

Summary of the geology of the Grampian Highlands

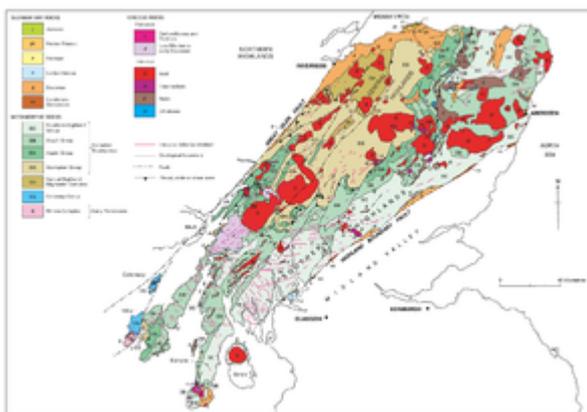
From Earthwise

[Jump to navigation](#) [Jump to search](#)

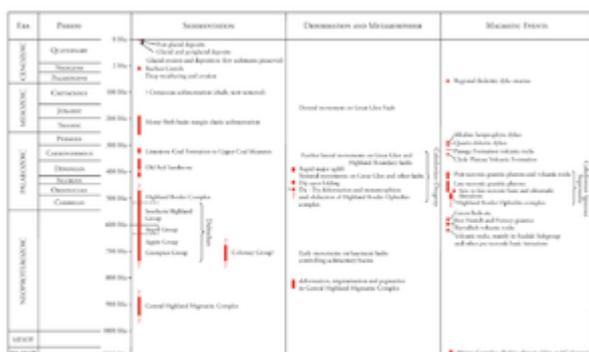
Stephenson, D, and Gould, D. 1995. British regional geology: the Grampian Highlands. Fourth edition. Reprint 2007. Keyworth, Nottingham: British Geological Survey.

Summary of the geology

The Grampian Highlands are mostly made up of metamorphic and igneous rocks, part of the eroded root zone of the Caledonian mountain belt, which developed in late Precambrian to early Palaeozoic times (P915452). The name 'Caledonides' was given by E Suess to this mountain belt which extends from the eastern seaboard of North America to Scandinavia and Greenland; in Britain and Ireland its width is from north-west Scotland to central Wales. The Grampian Highlands portion of the Caledonides belt is very well defined by two major dislocations, the Great Glen and Highland Boundary faults (P915411). Late Palaeozoic and Mesozoic rocks are now found in large basins of deposition to the north and south of the Grampians and in small internal basins, but may formerly have extended over much of the region. Since Devonian times, however, the area has been mainly one of erosion. Apart from some Carboniferous rocks along the Highland Border and a small area of Permian to Jurassic rocks near Lossiemouth, the only significant post-Devonian deposits are the widespread Quaternary glacial deposits.



Solid geology of the Grampian Highlands. P915411.



Geological sequence and events in the Grampian Highlands. P915452.

The only pre-Caledonian basement rocks exposed appear to be the metamorphosed acid and basic plutonic rocks of the Rhinns of Islay and Colonsay, dated as about 1800 Ma (million years old) ([P915452](#)); they are not correlatives of the Lewisian gneisses of the foreland to the north-west of the Great Glen Fault. The Rhinns rocks are overlain by the low-grade Colonsay Group metasedimentary rocks, whose correlation across a splay of the Great Glen Fault with the rocks on the mainland of Scotland is still uncertain, although a late Precambrian age for the Colonsay Group seems most likely.

