MESH deepwater survey
BGS cruise 05/05

Multibeam surveys Rockall Trough 2005

During Cruise CD174 in August and September 2005 the NERC Royal Research Ship Charles Darwin surveyed the slopes and the deep-water basins occurring to the west of the Scottish mainland. The survey equipment used for this cruise is summarised on Figure 1.

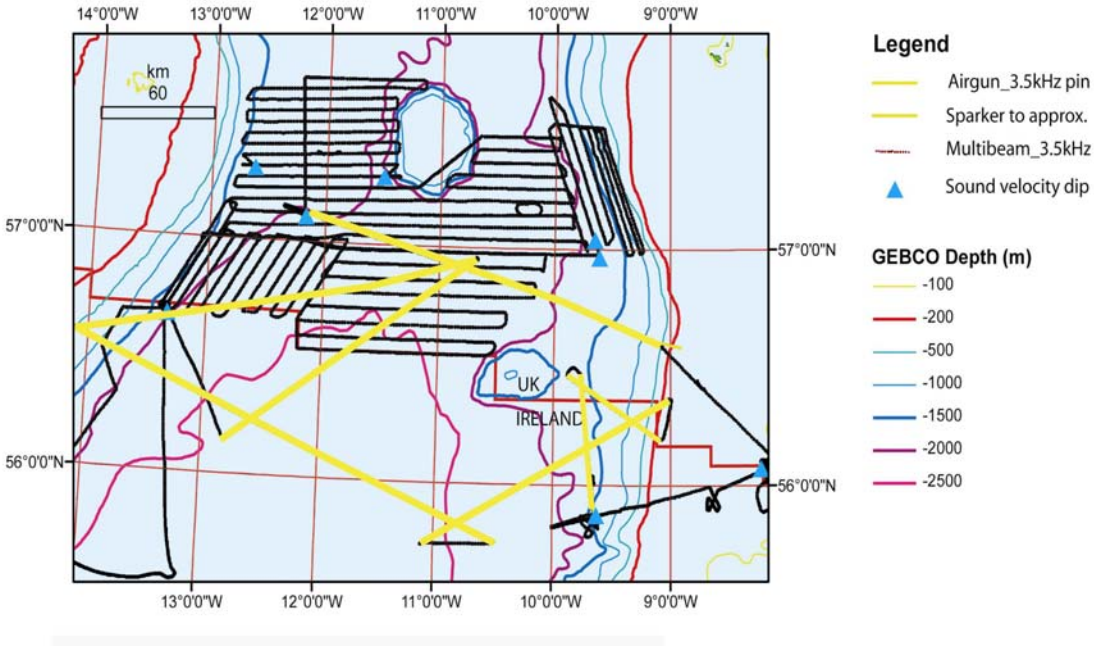

Figure 1. Track plot: multibeam with Simrad EM12.

Regional environmental setting

The coast and parts of the adjacent continental shelf were connected to the land by regional ice sheets during at least 4 regional glaciations at intervals between 10,000 years ago and more than approximately 800,000 years ago. The glacigenic erosion formed the complex fjord-like shape of the Scottish coastline and transferred mainly non-biogenic gravelly and muddy sediments from the Scottish mainland and shelf to the seaward margins of the continental ice sheets, the continental slope and deep-water Rockall Trough (Stoker et al, 1995). Although the modern seabed has very little non-biogenic sediment input it is in a boreal temperate climate zone set in a fertile sea with strong near-bottom currents on the upper and middle slope. In these environments the modern sediments mainly consist of mixtures of reworked glacial sediments and post-glacial biogenic carbonates. Thus the modern sediments are muddy in locations that are sheltered from near-bottom currents, they are sandy in the

more exposed locations, typically in less than approximately 700m water depth, and all the sediment size fractions typically contain >10% biogenic carbonate. Geostrophically-generated near-bottom currents (e.g. Huthnance, 1986) range from less than 50cm/sec to more than 200cm/sec, so that the exposed upper and middle slope seabed environments are characterised by mobile sands and silts (e.g. Pantin, 1991). Current speeds vary on a regional scale with the slope and basin geometry, that is, with the geological structure that underpins the changes to the seabed geomorphology.

Sediment waves are found in environments ranging from the upper slope to the deepest-water basins. They vary in size from the almost-ubiquitous sand and silt ripples (<60cm wavelength), usually on the upper and middle slope to the large mudwaves (>100m wavelength) originating from sediment drape over pre-existing structure, for example channel levees and submarine landslides and as mudwaves on the middle to lower slopes. Outside of the submarine topography generated by canyons and submarine landslides, the modern deep-basin sedimentary processes are dominated by erosion and deposition from contour-following currents (contouritic processes) and by deposition from the water column by slow settling and slow lateral advection (hemipelagic processes).

Regional slope angles at the margins of the Rockall Trough typically range from 1-4º and occasionally 7-14º on the upper slope. Relatively abrupt increases of slope angles commonly map to sediment-drift (contouritic) bedforms, rock crop at or near seabed in areas with very strong currents and to features formed by canyon and submarine landslide processes, these last occurring more frequently south of approximately 57ºN (Armishaw *et al.*, 1998). Very large submarine landslides occur south of approximately 56.5ºN on the Barra and Donegal Fans (Holmes et al, 1998). Active modern submarine landslides map to relatively steep slope angles, prograding deposits associated with fan build-out towards deep-water and to proximity to the epicentres of modern seismicity (Holmes, 2002).

