Chapter 11 Inner Hebrides

Introduction

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The Inner Hebrides comprise the islands from Skye in the north to Islay in the south (Figure 11.1). By virtue of their position and topography, they give rise to a diverse series of environments. The Quaternary history of the islands can be understood in terms of the interplay of changes in the local environments resulting from climatic and sea-level variations and the, at times, dominant influences from the nearby mainland. Thus the history of glaciation is that of the interaction of locally nurtured ice caps and the invading mainland ice-sheet. The Holocene vegetational history is also one of local floristic diversity resulting from plant migration from the mainland, with a number of trees and shrubs reaching the northern or western limits of their ranges in the islands. No interglacial or interstadial sites are known from the Inner Hebrides and the established Quaternary history is thus relatively short, being confined to the Late Devensian. Although various shore platforms have been ascribed to interglacial or pre-glacial episodes, their origins remain uncertain. The area is a classic one for features of mountain glaciation, shore platforms and raised beaches. The principal themes of research have therefore focused on these aspects and, in addition, on the interaction of local and mainland ice, landforms of the Loch Lomond Readvance and Lateglacial and Holocene vegetation history.

The principal islands and mountain groups of the Inner Hebrides relate to the central Tertiary igneous complexes of Skye, Rum and Mull. Tectonic warping and accompanying erosion in the Tertiary would have fashioned a landscape with a magnitude of relief similar to that of the present by the time of the onset of glaciation, but subsequent glacial erosion has produced many of the familiar and dramatic details of the scenery. Thus it is likely that many of the islands, such as Skye, Mull, Scarba, Jura, and Islay, were initially attached to the mainland, with glacial erosion producing the intervening narrow stretches of sea (Sissons, 1983c). It may be noted that due to sea-level change since the last glaciation, Knapdale and Kintyre were, at different times, islands, whereas the Ardnamurchan peninsula, although never an island, has many affinities with the neighbouring islands.

Striations, roches moutonnees and the trans port of erratics provide clear evidence of the interplay of the mainland ice-sheet and the glaciers and ice-caps developed during the last glaciation on the islands. The mainland ice overwhelmed almost all the islands, flowing in a westerly or north-westerly direction (Clough and Harker, 1904; Harker, 1908; Peach *et al.,* 1910b, 1911; Cunningham Craig *et al.,* 1911*;* Bailey *et al.,* 1924; Bailey and Anderson, 1925; Richey and Thomas, 1930), but local ice on both Skye (Harker, 1901) and Mull (Bailey *et al.,* 1924) was sufficiently powerful to maintain independent ice centres, and no mainland erratics are found in the central mountain areas of these islands. Surprisingly, in contrast to other areas of Scotland where the ice-sheet traversed part of the sea floor (see Mill Bay, Baile an t-Sratha, Boyne Quarry, Kippet Hills, Port of Ness, Nith Bridge and Port Logan), there are few reports of shelly glacial deposits in the Inner Hebrides. Only in western Islay have shelly tills (Synge and Stephens, 1966; Peacock, 1974b) and poorly fossiliferous glaciomarine sediments (Benn and Dawson, 1987) been described. A possible lateral limit of the last ice-sheet has been recognized on the Trotternish peninsula on Skye by Ballantyne (1990).

The most spectacular effects of glaciation occur in the Cuillin Hills of Skye. The Cuillin have the greatest frequency and magnitude of ice-eroded corries and rock walls in Scotland, and the summit ridge of aretes and pyramid-shaped peaks is the product of headward erosion of the corries. Also in the Cuillin and particularly by Loch Coruisk is a quite outstanding development of ice-moulded and striated bedrock. Other small-scale features resulting from ice erosion that are of particular note in the Inner Hebrides are the bowls, channels and troughs (p-forms) reported by Gray (1981) at Scarisdale on Mull.

All the Inner Hebridean islands were close enough to the centre of the last mainland ice-sheet to have been strongly influenced by glacio-isostatic depression and rebound. This has resulted in a complex and often impressive development of raised marine erosional and depositional features around the coasts. Three distinct generations may be recognized; those that pre-date at least one period of glaciation; those that are contemporaneous with the retreat of the last ice-sheet;

and those that post-date the disappearance of the last ice-sheet.

