
Excursion for Day 4

Prograde sequence in the Ballachulish Slate along the Gleann a' Fhiodh – Coire Chaorann ridge; appinite and quartzdiorite relations; migmatites and CRD+GRT and OPX hornfelses

Table 4 Itinerary for stops for day 4. Prograde sequence in the Ballachulish Slate along the Gleann a' Fhiodh – Coire Chaorann ridge; appinite and quartzdiorite relations; migmatites and CRD+GRT and OPX hornfelses

	Grid ref.(sheet NN)	Features
Stop 4-1 Low point of ridge	[NN 0690 5425]	Quartzite and regional grade crenulated graphitic slate. Zone I
Stop 4-2	[NN 0670 5415]	Incipient cordierite spotting in grey phyllites, Zone II
Stop 4-3	[NN 0655 5410]	Widespread cordierite spotting in grey phyllites, Zone III
Stop 4-4	[NN 0620 5380]	Cordierite-rich hornfelses, Zone III
Stop 4-5	[NN 0585 5380]	Massive andalusite+cordierite hornfelses, Zone IVa
Stop 4-6	[NN 0560 5340]	Massive brown-weathering andalusite-rich hornfelses and incipient melting phenomena. probable Zone V
Stop 4-7 Hill top	[NN 0545 5345]	Migmatized cordierite+K-feldspar+andalusite+sillimanite hornfelses, Zone V, subzone of partial melting
Stop 4-8	[NN 0535 5340]	Appinite and quartz diorite relations
Stop 4-9	[NN 0510 5305]	Well exposed migmatites
Optional Stop 4-9A	[NN 0475 5280]	Coarse andalusite and corundum
Optional Stop 4-9B	[NN 0385 5330]	Orthopyroxene-garnet hornfelses

The purpose of this excursion is to examine the well exposed prograde sequence of pelitic mineral assemblage zones developed in the graphite-rich Ballachulish Slate lithology. The prograde sequence in this lithology shows similarities to that examined on Day 3, but differs in Zone IV (upper cordierite zone), in that andalusite appears before K-feldspar. The traverse ends with examination of relations between appinite and quartz diorite of the main igneous complex, some well exposed migmatitic outcrops, and optional examination of garnet-orthopyroxene hornfels. (Figure 12) gives both geological and topographic maps for the excursion.

This is an all day traverse, involving 7–8 km of moderate walking with ca. 350 m elevation gain.

Note: To get to the start of the walking traverse as described below involves a drive of approximately 6km along the Forestry roads, and it is therefore necessary to have a key to the Forestry gates (see section on Logistics for Field Excursions). If, at the end of Day 4, it is desired to do Option (c) and examine the garnet-orthopyroxene hornfels (Stop 4-9B), it will save 3-4 km of walking at the end of the day if two vehicles are used. For this option, use the first vehicle to go to the start of the traverse and leave the second vehicle by the forestry road in Glen Duror at [NN 0370 5340] (to reach this point, refer to the 1:25,000 OS map and the note under the driving instructions for Day 4 below).

Directions to start of Day 4 traverse: You will drive well into the Glen Duror forest. taking much of the same route as followed on Day 2. Start at the junction of the Auchindarroch road with the A828 just north of the Duror Hotel, and set your odometer to zero at this junction. Follow the main paved road (1.75 miles (1.2 km), to where a paved road forks off to the right, whilst straight ahead the paving gives way to a dirt track which soon forks to give two tracks both barred by gates. You should proceed to the left-hand gate [NN 0050 5515], which is usually locked. but may be opened with the Forest Enterprise key (see section on Logistics for Field Excursions).

From the gate follow the 'main' (most 'straight-on') forestry road/track, avoiding the road to the right at 0.9 miles (1.5 km). At 1.65 miles (2.6 km), as measured from the A828, the road forks, with the exposures on the N (left) side of the road comprising Stop 2-1, and you take the right hand fork, which goes downhill and joins with a lower road at about 1.75 miles (2.8 km).

Note: this fork joining the upper and lower roads was constructed in the late 1980's and so does not appear on the 1978 Ordnance Survey map, although it has been added to the Coloured Map (Map 1), (Figure 7) and (Figure 10).

Continue along the main road/track beside the River Duror. At 2.05 miles (3.3 km), a small hydro dam is encountered in the River Duror. At 2.25 miles (3.5 km) proceed through gateposts (gate may be missing). At about 2.9 miles (4.6 km) a road comes in from the left (north). To head to the start of the traverse, turn left (north) onto this road.

Note for vehicle access to Stop 4-9B: If you have two vehicles and wish to leave one near to the end of the traverse at Stop 4-9B, do not turn left onto the road coming in from the north. Instead, keep straight on. After about 50 m, at [NN 0310 5360], is another intersection where a road goes off to the right. Using the OS 1:25,000 map as a guide, follow this road to the parking place at [NN 0370 5340] (see (Figure 12)).

Continuation of directions to start of Day 4 traverse: Continuing from the road junction at 2.9 miles (4.6 km) and heading northwards, proceed for about 300 m to an intersection (3.05 miles. 4.9 km from A828). At this intersection turn right and continue following the road/track heading ENE. Stop 2-2 and the parking place for the start of the Day 2 foot traverse are passed at 3.95 miles (6.3 km). At ca. 4.05 miles (6.5 km), a road comes in from the right (at [NN 0440 5440]), which you ignore and keep heading ENE for about another 0.4 miles (0.6 km) until the road bends round to the right (south) just after some light-coloured exposures on the left hand side of the road (4.5 miles; 7.1 km). Park the vehicle in the adjacent lay-by [NN 0505 5455].

Note: this was the termination of the forestry road when the 1978 1:25,000 Ordnance Survey topographic map was prepared. In the late 1980's the road was extended to the south and east for another 0.4 miles (0.6 km), as shown on the Coloured Map (Map 1). (Figure 7) and (Figure 12).

Walking directions from parking place to start of traverse: Before commencing you may wish to examine the exposures adjacent to the parking place. They are of fine-grained biotite quartz monzodiorite, part of the later 'granite' of the igneous complex. The fine-grained texture of the rock is probably due to its location close to the contact with quartzite. Other more 'normal' textured granites are found in nearby exposures occurring back along the forestry road.

From the lay-by proceed eastwards through the forest along the Glen Duror–Ballachulish footpath (indicated by a blue marker). After about 0.75 km, the forest ends at a fence with a stile. Cross the fence and continue following the path eastwards in the open glen for another ca. 1.5 km until a prominent stone cairn, slightly off the path down the slope towards the river, is reached [NN 0685 5485]. Set altimeter to 240m.

