Dorset GA Group

Newsletter Winter 2019

https://dorsetgeologistsassociation.org/

Contents

Welcome to the Winter Newsletter!

As usual, this issue is a very eclectic mix but there's nothing wrong with that, Geology is a very diverse subject. In the absence of field reports I'm very grateful to those contributors who have sent me other interesting articles. Leastways I hope they're interesting! Please do support our events , they are the result of a lot of effort by the Committee. Can I also remind you that membership renewals are due on 1st January 2020. May I wish you a happy festive season and healthy New Year.

Kelvin

Holiday Rocks 2019

Walking the Jurassic Coast

The Dorset and East Devon World Heritage Site**,** usually known as The Jurassic Coast, is England's first natural World Heritage Site. It was inscribed by UNESCO in December 2001 for its unique insight into the earth sciences. These sedimentary rocks, which were formed between 250 and 65 million years ago, record 185 million years of the Earth's history. An eastwards progression through the Site provides a walk through time in the Mesozoic Era which includes the Triassic, Jurassic and Cretaceous periods. On fourteen consecutive Saturdays, I completed a guided walk, of about 95 miles, along the whole of the World Heritage Site. We began at Exmouth in the spring and walked all the way to Studland in mid-summer. We made use of X53 and other buses which run parallel to most of the Coast Path. We left cars at the end of each day's walk, caught the bus to the beginning and walked back to the cars. We studied the geology and erosion processes along the coast together with the formation and the extraction of a variety of minerals.

This public footpath is part of the Coastal Path which is presently being completed round the whole of the Country. This section is quite popular and well-trodden with thirteen Sites of Special Scientific Interest, SSSIs, and sixty-six Geological Conservation Review Sites. It is managed by the Jurassic Coast Trust.

We were a fairly small group varying between six and nineteen persons and had a different local guide for each walk, sometimes a geologist, sometimes a quarryman or a warden from the National Trust. This worked well as they described a variety of different aspects of the coast and the adjacent countryside.

Sea Stacks at Ladram Bay (L) and ammonite fossils at Charton Bay (R)

I shall try to describe some of the highlights of this walk but there was so much to see that I shall not have space for everything of interest.

Exmouth We started the walk at the Geoneedle (an obelisk showing some of the types of stone found on the Coast) at Orcombe Point on the outskirts of Exmouth. The wind was blowing hard and we had several heavy showers but this was the only wet day during the whole walk. The east Devon coast, usually referred to as the Triassic Coast, has a series of dramatic cliffs of New Red Sandstone which were laid down 250 million years ago in desert conditions. The Budleigh Salterton Pebble Beds were transported here by a giant river flowing from the south (or what is now France) in Triassic times.

Ladram Bay There is a popular beach here with several spectacular New Red Sandstone sea stacks just a few yards offshore, and then we had a couple of steep climbs to High Peak and Peak Hill. The Hooken landslide, which occurred in1789-90, is a jumbled mass of rocks with a narrow footpath winding its way through. An isolated white cliff of chalk stands out at Beer and this hard chalk has been quarried for many years at Beer Caves for high quality masonry work. At Sidmouth, there is a fine museum and they have a day of geological talks once a year. There is a splendid view of the red cliffs again at the eastern end of the town.

The Undercliffs This National Nature Reserve between Axmouth and Lyme Regis is a series of landslides about five miles long and is one of the most important wilderness areas in the country. This was a splendid walk. We climbed up over Goat Island and looked down into The Chasm, which was formed by the famous landslide on Christmas Eve in 1839.

Lyme Regis The lower part of the town was built on a series of landslips which are still active. A major programme of works in the last few years will help to stabilise the buildings of the town. Mary Anning was the first to find some important fossils here and her original ichthyosaur skull is in the museum. Many more fossils have been found since then and are more still emerging. DGAG has a stall at the annual Fossil Festival which attracts large numbers of both children and adults.

Golden Cap, the highest point on the south coast of England

The River Bride enters the sea at Freshwater, near Burton Bradstock

Charmouth The exposure of Jurassic rocks, laid down about 200 million years ago, continues at Charmouth with the Heritage Coast Centre and a fossil shop. This is a good place to start fossil hunting under the guidance of the Jurassic Coast Fossil Warden. We passed by more landslips and after two more steep climbs reached Golden Cap. This is the highest point on the south coast of England with glorious views to both the east and the west along the coast. The harbour at West Bay used to be repeatedly damaged by storms rolling in from the Atlantic. It has been completely rebuilt with extensive rock armour to protect the entrance to the harbour. Burton Cliff, just east of West Bay, is composed of yellow Bridport Sands and dominates a wide popular

The Fleet This sits behind Chesil Beach and is the largest tidal lagoon in the country with a great variety of wading birds and other wildlife. We visited the Swannery at Abbotsbury where they have managed the swans since the fourteenth century and then walked, on level ground for a change, along the side of the Fleet.

Chesil Beach This stretches eighteen miles from West Bay increasing in size until it is fifteen metres high at Chiswell. The pebbles are pea sized at the western end increasing to the size of big potatoes at the eastern end. The village used to be flooded from time to time but a highly effective flood management scheme has been built. This depends on a large culvert which collects the water that percolates through the Beach and discharges it into Portland Harbour.

The Isle of Portland This huge block of limestone has been quarried since Roman times. We started high above the sea at The Verne Prison descended in easy stages and eventually reached a wide, open green space at the Coastal Strip where there may soon be an underground quarry for mining Portland stone. We visited the three lighthouses and two raised beaches at Portland Bill and then walked up the West Weares to Tout Quarry where there is a collection of open-air sculptures.