The first of these three groups has two separate elements: the first at close to present sea level and the second at high level, generally above 18 m OD. Close to present sea level is a set of apparently horizontal rock platforms. Their surfaces are striated and the backing cliffs can, in places, be seen to disappear beneath glacial drift. On Northern Islay and the West Coast of Jura, Dawson (1980a) has termed this set of platforms the Low Rock Platform and it, or they (as there appear to be a number of levels in different parts of the Hebrides), have been suggested to be of interglacial origin (Dawson, 1980a; Sissons, 1981a, 1983c). There is no direct evidence for this, however.

These low platforms are in marked contrast to the second set of platforms comprising the so-called High Rock Platform, examples of which occur widely throughout the Inner Hebrides as well as on certain of the neighbouring peninsulas, such as Ardnamurchan and Applecross. These rock platforms are frequently spectacularly developed, as in Northern Islay, and range in altitude from 18 m to as much as 51 m OD. Originally thought to be 'preglacial' (Wright, 1911) because of the striations and glacial deposits found in places on the platform surfaces, their age is today considered much less certain. An interglacial origin was favoured until recently (McCann, 1964, 1968; McCann and Richards, 1969; Jardine, 1977), but has been supplanted in favour of the idea that the platforms formed contemporaneously with the last ice-sheet (Sissons, 1981a, 1982b; Sutherland, 1981a; Dawson, 1984; Gray, 1985). Sissons (1981a, 1982b) noted that not all fragments of the platform carried evidence of glaciation and, further, that there was a distinct line running through the Inner Hebrides to the east of which high rock platforms were either absent or only very poorly developed, whereas to the west they were typically very clear and extensive features (Figure 11.1). Sissons argued that this contrast was due to ice occupying the eastern area while the platforms were being formed to the west. Minor advances and retreats of the ice-sheet would have resulted in glaciation of certain of the platforms, but those formed during ice retreat would not be glaciated. A corollary of Sissons' hypothesis is that the platforms should be isostatically tilted. Unfortunately, the number of accurate altitudes available on the inner margin of the platform fragments is as yet too few to test this prediction. Sissons (1981a, 1982b) also suggested a chronology for the development of the rock platforms, envisaging initial expansion of the Scottish ice-sheet in the Early Devensian (see Sutherland, 1981a) and glaciation (and accompanying platform formation) continuing throughout the Devensian until final decay of the ice towards the end of the Late Devensian. There is as yet no direct evidence to support such a chronology.

During ice-sheet retreat in the Late Devensian, the most rapid deglaciation initially occurred in the deep-water channels between the islands, and the residual ice masses on the islands then flowed outwards into these ice-free areas. At a relatively late stage, however, a north-westerly ice flow was maintained across Islay and Jura, and as the Paps of Jura emerged from the ice as nunataks, the remarkable medial moraine of Scriob na Caillich (Dawson, 1979b) on the West Coast of Jura was deposited. At about this time the end moraine at Coir' Odhar in Northern Islay (McCann, 1964; Synge and Stephens, 1966; Dawson, 1982) was also formed. Sea level at this period was relatively high and the second generation of raised marine features was formed during the subsequent fall. These features consist of glaciomarine deltas as well as gravel spreads and shingle ridges. The last are most spectacularly developed along the West Coast of Jura (McCann, 1964; Dawson, 1979a, 1982), where staircases of over 20 distinct ridges have been mapped. In central Islay a moraine records the position of the ice-sheet margin while relative sea level fell by up to 12 m (Dawson, 1982).

