Barra

Barra – the Physical Background

Noel Fojut

AS WITH all islands, the physical facts of Barra's location, geology and climate have a profound influence upon the nature of life for inhabitants and visitors. Even today the constraints of time, tide and weather are no respecters of timetables, while weather variations within a single day can give the lie to the changing seasons. How much more so in, centuries past, must the physical geography of Barra have determined human options, closing off opportunities with one hand while opening up connections with the other. Determinism may be an unpopular concept in modern science, yet anyone spending a winter on Barra might think again.

Barra's story begins in an unimaginably distant geological past. An area of lighter crustal rocks, a 'craton' as geologists of 3000 million years later would term it, formed the basis for an early continent (Fettes *et al* 1992: *passim*)[1]. This area, of unknown extent but including much of what is today the Western Isles, rode high above the heavier rocks of the ocean floor. Despite endless crustal movements, continents spreading and being destroyed, oceans opening and closing, these rocks remained unabsorbed. Most of the upper crust of the Earth from that early date has long been re-cycled, drawn down into the lower reaches, melted and re-cycled. But not the rocks of Barra. Despite intense pressure and folding, sometimes as much as 25 km below the surface at the root of an ancient mountain chain comparable to the Alps or the Andes, they survived, to form what today we call the Lewisian gneiss.

The gneiss, with its distinctive grey hues mottled with patches of granite, was already ancient when crustal movements created a huge fault. Running the full length of the east coast of the Long Island, this is the Outer Hebrides Thrust,

1 Fettes *et al* 1992 covers the Outer Hebrides. It is intensely detailed, requiring good geological knowledge to read with any degree of profit. Boyd and Boyd 1996:11-29 provides a good non-technical geological summary for the whole of the Hebrides.

created around 1700 million years ago. Rocks from the east rode up westwards over more recent rocks, in a manner analogous to the better-known Moine Thrust of the North West Highlands. Recent research has suggested that at times the Thrust later acted as a normal fault, with younger rocks displaced downwards to the east, towards the Minch. Research work continues – a fault line so ancient will have had more than one incarnation, and with movements in both normal and reversed directions during its long life. There are still occasional movements along the fault today.

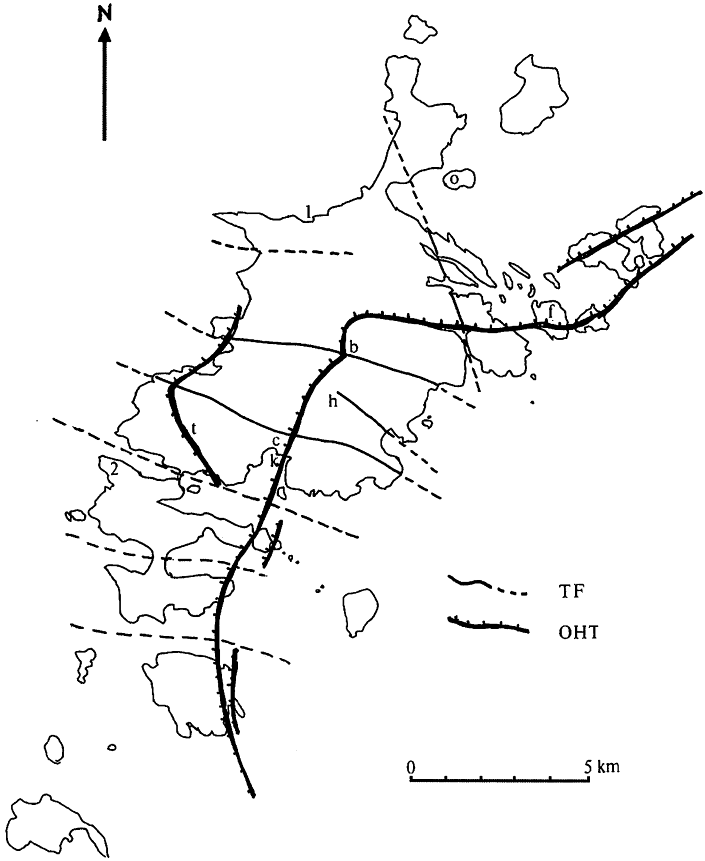

Fig 1 Geological features affecting the modern landscape of Barra: OHT = Outer Hebrides Thrust; TF = tension faults. Key locations mentioned in text: b = Beul a'Bhealaich; c = Castlebay; f = Fuiay; h = Heaval; k = Kisimul Castle; o = Orosay; t = Ben Tangaval; 1 = Cleat; 2 = Traigh Varlish.

