Marine Geoscience Report 019

Roaringwater Bay and Long Island Bay

Overview

Roaringwater Bay and Long Island Bay, on the south-west coast of County Cork, form an interconnected marine system shaped by varied geology and marine habitats. Long Island Bay forms the outer portion of this system, opening into the Atlantic Ocean, while Roaringwater Bay forms the sheltered inner portion. The region contains several offshore islands, including Cape Clear, Sherkin Island, and Long Island, which follow a broadly south-west to north-east orientation consistent with regional bedrock structure and folding pattern.

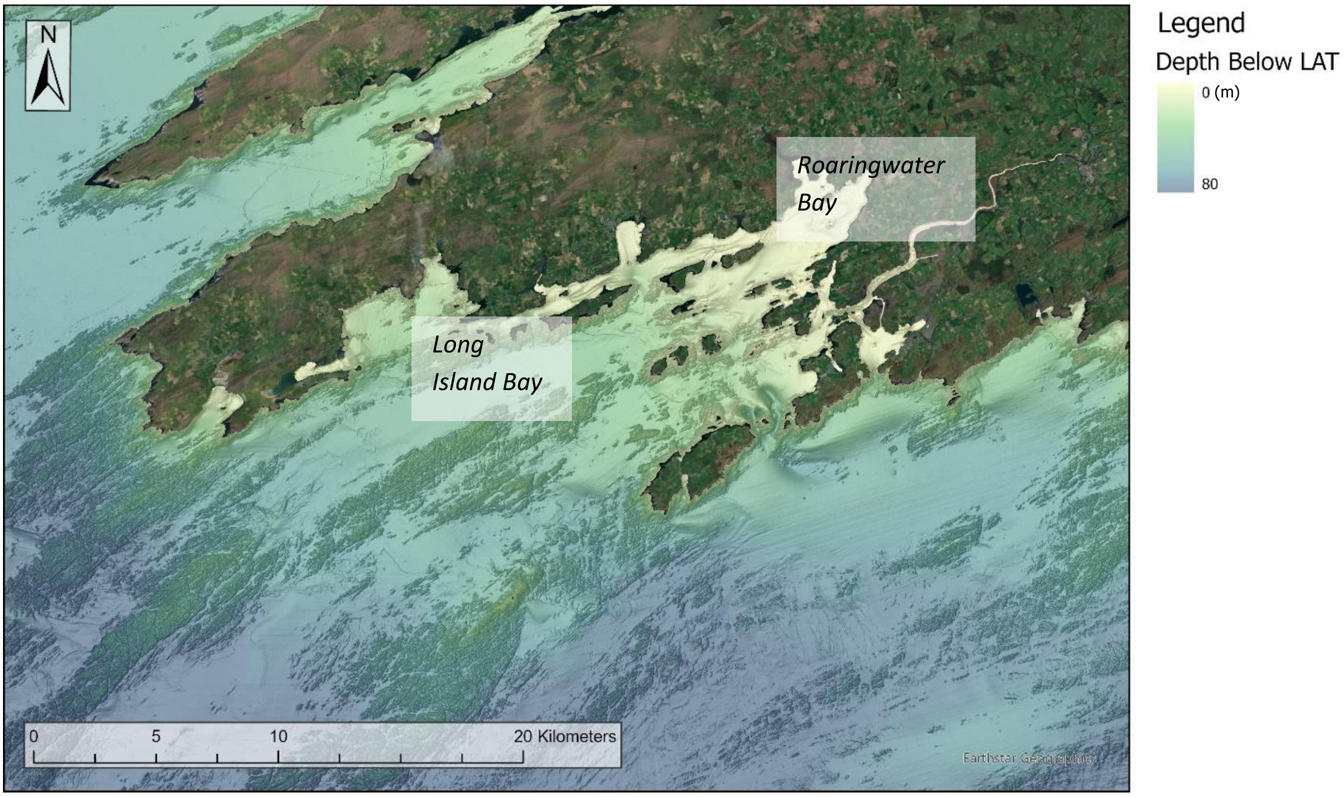

Figure 1: Overview of Bathymetry of Roaringwater and Long Island Bay. Depths are given referenced to Lowest Astronomical Tide (LAT).

The area contains rugged cliffs, headlands and submerged reefs shaped by Atlantic wave action. The range of shoreline types, from the rocky outer shores of Sherkin Island to the sheltered mud and sand habitats of the inner bay, supports a wide variety of habitats. Roaringwater Bay is designated as a Special Area of Conservation (SAC) due to important habitats such as reefs, sea caves and sea cliffs, as well as protected species like otters, grey seals, and harbour porpoise (National Parks and Wildlife Service, 2011).

Regional Geological History

The geology of Roaringwater and Long Island Bays reflects the tectonic evolution of the Munster Basin, a major sedimentary basin that developed during the Devonian period, approximately 415-360 Ma (Sleeman & Pracht, 2002). The bedrock consists mainly of Old Red Sandstone (ORS), deposited in fluvial environments during the Devonian. These were followed by Carboniferous marine clastics and limestones, deposited as the basin deepened and transitioned into a marine setting (Hennessy, et al., 2023).

The region was subsequently deformed during the Variscan Orogeny, around 300 Ma. This continental collision and mountain-building event produced widespread folding and faulting, mainly orientated south-west to north-east. Vertical or steeply dipping strata now form many of the ridges and troughs that characterise the peninsulas and inlets of south-west Ireland. The peninsulas generally correspond to anticlines, while the inlets correspond to synclines (Hennessy et al., 2023). In places, such as Sherkin Island, mudstones underwent low-grade metamorphism and were transformed into slate. This is reflected in the historical slate quarrying that took place on the island during the 19th century (Hennessy, et al., 2023).

