Scottish Highlands

A HILLWALKER’S GUIDE TO THE GEOLOGY & SCENERY

The Scottish Highlands are home to Britain’s most spectacular mountain scenery. The stark hills, fearful crags, glorious glens and sparkling lochans make for a wide range of landscapes and hour-attractive features of landscape beauty, hillwalkers and mountain-lovers. This book is intended to help those who adore this landscape gain an insight into the geological forces that shaped it.

The first half of the book tells the story of how the rocks were created and shaped by the great forces of plate tectonics, colliding continents, volcanoes, mountain building and glaciation.

The second half of the book details 18 walks with a variety of geological features set among consistently fantastic views.

The 18 walks are widely spread, encompassing the isolated peaks of Sutherland in the far northwest, the rolling granite massif of the Cairngorms in the east, the haunting beauty of the Ardnamurchan peninsula in the west and a select choice from the vast range of stunning mountains in the central and southern Highlands.

Walk #1
Arkle

Walk #2
Ben Stack

Walk #3
Quintig

Walk #4
Breidiag

Walk #5
Meall a’ Ghluibsrais

Walk #6
Coire Mhul Phrachais (Beinn Eighe)

Walk #7
Beinn Bhein

Walk #8
Saurie na Abaid

Walk #9
Cuain Gorm

Walk #10
Cnoc Moragaidh

Walk #11
Glen Roy

Walk #12
Ben Nevis

Walk #13
Glen Nevis

Walk #14
Ben Hiant (Ardnamurchan)

Walk #15
Meall nan Coir (Ardnamurchan)

Walk #16
Bidean nan Bhein (Glen Coe)

Walk #17
Meall nan Tamachan ridge

Walk #18
Ben Lomond

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To the memory of Catherine Lowe and Mackie Swanson
Contents

Introduction ............................................ 7

CHAPTER 1  Before Scotland ............................... 11
CHAPTER 2  Gnarly Gneiss ................................. 17
CHAPTER 3  Torrid Torridonian .......................... 25
CHAPTER 4  Cambrian Capping ............................ 35
CHAPTER 5  Thrusting Times ............................... 43
CHAPTER 6  Metamorphic Menu ............................ 55
CHAPTER 7  Dalradian Deformation ...................... 63
CHAPTER 8  Grampian Granite ............................. 71
CHAPTER 9  Igneous Intrusion ............................. 77
CHAPTER 10 Atlantic Appearance ....................... 89
CHAPTER 11 Glacial Gouging ............................. 95

About the Walks ....................................... 111
Walk #1  Arkle ........................................... 117
| Walk #2 | Ben Stack .............................................. 125 |
| Walk #3 | Quinag. .................................................. 131 |
| Walk #4 | Breabag ................................................ 139 |
| Walk #5 | Meall a’ Ghuibhais .................................... 151 |
| Walk #6 | Coire Mhic Fhearchair (Beinn Eighe) ................ 159 |
| Walk #7 | Beinn Bhan ............................................ 165 |
| Walk #8 | Sgurr an Airgid........................................ 175 |
| Walk #9 | Cairn Gorm ............................................ 181 |
| Walk #10 | Creag Meagaidh ....................................... 189 |
| Walk #11 | Glen Roy ............................................... 195 |
| Walk #12 | Ben Nevis .............................................. 299 |
| Walk #13 | Glen Nevis ............................................. 207 |
| Walk #14 | Ben Hiant (Ardnamurchan) .......................... 213 |
| Walk #15 | Meall nan Con (Ardnamurchan) ..................... 217 |
| Walk #16 | Bidean nam Bian (Glen Coe) ......................... 223 |
| Walk #17 | Meall nan Tarmachan ridge......................... 231 |
| Walk #18 | Ben Lomond ........................................... 239 |

Acknowledgements & Sources ....................................... 244

Glossary of Geological & Geomorphological Terms ............... 246

Index of Place Names.................................................. 249
Introduction

The Scottish Highlands are home to Britain’s most spectacular mountain scenery. The stark hills, fearful crags, glorious glens and sparkling lochans make for a wide range of landscapes and have attracted generations of landscape lovers, hillwalkers and mountaineers of all description.

This book is intended to help those who adore this landscape to gain an insight into the geological forces that have shaped it. My aim is to explain, in clear straightforward language, why the basic ingredients of hill and glen are able to produce such a remarkably rich mix of landscape types. The mountains and valleys have a fascinating geological history; it is my aim in this book to delve into that history and extract a narrative that is accessible to the ordinary hillwalker and mountaineer. It is a fascinating story which I hope will open your eyes to seeing the landscape in new and more intimate ways.

