Farnham Geological Society

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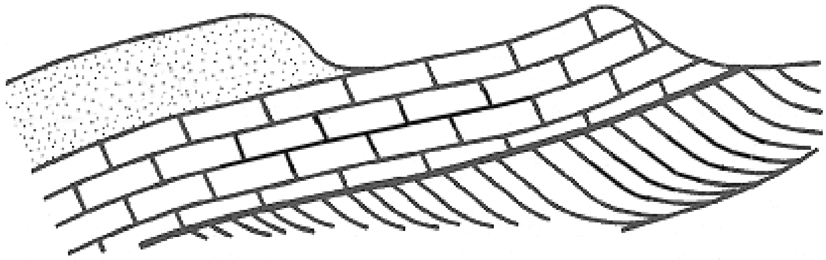

A local group within the GA

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Newsletter

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Editorial

This issue of the newsletter attempts to 'catch up' with all the reports form the various meetings and field trips, which would normally have been reported on in the 2010 newsletters, but the need to give justice to the 40th anniversary activities 'bumped' them off the agenda for those newsletters.

Once again, the members have been very proactive in providing me with notes and photos from field trips and I should like to thank them heartily for their contributions. Where their notes are missing, I have attempted to add some geology of the area for completeness.

Similarly, Janet has persuaded the speakers to provide summaries of their talks and thank you Janet for that, we now have good summaries of most if not all the talks.

There is a suggestion that we should provide an index of all articles in all newsletters – is anyone feeling full of enthusiasm and energy to compile such an index. I have started it off with the 2009 and 2010 articles. Please contact me, if you are keen to help, on lizaston2000@yahoo.co.uk.

Liz Aston

Were these the first true geologists?

I didn't shout "Eureka!" – but I really couldn't stop myself from jumping out of bed. This was when I read that recent archaeological discoveries in Sweden have shown that not only were Neolithic people experts in mining for the best rock types for their tools, but that they appreciated the associated geological sequences; something I have often wondered about but thought could never be demonstrated.

A number of Swedish flint mines were meticulously excavated, and found to have been refilled carefully according to the geological sequence from which the desired materials had been taken. Thus the chalk rubble in the lower part of these shafts extends to the same level as the chalk bedrock, whilst the overlying layers through which the shafts were dug are filled with sediments reinstating the order of the geological succession. The natural order of the rocks was therefore restored after each mine went out of use. It seems that the parent rock from which tools were obtained was highly significant to these ancient people, and in taking material from it they were at great pains to restore the order. This to me is an amazing discovery, and I wonder if there are any further examples to be found, for instance in yet unexcavated shafts at the “Grimes Graves” mine complex in Norfolk...

Reference: Prehistoric Society Research Paper 3. Pub. Oxbow Books 2010.

Joan Prosser

Santorini: The cause and devastating effect in the Aegean

Summary of April 2010 lecture given by Dr Fred Witham, Bristol University

Santorini's reputation as an idyllic Mediterranean tourist retreat belies its violent history. The island has been repeatedly destroyed and rebuilt by successive super-volcanic eruptions; the most recent of which caused the demise of the Minoan civilisation of Crete ~3600 years ago.

We explore the cause of volcanism in the Aegean, highlighting the region as one of the most tectonically active in the world. Following the collision of the African and European continents (as part of the orogeny giving rise to mountains from the Alps to the Himalayas), the Aegean region has been split into a number of ‘microplates' and rigid blocks (Figure 1). Greece and the Aegean are extending at ~3 cm per year. Simultaneously, Turkey is being squeezed out between the North and East Anatolian faults, with this motion and extension accommodated by rotations of the rigid blocks - like books falling sideways on a shelf. All of these motions can be seen in GPS measurements of continental motion.

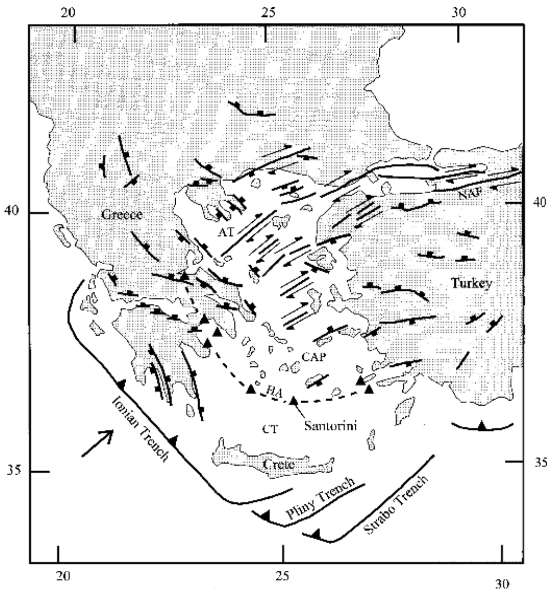


Fig. 1. The microplates and numerous faults of the Aegean Sea with their various and different character and senses of movement.

The active subduction of oceanic remnants in the Mediterranean gives rise to melt. It is the deep faults surrounding the blocks and microplates that allow melt to reach the surface, and they control the loci of volcanism in the Aegean.

Santorini is one of many volcanic islands in the Aegean, sitting on the margin of one of these microplates. Rather than a single volcano, Santorini is best viewed as a volcanic field much like Taupo in New Zealand or Yellowstone in the USA. Volcanic stratigraphy on Santorini shows two complete eruptive sequences over the last 400ka. Each phase comprises scoria and ash deposition over ~100ka, followed by two climactic eruptions. These large eruptions deposited large volumes of pumice, ash and ignimbrite (pyroclastic flow deposit) over Santorini and neighbouring islands. From analysis of the thicknesses and extents of deposition the magnitude of the eruptions can be estimated, they are far larger than any recent activity that displays similar styles of activity, e.g. Mount St. Helens 1980, Mt. Pinatubo 1991, or Montserrat, 1995. Given the devastation that these events unleashed, we can only feel for the Minoans of Crete, whose entire civilisation was wiped out by the eruption of Santorini 3,600 years ago.

