

Passage Group, Namurian, Carboniferous, Midland Valley of Scotland

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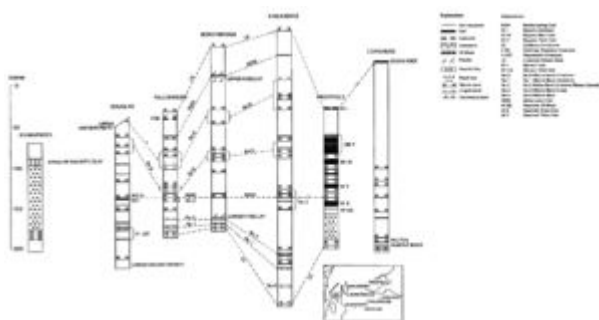
Cameron, I B, and Stephenson, D. 1985. British regional geology: The Midland Valley of Scotland. Third edition. Reprint 2014. Keyworth, Nottingham: British Geological Survey.

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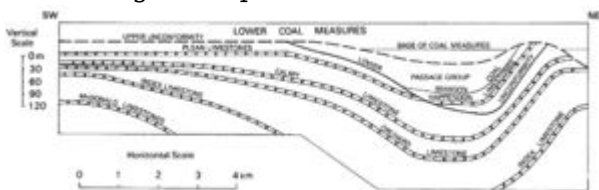
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Passage Group (now known as the Passage Formation)



Comparative generalised vertical sections of the Passage Group. P915534.



Diagrammatic section showing relation of strata above and below the lower and upper unconformities in the Carboniferous sequence of Douglas. P915535.

The uppermost division of the Namurian in the region, the Passage Group, includes the strata between the Castlecary Limestone and the base of the Westphalian (Coal Measures). In those areas where the Castlecary Limestone is missing the base of the group is drawn at the top of recognisable Upper Limestone Group beds and is therefore poorly defined in some areas. The top of the group cannot be accurately drawn in the region as the definitive base of the Westphalian, the Subcrenatum Marine Band has not been recorded in Scotland. The top of the group is taken at the locally defined base of the Coal Measures in the various areas.

The lower part of the group is assigned to the Arnsbergian (E₂) Stage but the later Namurian stages are poorly developed or absent. There is no diagnostic evidence for beds of Chokierian (H₁) and Alportian (H₂) age but miospores indicate that some deposits of the Kinderscoutian (R₁), Marsdenian (R₂) and Yeadonian (G₁) stages are present.

The rocks consist mainly of sandstones and thick beds of clayrock. Thin coals and beds of marine mudstone also occur as minor components of the succession. The clayrocks are of economic importance but the coals are not usually of workable thickness except in the Westfield area of Fife.

Lithology

The rhythmic character of the sediments of earlier groups persists into the Passage Group, but it tends to be obscured by the predominance of thick sandstone beds, many of which have erosive bases. The occurrence of numerous non-sequences which stem from penecontemporaneous erosion has resulted in the impersistence of even well-developed marine horizons, and episodes of coal-formation were short-lived.

The predominant rock-type is sandstone which is commonly medium- or coarse-grained, white, pale yellow or grey in colour and locally reddened. The sandstones frequently contain pebbly bands which in the lower part of the group may include fragments of ironstone, coal or oil-shale. The constituents of the sandstones are predominantly quartzose and they are classified as orthoquartzites and protoquartzites with a few subgreywackes.

The clayrocks are unbedded or poorly bedded. Some contain roots and are therefore seatclays, but in others there is no sign of roots. A red, purple or yellow mottling locally replaces the more usual grey colour and it has been suggested that this may be due to partial oxidation during periods when the water-table was temporarily lowered. Some of the clayrocks are refractory and are a valuable raw material. They are grouped into the Lower and Upper Fireclays and it is the former which is the most sought after.

There are several marine bands in the succession ([P915534](#)). They are usually thin, consisting of shale with marine fossils and, in the lower part of the succession particularly, contain thin bands of shelly limestone. The most widespread limestone is the Roman Cement or No. 2 Marine Band which occurs in the lower part of the sequence.

Coal seams and ironstones are present in the succession and are quite numerous, but they are thin and few have been worked.

Correlation

The marine bands in the Passage Group are best developed in the Kincardine Basin where the succession is thickest. However, the correlation of marine bands is hardly possible from one area to another. They tend to be impersistent due to minor non-sequences and there is no locality at which all known marine bands are present.

The marine bands were originally numbered from 1 to 3 in ascending order, but subsequently others were found and the numbering scheme has had to be modified. Currently there are Nos. 0, 1 and 2 Marine Bands and Nos. 3, 5 and 6 Marine Band Groups ([P915534](#)). Up to 16 or 17 individual marine beds are now known but many occur only locally.

