Excursion 10 Fintry

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Purpose: Three itineraries sample the best and most instructive outcrops of the Clyde Plateau Volcanic Formation (Strathclyde Group) and associated Early Carboniferous eruptive centres. They provide an introduction to the eruptive history of the area, and excellent opportunities for the study of processes of high-level magmatic intrusion and volcanic eruption.

Logistics: Full remote-terrain clothing, equipment and waterproof footwear with good grip are essential. Cars are the most suitable mode of travel. As with all the excursions around Fintry, take care not to disturb farm animals.

Maps: OS 1:50,000 Sheet 57 Stirling & the Trossachs; 1:25,000 Sheet 348 Campsie Fells; BGS 1:50,000 sheets 30E Glasgow and 31W Airdrie; locality maps figures 10.1–10.3

The concept of proximal and distal volcanic facies is useful in the interpretation of outcrops throughout the Campsie Block. (Table 10.1) summarises the principal characteristics by which the two facies may be recognised.

The Clyde Plateau Volcanic Formation around Fintry is markedly different in character from the distal succession of lava flows seen in most other parts of the Campsie Fells (Excursion 11). Fintry was a proximal area, where magma erupted at the surface, creating a landscape of craters and cinder cones. Changing patterns of eruption, repeated burial of earlier centres by later ones, and subsequent dislocation of a complex volcanic accumulation, make interpretation difficult. However, it is possible to build an outline of the sequence of events that created this part of the succession. The outcrops, presented in chronological order, combine to illustrate how the nature of the volcanicity was evolving. Most of the earlier eruptions came from many short-lived vents distributed along at least two parallel ENE-trending linear systems. The best exposed is the North Campsie

Linear Vent System, which stretches from Dumbarton to Fintry and extends beneath the younger lavas to the ENE of Fintry. The outcrop of the South Campsie Linear Vent System is restricted to the area north and NW of Kilsyth. Later eruptive centres have been identified with a similar trend along the line of Gonachan Glen, a few kilometres south of Fintry.

The final major phase of activity was centred around Waterhead Farm, 5 km SE of Fintry. Unpublished geophysical evidence from the 1960s suggests that there was a large magma chamber and associated central caldera here, as it coincides with a major positive gravity anomaly centred on Waterhead Farm. The simplest model is of a large basic intrusion with a volume of 200–300 km3, NW–SE diameter of 8 km, NE–SW diameter of 6 km, vertical height of 6 km, and depth to its top of less than 1 km. This chamber is much larger than that interpreted as underlying the Endrick valley at Fintry. The change in magmatic plumbing system is reflected in the character of later lava flows. The bulk of the earlier lavas erupted from the linear vent systems are non-porphyritic and microporphyritic basalts and hawaiites. However the lavas erupted from this, the Waterhead Central Volcano-complex, are typically macroporphyritic basaltic hawaiites and hawaiites with several intercalations of more-evolved mugearites. Numerous felsitic dykes and irregular intrusions are unique features of this volcano-complex.

MacDonald (1975) concluded that the Campsie rocks were probably generated by two-stage fractionation from a mildly sodic alkali basalt parent magma. Clinopyroxene was extracted under high pressure at great depth. Subsequent low-pressure fractionation involved removal of olivine, plagioclase and opaque oxides, generating a differentiated suite of basaltic hawaiites, hawaiites, mugearites, trachytes and rhyolites. A large magma chamber would have provided a suitable low-pressure environment for this second stage.

The 300 m-deep BGS Clachie Bridge Borehole proved the main strati-graphical units and their relationships in the Waterhead area. However, the rocks were highly disturbed, brecciated and intruded by the same range of magmatic and fragmental intrusions as are exposed in the Clachie stream section. To a depth of 120 m were aphyric and microporphyritic hawaiite lavas; from 120 m to 280 m dolostone (cementstone), mudstone and fine-grained sandstone of the Ballagan Formation; the basal 20 m were of calcretebearing sandstone (Kinnesswood Formation). The depth to the base of the volcanic formation was significantly greater than predicted, and led to a reconsideration of the local structure. The most-likely explanation is that there is a ring fault within which strata have been let down by about 100 m.

The development of such a caldera-like feature is usually associated with the late stages of eruptive activity in a central volcano when a waning magma column ceases to support the previously inflated overlying strata.