Stop 4-1. Quartzite and regional-grade crenelated graphitic slate, Zone 1. [NN 0690 5425], 372m.

Directions: While at the cairn, take a bearing of 185° to the low point of the ridge top to the south, which is where Stop 4-1 is located. Front near the cairn, cross the River Laroch where the Ballachulish-Glen Creran footpath crosses the river, but keep heading to 185° rather following this path. Note occasional boulders of dark grey cordierite-spotted hornfels in the river and along the banks. Ascend the slope southwards for ca. 700 m (elevation gain ca. 150 m) to prominent white exposures immediately east of the low point on the ridge. Note that this is several hundred metres to the northeast of where the Ballachulish-Glen Creran footpath crosses the ridge.

Description: To the east of the low point of the ridge are several exposures of white quartzite of the Appin Quartzite lithology. To the west of the low point, small exposures of crenelated grey phyllite with silty interbeds, characteristic of the Ballachulish Slate lithology, are scattered around this vicinity. On (Figure 12) and the Coloured Map (Map 1), a slide (fault) is indicated to pass between the grey phyllites and quartzites, cutting out the Transition Series lithology (Bailey & Maufe, 1960).

Samples collected from the grey phyllites contain the regional metamorphic assemblage Ms+Chl+Qtz with abundant graphite and sulphides, and hence belong to the Zone I regional metamorphic assemblage.

Stop 4-2. Incipient cordierite spotting in grey phyllites, Zone II. [NN 0675 5415], 380m.

Directions: From Stop 4-1, head SW for about 200m, contouring at about 380m along the north-facing (Gleann an Fhiodh) side of the slope. Along the way, examine closely exposures of phyllite for subtle evidence of spotting, which is best seen on clean cleavage surfaces. Stop 4-2 represents several small exposures along the ridge flank.

Description: Dark-grey crenulated phyllites, some with pyrite casts, are abundant. Silty interbeds occur in some exposures. Spots are fairly conspicuous in the crenulated phyllites, occurring as dark, 1-2 mm ovoid pits in the crenulated matrix. Fresh cordierite occurs in many of the spots. Primary chlorite is interlayered with muscovite in the matrix. The full assemblage is Ms+Chl+Bt+Crld+Qtz, definitive of Zone II (ca. 550 °C). The cordierite is thought to be introduced by the same reaction as in the Fraochaidh prograde sequence (reaction P1: Ms + Chl + Qtz = Crd + Bt + H₂O: see introduction). The location of the first occurrence of spotting (i.e., the initial cordierite-in. Zone I/II isograd) is difficult to determine exactly in this vicinity, but must lie between these exposures and Stop 4-1.

In one place (ca. [NN 0670 5415]), a late andesitic dyke with hornblende phenocrysts trending 035° cuts obliquely upslope. This is most likely a dyke of the Etive dyke swarm, some large examples of which are seen cutting across the slopes of Meall an Aodainn, visible over the ridge top to the SW.

Stop 4-3. Widespread cordierite spotting in grey phyllites, Zone III. [NN 0655 5410], 380m.

Directions: From Stop 4-2, continue heading WSW, contouring at about 380 m along the north face of the ridge, just below the ridge crest. The size and abundance of Crd-spotting increases markedly as one heads WSW. After about 100 m, large, dark shabby exposures are encountered above a steep-sided grassy gully with a few scattered trees. Immediately west of and above the gully is the Ballachulish - Glen Creran footpath, where a cairn is visible.

Description: The shabby exposures consist of abundantly spotted crenulated phyllite (see (Photo 16)), locally with silty interbeds and pyrite casts. The rocks are noticeably less fissile than at Stop 4-2, although crenulated cleavage surfaces are still obvious. The spots are also coarser than at Stop 4-2, ranging from 1-6mm across. Sometimes the spots weather down relative to the matrix on exposure surfaces, whereas in other places the spots weather up. The spots represent ellipsoidal inclusion-filled cordierite crystals that overgrow the matrix. The long axes (C-axes) of the ellipsoidal crystals generally lie parallel to the main cleavage. Most rocks from this locality contain fresh cordierite.

In contrast to Stop 4-2, samples taken from this locality show no primary chlorite, containing the assemblage Ms+Crld+Bt+Qtz. The absence of chlorite is characteristic of Zone III, and reflects consumption of chlorite through reaction P1. However, apparently primary chlorite has been observed in a single sample from about 50m west of the Ballachulish - Glen Creran footpath at about [NN 0655 5405], 380 m.

Consequently, there appears to be a narrow zone where rocks may contain either the Zone II (Chl-bearing) or Zone III (Chl-absent) assemblage: an effect which may be expected where the rocks have a range of bulk compositions (e.g. Fe:Mg ratios) and/or fluid-compositional variations. Neglecting the single sample noted above, the Zone II/III isograd for most rocks lies between Stops 4-2 and 4-3 as indicated on (Figure 12). Combined with the approximate constraints on the location of the Zone I/II isograd, the total width of Zone II in this vicinity is between 150 and 200 m, which is the widest interval for this zone in the aureole.

Stop 4-4. Cordierite-rich hornfelses, Zone III. [NN 0620 5380], 450m.

Directions: From Stop 4-3, cross the steep gully and the Ballachulish - Glen Creran footpath, and proceed across a level area with little exposure. As the ridge top rises to the WSW, follow the north-facing side of the ridge (going obliquely uphill, roughly parallel to the ridge top), where there are numerous good exposures of cordierite-spotted hornfelses, sometimes interlayered with more psammitic rocks and commonly showing small scale folds and locally strong

crenulation cleavage. As one goes up grade, the cordierite-spotted rocks become harder and less fissile, although crenulated cleavage surfaces are still obvious. Continue going uphill around the hillside until the slope faces NW (close to the ridge top), where there are good exposures below which lie many angular boulders.

Description: The exposures contain cordierite-pitted, crenulated grey phyllite with folds of bedding and cleavage. These contain the characteristic Zone III assemblage Ms+Crd+Bt+Qtz. but compared to Stop 4-3 the rocks are more indurated.

Stop 4-5. Massive andalusite+cordierite hornfelses, Zone IVa. [NN 0585 5380], 490m.

Directions: From Stop 4-4, bear west slightly uphill across a grassy area with relatively little exposure. Head to a steep exposure with a prominent scarp face that runs downhill, and in front of which flows a burn ([NN 0595 5375]. ca. 480 m). Cross the burn and climb over the scarp face, continuing west for about 50 m to numerous dark, prominent exposures.

