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## Excursion 15 Perth

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This excursion illustrates the Lower Devonian rocks of the Strathmore basin in the Perth area, which are volcanic rocks of the Ochil Volcanic Formation, overlain by sedimentary strata of the Scone Sandstone Formation. In the Stirling–Perth area, these rocks were folded during the mid-Devonian Acadian orogenic event to form part of the southern limb of the ENE-trending Strathmore Syncline and the northern limb of the Ochil–Sidlaw Anticline. Latest Carboniferous quartz-dolerite dykes intrude both of these formations. The mainly grey, fluvial, channel sandstone bodies along with reddish-brown overbank or lacustrine silty mudstones are part of the sedimentary pile of the Strathmore basin. Bluck (1990) has expressed the view that this river system drained a mountainous area at some distance away, and since the continent–continent collision between Laurentia and

*Purpose:* To look at the Ochil Volcanic Formation (Arbuthnott–Garvock Group), including feldsparphyric basaltic andesite lavas, debris-flow conglomerates and interbedded fluvial and lacustrine strata; to examine the sedimentology of the overlying fluvial Scone Sandstone Formation, from which the Stone of Scone was probably hewn; to view quartz-dolerite dykes.

*Logistics:* Access and parking for cars and small coaches is available near or at all localities, but some are not suited to larger coaches without much increased walking distances. Facilities are available in Perth at the South Inch. Health and Safety is a significant feature, in a working quarry and walking beside the River Tay. Access is freely available except to Friarton Quarry (Tarmac), where advance notice is required and the usual hard hat, etc. obligatory. If travelling from Stirling, follow the A9 into Perth via Friarton Bridge.

*Maps:* OS 1:50,000 sheets 53 Blairgowrie and 58 Perth & Kinross; OS 1:25,000 Sheet 369 Perth & Kinross; BGS 1:50,000 Sheet 48W Perth; locality map (Figure 15.1).

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### **Locality 15.1 [NO 1350 2334] Corsiehill Quarry: quartz-dolerite dyke, andesitic lava and horizontal slickensides**

From the Friarton Bridge, leave the A90 at the north end to join the A85 Dundee Road into Perth. As the quarry is located on the northern side of Kinnoull Hill on Corsiehill Road, it is most easily accessed from the A85 by turning into Manse Road on the right, just before the left turn to the Queen's Bridge. From Manse Road, a right turn leads to Corsiehill Road. There is ample parking in the old quarry and beside the road.

The quarry is excavated in an easterly trending generally medium-grained quartz-dolerite dyke of the Central Scotland Late Carboniferous Tholeiitic Dyke-swarm. It is intruded into feldspar-phyric andesitic lava flows of the Ochil Volcanic Formation. Most of the dyke has been worked out, leaving only patchy selvages of fine-grained basalt dyke margin in contact with the andesitic lava on the north and south walls, but with its full width exposed in the west and east ends of the quarry. The quarry operated from before 1832 to after 1932 and is thought to have supplied roadstone aggregate. The youngest part of the workings was in the lava that is exposed in the embayments in the walls on the south side of the

quarry. The lava at the entrance to the quarry looks slaggy and is vesicular; some of these cavities are filled with calcite, chlorite and quartz. The more-massive but jointed dolerite is best seen below the wooden steps at the west end of the quarry. The two margins of the dyke may be examined in the south wall beside the car park and in the north wall in the wooded area east of the car park. In both places subhorizontal polygonal joints are visible on the vertical faces, as is to be expected where hot magma is intruded into vertical cracks and chills in contact with cold country rocks. In this locality the lavas are about 410 million years old and the dyke 300 million years old. Note some spheroidal (onion skin) weathering of the quartz-dolerite in places. In the SE extension to the quarry, subhorizontal slickensides can be seen in the lava.

## **Locality 15.2 [NO 1366 2282] Kinnoull Hill: viewpoint geology, feldspar-phyric basaltic andesite flows**

From the quarry, walk up Kinnoull Hill to the folly of Kinnoull Tower and the summit viewpoint. Follow the waymarked path to the west of the quarry uphill noting the andesitic lava knolls with large white feldspar phenocrysts (4 mm) near the picnic tables at the start. From the top of the hill and the tower (Plate 15.1) there are excellent views south and east over the NE Fife Hills (Ochil Volcanic Formation), including Norman's Law. The major break in slope on the north side of these hills marks the position of the large South Tay Fault that throws down to the north, with younger sedimentary rocks of the Upper Devonian and Lower Carboniferous under the low ground, mainly hidden by much younger Quaternary sediments. On the low ground, the River Tay is conspicuous and its confluence with the River Earn should be discernible. Also visible, except at or near high tide, are the modern intertidal deposits of the estuary. The terraces of the raised intertidal flats of the Holocene Carse Clay and the raised marine and beach deposits of Late Devonian age are part of this landscape tapestry.