Itinerary 10A: Cammal and Balmenoch burns, 3 km east of Fintry

Purpose: To examine two sections which include some of the cleanest and most accessible exposures of the early products of eruption.

Logistics: Access is at Spittalhill [NS 6470 8620], the first farm on the left of the Denny road (B818) about 1.5 km from the bridge over the River Endrick. Roadside parking is impossible at this locality and an arrangement for leaving vehicles must be made at Spittalhill. Walking is mainly in open farmland.

Locality 10.1 [NS 6434 8675] to [NS 6438 8692] Cammal Burn: volcanically derived sedimentary rocks and basic dykes.

The Cammal Burn is reached by following the fence heading NW from Spittalhill. The first three exposures in this stream section are of stratified volcaniclastic sandstones and conglomerates of a generally purplish hue. Rare fragments of lava up to 20cm long and odd pieces of scoria are found in the beds. One or two beds are distinctly unsorted, but the sequence has the appearance of being water laid. The most probable source of such material would be some of the earliest lava members recorded at the base of the volcanic pile to the east. The minor dykes cutting through these sedimentary rocks indicate the presence of rising magma.

Locality 10.2 [NS 6433 8699] to [NS 6432 8705] Spout of Balbowie, Cammal Burn: stratified tuffs and lava flow.

A short distance upstream, a magnificent 20 m section of finely bedded ash-fall tuffs is seen overlain by the first lava flow of the Lower North Campsie Lavas (Plate 10.1). Quartz grains are a significant constituent of the tuffs, as are comminuted lava and scoriaceous material. This material is interpreted as being partly derived from the underlying sedimentary rocks during the drilling out of a volcanic conduit and vent situated up wind from this locality. This would be achieved by gases rising ahead of the magma column as it entered the relatively low-pressure, near-surface environment and degassed or encountered groundwater. Rare blocks and bombs are revealed by weathering back of this exposure. They contrast markedly with the otherwise fine-grained nature of the tuffs. Spindle-shaped bombs have been noted, as have possible impact structures. Although the overlying lava is strongly jointed, it has prevented the Cammal Burn from cutting down into the tuffs. The Spout of Balbowie has resulted from the contrasting resistance to erosion of the lava and the relatively soft tuffs.

Locality 10.3 [NS 6491 8682] to [NS 6484 8696] Balmenoch Burn: proximal-facies lava and cinder-cone deposits.

Contour around the hillside eastwards from Locality 10.2 to reach the nearby Balmenoch Burn at the upper of two waterfalls. Here, the sheet of lava is built up of several flow units separated from each other by auto brecciated and highly amygdaloidal lava. The section upstream from this waterfall is not particularly worth examining due to the scoriaceous and degraded nature of the exposures. Such a sequence of material is regarded as typical of the lava preserved close to the eruptive centre from which it was derived: that is, lava of proximal facies.

Downstream are some of the best exposures of scoria deposits in the Campsie Block. Apart from a few tongues of slaggy lava and a few rotted dykes, all the outcrops are of purplish scoria bombs set in a red matrix of finer scoriaceous debris. The texture of the scoria is emphasised by pale carbonate infilling of the vesicles. Complete bombs of classic spindle shape are not easy to identify, but most scoria fragments exhibit the gradation from very finely vesicular chilled margins to coarsely vesicular interiors. Stratification is apparent in some exposures in which small (10cm or less) scoria bombs and fragments lie with their long axes parallel. A curious feature of some exposures is the pale 'fish-eye' structure of apparently bleached scoriaceous material surrounding unidentified crystals. With some individual bombs longer than 40cm, it is likely that these agglomeratic deposits accumulated close to a centre of eruption. The reddening of the comminuted matrix material is believed to be due to oxidation caused by circulation of steam through the deposits. At the time, they probably formed part of a cinder cone built up around a vent from which lava issued to the surrounding lower ground. If the tuffs of the Cammal Burn section (Locality 10.2) represent the reaming out of a volcanic pipe, these scoria deposits may represent the subsequent arrival at the surface of the explosively degassing magma itself.