Description: The rocks are (lark, grey-weathering, massive hornfelses, generally NE-striking with moderate-steep NW dips. Cordierite spotting and regional schistosity fabrics, although visible, are less obvious than at lower grade. Examining lichen-free weathered surfaces of the exposures, especially, surfaces normal to layering, the rock has a rough texture characterised by numerous small (< 1 mm) protruding points. On surfaces parallel to layering, small (< 5 mm long) prisms may additionally be discerned (see (Photo 17)). On broken surfaces, tiny (< 1 mm) glinting crystal faces (distinct from small biotite flakes) are visible.

These features are clue to the presence of abundant small andalusite crystals. The lull assemblage in the rock is Ms+Bt+Crd+And+Qtz, definitive of Zone IVa. In thin section the andalusite occurs in prisms whose margins range from dihedral to ragged, typically intergrown with biotite and quartz. consistent with andalusite formation by reaction P2a ($Ms + Crd = And + Bt + Qtz + H_2O$: ca. 600 °C). The andalusite isograd (i.e., Zone III/IVa boundary) is located in the vicinity of the scarp crossed en route to Stop 4-5.

Note that the Zone III/IV transition here, marked by the addition of andalusite to the Zone III Ms+Crd+Bt+Qtz assemblage. contrasts with the Zone III/IV transition examined in the Day 3 (Fraochaidh) traverse, in which K-feldspar rather than andalusite is developed up grade of the Zone III Ms+Crd+Bt+Qtz assemblage. The explanation for the contrast in prograde sequence is probably the difference in fluid composition between the graphite-rich Ballachulish Slate lithology of Day 4 and the graphite-absent Creran Succession phyllites of Day 3 (Pattison, 1989).

Stop 4-6. Massive brown-weathering andalusite-rich hornfelses and incipient inciting phenomena, probable Zone V. [NN 0560 5340], 590m.

Directions: From Stop 4-5, climb steeply uphill bearing 190–200° for about 300 keeping slightly to the east-facing slope of the hill, examining many good exposures of massive, andalusite-bearing hornfelses on the way. Eventually one reaches a small gulley-like feature with good exposure by a SW-trending fence at the top of the ridge ([NN 0575 5345], 570 m: indicated on the map); about 100 m to the SW, the SW-trending fence intersects with a NW-trending fence that runs uphill. The metapelitic rocks in the gulley strike NE, with a moderately steep NW dip, and consist of interbedded psammites and pelites; the latter show cordierite pits and are variably andalusite-bearing. Despite the Obvious amount of recrystallization, crenulated cleavage surfaces are still visible.

Optional examination of well developed ribbed texture in massive Zone IVa hornfelses Particularly good exposures of massive andalusite- and cordierite-bearing (Zone IVa) hornfelses, showing well-developed ribbed/pitted textures on weathered surfaces, are found about 100 m downslope to the ESE at [NN 0585 5340]. 540 m (indicated on map). To reach the exposures, a deer fence must be crossed (as of 1999). The ribbing is reminiscent of the white honeycomb-like ribbing or mesh seen at Stops 3-5 to 3-8 on Day 3 and Stops 5-2 to 5-6 on Day 5, only the ribs here are darker and lack K-feldspar, containing mainly muscovite and biotite. As seen elsewhere, the downward-weathering pits are the sites of weathered-out cordierite crystals. A strong preexisting crenulation fabric is seen in many layers.

Continuation of directions to Stop -1-6: From the gulley-like feature at the ridge top [NN 0575 5345]. bear SW, crossing the fence that trends uphill to the NW. Obviously layered exposures occur in the vicinity of the fence ([NN 0570

5340]: indicated on map), and these are more massive and brown weathering than at lower grade. From the fence, hear WSW, contouring along the south-facing slope for about 100 m to a prominent exposure above a scree slope: this is Stop 4-6.

Description: Compared to the (lark grey-coloured rocks up to and including Stop 4-5, the rocks at this exposure have a brownish colour and are strongly fractured, tending to break into angular chunks with brown, oxidized surfaces. The rock is massive and preserves none of the schistosity seen at lower grades, although primary layering is clearly visible. Many layers are psammitic. Some layers show numerous protruding 1–3 mm knobs which represent altered cordierite and andalusite crystals. In thin section, identification of the peak metamorphic assemblage is difficult because the rocks have been severely altered. Andalusite and altered cordierite are identifiable, and although no K-feldspar was observed, the outlines of sericitically-altered crystals are reminiscent of K-feldspar from other parts of the aureole. Sillimanite was observed in one sample. Based on the colour and massive texture of these rocks, the absence of schistosity, the occasional light-coloured ribbing, the rare presence of sillimanite, and a range of thin section textures, these rocks bear many similarities with Zone V rocks from elsewhere in the aureole (e.g., Day 3), even though fresh coexisting andalusite+K-feldspar has not been identified. If so, they indicate temperatures of about 650–700 °C.

Going from the east end of the exposure to the west end, there are changes in orientation of the layering and in textural and structural features of the hornfelses. At the east end of the exposure, the generally coherent layering has a strike and dip of about 055°/55° NW. At the west end of the exposure, the strike and dip of layering has passed across a steeply north-plunging anticlinal hinge and has a strike and dip of about 355°/80° W. Compared to rocks at the east end of the exposure, the rocks at the west end are more disrupted and contain more discrete quartzofeldspathic veins (both crosscutting and layer-parallel), with the change coinciding more or less with the change in orientation of layering. Locally boudin-type structures are seen at the west end, separated by quartzofeldspathic material, and in places the layering appears to lose its coherence.

The features at the west end of the exposure suggest the presence of a melt phase within the hornfelses. Whether this was a melt internally generated in the hornfelses or injected from the nearby quartz diorite, or some combination of the two, is uncertain and obscured by the degree of alteration of the rocks.

Stop 4-7. Migmatized cordierite+K-feldspar+andalusite+sillimanite hornfelses, Zone V, subzone of partial melting. [NN 0545 5345], 615m.

Directions: From the west end of Stop 4-6, hear WNW uphill for 100–150m until the top of a grassy knoll is reached, just beyond an old Li-trending fence. Examine small exposures in the vicinity of the knoll.

Description: Rocks in these small exposures show several of the macroscopic textures and structures seen in rocks at the west end of Stop 4-6, including local disruption of layering, small scale boudin-type structures and quartzofeldspathic veins. In some layers, the white ribbed texture of K-feldspar matrix surrounding downward weathering cordierite pits, such as seen abundantly in Zone IVb and at higher grades on Days 3 and 5, is present.

The main difference from Stop 4-6 is that many of the rocks are not as altered. The most common assemblage is And+Sil+Kfs+Crd+Bt+Qtz, with Kfs+Qtz-rich segregations showing igneous textures similar to those seen in migmatitic samples from elsewhere in the aureole. These rocks thus probably underwent internal partial melting, implying temperatures of about 700 °C. More abundant examples of migmatitic features are seen at Stop 4-9.

