Chapter 6 North-west Highlands

Introduction

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The north-west Highlands (Figure 6.1) contain some of the most spectacular scenery in the country, glaciation having resulted in valley overdeepening, watershed breaching and corrie formation in a landscape that already had considerable pre-glacial relief. There is relatively little known about pre-Late Devensian events in this region. The cave systems of Sutherland have recently been found to contain fossil material and other sediments that pre-date the Late Devensian, and published uranium-series disequilibrium dates on speleothems imply ice-free conditions around 122 ka (the Ipswichian) and again between approximately 38,000 BP and 26,000 BP (Lawson, 1981a; Atkinson *et al.,* 1986). The latter period of ice-free conditions is also substantiated by radiocarbon dates on reindeer antlers from Creag nan Uamh (Lawson, 1984) of approximately 25,000 BP. Thus there appears to have been an interstadial period towards the end of the Middle Devensian.

Late Devensian ice-sheet glaciation then ensued, although there is no site in the north-west Highlands that unequivocally demonstrates this. The ice shed during the period of maximum glaciation can be reconstructed from the transport of erratics, and it appears to have lain somewhat to the east of the present watershed (Peach and Horne, 1893a; Sissons, 1967a; Lawson, 1990). As some of the mountains of the region are capped by extensive areas of frost-shattered debris which show distinct down-slope limits (see An Teallach), it has been suggested that these mountains were not overtopped by the Late Devensian ice but existed as nunataks (Godard, 1965; Ballantyne *et al.,* 1987). If this is correct, then the occurrence of high-level erratics on certain of these summits (Ballantyne *et al.,* 1987) must be attributed to a pre-Late Devensian period of ice-sheet glaciation.

The period of deglaciation following the last ice-sheet maximum is noted in the north-west Highlands for the formation of end moraines at particular retreat stages. The most extensive of these moraines is that first described by Robinson and Ballantyne (1979) and attributed to the Wester Ross Readvance (see Gairloch Moraine); further moraines relating to this phase have been subsequently described by Sissons and Dawson (1981), Ballantyne (1986a) and Ballantyne *et al.* (1987) (Figure 6.1). The moraines apparently mark a specific phase in the deglaciation of the region and they have been related to a raised shoreline which is partly cut in bedrock (Sissons and Dawson, 1981). This has led to the supposition that the Wester Ross Readvance dates from the period at around 13,500 BP to 13,000 BP, when the climate changed from arctic cold to boreal as the oceanic polar front migrated north of Scotland. Other moraines have been reported from Easter Ross (see Achnasheen) (Sissons, 1982a) which may correlate with the Wester Ross Readvance (Sutherland, 1984a), although such an attribution is uncertain and a Loch Lomond Readvance age can also be maintained on the basis of the available field evidence (Ballantyne *et al.,* 1987).

Deglaciation of much of the lowland part of the region by 13,000 BP is suggested by the radiocarbon dates on basal organic sediments (see Cam Loch), but continued presence of ice in the high mountains during the Lateglacial Interstadial has been argued for on palaeoclimatic grounds (Bal-lantyne *et al.,* 1987). Subsequently there was an expansion of shrubs and heaths, such as *Empetrum* and *Juniperus,* and an accompanying increase in the acidity of the soils. This vegetational development, however, was briefly interrupted, with a re-expansion of indicators of disturbed soils and a decline in shrub cover shown by lower frequencies in pollen spectra, as well as an increase in the amount of mineral matter being washed into enclosed basins. This brief phase has been correlated with the Older Dryas (see Cam Loch and Loch Sionascaig) (Pennington, 1975b, 1975c). Following this, shrubs and heaths became reestablished and throughout much of the region the vegetation of the main part of the Lateglacial Interstadial was characterized by ericaceous dwarf-shrub heathland or tundra. The high representation of pollen of *Empetrum* suggests a strong oceanic influence.

The Loch Lomond Stadial was a period of glacier resurgence throughout the region. A large ice-field, with outlet glaciers descending close to present sea level in the west, occupied an area from the mountains in the south to as far north as

Torridon and there were numerous individual valley and corrie glaciers in the mountains farther to the north (Figure 6.1) (Peacock, 1970a; Robinson, 1977; Sissons, 1977a; Ballantyne, 1981; Boulton *et al.,* 1981; Wain-Hobson, 1981; Lawson, 1986; Ballantyne *et al.,* 1987). Major end-moraine systems (see Cnoc a'Mhoraire and An Teallach) and abundant hummocky moraines (see Coire a'Cheud-chnoic) were deposited by these glaciers and are prominent elements of the modern scenery of the valleys of the north-west Highlands. Periglacial processes were particularly active in the unglaciated areas at this time, and the major periglacial landforms on the mountain summits received their final fashioning, even though the frost-weathered detritus on certain summits was derived from earlier periods of periglaciation. Two of the most spectacular landforms of the region, the Baosbheinn protalus rampart (Sissons, 1976c) and the Beinn Alligin rock glacier (Sissons, 1975a), formed at this time, with landslides being important in the formation of each (Ballantyne, 1986a).

The vegetation during this period was characteristic of open tundra, with large areas of disturbed ground. At Creag nan Uamh a cache of reindeer bones, which has been radiocarbon dated to the stadial, raises the possibility that Man was present in the area at the time, despite the severity of the climate (Lawson and Bonsall, 1986a, 1986b).

