

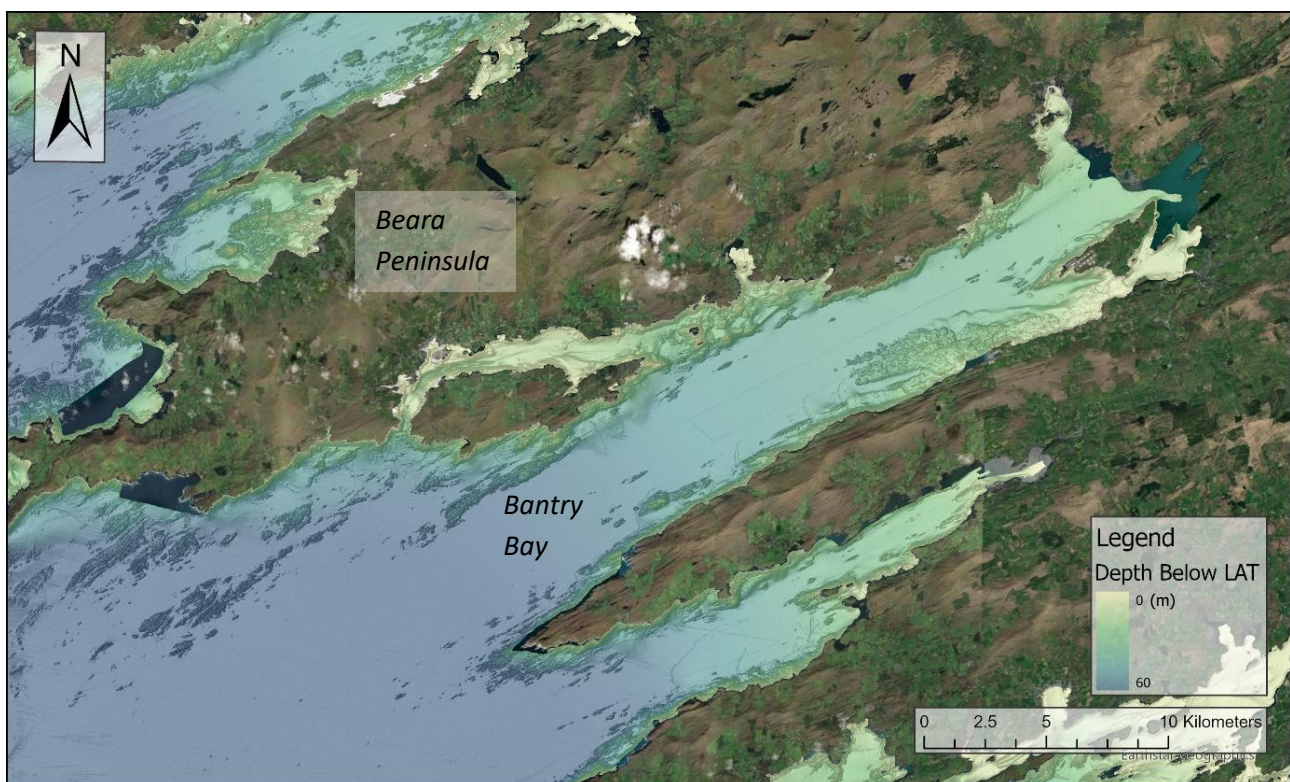


## Marine Geoscience Report 015

# Bantry Bay

### Overview

Bantry Bay, located on the south-west coast of Ireland, is a long, deep ria, or drowned river valley, extending 40 km in length and over 13 km wide at its mouth. The bay reaches depths of over 60 m, making it one of the deepest natural harbours in Europe. Berehaven Sound, between Bere Island and the Beara Peninsula, provides safe anchorage for vessels, including Ireland's largest whitefish fishing fleet, based in Castletownbere (The Bere Island Community, 2003).



*Figure 1: Bathymetry of Bantry Bay. Depths are referenced to Lowest Astronomical Tide (LAT).*

The bay is fed by several rivers, including the Mealagh, Ouvane, Coomhola, Glengarriff and Adrigole Rivers, which transport sediment into the marine environment. The bedrock beneath the bay consists of Devonian (419-359 Ma) Old Red Sandstone, overlain by Upper Devonian and Lower Carboniferous marine sandstones and mudstones. These rocks mark the transition from terrestrial to marine conditions during the Late Devonian and Early Carboniferous (Sleeman & Pracht, 2002).

Bantry Bay's present form reflects the combined influence of regional tectonic structure, glaciation and post-glacial sea-level rise, which together shaped the bay's ria morphology and varied seabed.

## Geology of Bantry Bay

Bantry Bay lies within the South Munster Basin, which formed as a half-graben during the Devonian period, approximately 415-360 Ma. A half-graben is an asymmetric extensional basin with a major normal fault on one side. The basin developed due to north-south crustal extension, which created accommodation space for thick ORS fluvial successions to accumulate. By the Late Devonian, relative sea-level rise led to the deposition of shallow-marine sandstones, mudstones and carbonate-rich sediments, which continued into the Carboniferous Period, beginning around 359 Ma (Sleeman & Pracht, 2002).