FGS proposed field trips 2011

April 3 - 10 WEST BRITTANY: *Led by Dr Denis Bates, with Drs Alan Bromley & Graham Williams*
A beautiful coastline exposes Pre-Cambrian metamorphics, Ordovician sediments, pillow lava and igneous intrusions, Silurian graptolitic shale, and fossiliferous Devonian marine reefs. Special features include a rare igneous intrusion into soft sediment, tectonic and soft sediment deformation and slumps, and possible glacial drop-stones. Carnac’s magnificent menhirs, dolmens and 3000 standing stones fully deserve their world heritage status. This will be great trip with our old friends and teachers, the Bates and the Bromleys.

May 15 BRACKLESHAM & CHICHESTER: *Led by David Bone & Mike Rubra*
Our own Mike Rubra will lead us on a building stones tour around the environs of Chichester. David Bone will take us along the Bracklesham foreshore hunting for the remains of sharks, rays, parrot fish, turtles, crabs, lobsters and many other unusual Eocene fossils; there are numerous bivalves and snails, and some gigantic foraminifera.

June 5 **CUCKMERE, NEWHAVEN, BIRLING GAP:** *Led by Drs Martin Bates & Graham Williams*
Early Tertiary sediments mantle the cliff tops, unconformably overlying one of the most outstanding, complete, continuous and accessible Chalk sections, famous for fossil sea urchins, molluscs and sponges. Quaternary sediments include loess and dry valleys filled with "head"; sediments at Cuckmere have yielded mammoth remains and a stone-age hand axe.

June 24 **MID-SUMMER'S EVENING GEOWALK:** *Led by Dr Graham Williams*
The Geology and Landscape of the Surrey Hills - Part 2: in 2008, part 1 concentrated on Middle Cretaceous rocks; part 2, from White Lane to St Martha's (nr Guildford) is across predominantly Upper Cretaceous rocks.

July 1 - 4 **THE DERBYSHIRE PEAK DISTRICT:** *Led by David Walmsley*
Particularly famous for Carboniferous rocks, mineralization and mining - lead mining and Derbyshire Blue John (fluorite) immediately spring to mind. Places we plan to visit include the Odin lead mine, Winnat's Pass, Mam Tor ("shivering mountain"), Manifold Valley, and Wirksworth national stone centre. Caves, with stalagmites and stalactites, in karstified Carboniferous Limestone were used by stone-age man and mammals including mammoth, woolly rhinoceros, hippopotamus, cave lion, and lynx (evidenced by bones and artefacts).

Sept 4 -10 **INVERNESS to CAITHNESS:** *Led by Donald Milne*
"A wild and lonely place" with a warm hotel, and a magnificent Scottish menu based on local fish and game, created by a french lady chef. The geology is just as good, from the Jurassic of the Brora-Helmsdale half-graben to the Old Red Sandstone (with fossil fish) of the Pentland Firth to the Lewisian metamorphics, Torridonian sediments and Moine Thrust at Inchnadamph (perhaps including the famous Cambrian Durness Limestone). This promises to be a very special trip with that archetypical Scottish gentleman - Donald Milne.

October 1 - 2 **GEOLOGY & ARCHAEOLOGY of the ISLE of THANET:** *Led by Drs Graham Williams and Martin Bates*
A small "island" with wonderful exposures of late Cretaceous, early Tertiary and Quaternary sediments. We will see the K / T boundary (think "dinosaur extinction"), a chalk sequence well-known for echinoids and ammonites, and a Palaeocene to early Eocene sequence ranging from shelly Thanet Sands to London Clay famous for its landslips; we will search for shark and ray fossils, and consider some engineering geological aspects of the London Clay. Quaternary periglacial deposits, loess and coombe rock are well developed; Palaeolithic artefacts have been found: expect Martin to give his usual erudite explanation of geology and archaeology.

Please contact me if you wish to join any of the trips

Graham Williams - FGS Field Trip Secretary

Thailand: land of smiles and plate-collisions

Summary of September 2010 given by Dr. Michael Ridd, Consultant

Notwithstanding the recent political and social disturbances, for the last 200 million years Thailand has been a peaceful place. Since those early Jurassic times there have admittedly been some pretty big fault movements (for example, the development of Tertiary fault-bounded basins in which most of the country's oil and gas deposits formed), but the really big plate movements took place in the 100 million year period between the end of the Carboniferous and the beginning of the Jurassic, i.e. in the Permian and Triassic Periods. This short note describes those movements.

After decades in which Alfted Wegener's theory of Continental Drift was dismissed as impossible by a large part of the geological community, the 'sixties saw a revolution in thinking and soon Plate Tectonics (the new name for Continental Drift) was being invoked to account for many of the Earth's hitherto puzzling geological features. This acceptance of the essential truth of Continental Drift came about largely through a study of the oceans. Changes in the Earth's magnetic field over millions of years had been imprinted on the volcanic rocks which form the oceanic crust allowing movements of the continents to be traced, much as footprints reveal to a tracker an animal's movements.

The first hint that Thailand may not always have been a part of Asia came in the early 'seventies. Geologists studying the Palaeozoic succession in Peninsular Thailand found that the immense thickness of 'pebbly mudstone' (the modern term is 'diamictite') which forms the mountainous backbone of the peninsula contains pebbles, cobbles and even massive boulders of exotic rock in a sandy mudstone matrix (Fig. 1).

Fig. 1. 'Pebbly mudstone' (diamictite) of Late Carboniferous-Early Permian age outcrops on Phuket Is., Peninsular Thailand, interpreted as a glacial-marine deposit, supporting the theory that this part of SE Asia was formerly part of the Gondwana supercontinent.