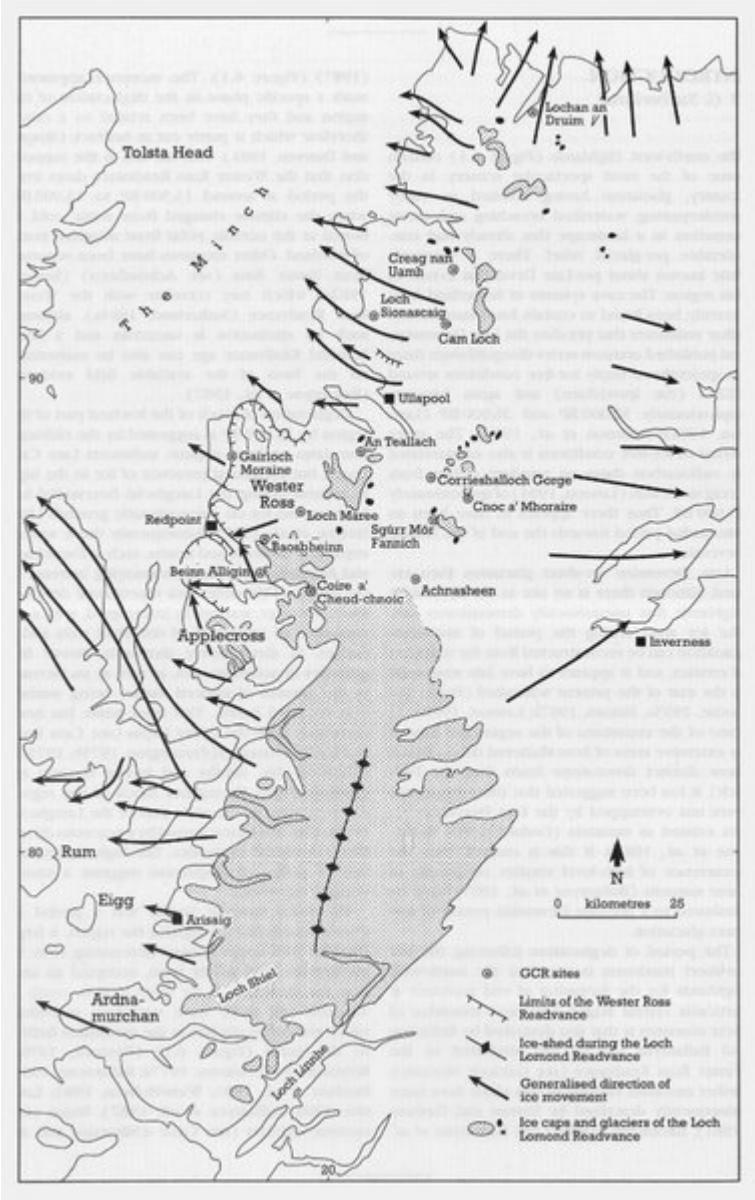
The change in climate at the end of the stadial was marked by a regular plant succession from dwarf-shrub tundra, through a juniper-dominated phase to, at around 9000 BP, the expansion of first birch and then birch–hazel woodland (see Loch Maree and Loch Sionascaig). Latterly in the southern part of the region, communities of oak and elm became established in favourable localities (Moore, 1977; Williams, 1977), but by around 8300 BP pine appeared, apparently earlier at certain sites in Wester Ross and farther north (see Loch Maree) compared with sites farther south, and even compared with neighbouring sites in the region (Loch Clair, Pennington *et al.,* 1972). In the northern part of the region there was probably only a brief phase of pine expansion in what was predominantly a birch-forest zone (see Lochan an Druim).

Reduction in the forest cover began around 5000 BP to 4000 BP, with accompanying expansion of blanket bog, possibly due to a climatic change to cooler and moister conditions. The role of Man in this process, although apparent farther south, remains to be clearly demonstrated in this region. Extensive clearance of birch forest in the last 1500 years can be more directly attributed to human activity.

Sea-level changes around the coasts have not been studied in detail. Following the phase of high sea level accompanying ice-sheet decay, there appears to have been a long period when sea level was below that of the present, and the only evidence for later higher sea levels is the sequence of beaches formed at the maximum of the Main Postglacial Transgression and subsequently. None of these shorelines has been dated, although by comparison with elsewhere in Scotland they can be presumed to have been formed during approximately the last 6000 years.

During the Holocene the mountain summits have continued to be the focus of periglacial activity, albeit at an intensity much reduced from the Loch Lomond Stadial. Small-scale patterned-ground features occur on many summits, and down-slope movement of detritus is recorded by buried organic horizons under solifluction lobes and terraces (White and Mottershead, 1972). A recent increase in such activity may be indicated by the soil horizon buried near Sgùrr Mòr in the Fannich mountains in the last few hundred years (Ballantyne, 1986c). On An Teallach a notable feature is the extensive deposit of wind-blown sand with interstratified organic horizons. Following deposition of much of the sand during the early Holocene there has been a recent resurgence in sand blowing, possibly as a consequence of grazing pressure (Ballantyne and Whittington, 1987).

References



(Figure 6.1) Location map and principal glacial features of the north-west Highlands (modified from Johnstone and Mykura, 1989).