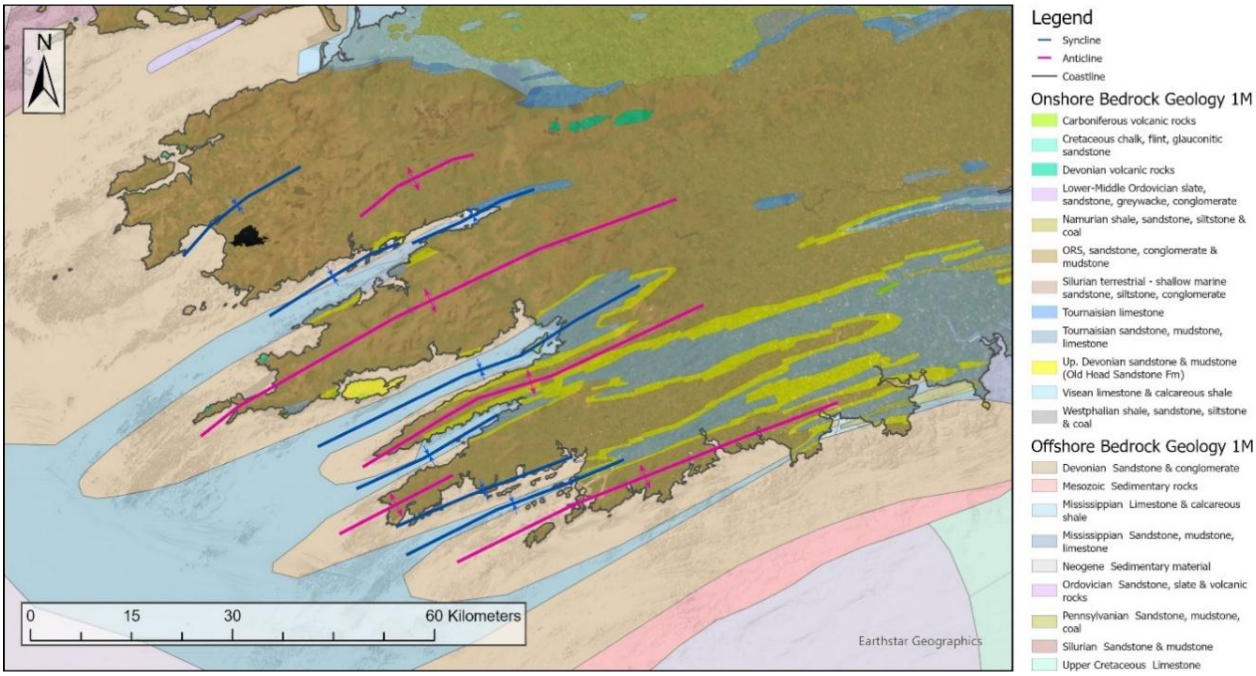

Figure 2: Regional Geology of West Cork. Syncline and anticline axes from (MacCarthy & Meere, 2007).

After Variscan deformation, there is little geological evidence until the Quaternary, around 2.58 Ma. This gap in the geological record is largely due to prolonged uplift and erosion (Hennessy, et al., 2023). From the Quaternary onwards, glacial and post-glacial processes deposited a range of unconsolidated sediments, such as glacial till, marine sands, and muds, which are particularly evident in inner Roaringwater bay (Dixon.Brosnan, 2004).

The rocky seabed and the islets within Roaringwater Bay typically coincide with the anticline axes, where harder Devonian bedrock is exposed, as shown in the image below. Synclinal lows act as traps for muds, occupying the depressions between anticlinal highs. This relationship is clearly illustrated in the sediment classification map below, which includes the positions of anticlines and synclines across the bay, with the fold names from (MacCarthy & Meere, 2007).