Lateral variation

The thickest development of the Passage Group, about 335 m, occurs in the Kincardine Basin. Sixteen or seventeen individual marine bands are present but they tend to be reduced in number and in variety of fauna where the sequence is thinner. Many are also cut out by local non-sequences.

The two principal components of the succession, the sandstones and the clayrocks are subject to marked lateral variation in thickness and lithology.

The commercially important 'Lower Fireclays' lie between No. 2 Marine Band and No. 3 Marine Band Group and individual bands can be up to 18 m thick in places. It is not possible to correlate bands of fireclay even over fairly short distances. The 'Upper Fireclays' overlie No. 6 Marine Band Group.

Two coals seams are fairly persistent throughout the area. The Netherwood Coal occurs within the No. 3 Marine Band Group and the Bowhousebog Coal occurs within the 'Upper Fireclays'. The top of the group is taken at the base of the Lowstone Marine Band.

In Midlothian the Passage Group, formerly known as the Roslin Sandstone, is up to 240 m thick. It is predominantly arenaceous and is locally reddened. The number of marine bands is greatly reduced compared with the Kincardine Basin succession and correlation with that area is not possible.

The top of the group is lithologically determined and is taken at the base of the Seven Foot Coal, the local base of the Coal Measures.

In the Douglas outlier the typical Passage Group lithologies of sandstones and clayrocks are developed and locally there are unusually thick coals. The base of the sequence is an unconformity which rests on various levels in the upper part of the Upper Limestone Group. The top of the group is placed at the base of the Porteous Band which is a marine horizon marking the local base of the Coal Measures.

An unconformity in the upper part of the group cuts out part of the sequence ([P915535](#)). It has least effect in the area around Happendon, but progressively more of the upper part is cut out to the north, west and south. In the area south-east of the Kennox Fault the group is cut out completely and rocks of Coal Measures age rest unconformably on rocks of the Limestone Coal Group and Lower Limestone Group. The maximum residual thickness is about 200 m.

There are several coal seams but they are only a few centimetres thick. Mottled red, yellow and grey clayrocks occur in the upper half of the sequence.

A group of three thin limestones called the Happendon Limestones occur in the lower part of the sequence and these may correlate with the Nos. 0, 1 and 2 Marine Bands of the Kincardine Basin. The Manson Shell Bed which lies in the middle of the succession is possibly equivalent to the No. 3 Marine Band Group and consequently the underlying Manson Coal could correlate with the Netherwood Coal. The Manson Coal is as much as 6 m thick in places.

The development at Westfield, in Fife, is extraordinary. The Passage Group rocks occur in a synclinal outlier lying between the Kincardine Basin and the east Fife-Midlothian Basin and it is thinner than the sequence in either of these two areas. The succession can be subdivided into three parts. The lower part rests on the Castlecary Limestone and consists of sandstones and a lava flow. The middle subdivision, called the Boglochty Beds, contains a number of very thick coals. The thickness varies from 30 to 150m and one-third of that thickness consists of coal. In addition to coal there are two oil

shale seams, the Westfield Shale and the Canneloid Shale. Marine bands occur at several levels in the Boglochty Beds and miospore evidence suggests a correlation of one of the bands with the No. 3 Marine Band Group in the Kincardine Basin. The upper subdivision consists mainly of sandstone.

The top of the Passage Group is taken at the base of the Bogside Ironstone and Coal which is an horizon that can be correlated with other areas. However, the evidence of miospores indicates that the Namurian/Westphalian boundary falls near the top of the Boglochty Beds.

At Westfield there has been a large opencast mine, over 200 m deep from which the coals of the Boglochty Beds, amongst others, have been extracted.

In Ayrshire, north of the Kerse Loch Fault, the Passage Group rocks consist of a thin and variable lower sedimentary subdivision, the Passage Group Volcanic Formation and the Ayrshire Bauxitic Clay.

The lower sedimentary subdivision consists of sandstones and clayrocks with bands of marine shale. The formation is 30 m thick at its maximum and rests unconformably on various horizons in the Upper Limestone Group.

The Passage Group Volcanic Formation consists of a pile of basalt lavas with minor intercalations of sandstone and clayrocks. The formation is thickest in the Troon area where it measures about 150 m.

The Ayrshire Bauxitic Clay varies in thickness from about 1.5 to 9 m and is the product of decomposition and leaching of the underlying lavas. The rock consists mainly of kaolinite with minor amounts of the bauxite minerals boehmite and diaspore, but varying amounts of iron and silica limit the economic value of the deposit. It has been worked at several localities for the chemical industries. The top of the Passage Group is the top of the Ayrshire Bauxitic Clay.

In south Ayrshire the group is poorly known but in the New Cumnock area about 80m of strata have been assigned to it. The beds consist mainly of sandstones and clayrocks but two thin limestones are present.

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