(R) One of the old cranes at a Portland coastal quarry is still in use

Lulworth Cove This forms a perfect horseshoe and along with the Lulworth Crumple at Stair Hole, and Durdle Door, are textbook examples of coastal erosion which attract many visiting school and university students. This is probably the finest scenery and the most important geology on the south coast and, arguably, some of the best in the country.

The Chalk cliffs at Bat's Head

Durdle Door, perhaps the best known image of the Jurassic Coast

Arish Mell, Flower's Barrow and Worbarrow Bay

The Range Walks This next section is used by the Army but the Range Walks are open during the school holidays and most weekends throughout the year. We admired the remains of the trees in the Fossil Forest on a remote ledge high above the sea. This is presently closed but will reopen to the public early in 2020 after the steps have been made safe. Flowers Barrow, on the top of the cliff at Worbarrow Bay, is a hill fort which was built in the Iron Age but about half of it has fallen into the sea over the past 2500 years as a result of coastal erosion. Gad Cliff which dominates the view of this part of the coast consists mainly of limestone but the slopes of the undercliff are inaccessible. There are several steep climbs here and this is said to be quite the most strenuous part of the Southwest Coastal Path between Poole Bay and Minehead.

Tyneham The village has been deserted since 1943 when the Army used the area for training during the War. It has a church, a school room and several cottages open to the public. The buildings have recently been closed but will be assessed, repaired and made safe for visitors.

Kimmeridge We then dropped down to Kimmeridge and The Museum of Jurassic Marine Life which is well worth looking at and where the international Marine Reptile Conference will take place on 5th to 7th May 2020. The Fine Foundation Marine Centre and the Wildlife Reserve at Kimmeridge are run by the Dorset Wildlife Trust. We passed one or two working quarries and many more which had been worked out. Further on, we looked at St Aldhelm's chapel, Anvil Point lighthouse, Durlston Country Park National Nature Reserve and then the Victorian Durlston Castle which has been refurbished to provide a visitor centre with exhibition and conference facilities at the eastern end of the World Heritage Site. We walked past Swanage and across the top of the Chalk hills (late Cretaceous period, 65 million years ago) of Ballard Down past Old Harry and the other sea stacks to the end of the World Heritage Site at Redend Point. I have only had room to describe a small fraction of the many, many sites of interest along this walk but it was a thoroughly enjoyable experience. *(article concludes on page 4)*

If you are interested in doing one, or more, of the stages then visit www.jurassiccoast.org. You will also find several books to guide you on your way together with details of walks and other events along the coast throughout the year. Better still, sign up to becoming a Friend of the Jurassic Coast.

Dr. John Larkin

The abandoned quarry at Winspit

The chalk cliffs and Old Harry at Handfast Point

The Hot Rock Slot

Instead of presenting a generalised account of a particular rock-type, the idea behind this contribution is to examine a single rock specimen in detail and to provide evidence for the various stages in its geological history. For this, I've chosen an interesting sample of calc-silicate rock (Fig. 1) from a disused quarry at Bonawe on the S shore of Loch Etive in W Scotland (NGR: NN 021 327).

Before launching into details, here is the geological history of the rock, at least as far as can be deduced from the sample itself and its geological context:-

1. Deposition in shallow-marine tidal flats as finely interbedded mudstones and impure dolomitic limestones at some point before 600 Ma ago in an ensialic sedimentary basin.
2. Burial and lithification beneath a thick accumulation of sediments.
3. At least two phases of intense ductile deformation and a phase of regional metamorphism in a Lower Ordovician orogeny, at the end of which the rock was *ca*. 32 km below the Earth's surface.
4. Erosion of the thickened crust.
5. When the rock was *ca*. 8 km below the Earth's surface, intrusion of granitoid magma *ca*. 400 Ma ago caused rapid heating to *ca*. 700-800 ºC and recrystallisation.

Further erosion and, ultimately, exposure on the Earth's surface.

Fig. 1.The hand-specimen of calc-silicate hornfels discussed in this contribution. The squares on the mat are 1cm across. Image: Giles Droop.

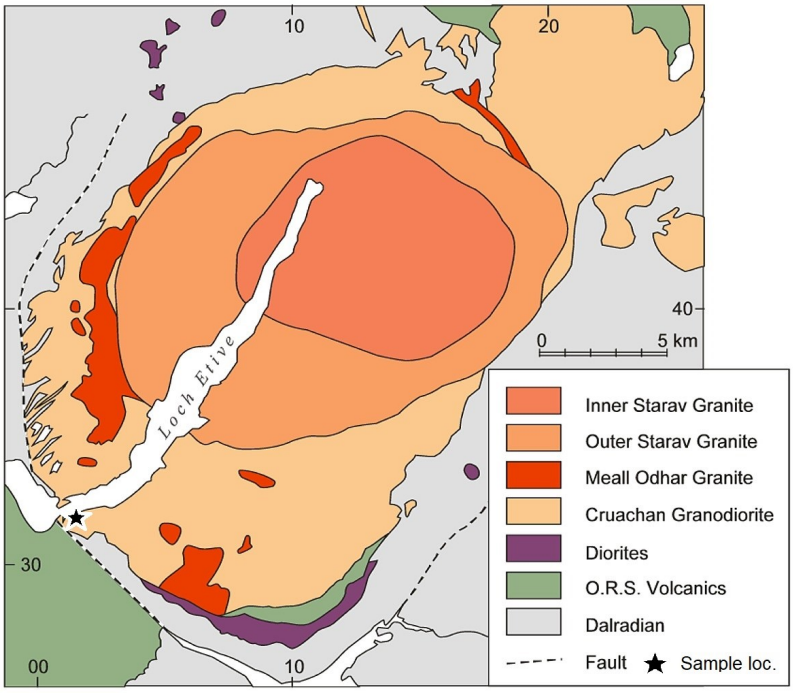


Fig. 2. Sketch map of the Etive intrusive complex in W Scotland showing location of the sample. Grid coordinates: OS sheet NN. Image: Giles Droop.

