Chapter 16 Western Central Lowlands

Introduction

D.G. Sutherland and, E. Gordon

The commonly termed Central Lowlands of Scotland (Figure 16.1) do in fact contain a number of hill groups reaching over 600 m OD. The term, therefore, is somewhat inexact but it is useful in highlighting the contrast between the Midland Valley and the mountainous areas to both the north and south. As both these mountain areas were major sources of ice during the Pleistocene, and as there is no evidence for a significant build up of ice within the central belt itself, the history of glaciation of that area is indeed that of a lowland that has been repeatedly invaded by external ice. At times the ice originating in the south-west Highlands has been dominant, whilst at other times Southern Uplands ice has expanded to the north over ground once glaciated from the opposite direction. This led J. Geikie (1877) to coin the phrase, by analogy with social history, of the 'debatable ground' for the southern central belt where the two ice masses held alternate dominance. The Quaternary history of the western Central Lowlands has been reviewed in part recently by Price (1980) and Jardine (1986).

The western Central Lowlands have long been known for mammalian fossil occurrences, including mammoth, reindeer and woolly rhinoceros, that pre-date the last ice-sheet glaciation. These derive from two distinct areas, the Ayrshire Lowlands, as at Kilmaurs (Bryce, 1865b; Young and Craig, 1869), Dreghorn (Craig, 1888) and, most recently, Sourlie (Jardine and Dickson, 1987; Jardine *et al.,* 1988), and from the lower Clyde Valley, as at Bishopbriggs (Bryce, 1859; Rolfe, 1966), Baillieston (Kirsop, 1882), Mount Florida (Macgregor and Ritchie, 1940), Chapelhall (Bryce, 1859) and Carluke (Smith, 1871). In all the locations the fossils are described as occurring within or below deposits of the last ice-sheet, and radiocarbon dates are available from three localities. Samples from Bishopbriggs (Rolfe, 1966) and Sourlie (Jardine and Dickson, 1987; Jardine *et al.,* 1988) suggest ages of about 27,000–30,000 BP for the fauna, but the two museum samples dated from Kilmaurs gave contradictory ages of 13,700 + 1700 −1300 BP (GX–0634) (Sissons, 1967b) and >40,000 BP (Birm–93) (Shotton *et al.,* 1970).

Two other types of deposit pre-dating the last glaciation have been reported from the same general areas: terrestrial organic sediments, and sands, silts and clays containing marine shells. These have not, in general, been studied in detail, although the organic sediments at Sourlie contain plant macro- and microfossils indicative of a treeless vegetation (Jardine and Dickson, 1987; Jardine *et al.,* 1988). The marine deposits are best exposed at Afton Lodge. As with other high-level shell beds in Scotland, it has been disputed whether they are in *situ* (for example, Holden, 1977a) or have been transported as large glacial erratics (Eyles *et al.,* 1949). Sutherland (1981a) has suggested that they are indeed in *situ* and result from a marine incursion during the period of build-up of the last ice-sheet, which he further suggested occurred during the Early Devensian. He also considered that the shelly deposit, which apparently overlay the stratum containing the terrestrial fossils at Kilmaurs (Bryce, 1865b), confirmed that such a marine transgression had occurred. Similar deposits may occur in the south of Arran (Bryce, 1865a; Tyrrell, 1928; Sutherland, 1981a). The dating and sedimentology of all these deposits, however, is uncertain and awaits new evidence.

The last expansion of ice into the western Central Lowlands occurred during the Late Devensian. The initial advance was from the south-west Highlands, and as this ice advanced into the lower Clyde Valley, it dammed the river, producing a sequence of glacial sediments overlying terrestrial and lacustrine deposits (Sissons, 1964; Price, 1975). Throughout the lower Clyde Valley area there are also numerous buried channels, possibly the result of subglacial meltwater erosion (Clough *et al.,* 1916, 1920; Sissons, 1967a; Jardine, 1977; Menzies, 1981). The advancing ice overrode these channels and buried them under glacial deposits. The most spectacular results of this process are seen at the Falls of Clyde, for here, on deglaciation, the river did not regain its old buried valley (Ross, 1927) but cut a new one, with the consequent formation of a sequence of waterfalls.

In the Glasgow area there has long been recognized two till units, red and grey in colour. In places the red till (containing Old Red Sandstone lithologies) has been observed to overlie the grey till (containing Carboniferous lithologies) and they are sometimes seen to be separated by, or overlie, sands and gravels (Bennie, 1868; Clough *et al,* 1925; Jardine, 1973; Browne and McMillan, 1989). Although it has been proposed that the till units might represent separate glacial periods (Sissons, 1967a; Jardine, 1968), more recent work (Menzies, 1976, 1981; Abd-Alla, 1988) suggests that the contrasts in till colour and composition simply reflect the distribution of different bedrock lithologies eroded by the ice. Locally, the till contains marine fossils (Wright, 1896; Browne and McMillan, 1989). However, an earlier till has been recognized by Browne and McMillan (1989). This till is stratigraphically below the till units described above, has not proved to be fossiliferous and may have been subject to a period of subaerial weathering (Browne and McMillan, 1989). The glacial deposits in the Glasgow area are extensively drumlinized (Elder *et al,* 1935; Rose and Letzer, 1975, 1977; Menzies, 1981; Rose, 1987). The orientations of the drumlins clearly indicate how the ice flowlines diverged as the ice moved out from the Highlands and across the Midland Valley (Sissons, 1967a).

