
DEN WICK

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OS Grid Reference: HY576088

Highlights

The sequence of sediments in the coastal section at Den Wick is representative of the multiple till deposits of Orkney. The lithological contents and clast fabrics of the two tills provide evidence for changing ice-flow patterns during the last glaciation of Orkney.

Introduction

Den Wick (HY 576088) is a coastal section on the Deerness peninsula in the eastern part of the Mainland; it shows one of the best examples of a multiple till sequence in Orkney. Two tills are present and have been described by Rae (1976). Their lithological characteristics provide significant evidence for reconstructing former ice-flow directions, and they demonstrate important general relationships between till properties and the source bedrock lithologies.

The first suggestion of multiple drift units on Orkney was made by Wilson *et al.* (1935), who noted the occurrence of a grey or yellowish clayey rubble below the more usual grey, red or purple till of sandy-clay composition, but they concluded that the former was little more than fractured and locally transported bedrock. Subsequently, Rae (1976) formally established and defined the existence of more than one till on the basis of colour, lithology and sedimentological properties. He argued that the till characteristics at a site reflect the bedrock composition up-ice and that contrasts between individual till units at a site relate to changing ice-movement patterns. Rae (1976) recorded twenty multiple till sections in Orkney.

Description

At Den Wick, Rae (1976) noted the following sequence:

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|----|------------------|----------|
| 3. | Red till | 1.5–>3 m |
| 2. | Brown till | >5.5 m |
| 1. | Striated bedrock | |

The contact between the two tills was sharp and undulating, and locally a thin sand and gravel horizon, 0.1–0.15 m thick, intervened between the tills. However, Rae considered that at this and all the other sites, there was no significant evidence to support more than one glacial episode, and therefore the multiple tills were deposited by a single ice-sheet.

From the orientations of striae on the bedrock beneath the brown till, the lithological composition of the till (a relatively high percentage of Lower Eday Sandstones) and clast fabric measurements, Rae concluded that the ice movement associated with the lower till was from between south and south-east. Ice following such a flow pattern would have traversed the Lower Eday Sandstone most of the way across the Deerness peninsula and avoided the Middle Eday Sandstones.

The overlying red till has a relatively higher content of red sandstone clasts similar to the Middle Eday Sandstone. Since no onshore outcrop of this lithology appeared to fit with the pattern of striations observed beneath the red till elsewhere in Deerness where it rests directly on bedrock, Rae postulated an offshore outcrop, an interpretation supported by the presence of chalk erratics in the red till but not in the brown till. The red till was therefore associated with ice flow from a more easterly azimuth than the underlying brown till. Shell fragments have been recovered from both till units (A. M. Hall, unpublished data).

Interpretation

Den Wick is an important section representing one of the key elements of the till stratigraphy of Orkney. The multiple till sequences, of which Den Wick is a particularly good example, are important in several respects. First, their lithological and sedimentological characteristics demonstrate close relationships with the source bedrock traversed by the ice. Second, the superimposition of the different till units indicates changes in ice-flow direction, thus supporting the inferences based on striation patterns. Third, the contacts between the different units at individual sites provide no conclusive evidence for deposition during more than one glacial period. Fourth, the superimposition of the multiple till units in a consistent fashion (Rae, 1976) and the inferred shifts in the direction of ice flow provide important evidence for significant changes in the wider regional dynamics of the ice-sheet and its driving forces. Further study at both regional and national scales, coupled with ice-sheet modelling, is required to elaborate the origins of these changes and the extent to which they may relate to climatic factors and other variables that determine ice-sheet flow patterns. Multiple till sequences, like that at Den Wick, will be an important source of field evidence to provide constraints on the appropriate mathematical models.

Conclusions

The sediments at Den Wick are representative of the multiple till deposits of Orkney. They comprise two superimposed tills, each containing distinctive rock fragments derived from the bedrock over which the ice that deposited the tills had flowed. The tills provide evidence, in the form of their stone orientations and rock and shell contents, for former ice-flow directions. The till succession indicates a change in the flow pattern during the course of a single glaciation, suggesting a significant change in ice-sheet dynamics.

Reference list

- Rae, D.A. (1976) Aspects of glaciation in Orkney. Unpublished PhD thesis, University of Liverpool.
- Wilson, G.V., Edwards, W., Knox, J., Jones, R.C.B. and Stephens, J.V. (1935) The geology of the Orkneys. *Memoirs of the Geological Survey of Scotland*. Edinburgh, HMSO, 205pp.