Itinerary 10B: Dunbeg, Kilewnan Burn and Dunmore, from Fintry Village

Purpose: To examine the volcanic pipes or conduits that carried magma to the surface and the material that now occupies them. Some exposures of the pre-existing sedimentary strata can also be examined. These belong to the Clyde Sandstone and Ballagan formations (Strathclyde Group). The excursion ends at the Fintry 'phonolite' quarry. On this walk, good views can be had of the mountains to the north – Ben Vorlich, Stuc a' Chroin, Ben Lomond, Ben Ledi and Ben Venue, as well as drumlin fields in the Endrick Water valley and views of the lava scarps at Stronend in the Fintry Hills.

Logistics: Walking is mostly on footpaths. The distance involved is less than 4 km with an ascent of over 250 m. Electric fences may be a hazard on this route. Follow the old quarry road which heads uphill from opposite the road junction in the centre of the village [NS 6162 8672]. Passing the quarry entrance [NS 6142 8656] for the moment, follow the track across the stream and into and through Fintry Wood above the west end of Fintry. The first destination is the small prominence of Dunbeg which projects from the NW shoulder of Dunmore about 500 m slightly north of west from the quarry entrance.

Locality 10.4 [NS 6085 8660] Dunbeg: agglomerate infilling a volcanic neck and Downie's Loup Sandstone Member.

The wall that passes just south of Dunbeg very nearly follows the boundary between the sandstone country rock cropping out to the south and the agglomerate infilling a volcanic neck to the north. The fairly massive pale sandstone is typical of the Downie's Loup Sandstone Member (Clyde Sandstone Formation) that immediately underlies the volcanic pile along the northern outcrop of the Campsie Block. There is remarkably little evidence in the sandstone exposures for any disturbance caused by the intrusion of the 130 m-diameter volcanic neck, exposures of which can be inspected immediately across the wall. The neck itself consists largely of coarse agglomerate with only rare irregular 'squirts' of intruded basaltic material. The character of the fragmental rock indicates derivation from a pre-existing lava pile of aphyric and microporphyritic lava flows. Some scoriaceous and tuffaceous fragments may also be seen. A narrow zone of much finer grained fragmental rock is present at the southern neck margin. This material is an intrusive tuffisite with rare fragments of reddened sandstone. From the nature of the material occupying the neck, it seems probable that it is in fact a diatreme. Little, if any, magma is likely to have been transported to the surface through this pipe after it was reamed out. After the explosive escape of the gases, the shattered country rock appears to have collapsed back down the pipe to give the present disposition of fragmented younger volcanic rocks circumscribed by older sandstones.

Locality 10.5 [NS 6026 8684] Kilewnan Burn: dolostones ('cementstones') and siltstones of the Ballagan Formation.

These outcrops are reached by contouring round the north-facing slopes of Dunmore and descending slightly into the stream section exposed by the Kilewnan Burn. Almost the entire route is across one of the many major landslips that scar the steep slopes of the Campsie Block. None of the apparent outcrops encountered is *in situ*, and several backslip hollows can be seen, including one reputedly used for a Covenanters' meeting. The 4 m section of Ballagan Formation can be seen as the lowest exposure in the west bank of the stream. The interbedded dolomitic limestones and siltstones are not really typical of the Ballagan Formation, as these beds have a lower proportion of dolostone (cementstone) than normal, and also show more common red and green staining. Such characteristics are typical of an upper facies within this formation, which hereabouts is about 400 m thick. At the top of the section, the fine-grained sandstone exposed is taken as the basal bed of the overlying Clyde Sandstone Formation.

Locality 10.6 [NS 6025 8677] Kilewnan Burn: Downie's Loup Sandstone Member.

A short distance upstream are some exposures and blocks of white flaggy sandstone amongst and above tree roots. Fresh and recently exposed surfaces reveal desiccation cracks, rain pits and ripple marks. A horizon bearing concretionary calcrete (cornstone) can be examined near the top of the section. Such developments have been interpreted as evidence of leaching and redeposition in pedogenic limestone soils subjected to alternating arid and moderately wet conditions.

Locality 10.7 [NS 6027 8674] Kilewnan Burn: tuff and agglomerate within volcanic neck.