Stop 4-8. Appinite and quartz diorite relations. [NN 0535 5340], 620m.

Directions: From the knoll of Stop 4-7, low exposures are seen about 75 m away bearing 300° ([NN 0535 5350]: indicated on map) and about 100 m away bearing 230° ([NN 0535 5335]; 620 m). The second locality is Stop 4-S. It is located on the flank of a knoll, just to the west of the old fence crossed on the way to Stop 4-7, but which now trends in a southerly direction.

Description: The rock is a medium- to coarse-grained, hornblende-rich, monzodiorite with minor clinopyroxene, quartz and pyrrhotite, belonging to the Appinite Suite of mafic intrusions. The main content and grain size varies from exposure to exposure, and some rocks are quite biotite rich. Semipelitic xenoliths are present locally.

More exposures of appinite are encountered continuing SSW downslope towards Stop 4-9. After about 200 m (ca. [NN 0530 5315], indicated on the map), the grain size of the appinite decreases, the rock becomes more leucocratic and quartz may be visible. The more leucocratic varieties resemble the marginal phases of the quartz diorite of the main igneous complex elsewhere in the aureole. The absence of obvious cross-cutting relationships between the appinite and quartz diorite led Weiss & Troll (1989) to argue that the two magmas mixed and formed a hybrid transition tone, implying that the appinite magma was not completely consolidated by the time the quartz diorite intruded.

Stop 4-9. Well exposed migmatites. [NN 0510 5305], 560m.

Directions: From Stop 4-8. head SW downslope for about 400 m, crossing a burn draining from a small pond located at [NN 0530 5305]. Stop 4-9 is a prominent dark isolated exposure in front of ridges of dark exposures to the SW and surrounded by low light-coloured exposures to the NE.

Description: The rocks are migmatitic metapelitic rocks within 50 m of quartz diorite of the igneous complex, the latter represented by the small light-coloured exposures to the immediate northeast. Structures developed during partial melting are well displayed, and the flow structures in the semipelitic layers provide strong evidence for them having contained substantial melt (Pattison & Harte, 1988; Marie et al., 1991a). Notable features developed at this exposure include: disaggregated rectilinear hornfels boudins in a semipelitic matrix, the latter locally showing superb evidence of flow; a range of quartzofeldspathic veins, many of which cross-cut sharply the hornfels but which show more diffuse transitions into the semipelite and in some cases merge into the semipelite; and the mesh texture of K-feldspar-rich matrix surrounding cordierite pits in metapelitic layers (see (Photo 10), (Photo 12), (Photo 20), (Photo 21) and (Photo 25)). Exposures uphill to the SW show more good exposures of high grade metapelites, cut by a variety of veins.

Options from Stop 4-9.

a. To return to the vehicle left at [NN 0505 5455], retrace the day's route approximately to Stop 4-4. From here, descend the slope to the north, cross the River Laroch and follow the Ballachulish - Glen 'Juror footpath back to the vehicle.

b. Optional Stop 4-9A — coarse andalusite and corundum. [NN 0475 5280]; 550 m.

To visit some particularly good nearby exposures with corundum and coarse-grained andalusite, bear about 240° from Stop 4-9 for about 400m. keeping at about the same elevation and crossing some small burns, to some obvious slabby N- to NW-facing exposures. The rock is mainly quartzite interbedded with pelite; the latter contains the coarse grained andalusite (up to 4 cm long).

Optional Stop 4-9B—orthopyroxene-garnet hornfelses. NN 0380–03850 5330, 280 m.

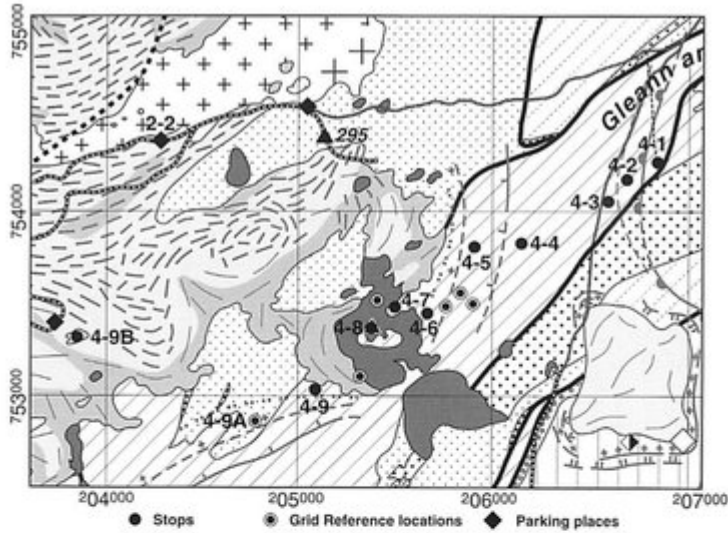
This optional stop is at a locality where metamorphic hypersthene has been found (see the Coloured Map (Map 1) and (Figure 12)). If time does not allow a visit to this locality at the end of the Day 4 traverse, it may be visited separately and directly by driving along the forest tracks to the parking place at [NN 0370 5340] (see 'Note for vehicle access to Stop 4-9B under the initial directions for Day 4), and then using the locality description given below

From Stop 4-9, head westwards descending the adjacent burn all the way down to the edge of the forest where there is NNE-trending fence. Follow the burn down a fairly steep grassy gully through the trees until a prominent NS-trending cut (corridor) in the forest is reached (possibly a track as of 1999). Descend an ill-defined path through the forest on the north side of the burn. In the burn [NN 0380 5330]–[NN 0390 5330] adjacent to the path are low, partly moss-covered exposures of cordierite-rich hornfels that locally contain dark red garnet crystals and rarely hypersthene. The hypersthene is not easy to identify in hand sample. These rocks belong to a large pelitic raft in the diorite of the igneous complex (see Coloured Map (Map 1)), and are the highest-grade rocks in the aureole, with temperatures of 800–850 °C

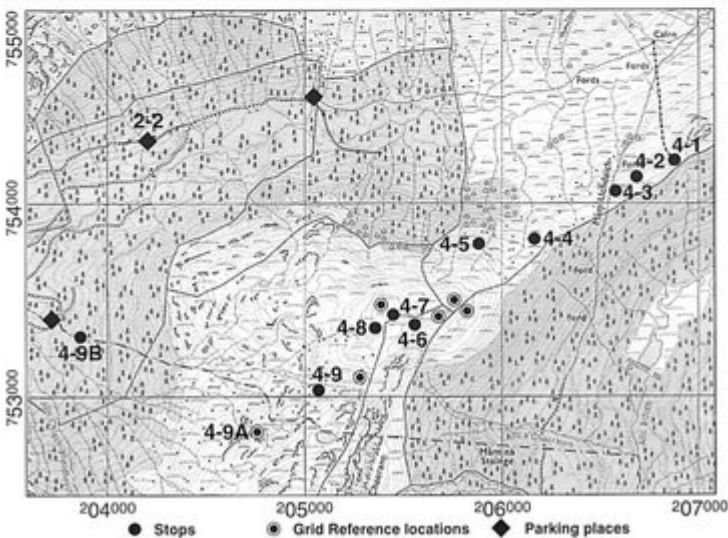
(Pattison. 1989). Sadly, it is difficult to obtain fresh samples from here, because the Crd, Opx and Kfs are usually completely altered.