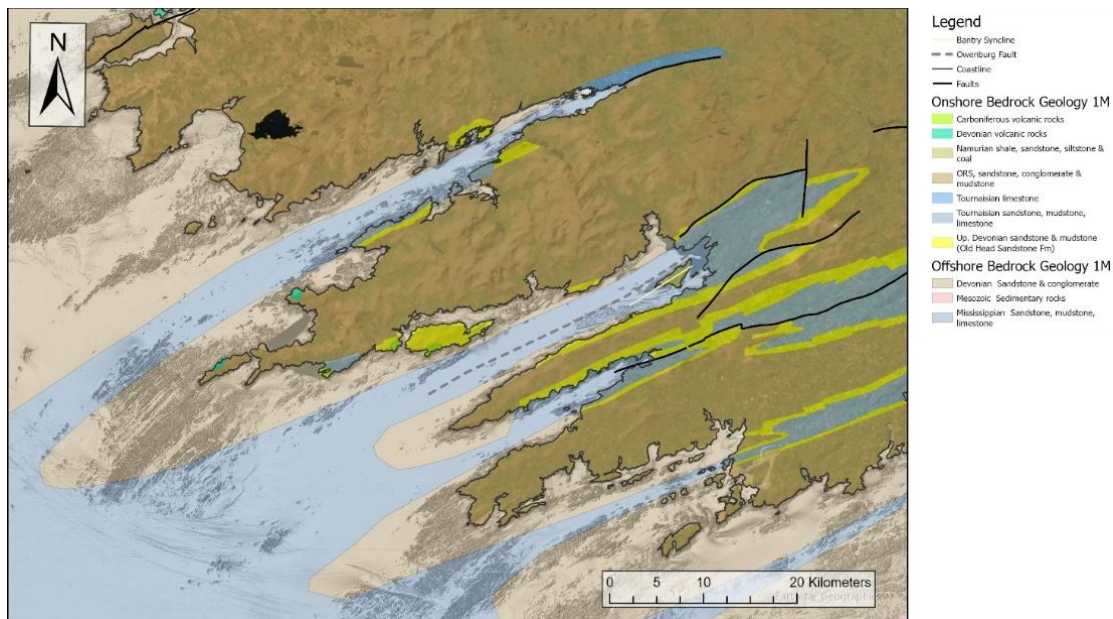


Figure 2: Geology of Bantry Bay.

The onset of the Variscan Orogeny, a continental collision and mountain-building event during the Late Carboniferous, around 300 Ma, resulted in intense folding and faulting. This produced east-west and south-west to north-east trending ridges and synclines that dominate the structural framework of the region.

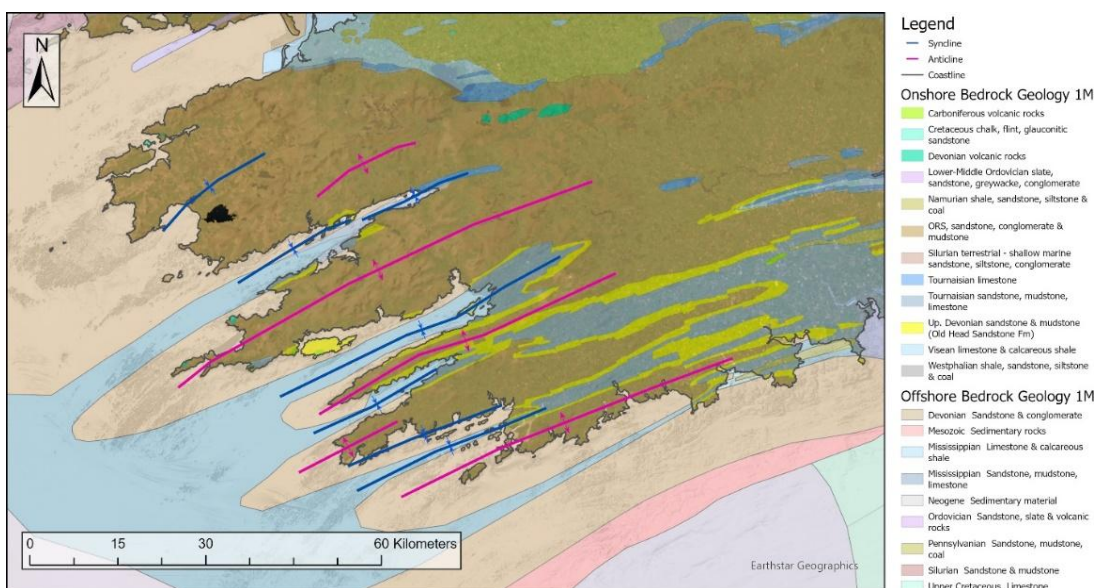


Figure 3: Late Carboniferous deformation (~300 Ma) produced SW – NE trending anticlines and synclines that guide the alignment of the peninsulas. Input from (MacCarthy & Meere, 2007).

In Bantry Bay, these structures are visible both onshore and on the seabed, where faults offset ORS formations and create zones of weakness that have helped shape the modern seabed morphology (Hennessy, et al., 2023).