The Outer Hebrides Thrust, which like most thrusts is composed of several sub-parallel lines of movement, is clearly visible in the landscape of present-day Barra. Crushing and sliding movements along a broad plane transformed the rocks on each side of the fault, creating harder rocks where heat was generated by the movements and softer rocks where crushing was predominant. The large slab of rocks running uphill behind Castlebay toward the summit of Heaval is composed of rocks partially liquidised and reset. Kisimul Castle sits directly on the fault, its rock made a little harder than the surroundings. The gaps between the rocky islands at the northeast end of Vatersay, so clearly visible from Castlebay, correspond to rocks crushed by fault movements. A band of altered rock along the fault line runs very visibly across Fuiay, off the eastern entrance to Northbay. On the west side of Barra a secondary fault, apparently of the same age, curves around the west side of Ben Tangaval.

Then, for a little over a mere 1000 million years, there is no record of geological change: for most of this time, no doubt, modern Barra lay deep below crumbling mountains, slowly rising as erosion removed the vast overburden, which was washed off in great sheets of sands and gravels, some of which went to form the Torridonian sedimentary rocks of the western seaboard of the Scottish mainland.

About 400 million years ago, crustal movements reawakened the old continental core of the Outer Hebrides once more. The great fault was reactivated, and as mountains built up over what was to become the Scottish mainland the crust was stretched slightly, creating a series of faults that now run more or less east to west across Barra. These became lines of weakness to be exploited by later erosion, and today are dominant landscape features. The gaps between Barra and Vatersay, the dip running from Borve up the valley and under Beul a Bhealaich across to Earsary and, running north-west to south-east, the fault which runs across the inner end of Ardmhor and forms the seaward portion of Loch Obe, are all examples of Caledonian fault lines. Meanwhile the Minch, formed by down-faulting along a north-south line running offshore just to the east of the Outer Hebrides Thrust, had become what it remains today – a great fault-defined trough into which sediments were washed from surrounding shores.

Over the millennia, Barra may have been submerged from time to time, receiving a capping of sedimentary rocks, but any such deposits have long since eroded. The general pattern, of the Outer Hebrides riding high on the western edge of an active geological zone, continued until relatively recent times. 70 million years ago the Atlantic began to open, accompanied by a great burst of volcanic activity, which threw up the great gabbro masses of the Rum and Skye Cuillin and the complex rocks of Mull and Ardnamurchan. The opening of the Atlantic split Greenland and Labrador apart from Western Scotland. The landscapes of most of the Inner Hebrides were dramatically transformed at this time, with the creation of distinctive volcanic features, especially in Skye, Mull and Rum. But on Barra, only a few dykes of intruded igneous rock mark the violence experienced a few kilometres to the east. Examples may be seen along the northwest shore of Vatersay, around Traigh Varlish, and on the headland leading towards Orosay at Eoligarry. These dykes are outlying products of the volcanic centre which today is marked by Ben More on Mull.

On Barra, the slow erosion of the Lewisian gneiss continued. By this time dinosaurs were abroad, and the landmass that was later to become Barra lay 30 degrees south of the Equator, enjoying a sub-tropical climate. The generally rounded contours of the island's overall shape, with deep-weathered pockets, are a product of the millions of years the ancestral Barra spent drifting slowly northwards through tropical zones. The broad outlines of Barra's landscape were determined long ago.