The calc-silicate rock: The rock in question is a hornfels, collected from a large (10m wide) xenolith in the Cruachan Granodiorite, one of the intrusions that comprise the Etive Complex (Fig. 2), a member of the Silurian-Devonian 'Caledonian Granite' suite.

The rock (Fig. 1) is very fine-grained and consists of pale green layers with the mineral assemblage diopside + feldspars + quartz etc. alternating on a mm- and cm-scale with dark layers with the assemblage biotite + hornblende + feldspars + quartz etc. The layers have clearly been folded at some stage and are of irregular thickness suggesting that they originated as bedding. The green colour of the paler layers is due to an abundance of diopside, a Ca,Mg-rich mineral ($CaMgSi_2O_6$), suggesting the presence of much dolomite ($CaMg(CO_3)_2$) in the original sedimentary precursor ('protolith'). The presence of biotite in the darker layers suggests that they originated as clay-mudstones. Fig. 3 is a sample of the hornfels-granodiorite contact and shows the igneous rock cutting across the layering. Other calc-silicate hornfelses from the same locality include some with abundant grossular-andradite ('grandite') garnet and wollastonite ($CaSiO_3$) (Fig. 4), the latter derived from calcite and quartz in what must have been an impure limestone protolith.

Fig. 3. A specimen across the contact between calc-silicate hornfels and the Cruachan Granodiorite, from the same locality. Image: Giles Droop.

Fig. 4. A specimen of hornfels rich in wollastonite (white) and grandite garnet (pale brown), from the same locality. Image: Giles Droop.

Stratigraphic and sedimentary context: The calc-silicate rocks described here belong to the Dalradian Supergroup of metasediments, which collectively outcrop in a broad area between the Highland Boundary Fault and Great Glen Fault in Scotland. Similar calc-silicate hornfelses outcrop along the SW side of the Etive Complex and, away from the thermal influence of the intrusion, can be correlated with a strip of calcareous and dolomitic mica schists of the Ardrishaig Phyllite Formation; gypsum pseudomorphs have been recorded in these rocks indicating deposition in tidal flats which periodically dried out. Stratigraphically, the Ardrishaig Phyllites underlie the Tayvallich Volcanics, whose eruption has been dated at 601 Ma by precise U-Pb dating of zircon.

Taken as a whole, the late Proterozoic Dalradian sedimentary basin must have been many kilometres thick. Its current situation, to the NW of Lower Palaeozoic rocks marking the Iapetus Ocean (Southern Uplands, Lake District and Wales), indicates that it formed as a basin on the margin of Laurentia. The complete absence of any ophiolitic rocks within the Dalradian implies that the basin was 'ensialic', i.e. underlain by (thinned) continental crust rather than oceanic crust.

The Grampian Orogeny: The next detectable event was the Grampian Orogeny which affected the whole Dalradian in Early Ordovician (Arenig) times, as dated by U-Pb and Rb-Sr geochronology on contemporaneous basic intrusions in NE Scotland. This orogeny is thought to have been the result of collision of an island arc with the Laurentian margin. Its effects were twofold: (i) repeated plastic deformation resulting in polyphase folding on scales from mm to 10's of km, and (ii) regional metamorphism which converted the Dalradian sediments to slates, phyllites schists and gneisses, with the higher metamorphic grades achieved deeper in the folded pile. Away from the Etive Complex, the Ardrishaig Phyllites now contain greenschist-facies mineral assemblages such as dolomite ± calcite + chlorite + muscovite + biotite + epidote + albite + quartz.

Deformation and regional metamorphism: In our calc-silicate rock, evidence that the bedding was folded (at least) twice is provided by a fold interference pattern (Figs.1 & 5), the most obvious part of which is the banana-shaped closed loop in the top centre of the sample. A set of tight early folds (which we can call F1) has clearly been bent by a group of second folds (F2), as confirmed by the fact that the F1 axial traces (red in Fig. 5) have been bent around the F2 folds (with straight-ish axial traces – in blue). [In 3-D, the imaginary plane joining the hinge lines of successive bent layers within a single fold is called the 'axial plane'. An 'axial trace' is the line made by the intersection of the axial plane with the erosion surface, or sample surface.] The timing of the metamorphic peak relative to the folding cannot be determined in our calc-silicate sample, but porphyroblast-schistosity textural relations in garnet mica schists indicate that temperatures rose as the F2 folds developed.

At the thermal peak, the Ardrishaig Phyllites had been heated to *ca*. 450 ºC and subjected to a load pressure of *ca*. 9 kbar (equivalent to a depth of burial of *ca*. 32 km below the Earth's surface). These P-T conditions were estimated by thermobarometric techniques based on the stability relations of mineral assemblages (more of which below).

Uplift and erosion: Over the next 150 Ma erosion, perhaps accompanied by gravitational spreading, removed much of the overburden until, by the end of the Silurian, the Ardrishaig Phyllites were close to the Earth's surface, as testified by the deposition of the Early Devonian Lower Old Red Sandstone and Lorne Lavas (green in Fig. 2) upon unconformities on eroded Dalradian rocks further west.

