EIG FIELD TRIP 2018

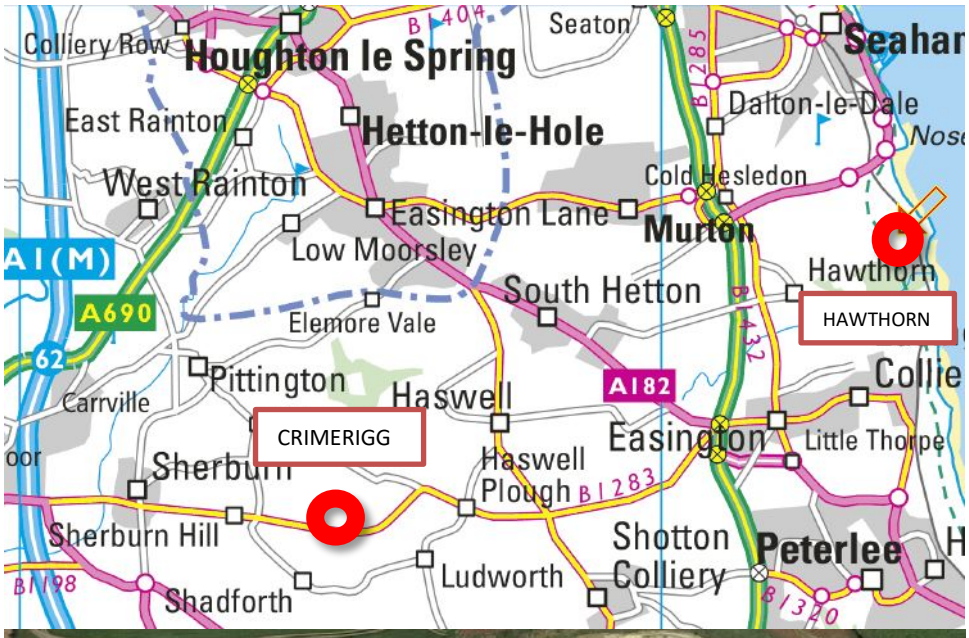
WEDNESDAY 12th SEPTEMBER 2018

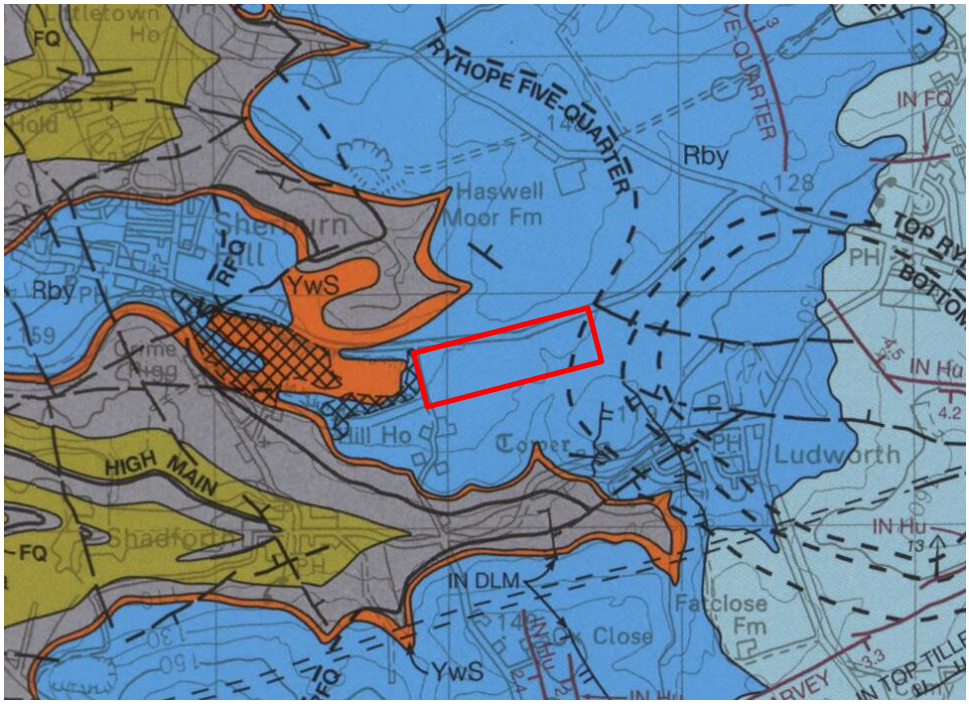
Crimerigg Quarry (Breedon) & Hawthorn Quarry (Tarmac)

