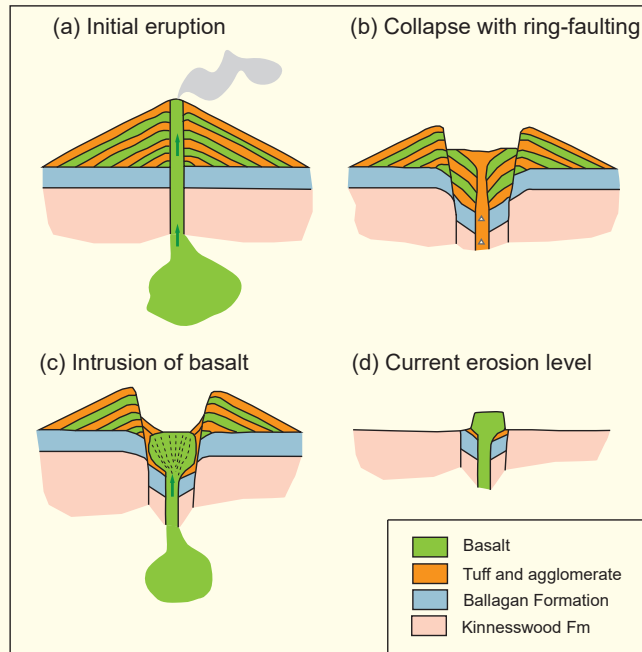




irregular beds of paler rock (photo left). These are concretions of calcium carbonate formed by water percolating along the layers. These bands are called cementstones. This combination of shale with cementstone bands

can be found quite widely in central Scotland and it has been assigned to the Ballagan Formation, which are the basal beds of the Carboniferous. These were deposited in coastal lagoons about 330 million years ago, immediately prior to the volcanic phase. The shales and cementstone bands would have been originally horizontal, they are now tilted, folded and broken up, and are thought to have collapsed into the open vent. Some sandstone beds next to the basalt block (probably from the underlying Devonian Kinnesswood Formation) are also thought to be collapsed blocks. White veins of calcite are common, precipitated from hot water circulating in the volcano.

From the bay it is worth wandering around the fallen blocks of basalt to the end of the path at Locality 3 which overlooks the steep western face of the rock.



Locality 3 [NS 3988 7452]

West face

Sitting under the dramatic western face of the rock is a good place to review the geological history of the volcano - summarised by the diagrams on the previous page. In (a) an initial circular cone of ash and lava was developed over the Ballagan Beds, fed by magma from a chamber below. When this eruptive phase ceased (b), the central part collapsed into the void left by the now-empty magma chamber, forming a set of ring faults around the cone, with unstable blocks of the bedrock beneath the volcano falling and sliding into the vent.

Subsequently magma rose again into the crater (c), probably forming a lava lake as there is a distinct lack of gas bubbles (amygdales) in the basalt. The cooling joint pattern is strongly suggestive of an inverted cone shape to the lava body, which effectively plugged the crater as it cooled and the volcano became dormant. The now-extinct volcano has been deeply eroded over the millennia, especially during the last Ice Age - leaving the remnants seen today (d).

Retrace the outward route back to the parking and if the Castle is open (check Historic Scotland website), it is very worthwhile climbing to the top.

Locality 4 [NS 3990 7451]

Summit

The summit is a good vantage point for viewing the course of the River Clyde from the restricted channel near Bowling down the widening estuary: the valley of the River Leven and the Cowal hills to the west; Ben Lomond to the north, and Dumbuck volcanic vent and the lavas of the Kilpatrick Hills to the east - which flowed from vents like this one.

In the high-level gully which crosses the central part of the Rock there are good examples of features formed during the Ice Age some 25,000 years ago such as glacial striae, first described as long ago as 1855 and very small-scale roches moutonnees: looking one way along the western face of the gully the basalt appears quite rough, whereas looking the other way the same surface appears smooth.