Contact metamorphism: At *ca*. 405 Ma, huge volumes of calc-alkaline magma, probably generated by the closure of the Iapetus ocean, intruded the Dalradian schists, building the Etive ring complex with pulses of diorite, granodiorite and granite (Fig. 2). The heat given out by the outer members of the complex, particularly the Cruachan Granodiorite, thermally metamorphosed the Dalradian schists to a distance of 1-2 km from the contact, producing a thermal aureole, the highest-grade rocks, of pyroxene-hornfels facies, being produced closest to the igneous contacts (i.e. in roof-pendants, xenoliths and innermost aureole). The effect of this contact metamorphism on the Ardrishaig Phyllites was to cause decarbonation of the dolomite by reaction with quartz:

$$CaMg(CO_3)_2 + 2SiO_2 = CaMgSi_2O_6 + 2CO_2$$

dolomite quartz diopside fluid

and, in calcite-rich rocks, decarbonation of calcite:

$$CaCO_3 + SiO_2 = CaSiO_3 + CO_2$$

calcite quartz wollastonite fluid

Chlorite and muscovite were also replaced by minerals such as K-feldspar, grandite garnet, biotite and hornblende. The contact metamorphism was essentially static, i.e. did not involve deformation, so the high-grade mineral assemblages developed random, granular textures; also, because the heating was very rapid, nucleation rates were high, so the rocks developed with fine-grained granular textures characteristic of hornfelses (Fig. 6).

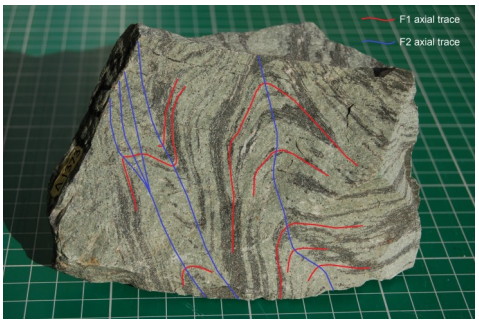


Fig. 5. Evidence for two phases of folding of bedding: axial traces of tight first folds (F1 – in red) are clearly bent by the more open second folds (F2 – in blue).

Image: Giles Droop.

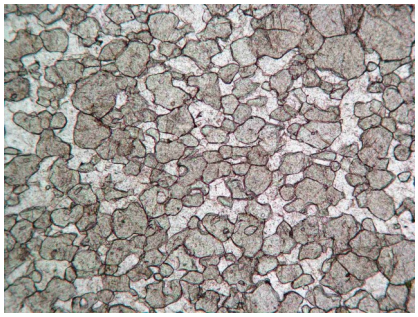


Fig. 6. Photomicrograph of diopside-feldspar hornfels, showing typical granoblastic texture and small grain-size. Plane-polarised light. Field of view 2mm across.

Image: Giles Droop.

Further evidence for shallow-crustal metamorphism comes from thermobarometry on hornfelses containing the well-equilibrated assemblage grandite + wollastonite + plagioclase + quartz, for which one can write the following reaction below:

$$Ca_3Al_2Si_3O_{12} + SiO_2 = 2CaSiO_3 + CaAl_2Si_2O_8$$

grossular in grandite quartz wollastonite anorthite in plagioclase

Electron-microprobe analysis of the compositions of these coexisting minerals reveals that the quartz and wollastonite are virtually pure but that the grandite and plagioclase are solid-solutions (25% grossular and 30% anorthite, respectively). Now, the fact that the impure grossular + quartz and the impure anorthite + wollastonite assemblages were in equilibrium (equally stable) means that the P-T conditions of metamorphism must lie on the equilibrium curve for this reaction, duly corrected for the impurities.

Fig.7 shows the experimentally located position of this curve for all pure minerals (A), and the one corrected for the anlaysed mineral compositions (B). At realistic solidus temperatures of granodiorite (*ca*.800 ºC), the latter yields a modest pressure of *ca*. 2 kbar, corresponding to a depth of burial of *ca*. 7 km.

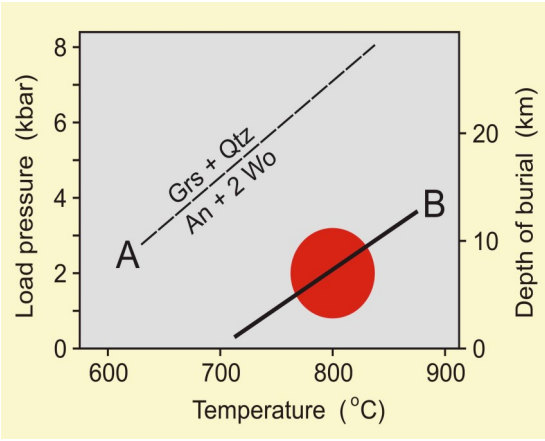


Fig. 7.Graph showing approximate pressure-temperature conditions during contact metamorphism.

A:Experimentally determined position of the grossular + quartz = anorthite + wollastonite equilibrium curve with all minerals pure.

B: ***B: Calculated position of the same equilibrium for impure minerals in another hornfels from Bonawe.***

Further erosion and exhumation: This segment of crust has been fairly stable over the last 400 Ma (at least, if one ignores the Early Tertiary magmatism related to the opening of the North Atlantic, as seen in the spectacular volcanic centres of Mull, Skye and Ardnamurchan to the west). Continued slow erosion of the thick Grampian orogenic pile with its Caledonian igneous complexes finally gave us the beautiful mountainous topography of the Highlands we see today.