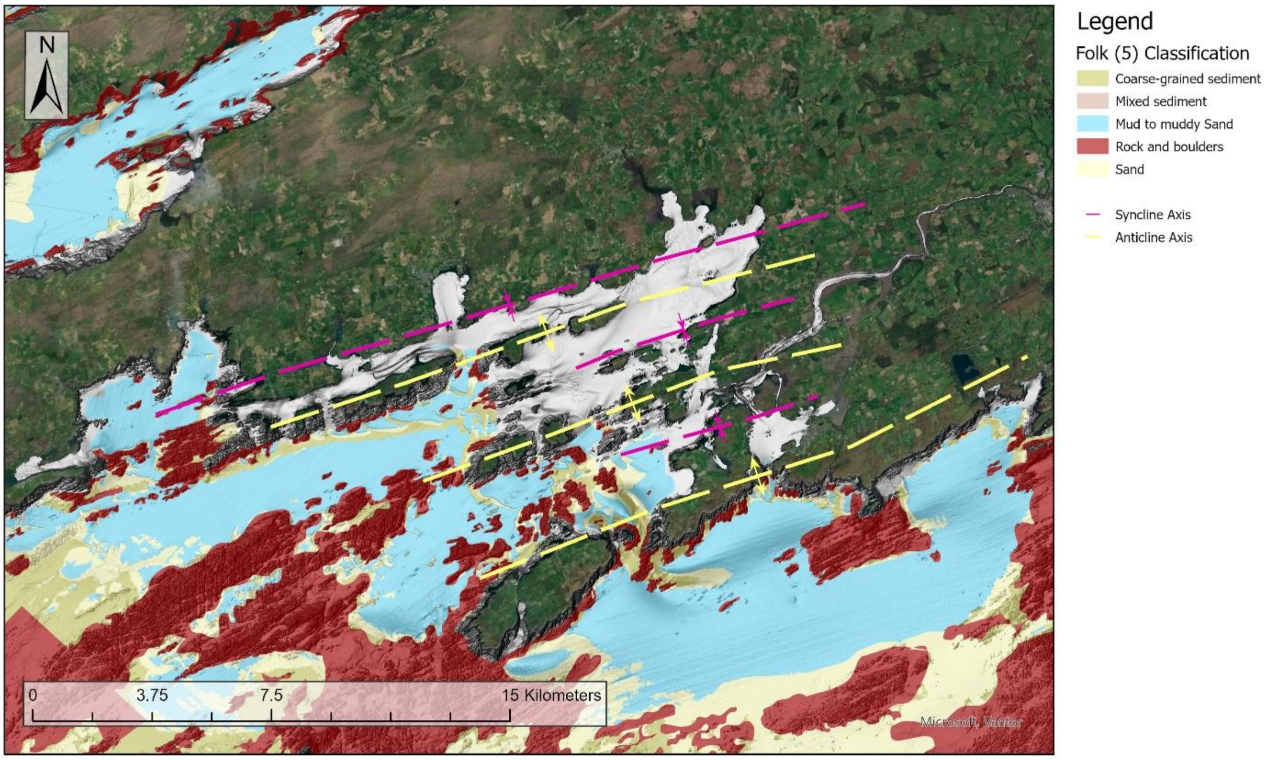

Figure 3: Sediment classification map with structural input from (MacCarthy & Meere, 2007).

Geology of Roaringwater Bay

The bedrock within Roaringwater Bay is primarily composed of Devonian ORS, which appears at the surface as outcrops and reefs that align broadly south-west to north-east, consistent with regional structural trends.

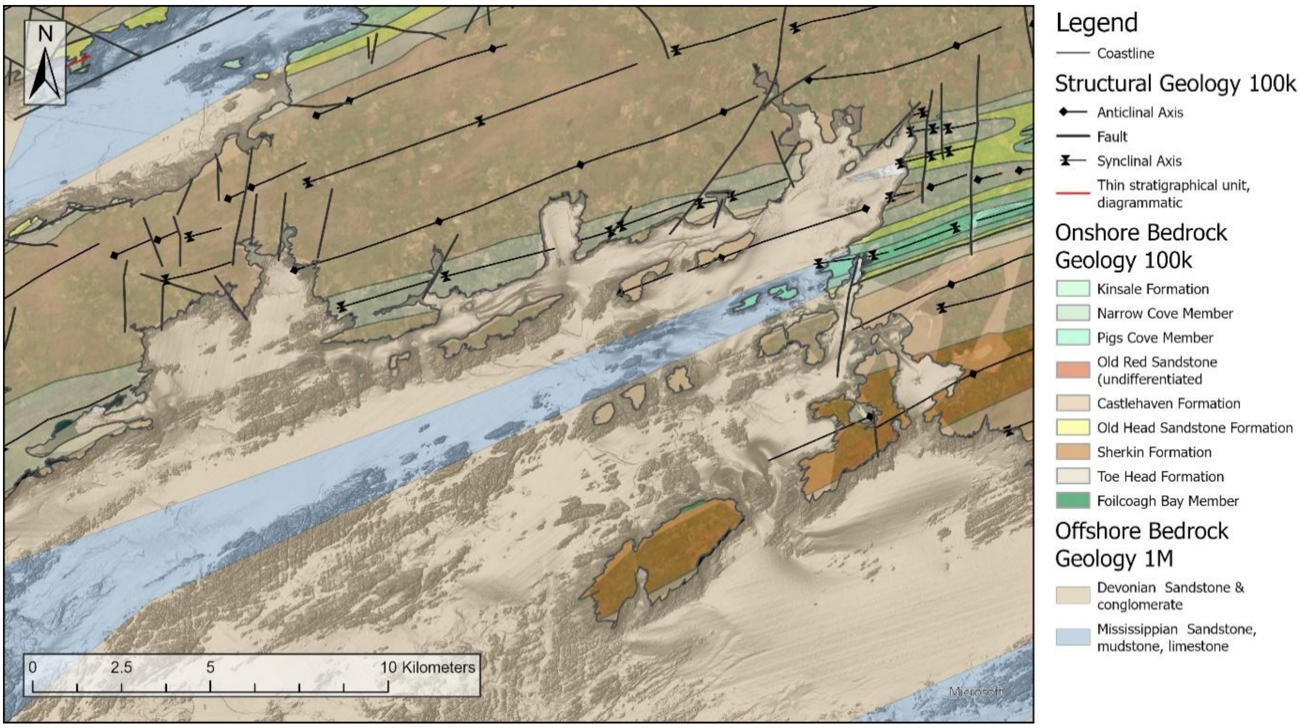

Figure 4: Geology of Roaringwater and Long Island Bay.

The islands of Long Island, Sherkin, and Cape Clear are situated along anticlinal axes, forming topographic highs in the region. These features reflect second-order folds within the Devonian succession, superimposed on the broader Variscan folding pattern that forms the peninsulas (Bowden, et al., 2016).

Plunging chevron folds with north-east to south-west trending fold axes are evident, orthogonal to the regional cross-joint systems. These folds are older than the jointing patterns. North-west trending joints, interpreted as Variscan or post-Variscan in age, dissect the bedrock and influence erosion and seabed topography (Bowden, et al., 2016).