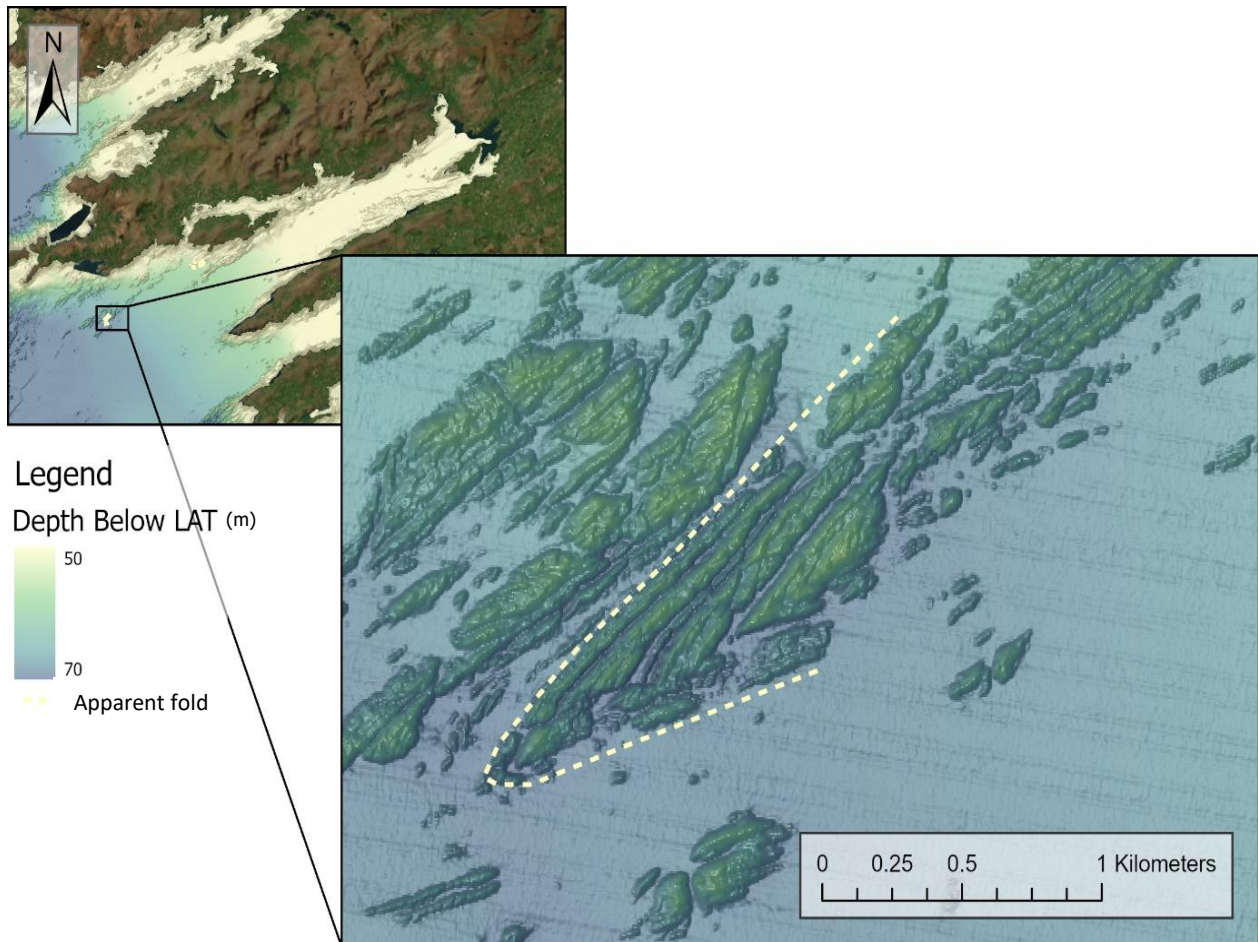


Figure 4: Apparent folds in the bedrock on the seabed.

Although igneous rocks are not a major component of the Munster Basin, intrusive rocks occur on the northern shores of Bantry Bay. Alkaline igneous intrusions, including trachyte, occur along the northern shore and on Bere Island. These intrusions, which are thought to have been emplaced into Devonian and Carboniferous rocks. None of the sheet-like intrusions has been successfully dated but most were intruded before the Variscan folding (Sleeman & Pracht, 2002).

Overlying the bedrock, Bantry Bay contains six distinct sedimentary units that reflect glacial and post-glacial processes. The oldest sediments, deposited before the Last Glacial Maximum (LGM), infill bedrock depressions and are overlain by glacial deposits. These glacial sediments are truncated by tidal and estuarine deposits, which record the marine inundation of the bay following deglaciation. The uppermost sedimentary unit represents fully marine conditions, which became established approximately 11,000 years ago (Jordan, et al., 2019).