The Highland ice transported a characteristic sequence of erratics, a fine example of which is Clochodrick Stone. These erratics can be traced into the northern margins of the Southern Uplands (Sutherland, 1984a), indicating that the expansion of Highland ice occurred at a relatively early stage of the last glaciation, for subsequently the Southern Uplands ice became more dominant, advancing northwards into the southern Central Lowlands and deflecting the Highland ice to both east and west. The stratigraphic consequences of this differential development of the two ice centres is a bipartite till sequence throughout much of the southern Central Lowlands, in which a basal till derived from Highland ice is overlain by a till carrying Southern Uplands erratics. Such a sequence is well illustrated at Nith Bridge (Holden, 1977a, 1977c).

On deglaciation very extensive sequences of meltwater channels, eskers and kames were formed (MacLellan, 1969; Cameron *et al,* 1977). From slightly to the west of the Ayrshire–Clyde watershed, these glaciofluvial features are oriented to the east or north-east and drainage was to the North Sea (Sutherland, 1984a, 1991a). The most outstanding examples of the glaciofluvial deposits formed at this time are the Carstairs Kames (Goodlet, 1964; Sissons, 1967a; MacLellan, 1969), but they are only part of a wider integrated glacial drainage system that operated during the greater part of the deglaciation of central Scotland. Only after the lower Clyde Valley had become free of ice could meltwaters abandon their easterly routes and flow towards the northwest (Browne and McMillan, 1989).

In Ayrshire, west of the Clyde watershed, there is a relative paucity of meltwater phenomena (Holden, 1977a). However, in the upper basin of the River Ayr, there is a particularly interesting sequence of deposits in which an upper till unit, as seen at Greenock Mains, has been interpreted as resulting from a late readvance of the ice-sheet (Holden, 1977a, 1977d). If this is indeed correct, then it implies that active ice occupied the Firth of Clyde after much of the Central Lowlands had been deglaciated. A westwards flow of ice across Kintyre from Arran and carrying Ailsa Craig microgranite to the north coast of Ireland may have occurred at this time and been the counterpart of the readvance in Ayrshire. For reasons of climatic amelioration and the assistance that the deeper waters of the inner Firth of Clyde would have given to ice wastage by calving, this late-stage ice mass may have collapsed rapidly (Sutherland, 1984a). Radiocarbon dating of marine shells around the head of the Firth of Clyde has indicated that these events took place prior to 13,000 BP (Browne *et al,* 1977; Sutherland, 1986).

