

Late-tectonic granitoid intrusions, Caledonian magmatism, Grampian Highlands

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Late-tectonic granitic intrusions

Three distinct suites of late-tectonic granitic intrusions are recognised in the northern Grampian Highlands. Two of the suites consist of S-type granites, commonly foliated and garnet-bearing, which postdate the regional migmatisation, the major basic intrusions described above and the D₃ tectonic episode. One suite in the north-east (36–45) is dated at 475–470 Ma, and the other, in the north-west (46–52), is dated at 445–435 Ma (See table in [Caledonian magmatism, Grampian Highlands](#)). The third suite (53–55) consists of I-type diorites, tonalites and granodiorites.

(i) North-eastern biotite-muscovite-granites

Several members of this group have yielded U/Pb monazite ages of 470 to 475 Ma and Rb/Sr isochrons of 435 to 470 Ma (Pankhurst, 1970; 1974; Pidgeon and Aftalion, 1978; Kneller and Aftalion, 1987). The former has been taken as the best estimate of the time of intrusion and the latter as the age of the main cooling episode. Age determinations for individual intrusions are listed in [Caledonian magmatism, Grampian Highlands](#). The **Kemnay** (36) and **Aberdeen** (37) granites comprise grey, foliated biotite-muscovite-granite with a composition very similar to that of the minimum melt (Munro, 1986b). Some primary muscovite occurs, although most of the muscovite is secondary. Contacts with the Dalradian country rocks are gradational, passing through a zone containing partially digested xenoliths into country rocks which had previously suffered regional migmatisation. The **Auchlee** (38) and **Cove** (39) granites to the south of Aberdeen are similar in composition to the Aberdeen granite and also show gradational contacts. The **Strichen** (40), **Forest of Deer** (41), **Aberchirder** (42), **Longmanhill** (43), and **Lochlundie** (44) (Read, 1923) granites are all light grey, unfoliated, porphyritic biotite-granites showing marked similarities to the Kemnay and Aberdeen intrusions. However, muscovite, where present, is secondary.

The basic masses of the north-east Grampians are cut by a suite of biotite-granites, of which **Ardlethen** (45) is the largest, and has associated aplites and pegmatites, the latter muscovite- and tourmaline-bearing with rare beryl. This suite is roughly coeval with the Aberdeen and related granites, but its members lack a foliation and the finer-grained members are frequently reddened.

(ii)North-western biotite-muscovite-granites

The members of this suite of late-tectonic granitic intrusions were probably intruded at 445 to 435 Ma in: [Caledonian magmatism, Grampian Highlands](#). Initial $^{87}\text{Sr}/^{86}\text{Sr}$ ratios of members of this suite are in the range 0.714 to 0.718, indicating that they are S-type granites with magmas involving melting of a metasedimentary protolith. No significant gravity or magnetic anomalies are associated with them.

The **Ardclach Granite** (46; Horne, 1923) is pink, coarse grained and biotite and muscovite bearing; megacrysts of potash feldspar are zoned, with inclusion trails. Contacts of the pluton are poorly defined, with a xenolithic medium-grained marginal granodiorite facies passing outwards into a vein complex.

The **Moy Granite** (47) varies from porphyritic biotite-granodiorite to rare biotite-granite (Zaleski, 1985). The abundance of feldspar megacrysts increases towards the southern part of the intrusion. Rafts and xenoliths of country rock are locally abundant close to the eastern margin of the granite. The margins of the intrusion are marked by intense granite veining. There is little evidence of hornfelsing of adjacent country rocks. The Moy Granite was subsequently intruded by the post-tectonic Saddle Hill Granite.