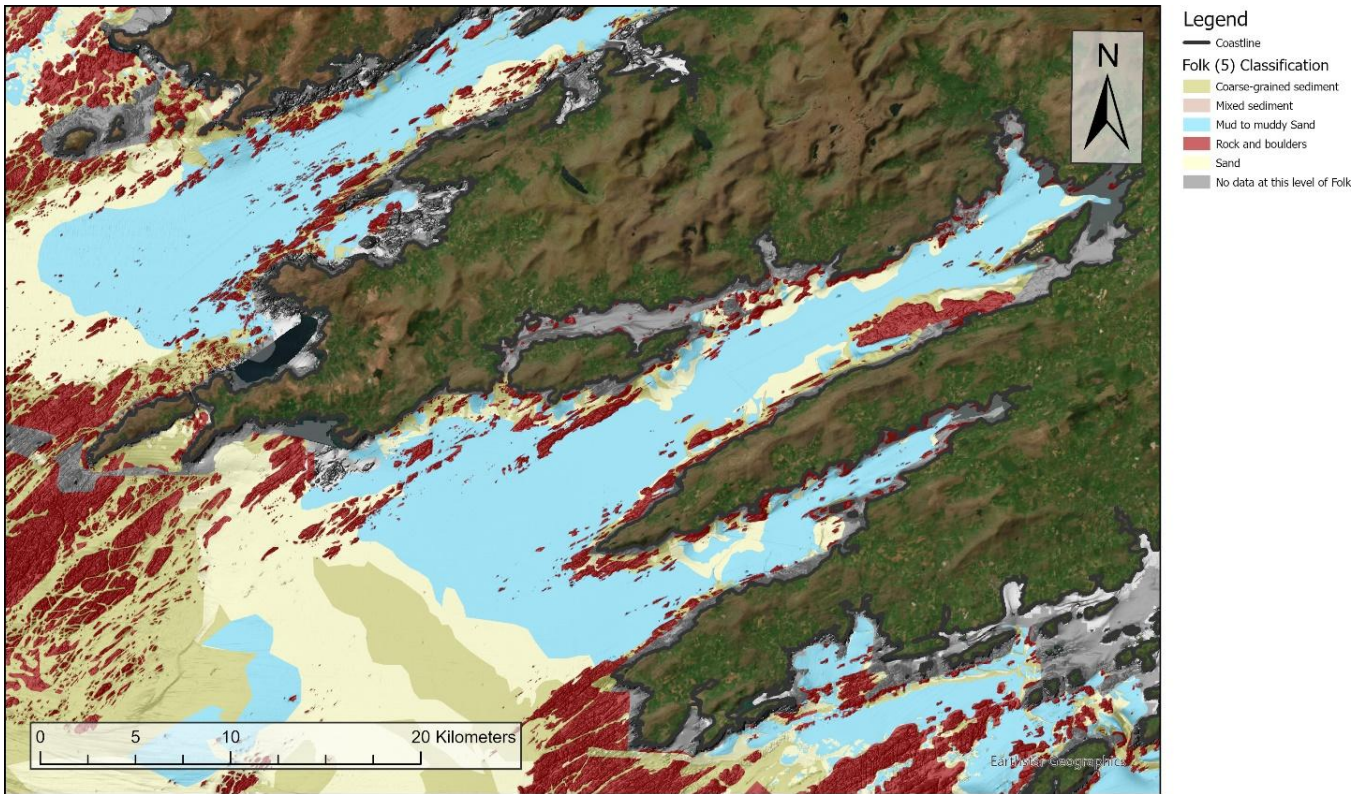


Figure 5: Sediment classification map of Bantry Bay.

During the Last Glacial Maximum (LGM), around 24 ka, global sea level was much lower and the coastline lay far offshore across a landscape shaped by glaciation (Ó Cofaigh, et al., 2012). As sea level rose during deglaciation, low-lying valleys were progressively inundated, producing the ria coastline observed today.

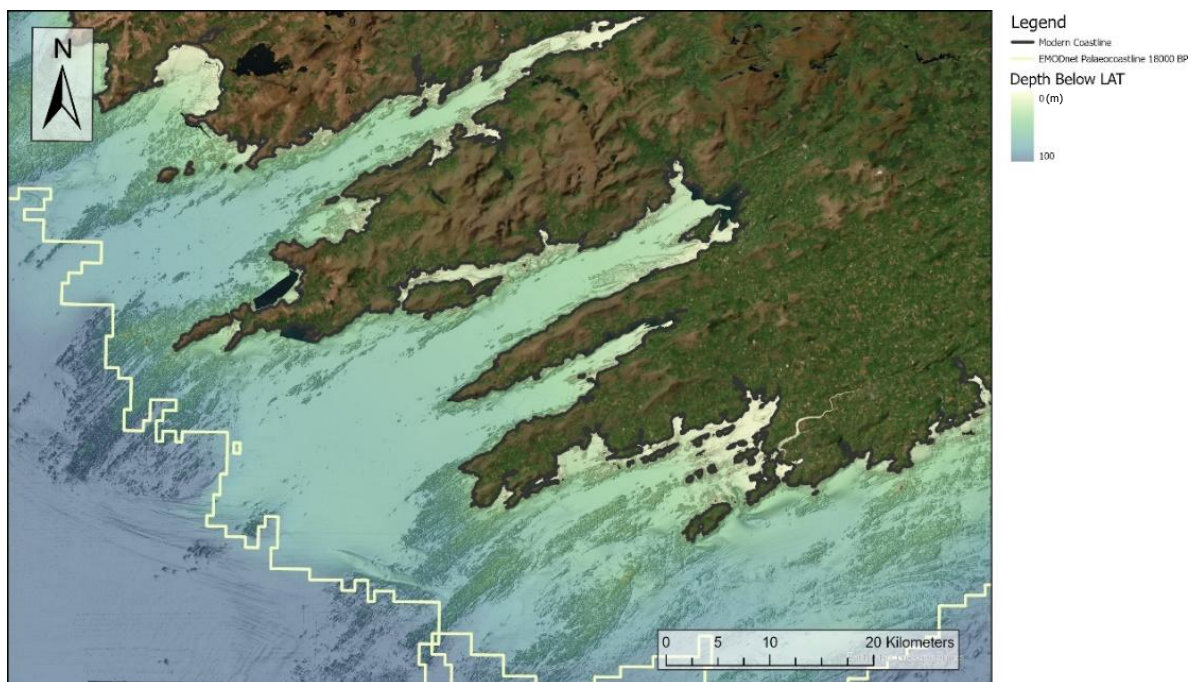


Figure 6: Modelled palaeocoastline of Ireland approximately 18 ka. Palaeocoastline data from (Brooks, et al., 2011).

## Bere Island

Bere Island is the largest island in Bantry Bay and lies on the southern limb of an anticline that forms the core of the Beara Peninsula. The island is primarily composed of Upper Devonian sandstones and siltstones belonging to the Old Head Sandstone Formation. The Bere Island Member, the uppermost part of this formation, is distinguished by fossil-rich mudstones and limestone lenses, indicating periodic marine incursions during the transition from Devonian to Carboniferous environments (Hennessy, et al., 2023).