But one last episode was to come. The changing shore lines of the widening Atlantic, perhaps combined with changes elsewhere and maybe global climate changes, led to a period when ocean circulation failed to redistribute warmth northwards, and the Ice Age was born. Like much of Scotland, Barra would have been affected by the four main cold phases and many smaller oscillations. At times it was covered completely by ice moving west from the Scottish mainland, while at others it probably supported its own small ice cap, or a southern lobe of a Long Island ice cap. But it has to be said that the old, hard rocks were little affected by such trifling matters as several hundred metres of ice grinding over them, and there are no classic glacial erosion features on the island. Some shallow clays and gravels were laid down; a few rock faces steepened, and much of the soil swept away. But Barra was already too gently rounded for the ice to make much difference (Hall 1996:5-11).

Offshore, matters were very different. Deep submarine troughs occur along the east side of the island, reaching up to 250m deep at the south end of the Barra Isles. These have been attributed to glacial erosion, but it is hard to fit into any of the terrestrial evidence, even allowing for softer sediments and weaknesses along the Minch Fault (Sissons 1967:52). On the western edge of the continental shelf, in the Atlantic beyond Barra, vast quantities of glacially-eroded debris carried out by the glaciers from the west of Scotland piled up, subsequently collapsing in vast underwater avalanches down the slope into the depths to create the Barra Fan. (Holmes 1997:92). This is the southernmost of a series of such continental slope deposits which includes those of Norway responsible for the huge, and increasingly well-documented Storegga Slide of about 6000 BC, which created a tsunami responsible for depositing a layer of sand on coastal sites along the eastern Scottish littoral (Smith 2002:468).

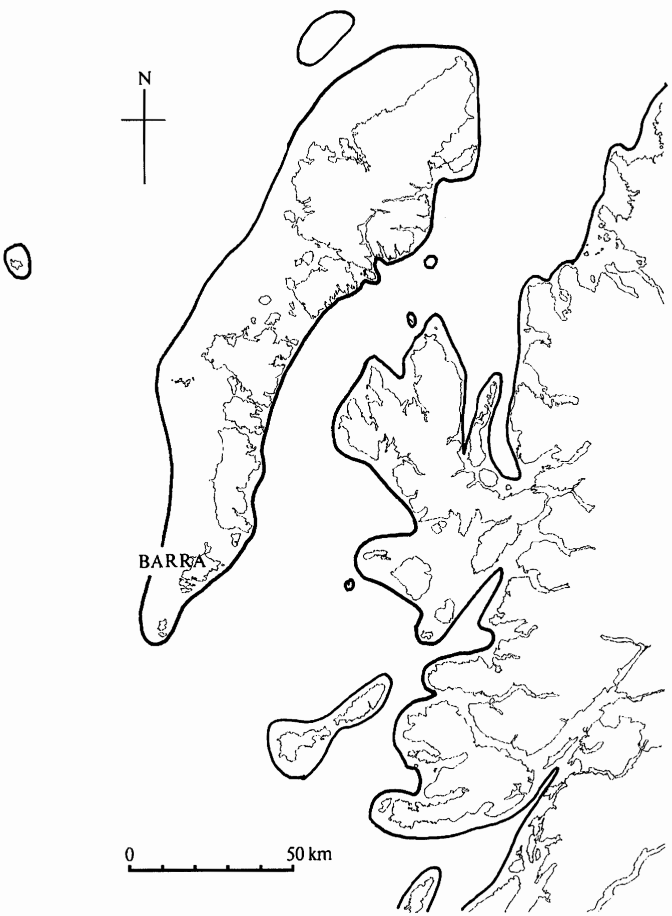

Fig. 2 Hebrides and West Highland coast, showing approximate coastline at lowest sea level immediately after last glaciation.

Barra has important claims to the interest of geomorphologists studying relatively recent phenomena. At Cleat[2] a beach of small gravel, plastered on the foot of the cliff at the east end of the bay, appears to date from the period before the last glacial episode. It looks as if the beach was frozen in situ and then buried beneath glacial till from the last ice-cover. Such survivals are rare in Scotland, and the Cleat exposure, though tiny, is important (Gilbertson *et al*, 1996:69) So too are the raised rock platforms visible along the N shore of Vatersay, west of Traigh Varlish, which have also been cited as examples of interglacial features (Gilbertson *et al* 1996:71).

