Comrie (Strathconon)

[NH 413 560]

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Introduction

Metabasic rocks, now mainly amphibolite sheets or pods, are particularly abundant in parts of the Moine Supergroup. Near Comrie, in Strathconon, lenticular amphibolitic mafic bodies are notably abundant in folded psammites and minor semipelites that lie in the lower part of the Loch Eil Group, here called the 'Tarvie Psammite Formation' (see Holdsworth *et al.,* 1994). The regional geology is shown in (Figure 6.47). The mafic bodies are pervasively foliated except in the central parts of thick lenses, where relict igneous textures are preserved. Original discordant relationships between the intrusive mafic bodies and the bedded Moine psammites can still be seen, although the amphibolite bodies are now strongly deformed.

Early mafic sheets that pre-date the structural fabrics and folds are locally common in the Moine metasedimentary succession, particularly around the Glenfinnan Group-Loch Eil Group boundary. Farther south in Glen Moriston (see Glen Doe GCR site report, Chapter 8) folded and boudinaged mafic dykes and sheets, now amphibolites and metagabbros, cross-cut the Ardgour Granite Gneiss (Millar, 1990, 1999). These metagabbros have been dated at 873 ± 6 Ma (Millar, 1999) and this age of intrusion is indistinguishable from that of the West Highland Granite Gneiss Suite at 873 ± 7 Ma (Friend *et al.,* 1997). The ages were obtained from zircons using U-Pb TIMS and SHRIMP methods respectively.

L.W. Hinxman first mapped the amphibolites around Comrie for the Geological Survey in 1900 and 1901. He noted their folded nature and commented on their particular density and thickness in the Scatwell-Comrie-Cnoc Dubh area, north-west of Loch Achilty (Horne and Hinxman, 1914).

Description

At the Comrie GCR site the amphibolitic mafic bodies and adjacent psammites are exposed on two smooth glaciated rocky knolls, 15–20 m high. They lie adjacent to the minor road between Contin and the dam at Loch Luichart (Figure 6.49), (Figure 6.50). Unfortunately, the two knolls that constitute the GCR site show considerable growth of lichen and moss that obscure some of the more-detailed geological features. However, contacts of the mafic bodies with the bedded psammites are well seen at numerous localities (Figure 6.49), and internal features are preserved in parts. For example, relict gabbroic textures in the amphibolites are exposed on clean slabs immediately east of the sheepfolds at [NH 4133 5602].

The mafic rocks are black and mottled black and white, medium-grained, hornblende-rich amphibolites, with some coarser-grained patches that retain relict igneous textures. Hornblende clots up to 2 cm by 1 cm are seen, and euhedral feldspars, now recrystallized, still show ophitic textures in places. Brick-red garnets from 1 mm to 2.5 mm across are very abundant close to the margins of the metabasic body but sparse or absent elsewhere. The amphibolites contain a foliation defined by the hornblende alignment, but the marginal 10–35 cm-wide zone is strongly foliated. Locally, shear zones marked by finely foliated amphibolite also occur within the metabasic bodies. Horne and Hinxman (1914) gave petrographical descriptions of the Comrie mafic rocks. The typical amphibolite consists of green hornblende and plagioclase feldspar (upper andesine) laths with development of irregular sphenes containing ilmenite or rutile cores in places. Anhedral quartz and sieved epidote-clinozoisite grains are developed, probably as a result of the breakdown of labradoritic plagioclase feldspar to a more-albitic (Na-rich) variety during metamorphism. Other thin sections contain up to 80% green hornblende with subsidiary plagioclase feldspar, quartz and irregular garnets and sphene. llmenite, magnetite and ruffle are common accessory minerals.

The Tarvie Psammite Formation in this area consists of feldspathic psammites with siliceous and micaceous beds and minor semipelitic units. Cross-beds are seen at [NH 4126 5602] and hematite-stained seams are present, probably representing magnetite-rich heavy-mineral laminae in the original sands.

Some 130 m SSE of Comrie farm buildings, small rocky psammite exposures by the track show excellent tight small-scale folds with a penetrative axial-planar cleavage that dips steeply south-east. Minor thin lenticular amphibolite sheets up to 60 cm thick are present in the psammites. The folds and related penetrative cleavage are clearly refolded by secondary open folds with an accompanying NNW-trending steeply dipping cleavage.