Giles Droop

Crookhill Brick Pit SSSI

The DIGS group has been hoping to carry out some conservation work at the Crookhill Brick Pit SSSI at Chickerell, on the N.W. outskirts of Weymouth for some time. I have been familiar with the site since 1971 when I started teaching geology at Weymouth Grammar School (now Budmouth Technology College). At that time the brickworks had recently closed (1969) and the Oxford Clay was well exposed. Although there was small scale business activity on the site most of it was abandoned. As the site was only a few hundred metres from the school it was ideal for a first field trip for GCE 'O' level or 'A' level students. The Oxford Clay (*Kosmoceras compressum* zone) was well exposed and fossils could be easily found (impressions as the original shell material had ben lost) as well as abundant septarian nodules and gypsum crystals. The septarian nodules were piled up by the remains of a conveyor belt which carried clay into the brick works processing area. After 1985 I rarely visited the site as I was teaching at Weymouth College and other localities were more accessible e.g. Bowleaze Cove. It should be noted that a similar horizon to the brick pit is exposed on the Fleet shore north of Tidmoor Point but it is not very accessible requiring a 1.5 km walk from the nearest parking point on Fleet Lane (SY 645795).

Web-sourced image of Crookhill Brickpit looking NE, date unknown.

More recently the site has become a Local Nature Reserve as well as being occupied by a premix concrete depot and a Weymouth and Portland Council Depot. This has meant that the exposure of Oxford Clay has become much less accessible and over the years, trees have grown along with scrub vegetation (bramble and gorse) obscuring the geology. To make things more difficult the site is not only a geology SSSI but also a home for Great Crested Newts! So, it is a Special Area of Conservation (SAC). In the last few months the group has been working with Natural England and Dorset Council (Conservation Officer Lyn Cooch) to see if conservation work can be carried out so that the rock face is exposed and accessible. The conservation was started in October avoiding the bird nesting season and the time when the Great Crested Newts start hibernating. The first session cleared a path through the wooded area to the N.W. exposure where the lower part of the Oxford Clay is exposed.

Kosmoceras compressum

Northern exposure

North-western exposure

Unfortunately, the Kellaways Beds are not exposed in the brick pit although were seen in the Putton Lane Brick Pit (closed 1965 I think), but this is now the Bennett's Water Garden. A further conservation session is planned for early November when another rock face will be accessed higher up the succession within the Oxford Clay. A rolling programme of conservation is planned, returning each year as the wildlife allows! If you would like to help please get in touch with me and I will keep you informed of conservation sessions, possibly in the spring but more likely in autumn 2020 after the bird nesting season. *Alan Holiday*

Dorset Volunteer Awards Evening 2019

Talking of DIGS, several members attended the Awards evening in Dorchester to collect a Volunteer Group of the Year Certificate. It was quite a long evening as there were many nominees but it was nice for the DIGS Group to get some external recognition. The photograph shows some DIGS members with the Award, presented by Angus Campbell, the Lord-Lieutenant of Dorset. Photo credit: Emma Reed. *Kelvin Huff*

DGAG Dinner 2019

24 members and guests sat down for a three-course meal at the Rembrandt Hotel in Weymouth for our annual dinner. We were well looked after by the staff and a very pleasant evening was enjoyed by all. Our guest speaker this year was Dr. Jon Murden of Dorset County Museum who gave an entertaining after-dinner talk. The first half covered the Dippy event of 2018 and Jon outlined how it had been a roaring success in economic, educational and social terms. In the second part of the talk, Jon outlined the ongoing redevelopment of the museum (due to re-open in Summer 2020) and expressed his thanks for DGAG's support, not least in maintaining the lecture programme at the County Hall venue. His talk left us all looking forward to exploring the new museum, especially the geology sections. We are fortunate to have this opportunity to visit 'a world-class contemporary museum and exhibition space, complete with new galleries, learning centre, collections storage, library and visitor facilities including a café and shop.'

Kelvin Huff

Photo Credits: AH

Kingston Lacy Part 6: Interior Stone: Igneous and Metamorphic

William Bankes added his 1814-1820 Grand Tour Collections' stone; to that of his father's inheritance, to Charles Barry's restoration requirements and his own shipments from Venice between his 1841 exile and death in 1855. At least twenty of the most popular, rare and sought after C19th hard polished stones can still be seen amongst both prominent and even most minor features finally included in the fastidious Italianate palazzo interior to his updated Anglo neo-classic Palladian Exterior.

Egyptian Stone – Granite

Images 1 and 2. Main hallway with Monumental Red Aswan Granite, MRAG sawn at Wimborne, polished in London 1844. Sourced from the Aswan exposure of intruded pre-Caledonian Arabian-Nubian Shield rock. 606 Ma .

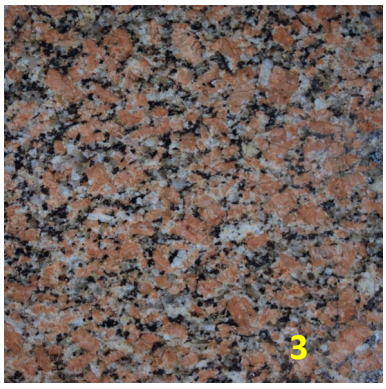
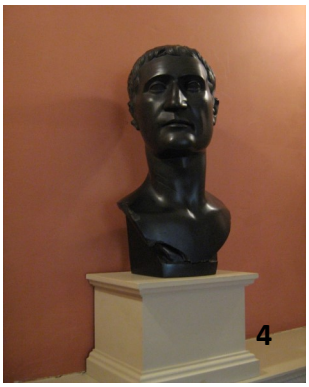


Image 3. Table-top close-up 9" x 9" revealing pink/red orthoclase of true acid rock MRAG granite with grey quartz and black biotite mineral-isation. Similar acid microgranites and layered altered intrusions are commonly available today.



Basalt

Image 4. A Green basalt; Roman Republic period bust, first found about 1780 at Canopus in the Nile delta. Egyptian or even Roman sourced Jordanian stone? Basalt was long quarried close to Cairo and in both Eastern and Western Deserts from three orogenic periods of around 230 Ma / 140 Ma & 90 Ma.