The **Grantown Granite** (48) comprises a fine- to medium-grained microcline-bearing granite with a subordinate leucogranite phase (Highton, 1999), and both are weakly to moderately foliated (Mackenzie, 1958). It is locally garnetiferous, and in places extensively recrystallised, with abundant epidote porphyroblasts. Muscovite is present throughout, but appears to be secondary. The main phases are cut by sheets and veins of foliated aplitic microgranite and pegmatite. Emplacement appears to have been by passive stoping, with the preservation of a 'ghost' metasedimentary stratigraphy through trains of rafts and xenoliths. Contacts are mostly obscured, with the exception of the western margin, which is seen to be sheeted and characterised by large screens of metasedimentary material. The intrusion has no discernible metamorphic aureole.

The **Glen Kyllachy intrusion** (49) is essentially formed of a coarse-grained foliated biotite-granodiorite, which is locally hybridised through the assimilation of metasedimentary material. It is cut by leucocratic variants and a weakly foliated microcline-granodiorite (van Breemen and Piasecki, 1983). Relationships with the Findhorn granodiorite are complex and unknown in detail.

The **Maol Chnoc** granite and vein-complex (50) lie to the north-east of the Foyers granite. They comprise a complex network of ramifying medium-grained intrusions ranging in composition from granodiorite to granite, with felsite stockworks (Highton, 1987). The biotite-granodiorite is strongly deformed, with prominent small-scale shear zones, mostly resulting from the forceful emplacement of the Foyers Granite.

The **Strathspey Complex** (51) consists predominantly of biotite-muscovite-granite which is locally garnetiferous (Smith, 1970); the granite is seen to grade into pegmatitic patches. Emplacement appears to have been by passive stoping, but with many metasedimentary enclaves, preserving a ghost stratigraphy and structure. The margin of the body is a sheeted vein complex several kilometres wide. The complex postdates the local D_4 folds but predates the NE-striking Loch Tay fault system.

The **Loch Laggan Granite** (52) is an intense vein-complex of granites and pegmatites but also includes some aplites and microgranites (Anderson, 1956; Key et al., 1997). It is older than the main phases of the Corrieyairack and Strathspey complexes.

(iii) North-eastern diorites to granites

The members of this suite range from diorite to granodiorite, are in some cases foliated, and are highly xenolithic, with the more acid members carrying xenoliths of the more basic phases.

The **Kennethmont Complex** (53; Sadashivaiah, 1954; Read and Haq, 1965; Busrewil et al., 1975) was emplaced at the western end of the Inch basic mass and ranges from diorite to granite in composition. A Rb/Sr whole rock isochron of 453 ± 3 Ma and initial Sr isotope ratio of 0.7145 (Pankhurst, 1974) were obtained from the pink granite of the complex, which Busrewil et al. (1975) have suggested is a later, unrelated post-tectonic intrusion cutting the diorite and the xenolithic grey granite. The Kennethmont diorites were originally considered (Sadashivaiah, 1954) to be hybrids resulting from contamination of granitic magma by assimilation of gabbroic material from the Inch mass. However, Busrewil et al. (1975) regard the diorite as representing the primary Kennethmont magma, with the grey granite being a differentiate of it.

The **Syllavethy** intrusion (54; Gould, 1997) varies from a foliated, xenolithic quartz-diorite to an unfoliated grey granodiorite. The **Tillyfourie Tonalite** (55; Harrison, 1987) consists of tonalite with minor granodiorite showing a marked foliation. Both are associated with an extensive tonalite–granodiorite vein complex in the area between them. No age data are available for either intrusion or for the vein complex, but the Tillyfourie Intrusion and the vein complex are cut by the late-tectonic Corrennie granite and the post-tectonic Crathes, Balblair and Bennachie granites, and the group is provisionally assigned to the late-tectonic suite. The small **Corrennie Granite** (84), which forms an elongate body of pink, leucocratic granite with a foliation defined by the streaking out of quartz crystals, cuts the Tillyfourie intrusion.

Seven-fold division of the Caledonian Igneous Suite

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[Syntectonic granitic intrusions](#)

[Syn- to late-tectonic basic and ultramafic intrusions](#)

Late-tectonic granitoid intrusions

[Post-tectonic granitoid intrusions](#)

[Late- to post-tectonic minor intrusions](#)

[Lower Old Red Sandstone volcanism](#)

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