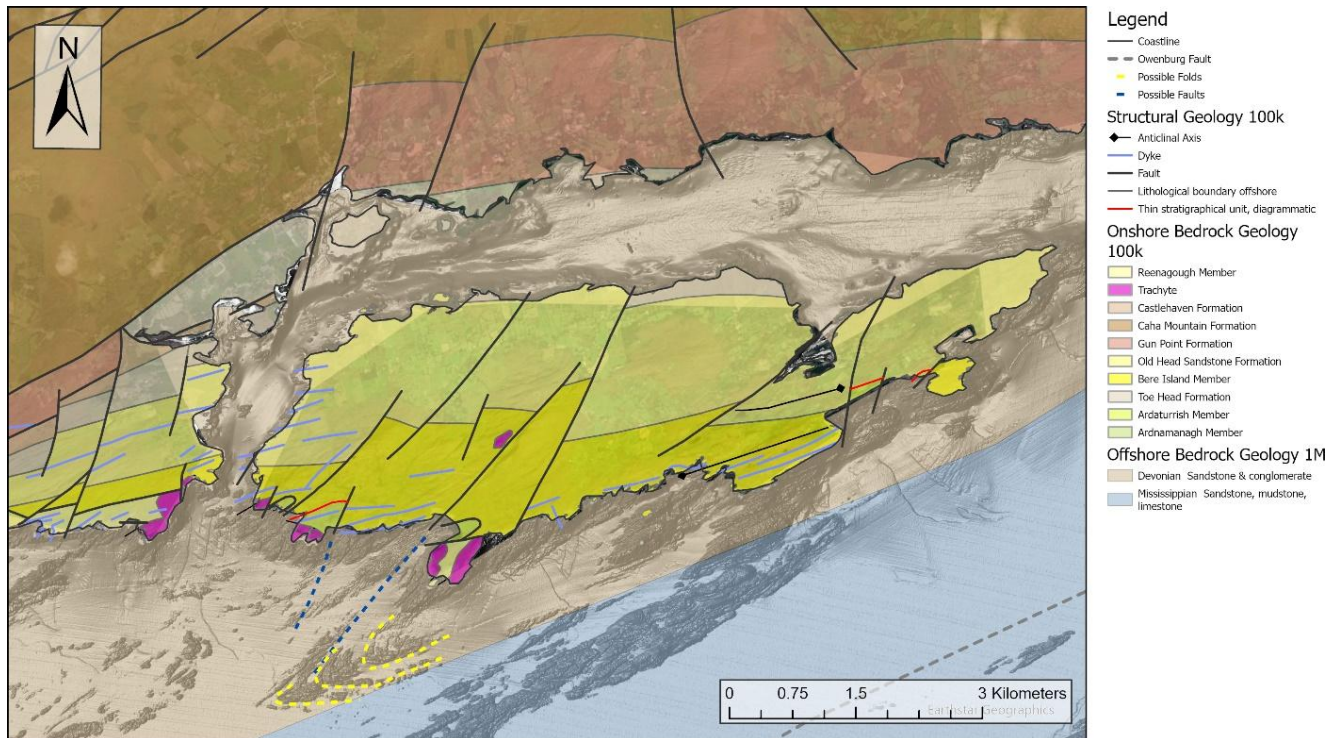


Figure 7: Geology of Bere Island, with inferred faults and folds.

Some igneous intrusions are present within the Lower Carboniferous Reenydonagan Formation, with small patches of intrusive Devonian to Carboniferous igneous rocks scattered throughout the region (Sleeman & Pracht, 2002). A dyke network, oriented west-south-west to east-north-east, follows the regional structural trends of the South Munster Basin. Contact metamorphism of the surrounding sedimentary rocks has occurred in areas where igneous intrusions are in contact with ORS formations. This has caused red sandstones turning white due to heat exposure, while the igneous rocks themselves appear green due to their mineralogical composition and alteration processes (Grace, 2017).

