# Geology of the Aberfoyle district: Gravity anomalies



> **This topic provides a summary of the geology of the Aberfoyle district – covered by the British Geological Survey. 1:50k geological map sheet 38E (Scotland).**
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File:AberfoyleSD fig10.jpg

**Figure 10** Map of the regional variation in gravity anomaly across the Aberfoyle district. The range in anomaly values across the district is from about -5 to about +5 m Gal. Note the positive gravity anomaly (yellow to orange) trending along the north-western margin of the Highland Boundary Fault Zone (HBFZ). Negative gravity anomalies lie to the south- and north-east of the HBFZ (green to blue). Faults shown in red and geological boundaries to lithostratigraphical units shown in blue for reference. LTFZ: Loch Tay Fault Zone. DPF: Dukes Pass Fault. Shaded relief underlay derived from NextMap digital elevation data.

The regional gravity anomaly data for the Aberfoyle area are shown in Figure 10. Immediately to the north-west of the Highland Boundary Fault Zone (HBFZ), a series of concentric positive gravity anomalies of up to +5 mGal, lie on a north-east trend parallel to the HBF and are flanked to the south-east by north-easterly trending gravity anomaly contours. To the north, gravity anomalies become progressively more negative across the Highland Border Downbend and the ‘Flat Belt’, with values down to –12 mGal in the extreme north-west of the district. To the south-east of the HBFZ, near neutral gravity values give way gradually and then more rapidly to strongly positive anomalies in the ground to the south-east of the Aberfoyle district. Unpublished BGS gravity models suggest a thicknesses for the Dalradian of about 3 km beneath the Flat Belt, and about 5 km beneath the Steep Belt.

The wedge of positive gravity anomalies in the west of the district, north of the HBFZ, may reflect the steeply dipping wacke sandstones and semipelitic rocks of the Southern Highland Group in Loch Ard Forest, and relatively high density mafic rocks in the Highland Border Complex. Thus, the highest gravity anomalies are broadly coincident with the metasandstones and semipelitic rocks that underlie Loch Ard Forest and part of Loch Achray Forest (Figure 10), but such high anomalies do not extend to the north-east, where similar lithologies continue to crop out. Furthermore, Southern Highland Group rocks of similar density elsewhere in the north of the district are associated with negative gravity anomalies. It is possible, therefore, that the gravity high immediately north of the HBFZ results, at least partly, from a component of the putative wedge of mafic Midland Valley Terrane crust that is interpreted to extend north of the surface trace of the HBFZ in regional models, as discussed above and by Trewin and Rollin (2002)[1].

It is notable that the positive anomalies are broadly limited, and possibly displaced by, the Loch Tay, Dukes Pass and associated faults (Figure 10). In the north-east of the district, the trace of the Loch Tay Fault zone coincides with a re-entrant in the gravity anomaly contours. Similarly, the positive anomaly coinciding with the Achray Forest, to the north of Aberfoyle, is limited on its north-western side by the Loch Ard Fault (Figure 9).

The nature of the HBFZ at depth has already been discussed in the section on structure. The gravity data clearly reflect the location of the HBFZ, with reductions of about 5 mGal in the gravity field. The gravity fields on both sides of the fault decline consistently to the north-east, maintaining the difference across it (see below). Whether this relates to declining influence of basement or more local surface effects is unclear.

To the south-east of the Highland Boundary Fault, a broad region of neutral to weakly negative gravity anomalies coincides with the Lower Devonian outcrop, corresponding to the low density conglomerates and sandstones. The lowest gravity values and strongest gradients occur in the eastern part of this area, where anomalies reach –5 mGal. This low probably reflects the very coarse conglomerates of the Craig of Monievreckie Conglomerate Formation, which has its thickest development in this area. Unpublished BGS gravity models suggest some 4 km of Devonian strata adjacent to the Highland Boundary Fault, thinning to about 2 km to the south-east.

Gravity anomalies become weakly positive again in the south-east of the district, then increase strongly in the extreme south-east. The smooth increase in the regional gravity field is coincident with lower Carboniferous sedimentary rocks. The strongly positive increase reflects the influence of the lower Carboniferous basalts that form the Gargunnock Hills immediately south-east of the district. It is also possible that Midland Valley basement has an effect, since the regional models discussed by Trewin and Rollin (2002)[1] suggest that dense Midland Valley basement occurs at shallower depths to the south-east of the district.

# References


1. ↑ [1.0] [1.1] Trewin, N H, and Rollin, K E. 2002. Geological history and structure of Scotland. 1–25 in *The Geology of Scotland* (Forth edition). Trewin, N H (editor).(London: The Geological Society.)


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