Permian volcanic activity, Midland Valley of Scotland

Interbedded volcanic rocks of Permian age occur only in Ayrshire, where they form an annular outcrop around the overlying aeolian sandstones of the Mauchline Basin. Contemporaneous necks and sub-volcanic intrusions are abundant within and around the Mauchline lavas, and the late necks of east Fife and possibly East Lothian have late Stephanian to Lower Permian radiometric ages. Sills of various alkali dolerite rock-types are thought to be near contemporaneous with the Lower Permian lavas.

The Mauchline volcanic sequence, which increases in thickness eastwards from 100 to 238 m, rests unconformably but with no marked discordance upon Upper Coal Measures. Sediments resembling the overlying Mauchline Sandstones occur locally at the base of the sequence, as intercalations between flows and as infillings in slaggy flow tops. Lava flows are predominantly olivine-basalts of Dalmeny type, but some strongly silica-undersaturated basic types are characteristically present (nepheline-basanite, analcime-basanite, olivine-nephelinite) and analyses include some hypersthene-normative (transitional) basalts. Agglomerates and tuffs constitute a large part of the succession, becoming more abundant in the thicker, eastern parts.

Over 60 volcanic necks are known in Ayrshire, mostly within a 20 km radius of the Mauchline Basin, but also extending to West Kilbride in the north, Muirkirk in the east and Dalmellington in the south. Numerous lines of evidence suggest that these necks are contemporaneous with the Mauchline lavas and hence delimit the former extent of the volcanic field. Necks are known to cut the Coal Measures, post-Coal Measures alkali dolerite sills and the Mauchline lavas but not the Mauchline Sandstones. Those which cut older strata do so in areas where older volcanicity is not recorded. Many vents contain wind-rounded sand grains and some include large subsided blocks of Mauchline sandstone.

Vent agglomerates usually consist of a mixture of sedimentary and igneous material. Blocks and lapilli of Mauchline lava types are common and alkali dolerite, derived from sills, occurs locally. Plugs and other vent intrusions are predominantly of highly-undersaturated olivine-analcimite or monchiquite but alkali dolerite and camptonite are also known. Thin dykes and sills of monchiquite commonly occur in the vicinity of necks and monchiquite dykes are common in the Irvine valley and the Patna area. Many of the intrusions and agglomerates contain xenolithic megacrysts and nodules of carbonated peridotite.

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