INFOMAR Integrated Mapping for the Sustainable Development of Ireland's Marine Resource
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Geological Survey Suirbhéireacht Gheolaíochta Ireland | Éireann
Marine Institute Foras na Mara

Marine Geoscience Report 018

Islands of the Beara Peninsula

Overview

Located off the south-western tip of the Beara Peninsula in West County Cork, Dursey Island forms part of a distinctive geological and geomorphological setting, together with the adjacent islets known as the Cow, the Calf and the Bull. Dursey Island lies about 200 m offshore and is separated from the mainland by Dursey Sound, a narrow tidal channel characterised by strong currents that reach speeds of up to 4 knots (Admiralty Chart 2495). Dursey is connected to the mainland by Ireland's only cable car (Dursey Island, n.d.), which spans the sound and crosses over Flag Rock, a submerged feature that can be exposed at low tide.

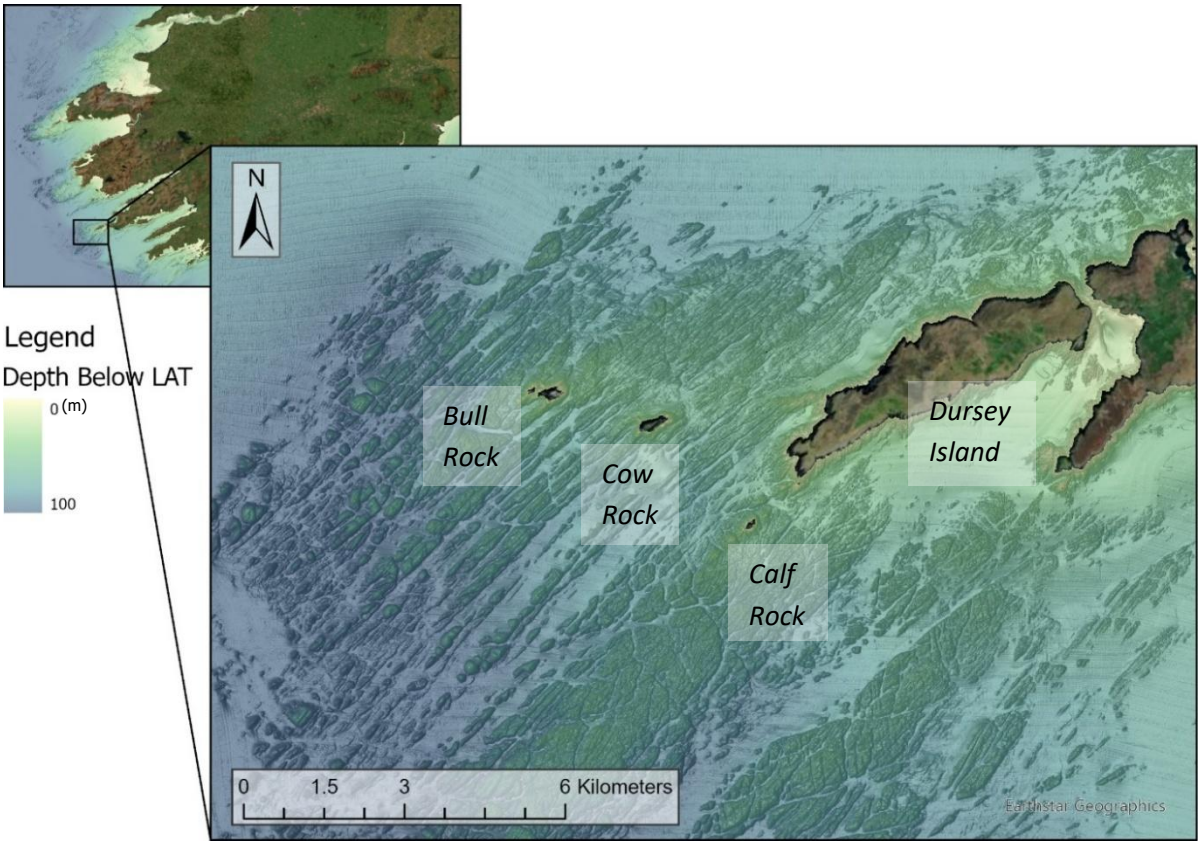

Figure 1: Bathymetry around Dursey Island, and the Cow, the Calf and the Bull Rock. Depths are referenced to Lowest Astronomical Tide (LAT).

