Rock around Port Sunlight

Port Sunlight in Wirral is a model industrial village founded in 1888 by William Hesketh Lever (later Lord Leverhulme). Originally the site of this village was a marshy area cut by muddy creeks or tidal inlets from Bromborough Pool which was an inlet from the River Mersey. The village, built to house employees at the Wirral soap-making factory owned by Lever Brothers (now part of Unilever), includes 900 Grade II listed buildings and was declared a conservation area in 1978.

This guide, a trail around Port Sunlight village, was inspired by Benjamin Cook and Samuel Thornley (former students at Wirral Grammar School for Boys). In 2006, during a week of work experience, they designed a geological trail around Port Sunlight and their original booklet was awarded a Wallace Pitcher prize by the Liverpool Geological Society.

The aim is to introduce the rocks and Earth materials used in the buildings and paved areas in the village. Although the bedrock (layer of rock immediately beneath the surface) is Triassic sandstone, many the buildings in the village are made of different types of rock and cover a wide age range.

To help you, in this guide you will also find:

- a map showing places where different rocks are used in the village,
- a glossary of terms,
- a geological timechart.

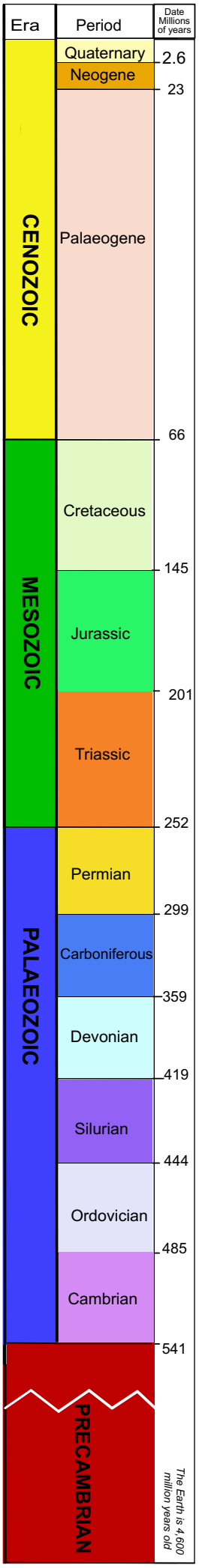
This is a self-led guide. Allow 90 minutes to complete the trail.

Dell Bridge and the Lyceum, Port Sunlight Village

There are three types of rock: **igneous** (rocks which formed when molten rock cooled and crystallized); **sedimentary** (rocks formed from fragments produced by the breakdown of other rocks) and **metamorphic** (rocks changed by heat and/or pressure).

Man-made materials are also derived from Earth materials. Examples include **bricks & tiles** (baked clays); **concrete** (a mixture of sand, gravel and limestone); **glass** (a mixture of sand and limestone); **mortar** (a mixture of sand and limestone); **metals** (for example lead used in flashings, copper used in lightning conductors, iron used in drain pipes and railings) and **alloys** (mixtures of metals, for example bronze used in statues).

This trail begins and ends at the War Memorial in the centre of The Causeway. The 16 localities mentioned in this guide are shown on the map.



1. The War Memorial


War Memorial and view along The Causeway

This memorial was designed by Sir W. Goscombe John on the theme of 'The Defence of the Home'. It is made of a pale, grey-white granite (an igneous rock) from Norway and includes sculptures and relief panels showing the armed forces at work.

Parts of the granite have been polished so it is easy to see the crystals in the rock. These crystals are more than 2mm across and of approximately the same size. The crystals differ in colour because they are made of different minerals. White is feldspar, clear is quartz, black is amphibole and silver is muscovite.

Other parts of the granite have been carved.


Detail of granite used in the War Memorial


Carving in granite

The sculptures (photos 1A and 1B) and relief panels (photo 1C) are made of bronze (an alloy of copper and tin). This War Memorial is a Grade 1 listed building.