The precise timing of deglaciation is unclear. A radiocarbon date of 16,470 ± 300 BP (SRR–118) (Harkness and Wilson, 1979) from marine sediments offshore from Colonsay (Binh *et al.,* 1974) may be too old due to contamination. The earliest dates from basal terrestrial sediments of 13,870 ± 150 BP (SRR–3121) at Loch Ashik on Skye (Walker *et al.,* 1988) and 13,140 ± 100 BP (SRR–1805) at Loch an t-Suidhe on Mull (Walker and Lowe, 1982; Lowe and Walker, 1986a) are also uncertain because of possible contamination (Sutherland, 1980). Lateglacial vegetational development has only been studied in detail on Mull and Skye (Birks, 1973; Birks and Williams, 1983; Walker and Lowe, 1982, 1990, 1991; Lowe and Walker, 1986a; Walker *et al.,* 1988). Throughout the Lateglacial Interstadial the vegetation of the islands was essentially treeless, and although tree birch occurred in the more southerly islands, its distribution was limited to those areas not exposed to westerly winds (Lowe and Walker, 1986a). It may have reached its north-westernmost limit at this period in south-east Skye (Birks and Williams, 1983). The early vegetation of the interstadial consisted primarily of open grass- and sedge-dominated communities, but a juniper scrub and then an *Empetrum* heath developed. As with the tree birch, exposure to westerly winds may have been the main factor in limiting plant diversity during this period (Walker *et al.,* 1988).

The Loch Lomond Stadial had a major impact on the Inner Hebrides. Glaciers readvanced or built-up anew on Skye (Walker *et al.,* 1988; Ballantyne, 1989a), Rum (Ballantyne and Wain-Hobson, 1980) and Mull (Gray and Brooks, 1972). The age of the readvance is established by the ice-transported shells at Loch Spelve on Mull, which gave a radiocarbon date of 11,330 ± 170 BP (1–5308) (Gray and Brooks, 1972), and the occurrence of only Holocene sediments in enclosed basins from within the readvance limits (Walker and Lowe, 1985). Radiocarbon dating and accompanying pollen analyses from such sites implies that the glaciers on Mull had largely disappeared by between 10,500 BP and 10,000 BP. On Skye comparisons of the pollen spectra from the basal sediments in enclosed basins within the readvance limits has indicated a diachronous retreat of the glaciers (Lowe and Walker, 1991). Initial retreat may have been underway by 10,200 BP and was apparently completed by the time of the juniper peak of the early Holocene vegetational succession, that is, no later than 9,600 BP.

During the latter part of the Lateglacial period a distinctive shoreline was eroded around the coasts of the southern islands. This shoreline, termed the Main Rock Platform, is isostatically tilted (Gray, 1978a; Dawson, 1980b; Sutherland, 1984a) and slopes away from the area of maximum isostatic depression in the south-west Highlands, such that it passes below present sea level in Northern Islay and around the coast of Mull. It has also been identified on the coast of southern Skye (Peacock, 1985). The evidence from the Isle of Lismore (see above) (Gray, 1987; Gray and Ivanovich, 1988) suggests that the platform could in part be a reoccupied, older feature.

The Loch Lomond Stadial vegetation reflected the harshness of the climate, with a dominance of open-habitat taxa and species characteristic of disturbed soils (Lowe and Walker, 1986a). Periglacial processes were particularly active (Ballantyne, 1991b), and the large-scale patterned-ground features found in the Western Hills of Rum (Ballantyne and Wain-Hobson, 1980; Ballantyne, 1984) were most probably fashioned at this period. On Jura the impressive protalus rock glacier of Beinn Shiantaidh (Dawson, 1977) was formed.