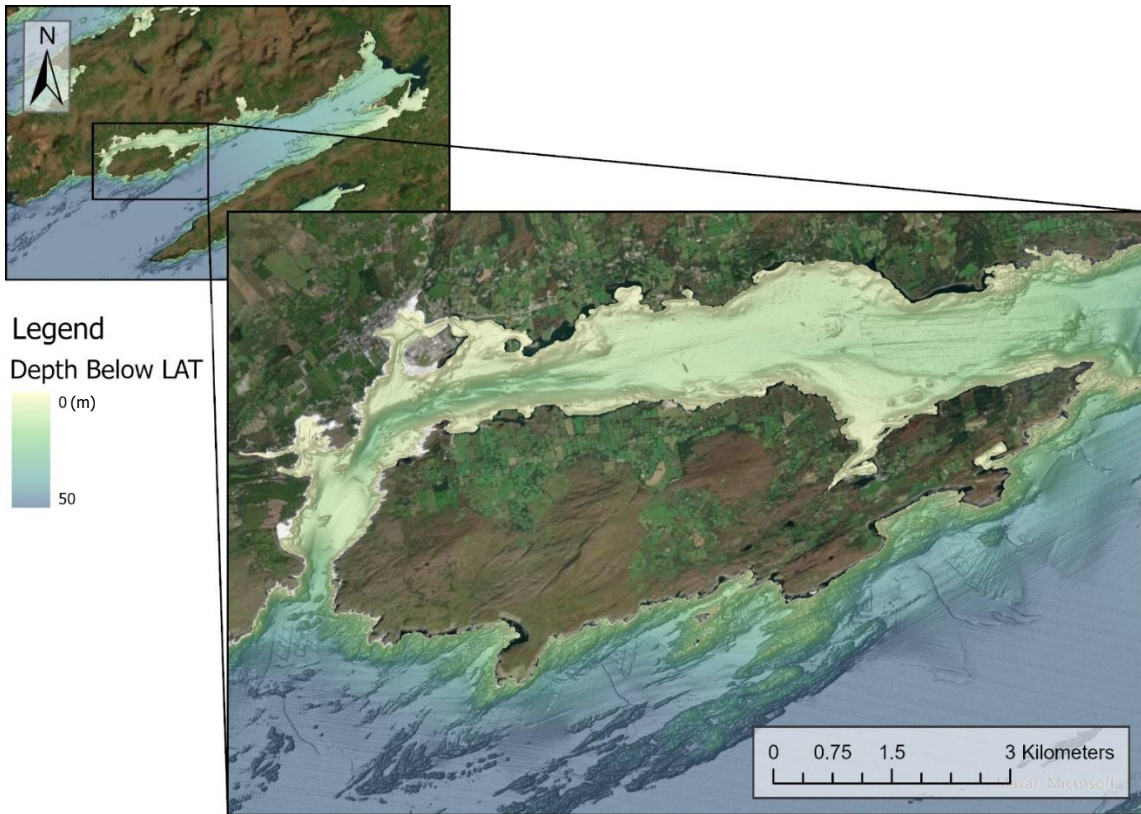


Figure 8: Bathymetry of Bere Island.

The dominant east-west and south-west to north-east structural grain of the region is reflected in the bathymetry, with folded bedrock visible as seabed ridges.

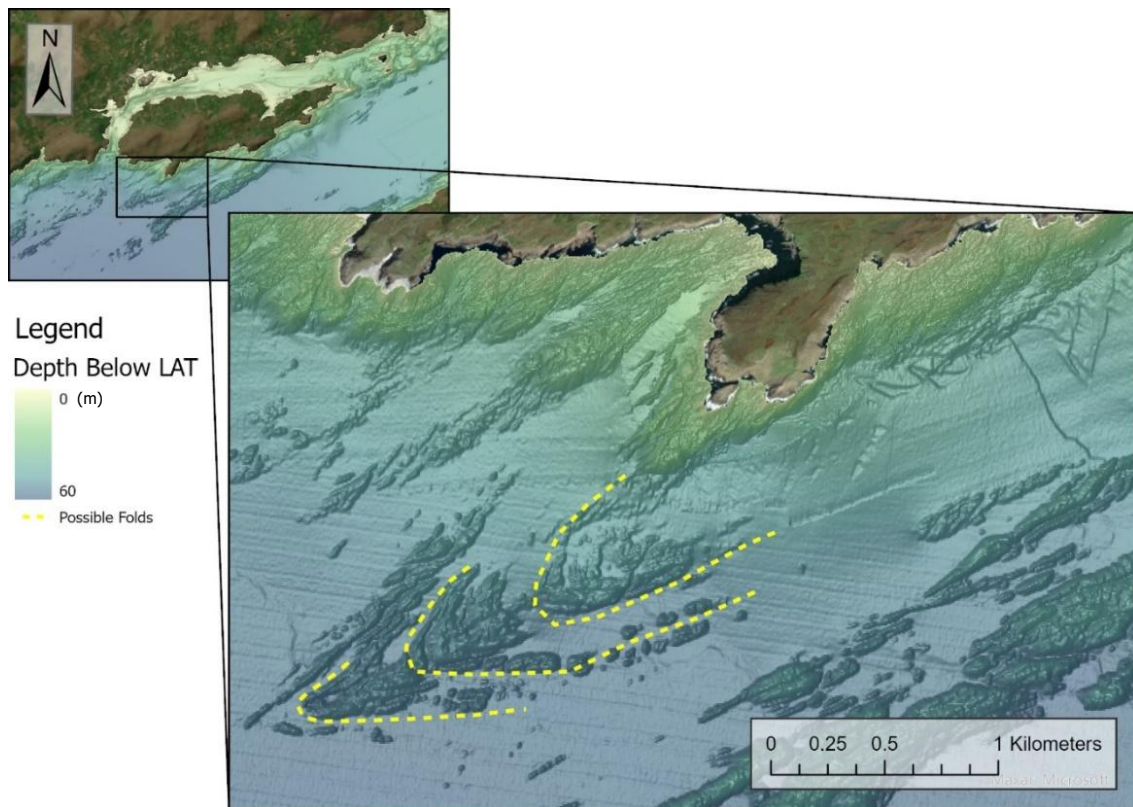


Figure 9: Possible folded bedrock to the south of Bere Island.

A deep channel runs to the north of Bere Island, and near Castletownbere the seabed has been dredged to accommodate large fishing vessels.

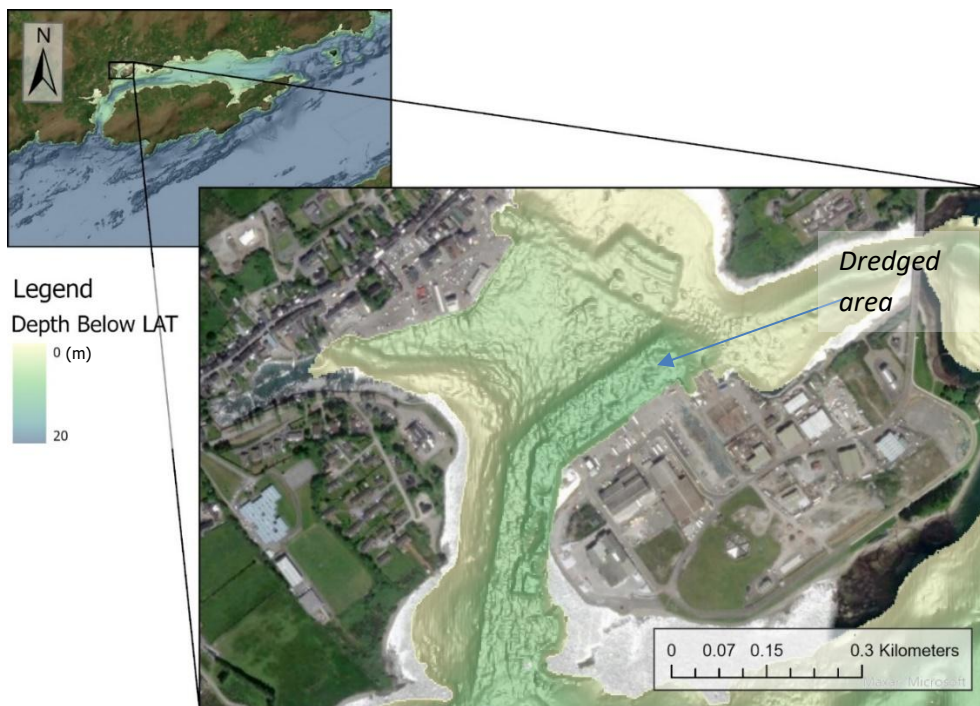


Figure 10: Bathymetry around Castletownbere with dredged area indicated.

