Northern Islay, Argyll and Bute

[NR 363 766]–[NR 425 774]

Potential GCR Site

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Introduction

The coastline of northern Islay in the Scottish Inner Hebrides is characterized by some of the finest examples of emerged shore platforms and emerged gravel beaches to be found anywhere in western Europe (see (Figure 3.1) for general location). This coastline is the UK type locality for a feature that has come to be known in the literature as the 'High Rock Platform', a 650 m-wide shore platform formed during the Quaternary Period and now found at an elevation of *c.* 33 m OD. It is backed by a cliff of up to 70 m OD and fronted by two lower shore platforms, the Low and Main Rock platforms, respectively at, and slightly above, present sea level. The geomorphological interest of these emerged erosional landforms is enhanced by the presence of glacial and marine deposits resting on the platform surfaces. The emerged shore platforms and associated marine and glacial deposits of northern Islay are part of a network of sites from which the glacial history and pattern of isostatic uplift in Scotland was originally interpreted (e.g. Synge and Stephens, 1966; Sissons, 1974, 1976; Dawson, 1980a,b, 1991). The three distinctive platforms in northern Islay provide evidence of rates of isostatic uplift following degjaciation and this has implications for relative sea-level change in the region.

Unsheltered coasts in the Western Isles are exposed to high mean wind speeds, but the irregular form of the coastline causes great variation in wind climate. The northern coast of Islay is exposed between the north and west, but open water fetches are less from other directions. 68% of storm waves and 80% of swell waves come from the west (Ramsay and Brampton, 2000a). Much of the seabed around the west coast of Islay lies at about 50 m. In terms of exposure and open water fetches, the north-western coast is subject to high wave-energies whereas the eastern coast, south of Rubha a'Mhail is much more sheltered.

Description

In northern Islay, a high shore-platform, eroded in quartzite rock, forms a continuous level feature between the headlands of Mala Bholsa and Rubha a'Mhail (Dawson, 1993) (Figure 3.19). Along most of this coastline, the platform varies between 400 and 600 m in width and is backed by a cliff up to 70 m high. The height of the landward edge of the platform varies between 32 and 35 m OD, while the surface of the platform has a gentle seaward slope of *c.* 4° and is free of emerged stacks (Figure 3.20). In some areas, exposures reveal accumulations of till resting on the surface of the platform whereas in other areas the till is overlain by beach gravels. Elsewhere, accumulations of abandoned beach gravels rest directly on the high platform, but occur no higher than 27 m OD. Inland from Port a'Chotain, the platform is overlain by a prominent, arcuate end moraine at Coir Odhar (Figure 3.19).

The seaward edge of the High Rock Platform ends at a 20–35 m-high abandoned cliff, below which is a lower shore platform that extends almost continuously along the north Islay coast (Figure 3.20). The origin of this feature is complex, with many areas of the shore platform showing signs of moulding by ice (Dawson, 1991). Indeed, two distinct rock platforms exist in the intertidal zone of northern Islay (the Low and Main Rock platforms), both of which differ not only in width but also in morphology (Dawson, 1980a,b). The Low Rock Platform is the most conspicuous being regionally horizontal and generally about 100 m wide (but in places reaches 300 m wide; Dawson, 1980b). The smooth ice-moulded surface of the Low Rock Platform declines very gently seaward as a ramp. In places, for example near the lighthouse at Rhubha a'Mhail, the landward edge of the low platform is marked by a 1–2 m-high cliff rising to a higher shore platform at *c.* 2 m OD (the Main Rock Platform) which here is 10–25 m wide. Unlike the Low Rock Platform, the surface of the Main Rock Platform is characterized by an absence of smooth rock surfaces (Dawson, 1980b). Instead its regionally tilted surface is characterized by protruding angular quartzite ridges with occasional stacks and caves and arches being cut

into the backing cliff.