The next exposures upstream are similar in character to those at Dunbeg, although the relationships with the adjacent formations are more complex. Again the neck margin, as seen in the lowest exposures, consists of vertical zones of tuffs, passing inwards to coarser agglomerate (Plate 10.2). It is usually possible to detect small fragments of carbonised wood within the tuffaceous material. Sizeable blocks of sandstone have also been noted in some of the agglomerate exposures. The upstream neck margin appears to be a faulted one, with agglomerate thrown against calcrete-bearing sandstone. The sandstone is seen to be intruded at a higher level by a sill of basalt, the outcrop of which appears unaffected by the fault or by the neck. Such relationships suggest that the emplacement of the neck and the faulting pre-date the sill intrusion. Again there is little evidence for delivery of magma through this pipe, whilst the wood fragments clearly indicate infilling of the pipe with debris from the contemporary land surface. To avoid entrapment in Glenine, it is necessary to cross to the east bank and proceed upstream at a level well above the gorge.

Locality 10.8 [NS 6013 8648] to [NS 6021 8634] Kilewnan Burn: basaltic sill-complex.

During the traverse from Dunbeg to the Kilewnan Burn, the columnar jointing of the Dunmore intrusion is very prominent in the exposures high above (Plate 10.3). Dunmore is only the easternmost expression of this complex intrusion however. It continues for some distance to the west and reveals some of its complexities in the Kilewnan section. While proceeding upstream, keep well above the actual burn and note the character of the columnar exposures. Repeated surges of magmatic intrusion are apparent from the diversity of jointing attitudes. Abrupt changes in the orientation of the columns are common. Although the base of the intrusion can be seen to be fairly flat-lying and conformable in exposures at a considerably lower level downstream, the same situation is encountered at another two localities upstream. At the first [NS 6013 8648] (8a on (Figure 10.2)), the sill rests on sandstone, but at the second locality [NS 6021 8634] a 'window' (8b) through the base of the intrusion exposes stratified tuff and agglomerate.

From the overall outcrop pattern, post-emplacement faulting cannot be invoked. It seems more likely that the emplacement of such a considerable body of magma was preceded and accompanied by local disruption of the pre-existing stratigraphical units. Indeed, the possibility exists that some parts of the columnar jointed basaltic intrusions of the North Campsie Linear Vent System represent former lava lakes within open craters. Single bodies of basalt may be intrusive at lower levels and extrusive above. Evidence for this is not conclusive at Dunmore, but it is clear that the columnar basalt is surrounded by considerable thicknesses of tephra-cone deposits and that the unit is extensive at the stratigraphical level that must have been close to the contemporaneous surface.

Locality 10.9 [NS 6048 8648] Dunmore: columnar jointed basalt.

Leave the stream section where it emerges from the basaltic unit and the topography changes abruptly to one of grassy slopes. Turn towards the east and make for Dunmore (Plate 10.3). The summit is worth visiting for the panorama to the north and east. The rather featureless unexposed outcrop of the Devonian rocks to the north contrasts sharply with the mountainous landscape beyond the Highland Boundary Fault. To the south, the smooth foreground is underlain by the readily weathered tephra-cone deposits already referred to, with prominences formed by intrusive basalt. Beyond this poorly exposed area rise proximal facies lavas and interflow volcaniclastic deposits. The lack of massive lava flows results in the absence of the trap featuring so prominent in other parts of the Campsie Block.

Along the eastern flank of Dunmore there is a feldspar-phyric dyke trending south of east, but this is not easy to find. A clearly defined footpath on the way to the next locality descends from the summit of Dunmore and curves round the corrie-like hollow below the crags of Turf Hill. These crags are difficult of access and consist of considerable thicknesses of volcaniclastic materials, some of primary pyroclastic origin and some more probably redeposited as lahars. Beyond the chaotic surface of the landslip and Cooper's Burn, another neck forms a prominent feature. This one, however, is quite different in character from anything yet seen. The neck and associated sill-like intrusion exposed in the lower slopes to the north are of a single alkali-rich silica-undersaturated rock type known as 'phonolitic trachyte' (or feldspathoid-bearing trachyte in modern nomenclature), though it was formerly termed 'phonolite'. This is the rock exposed in the quarry.

Locality 10.10 [NS 6142 8652] Fintry Quarry: phonolitic trachyte intrusion.

The term 'phonolite' literally means 'sounding stone' (Greek). A blow with a hammer on a suitable block will demonstrate the phenomenon which arises from the tightly interlocking texture of the orthoclase and aegirine crystals that comprise the bulk of the rock. The quarry exposures are of pinkish, generally poorly columnar jointed rock that appears to be part of a sill inclined to the NE. Further exposures of the same rock, but in a fresher condition, are located just south of the road at the eastern entrance to the village.

