3 The Slochd

[NH 836 257]–[NH 833 240]–[NH 842 240]

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3.1 Introduction

The Slochd is one of the key localities described by Piasecki and Temperley (1988b) as representative of the gneissose and migmatitic basement rocks that stratigraphically and structurally underly the Dalradian Supergroup. These authors postulated the existence of an orogenic unconformity, but in most places where it is exposed, the apparent junction was interpreted as being obscured by a zone of ductile shearing, which they termed the Grampian Shear-zone or Slide (see the *An Suidhe* GCR site report). Crucially, at The Slochd, Piasecki and Temperley (1988b) presented evidence of an undeformed contact between older crystalline basement (their 'Central Highland Division') and its cover sequence (their 'Grampian Division'). The basement was considered to be of possible Grenvillian age (*c.* 1000 Ma) and to have experienced amphibolite-facies migmatization, gneissification and deformation prior to the deposition of the 'Grampian Division'. This was in agreement with evidence from the Grampian Shear-zone to the south, where Rb-Sr whole-rock and mineral (muscovite) ages from pegmatitic granite veins indicated that the basement rocks, and possibly the lower parts of the cover sequence, preserve the record of two tectonothermal events, namely the Knoydartian (*c.* 840–750 Ma) and the Grampian (*c.* 470–450 Ma). The evidence for an undeformed unconformity at The Slochd is no longer accepted, but the overall premise of an orogenic unconformity has been substantiated by subsequent work.

The Slochd GCR site includes the A9 road section described by Piasecki and Temperley (1988b) and extends for 1.5 km southwards, via scattered exposures and stream sections to the west of the railway line (Figure 5.8). The site is dominated by moderate to strongly gneissose, migmatitic psammite (Figure 5.9), semipelite and quartzite, which were assigned to what is now termed the Dava Subgroup of the Badenoch Group by Smith *et al.* (1999). These strata are locally in sheared contact with grey micaceous striped psammites and semipelites of uncertain stratigraphical affinity. These were considered by Piasecki and Temperley (1988b) and Highton *et al.* (1999) to be correlatable with the Grampian Group on lithological and textural grounds. One possibility is that they are equivalent to the Kincraig Formation at the *An Suidhe* GCR site.

The contacts between the two main lithostratigraphical units are poorly exposed and are marked by a series of narrow N–S-trending zones of blastomylonite and phyllitic semipelite and psammite that locally host distinctive sheets of quartzofeldspathic pegmatite. Podiform lenses of metagabbro and amphibolite are distinctive and widespread throughout the site. The rocks have moderately to steeply dipping foliations and occur in a broad zone of map-scale reclined folds (F2) that have been refolded about N–S-trending axes of later upright folds (F3). They preserve a variety of tectonic fabrics and amphibolite-grade metamorphic textures. Highton (1992) and Highton *et al.* (1999) have proposed a model of tectonic interleaving or imbrication to account for the disposition of the various lithologies.

The area was first mapped during the primary geological survey of the Highlands (Hinxman and Anderson, 1915) and was resurveyed at the 1:10 000 scale as part of the BGS 1:50 000 Sheet 74W (Tomatin, 2004). The resurvey included a ground-based magnetometer survey, which was carried out to detect the extent of the shear-zones and host lithologies (Leslie *et al.,* 1999). A brief description of the geology and a useful sketch of the A9 roadcut *cf*. (Figure 5.10)b are included in an excursion guide (Piasecki and Temperley, 1988b).

3.2 Description

The Dava Subgroup, equivalent to the ‘Central Highland Division’ of Piasecki and Temperley (1988a) and the ‘Central Highland Migmatite Complex’ of Stephenson and Gould (1995) and Highton (1999), comprises variably gneissose to locally strongly migmatitic semipelite, psammite with subordinate siliceous psammite, quartzite and pelite with lenses of pale-brown to cream-coloured calcsilicate rock. It is divided into the Slochd Psammite, Creag Bhuidhe Semipelite and Beinn Breac Psammite formations (Figure 5.8). The complete absence of sedimentary structures in these rocks precludes the determination of the stratigraphical relationships and inhibits detailed interpretation of the regional structure. Parts of the Dava Subgroup, mainly the Beinn Breac Psammite appear to be similar lithologically to the Glen Banchor Subgroup farther to the south at Kincraig and in Glen Banchor but detailed correlations have yet to be established.

