Joppa Shore

What is a RIGS and why should they be protected?

A Regionally Important Geological or Geomorphological Site (RIGS) is a landscape, landform or rock feature identified by a local RIGS Group as having significant value for educational and tourist information; academic research; for the history of science or for its aesthetic appearance.

With permission of the landowner, RIGS are indicated to the local council.

Why do geological sites need looking after?

Geology has great influence on everyday life. Soils and rocks provide essential water and raw materials. Demand is continually increasing for land for housing, commerce, waste disposal, recreation etc. This can lead to the destruction, damage or burial of important geological features.

Copies of this and other leaflets and posters can be obtained from:

Lothian & Borders RIGS Group
Chairman (Mike Browne), Secretary (David McAdam),
c/0 British Geological Survey
Murchison House
Edinburgh
EH9 3LA

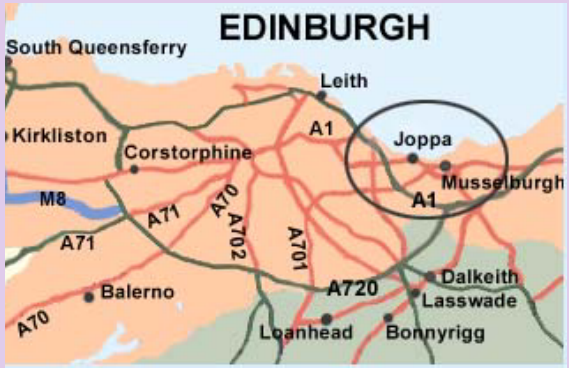
Joppa Shore

Joppa Shore is situated approximately 5 miles to the north-east of Edinburgh city centre. Musselborough Road runs alongside the shoreline.

Bus: Lothian No. 26 runs along Portobello Road and terminates at Joppa.

By car: Parking is available on the local streets.

On foot: Joppa Shore is easily accessible from local areas. Access to the foreshore is from the Pumping Station steps or Portobello beach in the west or by steps past the bus lay-by



TAKE CARE; Rocks may be slippery and at high tide some sections of the shoreline may be covered.

Produced by Lothian & Borders RIGS 2007

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Lepidodendrons from Bateman et al 1992.

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Joppa Shore

History

Geology

Regionally Important Geological Site

UKRIGS
GEOCONSERVATION ASSOCIATION

Lothian & Borders RIGS Group

Joppa Shore

The rocks seen at Joppa were laid down as soft sediment approximately 300 to 320 million years ago. They are part of the Geological time period known as the Carboniferous.

During the Carboniferous Scotland could be found close to the equator with a warm, tropical climate. The land experienced repeated cycles of subsidence leading to incursions of the sea. Other events occurred as a result of this subsidence such as the formation of river deltas to reclaim sea covered land and colonisation of this land by forests.

When covered by sea (marine) the base was muddy but beneath the clear tropical waters limestones formed. Later, deposition of sand and mud led to reclamation of the land and formation of freshwater lagoons. Eventually this newly reclaimed land was colonised by lycopod forests (similar to the mangrove swamps present in the world today). After all this the land would subside once more and the cycle would start again.

During the early Carboniferous the area was volcanically active. Several volcanoes were present erupting basaltic lavas and forming tuffs. The best preserved of these volcanoes is Arthur's Seat with excellent examples of other volcanic features around Edinburgh including Salisbury Crags (dolerite sill) and Edinburgh Castle Rock (volcanic plug).

Rock Types

At Joppa the rocks consist mainly of marine sandstones, mudstones and limestones. Coal was also present although this is now obscured on the shoreline by sand and silt. With close inspection the abundant fossils can be seen. These include Brachiopods, Bivalves and occasionally fish.

Two Late Carboniferous Lycopod (Lepidodendrale) trees. In the hot, humid swampy climate of the Carboniferous they could grow to be 35 metres in height. Unlike modern trees these had just a thin core of wood with a thick outer layer of tissue. This could have led them to being flattened in strong winds.

Black Gold

Coal formation

The rocks seen at Joppa are from the Carboniferous period. At that time there was no Atlantic Ocean and Scotland was part of a coastal plain stretching from Europe to North America. The climate was hot, tropical and mainly wet with seasonal dry spells. High sea levels meant that shallow seas, muddy lakes and swamps covered low lying land areas. Partially decayed plants were buried to form peat, later transformed by burial and heating to coal. The seams at Joppa widen inland where the coal was mined.