To the west of Dursey Island lie three small islets: the Cow, the Calf, and the Bull. These outcrops of Devonian Old Red Sandstone are distinguished by steep cliffs and rugged topography. Bull Rock, pierced by a natural arch, is steeped in mythology and is historically referred to as Teach Duinn, the gateway to the underworld (MacCarthy, 2018). The morphology of these islands, together with Dursey, is influenced by structural geology and records evidence of faulting and folding both onshore and offshore.

Regional Geology

The Beara Peninsula and its offshore features are underlain by rocks of Devonian age, deposited approximately 419 to 359 million years ago (Ma) within the Munster Basin. This basin formed during a period of extensional tectonics, which created accommodation space for the accumulation of fluvial sediments (Sleeman & Pracht, 2002). The dominant lithologies include sandstones, siltstones, and mudstones, all part of the Old Red Sandstone (ORS) Group.

Early deposition was characterised by sheet-flood processes, forming widespread fine-grained sandstones and siltstones in semi-arid conditions. Higher in the sequence, younger deposits reflect the development of more stable fluvial channel systems, as indicated by cross-bedded sandstones and overbank mudstones (James & Graham, 1995). The stratigraphic sequence records a transition from high-energy, sheet-flood environments to more organised fluvial systems.

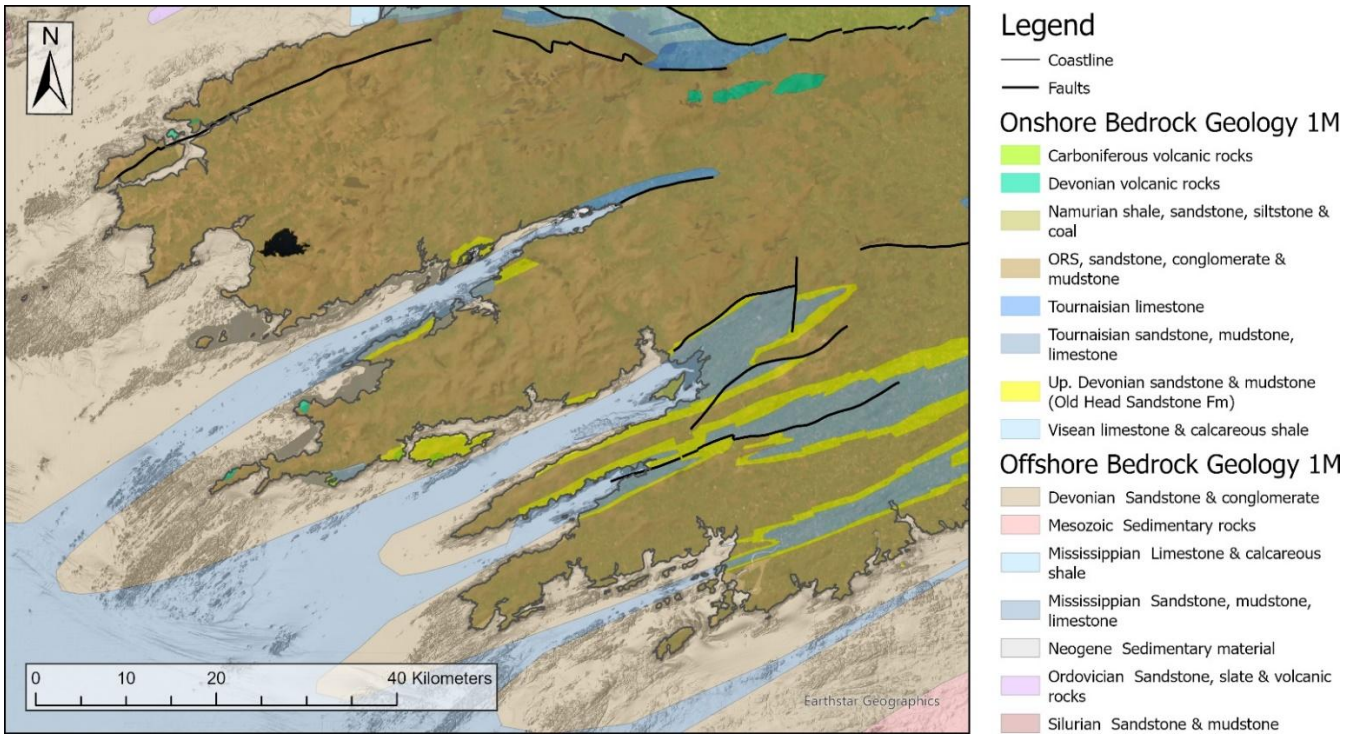

Figure 2: Geology of south-west Ireland.