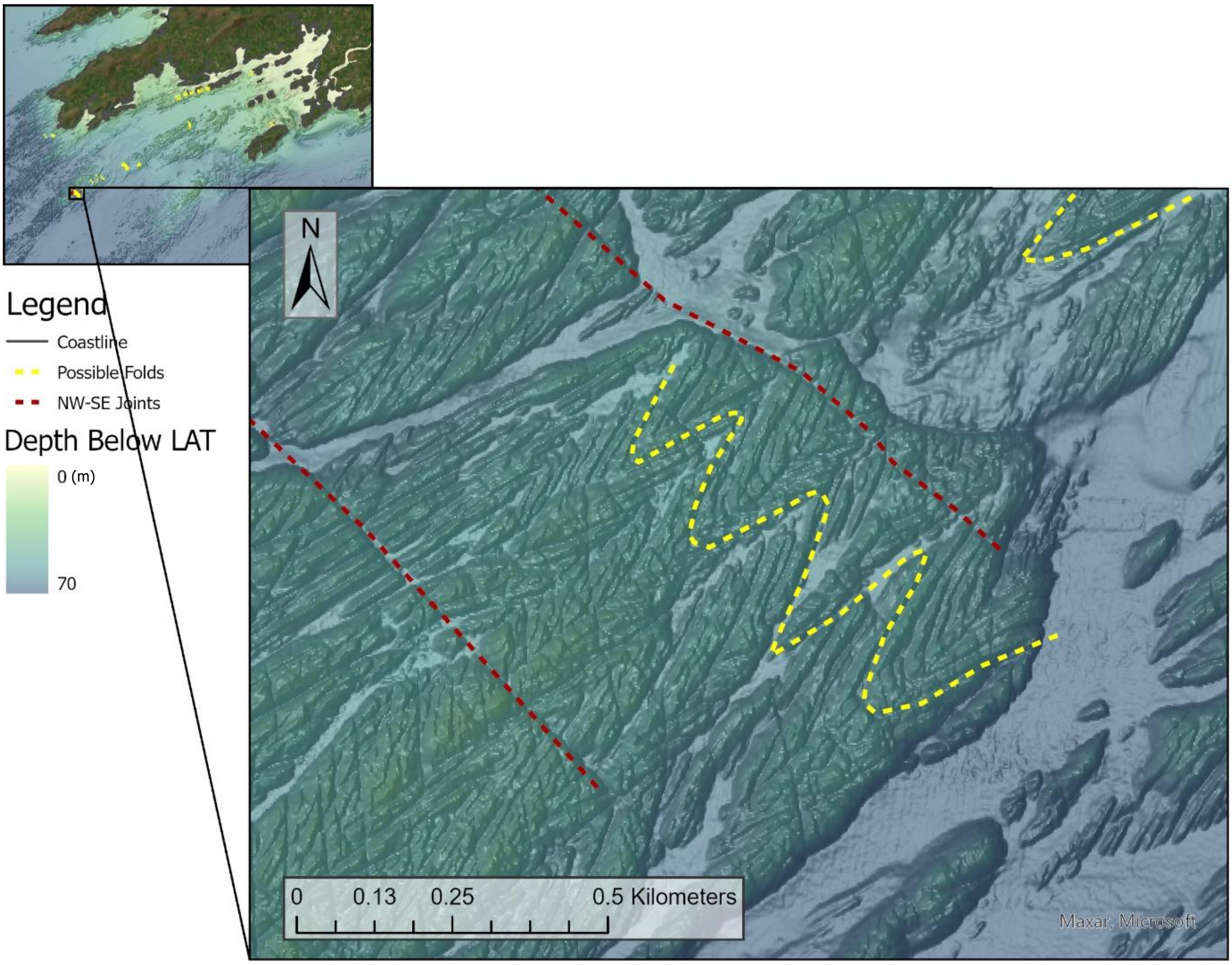

Figure 5: Chervon folds with an orthogonal joint system orientated north-west to south-east.

Joints are fractures without significant displacement, while faults involve movement along the fracture surface. Both features are visible in the bathymetric data. These structures are particularly well expressed on the seabed, where folded strata, fault-aligned depressions and joint-defined ridges can be observed.

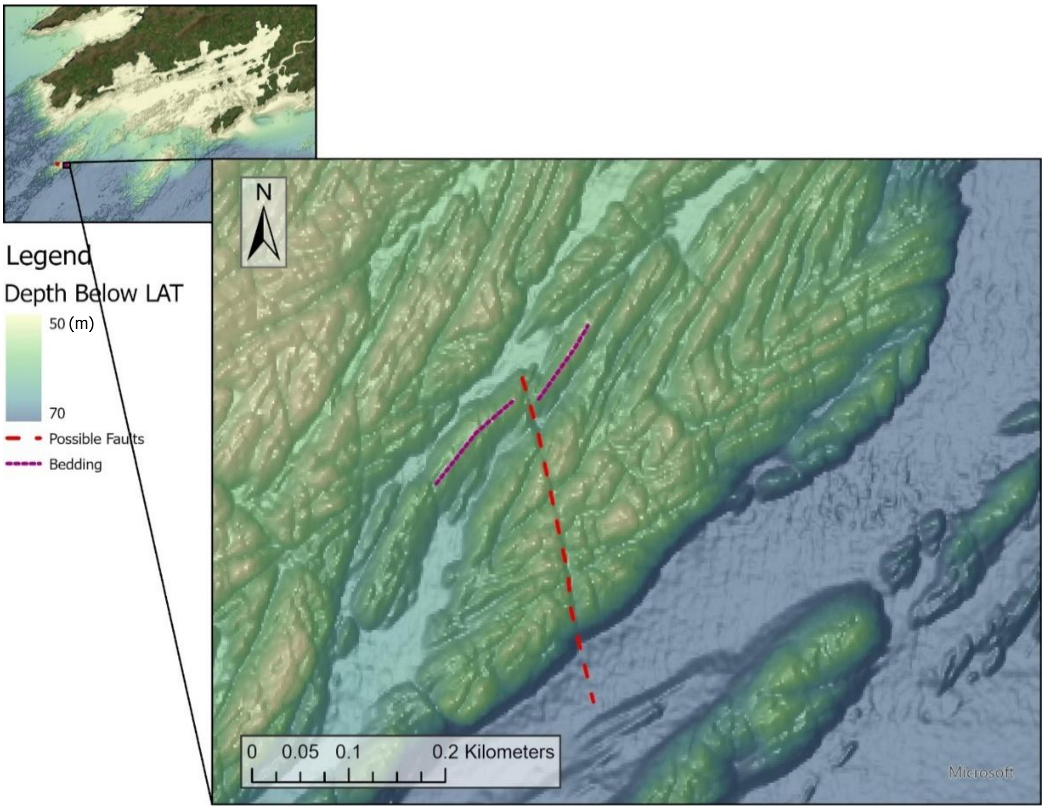

Figure 6: North-west to south-east orientated fault with displacement of bedding evident.