1A

1B


1C

There is green staining (verdigris) on the granite below the panels and sculptures (photo D). Verdigris forms when the copper in the bronze is weathered. This means it was exposed to oxygen, pollutants, acid rain and bird droppings which all reacted with the metal.

From the War Memorial walk along Jubilee Crescent to the archway to the Hillsborough Memorial Garden.


1D

2. Archway to the Hillsborough Memorial Garden

Entrance to Hillsborough Memorial Garden

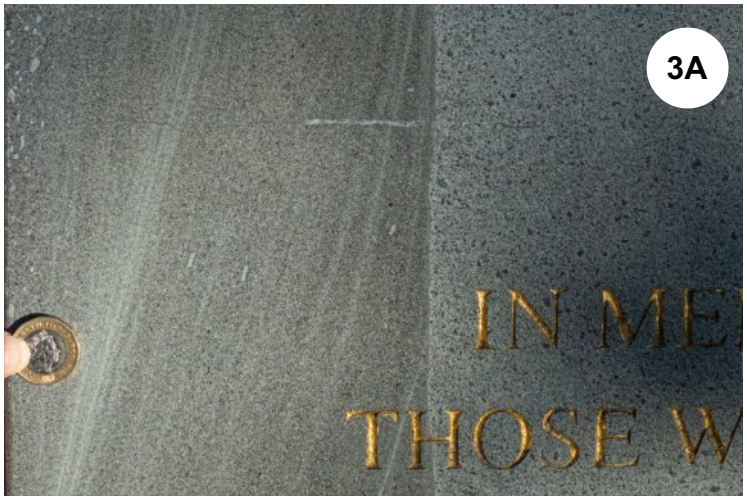
This archway is made of a white sedimentary rock known as Portland Limestone, which formed in the Jurassic. This rock resists weathering but is soft enough to be carved and shaped by stonemasons.

Another feature of this limestone is the fossils it contains. Most of the shells were broken before they became fossils and are preserved as fragments, but you may be able to spot whole oyster shells (photo 2A).

3. The Hillsborough Memorial

View through the archway to the War Memorial

Go through the arch way to enter the Hillsborough Memorial Garden. and see the view of the War Memorial and the Lady Lever Art Gallery. The memorial to those who died in the Hillsborough Tragedy in 1989 is near the balustrade (photo 3A). It is made of a green igneous rock from Borrowdale in the Lake District. This rock is a volcanic rock called tuff and formed during the Ordovician. Look at the rock and notice it shows layers with grains of different size and evidence of cross-bedding.



Look at the ballustrade (photo 3B). Most of this structure is made Portland Limestone, although some of the supports have been replaced by shaped concrete pillars. Notice the metal ties that are holding the Portand Limestone blocks together on the ballustrade.

From the archway walk to Bolton Road. Cross the road to the bowling green. Turn right at the bowling green and walk to Bridge Street. Turn left at Bridge Street. At the bend in the road take the path towards Dell Bridge.

Mosaic below the ballustrade

Look over the ballustrade to see the mosaic on the ground below. This patterned area is made of small irregular pieces of colorued tiles held in place by mortar.

4. Path over Dell Bridge

This footbridge is built of blocks of pink and red-brown coloured sandstone.

On either side of the bridge steps the path is paved with setts (photo 4A). Setts, rectangular pieces of quarried stone, are usually made of hard-wearing igneous rocks. These setts are made of granite from Shap in Cumbria. The colours in the granite are produced by the different minerals in the rock. If you look at the crystals in the granite you will see that some of the pink coloured crystals are larger than others. These larger crystals are called phenocrysts and this rock is called a porphyritic granite.

Look at the capstones which are the shaped sandstone blocks forming the top of the bridge wall (photo 4B). The sandstone shows inclined layers. These were formed when currents deposited the sand grains in dunes which, when cut through, show inclined layers which are a sedimentary structure called cross-bedding.

Look at the grains in each set of cross-bedded sandstone. Notice that the grains in some of the sets may be fine (0.06-0.2mm), medium (0.2-0.6mm) or coarse (0.6-2mm). You may also see holes where a few larger grains (pebbles) have weathered out of the sandstone.