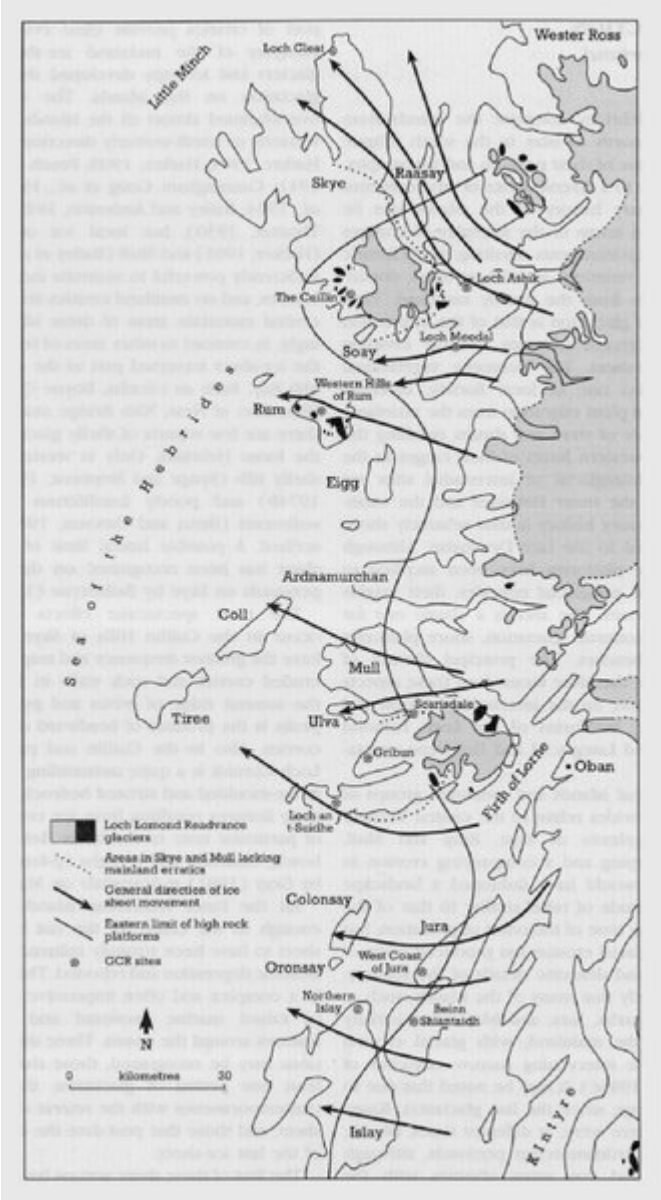
The early Holocene was initially characterized by rapid vegetational development as the climate ameliorated, and a plant succession from tundra heath through *Empetrum* heath and juniper scrub to hazel–birch woodland probably occurred in the first 1500 years. Details of this early phase are particularly well preserved at Gribun on Mull (Walker and Lowe, 1987). Subsequent development of the Holocene vegetation cover reflected the diversity of local environments, as is illustrated by the pollen sites in Skye at Loch Ashik, Loch Meodal and Loch Cleat (Birks, 1973; Birks and Williams, 1983). Around Loch Meodal, in the Sleat peninsula, during the middle Holocene the dominant vegetation was mixed birch–hazel–alder woods with some oak, elm, ash, rowan and holly. This was probably close to the northern limit of predominant oak at that time (Birks, 1977; Birks and Williams, 1983). Pine was absent, yet a short distance to the north around Loch Ashik pine flourished (Williams, 1977). In contrast again, at Loch Cleat in northern Skye only birch, hazel and willow scrub developed at this time (Williams, 1977; Birks and Williams, 1983). These three sites, considered together, demonstrate the diversity of vegetational development resulting from the geological, topographical and climatic variations on a single island in the Inner Hebrides.

Farther south than Skye, the vegetation of the middle Holocene consisted of birch–hazel scrub or woodland with some oak and elm (Andrews *et al.,* 1987; Walker and Lowe, 1987; Hirons and Edwards, 1990). Subsequent to 4000 BP woodland contracted and heathland and grassland expanded. A reduction in woodland cover at about this time has been widely noted in Scotland (see Allt na Feithe Sheilich and Loch Maree) and may be due to either an increase in storminess or human impact, or a combination of the two (Birks, 1987).

The final generation of raised marine features formed around the coasts of the inner Hebrides was produced at the maximum of, and subsequent to the Main Postglacial Transgression. As with the Lateglacial shorelines, the features are most impressively developed along part of the West Coast of Jura, particularly at Inver where as many as 30 distinct shingle ridges occur one above the other (Dawson, 1979). Radiocarbon dates on marine shells from Oronsay (Jardine, 1978, 1987) suggest that the maximum Holocene sea level was attained at around 6500–7000 BP. Thus the 'staircase' of shingle ridges at Inver was likely to have been formed in the last 6500 years.

Small-scale periglacial features are currently active on a number of mountains on Rum (Western Hills) and Mull (Godard, 1959).

References



(Figure 11.1) Location map and principal Quaternary features of the Inner Hebrides (from Peacock, 1983b; Sissons, 1983c; Ballantyne and Benn, 1991).