
ELC_15: Prestonpans Shore, Prestonpans

Site information

Location and summary description:

The site comprises a 2.6km section of coastline at the town of Prestonpans. The site displays strata from the Upper Carboniferous, increasing in age from west to east. The important stratigraphic horizon of the Index Limestone, is seen at the site.

National Grid reference:

Mid-point: [NT 38063 74308]

South-west end: [NT 36750 73838]

North-east end: [NT 38979 74900]

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

Site ownership: Crown Estates

Current use: Open shoreline

Field surveyors: Sarah Arkley and Eileen Callaghan

Current geological designations: None

Date visited: 30th April and 7th May, 2014

Other designations: Firth of Forth Ramsar, Wildlife site (Levenhall Links)

Site map

(Figure 20) Prestonpans Shore Location Map. The site comprises areas of bedrock exposure (coastal rock platforms), and beaches. Bedrock exposure is likely to vary over time due to changes in beach morphology. Areas of the site important for access or viewing of features are included as geologically significant site areas

Site description

Background

Prestonpans is located approximately 9 miles east of the City of Edinburgh. It is a town with a rich industrial heritage which has made use of its geological resources. Coal has been mined in this area for over a thousand years; originally it was used to boil seawater in large metal pans to produce salt. In more recent times the coal, clay and limestone deposits were used in the manufacture of bricks, pottery and glass.

Sedimentary rocks

Carboniferous sedimentary rocks are exposed in rock platforms along the shore, with strata of the Limestone Coal Formation in the east of the site, overlain by the Upper Limestone Formation to the west.

The uppermost unit of the Upper Limestone Formation, exposed in the westernmost rock platform comprises a massive fine- to medium-grained, buff-coloured sandstone forming an intertidal shore platform (ELC_15_P1). Sedimentary structures within the sandstones including ripples, cross-bedding (Photo_ELC_15_P2), and channels are indicative of deposition in fluvial environments. To the east the strata are cyclic, comprising beds of sandstone, mudstone and siltstones with ironstone beds and nodules (not greater than 5 cm). Fossilised worm casts are also present in the sandstone (ELC_15_P3). The softer mudstones and siltstones are weathered leaving the sandstones more prominent. These cyclic strata were deposited at a time when sea-levels were rising and falling creating marine and deltaic environments.

The Index Limestone (ELC_15_P4) is an important marker bed which divides the Upper Limestone Formation from the underlying Limestone Coal Formation. At this site the Index Limestone is pale to dark grey and although covered in barnacles, it is possible to identify fossil material: crinoidal debris, shells e.g. *Productus* sp. and gastropods (ELC_15_P5). The limestone has a distinctive weathered appearance (ELC_15_P6).

The Limestone Coal Formation is exposed in the eastern part of the site and comprises massive yellow sandstones with sandy mudstones to thinly bedded orange to buff coloured sandstones, grey mudstones, siltstones, sandy mudstone and ironstone nodules. The Limestone Coal Formation is typically characterised by the presence of thin coal seams, however coal outcrops are rarely seen within the site, possibly due to preferential erosion of the softer material. Organic rich mudstones and seatearths, commonly associated with coal, are seen in places on the rock platform (ELC_15_P7). Sedimentary structures including ripples (ELC_15_P8) and cross bedding are present in the sandstone and siltstone beds, indicating deposition occurred in a flat coastal deltaic environment. The prevalence of plant material in parts of the strata is also indicative of terrestrial settings.

Igneous rocks

To the western edge of the site a black, 'knobbly', medium-coarse grained quartz-dolerite dyke is exposed at low tide. This rock belongs to the Central Scotland Late Carboniferous Tholeiitic Dyke Swarm and was intruded into the surrounding sedimentary rocks.

Structural geology

Minor fractures within the sedimentary rocks are associated with alteration zones indicative of fluid flow (ELC_15_P10). Mineralised veins associated with narrow zones of fault breccia (ELC_15_P11) and offsets by minor fractures can be seen in the Limestone Coal Formation (ELC_15_P12) indicating minor brittle deformation of the rocks.

Made Ground The area known as Morrison's Haven was previously an old harbour which was infilled in the 1960's. A cliff section exposes spoil material approximately 3 metres high which includes sandstone boulders 30-40 cm in diameter, coal and ironstone nodules (ELC_15_P9).