The Slochd Psammite Formation dominates the eastern part of the GCR site and forms the core to a major reclined fold. This unit is exposed at the south-eastern end of the A9 roadcut (Figure 5.10)a. Its upper contacts are poorly exposed or faulted (as in the roadcut) but are marked by narrow zones of ductile shear and are assumed to be highly tectonized. The formation is dominated by coarse-grained, cream to pinkish-yellow gneisosse feldspathic psammite (Figure 5.9). It is commonly strongly migmatitic and contains monzogranite leucosomes, which coalesce locally into discordant veins and sheets of gneissose granite up to 10 cm in thickness. Zircons extracted from various parts of this rock (at [NH 8380 2520]) have yielded U-Pb ages that indicate new zircon growth at 840 ± 11 Ma (Highton *et al.,* 1999). Thin bands of semipelite occur sporadically and thicken locally into mappable units, as in the railway cutting at [NH 8418 2405].

The Creag Bhuidhe Semipelite Formation crops out north of the A9 around Carn nam Bain-tighearna and in stream sections south of Torr Mor (Figure 5.8). It is a medium- to coarse-grained gneissose biotite and muscovite semipelite that is spectacularly migmatititic, with a well-developed stromatic texture defined by layers of tonalitic leucosome and bound by screens of biotitic melanosome. All of the original texture in these rocks has been destroyed by metamorphic processes.

The Beinn Breac Psammite Formation is exposed in crags south of Torr Mor (e.g. at [NH 8319 2454] and [NH 8311 2365]). It is composed of grey medium- to coarse-grained banded micaceous psammite and psammite, variably gneisosse with bands of siliceous psammite and quartzite. Interbedded units of semipelite and impure quartzite and pods of calcsilicate rock are common, particularly towards the contacts with the Creag Bhuidhe Semipelite Formation. The contact with the Creag Bhuidhe Semipelite Formation is marked by a prominent band of feldspathic and migmatitic quartzite, locally interbanded with semipelite and micaceous psammite. This unit, which can be traced around the western limb of the fold structure, is lithologically similar to the Blargie Quartzite of the Kincraig and Glen Banchor districts.

The structurally, and probably the stratigraphically, highest strata are mainly bound tectonically by zones of ductile shear. These strata comprise interlayered and striped, non- to weakly gneissose, grey micaceous psammite and semipelite with lenses of calcsilicate rock. The central section of the A9 roadcut provides a section through the northern part of a thin shear-bounded unit (Figure 5.10)b. The main exposures within the GCR site are west of the railway line at [NH 8403 2418] and south-west of Torr Mor in the Allt Ruighe an-t sabhail [NH 837 242]. Together these strata form the easternmost outcrops of a series of shear-bounded lenses of non-gneissose striped psammitic and semipelitic units that elsewhere contain beds of quartzite. The semipelitic component is segregated, dark and interlayered with thin ribs of quartzite and calcsilicate rock grading outwards into striped garnet-muscovite-kyanite-fibrolite-bearing banded semipelite and psammite. Muscovite porphyroblasts up to 6 cm in diameter are common and weather proud locally to impart a knobbly appearance to the rock. These strata host pegmatitic granite veins and, where strongly sheared, contain common lenticular ribbons of quartz-feldspar augen and veins of quartz, particularly towards the contact with the adjacent quartzite.

At the north-west end of the A9 roadcut, a thin bed of quartzite intervenes between the above strata and the Creag Bhuidhe Semipelite. This unit can be traced for 1.3 km southwards before pinching out tectonically. It comprises pinkish orange to grey, well-jointed feldspathic quartzite, interlayered with banded gneissose psammite and rare thin lenses of semipelite, up to 5 cm thick. All contacts between these lithologies and the Slochd Psammite and Creag Bhuidhe Semipelite formations are sheared and are marked by fine-grained bands of mylonite and phyllonite. The evidence of grading in these rocks described by Piasecki and Temperley (1988b) has not been confirmed by the recent BGS survey.

Scattered outcrops of podiform dark-green metagabbro are a common distinctive feature of the Slochd area (Highton, 1992; Wain, 1999). These bodies, up to 50–70 m in length and 20 m in width, are hosted by all the main lithologies and are elongated within the main foliation. They are medium to coarse grained and commonly preserve relict ophitic textures and schistose amphibolitic margins. The largest mass (250 × 60 m) occurs 800 m south-east of Torr Mor at [NH 8394 2456] and is cut by late quartzofeldspathic pegmatite. The metagabbros are envisaged to have been emplaced after the peak of regional metamorphism and migmatization but before the main D2 shearing event.