The book is divided into two parts. The first tells the story of how the rocks were created and shaped by the gross forces of plate tectonics, colliding continents, volcanoes, mountain-building and glaciation. We look back over thousands of millions of years to discover some of the world’s oldest rocks in the northwest of the Highlands. We also dig into less ancient geological history, seeking scenic evidence of the powerful glaciers that carved out the present-day landscape in the fairly recent past just a few thousand years ago.
The second part of the book describes 18 recommended walks with a variety of geological features set among consistently fantastic views. The walks are widely spread, encompassing the isolated peaks of Sutherland in the far northwest, the rolling granite massif of the Cairngorms in the east, the haunting beauty of the Ardnamurchan peninsula in the west and a select choice from the vast range of stunning mountains in the central and southern Highlands.

![Photo 0.2](image)

The intensely deformed rocks of the Grampian Highlands: the Grey Corries seen from Aonach Mor. The rocks date from around 500 million years ago.

The book is limited to the Highlands so it does not cover the equally amazing geology and stunning scenery of the Scottish islands nor the varied landscapes to the south of the key geological feature known as the ‘Highlands Boundary Fault’ (see Chapter 1). This geographic limitation is logistically essential; to cover the geology of all these areas as well as the Highlands would have demanded either a much bigger book or have meant that less-than-adequate space could be devoted to the mountains of the Highlands.

I have written about what you can see around you as you walk the hills and glens. There is no need to carry any special geological tools such as a hammer or hand lens; it is also unnecessary to take samples back to the laboratory and subject them to various indignities in order to analyse them. I point instead to often quite conspicuous features in the rocks and the overall shape of the terrain in ‘reading’ the present-day landscape.

While geology is a fascinating subject, it is also a science and relies on a complex scientific terminology. My aim has been to minimise the use of jargon and make the processes that have shaped the landscape comprehensible to the average reader. This has meant some simplification of the jargon and a pruning of the detail. All the same, we will have to deal with a minimal set of terms such as ‘plate tectonics’, ‘plastic deformation’, ‘magma’, ‘moraines’ and the like.
When I first use a piece of jargon I have put it in quote marks (for example, 'continental plate'). Many of these terms are defined in the Glossary, but I have sometimes assumed that the meaning of a term is obvious from the context in which it appears.

While reading the book, the reader may well find it useful to have some maps of the areas covered to hand. This gives a good appreciation of the topographical structure of the landscape features under discussion. It also helps with locating places mentioned in the text (with the help of the list of grid references for all local places found at the back of the book).

Given the considerable area covered by the Highlands, a highly cost-effective and practical approach is to buy the computer-based version of the Ordnance Survey's 1:50,000 maps for the whole of Britain. At the time of writing (early 2012) this could be obtained for less than £70; online versions are also becoming available quite cheaply. Maps are discussed further in the section 'About the Walks.'
Photo 0.4   Binnein Mor
Walk #1
Arkle

Arkle and its northern neighbours, Foinaven (Fionne Bhein) and Cona Mheall, form a complex mountain massif where 500 million year old Cambrian quartzite sits on top of ancient gneiss up to 3 billion years old. This age gap is worth pondering. In many places in the world, rocks from the Cambrian period would be considered ancient – in the juxtaposition with the old gneisses, however, they are mere newcomers.
As recounted in Chapter 2, during their long lifetime the ancient gneisses have been subject to many different processes including being squeezed and heated, dropped deep down into the earth’s crust and then pushed back up again to the surface. At some point, the gneiss was uncovered by erosion on the earth's surface.

Between about 540 and 500 million years ago, the area was drowned beneath a fairly shallow sea and sediments of sand, silt and mud were deposited on top of the gneiss. The seas teemed with life and many animals' remains were fossilised as the sediments suffocated and entombed them. Others were transformed into calcium carbonate deposits. Today we are left with a variety of Cambrian rocks, including quartzite, siltstone, sandstone and limestone.

In the 500 million years which have passed since then, vast earth movements caused by shifting tectonic plates have taken place. The quartzite and limestone have been broken up, with massive lumps being thrust up into a great broad pile in the Moine Thrust Zone (see Chapter 5).

Much of this earth history is visible in these attractive mountains. The division between the gneiss and the quartzite angles across the mountainsides and is easily seen on the massif, both from a distance and from close up. It is also possible to see evidence of the thrusting and piling up of the rock layers and fascinating fossils can be seen in many places.