Below the capstones the sandstone blocks also show bedding, but notice that sets of cross-bedding in these blocks have different size (photo 4C).

Continue over the bridge to reach Park Road. Turn right along Park Road. Continue to the entrance to The Dell.

Near the entrance to The Dell note the iconic red post box and pair of K6 telephone kiosks. The K6 kiosks, made of cast-iron sections bolted together, stand on concrete bases.

5. The Dell

The Dell is a landscaped hollow which is used as a park. It follows the route of one of the tidal creeks that originally drained into Bromborough Pool. Most of these creeks were filled with man-made materials to above high-water mark, cut off from Bromborough Pool by a dam and then built over. The Dell is the only landscape feature that survives and marks where a former tidal channel ran from north-east to south-west in the area.

Along the edges of the steps into The Dell and around the grassed area at the bottom of the steps there are large blocks of a grey sedimentary rock called conglomerate (photo 5A).

The conglomerate formed during the Carboniferous. It is a coarse grained rock because it has grains more than 2mm in size. It contains rounded pebbles of different sizes (photo 5B), many of which are made of a hard, white mineral known as quartz.

Some blocks show layers where the conglomerate shows different grain sizes, colours or composition. This layering is called bedding and was caused by changes in the processes that deposited the sediment. The layers or beds were originally horizontal, but because the blocks were not placed in The Dell in their original orientation some are now vertical (photo 5C).

Look in the blocks for graded bedding where larger grains have been deposited first followed by smaller grains so the bed shows a decrease in grain size from the original bottom of the bed to the top of the bed.

Walk through the Dell to Dell Bridge.

6. Dell Bridge

The footpath goes under Dell Bridge which is a saddle-back bridge made of a red-brown sedimentary rock called sandstone, which was formed during the Triassic.

Footpath under Dell Bridge

The rock was soft enough to be carved by stonemasons. On the west side of the bridge the keystone is carved with a mask and above the mask there is a sundial (photo 6A).

On the right-hand side of the bridge, look at the solid masonry structure built to support the single arch of the bridge. The Triassic sandstone blocks in this structure show different types of bedding (photo 6B).

In these blocks you can see excellent examples of convolute bedding (formed when beds have been folded and crumpled) and cross-bedding.

On the opposite side of the bridge, notice the tool marks on the sandstone blocks (photo 6C. These marks were made chisels that stonemasons used t shape the blocks.

Continue under Dell Bridge and take the path to the left towards Bath Street. Cross Bath Street and turn right. Walk to Riverside. Turn left along Riverside to reach a crossroad. Cross Bolton Road and head for the Bridge Inn. Keeping Bridge Inn on your right, walk along Church Drive to Christ Church.