Late-stage post-tectonic pegmatitic granite veins, thin sheets of microdiorite and felsitic minor intrusions cross-cut all the rocks of the GCR site. Bands of biotite amphibolite and hornblende schist in the A9 roadcut, reported by Piasecki and Temperley (1988b), are re-interpreted here as foliated sheets of microdiorite intruded along contacts and deformed by late-Caledonian events.

The Slochd GCR site lies within a NW-trending deformation zone dominated by SW-verging reclined folds and fabrics and termed the Foyers–Cairngorm Lineament by Smith *et al.* (1999). The local structure is dominated by a map-scale F2 fold, cored by the Slochd Psammite, that has been refolded by an upright N-S-trending F3 fold into a classic hook interference structure. In the absence of facing and fabric evidence it is not known if the early fold is antiformal or synformal. All of the rocks contain evidence of an early phase of deformation (D1) associated with amphibolite-facies metamorphic conditions. An early gneissosity (S1), formed by solid-state recrystallization and probably mimetic on the original compositional layering, is preserved within rare intrafolial minor folds. The main deformation (D2) formed large-scale, shallowly plunging, tight to isoclinal reclined folds and reworked the earlier gneissose foliation. Minor folds have S2 axial stretching and mineral lineations, which plunge consistently at low angles to the north-north-west. Shearing and reworking along fold limbs and lithological boundaries were widespread locally, producing an intense S2 shear fabric. All earlier structures were then reworked and overprinted by an upright crenulation associated with the later open F3 folds. All three structural events took place under middle to upper amphibolite-facies metamorphic conditions. Unlike at the *An Suidhe* GCR site, no difference in tectonic histories of the postulated cover and basement rocks has been identified.

The Grampian Shear-zone is indicated by a series of narrow zones (a few metres wide) of distributed ductile shear that anastomose along or close to the main lithological contacts of the Dava Subgroup with the non-gneissose banded ‘cover’ lithologies. These zones, which have gradational boundaries with the enclosing lithologies, are identified by a marked grain-size reduction and the reworking of the S1gneissosity into fine-grained mylonitic, blastomylonitic and phyllonitic foliations that wrap subelliptical augen and porphyroblasts of plagioclase and muscovite. South-west of Bracklettermore, at [NH 8374 2285], a distinctive flaggy unit of semipelite hosts a thin (0.2 m) foliated vein of beryl-bearing pegmatitic granite with rotated and recrystallized augen of quartz and feldspar and porphyroblasts of garnet and muscovite. This vein is comparable to others observed at the *An Suidhe* and *Blargie Craig* GCR sites and is interpreted to have formed by strain-induced syn-tectonic recrystallization and to record an early phase of deformation that took place between 800 Ma and 750 Ma (Hyslop and Piasecki, 1999).

3.3 Interpretation

The Slochd GCR site exhibits a series of outcrops of high-grade metasedimentary strata and meta-igneous rocks whose early history has been destroyed by at least two high-grade tectonothermal events. Little grain-size, bed-form or other sedimentary evidence is preserved by which one could determine the environment of deposition of these rocks. The stratigraphical correlations of the ‘basement’ and ‘cover’ strata are unconfirmed but, by comparison with sections elsewhere in the Northern Grampian Highlands, correlations with the Glen Banchor Subgroup or Grampian Group are possible. If the non-gneissose strata are the lateral equivalent of the Kincraig Formation (Corrieyairack Subgroup), then a break in sedimentation is implied by the absence of any recognizable strata of the Glenshirra Subgroup at the base of the Grampian Group. Alternatively, the non-gneissose strata could represent a distinctive facies of the basement Dava Subgroup that has not been recorded elsewhere.

Piasecki (1980) was the first to propose that an orogenic unconformity separates what are now known as the Dava Subgroup and Grampian Group strata. In the absence of clear evidence he proposed, not unreasonably, that the

unconformity became the focus of ductile shear with the strain effects appearing to decrease with increasing distance from the contact. Crucial to this argument was the reported evidence in the Slochd A9 roadcut for an unconformable contact between migmatitic rocks (of the Slochd Psammite Formation) and overlying non-gneissose strata, and for the preservation of inverse grading in the latter. However, neither of these features has been confirmed by recent BGS surveys. The intensity of recrystallization and deformation during amphibolite-grade metamorphism has obliterated all early sedimentary structures and ductile deformation fabrics and has blurred original contact relations between the lithological units. The apparent striking textural contrasts between individual psammite units at The Slochd is a reflection of their bulk composition rather than of different tectonometamorphic histories. Thus microcline-rich feldspathic psammites of the Slochd Psammite Formation preferentially develop gneissose and migmatitic textures, in contrast to more-plagioclase-rich units of the 'cover' strata, which are comparatively unreactive and remain non-gneissose.