Coal mining

The coal seen at Joppa was mined inland at Newcraighall Colliery, nicknamed the "Klondyke" by miners after it was heard that there was enough to coal to provide work for 300 years. The mine was initially opened as a pit with two shafts later sunk in 1897. It closed after its reserves became exhausted in 1968. During its lifetime it employed 506 miners. It consisted of both a surface mine and a shaft 811 feet deep. In 1828 the biggest steam engine in Scotland built by Grant, Ritchie & Co Ltd, Kilmarnock, was installed at a cost of £6,000. This draining of the mine, along with the closure of the local sandstone quarry, led to a lowering of the water table locally. Since the closure of the colliery the water table has been rising with underground pipes and shafts below Joppa prone to flooding with red waters.

Present day

The steam engine and winding gear from Newcraighall can be seen at the Prestongrange Mining Museum. Although mining in Edinburgh is over, there are many working coal mines in the central belt of Scotland where there are large coal reserves.
The old site of Newcraighall Colliery is now occupied by Fort kinnaird Retail Park.

Salt Panning

The salt pans in Joppa date from the early 18th century when salt was made from the evaporation of sea water trapped in hollows in the ground called pans. Joppa itself was originally a settlement of saltpan workers and miners. The salt pans here were the longest surviving on the Lothian sea coast and were the home of the Scottish Salt Company in the 1930's.

Production

There was little change in the methods of production, the basic principle being to boil or evaporate seawater to dryness. Salt was a major Scottish export and was often, as at Joppa, closely linked with the coal mining industry with evaporation fuelled by coal. Salt is an essential staple and has been refined from many coastal areas in Scotland. Prestonpans salt was used extensively to preserve meat and fish.

Ownership and slavery

Owned between 1788-1808 by the Earl of Abercorn in 1889 the pans were bought by the Scottish Salt Company. Until the abolishment of slavery in 1879 salt workers could be treated legally as slaves.

Present Day

Salt was produced from 1630 at Joppa salt pans but production ceased in the 1950's after being rendered uneconomical as competition from purified mineral deposits increased. Some buildings of the old salt works can still be seen a hotel and adjacent rock cottage. Originally the hotel was the house of the salt works owner.

Joppa Shore Geology

The shore can be walked from either direction, if you walk toward the east (from Portobello) you are walking up sequence, that is, the rocks are getting younger in the direction you walk. You will initially notice that the beds of rock are tilted to the east at a 45-60 degree angle. Originally they were deposited almost horizontally, this tilt is the result of tectonic forces (imagine a vice squeezing something forcing it to bend). The Joppa Shore forms the western side of a large fold, the Midlothian Syncline. The steep dip of the strata along the shore means that a large vertical thickness of rock can be seen over a short distance.

During the Carboniferous the topography around what is now Joppa was low with widespread lagoons, swamps and shallow seas into which sandy rivers and deltas prograded from the north. The river lain sandstones, flood plain muds and lagoonal limestones and muds are deposits from these environments. Normally close to or at sea level, at times shallow seas covered the whole area forming the thin marine sediments.

Lower Coal Measures

These are the youngest rocks at Joppa Shore forming the base part of the Lower Coal Measures. Sandstone from river deposits is the dominant rock type seen, although some coal seams ranging from a few cm's to over 1m thick are present. The coal seams are mostly covered now by silt and sand, but occasional glimpses of coal can be found uncovered.

You can also find some dark grey mudstones which are flood plain and lake deposits. Freshwater fossils and plant remains can be seen in some units.

The Seven Foot Coal marks the base of the formation although as it is now dug away only the underlying rooted beds can now be seen.

Passage Formation

This has mainly sandstones, some quite thick,. Mudstones are interbedded with the sandstone becoming more dominant up section to the east. The sandstones represent river deposits, and the mudstones fossilised flood plain deposits. There are occasional marine units in the form of thin limestones with iron ribs.

There are no limestones or coal in the Passage Formation but rootlets and fireclays (fossil soils) are present. Fireclays have been worked locally, generally as an additional product during coal and sandstone quarrying, to be used for pipes and firebricks.

Upper Limestone Formation

These are the oldest rocks seen here and consist mainly of shallow water marine mudstones and siltstones. The only coal in this formation is generally present as thin seams and is unprofitable. Underlying the rocks visible here is a sandstone which was extracted from Joppa Quarry and used for local building stone.