Access and additional information

Access to coastline at Prestonpans is tide dependant. The John Muir Way passes through Prestonpans. Access from the western car park is easy and the path can be followed offering views of the strata to the east. On entering the town the John Muir Way does not always follow the coastline but there are points where one can view the rocks. There are no interpretation panels along the John Muir Way within the town but near the car park at the western end of the site there are panels describing the old harbour 'Morrisons Haven'. Interpretation panels within Prestonpans describe the Battle of Prestonpans in 1745 and there are several murals on the side of buildings highlighting the town's industrial heritage. The Prestongrange Museum is towards the south west of the site and exhibits Prestonpans industrial past.

Stratigraphy and rock types

Age: Upper Carboniferous

Formation: Upper Limestone Formation

Rock type: Sandstone, siltstones, mudstones, limestones and a few coals Age: Upper Carboniferous

Formation: Limestone Coal Formation

Rock type: Sandstones, siltstones, mudstones, coals and ironstones

Age: Carboniferous

Formation: Central Scotland Late Carboniferous Tholeiitic Dyke Swarm

Rock type: Quartz-microgabbro

Assessment of site: access and safety

Road access and parking Good access from car parks located at Morrisons Haven to the west of the site and Preston Links to the east of the site. There is also parking within the town with access onto the shore.

Safety of access Easy access to the shore but all visitors should be aware of the tide times when planning a visit, as most of the exposures are only visible at low tide. There is a walkway between the foreshore and the buildings but this can be very slippery and is also covered at high tide.

Safety of exposure The rocky exposures have an uneven surface and are often slippery with seaweed. Stout footwear is recommended. The site is exposed to the open sea and the weather forecast should be checked before visits.

Access Access is along the foreshore/beach and there are numerous footpaths leading down to the site from the town and car parks.

Current condition The rocks can be covered in barnacles and seaweed. The exposures which are subsumed within local buildings are clean and free of vegetation.

Current conflicting activities None known

Restricting conditions Tide: many of the geological exposures are located in the intertidal range and therefore covered at high tide.

Nature of exposure Intertidal and beach exposures.

Assessment of site: culture, heritage & economic value

Historic, archaeological & literary associations Morrisons Haven is the locality of an old fort (pulled down by Cromwell in 1650) and harbour. In the 18th century the harbour was a busy port used to export salt, coal bricks and ceramics from Prestonpans. It was abandoned in the early 20th century and partly filled in. The Battle of Prestonpans, 1745 was fought just on the outskirts of Prestonpans. Historic houses within Prestonpans are Preston Tower (NTS dating from the 14th Century), Northfield House (17th Century) and Hamilton House (NTS, 17th Century).

Aesthetic landscape Coastal

History of earth sciences John Muir Way passes through Prestonpans

Economic geology Prestongrange was an area of commerce and industry from the 13th Century. The coal mined in this area helped build the industries of glass making in 17th century, the first of its kind in Scotland. Salt panning in the 12th and 13th century, brick production and brewing (John Fowler & Co Ltd started brewing in 1720 in a former whisky distillery, brewing ceased in 1962

Coal mining ceased in 1961 and brick production ceased in 1975.

Many of the buildings along the shoreline appear to have been built using local stone (ELC_15_P13).

Assessment of site: geoscientific merit

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

Site geoscientific value

This site displays a sequence of coal bearing Upper Carboniferous strata from the Limestone Coal Formation to the Upper Limestone Formation. The Index Limestone is also exposed in a rare natural exposure of this important marker horizon within the Midland Valley of Scotland.

Prestonpans Shore provides an excellent example of Upper Carboniferous strata with regional lithostratigraphical and palaeontological significance.

Assessment of site: current site usage

Community The easy access to the shore and the shore walkway is used regularly by locals. The John Muir Way passes through Prestonpans which attracts visitors from further afield.

Education The site displays a variety of features suitable for amateur geologists to study depositional sedimentary environments. The exposure of the Index Limestone allows for the study of this important indicator as well as the fossils found within the strata.

Assessment of site: fragility and potential use of the site

Fragility Weathering/erosion; development of coastal defences

Potential use On-site interpretation, on site geo-trail, school and higher education.