The abandoned quartzite cliffs that mark the landward edge of the Main Rock Platform and the seaward edge of the High Rock Platform, are typically crenulate and indented. The cliffs are adorned with emerged geos, stacks, natural arches and caves (e.g. Uamh Mhor near Port a'Chotain, and the complex cave network on the headland of Mala Bholsa). The floor of the emerged caves and much of the surface of the extensive Low and Main Rock platforms is mantled by gravel beach deposits. Between Mala Bholsa and Port a'Chotain gravel accumulations are locally banked against the cliff. Elsewhere the gravels occur as ridges, the most conspicuous ridge located in the Port a'Chotain embayment where it is succeeded landwards by the most extensive suite of Holocene beach sediments on the northern Islay coast (Figure 3.19).

Interpretation

Since the Low and Main Rock platforms occur at, and slightly above, present sea level, their ages are important in the debates surrounding the age of the present coastline and whether it has been cut during the Holocene Epoch, or whether it is an older feature simply re-occupied by modern sea level. The origin of the High Platform of northern Islay has long generated scientific debate (e.g. Johnson, 1919; Sissons, 1967). Early workers considered the High Rock Platform to have a warm interglacial origin (McCann, 1968; Dawson, 1979) whilst other opinion considered the platform to represent the product of periglacial shore erosion followed by glacio-isostatic uplift (Sissons, 1982). Similar debate surrounds the origins of the Main and Low Rock platforms (e.g. Wright, 1911; Dawson, 1980a,b, 1991). The regionally tilted Main Rock Platform can be traced throughout much of the Inner Hebrides and is now thought to have been produced largely during the severe cold conditions of the Loch Lomond Stadial some 11 000–10 000 years BP (Dawson, 1991), the tilt reflecting differential crustal recovery following deglaciation. The glaciated and regionally horizontal Low Rock Platform has been interpreted as interglacial in origin on account of its lack of isostatic recovery and tilt (Dawson, 1980a) and thus pre-dates the formation of the Main Rock Platform.

Debate surrounds the origins of the emerged shore platforms, beaches and end moraines. The High Rock Platform was described by Wright (1911) as representing 'a preglacial plain of marine denudation', and was interpreted as having formed prior to the only apparent general glaciation of the area. A later, more detailed discussion considered that the High Rock Platform was interglacial in origin and that the Coir Odhar end moraine was the product of a Lateglacial readvance (McCann, 1964). Synge and Stephens (1966) disagreed with this view, suggesting that the Coir Odhar Moraine was the product of ice-sheet decay, although they agree that the High Rock Platform formed prior to the last glaciation of the area. Sissons (1982) asserted that the High Rock Platform had been cut in periglacial conditions but Dawson (1993) calculated that to achieve this would take 28 000 years of relatively stable sea levels, a level of stability not shown by evidence elsewhere. Accumulations of till resting on the High Rock Platform also demonstrate that the platform must pre-date at least one period of glaciation (Dawson, 1991). Beach gravels, which overlie the till up to 27 m OD in places, indicate that a period of high sea level occurred after glaciation (Dawson, 1991). In northern Islay, these beaches are thought to have been formed during the Lateglacial period when sea levels reached 27 m OD (Dawson, 1991). As a result, only the seaward part of the High Rock Platform was exhumed from beneath the till cover and the inner edge of the High Rock Platform which lies at 32–35 m OD was left untouched. It is therefore most likely that the platform itself is the result of abrasion and quarrying during interglacial conditions and has been re-occupied several times since during periods of high relative sea level.

The Main Rock Platform identified in northern Islay is also well developed throughout much of the Inner Hebrides, cropping out along the coasts of Jura and Scarba (Dawson, 1980a) and can be traced intermittently to the Oban area, where it rises to maximum levels of 10–11 m OD (Dawson, 1991). Towards the west and south-west from Oban, the altitude of the platform decreases at a rate of between 0.13 and 0.16 m km^{-1}, until it passes below present sea level in northern Islay, Colonsay and western Mull (Dawson, 1991). The origin of this platform has also been hotly contested (e.g. McCann, 1964; Synge and Stephens, 1966; Gray, 1974, 1978; Dawson, 1980a,b, 1982, 1991). It is now generally considered that this feature, which exhibits no evidence of glaciation, is a relatively young feature that was formed by very rapid and efficient periglacial shore erosion during the Loch Lomond Stadial (Younger Dryas), some 11 000 to 10 000 years BP (Dawson, 1980a, 1991). This interpretation is supported by the rapid rates of erosion identified on similar