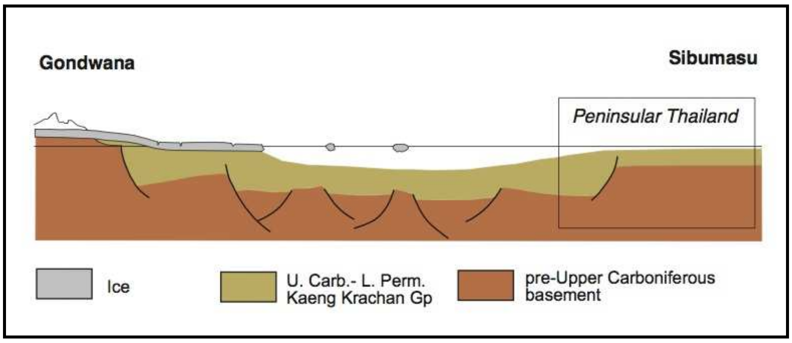


Fig. 2. Suggested tectono-stratigraphic model of Peninsular Thailand in the Late Carboniferous-Early Permian, showing glacial debris transported to the Gondwana margin by ice-sheets, from where it was then redeposited in the widening rift basin. The rift eventually led to the complete separation of the break-away continental fragment from its Gondwana parent.

They were exotic insofar as they included crystalline rocks like granite, and even very rare diamonds, for which there was no known source in Southeast Asia. Moreover, the diamictite facies passed eastwards into a mudstone facies which generally lacked the exotic clasts and was noticeably thinner than in the western part of the Peninsula. And so it was concluded that these rocks must have been transported from the west where there is now no adjacent continental block - just the Indian Ocean. It was postulated that the continental block which was the source of the Thai diamictites was probably India; and if that were true, then Thailand must have been part of the great southern supercontinent, Gondwana. The later interpretation that these diamictites had a glacial-marine origin (akin to Quaternary boulder-clay) strengthened the argument for a Gondwana origin, since it is well established that Gondwana underwent a period of glaciation in the Late Carboniferous-Early Permian. The immense thickness of the diamictite succession suggests that the rocks were deposited in a rapidly-subsiding basin which was probably fault-bounded. Fig. 2 is the suggested tectono-stratigraphic model, with ice-sheets transporting vast quantities of glacial debris to the Gondwana margin where it was dumped at the edge of a rapidly subsiding basin from where it slumped and was redistributed across the basin by marine processes. The subsiding basin was of course the widening rift, which resulted in the eventual separation of this break-away continental fragment from its Gondwana parent.

That is more or less the complete story as it can be told from the evidence of Peninsular Thailand, except that Australia and not India became accepted as the probable source of the diamictites. But meanwhile geologists working in Northern and Eastern Thailand were finding that Thailand was not a simple continental fragment. Running roughly north-south through the middle of the country is evidence of a suture. In the suture zone sediments from the deep ocean-floor such as banded radiolarian cherts are accompanied by oceanic volcanic rocks including spilites, and they were intensely folded and cut by thrusts at a time which can be determined as Late Triassic. And so it became clear that Thailand is composed of not one but two continental plates, which collided and fused together in the Late Triassic; the one on the east was given the name the Indochina Block (or Terrane, or Plate) and the one on the west including the diamictite succession of the Peninsula has been dubbed Sibumasu (a made-up name derived from Sino, Burma, Malaysia and Sumatra) (Fig. 3).

As well as the contorted ocean-bed deposits in the suture zone, further evidence that the Sibumasu and Indochina blocks had different histories came from their respective fossil faunas. After Sibumasu broke away from the glacial embrace of Gondwana in the Early Permian it began its c.75 million-year northwards drift across the Tethys Ocean (Fig. 4).

Platform carbonate rocks (Fig 5) were deposited on this drifting micro-continent and palaeontologists are able to show that they are cool-water forms. Meanwhile in the Middle and Late Permian broadly similar carbonate rocks were being deposited on seamounts within the Tethys Ocean and on the Indochina block, but their faunas are richer and more diverse than their Sibumasu correlatives and show that they were laid down in tropical seas (Fig 4).

The collision between Sibumasu and Indochina occurred in the Late Triassic. The volcanic arc which previously lay in front of the Indochina block (with a back-arc basin behind it, similar to the present day Japan Sea) was sandwiched between the two blocks and is now represented as the Sukhothai Fold Belt. Figure 6 is a cartoon illustrating the collision, this episode having been given the name Indosinian Orogeny. It was also a time of granite plutonic activity, the granite intrusions being said to 'stitch' together the accreted blocks.