Once the ice had melted, sea levels settled gradually, after much adjustment, to where they are today. It seems certain that for some time, commencing shortly after deglaciation, the whole of the Long Island was a single landmass, although probably always separated from the mainland and the Inner Hebrides. Barra, like the rest of the Long Island and unlike most of mainland Scotland, has remained more or less static relative to sea level since the end of the last glacial period. There are no high raised beaches: if anything the west coast of the island is probably a little lower now than when the ice first melted. This has implications for finding early human settlement, which has often been located on raised coastline sites, for example on Rum or Jura.

Also relevant for settlement was Barra's location: 75 km from the Scottish mainland at Ardnamurchan, and 56 km from Skye. But early arrivals probably avoided long sea crossings, settling Barra across the mere 6.5 km crossing from Eriskay and South Uist, from where the mere 24 km crossing from the Uists to Skye was available[3].

The principal physical changes in the last few thousand years have involved the accumulation on the western side of the island of shell sand, forming dune and beach formations with the machair sand plains so characteristic of the Isles. This sand accumulation, rather than sea level change, has been the principal agent of coastal modification since the first human

2 English versions of island place-names have been used above, as these are the forms used in cited sources and may make use of references easier. Cleat is particularly varied, appearing also as Cleit and as Cliad.

3 Evidence, as yet unpublished, has recently emerged for human presence in Harris by 5000 BC, during the later Mesolithic. Clearly the Minch would not have posed an insuperable obstacle for the early Neolithic farmers whose remains are the earliest archaeology so far identified on Barra – see MacLeod, this volume.

settlement of Barra. Both Barra (Eoligarry and the rest of the island) and Vatersay (North and South) were probably composed of pairs of separate islands until wave patterns began to build up the double-backed beaches which today unify them with their other halves (Gilbertson et al, 1996:99). Sandy beaches, while attractive to modern eyes, were not favoured landing places for earlier inhabitants, who would have preferred shingle beaches or small rocky coves where skin, and later wooden, vessels could safely be grounded or anchored.

On land, peat began to accumulate almost as soon as vegetation became established after deglaciation, in rocky basins and low-lying areas including fen slacks behind dune ridges. But the spread of hill, or blanket, peat over the higher slopes probably began a little earlier than 2000 BC, in response to climatic changes involving cooler and damper conditions. The contribution to this of agricultural activity, involving scrub and woodland clearance and soil changes caused by early ploughing and by grazing of domestic stock, remains to be resolved (Brayshay and Edwards 1996:20-26).

The key to Barra's vegetation, both natural and agricultural, lies in the interplay of the acidic peat and relatively immature, post-glacial soils with the encroaching sand. Barra displays the classic Hebridean machair – blacklands – peat sequence, running west to east, although in places the sand has come right across to the east side. The question of the human role in the genesis and maintenance of the distinctive machair landform is much debated in geomorphological circles. It is certainly accepted by botanists that the characteristic *flora* of the machair is maintained through cyclical ploughing, fallowing and fertilising, but the question of the contribution of human use to the *landform* itself seems more moot (Boyd and Boyd 1996: 100-109).

Barra is probably the sandiest of the larger islands of the Outer Hebrides. Crops grown on what are almost pure sands tend to be less reliable. They are very prone to drying, enhanced by strong western winds. It is common for crops, especially potatoes, planted in sandy areas to shoot strongly, and then to be blasted by salt-laden winds. Barley and oats tend to develop weak stems and poor root systems, becoming very prone to windthrow. On the heavier peaty soils, especially where mixed with sand, crops grow more steadily – for example in the Borve valley – but these soils are slow to warm up in the spring and if the summer is poor may never ripen adequately. The most reliable crop on Barra is, and has always been, grass, whether in the form of grazing for livestock or hay. But even here, it is late spring before there is much goodness in the hill grazings, and windy summers can parch the grass.