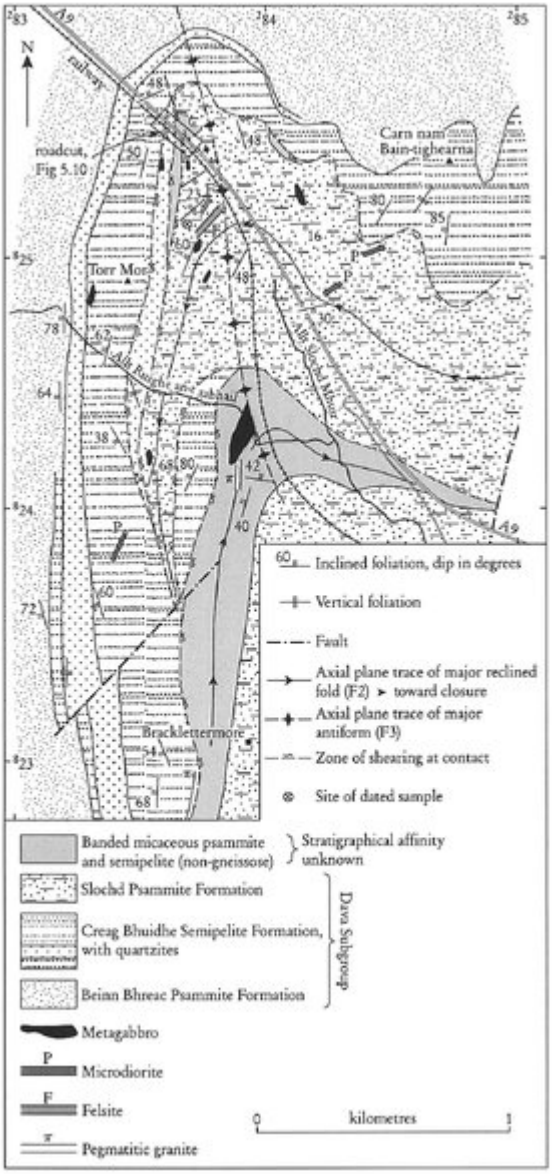
The timing of the various deformation and metamorphic events is also unclear. Peak amphibolite-facies metamorphism and development of gneissose and migmatitic fabrics is interpreted to have occurred at *c.* 840 Ma (Highton *et al.,* 1999). These fabrics were then strongly reworked in the Grampian Shear-zone and deformed during D2, whose age may be constrained, by analogy with dated monazites at Lochindorb (Noble *et al*., 1996), to have occurred at *c.* 800 Ma. However, the relationship of the dated monazites at Lochindorb and elsewhere to the regional D2 foliation, which is recorded in Grampian Group strata, and to the mylonitic fabrics in the Grampian Shear-zone, has not been confirmed and continues to be the subject of debate. Thus, unlike at the *An Suidhe* GCR site, there is no structural or metamorphic evidence at The Slochd to support an orogenic unconformity between any of the lithological units. There is however mounting evidence from elsewhere in the region that Piasecki (1980) and Piasecki and Temperley (1988b) were correct in their overall interpretation, even though some of their detailed evidence has not been substantiated.

3.4 Conclusions

The Slochd GCR site has played an important historical role in the development of ideas regarding the structural and stratigraphical relationships of the basal Dalradian strata of the Northern Grampian Highlands. It includes one of the first documented examples of a possible cover–basement relationship for the Dalradian, but much of the original evidence has not been confirmed by recent surveys. Although the roadcut is easily accessible, the strata are highly disturbed by later faulting and evidence for an 'unconformity' is problematical. However, sheared contacts with syntectonic granitic veins between gneissose and non-gneissose strata are present and, as is the case elsewhere in the region (e.g. the *An Suidhe* GCR site), these could represent shearing along an original unconformity in what has been referred to regionally as the Grampian Shear-zone.