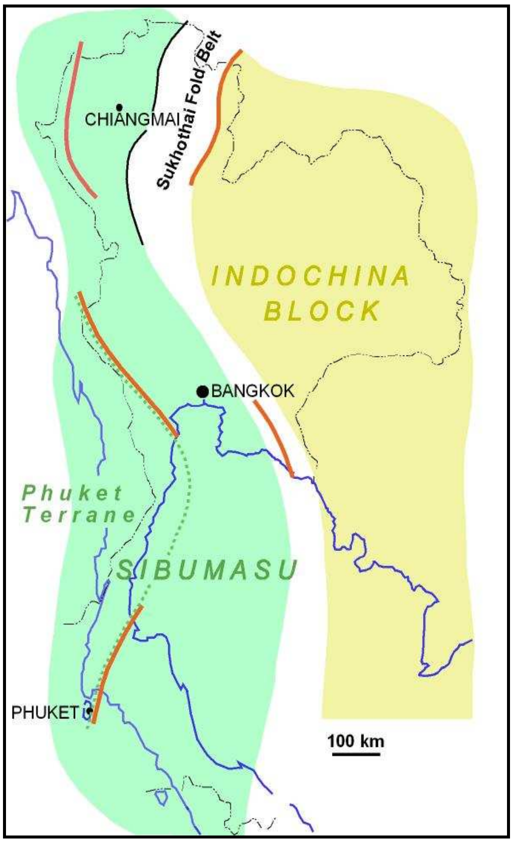


Fig. 3. The two principal continental blocks of which Thailand is formed, Sibumasu in the west and Indochina in the east. Both blocks had their origins on the edge of Gondwana although their histories of separation and subsequent drift northward are different. The suture between them is an indistinct zone running roughly along the eastern margin of the Sibumasu block. The uncoloured zone between the two blocks includes the Sukhothai Fold Belt where acid volcanic rocks indicate it was probably a volcanic arc until the blocks collided in the Late Triassic. The dotted green line is the eastern limit of the Phuket Terrane, the zone of immensely thick diamictite deposits. Red lines are major faults or other tectonic lineaments.

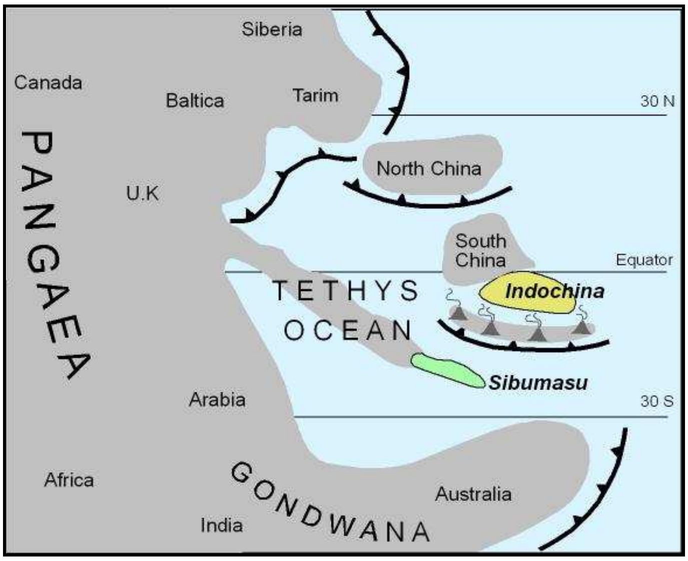


Fig. 4. Tethys Ocean in the Late Permian. A long thin NW-SE chain of continental slivers (perhaps forming a peninsula in the Tethys Ocean as shown here) has separated from Gondwana, and Sibumasu forms the distal part of that chain or peninsula. Sibumasu previously lay alongside NW Australia which remains part of Gondwana, itself part of the even bigger supercontinent Pangaea). As Sibumasu approaches Indochina (by now fused with South China) the intervening ocean is being subducted beneath a volcanic arc. In the Late Triassic Sibumasu collides with Indochina and the intervening volcanic arc is compressed to form the Sukhothai Fold Belt. The heavy toothed lines represent subduction zones.

Fig. 5. Rugged karst topography of Peninsular Thailand formed of Middle to Upper Permian Ratburi Limestone. The fossil faunas of this carbonate rock are sparse and indicate deposition in cool to temperate seas, further indicating that this tectonic block, Sibumasu was still at no great distance from Gondwana.

SE Asia was now a single cratonized block, often called Sundaland. Uplift and erosion of the craton resulted in a major unconformity with uppermost Triassic and younger Mesozoic sediments resting on highly deformed older sediments, volcanic rocks and granites. That is not to say that everything then became quiet. Northward tectonic-plate movements south and west of Sundaland continued, resulting in new subduction zones around the outer margins of Sundaland. India was transported north on one of these plates, colliding with Asia in the Tertiary and causing Sundaland to be squeezed eastwards out of its way. And those continuing plate movements made themselves felt on Boxing Day 2004 when a catastrophic earthquake occurred in the subduction zone between Sumatra and the northward descending Indian Ocean plate.

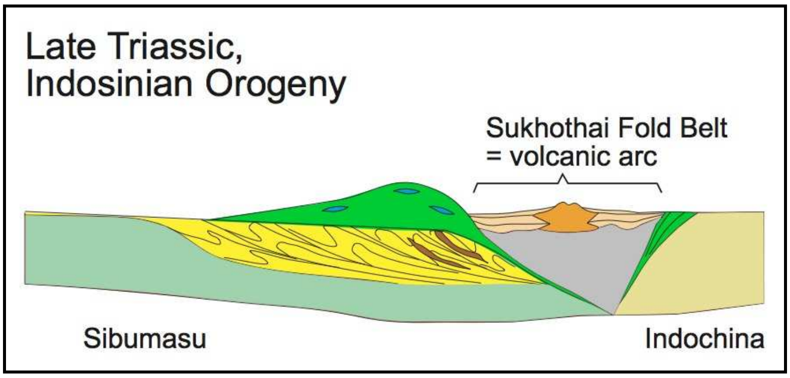
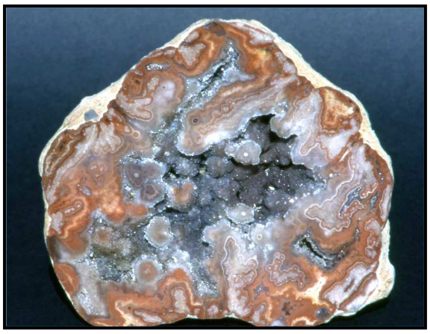


Fig. 6. The Late Triassic collision of Sibumasu and Indochina which 'cratonized' mainland SE Asia into a single tectonic plate, often called Sundaland. The yellow wedge represents rocks which were laid down on Sibumasu while it was still attached to Gondwana and subsequently during its northward drift across the Tethys Ocean, later to become deformed as a 'fold and thrust belt' on the leading-edge of Sibumasu. The green wedge above that represents the ocean-floor rocks which were scraped off the descending Tethys oceanic crust during Middle Permian to Late Triassic subduction and now form a contorted 'accretionary complex' thrust over Sibumasu; blue lenses in the accretionary complex are limestones which formed atop seamounts in the Tethys Ocean. The Indochina block and Sukhothai Fold Belt are separated by a narrow belt of oceanic and other rocks which were laid down in the back-arc basin which, along with the northern part of the Tethys Ocean, was squeezed out of existence by the collision.

