Caledonian magmatism, Grampian Highlands

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Caledonian magmatism, introduction

In the discussion which follows, the established divisions of Older, Syntectonic and Newer Igneous Rocks used in the third edition of this handbook have largely been modified, to become a seven-fold division of the Caledonian Igneous Suite. Each division or grouping is linked to one or more episodes in the history of deformation events in the development of the Caledonian Orogen, which spanned the period from about 750 to 390 Ma. Excluding the events recorded by the tectonically emplaced Highland Border Complex (Chapter 9), the principal magmatic episodes were as follows:

1. Pre-tectonic basic magmatism† (magmatism predates the Caledonian Orogeny as currently defined)

2. Syntectonic granitic intrusions† (magmatism predates the Caledonian Orogeny as currently defined])

3. Syn- to late-tectonic basic and ultramafic intrusions

4. Late-tectonic granitoid intrusions

5. Post-tectonic granitoid intrusions

6. Late- to post-tectonic minor intrusions

7. Lower Old Red Sandstone volcanism

The distribution of components of these groups, except for the minor intrusions, is shown on P915434; each is numbered and referenced in italics in the above articles, e.g. ***Dunfallandy Hill Granite*** (8).

The age of an intrusion with respect to the tectonic history of the surrounding rocks cannot always be determined from the local field evidence, especially in areas of poor exposure, and hence certain intrusions have been assigned to a suite by analogy with petrologically similar intrusions whose structural setting is better known. It should be noted also that the three latest suites were largely contemporaneous.

On P915434	Name	Age (Ma)	Type	$87Sr/86Sr_i$	Geochronological reference
Pre-tectonic basic magmatism					
2	Tayvallich	595 ± 4	U/Pb Zr	—	Halliday et al., 1989
Syntectonic granitic intrusions					
6	Ben Vuirich	590 ± 2	U/Pb Zr	—	Rogers et al., 1989
8	Dunfallandy Hill	481 ± 15	Rb/Sr WRI	0.7185 ± 0.0008	Pankhurst and Pidgeon, 1976
9	Glen Clova (Rough Craig)	549 ± 44	Rb/Sr WR	0.7166 ± 0.0024	Robertson, 1994
Syn- to late-tectonic basic and ultramafic intrusions					
14	Insch	489 ± 17	Rb/Sr WRI	0.7117 ± 0.0003	Pankhurst, 1970
23	Huntly	476 ± 5	K/Ar Bi	—	Brown et al., 1965
27	Haddo House	491 ± 6	K/Ar Bi	—	Brown et al., 1965
Late-tectonic granitoid intrusions					
(i) North-eastern biotite-muscovite-granites					
26	Belhelvie pegmatites	472 ± 5	Rb/Sr WRI	0.7185 ± 0.0016	van Breemen and Boyd, 1972
36	Kemnay	411 ± 7	Rb/Sr Mins	0.715 ± 0.002	Bell, 1968
37	Aberdeen	470 ± 1	U/Pb Mon	—	Kneller and Aftalion, 1987
38	Auchlee	439 ± 7	Rb/Sr Mins	0.733 ± 0.004	Bell, 1968
40	Strichen	475 ± 5	U/Pb Mon	—	Pidgeon and Aftalion, 1978
		455 ± 22	Rb/Sr WRI	0.7172 ± 0.0011	Pankhurst, 1974
42	Aberchirder	444 ± 9	Rb/Sr WRI	0.7157 ± 0.0008	Pankhurst, 1974
43	Longmanhill	470 ± 50	Rb/Sr WRI	—	Pankhurst, 1974
(ii) North-western biotite-muscovite-granites					
46	Ardclach	475 ± 7	U/Pb Mon	—	Zaleski, 1983
47	Moy (main phase)	455 + 27/ -15	Rb/Sr WR + U/Pb Mon	0.7185 ± 0.0001	Zaleski, 1983
49	Glen Kyllachy	443 + 5/-15Rb/Sr	WR/Bi	0.7176 ± 0.0004	van Breemen and Piasecki, 1983

