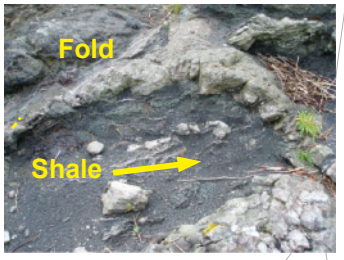
Agglomerate

This grey flattish mass of rock is a tuff formed from volcanic ash, indicating the proximity to the vent of the volcano. You should be able to see the different grain sizes from fine ash to larger sizes from underlying rock fragments caught up in the eruption.

Shale, Concretions and Calcite Veins

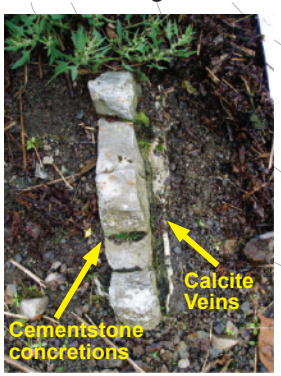


Photograph A

At the back of the bay area some of the vegetation has fallen away to expose the underlying beds of shale. Shale is a fine grained sedimentary rock formed by compaction of clay or silt. It is very soft and flaky.

You will also notice that there are pale rounded stones set into the shale. These are carbonate concretions. After the clay and silt were buried and started to turn to rock, water flowing along certain layers precipitated calcite (calcium carbonate) to form concretions which often joined to form a complete layer. This shale/carbonate association is called cementstone as these are the prime ingredients for making cement. There are also veins of the mineral calcite which formed when hot (the heat coming from the volcano) water saturated with calcium carbonate was forced into cracks and eventually built up to form these veins.

Photograph A shows a fold of cementstone with shale underneath and more concretions of cementstone and calcite veins. **Photograph B** shows an exposure of cementstone and calcite veins in parallel.



Photograph B

Dumbarton Rock - Where is it?

- Castle Road, Dumbarton, G82 1JJ

By road…
In Dumbarton off the A82 at Barloan roundabout. Follow the brown tourist signs for Dumbarton Heritage Sites and then follow the Dumbarton Castle signs.

By rail…
The nearest station is Dumbarton East. Exiting the station at Glasgow Road, turn right, and then left down Victoria Street and then Castle Road, following the signs for 'Dumbarton Castle' which takes you to Dumbarton Rock. Walking distance is approximately 1km/0.6mls. Alternatively, follow the signs 'The Castle Circular Path' which is a slightly longer walking route.

Access and Acknowledgements

Access by kind permission of Dumbarton Football Club Limited, such access taken to be fully at the users own risk.
NO ACCESS will be available on match days and **NO parking on the site will be permitted**.

The geological features in the bay area are subject to tidal influences and this may cause seaweed, sand, stones and marine debris to conceal or further expose the features.

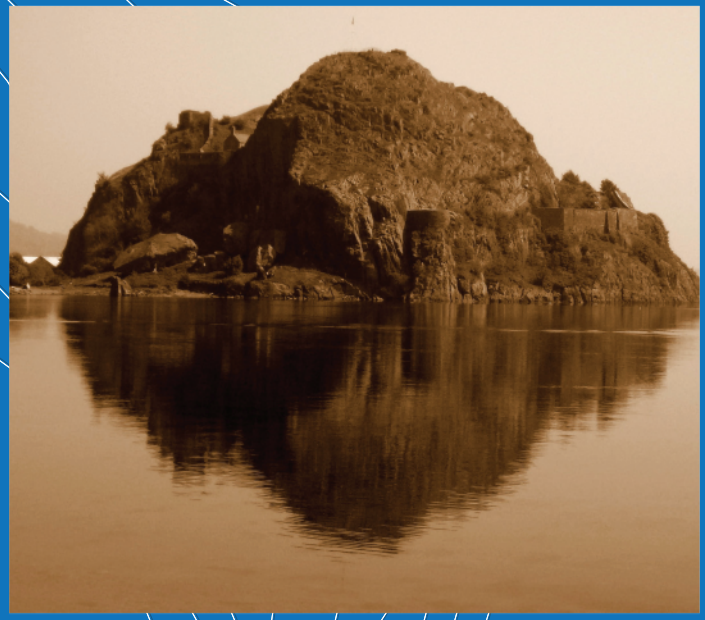
Strathclyde Geoconservation Group gratefully acknowledge the cooperation and financial assistance of West Dunbartonshire Council without whom the production of this leaflet would not have been possible.

Strathclyde Geoconservation Group gratefully acknowledge the cooperation and financial assistance of Historic Scotland in the production of this leaflet.

Thanks to C. Davies, Killearn, for artistic interpretations of diagrams and Ghyll McCallum, Levengrove Dental Care, Dumbarton, for the front cover photo.

This leaflet was conceived by Strathclyde Geoconservation Group (formerly known as Strathclyde RIGS Group) which is a sub-committee of the Geological Society of Glasgow. To know more about the Society and geoconservation, go to the website www.geologyglasgow.org.uk.

GEOLOGICAL FEATURES OF DUMBARTON ROCK



Photograph courtesy of Ghyll McCallum at Levengrove Dental Care

A Geological Trail

Setting the Scene

In the Early Carboniferous period, about 330-340 million years ago, there was widespread volcanic activity in the Glasgow area. Evidence of this can still be seen today in the lavas of the Kilpatrick Hills, Campsie Fells and Renfrewshire Heights. One of the volcanoes which poured out lava was at Dumbarton Rock. Today, all that remains is the basalt plug at the root of the long-extinct volcano.