30 years mineral collecting
Summary of October 2010 lecture given by John Pearce, Sussex Mineral and Lapidary Society

John congratulated the FGS on their 40th anniversary (SMLS is only 38 years old). He had been looking on our website and reading some of our past journals and was most impressed with the quality of their content and presentation. He reflected that the two Societies shared a number of things in common, i.e. both are active with over 100 members, take trips overseas, publish regular newletters and entertain the speakers well (Farnham has the best fish and chips anywhere), however SMLS is different in that it focuses on collecting minerals, which is not easy in the south of England and organises the Sussex Mineral Show on one Saturday each November.

John's talk involved a very rapid tour, firstly within the UK - the Isle of Sheppey with the beautiful white baryte clusters in the septarian nodules; marcasite from Samphire Hoe near Dover; potato stones from the Mendip Hills, white jack straw cerussite from Pentire in Cornwall. The latter site involved climbing down some steep cliffs before abseiling to the beach and climbing back into the adit. The jack straw cerussite is very fragile so candle grease was dripped on to the crystals before carefully packing them into ice-cream boxes and rucksacks. Having brought the specimens safely home, they were put in the oven to drive off the candle wax.



Potato Stone (15cm)from the Mendips

Calcite (3 cm) on Analcime, Talisker Bay, Isle of Skye

From Cornwall we were taken across the Bristol Channel to Taffs Well quarry north of Cardiff, where very large and distinctive calcite crystals can be found. The crystals have nailhead terminations and serrated edges, very distinctive for this region of South Wales. Furth north to Dry Gill in the Caldbeck Fells in the Lake District to find the English classic mineral, lustrous campyllite, a barrel-shaped, toffee-coloured variety of mimetite, also the fairly rare blue mineral plumbogummite. Next we crossed the Pennines to the small mining village of Nenthead and the Smallcleugh mine where you can explore underground in adits which are miles long. We looked at the underground "ballroom" which was used 150 years ago for the management's annual dinners. This was a lead, zinc mine and produced some beautiful galena cubes, also some classic lustrous black sphalerite (zinc sulphide). Sadly so much sphalerite has been extracted from this mine that it has become totally undervalued.

We then slipped over the Scottish border to Leadhills and Wanlockhead to Meadowfoot smelter. The waste material from the smelter, still containing some metals, was dumped, where it weathered and produced a range of beautiful microminerals with crystals 1-2 mm long. Most of these perfect crystals are white, blue or green, but John's wife Pam found some purple crystals which were identified by the NHM as the mineral elyite, a basic lead copper sulphate, the first time it had been found in the UK.

On the Isle of Skye and the very remote beach on the west coast, Sgurr nam Boc, over 9 years SMLS members gained access to the beach by landing from the sea and climbing the 800 ft high basaltic cliffs. Their reward was the best zeolite specimens ever collected from the UK, for example lustrous white stilbite crystals on pink heulandite, the specimen being over 6 in across. I suspect that SMLS is the only mineral club to possess an inflatable rubber dinghy; this was used to land individuals from the "mother ship", a clinker built fishing boat! Supposedly "Sgurr nam Boc" translates as "too greasy for a goat to climb"!

Stilbite (3 cm) on pink heulandite, Sgurr nam Boc, Skye

Tuperssuatsiaite (4 mm needles), Aris Quarry, Namibia

The overseas locations that SMLS have visited and collected include South West Africa and Namibia, where minerals from three locations were shown: golden needles of tuperssuatsiaite from Aris quarry south of the capital Windhoek, the radioactive brilliant yellow boltwoodite crystals from Goanikontes in the middle of a barren desert and azurite nodules from the mecca of all mines, Tsumeb. Tsumeb is the most famous mineral mine any where in the world and to have visited, gone underground and collected there is, to a mineral collector, beyond dreams.

Green apophyllite (5cm), Deccan Plateau, India

Iron stained mesolite, Punta del Aguila, Lanzarote

In India, SMLS visited the Deccan Plateau, home of the most exotic zeolite minerals in the world. Although you can buy these at shows, to have collected them yourself is very special. One that stood out was the specimen with green apophyllite crystals on white stilbite and laumontite.

At Lanzarote, green olivine can be found in the most recent lava flows of 1730-36, while zeolites can be found in the 15 Ma basalts which outcrop in Famara cliffs in the north-west and in Punta del Aguila in the south of the island. Although, a very similar suite of zeolites is found at these two outcrops, those at the southerly location are selectively iron-stained (yellow thomsonite with clear chabazite crystals). Most attractive.

At Sterling Hill and Franklin, the Mineral Fluorescent Centre of the world, in New Jersey, USA, mining was based on a zinc mine where the ore was not sphalerite (ZnS) but a mixture of zinc and iron oxides and zinc silicate (willemite). The climax of the trip was to collect around the quarries at night, where portable UV lights were carried. All the rocks fluoresce in bright, glowing colours.

Back into Bulgaria and the mining area of Madan in the south of the country. Here galena is a very special mineral, showing bright crystals, some with faces with fluid inclusions, with a triangular pattern corresponding to spinel twinning and some very strange shaped quartz crystals.

Lastly, Southern Ireland where green-blue botallackite crystals from the Copper coast (resulting from sea action on the mineral veins) were shown and finally, holy mountain at Croag Patrick where small gold crystals where found in situ in a large quartz vein.

