

Welcome to our Bishop Hill Geology Walk. This is one of a series of leaflets, which explains the geology of the Lomond Hills and how they were shaped by volcanic activity and many climates, including hot deserts, tropical humidity and several Ice Ages over millions of years. We hope an understanding of geology will add a new dimension to walking in the Living Lomonds area. If you enjoyed this walk you can find more geology walks at www.livinglomonds.org.uk

GRADING ROUTE A - HOLL RESERVIOR

Distance: 7.73miles/12.44km

Time: 5 hours

Terrain: (Strenuous) The route follows a wide gravel farm track path, which is used for farm vehicle access. The route climbs steadily with a steep section as it nears the Bishop Hill. Self-closing gate, stile and kissing gate on the way.

GRADING ROUTE B - PORTMOAK PARISH CHURCH

Distance: 2.5 miles/4km

Time: 2 hours

Terrain: (Strenuous) Long, steep, arduous slopes to climbing up from car park at Portmoak Church. Paths are often muddy, care should be taken on the descent back to the car park. Self-closing and kissing gates on the way.

Find Out More

The Living Lomonds Landscape Partnership is an association of organisations in Fife and Perth & Kinross.

Our aim is to re-connect people with the living legacy of the Lomond and Benarty Hills through a range of community based activities, volunteering opportunities and projects.

Visit the Living Lomonds website www.livinglomonds.org.uk to print more copies of this leaflet and other themed walks in the area.

MAKE YOUR WALK ENJOYABLE

Please wear sturdy footwear, take suitable clothing and some water and be aware that the weather can quickly change. A walking pole could be useful. Loose blocks of stone in the quarry can be a trip hazard.

SCOTTISH OUTDOOR ACCESS CODE

In the spirit of responsible access, please follow the **Scottish Outdoor Access Code**.

TRAVEL

Local Transport links can be found via www.travelinescotland.com

geoHeritage Fife was set up in 2000 to:

- * publicise Fife's geological heritage
- * provide educational resources in geology
- * promote geotourism

geoHeritage Fife | 01334 828623 | Scottish Charity No. SC 032509

Fife Local Geodiversity Sites (LGS) is concerned with identifying and assessing important sites and notifying the statutory planning authority of these sites. Fife RIGS was incorporated into geoHeritage Fife in 2005.

©2016 R.E.Garton & R.A.Batchelor



KINBURN (St Andrews)
CHARITABLE TRUST



Bishop Hill

Geology Themed Walk



Re-connecting people
with the hills

Historic Landscape



LOTTERY FUNDED



NAMES OF KEY LOCATIONS

1. Clamp Kiln
2. Limestone Quarry
3. Clatteringwell Quarry
4. Limestone Cliff
5. Carlin Maggie
6. Bishop Hill Views
7. Dolerite sill contact with sediments

©Crown copyright and data base rights
2016 Ordnance Survey 10002335

Geological History

The oldest rocks of the area are **sedimentary** rocks deposited in southern desert latitudes during the Devonian period 410-354 million years (Ma) ago. Most of the local rocks formed during the Carboniferous Period, 354 -299 Ma, when this part of the Earth lay close to the Equator. The landscape was dominated by rivers carrying sediment eroded from the Highlands into deltas and lagoons. These layers of sediment now form **sandstone** and **mudstone**. Coal seams formed from the decay of lush tropical forests. **Limestone** was deposited when the sea flooded low lying areas, preserving fossils of shells, crinoids ("sea lilies") and corals.

The Lomond Hills, the Bishop Hill and Benarty are the result of the intrusion 307 Ma ago of a sheet of molten rock (magma) between layers of sedimentary rock to form a layer (a **sill**) made of the dark coloured **igneous** rock quartz **dolerite** which resulted when the magma cooled.

Rock previously overlying the sill has mostly been eroded away, and the hard **dolerite** has protected the underlying **sedimentary** rock from later erosion. The **sill** forms the ridge between the Lomonds, the shoulder at the west end of the West Lomond, and most of the upper parts of the Bishop Hill and Benarty. The Lomond Hills peaks are two extinct

volcanic pipes which cut through the **sill** and fed molten lava to the surface. The lava has been eroded away, and the pipes are now filled with 297 Ma old olivine **dolerite**.

Between 19 000 and 13 000 years ago the area was covered by ice, which modified the underlying landscape and created the landscape seen today.

GLOSSARY

ANDESITE: A volcanic lava, dark and fine-grained.

DOLERITE: A coarse-grained igneous rock intruded into older rocks. Prefixed by "Quartz" or "Olivine" depending on the characteristic mineral.

IGNEOUS: Rocks formed from the cooling of molten magma

JOINTING: Cracks in rocks.

LIMESTONE: A sedimentary rock made of calcium carbonate, often containing fossils.

METAMORPHIC: Rock modified by intense heat and/or pressure.

MUDSTONE: A sedimentary rock formed mostly from mud.