The view east from the tower has featured in many Scottish calendars. The steep wooded cliffs of Kinnoull mark the position of a significant easterly trending fault, the Kinnoull Fault that throws down to the north. A similar fault forms the south side of Moncreiffe Hill. Both these faults connect to the North Tay Fault that throws down to the south. This fault, together with the South Tay Fault, form a small rift or graben on the crest of the Ochil–Sidlaw Anticline in which the younger rocks of the Upper Devonian and Lower Carboniferous are preserved. The view west from the tower is of the Ochil Hills, with Craig Rossie near Glen Eagles (Excursion 14) a distant feature. From the nearby summit viewpoint there is also a distant view of the Highlands and also, nearer, the 'dry valley' west of Perth of the Methven Gap, where about 14,500 years ago the retreat of glacier ice west to Crieff allowed the sea to form an embayment up the Earn valley to Crieff and east down this gap to Perth. On the return descent to the quarry, a good view is obtained of the Tay valley at Scone, with views to Dunkeld.

## **Locality 15.3 [NO 1200 2520] Quarrymill: Scone Sandstone Formation**

Quarrymill Woodland Park lies on the A93 (Perth to Blairgowrie Road), just south of Scone Palace on the east side of the River Tay opposite Perth (conveniently reached from Corsiehill Quarry). It has three waymarked walks and wheelchair accessible facilities. All start from the car park. Both the Millstone and Mill Pond routes are suitable for wheelchair users and have viewing platforms and picnic areas. The voluntarily staffed coffee shop is currently open Mon–Sat: 10am–4.30pm from the end of April to the end of September. Along the path at [NO 1232 2532] is a 45 m-long cliff, showing pale-red micaceous sandstone with cross-bedding. The colour of the sandstone is much paler at [NO 1226 2528]. Historic records call the quarries at this site 'Balcormac' and possibly also 'Kincarrathie', as no rock is known to crop out at or near the house of that name.

The best of the rather limited geology is to be seen from the path in small cliffs beside the Annaty Burn and in the Annaty waterfall. On the west side of the wood are overgrown and landscaped quarries from which stone was thought to have been worked for Scone Abbey and Palace, the old Perth bridges and very likely the Stone of Scone (Stone of Destiny) now housed in the Regalia Room in Edinburgh Castle. The Stone appears to be made of sandstone local to Scone. A smaller scale replica of it is located on Boot Hill in front of Scone Palace. Evidence provided by Fortey *et al.* (1998) about the Stone includes petrological descriptions of sandstone from Quarrymill, Lethendy, Huntingtower, Letham House, Crossgates and Kingoodie (Invergowrie), and is consistent with the suggestion that it came from Quarrymill.

## Locality 15.4 [NO 1141 2580] River Tay at Scone Palace

From Quarrymill, turn right out of the car park and travel north, passing the main entrance to Scone Palace, then turn left on to the Stormontfield Road at Old Scone. About 400 m on, turn left [NO 1136 2734] on the track down to the active Salmon Bothy [NO 1056 2656] beside the River Tay and seek permission to park. Note that access by car will be almost impossible during public events, when vehicles will be parked on the riverbank, almost to the exposure. The locality is a 1.3 km walk SE of here, beside the river.

Most of this exposure is as rock reefs in the river bed. It is neither visible nor accessible when the river is in flood or even just bank full. **Care needs exercising so close to this major river.** This locality provides the opportunity to compare these old river deposits with the modern ones of the Tay. In this reach of the river, there is an island with one channel usually almost dry. Here the gravel bed of the river is well seen with gravel bar features in the dry channel and imbrication of the gravel is seen after floods.