The view of Arkle and Foinaven from the main roads is that of their fairly uniform south-western flanks. Once up on either ridge, however, vistas of the immense glacial corries that bite deeply into the mountain ridges on their north-eastern sides can be enjoyed. There are wonderful views from the mountain tops of the rough, gnarly 'knock and lochan' territory of the ancient gneisses stretching towards Cape Wrath and the Atlantic Ocean (see Chapter 2).

Foinaven is the more substantial mountain with more corries and some highly dramatic ridges, but it is also considerably more remote with long walks in and out from whichever direction it is tackled. Cona Mheall is even more remote from the west but is accessible from the northeast, offering a superb display of 'imbricated' quartzite thrusts when seen from within Strath Coille na Fearna.

Arkle has a less demanding walk in and out than Foinaven, but it is still 4km each way from the start of the walk to the start of the climb up Arkle itself. It is also a bit lower than Foinaven, so is marginally more likely to be cloud free than its taller neighbour.
On the OS 1:50,000 map, Arkle looks a bit like a beheaded and de-trumpeted version of the messenger logo that used to grace British Telecom’s otherwise dull grey fleet of vans. The two ‘legs’, both bent at the ‘knee’, represent the crags below sharp edges to the plateau south of Arkle’s lower summit point (spot height 758m at grid reference NC 3099 4529).

The ridge narrows considerably for a short distance north of this point, providing an exciting route to the true summit (spot height 787m at grid reference NC 3027 4616) where the ridge again widens outs. The return route re-crosses the narrow section of the ridge then diverts to the left to pass a glacially scoured lochan.

The walk starts from the parking place at the beginning of a private vehicle track about 1km north of Achfary on the A838. Follow the vehicle track for just over 3km to the bridge at Lone. Initially the views are dominated by the bulk of Ben Stack on the left (see Walk 2), but as the track swings right past the estate buildings at Airdachuilinn, the elegant form of Arkle takes pride of place.

The boundary between the underlying gneiss and the overlying quartzite is quite clear (see Photo w1.1), sloping gently towards you and reaching ground level some distance before the track. The very bottom of the quartzite is hidden by the collection of scree at the base of the crags and much of the gneiss is hidden under vegetation, but there is quite a clear shelf where the quartzite meets the gneiss.

Photo w1.1
Approaching Arkle, the layers of Cambrian quartzite can be seen resting on ancient gneiss.
Arkle

The quartzite crags lie in clear layers, generally sloping down at the same angle as the contact between the two rock types. There is a clear upwelling to the right however, above the section where the gneiss dips below surface. A closer examination of this area of quartzite shows that the beds are rather broken up in places and not as regular as further left. These are in fact signs of the ‘imbrication’ (see Chapter 5) or the piling up of thrusted sections of the quartzite in front of the Moine Thrust. A pair of binoculars would be useful for obtaining a good close-up view of the imbricated strata.

After crossing the bridge at Lone, take the left-hand track towards a small plantation. As you approach the wooded area, you can see a gorge over on the right where the river has cut through the steep slope of the quartzite. You only get a glimpse of the gorge here, but it is best viewed later (especially on the descent).

As you enter the wood, the track passes through two or three large ‘erratics’, boulders dumped by the last melting glacier in this valley. The path starts to twist and climb through the woods and continues to climb as it leaves the trees. There are some minor quartzite outcrops on the left of the track as you ascend further.

There is a small cairn on the left of the track at about grid reference NC 317 428, marking the start of a narrow path that climbs steadily up the southern flank of Arkle (initially quite muddy). Follow the path for about 150m of ascent (to about a height of 300m), then start to bear right to pick up a stream somewhere about grid reference NC 317 434. Follow the stream up to its source, passing an enchanting little waterfall/cascade in a rounded amphitheatre with a series of ledges created by the tilted ‘bedding’ of the quartzite. As you ascend further, you can see how the tilted bedding defines the asymmetric slanting cross-section of the stream.

Another feature that becomes increasingly evident as you ascend is the presence of ‘quartzite pavement’, where the tilted bedding of the rocks is exposed at the surface with a little scrappy vegetation. Quartzite has a very high proportion of quartz or silica in its make up. It is a fairly stable mineral chemically speaking, so it does not break down to provide minerals for the formation of soil and growth of vegetation. Quartzite is usually applied as a label to metamorphosed sandstone (for example in the Grey Corries and the Mamores range), but throughout the Moine Thrust Zone the Cambrian quartzite is a sedimentary sandstone with a very high proportion of quartz.