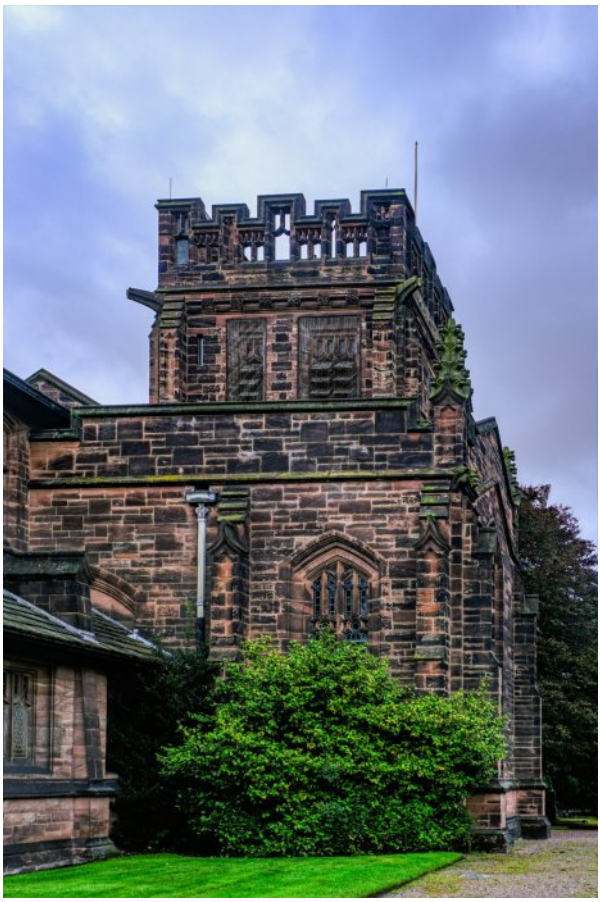
7. Christ Church lychgate


Lychgate at Christ Church

Walls of this entrance are made of red Triassic sandstone. The carved wooden archway is roofed (photo 7A) with yellow flagstone (a sedimentary rock).

Enter the church yard via the lychgate.

8. Christ Church



Tower of Christ Church

Christ Church is built of red Triassic sandstone ashlar blocks and has a roof made of grey York stone (a variety of sandstone from Yorkshire that formed during the Carboniferous). The red Triassic sandstone was quarried in North Cheshire and came from the Helsby Sandstone Formation.

Look at the sandstone blocks and notice that many blocks show cross-bedding (photo 8A).

The sandstone blocks occasionally show rounded pebbles forming layers within the sandstone ((photo 8B).

Triassic sandstone is an excellent building stone and is soft enough to be shaped and carved by stonemasons. Notice the details carved in the stonework around the windows (photo 8C and on some of the vertical pillars and vertical faces on the building.

In the church yard there are different decorative gravels used on the graves and headstones made of differing rock types. Examples of gravels include these four:

Green glass ‘gravel’

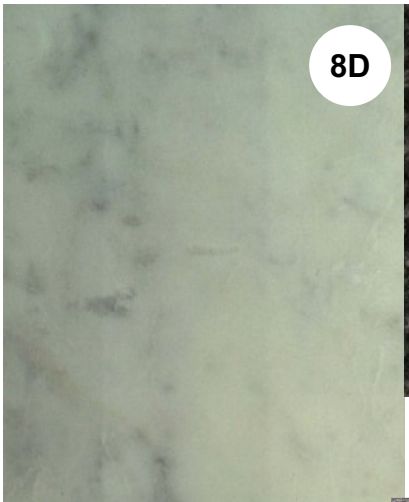
Quartz pebble ‘gravel’

Triassic pebble ‘gravel’

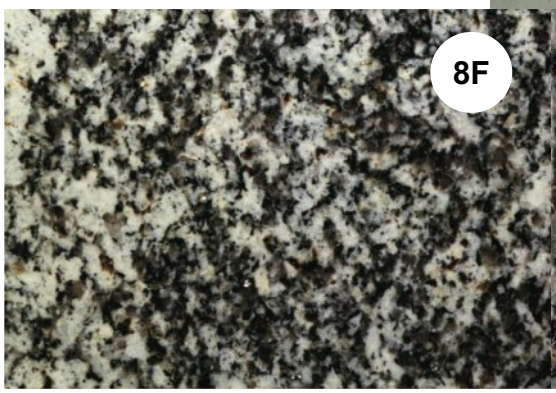
Flint pebble ‘gravel’

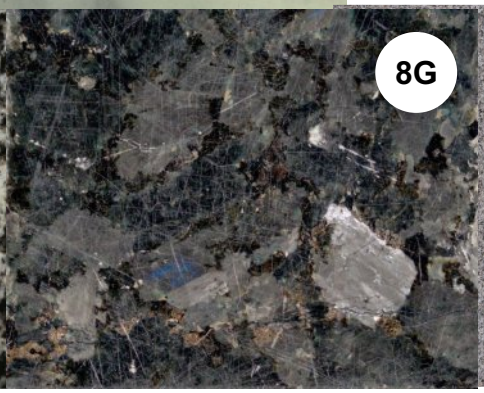
Look for these five examples of rock used for gravestones:

- white marble (a metamorphic rock) from Carrara, Italy (photo 8D)
- black gabbro (an igneous rock) from South Africa (photo 8E)
- pale, grey-white granite (an igneous rock) from Norway. This is the granite used in the construction of the War Memorial (photo 8F)
- larvikite (an igneous rock) from Norway – a rock distinguished by thumbnail-sized crystals of feldspar which create its characteristic blue and silver flash (photo 8G)
- white granite (an igneous rock) from Cornwall (photo 8H).