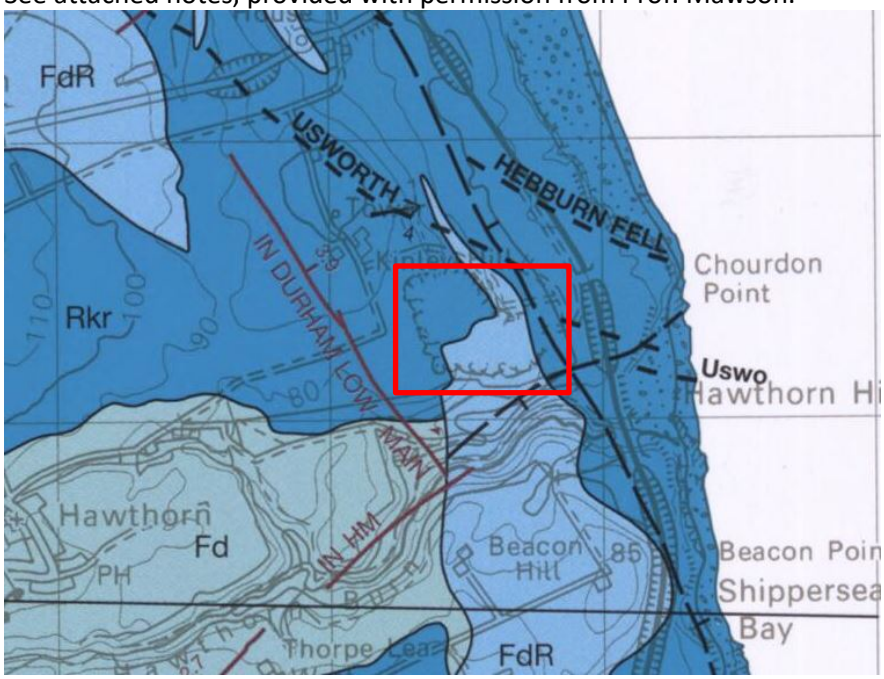
Sherburn
Co. Durham

Location	1) Crimerigg Quarry Breedon Shadforth Durham DH6 1LE 2) Hawthorn Quarry Tarmac Kinley Hill Farm Seaham SR7 8SW
Field Trip Leader	Linzi McDade, Breedon
Contact & Meeting Point	Linzi McDade, Breedon Crimerigg Quarry Main Office
Website	www.breedongroup.com www.tarmac.com
Objective	Tour of active and dormant quarries showing Permian Zechstein Group strata
Time of arrival **Length of Visit**	12th September 2018 / 12.30pm 3.5 hours
Max No	n/a
PPE required	Helmet Gloves Hi-Vis trousers and jacket/waistcoat. Eye Protection. Lace up safety boots (steel toecap)

Location Map



Outline of Trip	***Summary*** Visit to active quarry (Crimerigg) extracting dolomite, sand and clay from the lower sections of the Permian Zechstein Group (Raisby Formation and Yellow Sands) followed by visit to dormant quarry (Hawthorn) to view structures in overlying Ford and Roker Formations ***Crimerigg Quarry*** *c.1.5hrs* Large multi-product quarry producing aggregates Permian Raisby Formation and underlying Yellow Sands. ***Hawthorn Quarry*** *c.1.5hrs* Dormant Quarry and geological SSSI showing reef structures within Permian Ford and Roker Formations. *We will travel between sites following the visit to Crimerigg Quarry. Car-sharing will be preferable as parking space at Hawthorn Quarry is limited…*
Geology	***Crimerigg Quarry*** Raisby Formation (cream brown and grey, fine grained dolostone) overlying the Marl Slate Formation and Yellow Sands Formation (Zechstein Group). Yellow Sands Formation exhibit complex cross bedding – possible dune structures. Raisby Formation formed on sloping shelf at the edge of the Zechstein Basin. Complex structures from syn- & post-depositional processes.  ***Hawthorn Quarry*** Hawthorn Quarry shows sections in the Middle Magnesian Limestone and exposes the upper reefcore and reef-flat, with overlying boulder beds and stromatolite biostrome, of the Ford Formation. Bedded oolites, with thin variegated clays at the top of the section, are possibly