FGS thanks John for allowing us to reproduce his excellent photographs.

FGS annual lunch – 31st October 2010

The annual Society lunch, held at The Frensham Pond Hotel at the end of October, was well attended by both relatively new and long-standing members (as you can see below). The day was rather wet but the location was delightful. Lyn Linse has supplied a photographic memory for those who attended.

A lovely location

Good company, good food

From long-standing members …

… to some of the newest members

FGS field trip to Devon - October 2010

Saturday - led by Richard Bull – the FGS members visited Chippel Bay, where a full succession of the Lower Jurassic Blue Lias occurs. The classic Shales with Beef (fibrous calcite) and the Black Ven Marls could be seen above the Blue Lias. The Lower Jurassic beds in this area are fossiliferous with ammonites, belemnites and, occasionally, ichthyosaurs and plesiosaurs. Blocks of Cretaceous Upper Greensand were seen with trace fossils, including worm tubes; these blocks have come from a massive landslip inland. The Cretaceous was also seen at Pinhay Bay where Chalk and Upper Greensand lies above the Blue Lias, which in turn overlay the White Lias of latest Triassic age, Rhaetian. A range of bivalves including *Rhaotavicula contorta, Chlamys valonensis* and *Protocardia rhaetica* occur. The White Lias comprises pale grey limestones. One of these beds is highly 'jumbled' and appears to have been the result of a severe storm. The lowest beds (part of the Penarth Group) form a condensed sequence, just 30 cm thick.

The group went on to the Cobb to view Lyme Regis where the coastline is extremely unstable. The whole area is formed of Upper Greensand (weathered brownish green) and Chalk on the hilltops; these strata were deposited unconformably onto the grey Liassic marine clays. The underlying clays give rise to frequent landslides in the area and allow rapid sea erosion which exposing the many fossils, evident in the Lyme Regis Museum which was visited at the end of the day.

Sunday - led by Malcolm Hart and Graham Williams – the group went to Seaton Hole and to Beer, where the Upper Greensand and Chalk overly the red Triassic Mercia Mudstone. The vertical white cliffs of Chalk are the westernmost Chalk cliffs along the English Channel and the strata are different to those further east. Flint, often black and tabular, is common not only in the Upper Chalk but also in the top half of the Middle Chalk. The Middle Chalk shows numerous pale brown phosphate bands. The lower Chalk is of shallower water origin with hard-grounds and seriously condensed sequences with numerous chalk intraclasts. After viewing the gigantic landslip at Hooken Cliff the group continued to Branscombe, where the red Triassic mudstones crop out beneath the Cretaceous Chalk. Extensive gypsum 'beds' and fracture fills are a feature. Further west, towards Sidmouth, Triassic red-beds occupy most of the cliff.

Monday - led by Graham Williams – the party continued to Budleigh Salterton to view the Triassic Budleigh Salterton Pebble Beds and Otter Sandstone and on to Ladram Bay.

Fig. 1: View (~5mx5m) of cliff at Budleigh Salterton – note the steep (30°) dipping poorly sorted boulders at base of the cliff, then an erosion surface (1/3rd way up) dipping from R to L in the picture, above which there is a sequence of coarser boulder beds which are also poorly sorted but gradually fine upward, culminating in a thin sandstone (not visible in this photo). This upper boulder bed sequence probably represents one flash flood deposit. The steepness of dip of the beds and the size of the boulders in both sequences would suggest that they were deposited in a proximal wadi environment

Fig. 2 An excellent example of rhizoconcretions – these are root traces - over time the roots gain a coating of cement which is called a rhizoconcretion

The first stop was **Budleigh Salterton** (Judith Wilson) where the question "are these rocks fluvial or aeolian?" was posed. The rocks were red coloured, the lower layer consisting of some very large pebbles which quickly answered the question, as these could not have been deposited by wind (Fig. 1). Orientation of some pebbles and bedding structures indicated the direction of flow. Further along the beach, rhizoconcretions structures were seen, (structures which form around roots) and together with the presence of ferrous oxide converted from ferric oxide again indicate the presence of water.

Ladram Bay: There was an amazing outcrop here showing many sedimentary features. The lower bed was a jumbled up muddle, described as a sheet flood deposit above which was an erosion surface. Above this was a fine bedded sand, which had been laid down in a high energy environment, then a further erosion surface. Similar beds continued, each indicating water and high energy. The depositional environment was thus a desert sandstone over which vast intermittent flood materials were deposited.

The remaining question is "Which members of FGS took advantage of the sign welcoming nudists on the beach at Budleigh Salterton?

Liz Aston and Judith Wilson

FGS field trip to Portland - Sunday 6th June 2010

In sunshine, we approached the 'Island' of Portland driving parallel to Chesil Beach our leader for the day was Alan Holiday, chairman of Dorset GA. On the Isle of Portland, the geology is exposed both along the coastline and at the inland quarries. From the top of Portland Isle, it was possible to see the geology of the area, in particular the asymmetrical Weymouth Anticline. Portland forms the southern gently dipping limb of the anticline and due to the dip being only 1.5°, the topography of the area is flat (a table), due to the almost undisturbed nature of the massive Portland Beds.

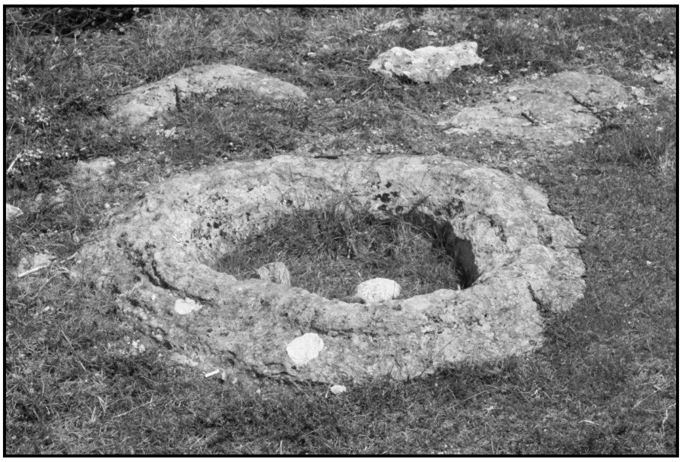
Looking north along Chesil Beach - the former naval base is the sailing centre for the Olympics

The cliffs at Weston - Here the Purbeck is separated from the lower Portland by a shelly seam.