North of Bere Island, the seabed contains more sediment accumulation, likely influenced by tidal currents and river input. South of the island, the seabed is characterised by extensive bedrock exposure. Seabed sediments near Bere Island consist primarily of muddy sands with gravel components, reflecting the influence of past glacial activity and modern sediment transport processes. Additionally, the seabed footprint of aquaculture in the area is clear in the bathymetry.

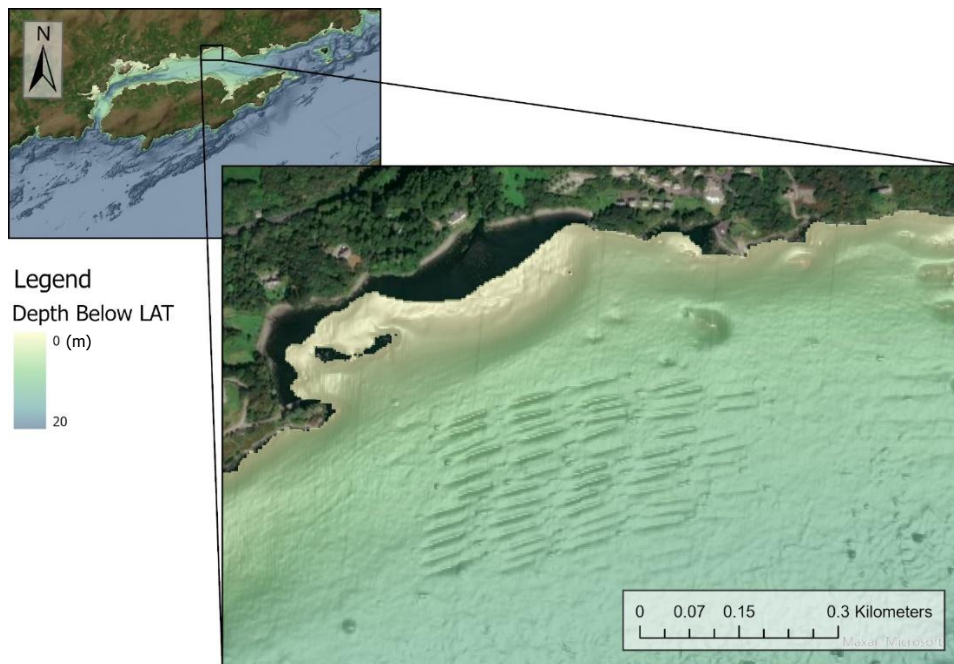


Figure 11: Seabed footprint of a mussel farm on the seabed.

## Whiddy Island

Whiddy Island, located near the head of Bantry Bay, is underlain by Lower Carboniferous marine sediments, forming part of the Bantry Syncline. The sedimentary succession records a coarsening-upwards sequence, indicating changes in depositional environments and a gradual reduction in sedimentation rates in deep-water conditions between 330 and 320 Ma (Hennessy, et al., 2023).

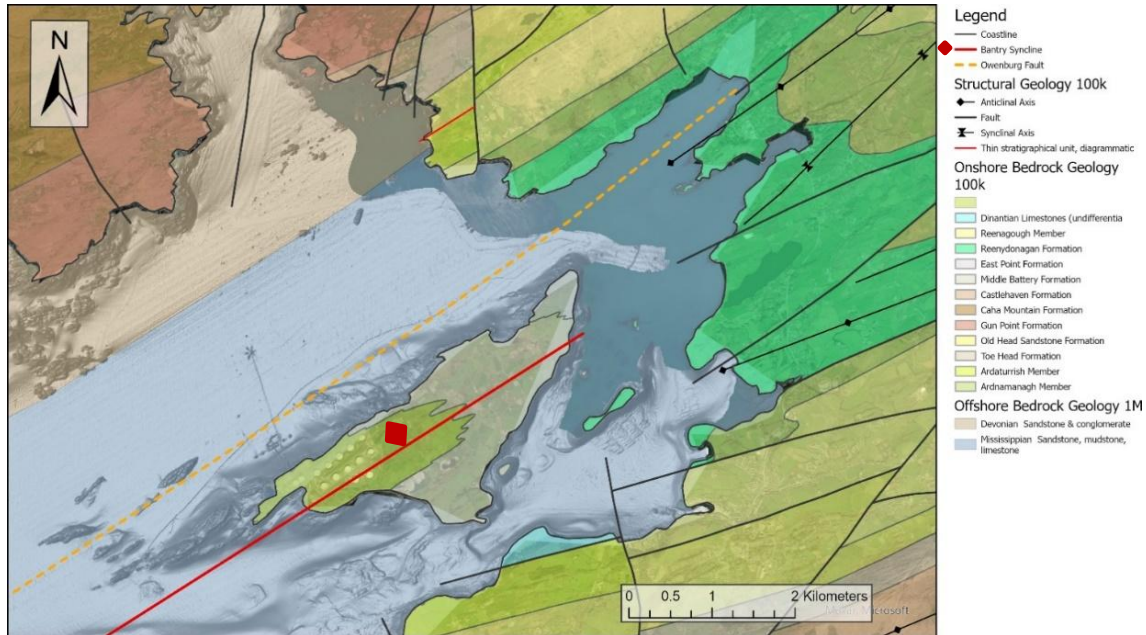


Figure 12: Geology of Whiddy Island.