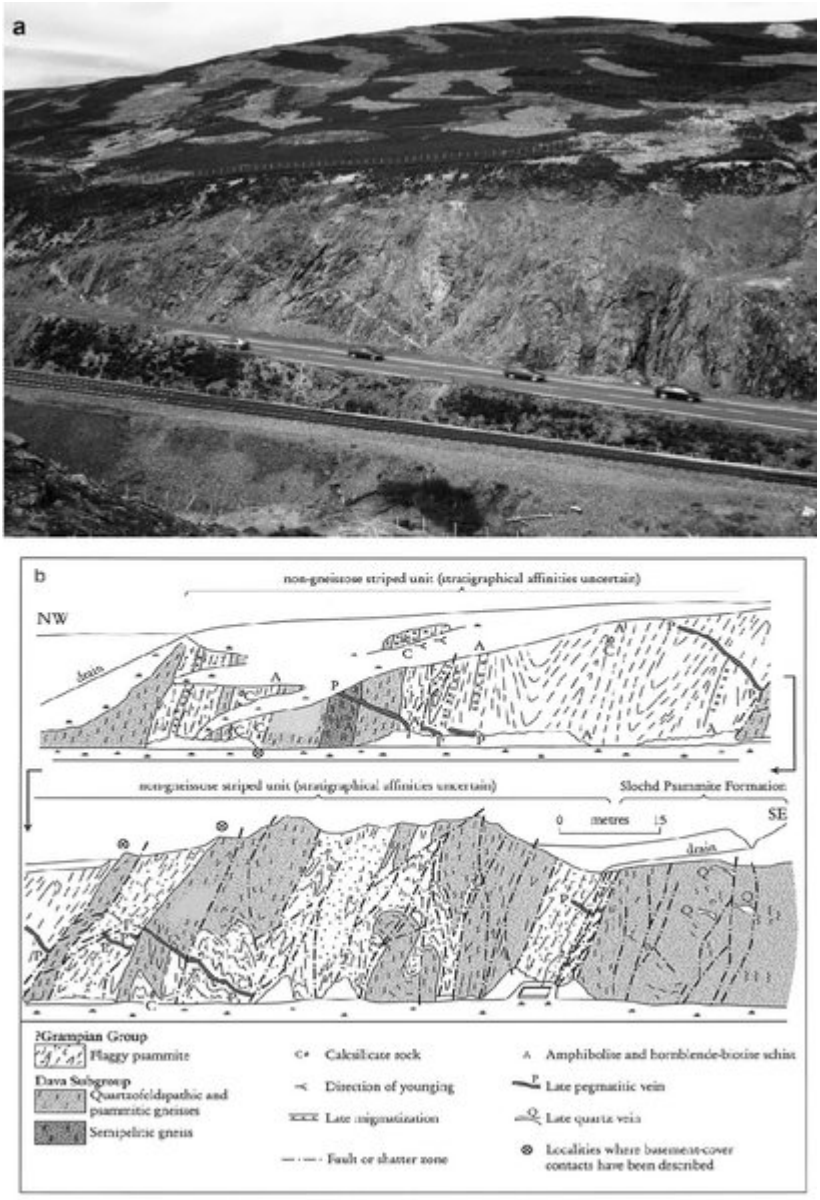
Migmatitic metasedimentary rocks of the Dava Subgroup of the Badenoch Group have provided the first radiometric evidence from south-east of the Great Glen Fault of new zircon growth during the Precambrian Knoydartian Event (*c.* 840 Ma). They clearly form an older basement to non-gneissose strata, which are tentatively assigned to the Grampian Group, although their exact stratigraphical relationships remain to be established.

References



(Figure 5.8) Map of the area around The Slochd GCR site(after BGS 1:10 000 sheets NH82NW and NH82SW, 1998).

(Figure 5.9) Migmatized gneissose psammite with leucosomes and incipient melt segregations, Slochd Psammite Formation, south-east of the road and rail summit at The Slochd at [NH 8370 2516]. Hammer head is 16.5 cm long. (Photo: BGS No. D 5586, reproduced with the permission of the Director, British Geological Survey, © NERC.)



(Figure 5.10) (a) The A9 roadcut at The Slochd [NH 8366 2548]. (Photo: BGS No. D 5582, reproduced with the permission of the Director, British Geological Survey, © NERC.) (b) Sketch of the geology seen in the A9 roadcut at The Slochd (after Piasecki and Temperley, 1988b).