Scotland’s Geological Story

Scotland’s spectacular scenery derives from a geological story stretching back 3.8 billion years. The distinctive rocks and landscapes have played a crucial role in our understanding of how the Earth works, dating back to the revolutionary ideas of James Hutton in the 18th century.

Earth’s continents are forever moving, splitting apart to make new ocean basins and colliding to form mountain ranges. Scotland has been caught up many times in these processes, resulting in a wide variety of rock types of different ages.

This geological diversity is reflected in Scotland’s scenery, as the rocks have been sculpted over millions of years to create the Highlands and Lowlands, the firths and the islands, the glens and serrated mountain ridges.

In the beginning...

The oldest rocks in Scotland are found in the Outer Hebrides and on the coast of the Northwest Highlands. The ‘Lewisian Gneiss’ is ancient, highly deformed rock that formed deep in the Earth’s crust 2800 million years ago and reveals a long history of volcanic events, mountain building, deep burial and slow erosion.

Caledonian Orogeny - a big crash

The most important event in Scotland’s geological past was a massive continental collision associated with the closure of an ancient sea called the Iapetus Ocean. This ‘Caledonian Orogeny’ involved the collision of three continents to form a huge mountain chain. The hard rocks that form most of the Scottish Highlands and Southern Uplands were created at this time.

400 million years ago, molten rock beneath these Caledonian mountains rose upwards to form granite, and sometimes erupted in large volcanoes. Near the end of the collision a large block of older rock was pushed on top of younger rocks in the Northwest Highlands creating the world famous ‘Moine Thrust’.

After the mountain building

The past 400 million years have been relatively quiet; most rocks remained above sea level as Scotland drifted northwards across the Equator. The Caledonian mountains eroded quickly and in low-lying areas sediments built up to form new rocks including the Old Red Sandstone and the coalfields of central Scotland, and later, the oil and gas bearing rocks of the North Sea.

In the Central Belt, volcanic activity created upland areas including the Campsies and Arthur’s Seat.

The final stretch – opening of the North Atlantic

Scotland’s final episode of rock creation was a dramatic period of volcanic activity centred on the west coast. This began after the dinosaur extinction, and created a thick pile of lava flows and large volcanoes; some of the underlying rocks contain dinosaur fossils.

And finally...

In the past 50 million years Scotland has remained on the edge of the Atlantic but the geological story didn’t stop. During the Quaternary Ice Age (the last two million years), the entire country has been covered by an ice sheet many times, and the moving glaciers and their meltwater have helped to shape Scotland as we know it. Natural processes continue to pick out the contrasts between different rocks to create today’s impressive landscapes. As the pioneering geologist James Hutton said, we can foresee “a different state that must follow in time, from the continued operation of that which actually is in nature”.

Discover more of Scotland’s fabulous geology!

There are visitor centres and museums across Scotland where you can find out more about local geology. A good starting point is the online gateway run by the Scottish Geodiversity Forum, with lots of news, information and links: www.scottishgeology.com

Scottish Natural Heritage

Scottish Natural Heritage (SNH) is the Government funded body that looks after all of Scotland’s nature and landscapes enabling people to enjoy, understand and appreciate it. Their website has further information about Scotland’s landscapes and geology: www.snh.gov.uk

Voluntary Geoconservation Groups and Geological Societies help people find more about Scotland’s geology and explore local geological sites. They organise lecture and excursion programmes and publish books and leaflets. Find one near you: www.scottishgeology.com
Geological map showing the 51 Best Places to explore Scotland's Geology

Find out more about the sites at www.scottishgeology.com/best-places/
For a key to the map see: www.scottishgeology.com/geology-of-scotland-map/

1 Unst, Shetland
Ancient ocean floor rocks

2 Eshaness Coast, Shetland
A blast from the past

3 St Ninian’s Tombolo, Shetland
Arcs of sand and shells

4 The Heart of Neolithic Orkney
Geological and human history entwined

5 North–West Hoy, Orkney
Old Red Sandstone coastal scenery

6 Achanarras Quarry
Where ancient fish shoals lie

7 Smoo Cave to Am Fairaid
Sandy beaches, caves and rock formations

8 Scourie Bay and Laxford
Older Rocks in Western Europe

9 Loch Glencoul
Continental collisions laid bare

10 Knockan Crag
Scotland’s most significant fault line

11 Luskentyre, Harris
Breath-taking coastal landforms

12 Trotternish, Skye
Summit to sea since the Jurassic

13 Beinn Eighe and Loch Maree
Thrust chaos and glaciation

14 Corrieshalloch Gorge
The carving force of glacial meltwater

15 The Black Isle & Hugh Miller
Museum Sandstones rich in fossil finds

16 Lach Sandstones, Elgin
A world of extinct herbivores, reptiles and fish

17 Spey Bay
The sea of stones

18 Portsoy
Beautiful pebbles and tortured rocks

19 Cuillin Hills, Skye
Mountains of fire and ice

20 Eigg
Jurassic reptiles and volcanic glass

21 Loch Monar
Rocks of ancient Caledonian mountains

22 Falls of Foyers, Great Glen
The smoking falls

23 Staffa
Nature’s organ pipes

24 Iona
Contrast in rock, colour and light

25 Luing and the Atlantic Islands
A tale of two oceans

26 Glen Coe
Scene of an ancient caldera collapse

27 Parallel Roads of Glen Roy
Unlocking the lines in the landscape

28 Schiehallion
The mountain that weighed the Earth

29 River Feshie
How modern-day landscapes are formed

30 Cairngorms
A subarctic landscape carved out of granite

31 Burn o’ Vat, Dinnet
Step inside a granite cauldron

32 Corrie Fee, Glen Clova
A gem from the last glaciation

33 Stonehaven
The power of colliding continents

34 St Cyrus Beach
A story of fire and water

35 Seaton Cliffs
Sandstone sculpted by the sea

36 Balmaha
Walk the Highland Boundary Fault

37 Flanders Moss NNR
Colourful ‘shaking’ bogs

38 Callander
Ancient rivers and glaciers

39 East Neuk of Fife
Folds, fire and fossils

40 Islay
Evidence for ‘Snowball Earth’

41 Arran
Scotland’s geology in one place

42 Fossil Grove
An ancient forest tale

43 Falls of Clyde
Glacial rivers shape the landscape

44 Holyrood Park
The volcano in Scotland’s capital

45 Dunbar and Barns Ness
Ancient seascape and volcanic hellhole

46 Siccar Point
James Hutton’s ‘abyss of time’

47 Ballantrae
A rare relic of an ancient ocean

48 Loch Skeen and Grey Mare’s Tail
Ice Age landforms and the ‘roaring linn’

49 Eldon Hills
The Borders’ volcanic past

50 Back Bay, Monreith
Twisted rocks of a long-lost ocean floor

51 Southerness
Solway’s ancient and modern shorelines

Best Places to see the different episodes of Scotland’s geology

In the beginning … 8, 11, 24
Caledonian Orogeny 1, 2, 7, 9, 10, 13, 18, 21, 25, 26, 28, 30, 33, 36, 40, 46, 47, 50
After the Orogeny 4, 5, 6, 15, 16, 34, 35, 38, 39, 42, 44, 45, 46, 49, 51
Opening of the North Atlantic 12, 19, 20, 23, 41
And finally… 3, 11, 14, 17, 22, 27, 29, 31, 32, 37, 43, 48

Map courtesy of National Museums Scotland