Clay Fm* - up to 20m blue and brown clay and silty clay, soft and rarely exposed.

The hardness of the rocks Influences the topographical shape of the landscape (see "cartoon" cross-section, attached); the mineral composition of the rocks Influences the fertility and, therefore, land use. Consequently, the different formations can be traced even in the absence of outcrop.

The Chalk and Upper Greensand have lithologies that provide similar weathering profiles and land use. The old divisions of Lower, Middle and Upper Chalk have been replaced by numerous Formation names. However, the Lower, Middle and upper Chalk can be distinguished in the landscape. Chalk provides very thin soils, which may be littered with flint where underlain by the upper Chalk; the Middle Chalk is harder, and may be seen as a steeper slope between the Lower and upper Chalk; the Lower Chalk and upper Greensand are "dirty" coloured, and ploughed soil may be seen as a darker brown colour than that of the Middle and upper Chalk. The upper Greensand provides a slightly gentler slope than the Lower Chalk. Subtle changes indeed, but once you get your eye in …… in terms of land use, Downland pasture is very characteristic; however, when left to nature, thorn bush thickets, and Oak - Beech - Yew woodlands develop.

The two clay Formations provide very distinctive landscapes; they contrast sharply with the Lower Greensand and Chalk landscapes, and with each other. Both the Atherfield and Gault Clay Frns have negligible porosity and permeability and therefore provide a "bottom sear to

the overlying water bearing porous rocks (Lower Greensand and Chalk respectively). The Chalk and Lower Greensand outcrop, and therefore rain water can enter these reservoirs. The top of both the Gault and Atherfield Clay bottom seals are marked by spring lines.

Atherfield Clay Fm is impervious and provides a very good spring line which can source rivers. It is a soft rock, but the high % of clay makes the rock very cohesive and relatively difficult to erode compared with overlying Lower Greensand. Therefore rivers not only bottom out on the sealing clay, they tend not to cut through it; instead they erode laterally, removing easily eroded Greensand; this results in wide flat bottomed valleys with extensive flood plains and poor quality, waterlogged farmland, characterised by a string of settlements.

Gault Clay Fm is an argillaceous silt (coarser grained than the Atherfield) and there is some minor porosity and low permeability, so the top of the Gault is marked only by an intermittent spring line eg Silent Pool. Rivers and streams are far less prevalent than on the Atherfield Clay. The Gault provides fertile farmland for arable crops; fertility is enhanced by a wash of Chalk, and sometimes farmers have quarried Chalk to spread over the Clay.

Hythe and Folkestone Sand Fms consist predominantly of quartz sand. Folkestone Sand Fm is medium- to coarse-grained, unconsolidated (soft) quartz sand; locally, near surface beds are characterised by almost random ferruginous cement which creates Carstone (up to 30% iron oxide). Hythe Fm is fine-grained, sometimes with a small % of clay minerals; locally some beds are poorly cemented with silica or calcium carbonate, and are relatively hard. Both Formations provide a rolling landscape sometimes broken by a steep slope (Hythe cemented beds) or isolated hill capped, and therefore protected from erosion, by a concentration of Carstone in the Folkestone Sand. Neither Formation makes particularly fertile farmland and both tend to support open woodland. However, the Hythe has a greater variety of minerals, and can provide pastureland. The Folkestone soils are very poor, acidic, with numerous carstone pebbles and boulders, and are characterised by open coniferous woodland, heath-land or low grade pasture.

The Hythe and Folkestone landscapes may be difficult to distinguish from one another. It is here that the Bargate Fm comes to our rescue. This very distinctive Formation is characterised by a very high % of "limestone"; the Formation is a sand or sandstone, the particles being up to 75% limestone grains which were eroded from outcropping Jurassic Limestone rocks to the north. Re-crystallisation of some of this carbonate in the subsurface provides a strong cement. Consequently, the Bargate Fm includes hard or competent rock which contrasts sharply with the softer underlying Hythe and overlying Folkestone Sand Fms.

Well cemented beds of the Bargate Fm are resistant to erosion, and form both steep slopes and plateaux. Around Godalming, where Folkestone Sand has been eroded from above the Bargate, the flat lying beds form a distinctive plateau; between Guildford and Dorking, where the Folkestone Sand survives it forms gentle slopes which pass down into steep Bargate Fm slopes before flattening out into gentle Hythe Fm slopes.

The calcareous Bargate Fm sandstone is more fertile than the acidic sands of the Hythe (below) and Folkestone (above) Fms, and can be seen as a line of bright green pastureland below dark Folkestone conifers.

Shere village:

We met at St James Church, much of which was built before 1190 in the Early English style. Interesting features include a fine late Norman Arch at the South Porch, a crusader chest from about 1200AD, 1f!' century brasses. The Horsham Slate roof caps walls built of local stone including Carstone (from the Folkestone sand), Bargate stone, Hythe stone and flint. There is a fine Iych-gate designed by Lutyens.

Shere was mentioned in the Domesday survey of 1086 as "Essira". Sheep and wool brought prosperity in the 15th century, particularly as the emphasis in England was moving from wool export to the much more valuable enterprise of making and exporting wool cloth; much of this cloth production was based on cottage industry, and a number of weavers' and tailors' houses were built in Shere. During the 15th to 17" centuries, Share's population grew; weavers, tailors, blacksmiths, wheelwrights all built houses along with those of the existing husbandmen and yeomen who farmed the surrounding land; the Tillingboume supported a water mill. The centre of the village is characterised by these buildings, mostly timber framed, some built as "open Hall" houses. Shere is also a favourite location for film sets, with two productions in the last couple of years.

We will see a number of fine examples of old buildings along Lower Street, including a single bay (timber framed) hall house (now with wings) built around 1475, the Old Forge and the Old Prison timber framed buildings, the latter with flint infill (early 1600s), an early 17008 (brick) house that incorporates part of a medieval parlour wing, finishing at the White Horse open hall house which has been an inn since the late 1600s. Old (field boundary) walls along Lower Street are largely of Bargate stone, with Carstone, Hythe stone and flint.

Graham Williams, Leader of the fieldtrip