From the Opx-Grt-hornfels locality it is only ca. 200 m down the path by the burn to the forestry road at [NN 0370 5340], where you may have left a second vehicle (see instructions for start of Day 4). From [NN 0370 5340] follow the forestry roads back to the vehicle you left at the start of the Day 4 traverse (see earlier instructions and the 1:25.000 OS map).

End of day 4

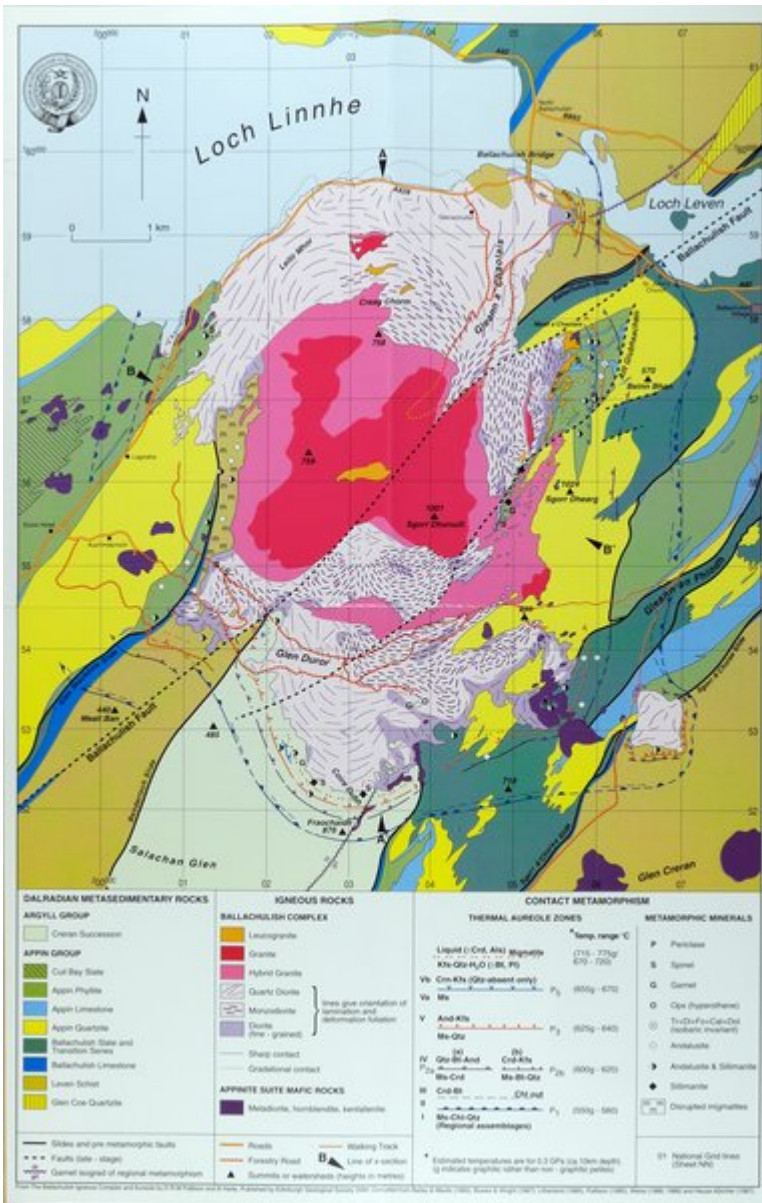


DAY 4

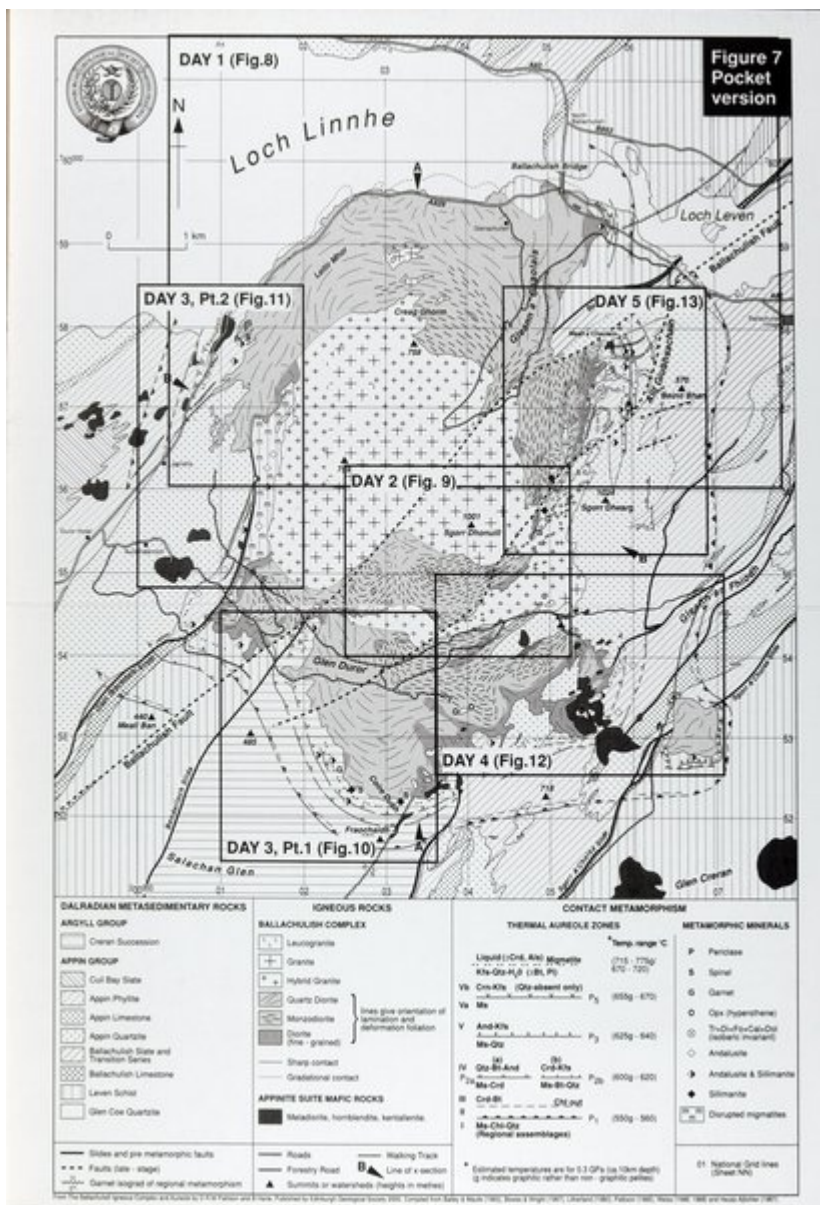