The exposures, which start at [NO 1141 2580] and end at [NO 1154 2554], are well worth visiting unless a lot of slime covers the rocks from agricultural pollution by farm fertilisers. The Scone Sandstone Formation here consists of reddish purple sandstone and some conglomeratic beds of fluvial origin. The clasts, up to cobble and boulder size, consist of concretionary limestone ('cornstone') known as calcrete [NO 1147 2564]. Such deposits form as part of a soil profile in a semi-arid climate with wet and dry seasons. As the groundwater table rises and falls, the salts in the sediments are leached downwards to form nodules that may coalesce to form rubbly beds of calcrete. In subsequent times of severe flood, the calcrete is eroded and transported as gravel. At this locality, confusingly, some calcrete nodules also occur *in situ* in the sandstones. Rare clasts of lava and quartz and more commonly of red and green mudstone may also be seen. Trough cross-bedding is present in the sandstones (Plate 15.2), well seen at [NO 1143 2574], near a fisherman's hut. Whereas most of the sandstones were laid down in sand bars in a braided river, the clay clasts are the remnants of overbank floodplain deposits destroyed in flood events.

## Locality 15.5 [NO 1160 2134] Friarton Quarry: Ochil Volcanic Formation, autobreccia, interbedded sedimentary rocks, quartz-dolerite dykes

From Scone Palace, return to Perth and cross the Tay to the west bank at the Victoria Bridge. Turn left (south) and then right at the Fergusson Gallery and follow the A912 from the traffic lights at the north end of the South Inch, passing Perth Prison. Turn right uphill at the end of the housing on the western side of the road in south Perth [NO 1160 2150]. This road leads shortly on the left to the entrance to the quarry [NO 1136 2150]. This quarry is still working (Tarmac) after more than 70 years but perhaps of limited future. How the faces will remain should the quarry close is not known, but they may provide an opportunity for provision of conservation sections. Strict health and safety controls apply to visitors, who are not allowed within set distances of the base of faces and from their top edges, the latter normally guarded by high artificial ridges. Full personal protective clothing is essential (including hard hat, long sleeved yellow jacket, eye protection, and footwear with hard toe-caps and ankle protection).

From near the site office there is a good view of the Tay valley and the wooded scarp formed by the Ochil Volcanic Formation at Kinnoull Hill. The face of the hill is the position of a major fault that throws down to the north. There are excellent views south and east over the NE Fife Hills (also Ochil Volcanic Formation), including Norman's Law. Also well seen is the low ground beside the River Tay, with the terraces of the Holocene Carse Clay and the raised marine and beach deposits of late-Devensian age. The view west is of the Ochil Hills.

The quarry exposes andesitic lava flows, up to 15–20 m thick, and interbedded sedimentary rocks consisting of siltstones, mudstones and sandstones in which lava grains are a significant component, all belonging to the Ochil Volcanic Formation (Plate 15.3). Baked mudstone can be seen immediately beneath the lava at [NO 1145 2105]. The lava at this point is heavily veined with bright green malachite. Two or three easterly trending late-Carboniferous quartz-dolerite dykes cross-cut these rocks. The best-exposed dyke is about 35 m wide and is easily traceable in the quarry floor and east wall. On the west side, the dyke is finer grained, veined and shows green-coloured hydrothermal effects [NO 1136 2112]. It is generally medium grained but is fine grained (i.e. basalt) at the contacts with the country