Geodiversity summary

This site contains a good variety of geological features especially associated with sedimentary strata. It exposes a sequence of the Upper Carboniferous along with a dyke intruding into this sequence. The sedimentary structures seen allow interpretation of the terrestrial, deltaic and marine depositional environments of the upper Carboniferous.

The coastline is attractive and has easy access. There are numerous possibilities for adding geological interpretation to this site, especially along the John Muir Way.

Site photos

(ELC_15_P1) Intertidal shore platform showing the barnacle covered massive bedded sandstone of the Upper Limestone Formation. This sandstone is medium grained, buff in colour and dipping to the south-east. Photo is looking to the south-west. © BGS, NERC.

- (ELC_15_P2) An example of cross-bedding showing a curved base with the darker area of rock showing a sharp erosive top. This type of sedimentary structure can indicate the possible environmental setting at the time the sands were deposited. In this case the sharp erosive top could indicate a deltaic palaeo environment. © BGS, NERC.
- (ELC_15_P3) The features seen in the sandstone are known as trace fossils. These show animal activity during the time when the sediments were laid down. In this case the 'worm casts' show the trails and burrows made by most probably worms as they moved or burrowed through the sediment.. © BGS, NERC.
- (ELC_15_P4) Index Limestone exposure (marks top of the Limestone Coal Formation). The limestone is approximately 60 cm thick, and would have been deposited in a warm shallow marine environment. Photo looking north north-west. © BGS, NERC.
- (ELC_15_P6) Erosive feature seen on surface of the Index Limestone. As limestone is soluble in water, joints in the limestone are easily weathered forming a feature known as a 'limestone pavement'; the slabs formed are known as 'clints' and the fissures are termed 'grikes'. © BGS, NERC.
- (ELC_15_P5) Shell debris including the spiral outline of a gastropod within the Index Limestone. Most gastropods are marine and live in shallow seas. © BGS, NERC
- (ELC_15_P7) Buildings at the foreshore incorporate outcrops of bedrock. In this case coal with ironstone nodules can be seen under the stone work. 'Seat earth' can be seen to the foreground of the photograph. Seat earth is a thin horizon of fossilized rootlets found beneath coals representing the soil in which the vegetation grew. © BGS, NERC
- (ELC_15_P8) Ripple structures seen on the surface of the bedding plane. The ripples appear asymmetrical which indicates flow direction. In this case the more gently dipping side of the ripple (stoss side) appears to be to the left of the photograph whereas the steeper dipping side (lee side) appears to be to the right of the photograph. This indicates that the flow direction is from left to right. © BGS, NERC
- (ELC_15_P9) A cliff section near Morrisons Haven showing the material used to infill the harbour, creating an area of made ground. The spoil used to form this made ground would probably have come from the old coal mine workings within the Prestonpans area. © BGS, NERC.
- (ELC_15_P10) Fluid flow within fractures has redistributed iron throughout the sandstone matrix, creating a handed 'halo' effect around fractures. © BGS, NERC.
- (ELC_15_P11) A mineralised fault-breccia cross cuts mudstones and shale layers. The fault-breccia formed during faulting and related displacement of the strata, with fault-breccia clasts composed of the same lithology as the surrounding wall rock. © BGS, NERC.
- (ELC_15_P12) Faults with cm-scale, normal displacement are found throughout the site cross-cutting strata. Some of the fault planes have been mineralised by calcite (white mineral), evidence that fault planes here acted as conduits to fluid flow. © BGS, NERC.
- (ELC_15_P13) The buildings along the shoreline are composed mainly of local stone. Features such as cross-bedding and weathering processes can be seen in these building blocks. Here a plant fossil '*Lepidodendron*' can be seen within the stone. © BGS, NERC.