DAY 4

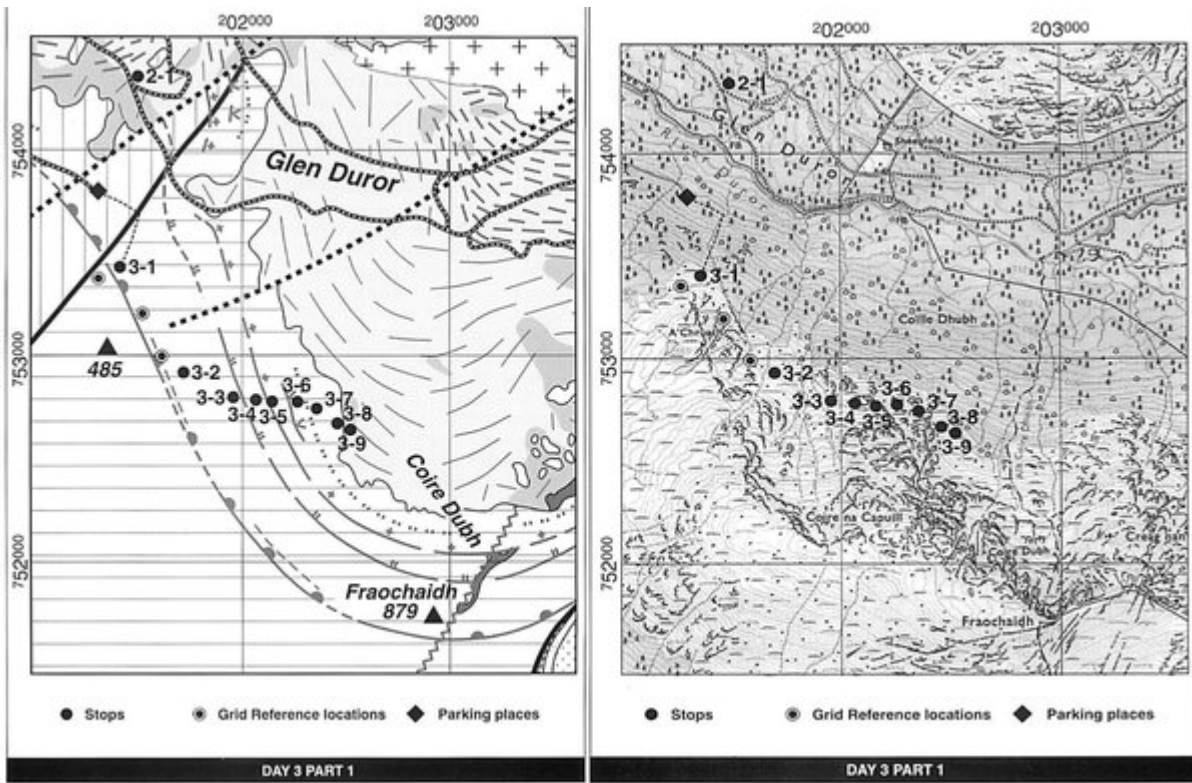
(Figure 12) (a) Geological map showing location of field stops for Day 4 (see (Figure 7) for key to geological map) (b) Corresponding topographic map showing location of field stops for Day 4 (reproduced with permission by the Ordnance Survey).



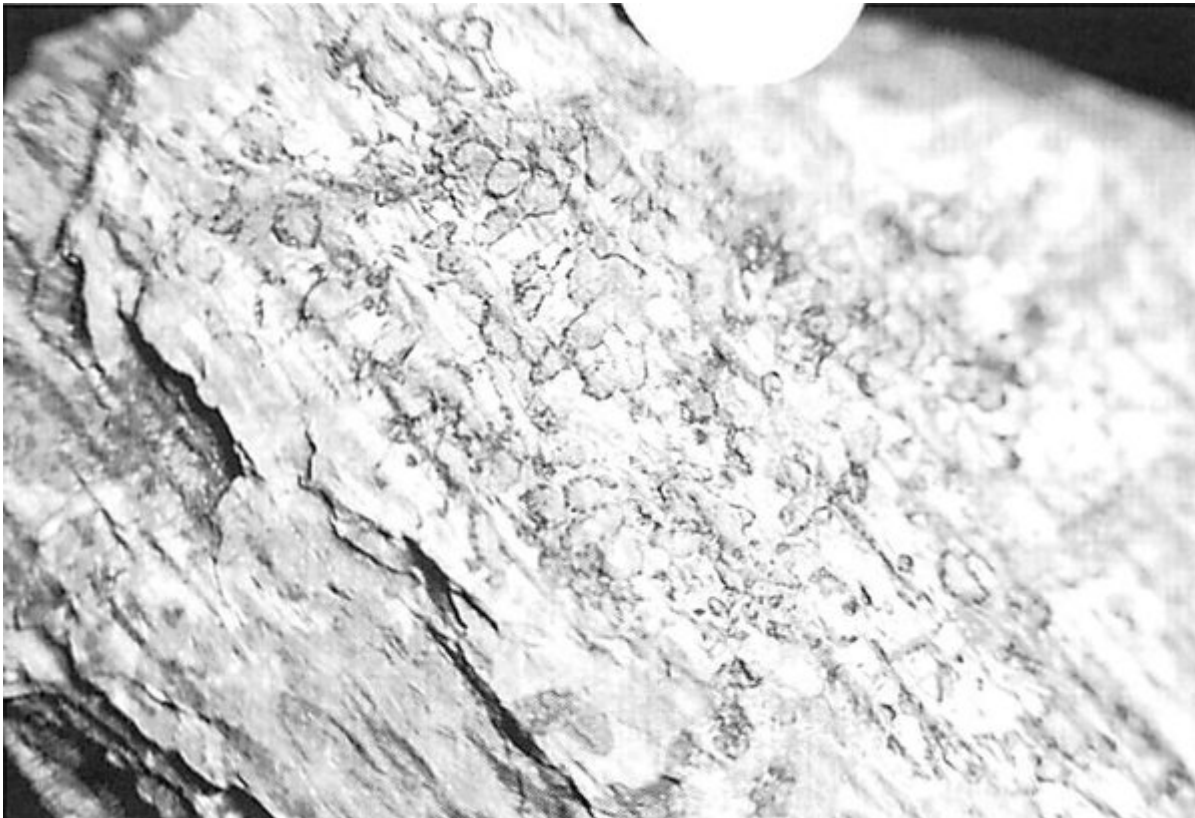
(Map 1) Geological map of the Ballachulish Igneous Complex and aureole. (map in endpocket).