Figure 1 shows a cross section of what the volcano would have looked like and the underlying, older rocks which are shales with carbonate concretions (cementstones), and underlying them, sandstones of the late Devonian period about 350 million years ago.

The lava is basalt, which is a dark coloured, fine grained volcanic rock.

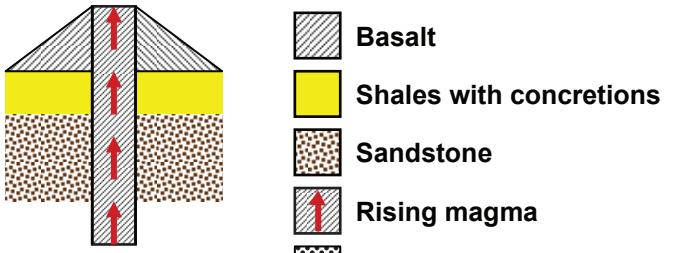
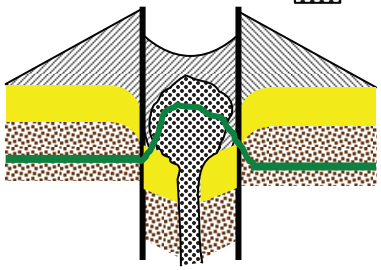


Figure 1

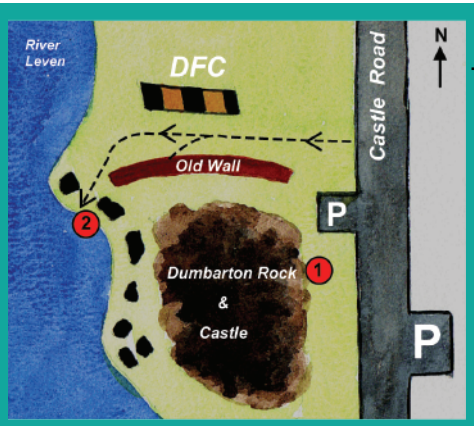


Present Day Erosion Level

Figure 2

As the magma chamber (the source of the lava from deep within the Earth) empties, the flow of lava in the vent ceases, accompanied by fracturing and subsidence. Eventually the lava cools and solidifies filling the vent to form what we call a 'plug'. During the eruptions some of the underlying rocks are broken up and become trapped in the lava. After hundreds of millions of years, the area of the volcano erodes to expose the remains of the plug and some of the underlying rocks, which is shown in **Figure 2**.

Schematic map of Dumbarton Rock



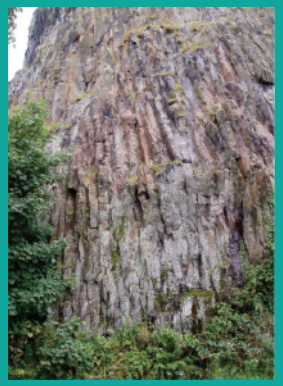
P *Parking*
Access path via Dumbarton FC area

1 *Locality 1;* Columnar Jointing

2 *Locality 2;* Bay Area also showing Basalt Blocks

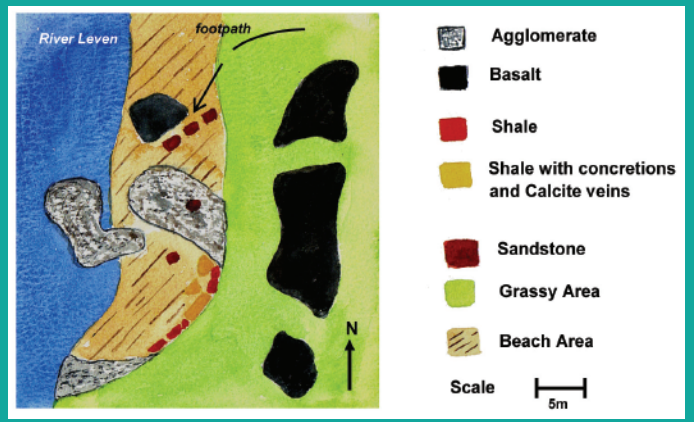
The distance from *Locality 1* to *Locality 2* is approximately 300m.

Locality 1 - Columnar Jointing



As the basaltic lava cooled its volume decreased causing cracks to form. The surface cooled first so the cracks formed at right angles to the cooling surface dividing the basalt into columnar segments. Prime examples of columnar jointing are Fingal's Cave on the Isle of Staffa and the Giant's Causeway in Northern Ireland.

Locality 2 - Bay Area



The Sheared Blocks of Basalt

About 10,000 years ago vast sheets of ice covered an area of Scotland as far south as the Loch Lomond area. As the temperature warmed the ice melted rapidly, in terms of geological time, causing the land to readjust to the loss of weight of the ice; it did so by fault movement causing earthquakes. These earthquakes caused the huge basalt blocks to break off from the main park of the Rock leaving a sheer face and the blocks strewn below.

The large fallen basalt block, featured in the photo, sitting at the water's edge, has much of its surface weathered so that you don't see the original surface, but you might find a 'fresh' surface which will show you dark colour and very fine grained texture.

Sandstone

Next to the large fallen basalt block are three smaller blocks of red sandstone. These are examples of the underlying Upper Old Red Sandstone of the Devonian period. These rocks are steeply dipping (i.e. they would originally have been laid down horizontally but are now turned by ~ 80 degrees.)

This disruption was caused by the fracture and subsidence of the vent as illustrated in **Figure 2**.

There are other pieces of sandstone in the bay area which were caught up in the melee. Can you spot them?