The individual layers of quartzite, exposed as pavement or in the stream bed, represent the layers of sediment laid down in succession. Its upper surface layer is known as a ‘bed’ and would have been a sea floor more than 500 million years ago.
The pavement is far from smooth; rather, it is broken by joints which were formed when the wet sediment dried out and contracted slightly as it was transformed into rock. Millions of years later the jointing has been exploited by freeze-thaw cycles to break up the rock. Combined with the tilted bedding of the rock, this irregular jointing makes it rather awkward to walk on. The pavement is also covered with loose lumps of quartzite, broken off the main outcrop by repeated cycles of freeze and thaw (see Photo w1.2).

One particular feature of these rocks is what is known as ‘pipe rock’. Often reddish in colour, the pipe rock is believed to contain the fossilised remains of worm burrows in the sand from which the rock was formed (see Photos w4.7 and w4.8). The ‘pipes’ are white, somewhat less than 1cm in diameter, and can be seen in outcrops and individual boulders in both plan and section views.

The pipe rock is seen on various levels as you ascend (and again on the ascent to the col between the two high points). Geologists believe that the rock occurred at only one level in the original rocks. However, it can be seen on so many different levels on Arkle because of the thrusting caused by the collision of two continental plates. The original beds have been broken and then thrust upwards above the same type of rock. Each noticeable recurrence of the pipe rock that you pass as you ascend represents another broken part of the rock that has been thrust upwards. This repeated piling up on top of itself of a layer of rock is known as ‘imbrication’ and is a common feature in the Cambrian quartzites and other rocks of northwest Scotland (see Chapter 5).

On reaching a height of about 700m, break away from the stream bed and bear left to reach the top of the crags overlooking the valley between Arkle and Ben Stack for tremendous

![Photo w1.2](image-url)

Quartzite ‘pavement’ on Arkle.
views of the lake strewn area. Then aim for the highest point on this part of the mountain (spot height 758m, NC 309 453) for equally stunning views of Foinaven in the middle distance and Am Bathaich below you. This east-facing corrie has eaten into Arkle, leaving a narrow ridge circling round the top of this natural quarry (see Photo w1.3).

Descend from the plateau towards the col, keeping an eye out for an obvious outcrop of pipe rock. See if you can also spot the corresponding pipe rock layer on the other side of the col as you start to re-ascend. It is from this point that the ridge begins to narrow, but nowhere precipitously.

For one short section, the ridge top is defined by the gently tilting quartzite bedding (see Photo w1.4). Take care not to trip up on the knobbly rock outcrops, as your attention will inevitably be drawn to the ever more impressive views of Am Bathaich. Look at where the northern corrie wall joins the main ridge to see clear deformation folds caused by the thrusting of the broken sections of the quartzite during mountain building (see Photo 5.1). The tilted bedding underfoot is the surface expression of one of the imbricated thrusts.

The narrow section of the ridge soon comes to an end and the summit plateau widens out. Walk out for 150–200m beyond the summit cairn for super views of Foinaven’s southwest flank and the underlying gneiss basement rocks stretching off into the distance. The sloping
boundary between the quartzite and gneiss is again very clear and it is obvious that Foinaven’s north-westernmost summit point, Ceann Garbh, is entirely formed of gneiss. There are also superb views over the knock and lochan territory to the north and west (see Photo w2.2).

When you’ve seen enough of the distant views, it is time to turn round and re-cross the narrow ridge and the slight col between the two summit plateaux. On this return leg, the views are again dominated by Am Bathaich and Foinaven. You can clearly see the sloping quartzite strata in the corrie’s southern wall, with deformation zones indicating the imbricated thrusts where the wall joins the main ridge (see Photo w1.5).

Return to spot height 758m and then head down roughly south-southeast along the edge of the plateau above another impressive corrie, An Garbh-choire. Aim for just north of Meall Aonghais, where you then swing left towards the south of Lochan na Faoileige. This is a classic glacial scouring area. The lack of vegetation on the quartzite ‘pavement’ emphasises the flow of large glaciers or ice sheets across this col, scraping into the rock and even scouring...
out a basin which is now occupied by the lochan. There would have been no vegetation at all at the end of the ice age, something which can easily be comprehended here given how little vegetation has managed to take root even after some 10,000 years.

Pick a route to join the vehicle track at about grid reference NC 334 447. Turn right and follow the track back to the starting point. As you approach the point where you left the track on the outward journey, enjoy the excellent views of the gorge cut through the hard quartzite outcrop by glacial meltwater. Savour the last views of the crags of Arkle on your right until the track turns south near the estate buildings, allowing you to enjoy the fine vistas of Ben Stack.