Some of the rocks used as gravestones





These rocks are of different ages. The marble formed in the Jurassic whereas the gabbro and the grey-white granite were formed during the Precambrian. Larvikite and the white granite formed in igneous intrusions that crystallisd during the Permain.

9. Lady Lever Memorial, Christ Church

Near the lychgate, at the north end of the church, is a loggia (room with open sides) which is the Lady Lever Memorial. The sandstone arches of the loggia, the pillars and the vaulted ceiling of the loggia are richly decorated with carvings. Notice the loss of detail in the carvings on the more exposed parts of the loggia (photo 9A).

Chest tombs in the loggiaa

Inside the loggia are the chest tombs of Lord and Lady Leverhulme. The tombs are made of a metamorphic rock which is a serpentinite marble from Italy. It formed during the Jurassic.

The memorial includes bronze effigies of Lord and Lady Lever by W. Goscombe John.

Flagstones in the loggia are York stone (a sandstone that formed during the Carboniferous).

9A

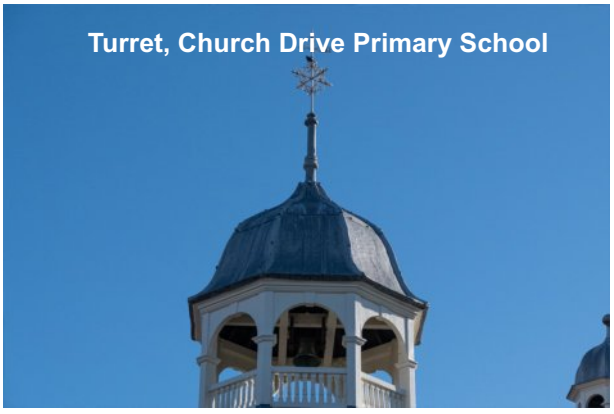
Sandstone carvings, Lady Lever Memorial

Retrace your steps to the lychgate and leave the church.
Turn right along Church Drive and walk to Church Drive Primary School.

10. Church Drive Primary School

This building is largely made of brick. Notice that the roof of the octagonal turret (which has its own weathervane) is covered with metal flashing made of lead.

Just beyond the main entrance to the school there is a smaller door into the building. Notice how blocks of red and yellow sandstone are used for decoration to the brick building around this entrance.



Turret, Church Drive Primary School

Sandstone blocks used for decoration on the building made of man-made bricks

Copper canopy

Above this entrance is a tented copper canopy. It would originally have been bright, shiny copper but has now tarnished to green (verdigris) which formed when the copper was weathered.

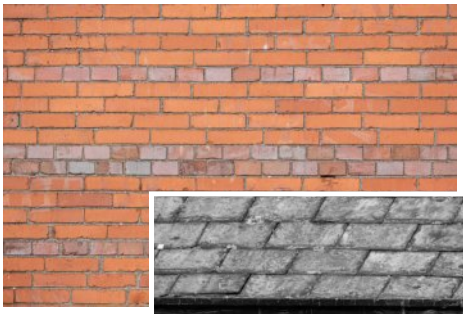
Cross Church Drive and turn left along Windy Bank.

11. Windy Bank

The terraced houses at 14-16 Church Drive and 25-27 Windy Bank are made of red brick with bands of blue brick for decoration. Red clay when fired in a kiln normally forms red bricks. If fired at a high temperature in a low oxygen, reducing atmosphere, it takes on a deep blue colour.