Castlecary Limestone Unit

This limestone unit is found at the top of the Upper Limestone Formation. The 4 metre thick bed can be traced across Scotland and indicates a period of relatively high sea level. Marine fossils, including crinoids (sea lilies), bivalves and brachiopods, show this was formed in shallow water.

1

Faulting

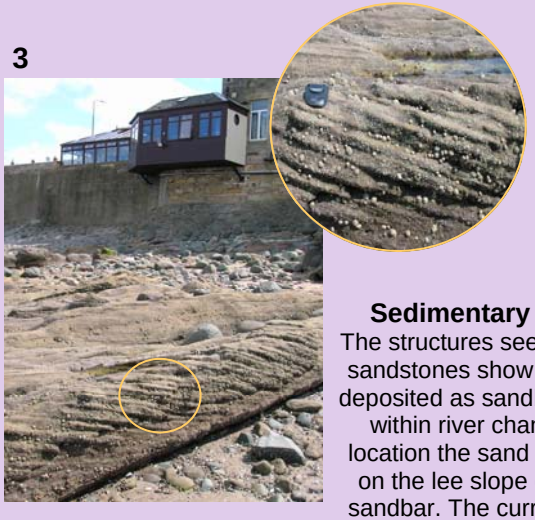
Looking out to the Firth from the bus lay-by, faulting in the Lower Coal Measures is seen. Transform faults move rocks sideways rather than up or down. The fault surface is indicated by the coloured line.

2

Coal

The photo shows a thin seam of coal. There are several of these seams in the Lower Coal Measures, varying in width up to 2metres. They have mostly been dug away, although some patches can be seen when free of silt.

3



Sedimentary structures

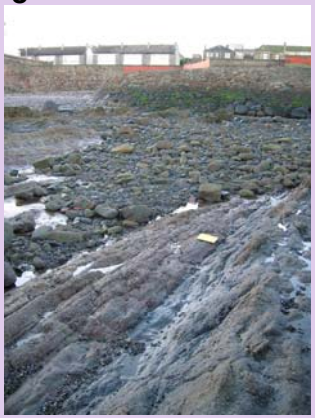
The structures seen in here in the sandstones show that they were deposited as sandbars and dunes within river channels. At this location the sand was deposited on the lee slope of a migrating sandbar. The current flow would have been left to right.

4

Bedding and folding

Bedding is clearly seen along the shore, made more obvious by the erosion of softer less resistant beds. The more resistant, usually as seen here, sandstone beds stand out prominently. The sharp base of the sandstone ridge probably marks the base of the sandstone channel. The underlying freshwater lagoonal mudstones have eroded away here. The beds (strata) are tilted to a 45 angle.

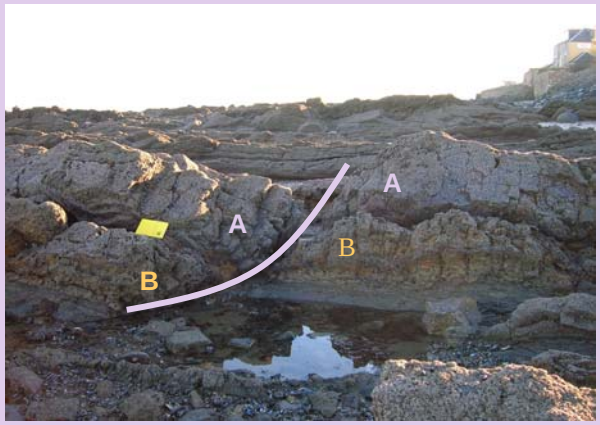
5



Colour

The different colours of the rocks gives information about the environment and level of the water table on the flood plains at the time of deposition of the sediment. The dark grey organic rich mudstones were laid down at times of high water level. The red and yellow muds formed during drier climatic periods.

6



Faulting

Faulting accompanied folding of the rocks. One of the small faults visible on the shore is shown here. The fault plane (the surface along which movement occurred) is highlighted by the solid line. A small displacement of two sandstone beds (one thick A and a thinner bed B) can be seen.

7

Soft sediment deformation

The load balls found here are an example of soft sediment deformation. Movement occurred before the sediment had solidified, allowing wet sand to sink into the mud (or vice versa). This feature only affects this one unit so would have been caused by a short term event. The most likely cause for this here is an earthquake.