

MESH shelf survey BGS cruise 05/05

Survey area summaries

Six areas were surveyed with sparker and boomer profiling equipment on the shelf between Ireland and Scotland. The areas were selected to cover a range of seafloor topographies and they have revealed individually most areas have a wide range of potential habitats.

North Maiden

The four sparker profiles show well-layered country rock, presumed to be Permo-Trias sandstones and siltstones dipping at about 3° to the south with evidence for normal faulting. The seabed frequently shows a step-like topography with rises up to 12 m in height, reflecting differential erosion of the outcropping sedimentary rock. This topography creates contrasting habitats on treads and rises with linear habitat boundaries. There is therefore potential confusion with other linear bedforms such as sediment waves. The orientation of these linear habitats is controlled by the bedrock geology not the bottom currents

Through the sandstone an intrusion rises 80 m above the surrounding seafloor. The flanks show angles in excess of 30° . The top is predominantly flat, tilted to the south. Pinnacles of 10 - 20 m height rise up from a lower level on the southern flank.

There is little evidence of any sediment cover of the bedrock. The most likely area is a hollow within the intrusion on the north side where the seabed appears smooth and horizontal over a distance of at least 150 m. This swept topography fits with basal current predictions by POL of 1 - 1.25 m/s. There may be small sediment drifts, <3 m height, more than 2 kilometres south east of the intrusion. There is no evidence of sediment backed against the intrusion.

North Channel

Ten profile lines (sparker and boomer) show well-layered country rock, presumed to be Permo-Trias sandstones and siltstones gently dipping with normal faulting. The dip of reflectors and the frequency of anticlines and synclines increases to the south and east. Where the top of the bedrock is buried it often shows a step-like topography, suggestive of differential erosion of the sedimentary rock. In addition there are at least two intrusions of acoustically opaque rocks at Laconia Bank and one at Shamrock Bank. These intrusions form steep cliffs up to 60° and 100m high. In the northwest corner, on Middle Bank, the exposed bedrock, acoustically opaque, appears to have two type topographies. An outer smooth surface with bedrock close to and only occasionally breaching the seabed and a hummocky one at the limits of the survey with trough to crests heights up to 30m.

The most extensive unconsolidated sediments occur south of Shamrock Bank where the bedrock is covered by 30ms (~24m) of sediment with an acoustic facies reminiscent of glacial deposits. These extend a short way around the western end of Shamrock Bank into the trough with Laconia Bank. In this trough there are extensive areas of bare rock but sediment banks or drifts can be seen, most notably in the centre at each end of the trough, possibly reaching 30m in height. Other drifts occur on Laconia Bank itself between local highs of the different intrusions, reaching 10-12m in height. The top of the intrusions on Laconia Bank show gullies 3m deep, 10-20m wide which may relate to fracturing pattern. These gullies have the potential to provide a diverse habitat.

North of Laconia Bank rockhead is close to surface but often with a cover of coarse sediments including possible gravel banks that appear as mounds 5m high and up to 100m wide. The eastern end of some survey lines suggest a deeper basin of acoustically well layered sediments lies close.

Hempton's Turbot Bank

This feature comprises both a major sand bank and a series of large and smaller sand waves both on and off the bank. The bank has a horizontal base and reaches 24 m in thickness. However at the eastern end it just edges on to an area of more uneven topography (variations 1-2 m max). On top of the bank and extending 8 km to the east are numerous sand waves including 4 large ones, 20 m in height and many small ones. These are frequently asymmetrical such that when the wave occurs on the north and western parts of the bank it faces south east and reverses on the southern side. The large sand waves in the centre of the bank appear symmetrical. The waves at the eastern end of the bank and beyond face north west. Internal reflectors can be seen in some sand waves and they tend to parallel the steeper face of the wave. At the western end of the bank is a thin sequence of westerly dipping fine layering abutting the sand bank.