The roofing on these houses is grey slate (a metamorphic rock). Notice the cast iron metal gutters and drain pipes on these buidings, the lead flashing and the pargetting (moulded decorative plasterwork) under the roof in the centre of the terrace.

Terraced houses in Windy Bank



Details of building materials used in the terrace

Belgian Cottages

The Belgian Cottages (Nos 23-24 Windy Bank) were built in Flemish style using bricks from Belgium.

Notice that slate has also been used as roofing material. These cottages have decorative window surrounds made of smooth red terracotta bricks. These bricks are also used on the stepped gables and architraves.

Details of materials used in the Belgian Cottages.

At the Belgian Cottages, look across the grassed area on the opposite side of the road. Here you will notice a cast iron lamp post and, nearer to the telephone kiosk , a cast iron ventillatiion pipe.

As you walk along Windy Bank, notice that other types of roofing materials have been used on other buildings. These include man-made tiles and stone roofing ‘slates’ (not metamorphic slates, but roofing material made from sedimentary rocks that can be split into layers). 22 Windy Bank is built with man-made tiles and has pebble-dashed walls.

12. Setts in Windy Bank

Between 22 and 23 Windy Bank there is a side road, At this road crossing the road is paved with setts (pieces of rectangular quarried stone). These setts are made of basalt and dolerite (two types of dark-coloured igneous rock that are hard-wearing). Basalt and dolerite contain the same minerals, but you will be able to recognize the dolerite because it is easier to see its crystals. Notice that sandstone (photo 12A) and concrete dimple paving (photo 12B) are used at the pavement edge.

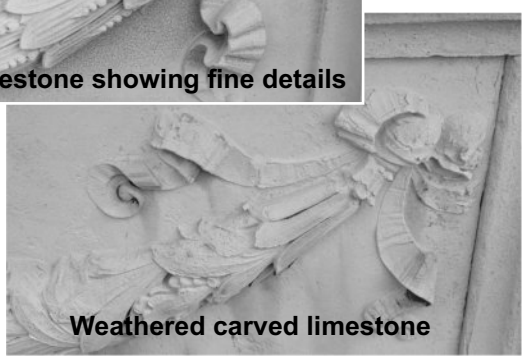
Continue along Windy Bank and walk towards the Lady Lever Art Gallery. Turn right at Queen Mary’s Drive. The entrance to the art gallery is on the right.

13. Lady Lever Art Gallery

The Lady Lever Art Gallery, built in 1914-22, is a reinforced concrete structure with a cladding of a white sedimentary rock known as Portland Limestone, which formed during the Jurassic.

Portland Limestone is an even-grained rock that is soft enough to be carved by stonemasons. Examples of decorative carving can be seen in the pillars and around the windows near the main entrance on Queen Mary’s Drive.

Note that some carvings have been weathered and lost their finer details so that the carved designs are not as clear as others.



Above: Decorative carved limestone at the art gallery entrance

The Portland Limestone contains varying amounts of shell fossils. Most shells were broken before they became fossils and are preserved as fragments, but you may be able to spot whole oyster shells that are several centimetres long.

Look carefully at the grains in the limestone. As well as the shell fossils you may be able to see highly spherical grains about 1mm across. These are ooliths and are formed when calcium carbonate is deposited around a central nucleus while being washed around in shallow water.

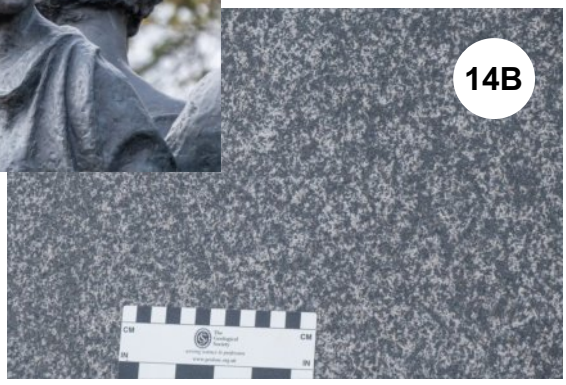
Above: Details of shell fossils and ooliths in the limestone

From the Lady Lever Art Gallery, cross Queen Mary's Drive to the Leverhulme Memorial

14. Leverhulme Memorial

The Leverhulme Memorial is a monument to Lord Leverhulme. It consists of an obelisk over 4-metres high with a figure on the top. This is named 'Inspiration'. There is a separate group of four figures beside it (photo 14A). The figures are in bronze (an alloy of copper and tin).