The seabed also contains several sedimentary bedforms. Banner banks are elongated accumulations of sediment shaped by tidal currents. Their position and orientation are influenced by local hydrodynamic conditions and the underlying topography.

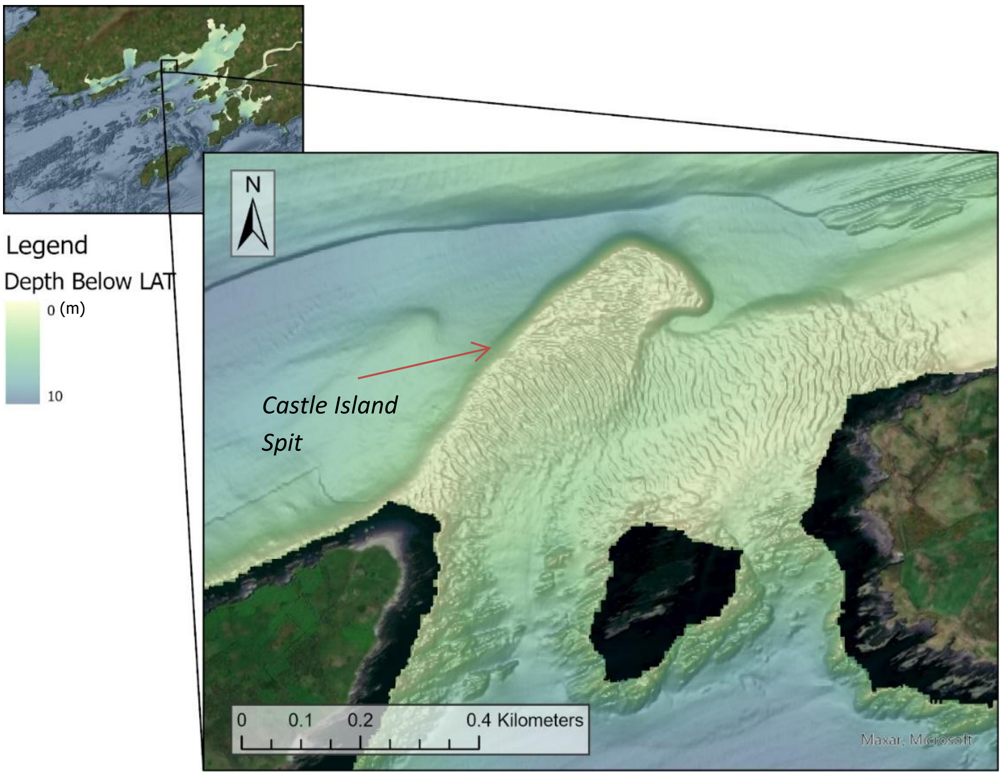

Figure 7: Banner Bank, the Castle Island Spit, east of Castle Island.

On and to the east of the banner bank, a distinct sandwave patch between Castle Island and Horse Island shows rhythmic bedforms formed by sediment transport under strong tidal flows. These sandwaves are slightly asymmetrical, suggesting a dominant flow direction toward the north-east.

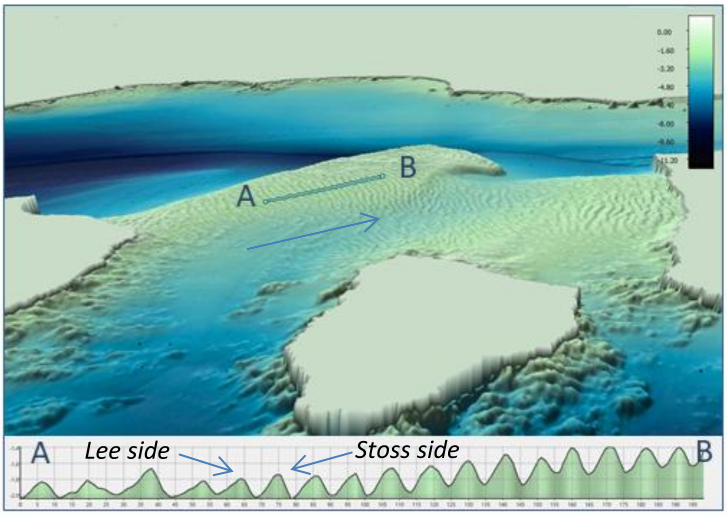

Figure 8: 3D Bathymetry of sandwaves, with elevation profile orientated from south-west (A) to north-east (B). Current direction indicated by blue arrow.

A deep channel between Long Island and the mainland records scouring by fast-flowing water through the constricted passage, with clearly defined bedform structures visible in bathymetric data. Tidal currents in this area have been measured at speeds of up to 1.5 knots (Admiralty chart 2184) flowing to the south-west, contributing to the observed sediment dynamics and channel morphology.