The base of the bank of slightly uneven topography noted under the eastern end extends as the seafloor north and east of the bank. It has a hard acoustic signature and is considered to be zone of winnowing of outcropping glacial material, probably morainic. This is based on the few internal reflectors seen below and their irregular shape. Beneath most of the sand bank and beyond it to the west are a series of gently westerly dipping reflectors. These appear to overlie an extension of the irregular, possible morainic, material. A similar sequence of dipping reflectors is seen in the northeast corner dipping to the north. Bedrock varies from 60 to 120ms below seabed and shows internal reflectors dipping to the north. In a few places there is evidence that these reflectors influence the geometry of the bedrock unconformity.

NW Islay

This area of sediment waves with their crests aligned WNW – ESE is in 50-60m of water. These waves are up to 10m in height, and overly a similar thickness of the same sediment in the south but much less in the north of the area where the sediment below the troughs between waves is thin and may be absent. In this area gravelly sediments probably occur. The overwhelming majority of sediment waves are asymmetric with steeper northern faces. Reflectors between waves indicate that some

climb the backs of others. There is a strong basal reflector to the sediment wave unit that is clearly erosive.

The underlying Quaternary reflectors dip to the west dividing opaque and well-layered units, the latter predominant in the west. These well layered units often eroding underlying units. A small deltaic unit close to the base of the sediment waves has been detected in the southeast of the area with foresets indicating sedimentation migrating northwestwards.

Bedrock with weak subhorizontal bedding can be seen through the multiple more than 200m below seabed

Stanton Banks / buried channels

The seabed varies from well layered units in the Malin Deep, presumed to be muds to infill between the outcrops of Lewisian rock on SB3 and SB1 which are likely to be coarse grained and shows no fine scale differentiation. The depth of infill appears to relate to the wider bank rather than influence by local outcrops. This together with the presence of a possible sediment drift on the northside of SB3 suggests much reworking of the seabed sediments on the banks. Small scale troughs (~1m deep) are seen at the seabed leading into the deeper water.

The layered unit at the seabed in the Malin Deep shows asymmetric infilling of the basin, possibly from the southeast, though could be a meandering sedimentary body. Below seabed the profiles shows several units and unconformities. They appear to indicate a patchy distribution of morainic / proximal glaciomarine deposits in a deeply eroded basin cut into sedimentary rocks followed by a long period of quiet sedimentation. This was interrupted by regression and transgression leading to the planation of these finely layered sediments followed by a period of coarser sediments from the sides, small fans? possibly from Stanton Bank. This was followed then by a return to fine sedimentation presumably as water depths increased leading up to the present day seabed where sedimentation has ceased and shows signs of modification and minor erosion probably due to reworking. Channel infill indicates a debris slide towards eastern end although alternative explanations of local unconformity and shallow gas can not be ruled out..

Iceberg Ploughmark area

This study consisted of three short lines across an area of iceberg ploughmarks identify on sidescan / swath surveys. A line was run from Stanton Banks 3 to this area to provide correlation of seismic sequences.

West of about 8°27'W small depressions (2ms) seen in seabed reflector recorded by the sparker system. These are probably iceberg ploughmarks occurring in water depths less than 185ms depth (140m). and increase in frequency westwards and with the shallowing seabed. These depressions not so clearly seen on the boomer record, and certainly not any infilling sediment. Bedrock consisting of bedded sediments with several anticlines extends from Stanton Banks 3 to about half way to the Iceberg Ploughmark area before going out of range, 440 millisecond depth.

Within the ploughmark area the Quaternary stratigraphy is very uniform with reflectors varying very little in height. A channel approximately 2 km wide can be traced E-W at 55° 56.5'N. Overlying this at 320ms depth is a layer of well-bedded sediments up to 25ms thick, possibly dipping to the north but cut out to the north by massive units of glacial deposits. Top of massive unit shows buried ploughmarks with a frequency greater than that seen at the seabed.

Survey area

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1. North Maiden
2. North Channel
3. Hempton's Turbot Bank
4. NW Islay
5. Stanton Banks / buried channels
6. Iceberg Ploughmark area