(Figure 7) Outline of area for field excursions. Geological map showing location of field stops for Day 1 (see (Figure 7) for key to geological map).



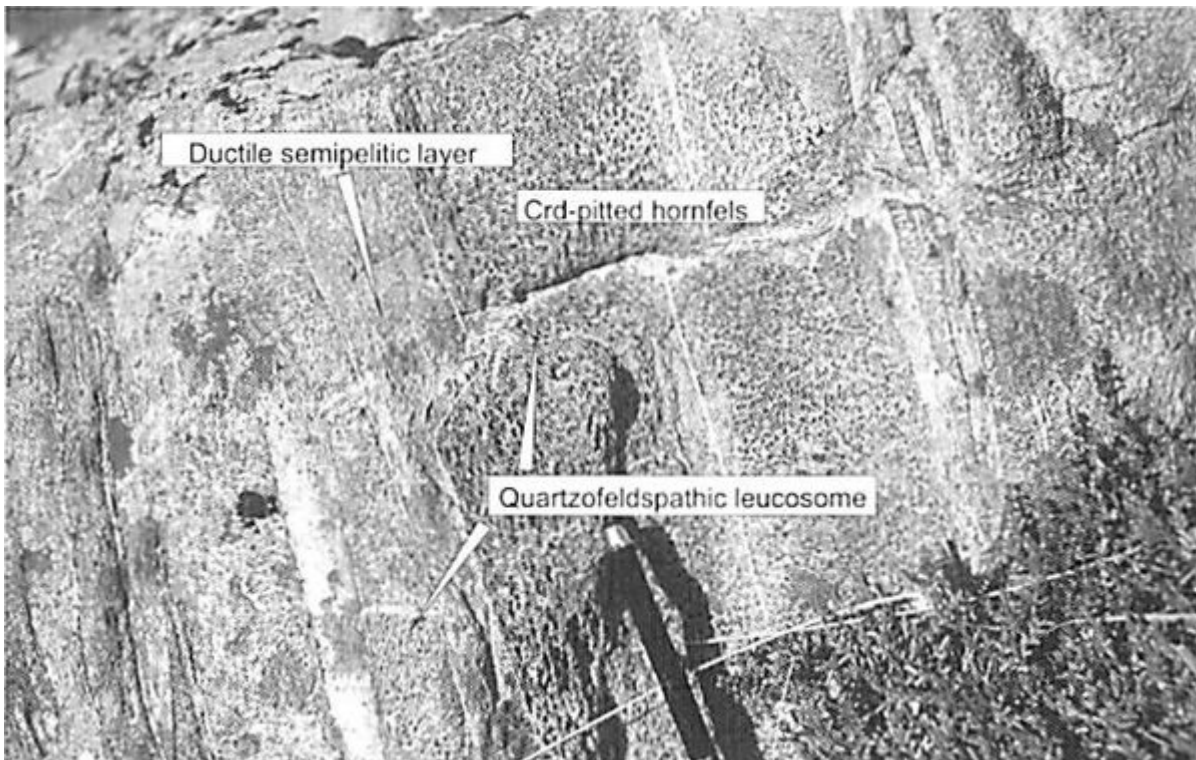
(Figure 10) (a) Geological map showing location of field stops for Day 3 Part 1, Fraochaidh traverse, (see (Figure 7) for key to geological map). (b) Corresponding topographic map showing location of field stops for Day 3 Part 1 (reproduced with permission of the Ordnance Survey).



(Photo 16) Stop 4-3. Crenulated graphitic phyllite of the Ballachulish Slate lithology with abundant cordierite porphyroblasts forming roughly ovoid 'blobs'. Characteristic of Zone III in this vicinity.



(Photo 17) Stop -1- 5. A crenulated cleavage surface of the graphitic phyllite of the Ballachulish Slate lithology. The short elongate ribs, with widely varying orientation, mark the occurrence of abundant mm- to cm-long andalusite prisms. The full mineral assemblage in the rock is andalusite + cordierite + biotite + muscovite + quartz, characteristic of Zone IVa (see discussion under Stop -1-5). The andalusite in the rock shown is a little coarser grained than in most exposures in Zone IVa.