Grecian Intermediate

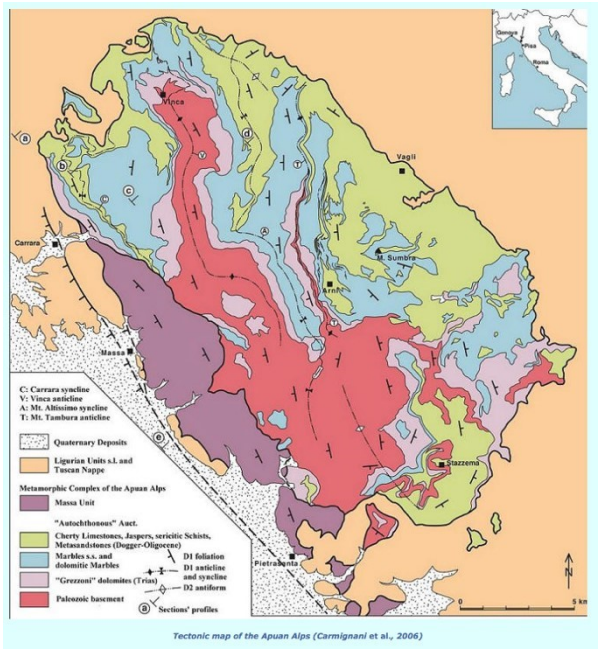
Image 5. The Drawing room console tables both have green Porfido verde antico medallions, 6"/150mm across. Thought serpentinite by William Bankes but epidote and chlorite minerals are now known to produce the green colouring in this igneous stone.

Image 6. The medallions are inaccessible to visitors - so are best seen as above. Never quarried, this stone is a porphyritic andesite or dolerite of Permian to Carboniferous age, coming only as loose blocks from south of Sparta, Laconia, Greece. Much favoured by Romans but ignored by the Greeks who invariably worked white marble.

Image 7 shows Westminster Cathedral flooring, here 12”/300mm across shows the typical black matrix but that colour may trend to green or violet. The phenocrysts are of light coloured plagioclase feldspar and black pyroxenes. Never found as large boulders this hard stone was predominantly used in decorative work and ecclesiastic cosmati flooring. (Some folk will notice crossed and star-shaped feldspar forms as known from Quartz porphyry alkali felspars in the Praa Sands’ elvan dyke).

Eastern Mediterranean: Snowflake obsidian

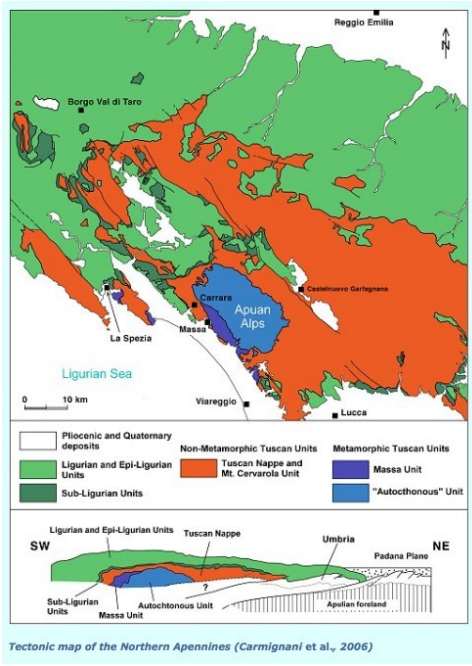
Image 8 shows presumed C19th souvenir polished cristobalite snowflake obsidian obelisks in the Egyptian room, are crudely engraved in English as: ‘Obelisk called Cleopatra’s Needle in Alexandria’. This is not an Egyptian stone but the Ancient Egyptians used Cretaceous obsidian imported from the eastern Mediterranean and southern Red Sea regions. (Wikipedia.)



Tectonic map of the Apuan Alps (Carmignani et al., 2006)

http://www.apuanegeopark.it/ENGLISH_VERSION/apuanegeopark_geology.html

Apuan Alps Eastern – Marble



Tectonic map of the Northern Apennines (Carmignani et al., 2006)

True marbles – white, grey and blue Carrara marbles of the Apuan Alps have been predominantly worked inland of Carrara and Massa and multi-coloured breccias, southwards around Stazzema and Seravezza. The geological age of the marbles is variably of Late Triassic/Early Jurassic origins and metamorphosed in the Tertiary to now contain a vast range of minerals and hence being both variously textured and coloured. The earliest, UK-sculpted white Kingston Lacy Carrara feature, must be in the Library; probably brought from the ruined Corfe Castle. The fireplace paneling is surmounted by rather opaque but purely white Carrara marble fleur-de-lys emblems of the Bankes’ family. **(9)**

The paneling **(10)** is of a most rare white calcite cemented; coarse-grained black graphite disseminated marble - of provenance as yet unknown and far too coarse for Carrara. (Oregon settlers from 1830’s produced the then only similarly textured and only locally commercial polished stone from the now, Tate Quarry; world’s deepest today; White Cherokee/Georgia Marble http://midgagmsorg.ipage.com/?page_id=858) **See p.11**

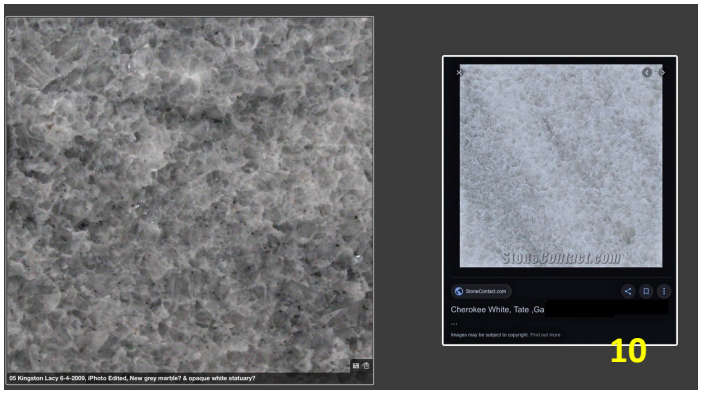


Image 11. Apuan Alps Statuary Carrara is the very finely-grained, most translucent and pure white marble, whereas the graphite-streaked or clouded stone, long called Sicilian Carrara in Britain, is abundant and much used in high status flooring and stairways. ('Sicilian Carrara' referred merely re-shipment by Sicilian stone trading ports).

