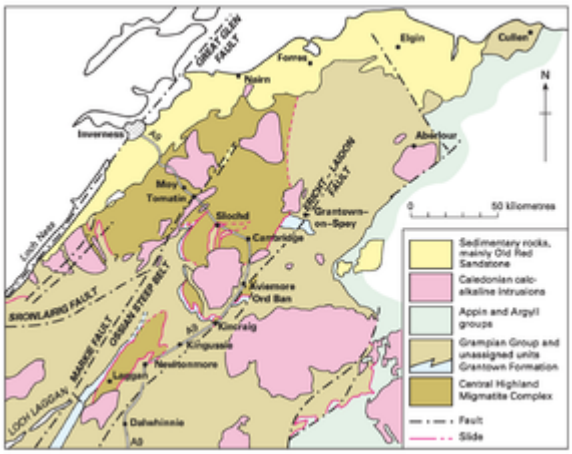
Central Highland Migmatite Complex, Grampian Caledonides

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

Central Highland Migmatite Complex

Large areas of migmatites occur in the northern part of the Grampian Highlands (P915416). Those east and south of Inverness were generally regarded as stratigraphically equivalent to the surrounding psammitic rocks, and all were equated with the younger part of the Moine succession north-west of the Great Glen Fault. Detailed mapping, with concomitant isotopic age determinations, of the migmatites in the 1970s led to the radical re-interpretation of their stratigraphical and structural significance (Piasecki and van Breemen, 1979a; 1979b; Piasecki and Temperley, 1988). The migmatites were recognised as a distinct tectonostratigraphical unit referred to as the Central Highland Division, and regarded as an older basement to the adjacent psammites. Recently this interpretation has been challenged and the traditional view that the Central Highland Division comprises migmatised versions of the adjacent rocks has been restated (Lindsay et al., 1989); here it is referred to as the Central Highland Migmatite Complex.



Distribution of the Central Highland Migmatite Complex (modified after Piasecki and Temperley, 1988). P915416.

The main outcrop of the Central Highland Migmatite Complex covers about 100 km^2 to the south-east of Inverness with isolated outcrops occurring at Ord Ban, Kincraig and Laggan. The base of the migmatites is not exposed but the highest parts are infolded with Grampian Group metasedimentary rocks. This upper contact is defined as being at the limit of migmatisation but in many places the contact is at a tectonic break, the Grampian Slide Zone (see next section and Chapter 6). Within the migmatite complex are tectonic slices of non-migmatitic, recognisable Grampian Group lithologies, and podded metagabbroic sheets (Highton, 1992). Pegmatites and quartz veins are particularly well developed in shear zones such as the Grampian Slide and are of great significance in the dating of tectonothermal events (Chapter 6).

Migmatitic semipelite showing both fine- and coarse-grained contorted leucosome segregations. Central Highland Migmatite Complex. P220399.

The migmatitic complex consists of coarse-grained psammites, quartzites and pelitic and semipelitic gneisses at upper amphibolite-facies metamorphic grade. The gneisses are generally migmatitic, with granitic (quartz-alkali feldspar) leucosomes predominant in the psammitic rocks and trondhjemitic (quartz-plagioclase) leucosomes in the semipelites (P220399). Metasedimentary calc-silicate bands and pods are usually confined to notably striped psammitic units.

Four main lithofacies were recognised by Piasecki and Temperley (1988):

1. Coarse quartzofeldspathic gneisses, with alternating feldspathic, siliceous and biotitic bands, commonly accentuated by parallel quartzo-feldspathic veins.
2. Coarsely foliated, massive to regularly layered semipelitic gneisses; usually migmatitic and commonly with quartzofeldspathic or siliceous ribs, grading into other gneissose lithologies.
3. Psammitic, often migmatitic, gneisses, in which quartz-rich layers are interbanded with layers containing more biotite and/or feldspar. In rare non-migmatitic areas of low strain, rhythmic banding is present, with the preservation of thin, graded units.
4. Very coarse-grained, usually massive, feldspathic quartzites, typically conspicuously migmatitic. With the development of biotitic layers the quartzites grade into psammitic gneisses.

Pods and lenticular bodies of gneissose amphibolite (metagabbro), with or without garnet, are common in the semipelitic and quartzofeldspathic gneisses.

No attempt has yet been made to establish an overall internal stratigraphical framework within the migmatite complex. The intense high-grade tectothermal deformation, lack of marker horizons, rarity of preserved sedimentary structures and variable degrees of migmatisation are such that the original stratigraphy within the complex is very difficult to identify. Some local structural–lithological successions have been recognised and, in Glen Banchor, Piasecki and Temperley (1988) produced the following tripartite subdivision of a well-exposed 1000 m-thick section.

1. *Upper Psammitic group*. Psammites containing discontinuous quartzites pass structurally upwards into micaceous psammites lacking interbedded quartzites. These psammites are overlain by a semipelite unit which contains numerous pods of garnet-amphibolite. The structural top of the group is defined by a psammitic unit with interbanded thin quartzites and pods of garnet-amphibolite.

1. *Middle Pelitic group* Essentially coarse-grained, biotite-gneisses with associated fine-grained schists rich in muscovite and almandine garnet. The gneisses occur in lensoid areas of low ductile strain, and the schists are interpreted as their reworked equivalents. The upper part of the group is highly sheared and contains at least three zones of very high strain.

1. *Lower Siliceous group* Thick units of psammitic gneisses, massive feldspathic quartzites and only minor semipelitic units.

Throughout the Central Highland Migmatite Complex sedimentary structures have been largely obliterated and replaced by ductile tectonic fabrics and metamorphic textures. An early widespread gneissification produced migmatites with regularly spaced and sharply defined layers. The layering, which ranges from several millimetres to centimetres in thickness, is defined by varying proportions of feldspar, quartz and biotite produced by quartz-plagioclase (trondhjemitic) segregation. The gneissose banding appears to be broadly concordant with the original bedding. A second migmatisation, also with trondhjemite segregations, accompanied a later localised development of ductile shearing and folding. Minor folds of the early migmatitic banding, and ductile shear zones are the main structures seen at outcrop. The folds include early recumbent isoclines and later more open asymmetric upright folds. The shears, including the Grampian Slide, are developed preferentially along lithological boundaries or within the least competent lithological horizons. Within the shear zones a mylonitic fabric largely obliterates the gneissose banding and is planar and penetrative in the psammitic lithologies but is commonly lenticular or ribbon-like in the more pelitic rocks. Numerous *en échelon* lenticular and laterally persistent quartz veins, and boudinaged pegmatites, are developed subparallel to the mylonitic foliation.

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