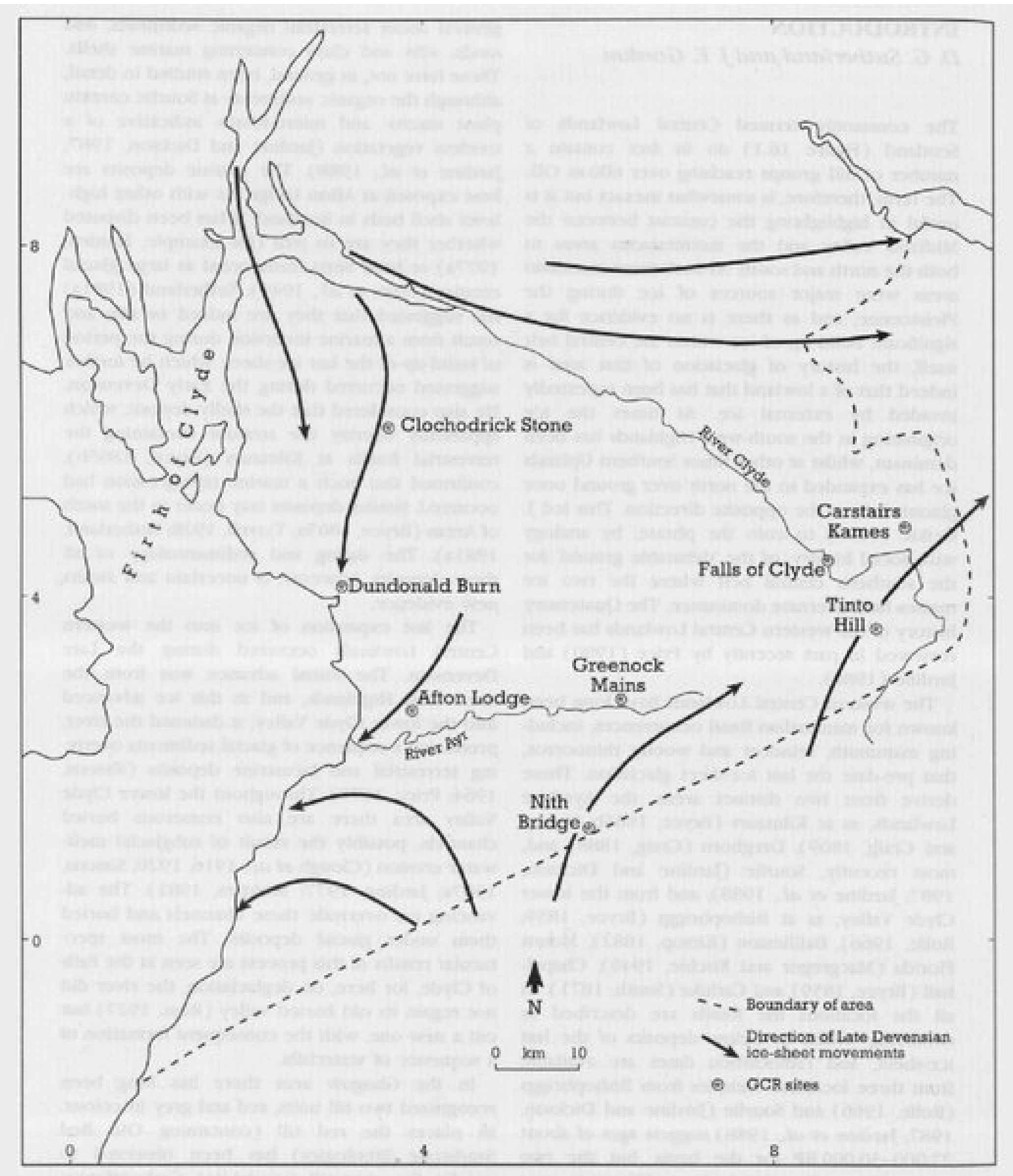
During the Loch Lomond Stadial small glaciers formed on Arran (Gemmell, 1973; D. G. Sutherland, unpublished data), and periglacial activity was intense. Ice wedges formed near sea level (Rose, 1975), and radiocarbon dating of buried organic sediments on the flanks of Late Devensian drumlins indicates significant slope instability and solifluction at this time (Dickson *et al.,* 1976). The summits and slopes of the hills in the south of the area are extensively covered in frost-weathered debris and solifluction deposits (Galloway, 1961a; Tivy, 1962; Ragg and Bibby, 1966). On Tinto Hill, where the vegetation has been stripped back, stone stripes are actively forming today.

On deglaciation of the Ayrshire coast the marine limit was at about 25 m OD (Jardine, 1971), or as much as 28 m OD (Boyd, 1986a), with the sea penetrating inland along the lower part of the river valleys, such as that of the Irvine (Boyd, 1986a). Around Arran, the marine limit was also formed on deglaciation, the sea reaching to around 27 m OD in the south of the island and over 30 m OD in the north (Gemmell, 1973; D. G. Sutherland, unpublished data). There has been debate as to whether the sea entered the Clyde estuary area at this time via the Lochwinnoch Gap, while the lower estuary was still occupied by ice (Peacock, 1971c; Price, 1975; Price *et al.,* 1980). The situation remains unclear, not least because of the difficulties in defining the marine limit in the Glasgow area (Sutherland, 1984a), and although rockhead altitude in the Lochwin-noch Gap is sufficiently low for the sea to have passed along its length (Ward, 1977; Institute of Geological Sciences, 1982), such an event still awaits demonstration by the identification of suitably placed marine sediments.

The western Central Lowlands have been the focus of much research on Quaternary deposits during the last 150 years but, curiously, relatively little has been published in recent times on the Lateglacial and Holocene vegetational history of the area. An exception is the work of Boyd (1982, 1986c, 1988; Boyd and Dickson, 1986) who has studied Holocene environmental change in the Irvine area. On Arran, vegetational change during the Holocene has been studied at a number of sites (Robinson, 1981, 1983; Boyd and Dickson, 1987; Afleck *et al.,* 1988; Edwards and McIntosh, 1988; Robinson and Dickson, 1988) and, in Ayrshire, the history of forest clearance has been investigated at Bloak Moss (Turner, 1965, 1970).

In the Irvine area, as well as more widely along the Ayrshire coast, there is well-preserved evidence for the sea-level changes that occurred during the Holocene (see Dundonald Burn). Following a period of relatively low sea level in the early Holocene, the Main Postglacial Transgression resulted in marine invasion of the coastal zone and the burial of terrestrial peats by marine sediments (Jardine, 1964, 1971; Boyd, 1988). At and following the maximum of the transgression, estuarine sediments were laid down in sheltered embayments; on the more open coasts extensive sequences of shingle ridges were deposited and large sand-dune systems developed on their surfaces, as near Irvine.

[References](#)



(Figure 16.1) Location map of the western Central Lowlands.