Historically, the deep-water areas of the western Rockall Trough have been relatively sediment starved compared to those of the eastern Rockall Trough and there are relatively few submarine landslides in the UK zone. The seabed morphology of the unconsolidated sediments is predominantly shaped by contouritic sediment erosion and sediment transport connecting to the Feni Ridge. Hemipelagic sediment deposition is characterised by sediment plastering or sediment drape over underlying structures.

Ongoing interpretation

The new data is currently being re-processed. Plans are that the newly processed data will be merged with multibeam surveys previously acquired from surrounding areas: IFREMER and NERC data to the east and north, Irish data to the south, and DTI Strategic Environmental Assessment survey data acquired in 2005. Shipboard interpretations of partly processed data show that there are many new features to be interpreted from the CD174 data (Figure 2).

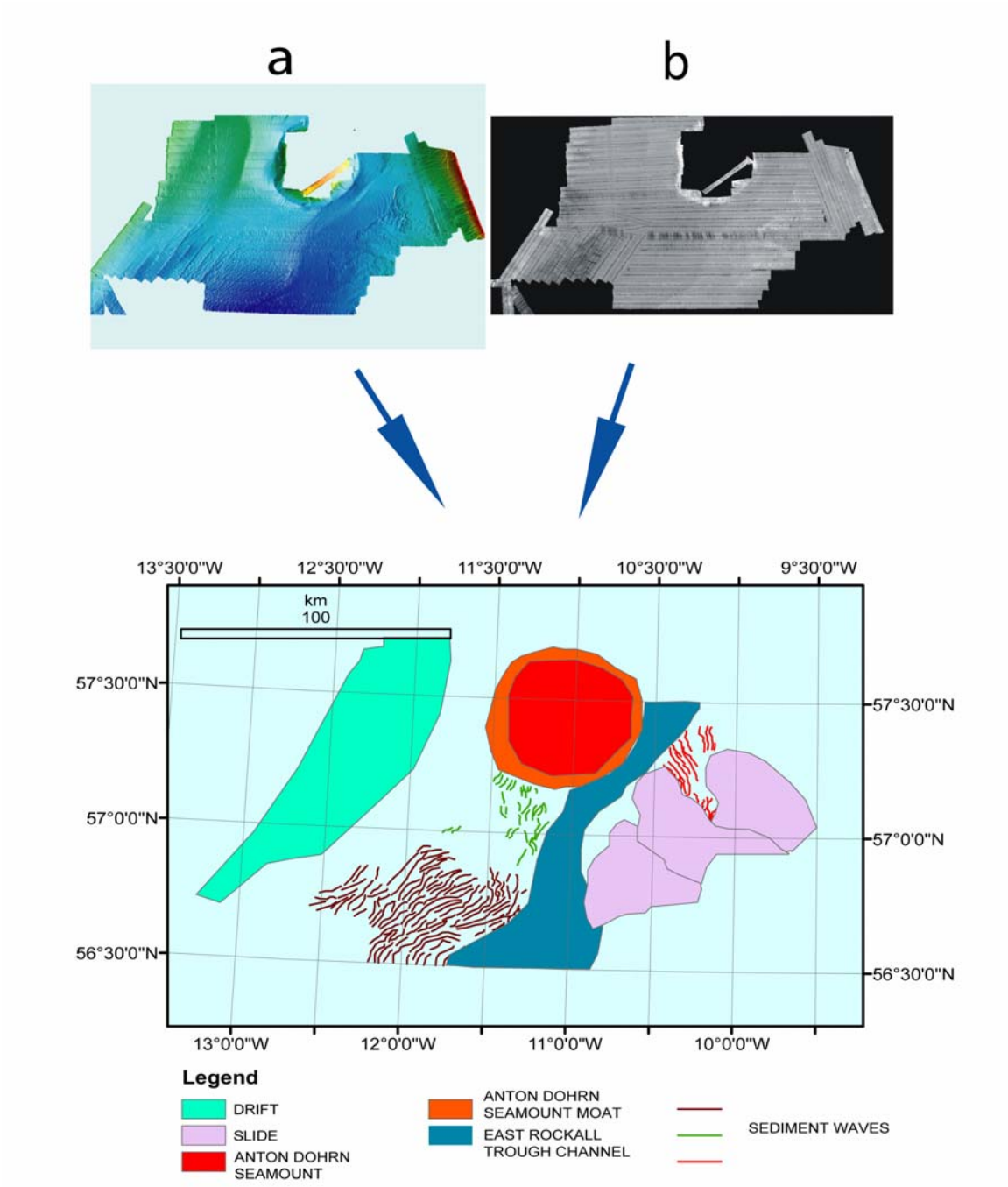

Figure 2. Examples of a.seabed relief and b.backscatter images and preliminary interpretation.

Selected References

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