Petrographic and geochemical similarities between this intrusion and an extensive trachytic lava flow at the base of the Fin Glen Lavas (north of Clachan of Campsie), make it tempting to associate the two. The neck above the quarry, and especially its marginal exposures, certainly give the impression of having delivered a substantial volume of magma. The cross-sectional dimensions of volcanic pipes in the Campsies are believed to provide an indication of the depth below the contemporaneous surface of the present level of exposure. This rule of thumb follows from the upward-flaring trumpet shape of the pipes in vertical section. This consideration, the stratigraphical level of the distinctive trachyte flow, its outcrop pattern, and its variation in character over its outcrop area, all combine with the petrological evidence to link the flow with a centre of eruption fed by the phonolitic trachyte neck at Fintry. Less debatable, however, is the observation that the phonolitic trachyte represents a late phase in the evolution of the North Campsie Linear Vent System. Considerable differentiation must have taken place to generate this rock. This typically occurs in alkali basaltic magma stagnating in a high-level magma chamber. There is geophysical evidence for the existence of this beneath the Endrick valley at Fintry, as there are anomalous positive gravitational field-strength values, indicating the presence of a substantial body denser than the surrounding sedimentary rocks. It seems likely that the activity, originally dispersed along an extensive linear system, eventually became focused at one or more preferred locations, of which this was one.

Itinerary 10C: Dungoil and Clachie Burn areas

Purpose: This itinerary allows examination of outcrops representing later phases in the complex eruptive history of the Campsie Block, including aspects of the Waterhead Central Volcano-complex. The principal points are the petrographic variations and the complexity of the magmatic activity.

Logistics: Leave Fintry travelling eastwards on the B822 towards Lennoxtown and park near the cattle grid [NS 6460 8410].

Locality 10.11 [NS 6410 8420] to [NS 6395 8430] Eastern slopes of Dungoil: 'Old Silver Mine' and complex coarse-grained intrusion.

A full appreciation of the outcrops between here and the major neck intrusion of Dungoil would require several hours. It is possible, however, to see the main features in less than an hour, without visiting Dungoil. This is one of the largest neck intrusions in the Campsies, consisting of microporphyritic hawaiite, and is considered to represent the highest level of a flared, trumpet-shaped conduit. One of eight neck intrusions, it belongs to a short linear feature that succeeded the Gonachan Glen system as activity continued to move south-eastwards, eventually becoming concentrated in a single large eruptive centre, the Waterhead Central Volcano-complex. This lies in the low ground between Dungoil and Meikle Bin.

To reach the first exposures associated with the volcano-complex, head for the cattle shelter on the lower slopes of Dungoil, about 380 m just to the north of west from the cattle grid on the Lennoxtown road [NS 6415 8418]. The small gully (11a [NS 6410 8420]) that extends 200 m or so to the west of the shelter contains mineral workings described on old field maps as an 'Old Silver Mine'. The small stream is referred to locally as the Silvermine Burn and the small spoil heap as 'Silver Knoll'. From the degraded evidence, all that can now be seen is a 4 m-wide microgranite dyke with veins of baryte. The immediate country rock consists of indurated lava. To the north, west and south of the gully, are numerous exposures of abundantly porphyritic basalt and dolerite. Large plagioclase crystals make up the bulk of the rock, with pseudomorphed olivines present locally. In thin section, some specimens appear to have formed as plagioclase cumulates. These exposures are part of an irregularly shaped intrusive body of feldsparphyric dolerite and gabbro that lies between the summit of Dungoil and the Lennoxtown road. It is interpreted as a plug within a volcanic neck whose outline is the result of lateral penetrations into the surrounding lava flows and interflow tephra.

Relationships with the country rock are complex locally, especially towards the NE margins of the body (11b from [NS 6395 8430] to [NS 6400 8440]), where veins of intrusive tuffisite and coarser explosion breccias extend for some distance into the lava succession. These fragmental rocks commonly contain disseminated pyrite and consist of brecciated lava material and finer grains of quartz, fractured plagioclase crystals and glassy material. The intrusive dolerite in these north-eastern exposures is characterised by a local abundance of xenoliths of hornfelsed lava and sandstone. The 'dolerite' is also highly variable in character from gabbroic texture through porphyritic variations to chilled aphyric basalt. Most of the rest of the exposures within the 500 m diameter of the intrusion are of massive feldspar-phyric dolerite of less variable character. This rock is unlike any of the neck intrusions associated with the linear vent systems and represents a magmatic system in which large feldspar crystals were allowed to develop, separate and accumulate.

