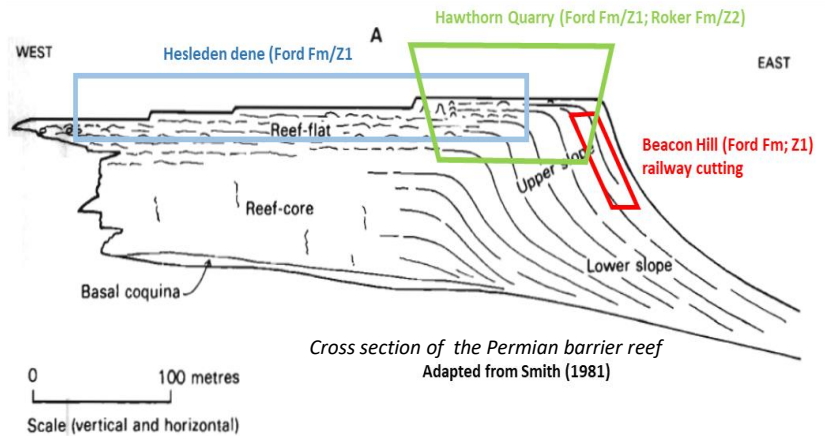
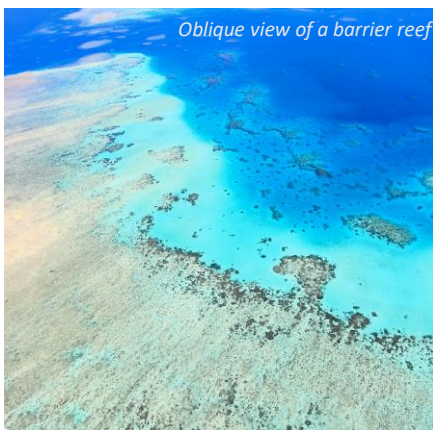


Reading the Rocks: Walk 4 Easington colliery to Hawthorn Hive

Permian rocks: (290-248 million years ago) Permian Magnesian limestone forms the solid geology of the Durham coast above present sea-level. During the early Permian the area was terrestrial, hot and arid with desert conditions (The Yellow Sands). However, as sea-level rose regionally the Zechstein Sea inundated the area. This sea was partially landlocked and periodically dried out as sea-level fluctuated up and down. This resulted in the cyclical deposition of carbonates and evaporites.

From the Blast beach south to Blackhall Rocks several formations formed along the edge of an ancient barrier reef system. In brief, the Upper Permian Zechstein Group is composed of three main carbonate formations marking high sea-level stands: the Ford Formation (Z1), Roker Formation (Z2) and the Seaham Formation (Z3). Each is separated by evaporites/anhydrites formed during low stands.

Beacon Hill formed at the edge of the ancient reef as part of the Ford Fm and marks the transition from shallower water to the west and deep water to the east. At Hawthorn quarry the limestone formed in shallower water as part of the reef flat.



Quaternary sediments: Most of the 'ice age' history on the Durham coast comes from the Last Glacial Maximum (LGM) (~ 28,000 – 18,000 yrs ago) with sediments laid down by glacial processes.

Easington Raised Beach in Shippersea Bay is very unusual and the most northerly known interglacial beach deposit in England. It lies directly on bedrock at 33 m OD and is covered by LGM glacial sediments. The ERB has pebbles bored by marine organisms and littoral, temperate/cold climate, marine macro/micro-fossils. It contains numerous gastropods (e.g. *Littorina littoralis*, *Nucella lapillus*, *Gibbula umbilicalis*, *Patella vulgate*) and benthic foraminifera characteristic of intertidal and sub-tidal environments. It comprises bedded, imbricated, well-rounded sands and gravel. Optically stimulated luminescence dates and amino acid ratios date the beach to 240 - 200 ka BP (MIS 7). The elevation of the beach implies a long term uplift rate of 0.19 mm a⁻¹.



The Hawthorn Dene: The Durham 'denes' are steeply incised palaeo-valleys cut postglacially. Several theories may explain their formation including subglacial drainage, excess meltwater discharge with rivers adjusting to base level and glacial lake outburst floods. Hawthorn dene is over ~30m deep and cut into the Permian Magnesian limestone.



The denes form sheltered habitats. Hawthorn Dene is a SSSI and nature reserve. The denes harbour remnants of ancient woodland. Trees include ash, yew, field maple, wych elm, birch, beech and hazel. Snowdrops, wild garlic, wood anemones, sweet woodruff and rare flora such as bird's-nest orchid and herb paris cover the valley. Other highlights include: Lime Kiln (C18th), the former Hawthorn Towers site and old railway.

Limestone grasslands and Easington Colliery Nature Reserve

- Easington Colliery began when the pit was sunk in 1899. Thousands of workers came to the area from all parts of Britain. The mine was closed on 7 May 1993 with the loss of 1,400 jobs. On 29th May 1951 an explosion in the mine resulted in the deaths of 83 men.
- Rockwaste from the mine was mechanically dumped using aerial conveyor belts and transported along the coast by wave action and longshore drift. The cessation of tipping has enabled natural processes to partially rejuvenate the coast but waste still remains in pockets. *Turning the Tide* (early 1990's) was the first project to try and clear up the Durham mining legacy. The *Durham Heritage Coast*, *Limestone Landscapes*, *Seascapes* initiatives have followed.
- The site of the former pit is now a nature reserve and forms part of the magnesian limestone grassland habitat along the coast and which is managed by organisations such as Durham Wildlife Trust and the National Trust.
 - 92% of the coastal Magnesian Limestone grasslands in Britain occur here in County Durham
 - Wild flowers: *Birds foot Trefoil*, *Red Fescue*, *Glaucus Sedge*, *False and Downy Oat-grasses* and *Quaking-grass*, *Bloody Cranesbill*, *Carlina Thistle*, *Fragrant Orchid*, *Pyramidal Orchid*.
 - Invertebrates, butterflies and moths: The *Durham Argus Butterfly* (<https://www.nationaltrust.org.uk/durham-coast/features/durham-argus-butterfly-project>). Adult Durham Argus butterflies feed on *wild thyme*; larvae feed on *Common Rock-rose*. *Cistus Forester*, *Burnett Moth* and *Least Minor Moth*. *Common Blue*, *Orange Tip*, *Wall Brown* and *Dingy Skipper* are all common butterflies

