
ELC_13: Gullane Shore

Site information

Location and summary description:

The site comprises a 1.5 km section of coastline located to the west of the town of Gullane between Gullane Point and Bleaching Rocks. Cliff and coastal platform sections along the coast at the site expose sedimentary strata of the Dinantian age (early Carboniferous) Gullane Formation and younger intrusive igneous rocks.

National Grid reference:

Mid-point: [NT 46590 83094]

West end: [NT 46152 82728]

East end: [NT 47316 83158]

Site type: Natural section/exposure; Natural landform; Natural view

Site ownership: Crown

Current use: Open Country

Field surveyors: Sarah Arkley, Katie Whitbread

Current geological designations: Firth of Forth SSSI

Date visited: 11th June 2014

Other designations: Firth of Forth SPA, Ramsar, Aberlady Bay Local Nature Reserve

Site map

(Figure 18) Gullane Shore Location Map. The site area comprises bedrock exposures in shore platforms and coastal landforms including inlets and areas of beach in the immediate vicinity of the main rock outcrops. The exact area of bedrock exposure is likely to vary in time due to changes in the beach morphology. This site is adjacent to the Aberlady Bay Site ([ELC_30](#)) and Gullane Bents Site ([ELC_29](#)), here greyed out.

Site description

Background and site area

Gullane Point is located west of the town of Gullane, forming a broad peninsular with the wide beach of Gullane Sands to the east. Between Gullane Point and Gullane Bents to the west there is a 1.5 km shore section containing rock platform and cliff exposures. Sandstone exposed in these shore sections was formerly quarried at three sites located close to the coast near Gullane Bents. These quarries are now infilled or overgrown and no rock is exposed.

Sedimentary rocks

The sedimentary rocks exposed in the shore and coastal cliffs at Gullane form part of the Gullane Formation of the Strathclyde Group (formerly called the Calciferous Sandstone Measures). The Gullane Formation comprises a cyclic sequence of sandstone, siltstone and mudstone containing ironstone nodules, conglomerate beds and some thin

seatearths.

In the west of the section, just to the east of Gullane Point, a variety of well-exposed sedimentary features indicative of shallow marine or estuarine and fluvial environments are visible in the sandstone units. Tabular sand beds 0.2–1.5 m thick are common in the west of the section near Gullane Point and are interbedded with some siltstone beds. These beds commonly contain abundant trace fossils including prominent beds dominated by 2–3 cm diameter, 10–20 cm long vertical burrows (*Diplocraterion*), and/ or dense networks of finer irregular burrows. The fine irregular burrows also occur in siltstone beds where they are seen as casts of sandstone.

In places, the tabular sandstone and siltstone beds are cut by medium- to coarse-grained, erosional channel sands with abundant organic rich laminae towards the base and fine lenticular bedding formed in laterally-accreting channel bars defined by fining-up sediment packages 1–2 cm thick. Conglomerate beds with erosional bases also occur in places. These beds comprise a clast-supported, sub-angular to sub-rounded gravel of quartz, quartzite, red mudstone and other lithic clasts in a coarse sandy matrix and appear to fine upwards.

Complex soft sediment deformation in some of the thicker sandstone beds indicates mass flows of sand during or soon after deposition. A particularly good example is seen in an approximately 10 m thick massive sandstone bed exposed in a vertical cliff at Bleaching Rocks. At the base of the

deformed sandstone is a sharp contact with a 0.5 m thick laminated pinkish-sandstone that thins to the east to c. 0.1 m thick. It is possible this sandstone may be a liquified 'sliding layer' between the deforming sand body and the underlying siltstone with laminations caused by 'streaking' out of the strata.

In the centre of the section at Hummell Rocks, dark grey, shaly mudstone with abundant large bark fragments visible in the flat surfaces of the rock platform. Bark textures include irregular linear ridges, and a regular pattern of slightly tear-drop shaped marks consistent with *Lycopod* bark.

Igneous rocks

The sedimentary strata are intruded by igneous rocks (Analcime-Gabbro) of the Lower Gullane Head Sill and Upper Gullane Head Sill (Midland Valley Carboniferous to early Permian Alkaline Basic Sill Suite). Due to the westerly dip of the strata, the upper sill is exposed in the rock platform to the west of the section at Gullane Point, and the lower sill crops out to the east at Hummell Rocks and in the cliffs at Corby Craigs.

The Analcime-Gabbro (formerly called Teschenite) is a medium to coarse-grained crystalline rock with a greenish-grey colour. In many areas 2–3 mm diameter abundant Analcime phenocrysts are present and altered to a rust-red colour. At Gullane Point, a complex zone occurs in centre of upper sill with paler igneous rock apparently intruded into the magma forming the analcime-gabbro. Abundant mineralised hydrothermal veins occur in this area.

The lower contact of the upper sill with the underlying sedimentary rocks can be seen in the rock platform near Gullane Point at low tide. The contact between the lower sill and the underlying sandstone can be seen in the base of the coastal cliff at Maggie's Loup. Large polygonal cooling joints are developed in the upper sill in the region of The Old Man west of Gullane Point, and in the lower sill at Corby Craigs.

