

Carboniferous, Grampian Highlands

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Stephenson, D, and Gould, D. 1995. British regional geology: the Grampian Highlands. Fourth edition. Reprint 2007. Keyworth, Nottingham: British Geological Survey.

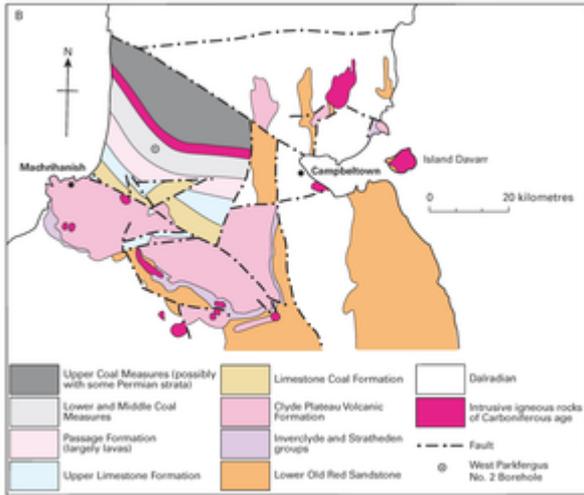
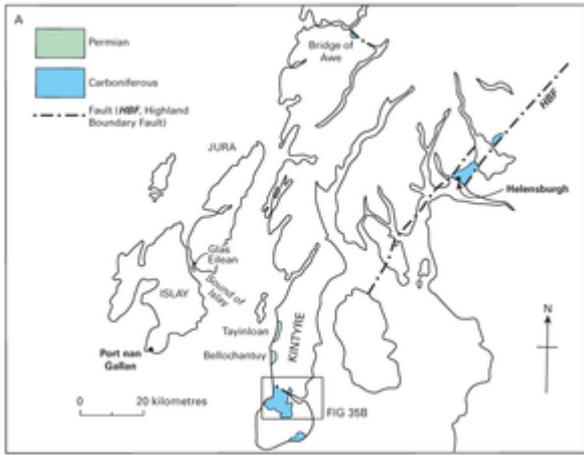
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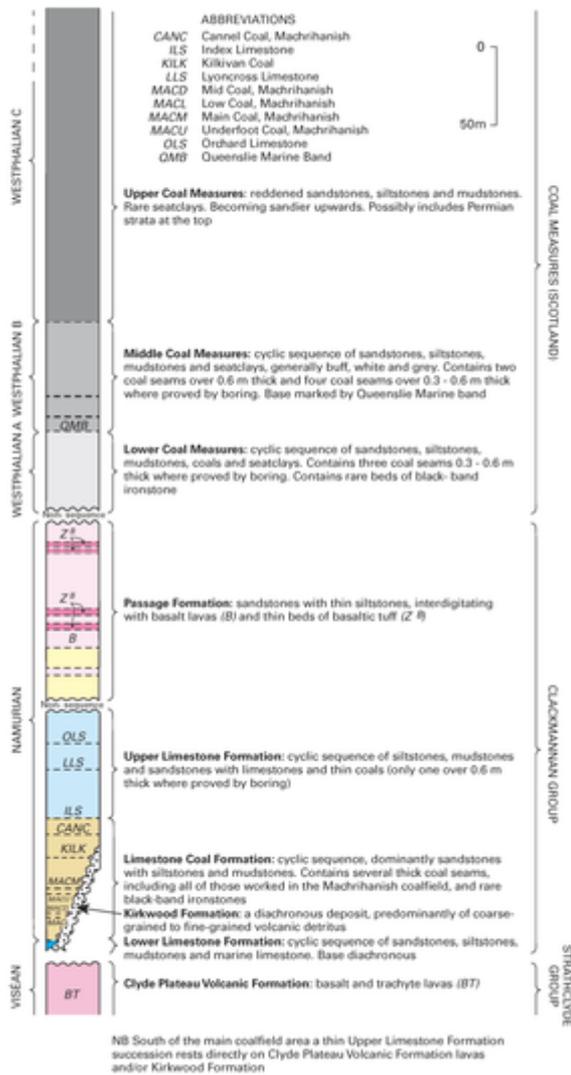
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Carboniferous

