Mourne Mountains Complex, Palaeogene intrusive centre, Northern Ireland

From Earthwise


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Mourne Mountains Complex

Panoramic view of the south side of the Mourne Mountains extending from the east flank of Finlieve to the west flank of Slieve Binnian. Looking north from Aughrim Hill [J 282 180] the contact between the western and eastern centres follows the Kilkeel-Hilltown Road. (P948032)

The Ben Crom reservoir from the Brandy Pad [J 333 284], 1 km east of the Hare’s Gap. The base of the cliffs on Ben Crom is the contact between fine- to medium-grained granites of the G2 Inner facies forming the summit area and fine-grained
G3 granite. (P948033)

Geological map of the Eastern Mournes Centre - from Hood, D N. 1981 (12); Cone-sheets and dykes not shown. (P947867)

<table>
<thead>
<tr>
<th>Granite Type</th>
<th>Colour, as per Figure 15.3</th>
<th>Petrographic characteristics of the granites of the Eastern Mournes Centre (12). (P947945)</th>
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(P947945)
Geological map of the Western Mournes Centre - from Gibson, D. 1984 (13); Conesheets and dykes not shown. (P947868)

<table>
<thead>
<tr>
<th>Granitoid type</th>
<th>Finer-grained marginal</th>
<th>Finer medium-grained</th>
<th>Coarse-grained</th>
<th>Meta-meso-grained</th>
<th>Meta-gneissic</th>
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</thead>
<tbody>
<tr>
<td>Colour</td>
<td>pale, greyish-brown</td>
<td>deep, greyish-brown</td>
<td>light grey</td>
<td>pinkish-grey</td>
<td>bluish-grey</td>
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<tr>
<td>Quartz</td>
<td>small, dark, equant grains</td>
<td>pink grey, small grains</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Plagioclase Feldspar</td>
<td>white, small, anhedral grains</td>
<td>white to cream with bushy large subhedral grains</td>
<td>very fine to medium-grained interstitial grains</td>
<td>white, small, subhedral grains</td>
<td></td>
</tr>
<tr>
<td>Alkali Feldspar</td>
<td>pale pink to greyish-brown subhedral grains</td>
<td>dextral, subhedral, subhedral</td>
<td>fine to medium subhedral grains</td>
<td>fine subhedral grains</td>
<td></td>
</tr>
<tr>
<td>Texture</td>
<td>granule with drusy cavities</td>
<td>granophyric, porphyroblastic to granitic</td>
<td>coarse-grained, granitic</td>
<td>monomineralic to granitic</td>
<td>monomineralic to pseudomorphs</td>
</tr>
</tbody>
</table>

Petrographic characteristics of the granites of the Western Mournes Centre (13). (P947946)
Rhythmic layering in boulder (90 cms long) of G1 granite from the Eastern Mournes Centre. (P948034)

The Hare’s Gap and Slieve Bernagh from the Diamond Rocks [J 331 286] on the Brandy Pad, all formed of fine-grained granite of the G2 Inner facies. (P948035)

A. Mode of intrusion of the Mourne Granites (15) and B. revised interpretation based on the mapping of the Eastern Mournes Centre.
The Mourne Mountains granite complex was intruded into Silurian greywacke and slate country rock at a high level in the crust around 56Ma but did not reach the surface. The complex consists of five principal granite intrusions (G1-G5) which are divided between a western and an eastern centre. Each of the four youngest granites (G2-G5) was emplaced as a series of smaller magmatic pulses that are distinguished by distinct textural variations. Geophysical evidence indicates that denser, more basic rocks underlie the granite complex. Rare xenoliths of gabbro and anorthosite are found in some later dykes and may have originated from that basic body.

Geochemically, the five granites form a single subalkaline acid fractional crystallization series, in which G1, the most basic, originated by differentiation of a crustally contaminated basaltic melt in the upper continental crust.

The Eastern Mournes Centre consists of three intrusive members. The earliest component G1, a hornblende-biotite syenogranite was followed by G2, a biotite granite with abundant dark quartz and finally by G3, a fine-grained aplitic biotite syenogranite. Each main granite, G1 Roof, G2 Outer Mafic Facies, G2 Outer Normal, G2 Inner and G3 can be recognised in the field by its petrographic characteristics. In addition, a range of textural variations from fine- to coarse-grained has been recognised within G2 and G3 and many internal contacts are exposed between the different types.

The Western Mournes Centre consists of two granites. G4 is biotite granite and G5 a biotite ± amphibole microgranite or granophyre. Each granite can be recognised in the field by its petrographic characteristics and a range of textural variations. In each centre there were sufficiently long intervals between the intrusion of successive magma pulses to allow each magma to solidify and a fine-grained margin to form on the later intrusion.

Direct field evidence of the involvement of crystal fractionation in the crystallisation of felsic magmas is rare in British Palaeogene granites. However, in the Mourne Mountains Complex a boulder, some 0.9 m in length, which probably originated from the G1 Roof granite in the Eastern Mournes shows rhythmic layering. The layering appears to have formed by the settling of dense mineral clusters and consists of dark, 1-2cm thick mafic-rich layers enriched in fresh olivine (fayalite), amphibole, biotite, Fe-Ti oxides, zircon, apatite and allanite relative to the adjacent, paler, leucocratic cumulate.

One of the most notable features of the Mourne granites occurs at the Diamond Rocks. Here the granite, which is a fine-grained facies of a pulse of G2 magma located just below a roof formed in the same granite, has developed a ‘drusy’ texture as a result of gas streaming in the volatile rich magma. The drusy cavities contain a concentration of euhedral crystals of smoky quartz, feldspar, mica, beryl and topaz.

At the present level of erosion, the geometry of the intrusions indicates that the three early granites (G1-G3) are arranged within one another with a marked eccentricity towards the southwest. The granites were probably emplaced in a series of pulses of rising magma. Each pulse was introduced into an ever-widening sloping ‘wall’ fissure connected to a ‘roof’ fissure, the space created by the subsidence of a block or blocks of country rock bounded by outward-sloping ring fractures—the cauldron subsidence or ring dyke model of emplacement. In the Eastern Mournes Centre only roof pendants of G1 remain (hence the name G1 ‘Roof’) and an original ring dyke for this granite cannot be inferred with any certainty. Outcrops of the Outer portion of G2 may represent relatively steeply sloping walls without any true roof connections. In contrast, exposures between and within G2 Inner and G3 show flat or gently sloping roof-type contacts.
Centre the same mode of intrusion has been proposed for G4 and G5, although at the present level of erosion only flat-lying roof contacts are exposed. This emplacement mechanism allowed the granites to be intruded without causing significant uplift or doming of the country rocks.

Fragments of the Silurian country rocks that formed the ‘roof’ of the granite complex are exposed on several peaks in the eastern and western Mournes. Also, a screen of Silurian country rocks is exposed as a thin sliver wedged into G2 Outer at the eastern edge of the Eastern Mournes Centre at Slievenagarragh. During intrusion of the granites the country rocks were indurated and thermally metamorphosed to form diopside- and biotite-bearing hornfels extending several hundred metres from the contact. The hornfels is well exposed around the eastern edge of the Mourne Mountains in coastal cliffs, in the river above Bloody Bridge [J 387 269] and in the Glen River [J 370 299] southwest of Newcastle.

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