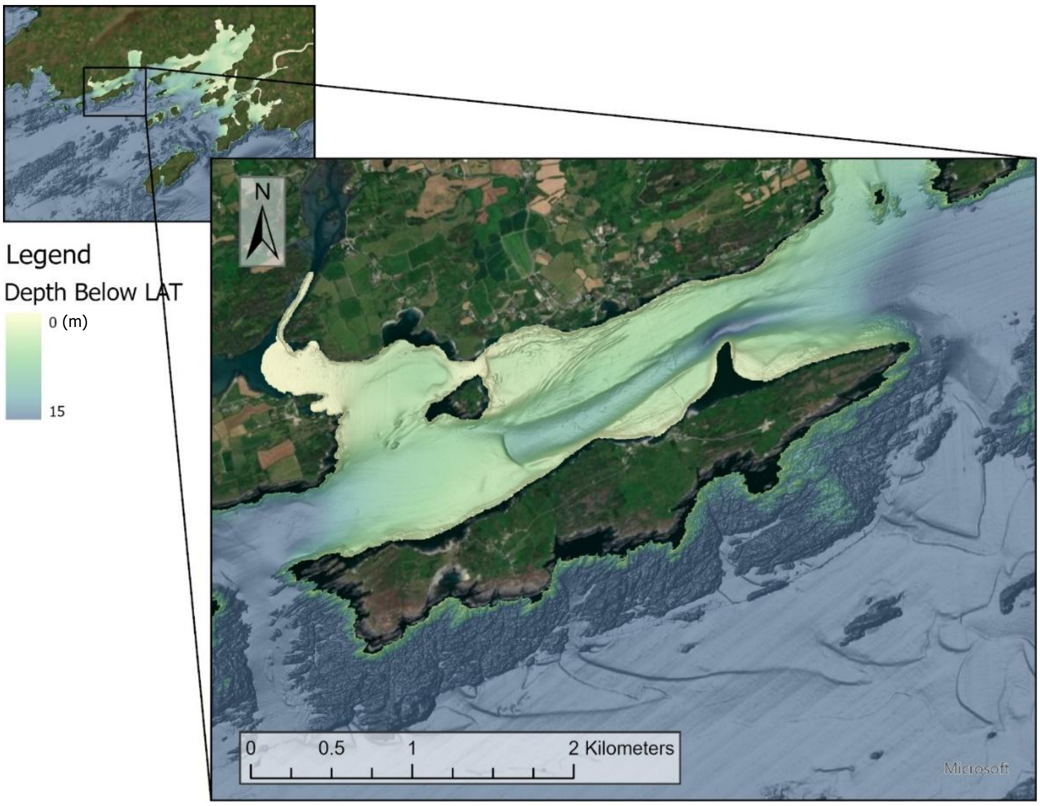

Figure 9: Bathymetry of Long Island Channel, between Long Island and the mainland.

Deep scour and active sandwave development are also observed between Turkhead and the nearby islets, where strong tidal flows interact with bedrock highs and constricted channels to generate pronounced sediment bedforms.

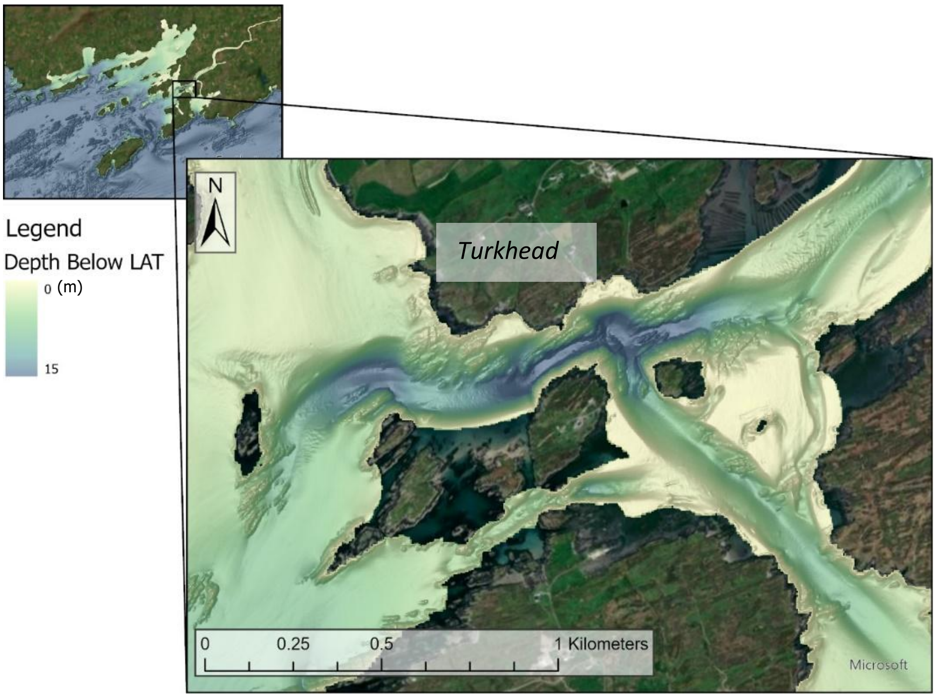

Figure 10: Scour channel and bedforms between Turkhead and islets.

Numerous mussel farms are also present throughout the inner bay. These indicate areas of lower-energy conditions and fine sediment accumulation, and contribute to the region's economic significance.