Image 12. Flaxman's 1786 Saloon sculpting left (photo Daderot) and the Drawing Room fireplace exhibit the best white statuary Carrara Marble.

Image 13. Most commonly amongst the Carrara Marble is a very fine grey/blue colouring and darker veining of disseminated graphite. Where cavities and veining of graphite occur the name *Bardiglio Carrara* is given. An unintended serendipity in William's choice of this graphite bardiglio stone, for this monument to his architectural achievement, must be that Eighteenth and Nineteenth Century Bankes family wealth was considerably based on their Borrowdale graphite wad/black lead mining, in Cumbria. The Bankes's rights to the graphite mining came in 1622 to Sir John following his marriage to Brave Dame Mary and brought in considerable wealth during the Napoleonic wars. *Peter Bath*

There will be more from Peter about the marbles of Kingston Lacy in the Spring 2020 Newsletter. *Kelvin*

Combe Martin

Combe Martin is a small coastal town in north Devon with a very long main street of over a mile in length. It is a linear town with a few side streets. The road follows the confines of a fault-controlled valley with the river culverted for much of its length in the town.
It is a holiday town nestled between Exmoor National park (forming the N.E. boundary) and the North Devon Area of Outstanding Natural Beauty (forming the town's western boundary). It is very well provisioned with ice-cream shops and the usual sea-side town shops. There are several car-parks, the most northerly being a few metres from the beach, both vertically and horizontally. There is a sloping footpath from the car-park to the beach which is mostly sandy when the tide goes out. The river's mouth forms the west side of the beach, both sides are flanked by well exposed rock exposures. The eastern side has a concrete "path" over an outlet pipe which can be a little slippery in parts due to algae. This path gives excellent easy access through the rocks giving the geologist, or anyone else, a close-up view of the strata and structures. Low tide is essential for visiting the bay. The strata are known as the Ilfracombe Slates, being low-grade metamorphosed Devonian sandstones, siltstones and occasional limestones.

Syncline

Folding is mostly about 50 degrees to the south and at first glance seems to be fairly uniform, that is until you go further along the outfall path. There are some nice synclines and anticlines displayed which are quite tight with some faulting. The slates have a fairly "silky" feel with a silvery grey to green sheen along the cleavage planes of the rock. In places the sandstones have quartz veining (which can be about 3cm thick). This seems to have been "sweated out" during the Variscan folding of the strata. Some of the veins have visible Galena and Sphalerite. The Galena contains small amounts of microscopic Silver which has been mined in the area. Some of the veins show a fibrous structure and slickensides. The slickensides sometimes occur on the bedding planes and cleavage surfaces showing that bedding plane slip has occurred during the folding.


Bedding and cleavage


Faulted fold

Some sedimentary structures are still visible, notably trace fossils. These occur in a few silt beds and are of burrows (*Chondrites*) with fine grained sandstone filling the burrows. They occur in very few of the silt beds which reach up to about 7.5cm thick. Towards the top of the cliff the beds show terminal curvature with downslope movement of the broken-up, cleaved rocks in the Pleistocene-age Head deposits.

There has been much small-scale mining in the area. The first recorded silver mine was mentioned in 1292. Mining was effectively stop-start as new technology was used. Industrialised working was used for a relatively short time.


Chondrites

An adit is visible in the cliff (appearing in 1984 after a storm removed the covering rock) which was possibly a trial adit for silver mining, though unsuccessful. It goes in about 30 metres.


Adit shaft

Mining has been for silver, lime (for burning for field-dressing and mortar) and iron. All mines are closed. The information centre, within the museum, sells informative booklets on the mining of the area, £3.50 each. The Combe Martin silver mine worked intermittently from1292 until 1880. In 1988 the Combe Martin Silver Mine Society was formed and it has opened the mine for visitors (Sunday 8 - 12.00 and Thursday 10.00 - 4.00). If you want to visit the mine contact cmsmsoc@hotmail.com or 01271 882442. One of the booklets shows photographs with lots of ladders! Check with them about access. Combe Martin is a fascinating place for geology with much to see if you look for the detail. It's another place on the list that I have to go back to and spend a day there, tides dependent, as there is so much more to see. *John Scott*

Book Review

"Origins - How the Earth made us" Lewis Dartnell 2018.

I can recommend this book to any DGAG member. Although a lot of the geological content will be familiar, the way it is tied into humanoid and human history is fascinating - from BIFs to the Black Death and voting patterns in the USA. Not only that, it's well written! I got my hardback version for £14.99 with free delivery from Blackwells. Digital downloads are also available (although actually, I prefer a book in my hands!).

One little gripe is that the diagrams are all in grey scale - the geological map of the UK is thus pretty poor... don't let that put you off, put this on your Christmas list! *Geoff Townson*

Book Review

World of Geology: Travels to Rocky Places
Tony Waltham. Whittles Publishing 219pp £18.99.