platforms in modern polar environments (Hansom, 1983; Dawson *et al.,* 1987) and from cosmogenic dating of the Main Rock Platform on Lismore, which indicates that it was cut during the Lateglacial period (Stone *et al.,* 1996). A further suggestion in support of a periglacial origin is that the platforms are wide and well developed in sheltered locations. Such locations can be argued to disadvantage wave abrasion and quarrying and to favour periglacial conditions (Hansom, 1983).

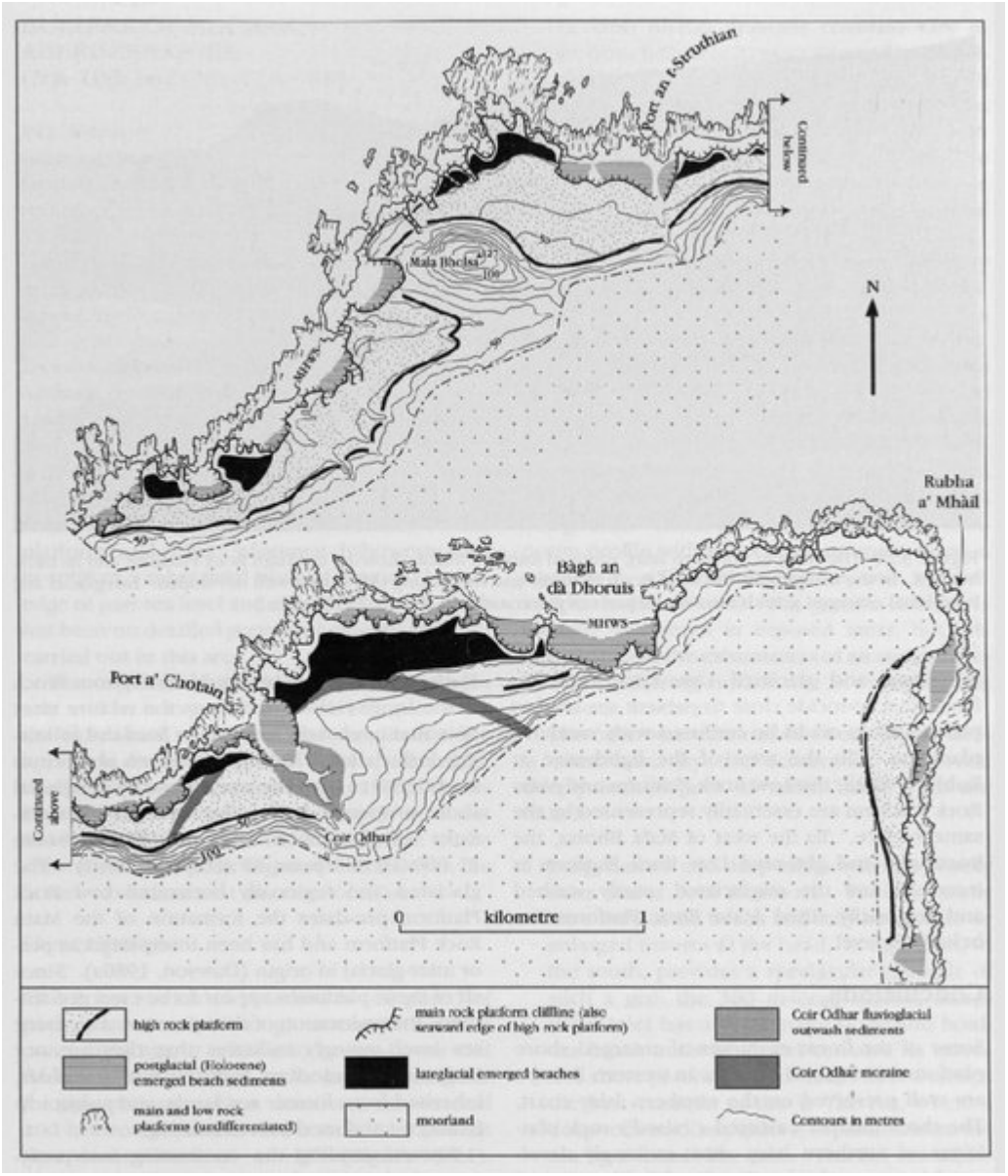
It has been estimated that global sea level at this time was approximately 45–50 m below present, thus the present elevations of this tilted shoreline reflect a pattern of substantial, but differential, isostatic recovery in western Scotland over the 10 000 years since the platform was cut (Dawson, 1991). Isostatic uplift, following deglaciation, was greatest at the centre of the last (Late Devensian) ice sheet in Scotland and the tilt of the Main Lateglacial Shoreline (i.e. the Main Rock Platform and its emerged gravel beaches) reflects this pattern. Northern Islay is of particular geomorphological significance because it is the location where the regionally tilted Main Rock Platform crosses the regionally horizontal and glaciated Low Rock Platform, forms that coincide close to present sea level in places and so could be confused with 'modern' planation. To the west of the lighthouse at Rubha a'Mhail, the Low Rock Platform and Main Rock Platform are essentially represented by the same surface. To the west of Mala Bholsa, the horizontal and glaciated Low Rock Platform is intertidal and the unglaciated, partly washed and regionally tilted Main Rock Platform lies below sea level.