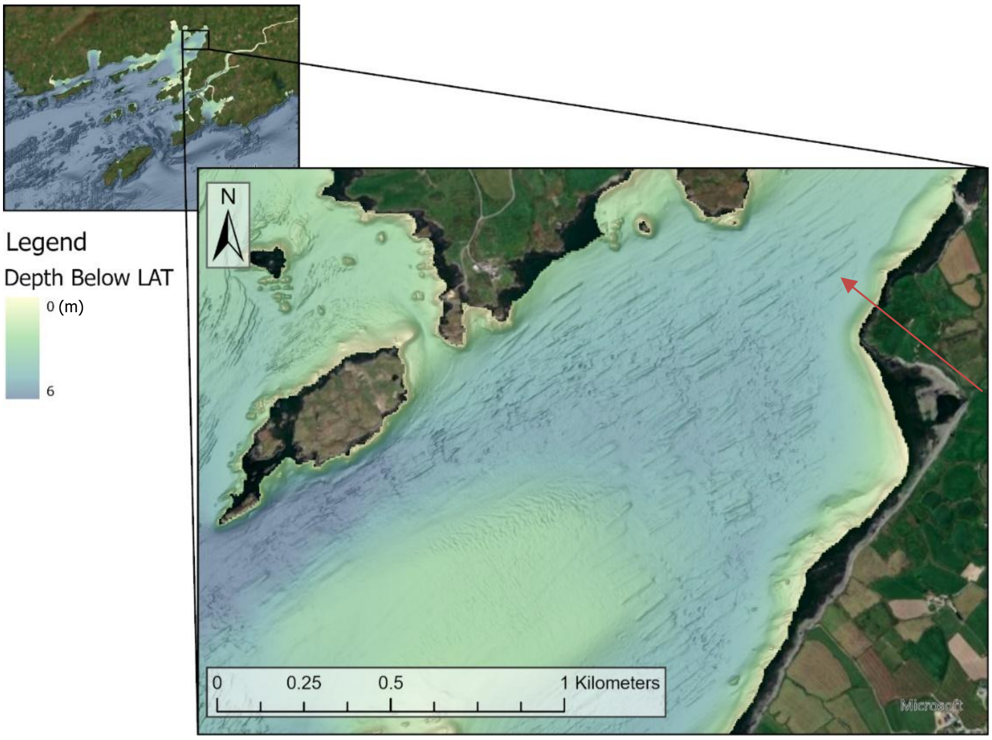

Figure 11: Seabed footprint of aquaculture, with arrow pointing to part of the mussel farm.

Cape Clear

Cape Clear Island, the southernmost inhabited island of Ireland, is geologically significant for its exposure of the Sherkin Formation, part of the ORS succession. This formation includes upper Devonian grey-green sandstones and mudstones. The Foilcoagh Bay Member, at the base of this formation, has been dated to around 375 Ma and comprises dark grey mudstone, along with rippled and flat-bedded sandstone (Sleeman & Pracht, 2002).

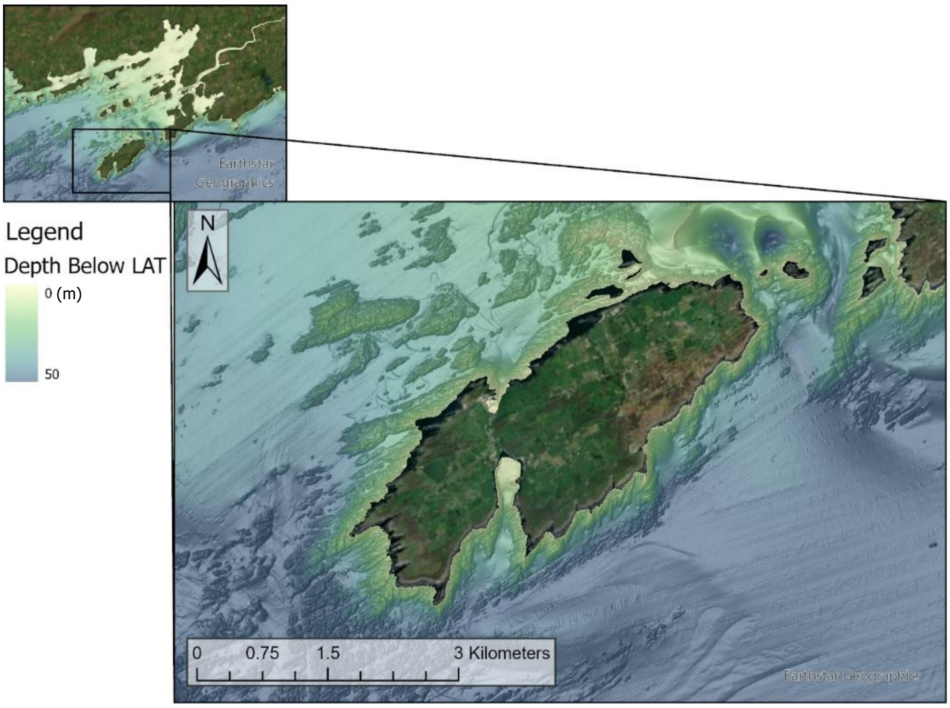

Figure 12: Bathymetry of Cape Clear.

The Foilcoagh Bay Member contains marine microfossils and organic matter, marking the first evidence of marine influence in the Munster Basin during the Devonian. These deposits indicate high-energy marine inundations into a coastal lagoon or lake setting, supporting interpretations that Cape Clear lay on the edge of the ORS continent during this period (Hennessy et al., 2023).