Structural geology

The sedimentary strata tend to dip shallowly to the west or south-west but are broadly folded to the east of Hummell Rocks. Several minor faults bisect the strata near Ironstone Cove and to the east of Hummell Rocks. These faults are exposed in places as zones of densely fractured rocks.

Faults and fractures within the igneous sills are commonly mineralised with calcite and well-developed slickensides can be seen in places.

Quaternary deposits and landforms

The coastal rock exposures comprise erosional cliffs and shore platforms interspersed with beaches in small bays. At the promontory of Hummell Rocks, a section in the back of a small bay exposes 1 to 1.5 m of raised beach deposits overlying bedrock. The raised beach deposit consists of c. 0.3–0.4 m of very shelly sand with fine gravel, overlain by well-rounded gravel and cobbles in a sandy matrix. The raised beach deposit lies at an elevation of 2–3 m above the high tide level and continues further inland where it is overlain by up to 4 m of blown-sand deposits. The raised beaches and overlying dunes to the west, at Gullane Point, and south are included within the adjacent Aberlady Bay geomorphological site ([ELC_30](#)).

Blown sand (dunes) overlie bedrock, marine beach or raised beach deposits along the landward edge of the coast from Gullane Sands to Gullane Bents. The sands flats along the shore of Gullane Bay which extend to the east into the area of the Gullane Bents geomorphological site ([ELC_29](#)) are an part of the beach-dune sediment system at Gullane Bents.

Access and additional information

There is good access to the coast via footpaths from the public car park at Gullane Bents. Access along the coast is facilitated by a network of footpaths through the dunes.

Stratigraphy and rock types

Age: Dinantian

Formation: Gullane Formation (Strathclyde Group)

Rock type: Sandstone, siltstone, mudstone with minor ironstone, seatearths, coal and limestone

Age: Carboniferous to early Permian

Rock type: Analcime-Gabbro

Formation: Upper and Lower Gullane Head sills

Assessment of site: access and safety

Road access and parking There is good access to the site via a public car park at Gullane Bents.

Toilet facilities are also provided near the car park. Access to the site can also be made from a parking area approximately 1 km north-east of Aberlady.

Safety of access Footpaths provide good access along the coast at high or low tide and there are rock exposures above the high-tide level at many points. Access to coastal platforms and the base of some cliff sections is restricted at high tide. Visitors should be aware of tide times and access routes when visiting the site.

Safety of exposure The cliffs appear generally stable, but care should always be taken beneath cliffs, particularly in over-hanging areas. Care should also be taken at cliff tops. Rocky coastal platforms and boulder-strewn areas can be hazardous and care should be taken in accessing these areas.

Access Access via the shore and adjacent footpaths

Current condition Many rock exposures are clean and free of vegetation. However, in the intertidal zone the sedimentary rocks in particular, may be largely covered by barnacles and algae.

Current conflicting activities There are several golf course located adjacent to parts of the site. The main access paths skirt the edges of the golf course areas. Golf course developments have resulted in landscaping of areas of the dunes.

Restricting conditions Many of the geological exposures are located within the intertidal range and are not visible at high tide.

Nature of exposure Vertical cliff sections, intertidal rock platform and beach exposures.

Assessment of site: culture, heritage & economic value

Historic, archaeological & literary associations Stone from the quarries at Gullane may have been used in the construction of Dirleton Castle. The quarries are now derelict or infilled and there is no exposure, but the sandstone units are well exposed in the coastal sections.

Aesthetic landscape Coastal landscape

History of earth sciences Not known

Economic geology Sandstone was formerly quarried from small pits above the shore near the car park. These areas are now overgrown and there are no exposed rock faces.

Assessment of site: geoscientific merit

| | Rarity | Quality | Literature/collections | Primary interest |
|--|----------|-----------------|------------------------|------------------|
| Lithostratigraphy | Regional | Good | | X |
| Sedimentology | Local | Excellent | | X |
| Igneous/mineral/metamorphic geology | Local | Good | | |
| Structural geology | Local | Moderately good | | |
| Palaeontology | Local | Moderately good | | |
| Geomorphology | Regional | Good | | |

Site geoscientific value

The shore section at Gullane is the type section for the Gullane Formation and is therefore the most important section through this part of the Carboniferous stratigraphy in the region. The site has excellent exposures of a wide range of sedimentological features, including plant and trace fossils, which are indicative of Carboniferous fluvial environments. There are also good exposures of associated intrusive igneous rocks and their contacts with the surrounding sedimentary rocks.

Gullane Shore provides an excellent example of Carboniferous fluvial sedimentology with regional stratigraphic significance.

Assessment of site: current site usage

Community The site is close to the attractive village of Gullane and close to numerous golf courses. Locals and numerous visitors frequent the site for recreation including walking, exercise and water sports.