The geological sequence exposed at Portland is: Portland Raised beach, Lower Purbeck Beds, Portland Freestone Series, Portland Sandstone, Kimmeridge Clay.

The cliffs at Weston showed the succession upwards from the dark Kimmeridge clay to the Portland sands which are then overlain by the massive Portland Stone which creates near vertical cliffs. A more detailed geology of the Portland Sands and in particular, the Portland stone was seen in the various quarry locations and, in particular, at **Fancy Beach Quarry**. Here the massive Base bed and the Whit Bed are easily identified in the quarry face but also in the large blocks of commercial stone marked up for sale. The Roach Bed which has less commercial value is however, fascinating to the geologist as it is riddled with fossils but their presence degrades its value so that its common use is as coastal defence blocks. The technology associated with quarrying is advancing and today very few quarrymen are employed but instead giant rock cutters are used in conjunction with water pumped into steel bags that are placed in the natural joints within the limestone to break away the large blocks. The Purbeck Beds which are so much in evidence at Lulworth Cove here form the overburden which is stripped clear before quarrying can commence.

At **King Burrows Quarry** the presence of stromatolitic limestone, salt pseudomorphs, ripple marks and fossil trees, together with fossil soil horizons at **Blacknor Fort** provides evidence of the Upper Jurassic paleogeography, i.e. shoreline deposits from very shallow water marine to subaerial.

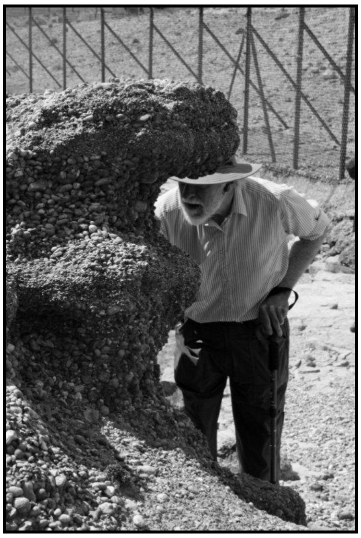


Stromatolitic limestone at King's Barrow Quarry form in shallow lagoonal waters.

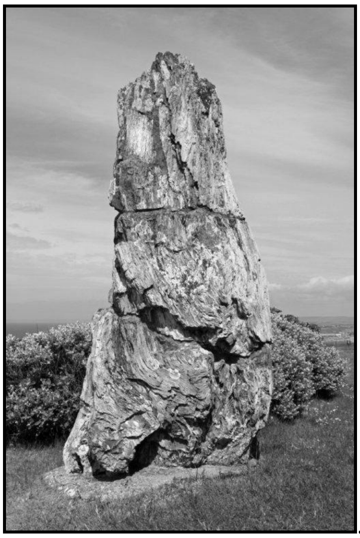
Blackmoor Fort: the uncomformity between the Purbeck and underlying Portland with paleosols at several horizons.

Recent deposits were seen at Portand Bill where raised beaches, deposited some 200,000 years ago were studied, including an amazing exposure more like a man made concrete feature than a natural one!

For those interested in the 'micro' aspects of geology there was a rich variety of fossils. Micro is probably not the correct word as the fossils on Portland include the ammonite *Titanites* seen in a wall at **The Heights Hotel** and at **Fancy Beach Quarry** and Dinosaur footprints at **Suckthumb Quarry** where a cross section through a large tree can be seen along the entrance path.

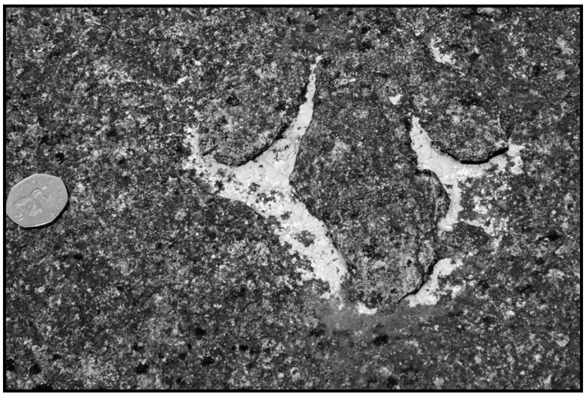


John Bradbury inspecting the well-cemented raised beach deposits at Portland Bill



Fossilised conifer tree formed of silicate, in grounds of Heights Hotel. Found in the Purbeck beds. Evidence of a fresh water lagoonal environment

Tufa deposited in the Portland



Dinosaur footprint – 3 toe prints point down the picture outlined by the white material

Adit mine entries cut into the Portlandian, which are back-filled with debris from current mining activities.
Note how the limestone beds decrease in size upwards from thick layers at the bottom through progressively thinner beds.

Other features of interest in the grounds of the Heights hotel included a fine example of Tufa and a large section of a fossilised conifer tree. The Roach stone was full of examples of *Aptyxiella portlandia* or as it is locally known the Portland Screw and fine specimens of the bivalve *Myophorella Trigonia* known locally as Osses ‘Eads.