50	Maol Chnoc	436 ± 8	Rb/Sr Mins	0.717	Clayburn, 1981
51	Strathspey	437 ± 16	K/Ar Bi	—	Miller and Brown, 1965
52	Loch Laggan	439 ± 7	Rb/Sr Mins	0.705 - 0.718	Clayburn, 1981
(iii) North-eastern diorites to granodiorites					
53	Kennethmont	453 ± 4	Rb/Sr WRI	0.7145 ± 0.0013	Pankhurst, 1974
Post-tectonic granitoid intrusions					
(i) South Grampian Suite					
56	Garabal Hill–Glen Fyne	406 ± 41	Rb/Sr WRMI	0.705 ± 0.003	Summerhayes, 1966
	Garabal Hill–Glen Fyne	429 ± 22	U/Pb Zr	—	Rogers and Dunning, 1991
57	Arrochar	426 ± 33	U/Pb Sph	—	Rogers and Dunning, 1991
65	Comrie	408 ± 5	Rb/Sr WRMI	0.705 - 0.707	Turnell, 1985
	Rubha Mor (Appinite pipe)	427 ± 3	U/Pb Sph	—	Rogers and Dunning, 1991
(ii) Argyll Suite					
66	Moor of Rannoch	408 ± 18	K/Ar Bi; Rb/Sr WRMI	0.7048	Miller and Brown, 1965; Clayburn, 1981
67	Strath Ossian	405 ± 9	Rb/Sr WRMI	0.7059	Clayburn, 1981
		400 ± 10	U/Pb Zr	—	Pidgeon and Aftalion, 1978
68	Ballachulish	406 ± 34	Rb/Sr WRI	0.7040 ± 0.0002	Haslam and Kimbell, 1981
72	Etive	401 ± 64	Rb/Sr WRI	0.7058 ± 0.0004	Clayburn et al., 1983
		396 ± 125	Rb/Sr WRI	0.7055 ± 0.0005	Clayburn et al., 1983
74	Foyers	c.415	various	—	Pankhurst, 1979
		405 ± 86	Rb/Sr WRMI	c. 0.707	Clayburn, 1981
		403 ± 97	Rb/Sr WRMI	c. 0.7045	Clayburn, 1981
75	Findhorn	413 ± 5	Rb/Sr WRMI	c. 0.706	van Breemen and Piasecki, 1983
77	Corrieyairack	434 ± 9	Rb/Sr WRMI	0.7056	Clayburn, 1981
78	Allt Crom	c. 405	Rb/Sr WR	0.7056	Clayburn, 1981
81	Crathes	420 ± 2	K/Ar Bi	—	Brown et al., 1965
(iii) Cairngorm Suite					
87	Moy (Saddle Hill)	407 ± 5	Rb/Sr WRI	0.7081 ± 0.0002	Zaleski, 1983
90	Ben Rinnes	411 ± 3	Rb/Sr WRI	0.7072 ± 0.0020	Zaleski, 1985
93	Monadhliath	419 ± 5	Rb/Sr WRI	0.7058 ± 0.0008	Harrison and Hutchinson, 1987

94	Cairngorm	408 ± 3	Rb/Sr WRI	0.7062 ± 0.0004	Harmon et al., 1984
95	Lochnagar	415 ± 5	Rb/Sr WRI	0.7065 ± 0.0002	Halliday et al., 1979
96	Glen Gairn	404 ± 6	Rb/Sr WRI	0.7081 ± 0.0015	Harrison and Hutchinson, 1987
98	Mount Battock	416 ± 4	Rb/Sr WRI	0.7058 ± 0.0004	Harrison and Hutchinson, 1987
102	Hill of Fare	413 ± 3	Rb/Sr WRI	0.7057 ± 0.0003	Halliday et al., 1979
103	Bennachie	400 ± 4	Rb/Sr WRI	0.7062 ± 0.0004	Darbyshire and Beer, 1988
104	Middleton	398 ± 19	Rb/Sr WR	0.7092 ± 0.0181	Darbyshire and Beer, 1988
105	Peterhead	406 ± 13 volcanic rock	Rb/Sr Mins	—	Bell, 1968
Lower Old Red Sandstone volcanic rocks					
108	Lorn Plateau	400 ± 5	Rb/Sr WRI	0.7047	Clayburn et al., 1983
		421 - 413	Ar degassing	—	Thirlwall, 1988
NB All Rb/Sr and K/Ar ages recalculated using the decay constants of Steiger and Jaeger, 1977. WR = Whole rock (no isochron) WRI = Whole rock isochron WRMI = Whole rock – mineral isochron Mins = Mineral age (no isochron) Bi = Biotite Zr = Zircon Mon = Monazite Sph = Sphene					
1 Average for complex 2 Appinitic diorite 3 Appinite 4 Meall Odhar Granite 5 Central Starav Granite 6 Tonalite and granodiorite 7 Granite.					

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