	of Zechstein Cycle 2 age. A wide variety of algal structures can be found within the biostrome and the reef yields a specialised fauna unknown at other outcrops of this formation. This site is highly informative and helps in the understanding of the later evolution of carbonate environments in mid-Magnesian Limestone times, with reef carbonates overlain by bedded, non-reef sediments. See attached notes, provided with permission from Prof. Mawson.  Excerpts from BGS map no. 27 Durham Contains British Geological Survey materials © NERC 2018
Driving time to Durham University	10 miles /15 km 20 mins

The succession of Zechstein Group carbonates in Hawthorn Quarry

Zechstein cycle 1 and 2 carbonates (Z1C and Z2C) of the Ford and Roker formations are well exposed in this large abandoned quarry near Seaham which shows the large-scale geometry of the Z1C reef and Boulder Conglomerate very well.

On the northeast side of the quarry Z1C (Ford Formation) reef facies passing laterally into and overlain by reef-flat facies (as seen at Blackhall Rocks) as well as back-reef apron facies are exposed. The reef contains basinward-dipping clinoforms which consist of sheets of laminated microbialite thought to have formed during periods of environmental stress that

prevented the reef frame-builders (bryozoans) from growing. Towards the top of the succession, the reef-flat facies contains many reef-derived cobbles and some boulders: it and the back-reef facies contain clinoforms orientated gently shelfwards - as in modern coral reefs, the reef-flat and back-reef apron built landwards into the lagoon behind the reef even while the reef growing was seawards.

The top of the reef is marked by exposure surface and is partly silicifed. It is overlain by collapse brecciated Z2C rocks where there is an embayment in the final reef-front. The Crinkly Bed is exposed behind the final reef-front where the Roker Formation is not brecciated; the Hartlepool Anhydrite was deposited basinwards of the final Z1C reef-front, not shelfwards of it. There is no Boulder Conglomerate on the northeast of the quarry: as elsewhere, its outcrop is restricted to locations immediately shelfwards of the Z1C reef.

On the southwest side of Hawthorn Quarry, palaeogeographically landwards of the exposures on the northeast side, the Z1C comprises reef-flat facies overlain by the Boulder Conglomerate. Above, a nearly complete Roker succession, about 60m thick, is exposed; it is not collapse brecciated and consists of three smaller-scale packages - parasequences (Z2C/1, 2 and 3 in ascending order). The Crinkly Bed with its unusual ripple-like macrostructures is again seen at the base of the Roker; as at Blackhall Rocks, it is associated with pisoid rock (partly silicified) and is overlain by large domical stromatolites along with a few columnar stromatolites and shallow-marine / lagoonal biolaminated grainstone / packstone facies (composed of coated grains). At the top of Z2C/1, these rocks are overlain by intertidal / supratidal facies: most of the carbonates forming Z2C/1 contain many vugs and formerly contained much early diagenetic gypsum and / or anhydrite indicating high-salinity.

The boundary with the second package (Z2C/2) is marked by a unit of brown clay which is thought likely to be the equivalent of the Orange Marker seen within slope-apron facies in Marsden Bay: the three packages forming the Roker platform can therefore be correlated from its slope onto the platform top. It is overlain by muddy lagoonal, shallow-marine heterolithic and ooid shoal facies belonging to Z2C/2. Muddy lagoonal / shallow-marine facies occur above the oolite and form the base of third package (Z2C/3), the top of which is not exposed. The stratigraphy forming Z2C/2 and Z2C/3 at Hawthorn Quarry is similar to that exposed to the north of the harbour at Seaham.

Michael Mawson 13.05.18