

Lower Limestone Formation

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Lower Limestone Formation (**LLGS**), Carboniferous, Midland Valley of Scotland

Lower Limestone Formation is part of the [Clackmannan Group](#).

Name

Forsyth et al. (1996)^[1] changed the name Lower Limestone Group to Lower Limestone Formation, without changes to the boundary definitions.

Lithology

The Lower Limestone Formation (see Browne et al., 1999, fig.3^[2]) comprises repeated upward-coarsening cycles of limestone, mudstone, siltstone and sandstone. The cycles may be capped by thin beds of seatearth and coal. The limestones, which are almost all marine and fossiliferous, are pale to dark grey. The mudstones (many of which also contain marine fossils) and siltstones are predominantly grey to black. Nodular clayband ironstones and limestones are well developed in the mudstones. The sandstones, which are usually fine- to medium-grained, are generally off-white to grey. Except locally, coal seams are thin (0.3 m) and few in number. Other minor lithologies include cancell and blackband ironstone. A few nonmarine fossiliferous beds are known. Upward-fining parts of the succession, dominated by fine- to medium-grained sandstone but lacking limestone, also occur. In the western part of the Midland Valley the sequence is condensed, with the intervals between limestones dominated by mudstone.

Genetic interpretation

The formation comprises *mixed shelf carbonate and deltaic ('Yoredale') facies*. The lower parts of the cycles, including almost all limestones and many mudstones, were deposited in marine environments. The upper parts of the cycles, including sandstones and coals, were deposited as

progradational lobate deltas.

Stratotype

The type section is from 81.98 to 292.51 m depth in the Wester Gartshore Colliery Underground Borehole (BGS Registration Number NS67SE/99) (NS 6824 7239) at Kirkintilloch, north-west of Airdrie (see Browne et al., 1999, fig. 3, col. 4^[2]).

Lower and upper boundaries

The conformable base of the formation is taken at the base of the Hurlet Limestone, which is underlain by sedimentary rocks of the [Lawmuir Formation](#), [Pathhead Formation](#), [West Lothian Oil-Shale Formation](#) or [Aberlady Formation](#) (Figure 6, Columns 1, 4A-E).

The top of the formation is drawn at the top of the Top Hosie Limestone (TOHO), which is overlain by cyclic sedimentary rocks of the Limestone Coal Formation.

Thickness

The maximum thickness of the formation is about 240 m in the Lathallan–Radernie area of east Fife (Forsyth and Chisholm, 1977, p. 60^[3]). In the western part of the Midland Valley it is condensed to less than 50 m (Browne et al., 1985^[4]). Generalised thickness were given of 45 m on Arran (BGS, 1987a) and 8.75 m in the main coalfield area at Machrihanish (BGS, 1996^[5]).

Distribution and regional correlation

Throughout the Midland Valley, the Isle of Arran and at Machrihanish. Browne et al. (1999, table 4^[2]) proposed a rationalisation of the principal named horizons across the Midland Valley of Scotland, using the Glasgow nomenclature as the standard.

Age and biostratigraphical characterisation

Visean to Namurian (late Brigantian to early Pendleian/early Serpukhovian). Ammonoids of zonal significance include *Paradimorphoceras marioni*, *Metadimorphoceras varians*, *Girtyoceras multicameratum* and *Beyrichoceratoides truncatus* Var. M all of P2 age found in the Neilson Shell Bed, and 'Cravenoceras' *scoticum* of E1 age found below the Top Hosie Limestone (Currie, 1954^[6]). The Hurlet Limestone is distinguished by the macrofauna in the underlying mudstone. Known as the Macnair Fauna, its upward sequence includes layers with inarticulate brachiopods, bivalves and finally articulate brachiopods (see Wilson, 1989, p. 104^[7]). The mudstones of the Neilson Shell Bed immediately above the Blackhall Limestone have a well-preserved fauna including the brachiopod *Tornquistia youngi* (abundant), the gastropods *Borestus wrighti* and *Tropidocyclus oldhami* and the bivalves *Euchondria neilsoni*, *Pernopecten fragilis* and *Posidonia corrugata gigantea*, all of which are confined to the Neilson Shell Bed (Wilson, 1989^[7]). The faunas of the Hosie Limestones are rich, though corals are relatively scarce and bryozoa are common only in the lower two limestones. The bivalve *Caneyella membranacea* (a very common fossil in the higher beds of P2 age in the Pennines area of England) is all but confined to the Hosie Limestones. It is more common in the lower two limestones (Wilson, 1989^[7]) perhaps corroborating Cozar et al. (2008)^[8] recognition on foraminiferal evidence that the Second and Top Hosie Limestones are both E1 (Pendleian or early Serpukhovian) in age. *Curvirimula* is the predominant nonmarine bivalve genus in the formation.

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