Small exposures of Carboniferous rocks occur along the River Awe, west of the Pass of Brander. In southern Kintyre, Carboniferous rocks of the Machrihanish Coalfield include both lavas and sedimentary rocks with several thick coals. Along the Highland Boundary Fault, in the Loch Lomond-Helensburgh area, Lower Carboniferous sedimentary rocks rest on the Upper Devonian and extend some distance into the Grampian Highlands ([P915443](#)).



A Carboniferous and Permian rocks of the South-west Highlands. B Carboniferous rocks of southern Kintyre. P915443.



Generalised sequence of the Carboniferous of southern Kintyre. P915444.

River Awe

A few exposures on the banks of the River Awe, mainly upstream of Bridge of Awe, reveal a small outlier of Carboniferous rocks, less than 0.1 km² in area, resting on Old Red Sandstone lavas. The outlier is probably fault-bounded on the north-east (Pringle and MacGregor, 1940). About 18 m of Carboniferous sedimentary rocks are exposed; basal conglomerates are overlain by reddish gritty sandstones, reddish mottled mudstones, purplish shales and some paler, fine-grained sandstones, the finer beds containing poorly preserved plant remains. The best plant remains have been recorded from an outcrop 90 m upstream of Bridge of Awe and include a calamite stem, *Asterocalamites*, and a fern rachis very like *Rhacopteris petiolata* (Göppert). Kidston (1899) considered these plants to be a Lower Carboniferous assemblage. Lithologically the Carboniferous rocks at Bridge of Awe have a strong resemblance to the lower strata in the outlier at Inninmore about 30 km to the north-west.

Kintyre

In southern Kintyre, the Lower Old Red Sandstone is overlain by a thin sequence of Upper Old Red Sandstone sedimentary rocks (McCallien, 1927). The lower part of the Upper Old Red succession is assigned to the *Stratheden Group* (Upper Devonian) and the upper, cornstone-bearing part to the

Kinnesswood Formation in the *Inverclyde Group* of late Devonian to early Carboniferous age. These sedimentary rocks are unconformably overlain by up to 400 m of olivine-basalts, mugearites, trachyandesites and trachytes belonging to the *Clyde Plateau Volcanic Formation* (Strathclyde Group). At Skerry Fell Fad, a dome-like mass of trachyte probably represents a highly viscous lava capping its feeder pipe. There are also a number of plugs, sills and dykes ranging in composition from olivine-dolerite to syenite and dacite (Macdonald, 1975). The lavas are overlain in places by reddish bauxitic clays, interpreted as detrital lateritic deposits formed by contemporaneous decomposition of the volcanic rocks (McCallien and Anderson, 1930).

The overlying Carboniferous sedimentary rocks form the Machrihanish Coalfield, which occupies the flat ground north and east of Machrihanish (McCallien and Anderson, 1930). The sequence resembles that of the Midland Valley and the same stratigraphical nomenclature can be applied ([P915444](#)). Sandstones containing a thin bed of limestone exposed on the shore at Machrihanish are doubtfully attributed to the *Lower Limestone Formation*. The *Limestone Coal Formation* is well developed in the south-western part of the coalfield, where it is about 100 m thick, and contains a number of coals, of which the Main Coal and to a lesser extent the Kilkivan Coal have been intermittently worked from the end of the eighteenth century. The Main Coal is 3 to 3.6 m thick, but the upper 1 m contains siltstone partings and is generally of inferior quality. The coal was worked from a number of collieries, principally the Argyll Colliery, which was abandoned because of major fire in 1925, and the Machrihanish Colliery, opened in 1944 and also closed because of fire in 1967. The Kilkivan Coal, some 35 m above the Main Coal, is up to 2.15 m thick. Other seams reach a considerable thickness in places, but are of limited lateral extent and are not sufficiently continuous to mine economically. The thick sandstone which forms the roof of the Main Coal was also mined as a source of moulding sand. In the eastern part of the Machrihanish Coalfield, borehole evidence shows that the lower part of the Limestone Coal Formation, including the economic coal seams, is absent and the sedimentary rocks lap on to an irregular surface of weathered lava and volcanic detritus (*Kirkwood Formation*).