Late Precambrian metamorphosed sedimentary rocks of the Dalradian Supergroup, and a wide variety of igneous rocks intruded into them, form most of the Grampian Highlands. The Dalradian sedimentary rocks, many kilometres thick, are mostly of shallow-water origin, although deeper-water turbidite deposition became predominant in late Dalradian times. The oldest of the metasedimentary rocks are now largely migmatized (Central Highland Migmatite Complex) and there is still debate as to whether they are stratigraphically part of the Grampian Group of the Dalradian or constitute an earlier basement; this handbook will take the former view. The protoliths of the migmatites and of the Grampian Group were mainly sandy sediments (the main rock types now are various psammites); most were shallow-marine shelf deposits but there are indications of penecontemporaneous faulting which led to development of small basins in which more muddy turbiditic sandstones accumulated. Stable shallow-marine deposition followed, resulting in deposition of quartzite-shale-limestone sequences of the Appin Group, in which some stratigraphical units maintain a constancy of character across the Grampians from north-east to south-west, and even into Ireland. Deposition of shallow-marine deposits continued and formed the Argyll Group, but growing instability on the shelf led to development of relatively small fault-bounded basins. The resultant deposits generally show poor stratigraphical continuity (although one barium-rich horizon extends intermittently for about 90 km) and increasing influence of turbidite deposition. Further indication of increasing instability and crustal extension is provided by the basic volcanic rocks which appear in the upper parts of the Argyll Group, and continue into the Southern Highland Group, particularly in the South-west Highlands. The dominant rocks of the Southern Highland Group are, however, turbiditic metagreywacke sandstones and siltstones.

There are still considerable disputes about the detailed structure of the Grampian Highlands, and particularly about the timing of the various events within the Caledonian Orogeny; radiometric ages conflict to some extent with the stratigraphical evidence. Nevertheless, the overall general structure is fairly well understood. It involved early recumbent nappe folding, probably directed towards the north-west overall but with at least one major SE-facing fold, the Tay Nappe, which dominates the Southern Highlands. The nappe folds were deformed by subsequent folds and thrusts of generally similar trend and form, and by a series of later, generally upright folds which trend in a variety of directions; they include a major monofold or downbend along the Highland Border. This downbend was probably associated with uplift prior to the obduction on to the margin of the Highlands of the Cambro-Ordovician rocks and ophiolite suite which together constitute the Highland Border Complex and which are preserved as a number of separate slivers within the Highland Boundary Fault Zone.

Generally, the metamorphism reflects the stratigraphy with the highest grade (upper amphibolite facies) being in the older rocks of the north-west and the lowest grade, greenschist facies, in the youngest Southern Highland Group rocks along the Highland Border. This general pattern is, however, modified in the North-east Highlands where there is extensive development of migmatite in the Argyll Group rocks of Angus and southern Aberdeenshire, and in northern Aberdeenshire where there are lower pressure-high temperature andalusite- and sillimanite-bearing assemblages. These are probably the result of the high local heat flow which also resulted in the intrusion of large volumes of basic and acid plutonic igneous rocks there. A narrow zone of greenschist facies rocks at

a low structural level is preserved adjacent to the Great Glen Fault Zone.

Early magmatic activity, already noted in the upper parts of the Dalradian sequence, is also found in small amounts at lower levels in the Appin and Grampian groups, and even in the migmatite complex, as small basic intrusions, now mainly represented by amphibolites. Magmatism culminated, however, during and after the late stages of the Caledonian deformation and metamorphism; in the Ordovician the layered basic masses and granites of the north-east referred to above, and then large plutons of granitic rocks and associated volcanics and dyke swarms in the late Silurian and early Devonian (P915452) were intruded. All of these igneous rocks constitute the Caledonian Igneous Suite.

It is evident that the post-orogenic plutonic rocks were intruded during a phase of very active uplift and erosion so that by early Devonian time the area of the Grampian Highlands was one of considerable relief in which the full range of Dalradian metasedimentary rocks and Caledonian igneous rocks was exposed at the surface. Late Silurian to Devonian deposition (Old Red Sandstone facies) was mainly to the north and south of the Grampian Highlands, in the Midland Valley and Orcadian basins respectively, but sediments also accumulated in mainly fault-controlled basins within the mountain belt (e.g. those of Tomintoul, Cabrach and Rhynie) or on the periphery (e.g. those of Oban and Kintyre). The rocks are mostly clastic— scree breccias, conglomerates, sandstones and siltstones. Around Oban there is also an extensive development of andesitic lavas within the Lower Old Red Sandstone. The Moray-Buchan coastal area represents the southern margin of the large, continental Orcadian Basin. The basal units of the Old Red Sandstone here are typically scree and fan breccias and conglomerates which pass upwards and northwards into a sequence of mainly lacustrine fine sandstones with fish-bearing limestone and calcareous sandstone beds.