Conclusions

Some of the finest examples of emerged shore platforms and gravel beaches in western Europe are well preserved on the northern Islay coast. The three distinct emerged ('raised') rock platforms of northern Islay, most strikingly developed between the headlands of Rubha and Mala Bholsa, have provoked much scientific debate concerning their origin. This is the type locality in the UK for the High Rock Platform, here emerged to an elevation of *c.* 33 m OD. The High Rock Platform is mantled with till and marine deposits, demonstrating that the platform pre-dates at least one period of glaciation and a later period of high sea level (Dawson, 1991). The regional tilt of the Main Rock Platform, which can be traced throughout much of the Inner Hebrides, reflects the relative rates of isostatic recovery in western Scotland following deglaciation. The highly uneven platform is considered to have been produced by periglacial shore processes during the severe cold conditions of the Loch Lomond Stadial some 11 000–10 000 years BP (Dawson, 1991). The glaciated and regionally horizontal Low Rock Platform pre-dates the formation of the Main Rock Platform and has been interpreted as pre-or inter-glacial in origin (Dawson, 1980a). Since all of these platforms appear to be emerged features, the co-location of the lower two at present sea level strongly indicates that they are not Holocene or modern features but are older, inherited from former sea levels, and subject to Holocene and modern retrimming.

Notwithstanding the contrasting interpretations that surround the origin and age of these emerged marine features, the complete assemblage of well-preserved marine and glacial features in northern Islay is of outstanding geomorphological and scientific importance. The juxtaposition of the three platforms facilitates observation and study of cliff-slope evolution since abandonment, as well as rates of platform/cliff formation under varying process regimes.

(Figure 3.1) High-cliffed coast of Great Britain, showing the location of the sites selected for the GCR specifically for coastal geomorphology features of hard-rock cliffs. Other coastal geomorphology GCR sites that include hard-rock cliffs in the assemblage are also indicated.



(Figure 3.19) Geomorphological map of the coast of northern Islay between Mala Bholsa and Rubha a'Mhail, northern Islay, showing a fine series of emerged rock platforms and beaches some of which have been capped by glacial moraines whose age informs the chronology for the platforms and beaches. MHWS = Mean High-Water Springs. For general location see Figure 3.1. (After Dawson, 1991.)

(Figure 3.20) The coast of northern Islay, south of Rubha a'Mhàil showing the High Rock Platform and its backing cliff. In the foreground the Main Rock Platform and its backing cliff is also well developed. Lateglacial and Postglacial emerged gravels also adorn parts of the coastline. (Photo: J.E.Gordon.)