Education The site contains a range of clear sedimentological features that would provide a good introduction to Carboniferous depositional processes and environments, and the relationship between sedimentary strata and intrusive igneous deposits. The site has potential for geosciences research, and teaching potential for Higher/Further and School level education. Use of the site for teaching purposes may be enhanced by leaflets or online information. Members of the general public may benefit from on-site interpretation such as sign boards or a Geo-trail.

Assessment of site: fragility and potential use of the site

Fragility Weathering/erosion

Potential use Research, higher/further and school education, on-site interpretation, geo-trail.

Geodiversity summary

The site comprises excellent geological features that are well exposed along a shore environment and is readily accessible by well-maintained paths. There are also good local facilities and amenities, and the area is already a prime recreational site. There is considerable potential for developing the geodiversity value of the site by the provision of geological information either on site or online and through engagement with local schools.

Site photos

(ELC_13_P1) View of the Upper Gullane Sill (foreground) and the northern end of Gullane Sands looking south from Gullane Point. © BGS, NERC.

(ELC_13_P2) Intrusive igneous rocks of the Upper Gullane Sill at Gullane Point. The rocks have been extensively hydrothermally altered giving them a sandy, rubbly and veined appearance. © BGS, NERC.

(ELC_13_P3) Lycopod Bark imprints in black shaly mudstone at Hummell Rocks. © BGS, NERC.

(ELC_13_P4) Burrow traces in sandstone at Hummell Rocks. © BGS, NERC.

(ELC_13_P5) View of Gullane Bay looking north-east from the Bleaching Rocks. The bedding of the sandstone in the foreground, visible due to iron staining, has been distorted by soft sediment deformation arising from mass flows in the soft, waterlogged sand soon after it was deposited. © BGS, NERC.

References

Site Map

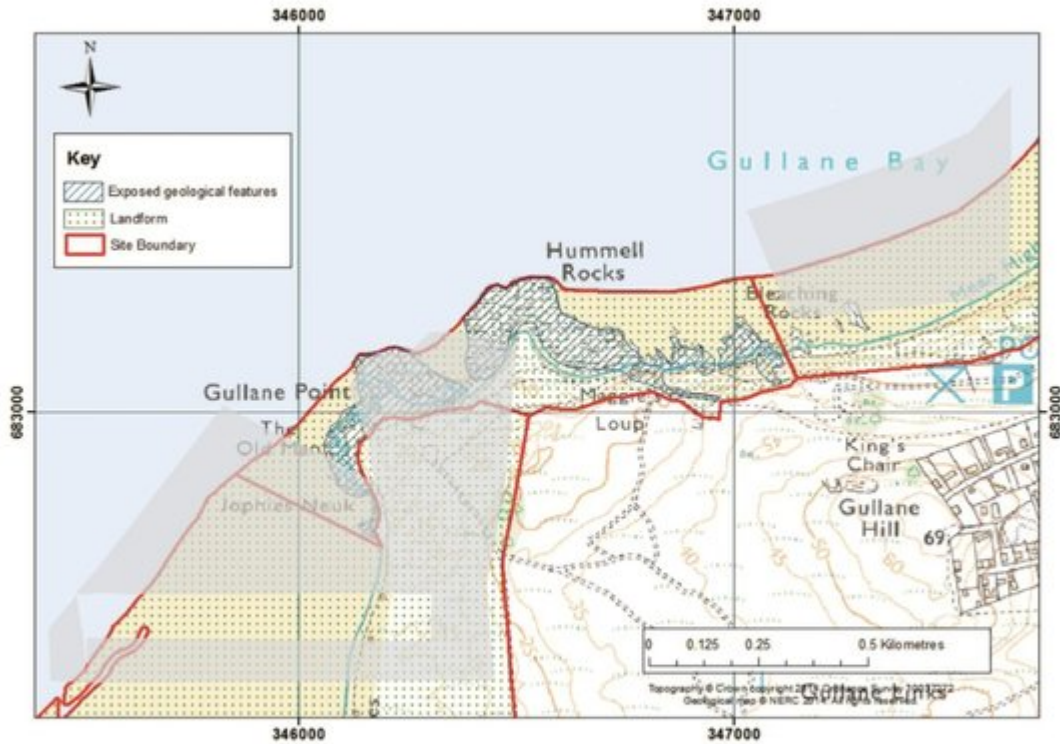


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(ELC_13_P1) View of the Upper Gullane Sill (foreground) and the northern end of Gullane Sands looking south from Gullane Point. © BGS, NERC.



(ELC_13_P2) Intrusive igneous rocks of the Upper Gullane Sill at Gullane Point. The rocks have been extensively hydrothermally altered giving them a sandy, rubbly and veined appearance. © BGS, NERC.



(ELC_13_P3) *Lycopod Bark imprints in black shaly mudstone at Hummell Rocks. © BGS, NERC.*



(ELC_13_P4) Burrow traces in sandstone at Hummell Rocks. © BGS, NERC.



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