Produced by the Strathclyde Geoconservation Group.
A subcommittee of the Geological Society of Glasgow
More information at: www.geologyglasgow.org

Dumbarton Rock

A Geological Trail

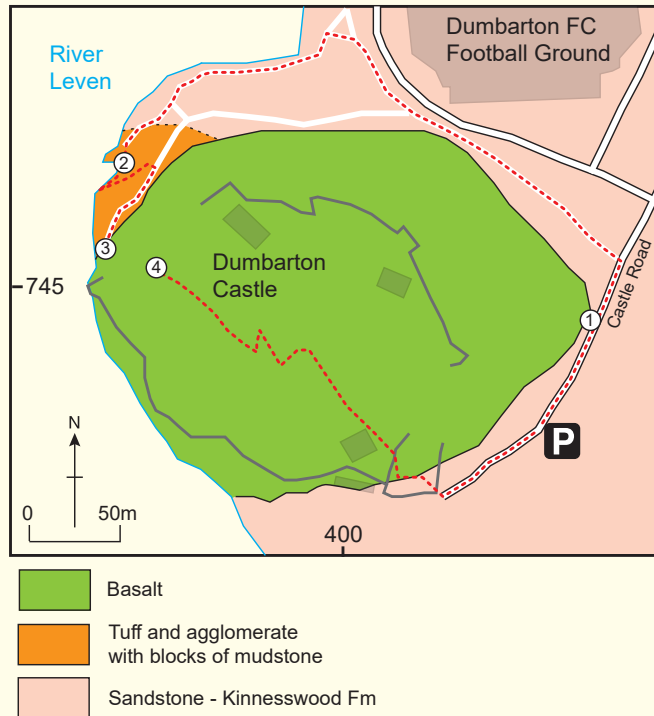


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Trail Map



Dumbarton lies off the A82. Follow the brown tourist signs for Dumbarton Visitor Attractions and then those for Dumbarton Castle. Parking is at the south end of Castle Road which is the southern extension of Victoria Street.

The nearest station is East Dumbarton. Exiting the station at Glasgow Road, turn right, and then left down Victoria Street and then Castle Road, following the signs for 'Dumbarton Castle'. Walking distance is approximately 1km. The Number 1 bus from Glasgow City Centre stops on Glasgow Road close to Victoria Street.

This is a short excursion, it is about 500 m from the parking area to Locality 3, and the same back. The paths west of the football ground can be muddy and the route from Locality 2 to Locality 3 is uneven and wends its way through the fallen blocks (often frequented by rock climbers).

In early Carboniferous times about 340-330 million years ago, there was widespread volcanic activity in the Glasgow area, evidence of which we can see today in the basalt 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. The excursion examines the basalt and also some interesting features relating to the volcanic eruptions.

From the parking area walk about 50 m NE along the road to a point where the vertical cliffs of the rock can be examined.

Locality 1 [NS 4014 7448]

Roadside Cliff

The steep cliffs are made of fine-grained basalt - an igneous rock formed during the cooling of molten magma. Basalt is one of the most common igneous rocks, forming the majority of Iceland for example. Here it is a fine-grained black rock with very small crystals of white plagioclase feldspar, with some olivine, augite and analcime - and it is hence classified as an alkali-olivine basalt.

As the basaltic lava cooled its volume decreased causing cracks to form. The surface cooled first so the cracks generally form a 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.



Here the basaltic magma was intruded into the vent of a small circular volcano rather than being extruded as a lava flow. Detailed analysis of these cooling joints shows that they average about 60 cm in diameter inclined radially outwards at a steep angle suggesting that the intrusion tapers downwards like an inverted cone.

To reach Locality 2 on the banks of the River Leven, the best way is to go through the football ground car parking area as the old path is inside the wall is now fenced off. At the SW corner of the main stand several paths have been

made through the woodland which are often muddy, so it may be preferable to go a few metres further north along the western end of the ground and take the paths that head west and then south towards the river. Locality 2 is a small bay on the riverside with a large fallen block of basalt on its northern shoreline.

Locality 2 [NS 3987 7456]

Bay

The map below shows the main geological features exposed in this small area. Most of the grey rock is volcanic ash, called a tuff (photo right), however, some patches have larger fragments - mainly of volcanic rock. These are called agglomerates. Around the bay there are several exposures of grey shale - a fine grained sedimentary rock formed by compaction of clay or silt. It is quite soft and flaky. There are