The troublesome soils and weather of Barra have led to a greater reliance on marine resources than in many other islands, with shellfish and sea fish of considerable importance. Until relatively recent times, most fishing was either from the shore or from small boats working close inshore.

The impact of climate and weather on those taking to the sea was even stronger than those working the land. While there has been little research on Barra itself, we can generalise the patterns from regional data. It seems that around the probable time of the first post-glacial visitors to Barra, the climate was milder than at present (perhaps by about 2 decrees C average summer maximum) and less windy. This benevolent situation persisted through the period assigned to the first farming settlers in the fourth millennium BC. A gradual decline set in, accelerating in the middle to late Bronze Age and accompanied by the increasing growth of peat on land which was becoming more waterlogged, its limited post-glacial fertility largely exhausted. Whatever woodland Barra possessed would have disappeared about this time, either cut for fuel or its regeneration inhibited by grazing animals, increased wind strengths and peat growth. That trees will grow in Barra, when protected from the wind and livestock, is clear to any modern visitor (Boyd and Boyd 1996:135).

There is a tendency, in summarising climate change, to arrive at the BC/AD divide and halt the story, perhaps mentioning the severe cold spell in the late-medieval / early modern period, the Little Ice Age. But it is worth bearing in mind that there was a distinctly pleasant spell of weather lasting several centuries at the end of the first millennium AD – just at the right time to foster the voyages of the Norse settlers who found in Barra, as elsewhere in the Western Isles, a relatively congenial landscape ripe for colonisation.

Today's climate is not a negligible factor in lifestyle and settlement patterns, and it is worth dwelling on. Barra has a humid but equable climate. Its record maximum daily temperature was recorded in 1995, at a modest 26 degrees C (the author is happy to say he was present on that occasion). The temperature differential between winter and summer is among the lowest in Scotland. There is between 110 and 130 centimetres of rain each year, and long-lying snow is a rarity in winter. The sea, like the land, has the lowest summer-winter temperature differential around Scotland, if not in NW Europe, and acts as a temperature regulator for the land[4].

4 See Boyd and Boyd 1996:30-50 for a detailed discussion of climate and hydrography, and other sections for discussion of their impact on farming and fishing.

The dominant element is the wind. It drives the mechanics of the machair system. The strength of the wind, and the salt it carries, impacts on all activities from farming to fishing. The sheer physical impact of the wind must never be underestimated, and the need to eat more and take breaks when working out of doors in windy conditions puts a rather different perspective on the stereotype of the "lazy crofter".

Shelter from the wind, for crops and for settlement, must always have been a priority; so one might have expected to find early settlement mainly on the sheltered, eastern, side of the island. But the most favoured sites for early (and later) settlement seem to have been the few relatively sheltered pockets on the generally exposed western side. On the east side, only Castlebay seems to be of any great age, and its splendid sheltered harbour may well account for this. But of course, our knowledge of the settlement patterns of early times may be biased, for example by re-use of older sites in more recent times.

There is, however, one very good reason why early settlement might be expected to favour the western side. The soils there are lighter, and easier to work with simple tools. Because clouds tend to build up in westerly winds along the north south rocky hills, the west side of the island receives more sunshine than the east, and also less rain – although it is more windy. The light soils dry out quickly, warming rapidly in the springtime to give a longer growing season than on the east (Boyd and Boyd 1996:38). This must have been a vital advantage in early times and remains so today. So it is perhaps no coincidence that the majority of early settlement sites have been located towards the western side.

To conclude: with geology two-thirds as old as the Earth itself and weather which changes every hour, to understand the prehistory and history of Barra, to contemplate why modern life is as it is, and to look into the future, all require a sound grasp on the physical geography of the island. While physical factors may not uniquely determine human options, they certainly narrow down the possibilities. Making a living, or simply surviving, on islands requires a close working knowledge of the natural world. Understanding human relationships with the natural environment is the key to understanding human life on Barra, both ancient and modern.

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