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# Mill Bay

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## Highlights

The coastal section at Mill Bay is the best locality for demonstrating the shelly till that is characteristic of the eastern part of Orkney. This deposit shows that the ice moved across the sea floor and then onshore in a west-north-west direction. The presence of the shells also provides an important opportunity to date the last main glaciation of the islands.

## Introduction

A coastal section at Mill Bay [HY 665 256], on Stronsay, provides the best available exposures of the shelly till of Orkney and has been described by Peach and Horne (1880) and Rae (1976). As well as demonstrating the characteristics of this important till unit, Mill Bay is particularly significant for the dating potential of the shells in the till.

## Description

The section at Mill Bay forms a continuous cliff 610 m high over a distance of nearly 1 km. Peach and Horne (1880) recorded a reddish-brown, gritty clay containing striated stones. In composition the till mostly includes material from the adjacent flagstones and siltstones, but a range of exotic rock types is also present, including igneous and metamorphic lithologies, fossiliferous limestones, chalk, flints and fossil wood. Peach and Horne inferred that the erratics were derived from the Scottish mainland. Numerous fragments of shells, including *Arctica islandica* (L.), *Mytilus* and *Mya truncata* (L.), are also present in the till, and according to Peach and Horne they appear smoothed and striated. Striations on bedrock at Mill Bay are aligned W15°–35°N. Peach and Horne also recorded large blocks of what appeared to be petrified wood in the till. Rae (1976) has provided additional sedimentological and litho-logical details of the till at Mill Bay, and noted the presence of a lens of grey till incorporated in the red till. Rae (1976) also obtained an infinite radiocarbon date of >44,300 BP (T-1152) from shell fragments in the till.

## Interpretation

The lithological composition and the erratic and shell content of the Mill Bay till clearly indicate that ice moved onshore from an easterly direction (Peach and Horne, 1880; Rae, 1976) in accordance with the general pattern established for the Orkney Islands. Although, strictly, the radiocarbon date is inconclusive, Rae argued that on the basis of probability it suggests an Early Devensian age for the till. More recently, preliminary results from amino acid epimerization analyses suggest that shells in the till are no younger than the last interglacial, which again lends support to the hypothesis that the maximum age of the till is Early Devensian (see Bowen and Sykes, 1988; Bowen, 1989, 1991).