This memorial was designed by James Lomax-Simpson, and the sculptor was Sir William Reid Dick.

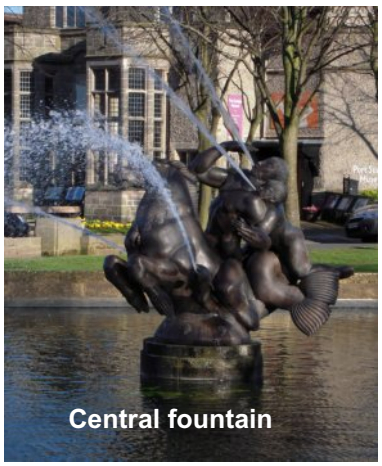


The obelisk is made of a dark-coloured igneous rock called dolerite (photo 14B).

Return to the Lady Lever Art Gallery. Turn right, cross Windy Bank and walk towards the pond and fountain at the end of The Diamond between Queen Mary's Drive and King George's Drive.

15. Fountain in The Diamond

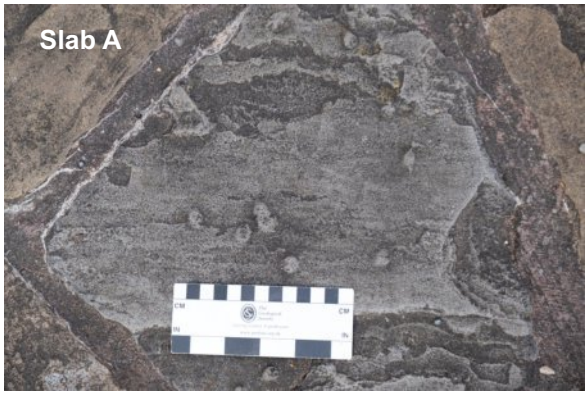
The fountain in the centre of the pond is made of bronze (an alloy of copper and tin) and shows a man and a boy with flipper feet mounted on a sea horse.



The grey-brown paving slabs near the fountain are sandstone. These slabs show various sedimentary structures and fossils. Some slabs show a series of very narrow and shallow ridges and furrows, called primary current lineation (photo 15A). These structures are formed in fast flowing water, parallel with the ancient current direction.

Some sandstone slabs show the fossils called trace fossils. No body part of the original organism is preserved, but the fossil shows a trace of where it lived.

Slab A shows a vertical U-shaped burrow where an animal that was like a present day ragworm lived. The fossil is shown as pairs of rounded lumps on the paving slab surface.



Slab B shows trace fossils that are horizontal burrows (possibly feeding burrows). These formed within the sediment when the animal burrowed in a direction parallel with the sea floor at the time it lived.

At the fountain, take the right-hand footpath in The Diamond. Continue along the footpath. Walk to the War Memorial until you reach a wide paved area where two paths cross. In the centre of this paved area find the analemmatic sundial.

16. Analemmatic sundial


Sundial in The Diamond

This horizontal sundial was constructed in the gardens of The Diamond, the central avenue in Port Sunlight, to commemorate the Diamond Jubilee, 2012. It is an analemmatic sundial, a special type of sundial, in which the gnomon (the part of a sundial that casts a shadow) is formed by a person who stands on one of the paving slabs selected according to the month.

The sundial hour pointers are made of two different rocks (photo 16A).

The hour pointers made of pale coloured rock have crystals larger than 2mm in size. This rock is composed of at least 3 minerals (shown by 3 different colours) and is granite (an igneous rock).