The seabed surrounding Whiddy Island varies from exposed bedrock striking south-west to north-east following the regional structural trends, to complex sedimentary bedforms.

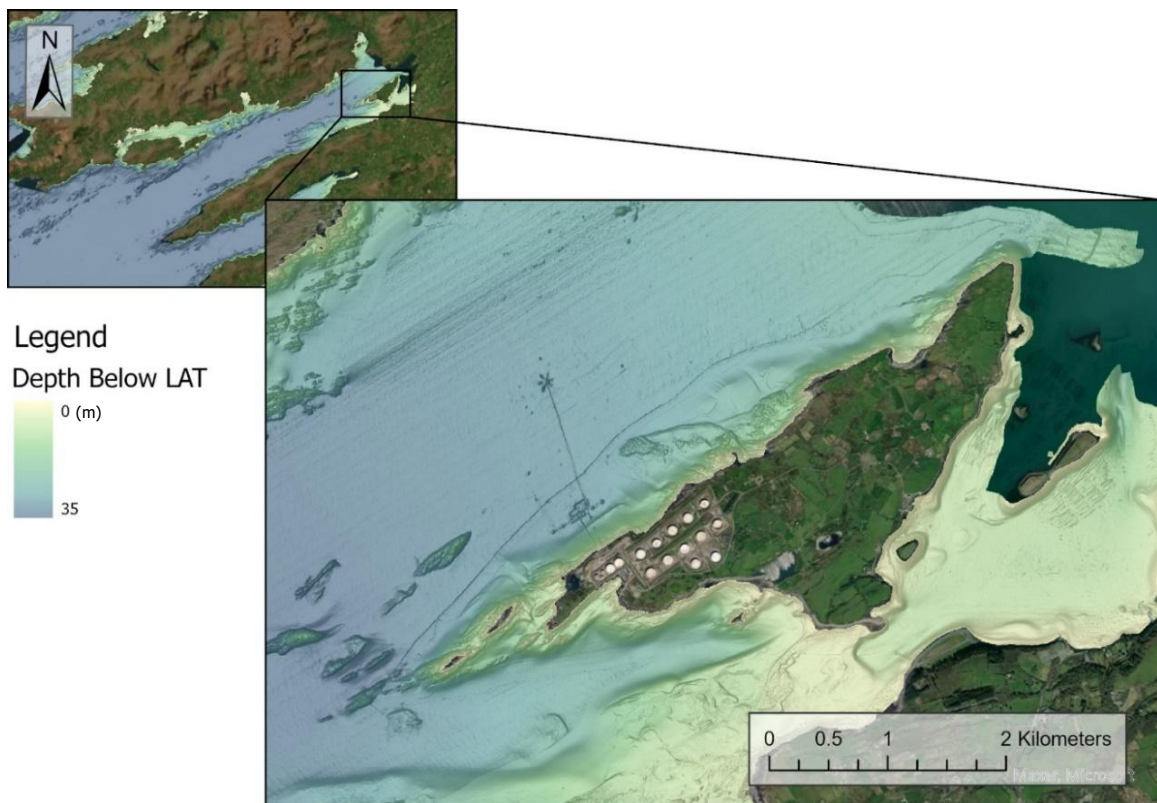


Figure 13: Bathymetry around Whiddy Island.

To the south-west of the island, several complex sedimentary structures are visible. These may be of glacial origin, potentially formed by past ice-sheet movement and meltwater processes.



Figure 14: Sedimentary structures and undifferentiated bedrock to the south-west of Whiddy Island.

Human activity is also visible on the seabed. Remnants of oil refinery infrastructure can be seen on the seafloor. The presence of large storage facilities on the island and associated subsea infrastructure reflects the importance of Whiddy Island in Ireland's energy sector.



Figure 15: Seabed expression of infrastructure related to the oil refinery.

To the east of the island, a mussel farm is present, modifying sediment deposition and influencing the local benthic environment. To the north of the island, a pockmark field has been identified, indicating areas of gas escape or fluid seepage from the subsurface. Similar pockmark fields have also been mapped in nearby Dunmanus Bay and Kenmare River. These features show how the Whiddy Island seabed is shaped by both geological processes and human activity.



Figure 16: Pockmarks to the north and seabed footprint of a mussel farm on the seabed to the south-east of Whiddy Island.

## Conclusion

The geology of Bantry Bay reflects a complex history of sedimentation, structural deformation, igneous activity, and glacial processes, shaping both the onshore and submarine landscapes. The bedrock, composed of Devonian ORS and Lower Carboniferous marine sediments, has been strongly influenced by east-west-trending folds and faults that continue to shape the seabed framework.

The bathymetry of Bantry Bay shows a varied underwater setting, with structural ridges, exposed bedrock, sediment accumulations and glacially influenced features. These reflect the combined influence of bedrock structure, past glaciation, modern sediment transport and marine deposition.

Bantry Bay's marine geology and sediment distribution provide important context for understanding its tectonic evolution, Quaternary glaciation and ongoing seabed processes. Further work using high-resolution seabed mapping, seismic profiling and sediment analysis would help test and refine the interpretation of the bay's geological history, particularly in relation to marine habitats, resource management and coastal infrastructure.

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