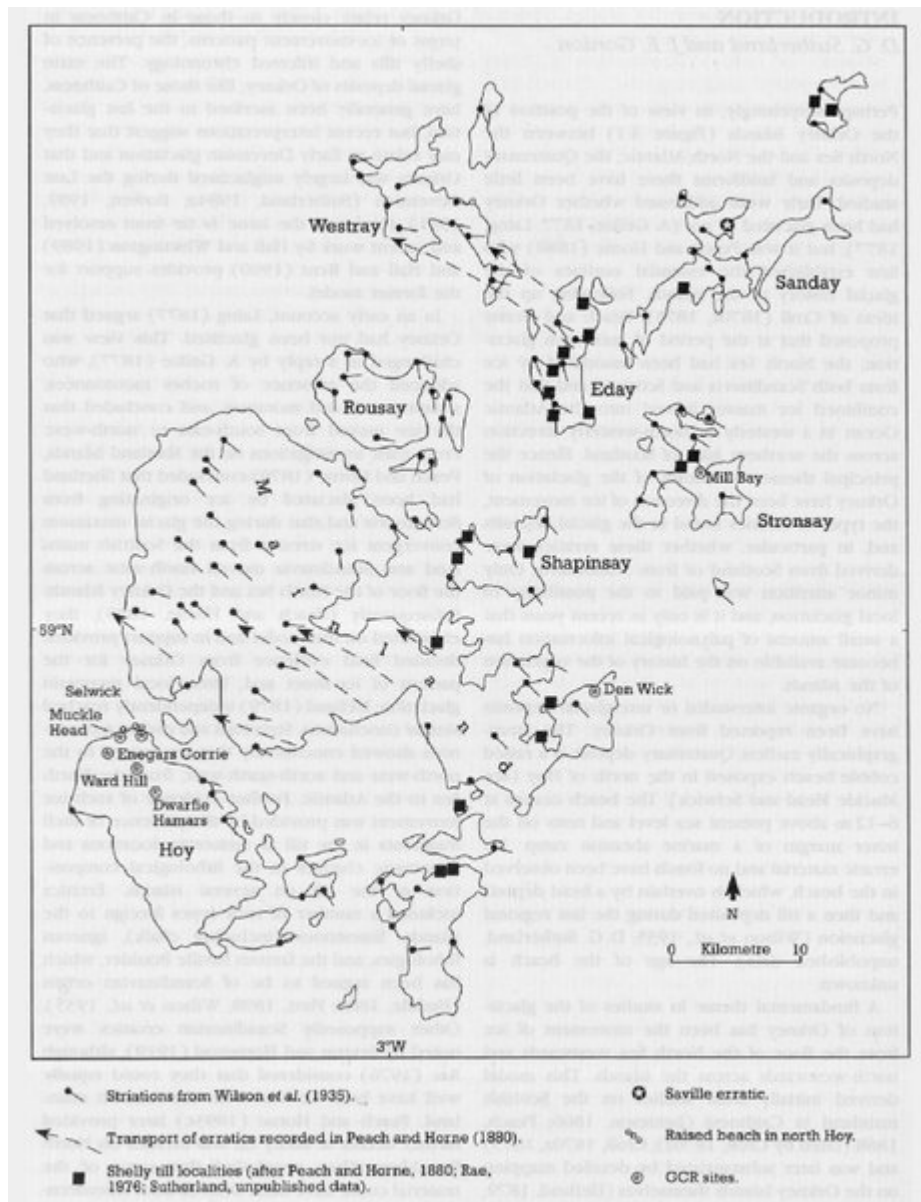
Mill Bay is an important reference site for the shelly till of Orkney, and it represents the best exposure of its type on the islands. Although shelly till is exposed at several other localities (see Peach and Horne, 1880; Rae, 1976), predominantly in the eastern half of the Orkney Islands (Figure 4.1), Mill Bay is one of the few sites where shell fragments are relatively abundant and it has also yielded a relatively wide range of erratic types. Mill Bay therefore demonstrates particularly well the general direction of ice movement onshore and towards the west-north-west. In a wider context, the Mill Bay till forms part of a lithostratigraphic unit that extends across Caithness and Orkney. This formation is thought to be the product of a single glacial episode in which ice from the Scottish mainland moved north-west from the Moray Firth Basin and adjacent North Sea Basin. As yet the age of the glaciation is not securely established, but Mill Bay provides significant dating potential. Preliminary results from amino acid analyses, taken in conjunction with those from Caithness and with other evidence from the central North Sea, provide some support for glaciation during the Early Devensian. If substantiated, this would be the first positive evidence for Early Devensian glaciation in Scotland. On the other hand, there is evidence from Caithness (see below) that the shelly till may in fact date from the Late Devensian. Sites such as Mill Bay therefore

have a major role to play in resolving this key issue of the limits of the last ice-sheet in northern Scotland and the adjacent shelf.

## Conclusion

Mill Bay provides the best available exposures in the shelly till (sediments deposited by ice) of Orkney. The presence of the shells of marine molluscs in the till, together with other evidence, indicates the movement of ice across the sea bed and then onshore and towards the west-northwest. Not only is Mill Bay an important reference site for demonstrating this pattern of ice movement, it is also significant for the potential provided by the shells for dating (by geochemical techniques) the last major glaciation of the islands.

## References



(Figure 4.1) Location map and principal features of the glaciation of Orkney, including patterns of striations, directions of transport of erratics and shelly till localities (from Sutherland, 1991b).