The whole field trip experience was excellent thanks to the superb local knowledge of Alan Holiday and the organisation of Graham William

Margaret Mathieson and Sally Pritchard with some photographs by Janet Phillips

Mount St Bernard Abbey - A fine building with interesting geology and history

Saturday 10th April, 2010, the first day of Farnham’s Charnwood Forest Geo Trip. We met at Mount Saint Bernard Abbey, a Trappist Monastery with an emphasis on silence, and a simple life of solitude. They Abbey was built close to the site of a smaller early medieval abbey which was closed and ruined by Henry VIII. In 1835, a new place of worship was constructed from an old ruined cottage in Tin Meadon led by Brother Augustine Higgs and about six other monks and designed by William Railton. It was finished and opened in 1837.

The building was built immediately afterwards, with a large donation from the Earl of Shrewsbury who engaged Augustus Welby Pugin a well known architect of the gothic style. The new place of worship was opened in 1844 and was granted Abbey status in 1848.

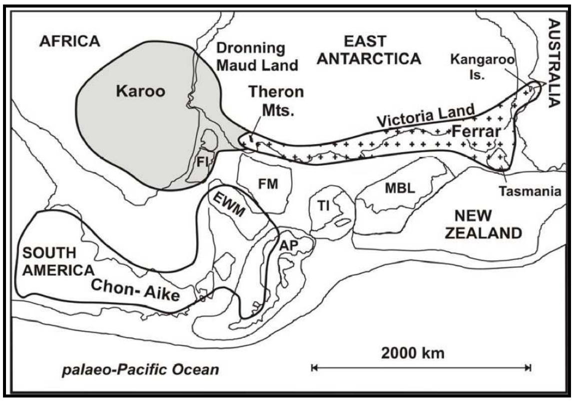
The external fabric of the Abbey comprises faced corners and carvings made of fine Oolitic Limestone with an infill of random stone walling, mainly from the Whitwick Quarry with a small amount of stone from the Bardon Hill Quarry. These rocks varied in colour from grey and green to purple which highlighted the creamy white oolitic limestones.

The infill stones are dacites and dacite breccias with plagioclase and quartz phenocrysts. They are collectively known as the Whitwick Volcanic Complex and Bardon breccia from the Bardon Hill Volcanic Complex. Both complexes developed in the Precambrian era. The Abbey and some of the surrounding farm and cottage buildings are roofed in a low-grade slate from the Swithland Formations (dark grey-green in colour). After 1900 the Swithland quarry closed because it was cheaper to import Welsh Bethesda slate in which you can see volcanic ash layers (slate colour is purple and ash layers are pale green). Many of the local cottages now have Welsh slated roofs. The Abbey interior was not available for a close inspection but is built of fine quality oolitic limestone blocks in the walls and arches. The arches are supported by aisle pillars also carved from the oolitic limestone or possibly a fine calcareous sandstone.

Barry Eade

Dolerite emplacement and continental break-up: the Theron Mountains, Antarctica

Summary of June 2010 lecture given by Dr Donny Hutton, Consultant



Sketch map of the Karoo-Ferrar magmatic province (Pankhurst et al., 1998). Note position of Theron Mts and areas of Jurassic magmatism in Gondwana.

The Theron Mountains, which lie in the northernmost part of the Transantarctic Mountains, offer perhaps the best exposures of a dolerite sill complex to be seen anywhere in the world and create an unprecedented opportunity to understand the processes that are involved in sill emplacement. These sills are Jurassic in age and are part of a world-wide set of such rocks which were intruded into flat-lying Permian sedimentary rocks in massive volumes and probably heralded the breakup of the supercontinent, Gondwanaland. One controversial idea is that bodies known as superplumes rose off the very deepest parts of the mantle and impacted on the base of the lithosphere like the flattened heads of giant mushrooms destabilising the rocks above and initiating continental rifting. The talk concentrated on: living and working at 80°S in a small, isolated tent encampment; trying to understand how dolerite sills actually grow and flow; testing the proposition that the sills are related to superplumes by using frozen flow direction indicators in these rocks. P.T. Leat & A.V. Luttinen demonstrate that there are four types of sills. The most abundant type correlate with the Mount Fazio tholeiites from Victoria Land, a second correlates with the distinctive Scarab Peak tholeiite, two other chemical groups are compositionally close to intrusions in the central Lebombo Monocline and in Dronning Maud Land. The sills indicate long-distance transport of magmas during initial stages of Gondwana break-up.

Reference: Pankhurst, R.J., Leat, P.T., Sruoga, P., Rapela, C.W., Márquez, M. Storey, B.C. and Riley, T.R. 1998, The Chon Aike silicic province of Patagonia and related rocks in West Antarctica: a silicic large igneous province. J. Volc. & Geoth. Res., 81: 113-136.

FGS monthly lecture programme for 2011

DATE	LECTURE	SPEAKER
Jan-14th	AGM and talk on GA excursion to Oman	Michael Cuming - Harrow & Hillingdon Geosoc
Feb-11th	Isotope Geology – History of the Earth	Dr Paul Stevenson – University of Surrey
Mar-18th ***3rd Friday***	Oceans, volcanoes and climate change: lessons from the Cretaceous	Dr Ian Jarvis – Kingston University
April-8th	Landslide activity in Paphos district, Cyprus	Dr Andrew Hart – URS/Scott Wilson Ltd.
May13th	Wildfire: The geological history of fire	Professor Andrew Scott – Royal Holloway
June-10th	Horsham stone and Sussex marble	Dr Roger Birch, Collyers College, Horsham
July-8th	NZ earthquake and Madeira DVD	Dr John Gahan, Farnham Geosoc
Sept-9th	Evolution of the Exe Valley	Dr Jenny Bennett, Open University
Oc- 14th	How Britain became an island	Dr Sanjeev Gupta – Imperial College
Nov-11th	Gemstones	Prof Andrew Rankin – Kingston University
Dec-9th	Geology of the London Basin	Dr Michael de Freitas – Imperial College