Locality 10.12 [NS 6430 8448] Disused quarry: lava sequence and felsic dyke.

On the way back to the cattle grid, it is worth visiting a small disused quarry some 300 m north of the cattle shelter. On the eastern side of this quarry (12a [NS 6430 8448]) are a series of flow units of non-porphyritic lava. The locally scoriaceous, autobrecciated and altered character of the rock is typical of proximal facies lava, as indeed is the division into flow units. The red-weathered rocks exposed at the quarry entrance are also typical of sequences close to their source vents. Of quite different character is the 4 m dyke that forms the west wall of the quarry. The distinctive pale-pinkish rock (rhyolitic in composition) appears to have a banded and xenolithic texture in hand specimen but proves to be in part fragmental in thin section. The small rock feature (12b [NS 6427 8439]) about 30 m to the SW of the quarry is also intruded by fragmental material. Here it takes the form of a narrow vein of tuffisite composed of comminuted lava, sandstone, and glassy material. Veins and irregular intrusions of such material are relatively common in the lava outcrops of this area.

Locality 10.13 [NS 6435 8363] to [NS 6414 8373] Clachie Burn: roof zone of a magma chamber?

Travel 600 m south of the cattle grid along the Lennoxtown road. There is parking at the roadside by the bridge [NS 6440 8360]. The 900 m section that stretches upstream from the exposures (13a [NS 6435 8363]) about 100 m east of Clachie Bridge is remarkable for the number and diversity of dykes and irregular minor intrusions. The country rock for the first 350 m consists of stratified, mostly chocolate-coloured tuffs that dip gently SE. These have a flaggy character in places with local colour variations that range through purple and green shades. The constituent grains of these tuffs are largely derived from the subvolcanic sedimentary strata. Upstream from the waterfall, which marks the junction between Lower North Campsie Lavas and tuff (13b [NS 6414 8373]), the country rock is of non-porphyritic lava, generally of slaggy, brecciated and altered character. Most of the original crystals have been replaced by carbonate minerals and chlorite. The lavas and tuffs have been penetrated by numerous minor intrusions, as can be seen above and below the waterfall. The face of the waterfall, 250 m upstream from Clachie Bridge, is defined by a number of dykes with complex cross-cutting relationships. This is where the Waterhead Ring-fault is believed to cross the Clachie Burn. The complex dyke swarm shows a range of compositions from basalt to microgranite. There is no consistent evidence about relative ages from the cross-cutting relationships, but a general sequence *is* indicated by variations in the degree of alteration. Aphyric and microporphyritic basaltic, hawaiitic and mugearitic dykes are commonly thoroughly carbonated, whereas many of the feldspar-macrophyric basaltic and trachytic dykes are unaltered, especially the former.