[References](#)

Site Map

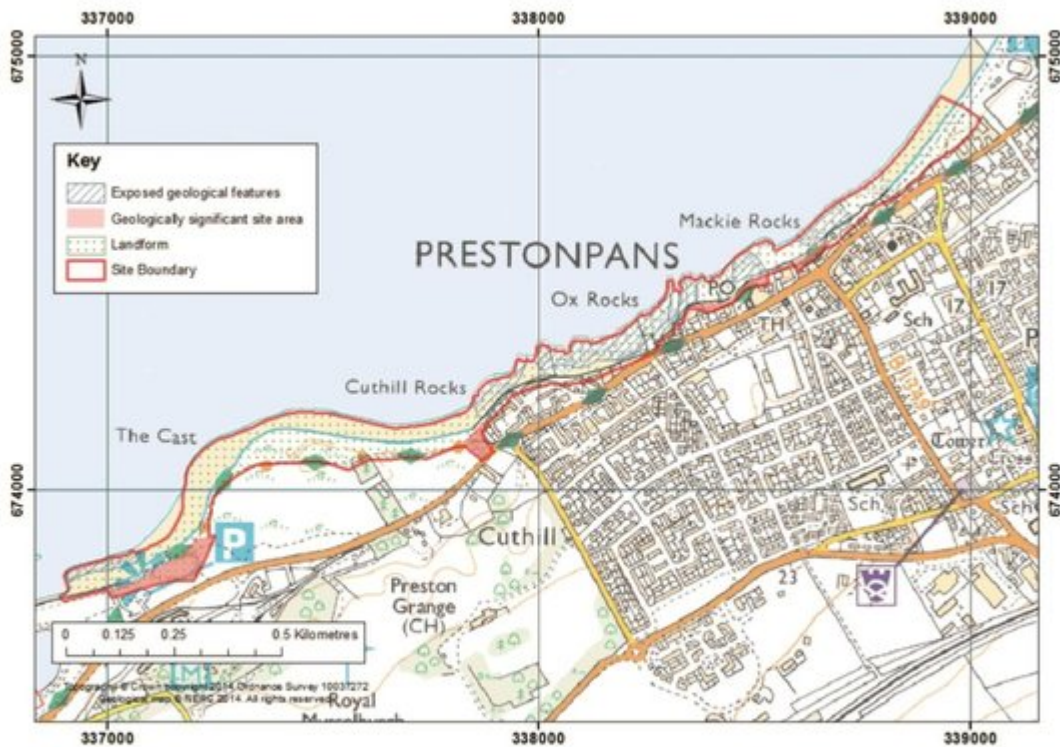


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(ELC_15_P5) Shell debris including the spiral outline of a gastropod within the Index Limestone. Most gastropods are marine and live in shallow seas. © BGS, NERC



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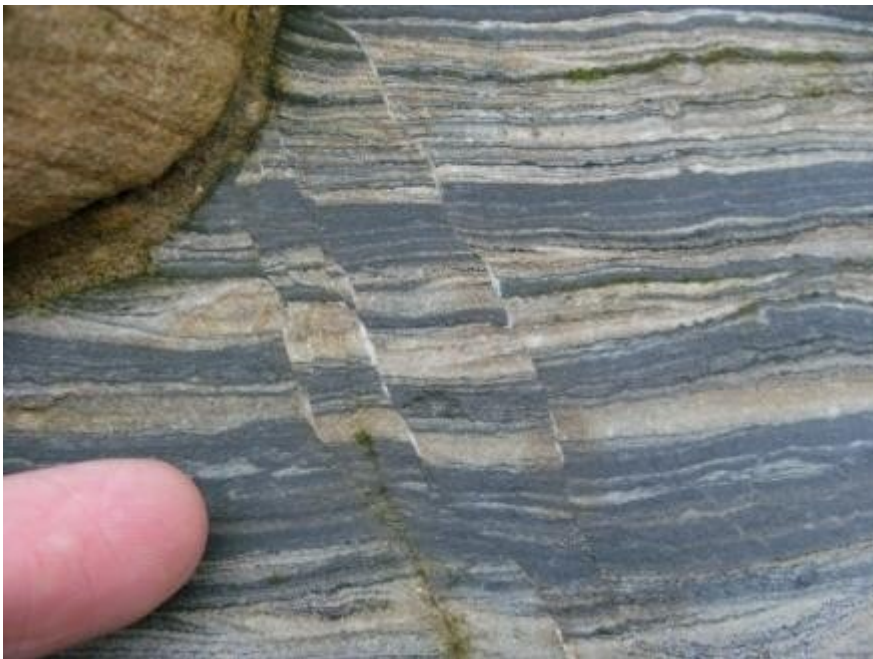
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