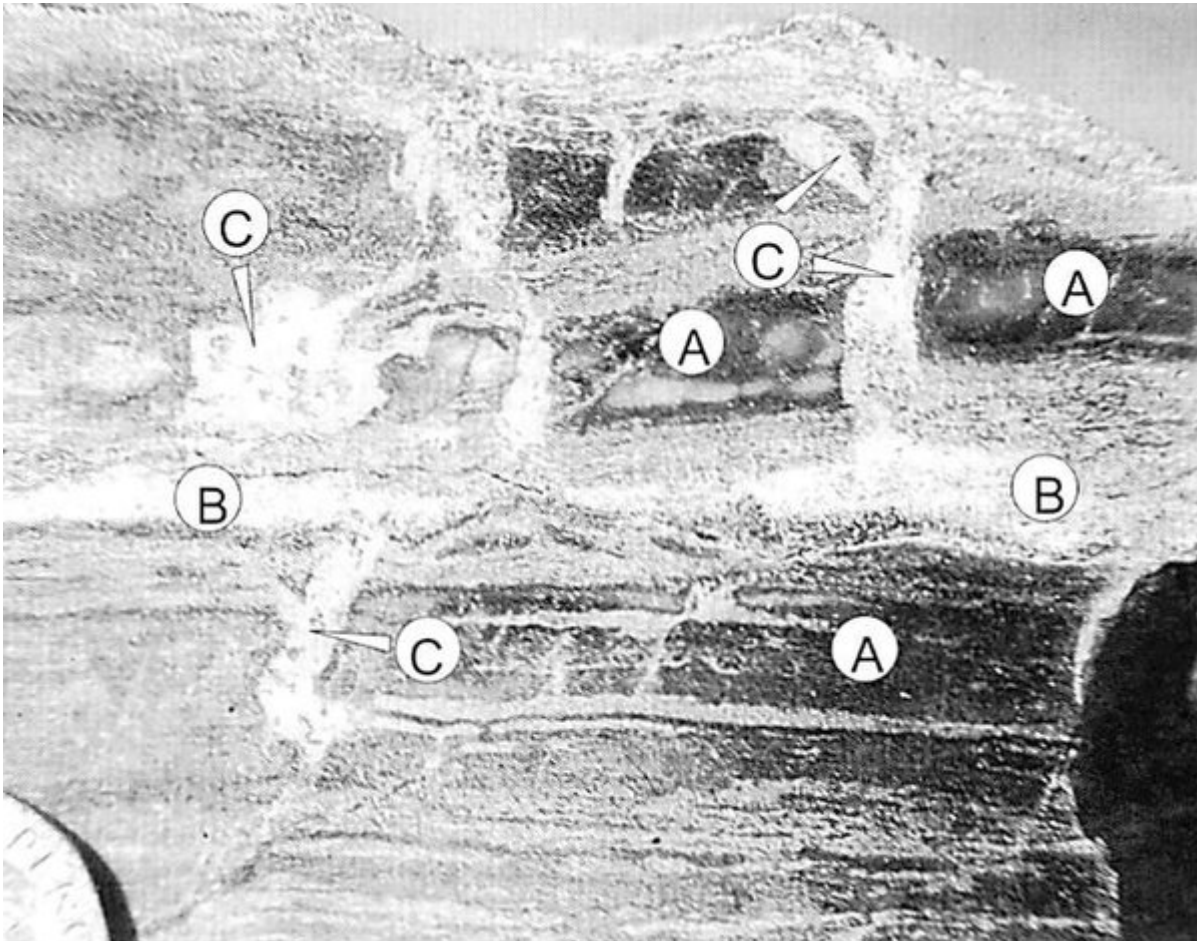
(Photo 10) Stops 1-8 and 1-9. Incipient migmatitic features in interbedded pelitic and semipelitic hornfels, upper Zone V. See description of Stop 1-9 for an explanation of the features.



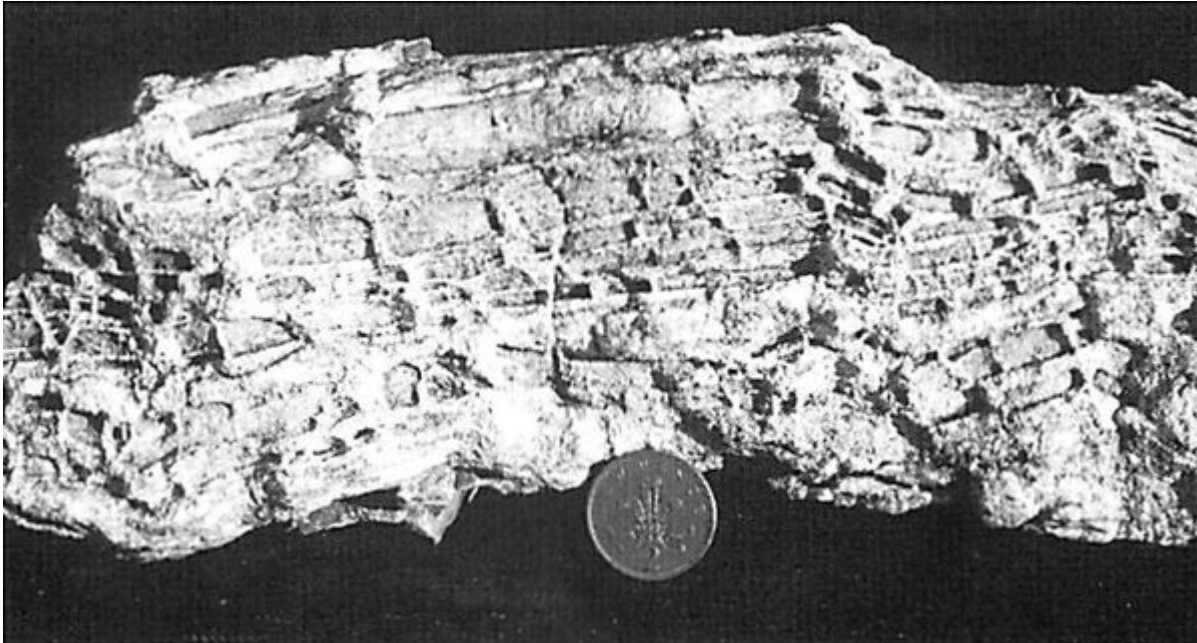
(Photo 12) Stops 3-4, 1-8, 5-2, 5-4 and 5-5. Massive Crd+Kfs-bearing pelitic hornfels characteristic of Zone IVb. The photograph was taken near Stop 5-5 in Coire Giubhsachain, but is representative of Zone IVb in many parts of the aureole. Note the mesh or honeycomb texture, defined by randomly orientated, weathered-out cordierite crystals (represented by pits) within a resistant, light coloured matrix rich in K-feldspar Note also that the matrix surrounding the pits is lighter colorant and more sharply defined than the matrix in hornfelses from Zone III (compare with (Photo 1)).



(Photo 20) Stop 5-6. Anastomosing veins rich in K-feldspar + quartz, within layered cordierite+K-Feldspar-rich pelitic and semipelitic hornfels. The prominent light coloured vein (lower left of photograph) is of granitic material from the igneous complex. See notes of Stop 5-6 (above 560 m) and Stop 1-9 for a fuller description and explanation of the veins and other features. From the ridge/plateau area around Stop 5-6.



(Photo 21) Stop 5-6. Detail of migmatitic rocks with boudin-type structures. The original lithology was of interlayered pelitic and semipelitic material and now shows rigid, pulled apart cordierite-rich hornfels (metapelite) layers (A), ductile semipelitic layers (B) and segregated Kfs+Qtz-rich leucosomes occupying the gaps between the pulled apart hornfels layers (C). Notice how the leucosome merges into the ductile semipelite, giving the impression of being extracted from it. Field of view is 5 cm across. See notes of Stop 1-9 for further explanation.



(Photo 25) Stop 5-10. Detail of 'chocolate-tablet' migmatite. The rock consists of interlayered pelitic and semipelite. Cordierite-rich hornfels layers and broken into angular fragments in a tablet structure, with mobile leucocratic material both cross-cutting and running parallel to the layering. The mobile leucocratic material separating the hornfels fragments merges into semi-pelitic layers and does not form extensively cross-cutting veins. Compare with (Photo 10) and (Photo 21).