Along the Highland Border near Loch Lomond, Old Red Sandstone facies rocks of Devonian age pass up generally conformably into cornstone-bearing sandstones of Lower Carboniferous age. Apart from two other small occurrences in the South-west Highlands the only other Carboniferous sedimentary rocks occur in the Machrihanish Coalfield on the Kintyre peninsula. Although north-west of the Highland Boundary Fault, this has stratigraphical affinities with the Midland Valley, and includes a condensed sequence of Carboniferous strata extending up to the Coal Measures.

The late Palaeozoic is also represented by two suites of minor intrusions. Thick dykes of quartz-dolerite, the northern edge of a swarm which is centred in the Midland Valley, occur in the Southern Highlands from Loch Awe to Aberdeenshire and are of late Carboniferous to earliest Permian age. Numerous thin dykes and small vents of alkaline lamprophyre occur in parts of the South-west and Central Highlands; they are younger than the quartz-dolerites, but have yielded some older radiometric ages.

North of the Central Highlands, the fault-controlled Moray Firth Basin (an embayment of the North Sea) developed from the southern part of the Orcadian Basin with more or less continuous deposition from Late Devonian times to the present. Most of this deposition remains offshore but on the Moray coast around Lossiemouth there are small outcrops of Permo-Triassic and Jurassic rocks, mainly continental facies sandstones which have yielded a rich reptile fauna.

There is no unequivocal evidence of Cretaceous rocks in situ in the Grampian Highlands but they occur offshore to the north and east and may have encroached on land; indeed the present river system has been interpreted as having developed initially on a Cretaceous cover, and angular flints are common in some Quaternary gravels.

The Palaeogene and Neogene appear to have been mainly times of erosion in the Grampians; little

evidence of deposits remain apart from some deep weathering profiles and gravels of probable fluvial origin in the north-east which are interpreted as being of Neogene age. In the south-west, however, there are several swarms of dykes, mainly basaltic, associated with the volcanic centres of the British Tertiary (Palaeogene) Volcanic Province, notably those of Mull, Arran and the submarine Blackstones Complex.

During Quaternary times it is probable that an ice cap was centred on the Northern Highlands and South-west Highlands during several glacial episodes. Over much of the area there is evidence of considerable glacial erosion, but deposits are mostly confined to those of the last (Late Devensian) glaciation; these include tills, various fluvio-glacial deposits and, near Inverness, glaciomarine sands and gravels. Inland from the Moray Firth and North Sea coasts, however, there are various isolated occurrences of older interglacial peats and glacial tills and gravels.

[Full list of references](#)

Retrieved from

'http://earthwise.bgs.ac.uk/index.php?title=Summary_of_the_geology_of_the_Grampian_Highlands&oldid=34545'

Category:

- [Grampian Highlands](#)

Navigation menu

Personal tools

- Not logged in
- [Talk](#)
- [Contributions](#)
- [Log in](#)
- [Request account](#)

Namespaces

- [Page](#)
- [Discussion](#)

Variants

Views

- [Read](#)
- [Edit](#)
- [View history](#)
- [PDF Export](#)

More

Search

Navigation

- [Main page](#)
- [Recent changes](#)
- [Random page](#)
- [Help about MediaWiki](#)

Tools

- [What links here](#)
- [Related changes](#)
- [Special pages](#)
- [Permanent link](#)
- [Page information](#)
- [Cite this page](#)
- [Browse properties](#)

- This page was last modified on 31 January 2018, at 15:47.

- [Privacy policy](#)
- [About Earthwise](#)
- [Disclaimers](#)