Look at the hour pointers made of darker coloured rock. Observe the crystal sizes, crystal shapes and colours of the minerals in the rock and decide how this rock is different from the pale-coloured granite.

Continue along the path to reach the War Memorial and finish the trail.

Glossary of terms

Amphibole: dark coloured silicate mineral containing calcium, magnesium and iron. Found in many igneous and metamorphic rocks.

Ashlar blocks: dressed (cut, worked) stone that has been worked until it has smooth surfaces and square edges.

Basalt: dark coloured, crystalline igneous rock with small crystals of plagioclase and pyroxene that are difficult to see with the naked eye.

Bedding: term that describes the layering that occurs in sedimentary rocks.

Calcite: the carbonate mineral which is the most stable form of calcium carbonate ($CaCO_3$).

Cladding: material that is attached onto another on a building to provide a skin or outer layer.

Conglomerate: a sedimentary rock made up of rounded to subangular grains more than 2mm in diameter (e.g. granules, pebbles, cobbles, and boulders).

Convolute bedding: bedding formed when beds were folded shortly after the sediment was deposited when the loose (unconsolidated) sediment was soft and easily deformed.

Cross-bedding: bedding formed when sediment was deposited on the sloping surfaces of ripples and dunes.

Dolerite: dark coloured, crystalline igneous rock made of medium-sized crystals of plagioclase and pyroxene.

Dolomite: a carbonate mineral composed of calcium magnesium carbonate.

Facing stone: stone shaped and used as a decorative facing material rather than as a load-bearing part of the building.

Feldspars: rock-forming silicate minerals that are common in igneous rocks.

Flagstone: a sandstone that splits into layers along bedding planes and mainly composed of quartz with some mica and feldspar. The mica can be seen as shiny flakes on the flat surfaces separating the layers (beds) in the rock.

Flashing: a sheet of thin, impermeable material used to prevent water seeping into a building.

Fossil: preserved remains, impressions, or traces of any once-living thing from a past geological age. Examples include bones, teeth, shells, leaf impressions, tracks, and trails.

Gabbro: dark coloured, crystalline igneous rock made up of large crystals of plagioclase and pyroxene.

Graded bedding: where larger grains have been deposited first followed by smaller grains so the bed shows grain size decreasing from the original bottom of the bed to the top of the bed.

Granite: light coloured, crystalline igneous rock with large crystals of quartz, plagioclase, orthoclase, and mica.

Impermeable: not allowing water or gases to pass through it.

Limestone: a sedimentary rock composed primarily of calcium carbonate ($CaCO_3$) in the form of the mineral calcite.

Marble: a metamorphic rock composed of recrystallized carbonate minerals such as calcite or dolomite.

Mica: a shiny silicate mineral with a layered structure.

Mineral: a natural solid material of fixed chemical composition with an orderly internal atomic structure.

Orthoclase: a type of feldspar mineral rich in potassium.

Paving slabs (or stones): naturally occurring rocks which can be cut, shaped, or split into slabs for paving material.

Permeable: allowing liquids or gases to pass through it.

Plagioclase: a type of feldspar that is rich in sodium and/or calcium.

Pyroxene: dark coloured silicate mineral containing calcium, magnesium and iron Found in many igneous and metamorphic rocks.

Glossary of terms (continued)

Quartz: a mineral composed of silica (silicon dioxide). Its chemical formula is SiO_2.

Slate: a metamorphic rock formed from mudstone. It has small crystals and splits (or cleaves) into thin sheets.

Stonemason: a person who accurately cuts and decorates stone and builds with it.

Terracotta: moulded baked clay, refined before firing to give a smooth surface so it can be used to provide decorative shapes.

Tuff: an igneous rock made of volcanic ash ejected from a volcano during an eruption.

Weathering: the breakdown of rocks at the Earth's surface, by the action of rainwater, extremes of temperature, and biological activity. It does not involve the removal of rock material.

Sketch map of Port Sunlight