Have you ever read the geological magazine "Geology Today"? If so you probably, like me, look at the front cover and then read the back cover before looking at the inside. The rear cover will have an excellent photograph of somewhere displaying some good geology and a write-up of about 500 words stating what is shown in the photograph. It has been said that it would be nice to have these and/or others like them in a book for easy perusal. That book has now arrived! The book contains 110 of Tony Waltham's photographs at a size of approx. 20cm square with the accompanying text on the page facing the relevant picture, The coverage of phenomena is wide and the geographic spread is vast. There are no photographs of Antarctica, but that is the only continent not illustrated. Topics covered include landslips, land sinking, geysers, glaciers, volcanoes, ice caves, lava flows, lava stalagmites, rivers (both surface and subterranean), and other erosional/depositional features. Britain is well-represented, with the Millook Haven chevron folds, Malham Cove, Mam Tor landslip and others included.

There is a contents section, a brief preface giving the idea behind the book, an introduction covering plate tectonics and the relationship between geology and the landscape. There is a basic world map showing the approximate location of where each photograph was taken. The only slight let-down is that there is no proper index. The content pages give the photograph title, which is often quite long, and the page number. It is not the easiest of ways to find a particular photograph or type of feature. Having said that it is a good book. My biggest problem is that I do not have the money or time to go and see these places for myself, so the book is the next best thing. Tony Waltham is a retired university lecturer and consultant in engineering geology who has travelled extensively and taken a great many photographs. He runs his own photographic library and is a lecturer on cruise ships.

John Scott

Holiday Rocks, 26th October

Our annual event covered three far-flung places of the globe. Pat Snelgrove kicked off the proceedings with a very informative talk on the geology and geomorphology of Montenegro. I then spoke about a recent trip to southern Alaska and the northern U.S.A. The latter included a rail trip from Seattle to Chicago, where I visited the excellent Field Museum of Natural History. After a welcome refreshment break, Alan Holiday spoke about a recent visit to southern Morocco with the G.A., featuring some spectacular geology and desert scenery. Anthony Brook brought his collection of specimens from the same trip along, which very much added to the interest (see P.1). It was a pity more members weren't able to attend a very enjoyable afternoon.

Kelvin Huff

Message from the Chairman, Alan Holiday

I have Proceedings of Geologists' Association going back to 1947 which I have partly inherited on behalf of DGAG. I have not had any requests for their loan (as far as I can remember – maybe John Scott?). I am trying to declutter in preparation for a move to a smaller property (not imminent but planned). I will not be able to take the journals with me – any suggestions? They are available on line but at a price through Elsevier.

Dorset Building Stone website

In 2017, an informal group of DGAG members began a project to document the building stones of Dorset. Since then, an enormous amount of material has been added to the website, which features descriptions of churches, secular buildings and of course the many building stones of Dorset. There is also a section on quarries and pits. Although inspired by Jo Thomas's seminal book, the website contains material never before documented in this way. I would encourage members to visit the site at : http://dorsetbuildingstone.weebly.com. Any member is welcome to join in with the research, just let me know. *Kelvin Huff*

DGAG Field Trips and allied events 2019 - 20

To book a place on our field-trips, contact Kelvin Huff or Alan Holiday using the details below. £2.00 day trip fee.

Wednesday December 11th: DGAG Lecture: 'Telling the stories of the Jurassic Coast', with Sam Scriven. Dorset County Hall, 7 p.m. £5, to include mulled wine and mince pies.

Saturday December 14th: DGAG Xmas workshop at Broadmayne Village Hall, 10 a.m. – 5 p.m. Lunch £4. **Please contact the Secretary to book a table and/or lunch, if required.**

Wednesday 8th January: DGAG Lecture: 'Offshore wind farms: the importance of geology for renewable energy' . David Shiston (Atkins). Dorset County Hall, 7 p.m. £5.

Saturday January 11th: DGAG AGM, Broadmayne Village Hall. 2 p.m.-5 p.m. Agenda items to the Secretary please.

Wednesday 12th February: DGAG Lecture: *tba*

Wednesday March 11th: DGAG Lecture: 'The Surface of Mars: ancient and modern processes on the Red Planet' . Joel Davis (NHM). Dorset County Hall, 7 p.m. £5.

Wednesday March 25th: DGAG Fieldtrip: Vale of Wardour and Chicksgrove Quarry.

Wednesday April 8th: DGAG Lecture: 'Carbonate concretions in the Dorset Jurassic'. Professor Jim Marshall, University of Liverpool. Dorset County Hall, 7 p.m. £5.

Website: https://dorsetgeologistsassociation.org/

DIGS (Dorset's Important Geological Sites)
The group welcomes anyone wishing to help with conservation work on Local Geological Sites. Please contact Alan Holiday if you are interested. Working parties go out on both weekdays and weekends.
alanholiday@btinternet.com

Wessex OUGS events

Please contact Jeremy Cranmer on:

wessexdaytrips@ougs.org or telephone 01305 267133 to book a place. £2.50 day trip charge.

Saturday 25th January 2020 : Wessex Branch AGM and Day of Lectures, Wool, Dorset.
A sociable day with three talks on the theme of 'hidden worlds', an excellent lunch, and a brisk AGM. The charge for the talks, refreshments and lunch is £8 per person.

Reminders: Contributors' deadline for the Spring Newsletter is: **Monday 23rd March 2020.**

Committee news:
We **still** need an Events Officer!
Kelvin

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Treasurer and Membership Secretary	Alison Neil	01305 832937	alison.neil@madasafish.com
Fieldtrip Officer	Val Fogarty		Tbc at the 2020 AGM
Website Manager	Geoff Rowland		rowland.geoff@gmail.com
Events Officer	*Vacant*		
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Ordinary	John Scott		johnandsuescott16@gmail.com
Ordinary	Robert Chandler		aalenian@blueyonder.co.uk