The transition to the Carboniferous Period saw the South Munster Basin gradually deepen as the sea advanced northwards. Around the Beara Peninsula, this marine transgression is mainly recorded by marine sandstones and mudstones. Towards the end of the Carboniferous Period, the region was affected by the Variscan Orogeny, around 300 Ma. This major continental collision and mountain-building event produced south-west to north-east trending folds across south-west Ireland (Sleeman & Pracht, 2002). The more resistant Devonian ORS forms the ridges and headlands of the Beara Peninsula, while the softer Carboniferous rocks have been preferentially eroded to form bays and valleys. The structure of the Beara Peninsula is characterised by a broad north-east trending antiformal fold that plunges gently to the south-west (Sleeman & Pracht, 2002). This tectonic activity also led to the formation of major fault zones, some of which extend offshore and influence the present-day seabed morphology.

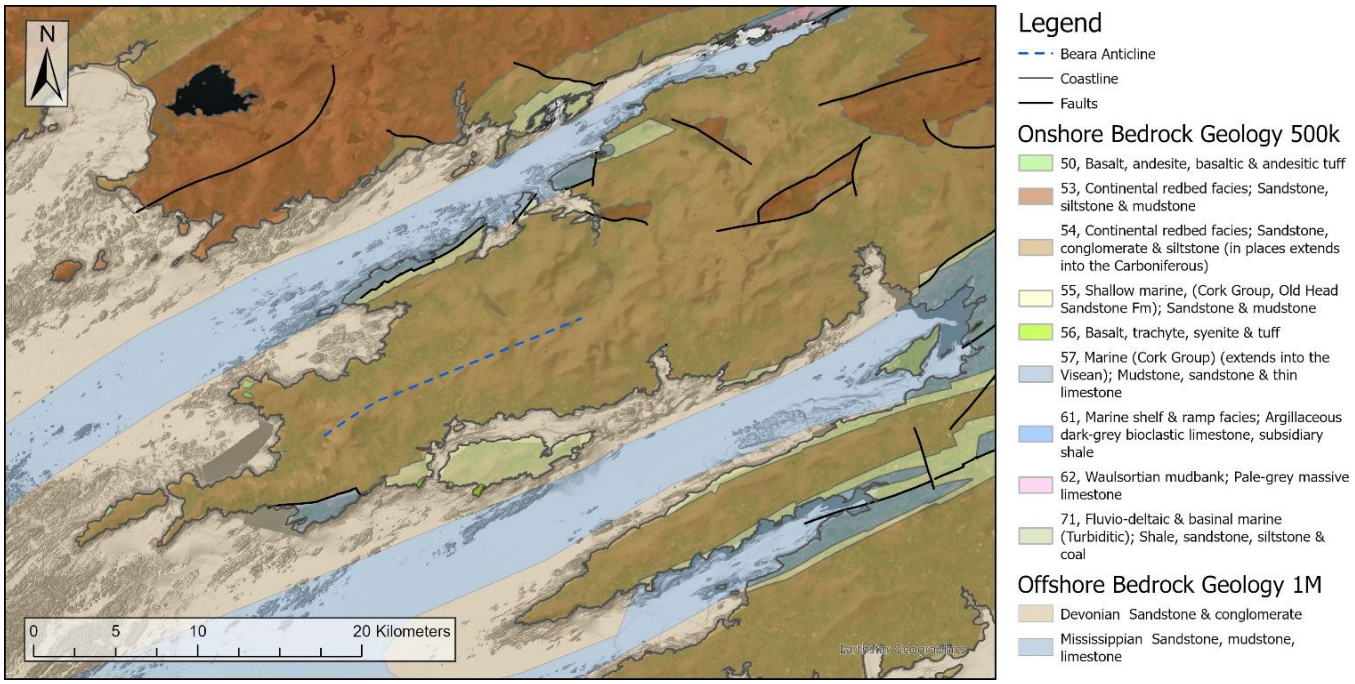

Figure 3: Geology of the Beara Peninsula, with the Beara Anticline inferred from (MacCarthy & Meere, 2007).

Following the Variscan Orogeny, there is little preserved geological evidence in South Cork from the end of the Carboniferous Period until the Quaternary, around 2.58 Ma. This gap in the geological record is largely due to uplift and erosion, which removed much of the material deposited during this interval, leaving a pronounced gap in the geological record (Hennessy, et al., 2023).