Contacts of the mafic sheets are normally parallel or sub-parallel to bedding in the adjacent psammite, but locally can be markedly discordant, for example at [NH 4141 5608]. The pervasive foliation in the amphibolite bodies is orientated close to bedding in the psammites, and passes through discordant contacts with virtually no deflection. Within the amphibolite are lenticular and irregularly shaped enclaves of pervasively recrystallized coarse-grained gneissose psammite. The psammite adjacent to the contact is typically pinkened, recrystallized and coarsened, and thin quartz and quartz-feldspar pegmatite veins are present. Horne and Hinxman (1914) record a 'calcareous biotite schist' at the margin of a thick metabasic sheet about 200 m north of Comrie Farm, but this appears to correspond to a sheared and faulted contact between the mafic sheet and the psammites.

Interpretation

The mafic rocks were originally dolerite (and rarely gabbro) sheets that intruded the dominantly psammitic Moine sequence prior to the first major penetrative deformation. Generally they were concordant with bedding in the adjacent Loch Eil Group metasedimentary rocks, but at least locally they cut across the bedding at moderate to high angles. U-Pb TIMS dating of zircons from the metagabbros at Glen Doe, farther south, show that similar mafic bodies were intruded at around 873 Ma at considerable crustal depth (Millar, 1999) (see Glen Doe GCR site report, Chapter 8). Only relatively minor contact effects are seen at Comrie and the main mineralogical changes and development of thin quartz and quartz-feldspar pegmatite veins can be attributed to subsequent deformation and metamorphism. The overall outcrop pattern in the Comrie area appears to reflect large-scale tight folding and boudinage of the more-competent metabasic sheets.

The mafic rocks have been metamorphosed to amphibolites, and normally contain a pervasive foliation that is contiguous with the penetrative S2 cleavage in the adjacent psammites. The presence of almandine garnet, generally close to the margins of the basic bodies, relates to either the original composition of the mafic intrusion (e.g. locally more iron-rich) or more probably to metamorphic fluid diffusion effects involving the adjacent psammites and subsidiary semipelites.

The intrusive mafic rocks in the Strathconon district form a distinct swarm, part of a larger suite within the Moine succession that extends from the north coast of Sutherland southwards to the Strontian Pluton (Smith, 1979). Winchester (1976) distinguished two separate swarms farther west in Ross-shire, one with a tholeiitic basalt geochemistry, and the other showing more-alkaline basalt affinities. Moorhouse and Moorhouse (1979) showed that geochemically distinct swarms ('suites') were also present in Sutherland. Millar (1990) found that the metadolerites and metagabbros in Glen Moriston are all tholeiitic with affinities to present-day Mid-Ocean Ridge Basalts, but different intrusions did show different geochemistries.