SANDSTONE: A sedimentary rock formed by the accumulation of sand grains.

SEDIMENTARY: Rocks formed from sediments eroded from older rocks.

SILL: Molten rock intruded conformably between layers of older rocks.

"ROUTE B"

Dolerite sill contact with sediments

Access for this route is from Scotlandwell. The path is steep and care is particularly needed on the return descent.

Dolerite sill contact with sediments

Begin the walk at Orwell and Portmoak Church car park in Scotlandwell (NO 183 019). Turn right on to the main road and walk east to the footpath on the left signposted "Bishop Hill", follow this path with a deer fence on its left, taking the first sharp right turning and continue up the hill, through woodlands to a field gate from where the cliff of the Bishop Hill is visible. Go through the gate and follow the path 6km (3.75miles) towards the cliff. On reaching spoil heaps and a small stream turn right and go towards the woods. At the fence go uphill and left to see the base of the dolerite sill.

The dolerite shows typical vertical joints formed during cooling of the molten rock. Beneath the sill, layered sedimentary rock is visible, which has been considerably hardened and bleached to at least 2m depth by the heat of the sill. The sedimentary rock is **mudstone**.

Further NW along the base of the sill the ground has been disturbed by quarrying of limestone. The spoil heaps include pieces of fossiliferous limestone, containing crinoids ("sea lilies") and brachiopods ("lamp shells").

< Return to Scotlandwell by the same route. >



"ROUTE A"

By road, go 1km west of Leslie Cemetery and turn right at a road signposted "Scottish Water" and continue for 2km, go straight across at the crossroads at West Balgothrie Farm. Park on the left beside Holl Reservoir (NO 224 035). Return to the crossroads on foot and go right signposted "Bishop Hill". 2.5km on pass around West Feal Farm and continue up the hill. After 0.5km at a sharp right turn in the path the disturbed ground on the right, with the remains of stone walls, is a former primitive "clamp" kiln for burning limestone. Clinker and fragments of partially burned limestone can be found on the path.

Please do not remove anything from the site.

Clamp Kiln

This is an old type of kiln where limestone was burnt. A shallow hollow (marked by dotted line in the photo) was cut out of the ground, and a mixture of crushed limestone and coal (or wood) was set alight.

Cross the stile and continue straight on up the hill on the track. At the metal gates at the end of woodlands continue straight on (NW) on the track, noting the hummocky ground on each side, which is spoil from quarrying.



Limestone Quarry



View from the path of disturbed ground in the distance, seen after emerging from the forest.

Approximately 320m further on from the metal gate, as the path curves to the right, turn left into a gap between spoil heaps - follow the third gully on the left - to a rock face. This is an old limestone quarry worked in the 1790's.

Clatteringwell Quarry



Entrance to limestone quarry seen from the path.

The limestone overlies the igneous sill and has been baked and hardened by heat during the intrusion of the molten rock.

The scree is made up mostly of limestone blocks. Many pieces contain fossils of corals, crinoids ("sea lilies"), shells and, rarely, sponges, creatures that lived in tropical seas. Fossils can be difficult to see in the quarry faces, but can be found in the spoil heaps. Crinoids ("sea lilies") and brachiopods ("lamp shells") are abundant in the quarry waste.



The white round shapes are fossil crinoids (the stems of "sea lilies") in a piece of limestone from the scree.



Limestone quarry



Limestone Cliff



Close-up view of mudstone.

Limestone quarry, showing layers of limestone separated by softer mudstone.



Example of crinoid stems at different stages of breaking up.

Examples of shells which can occur in the limestone:
Brachiopods (1-3),
Orthocone (4),
Goniatites (5-7),
Gastropod (8).



Return to the main path and follow the path NW. Where a wire fence and an old stone wall meet, follow the path left then right to a metal gate and continue for 200m. Look below to the left to the cliffs of the sill.

Carlin Maggie

The 10m high pillar is "Carlin Maggie". It is an isolated outcrop of the quartz dolerite sill that makes up the bulk of the upper Bishop Hill. Carlin Maggie is believed to be a feature of natural erosion of the dolerite by wind, rain and ice.

A legend says that Carlin Maggie was a local woman who was turned to stone by the devil who threw a lightning bolt at her.



Bishop Hill Views



View NW



View SW

As the view unfolds from the Carlin Maggie locality, look South over Loch Leven to Benarty, part of the quartz dolerite sill. To the West are the Cleish, Touch, Fintry and Gargunnock Hills, all composed of lavas of Carboniferous age, with a steep, ice-scoured scarp slope at the west end. The great mass of the Ochil Hills to the West is made of lava flows of Devonian age. The lower land between these hills is underlain by softer sedimentary rock which includes the Stirlingshire coalfield.

To the North and North-West the mountains of the southern Highlands are made of hard, ancient **metamorphic** rock which has been altered by high pressure and temperature.

< *Retrace your steps to Holl Reservoir car park.* >