References

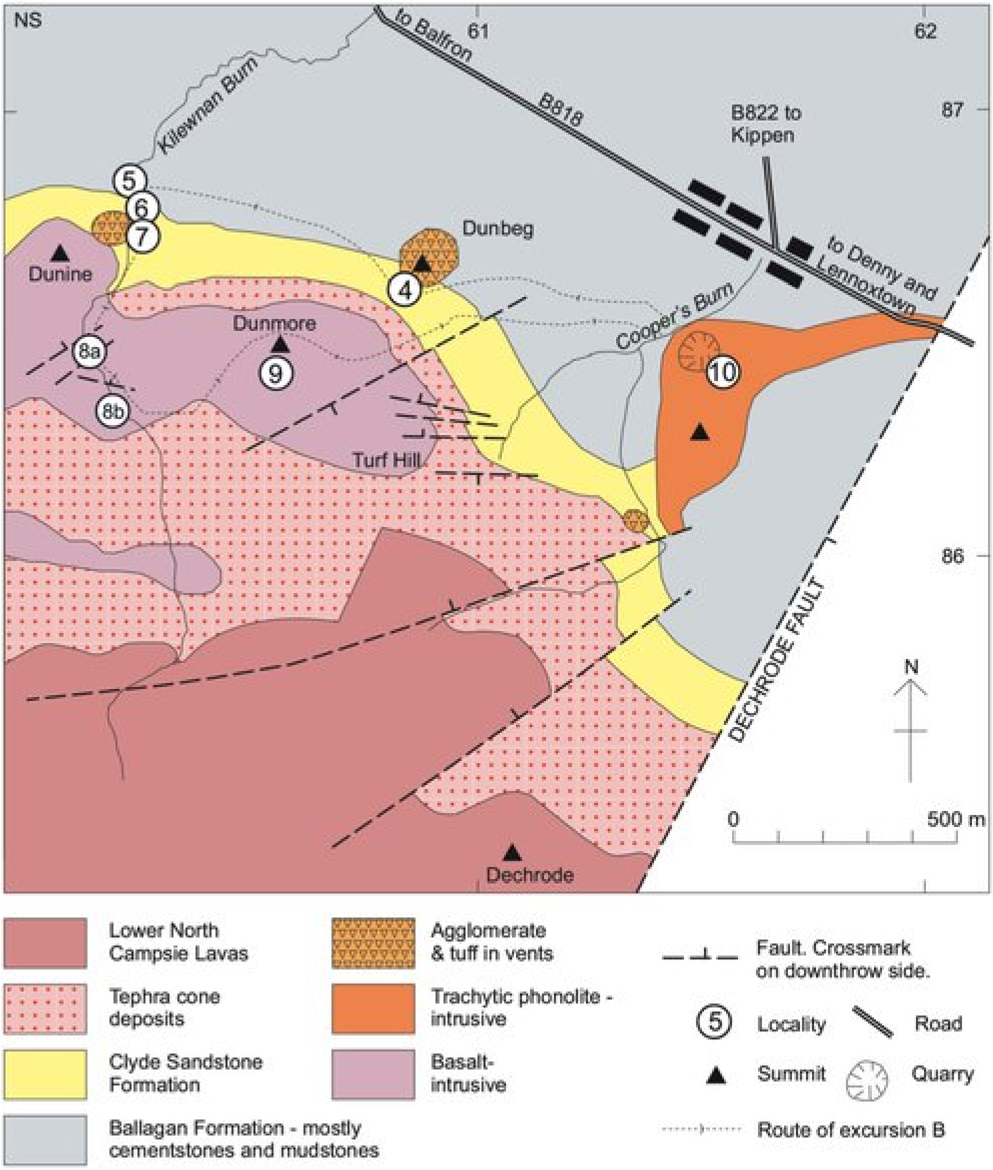
Table 10.1
Characteristics of proximal and distal basaltic sequences
Proximal
– fragmental rocks form high proportion of sequence
– blocks, scoria bombs and spatter usually present
– thick units of chaotic, coarsely fragmental rock common
– thickly stratified sequences of tuffaceous material common, usually incorporating blocks and bombs
– lava flows commonly compound and highly vesicular
– lava texture relatively coarse grained with ophitic clinopyroxene
– extensive bright red steam oxidation common in fragmental deposits close to conduit
– irregular minor basaltic intrusions common in sequences close to vents
– major columnar jointed basaltic intrusions commonly associated with conduit systems
– veins of intrusive tuffisite occasionally present in sequences adjacent to conduits
– sills commonly intruded in sedimentary strata beneath base of volcanic pile
Distal
– lava flows form high proportion of sequence
– blocks, scoria bombs and spatter always absent
– coarse fragmental deposits only thinly developed on upper flow surfaces
– tuffaceous material present only in thinly stratified sequences between flows
– lava flows commonly in form of simple, uniform sheets of predominantly massive character
– lava texture generally fine grained with granular clinopyroxene
– red-brown bole commonly restricted to interflow fragmental deposits
– intrusions rare and always in form of dykes

(Table 10.1) Characteristics of proximal and distal basaltic sequences

(Plate 10.1) Locality 10.2. Basal hawaiite flow of the Lower North Campsie Lavas resting on well-bedded ash-fall lapilli tuffs, Cammal Burn, Fintry.

(Plate 10.2) Locality 10.7. Early Carboniferous blocky agglomerate in Kilewnan Burn, Dunmore, Fintry.

(Plate 10.3) Locality 10.9. Columnar jointing in basalt sill under summit of Dunmore, Fintry.



(Figure 10.2) Itinerary 10B geological map with localities – Dunmore area.