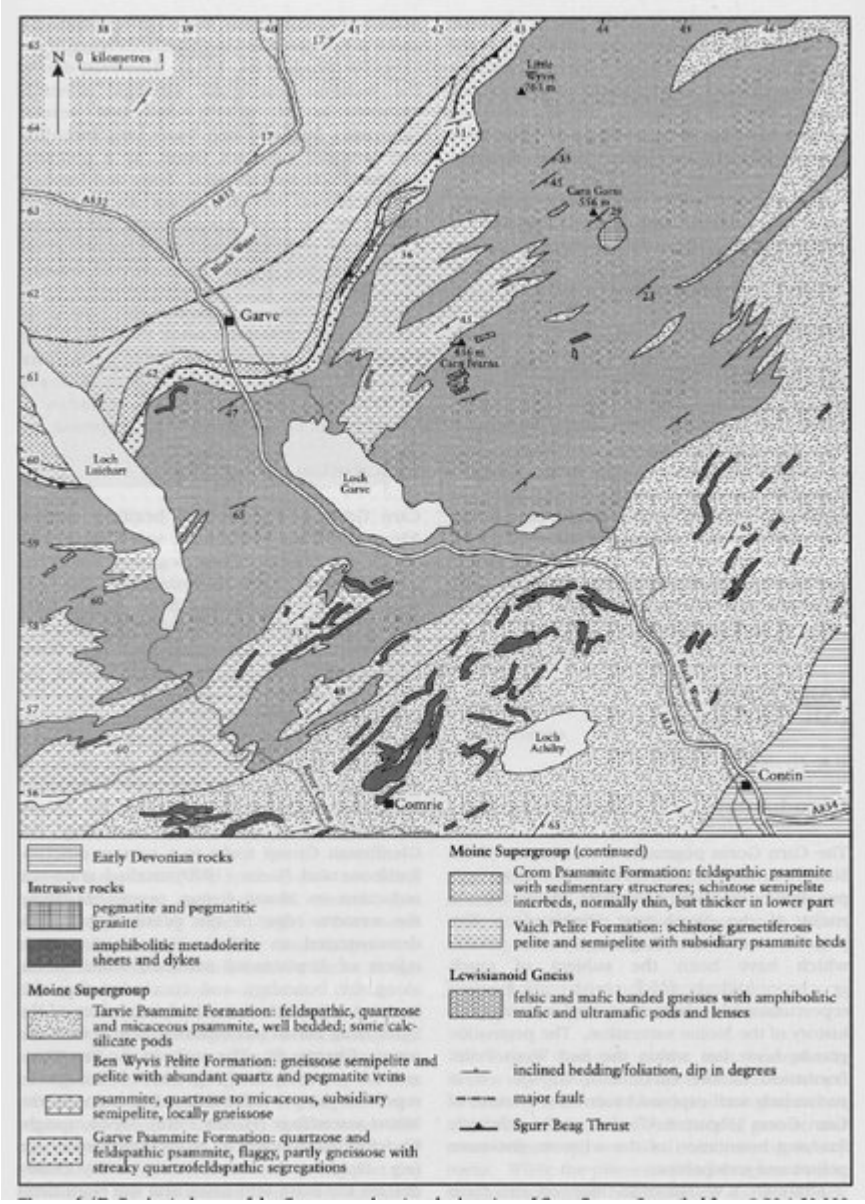
Conclusions

The Comrie site shows many of the typical features of the early mafic rocks that intrude the Moine metasedimentary succession of the North-west Highlands. Although pervasively deformed and metamorphosed under amphibolite-facies conditions, in their central parts they do retain igneous textures, and although normally concordant, locally show discordant contacts. Their metamorphic mineralogy and foliated nature attest to their pre-tectonic emplacement. The lenticular mafic intrusions form regional swarms or clusters, whose map outcrop pattern implies may have originally been quite discordant to the bedding in the psammites. The mafic bodies are particularly well developed in the lower, dominantly psammitic part of the Loch Eil Group. Their lenticular nature is largely a product of the Neoproterozoic and

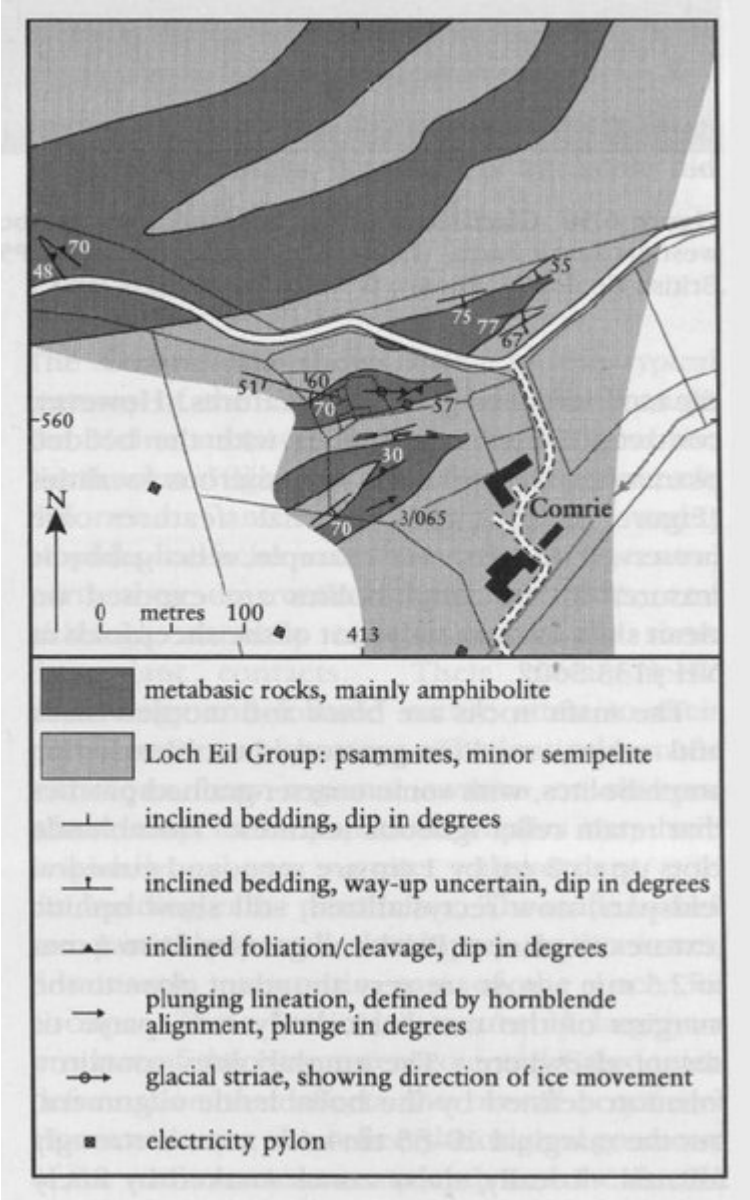
Caledonian deformation that affects the overall sequence. However, it may also reflect the original geometry of the mafic intrusions at depth and the ductile nature of the host metasedimentary rocks.

