





# 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 unit so would have been caused by a short term event. The most likely cause for this here is an earthquake.