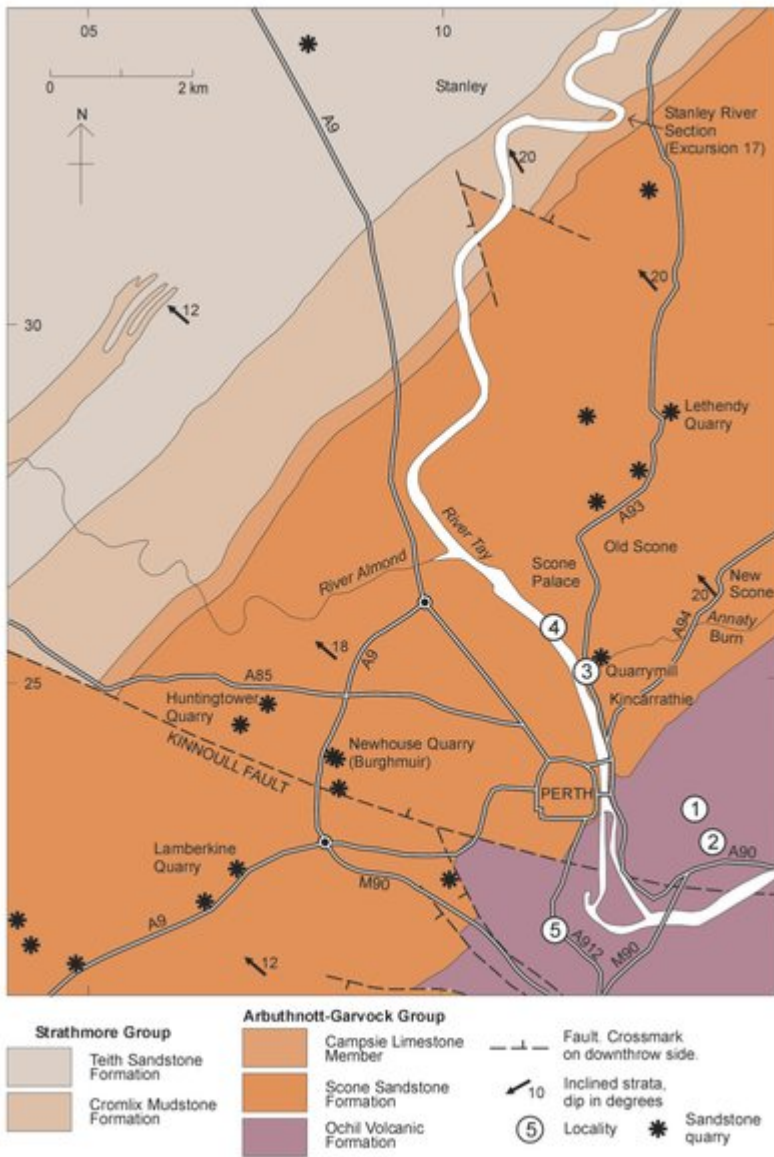
rock. Feldspar and pyroxene grains are identifiable as the main mineral component. Subhorizontal cooling joints (as at Locality 15.1, Corsiehill) are visible in the sections.

Brecciated andesitic rock is well exposed in the NE part of the site, just above the contact with sedimentary rock [NO 1168 2115]. A fertile discussion on the origin of the coarse breccia would consider possible origins but noting that mineralisation of the voids is also seen (calcite and baryte). The rock may be autobrecciated lava with the cavities infilled by sedimentary rock; the waterlain deposit laid down by percolating flow of groundwater.

Two further interpretations require that the wet sediment is laid down first and then either hot magma flows over the deposit as lava or is intruded into it as a sill. In both cases there is a violent interaction between the magma and the wet sediment producing the breccia and disrupting the bedding of the sediments by fluidisation; such breccia is known as peperite (Plate 15.4).

In the southern part of the quarry, several (up to 10?)m of well-bedded, purplish and greenish grey siltstones, mudstones and sandstones may be inspected. They show flat bedding and ripple cross-bedding. Rip-up clasts are present in the coarser beds and locally small granule (grit sized) lava fragments form fine conglomerates. The bedding is inclined at about 16° to the NW, reflecting the position of the quarry, which is located on the NW limb of the Sidlaw–Ochil Anticline, a major Mid-Devonian (Acadian Orogenic event) fold structure. Careful search of the finest rocks may produce examples of trace fossils in the form of trackways of unknown arthropod animals. Red hematite-stained plant remains are present in the greenish grey siltstones. Other sedimentary features include small sand dykes, desiccation cracks and load casts. The commonly seen small faults have associated hematitic staining, e.g. in the SW corner at [NO 1139 2095].

## [References](#)



(Figure 15.1) Geological map of the area around Perth, showing localities for Excursion 15. Adapted from Fortey et al. (1998, fig. 4).



*(Plate 15.1) Locality 15.2. Kinnoull Hill viewpoint – Ochil Volcanic Formation, North Tay Fault scarp and view eastwards towards Tay estuary.*



*(Plate 15.2) Locality 15.4. Trough cross-bedding and calcrete nodules in Scone Sandstone, River Tay, Scone Palace.*



(Plate 15.3) Locality 15.5. Bedded sandstone and mudstone dipping under andesitic lava flows of the Ochil Volcanic Formation, Friarton Quarry.



(Plate 15.4) Locality 15.5. Detail of loose block showing subangular to well-rounded masses of fine-grained igneous material within a matrix of green silty sandstone—peperitic texture as a result of injection of magma into wet, unconsolidated sediment, Friarton Quarry.