The Comrie site is important as a representative of the typical metabasic bodies in the Moine succession. The generally low strain in the Comrie area has preserved some of the original intrusive features of the intrusions.

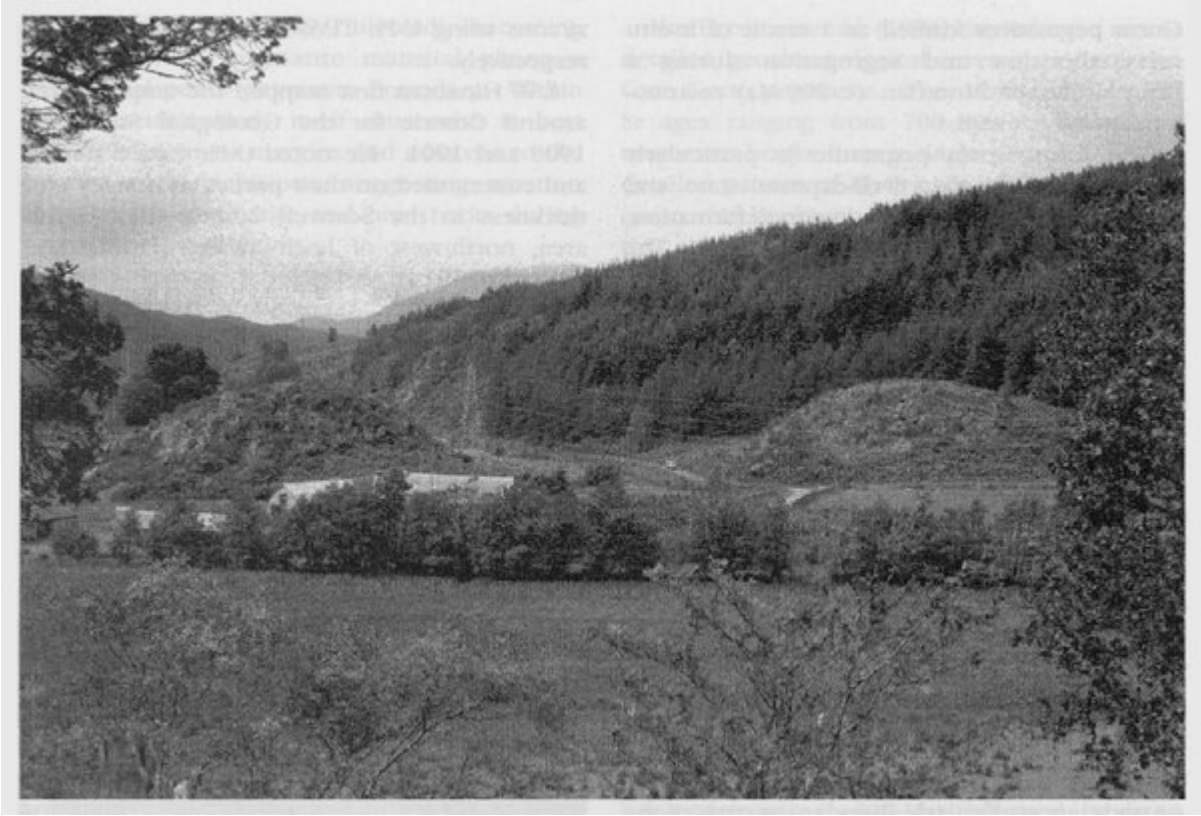
References



(Figure 6.47) Geological map of the Garve area showing the location of Carn Gorm. Compiled from BGS 1:50 000 sheets 83W Strathconon (British Geological Survey, 2001) and 93W, Ben Wyvis (British Geological Survey, 2004a).



(Figure 6.49) Geology of the area around Comrie Farm, Strathconon.



(Figure 6.50) Glaciated rock knolls formed of amphibolitic mafic sheets and lenticular pods. Looking northwest to Comrie Farm. (Photo: J.R. Mendum, BGS No. P552291, reproduced with the permission of the Director, British Geological Survey, © NERC.)