The *Upper Limestone Formation* is locally about 90 m thick, but is generally poorly developed. The formation includes limestones that have been correlated with the Index, Lyoncross and Orchard limestones of the Midland Valley sequence. South-west of the Drumlemble Fault, which bounds the Machrihanish Coalfield, rocks of the Upper Limestone Formation unconformably overlie the Clyde Plateau Volcanic Formation. A maximum of 20 m of limestone and limy shale rests on laterite in Tirfergus Glen and rests on bauxite in Torchoillean Burn (McCallien and Anderson, 1930). The unconformably overlying *Passage Formation* consists of sandstones and thin siltstones, interbedded with thick flows of basic lava and bands of reddish lateritic mudstone; the total thickness is approximately 150 m. In the West Parkfergus No. 2 Diamond Borehole, an intercalation of sedimentary rock above the lowest flow includes a marine band with remains of gastropods and ribbed brachiopods. The uppermost lavas have been weathered to bauxitic clay, indicating another break in the sequence. A 460 m-thick succession overlying the Passage Formation is assigned to the Communis, Modiolaris and Lower Similis-Pulchra chronozones of the *Lower and Middle Coal Measures*. The Vanderbeckei (Queenslie) Marine Band, which marks the boundary between these is present in the borehole and has yielded *Lingula* and one specimen of *Spirifer* (Manson, 1957; Brand, 1977). The coals in the Coal Measures appear to vary in both thickness and extent but locally seams up to 1.7 m thick are developed. Red sandstones exposed near the northern margin of the coalfield are probably reddened *Upper Coal Measures*.

Recent evidence from offshore surveys suggests that the Machrihanish Coalfield extends at least 15 km westwards into the Rathlin Trough. To the south, the succession in the Ballycastle Coalfield of County Antrim shows many similarities to the Limestone Coal Formation of Machrihanish (Wilson and Robbie, 1966).

Helensburgh-Loch Lomond

In the Helensburgh-Loch Lomond area, white, pink, and red-purple sandstones, with sporadic quartz pebbles and cornstone beds, overlie conglomerates of the Upper Devonian Stratheden Group (Paterson et al., 1990). The cornstone-bearing sandstones have been assigned to the Inverclyde Group (mainly Lower Carboniferous) because of their lithological similarity to beds of that age in the Midland Valley (Paterson and Hall, 1986). Exposure is confined to a few stream sections, but the junction with the underlying Devonian conglomerate is not exposed. The cornstones are impure irregular concretionary limestones up to 0.5 m thick which probably developed in soil profiles in Lower Carboniferous times. They usually occur at the top of upward-fining channel-fill fluvial sandstones developed in an evaporating environment after the channels were abandoned. A small fault-bounded area of grey mudstones with cementstones occurs in the Fruin Water, 2 km north-east of Helensburgh, where 5 m of grey mudstone with several thin dolomitic limestones (cementstones) and veins of gypsum overlie grey micaceous sandstone. On Ben Bowie, 2 km east of Helensburgh, the Inverclyde Group, about 170 m thick, is overlain by a 60 m-thick volcanic sequence consisting of basal tuffs overlain by feldspar-phyric basic lavas and mugearites. The volcanic rocks are correlated with the Clyde Plateau Volcanic Formation (Strathclyde Group).

East of Loch Lomond, the basal Carboniferous Kinnesswood Formation crops out on the hills north-east of Balmaha and overlies Upper Devonian conglomerates with slight angular unconformity. The sequence is about 50 m thick and includes well-developed cornstones up to 1.20 m thick which were formerly quarried and burnt for lime.

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