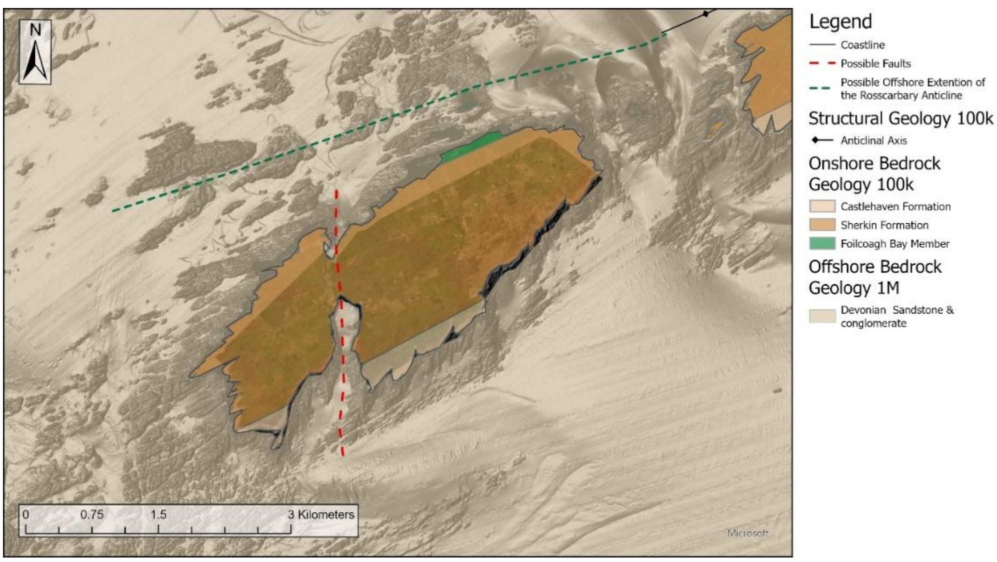

Figure 13: Geology of Cape Clear.

Between Cape Clear and Sherkin Island, intense scour and bedform development are visible. These features reflect strong tidal currents interacting with bedrock topography. Tidal flows in this area can reach up to 3 knots (Admiralty chart 2184) and vary in direction throughout the tidal cycle, further contributing to the complex sedimentary structures observed.

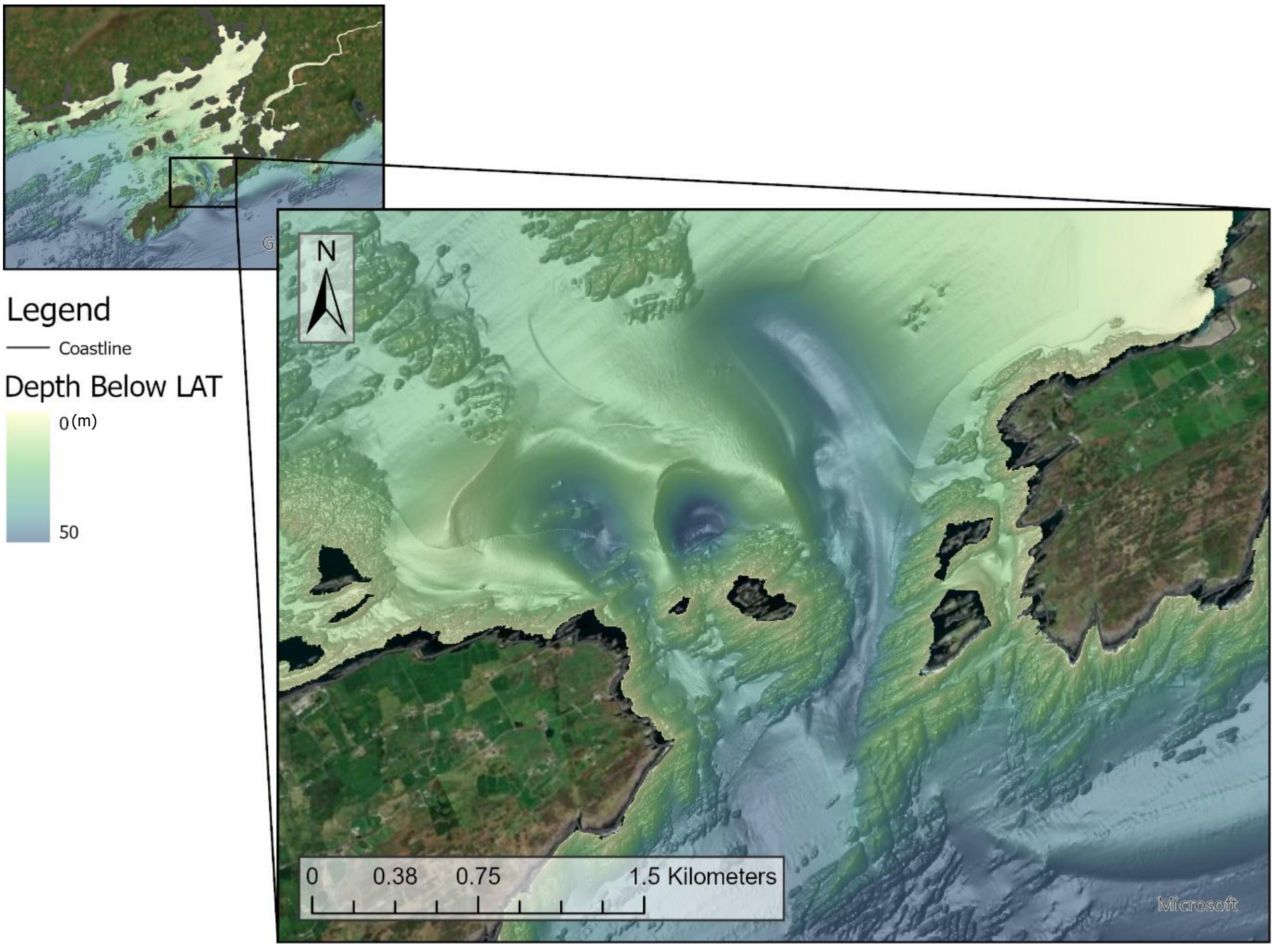

Figure 14: Scour channel and bedforms between Sherkin and Cape Clear.

Conclusion

Roaringwater Bay and Long Island Bay show how Devonian and Carboniferous bedrock, Variscan deformation, and Quaternary sedimentation combine to shape the present coastal and marine setting. The alignment of islands and inlets reflects the underlying tectonic structures, while seabed features show how tides and waves continue to rework the older geological framework. This varied seabed supports a wide range of rocky and sedimentary habitats, giving the area both geological and ecological importance.

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