Dursey Island

Dursey Island is primarily composed of rocks from the Caha Mountain Formation and Gun Point Formation, consisting of fine- to medium-grained sandstones, interbedded mudstones, breccias, and minor igneous intrusions. Apart from the igneous rocks, these lithologies reflect a fluvial depositional system similar to that seen on the mainland and confirm the island's geological continuity with the adjacent onshore strata.

Minor igneous intrusions occur as dykes and thin sheets. They cut Upper Devonian red beds and are generally interpreted as pre-Variscan, later folded and cleaved during the orogeny. Their distribution suggests emplacement along pre-existing faults and fracture corridors that developed during Devonian basin extension. East-west fault systems and reactivated extensional structures likely provided pathways for magma and helping to localise the dykes (Sleeman & Pracht, 2002). A possible fault trending south-west to north-east runs through the island, with minor faults and fractures trending perpendicular or sub-perpendicular to it (MacCarthy & Meere, 2007).

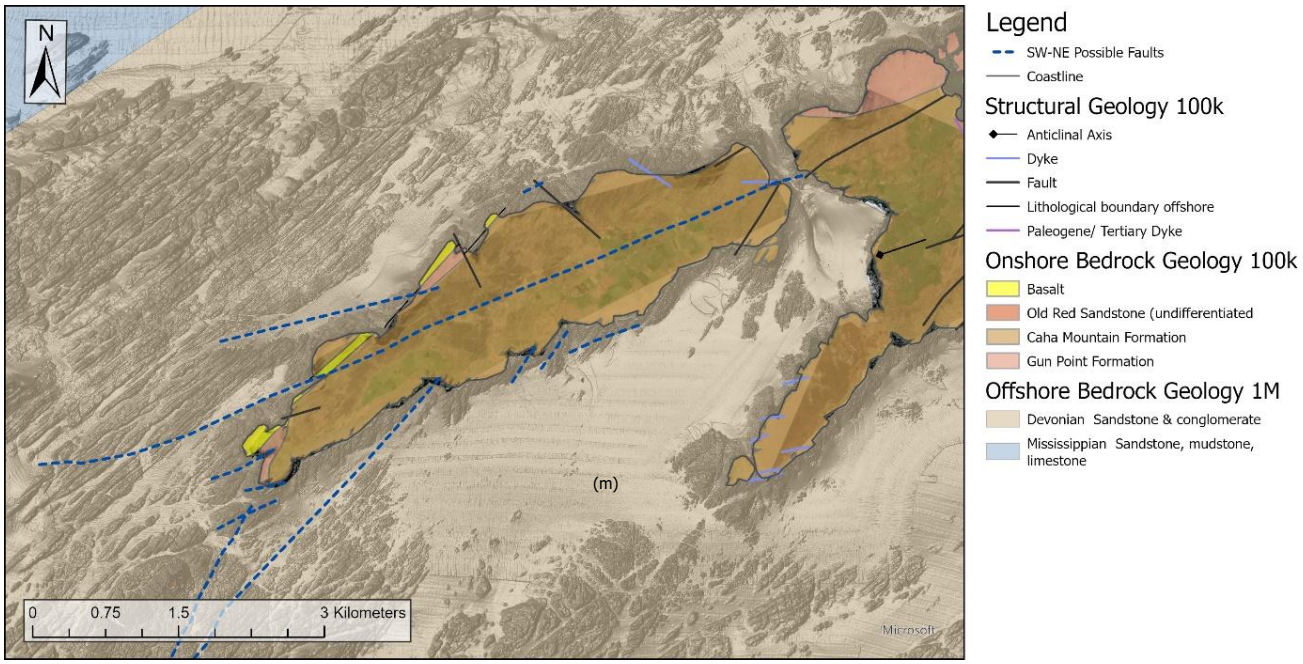

Figure 4: Geology of Dursey Island with possible faults indicated, with input from (MacCarthy & Meere, 2007).

INFOMAR bathymetry data reveal clear evidence of folding and faulting in the seabed around Dursey, including fault-aligned inlets and scour marks in Dursey Sound. The strong tidal race in Dursey Sound, with currents reaching up to 4 knots (Admiralty Chart 2495), generates significant seabed scour, which is evident in the bathymetric data. The narrowing of the sound funnels tidal flow, contributing to the increased current velocity.

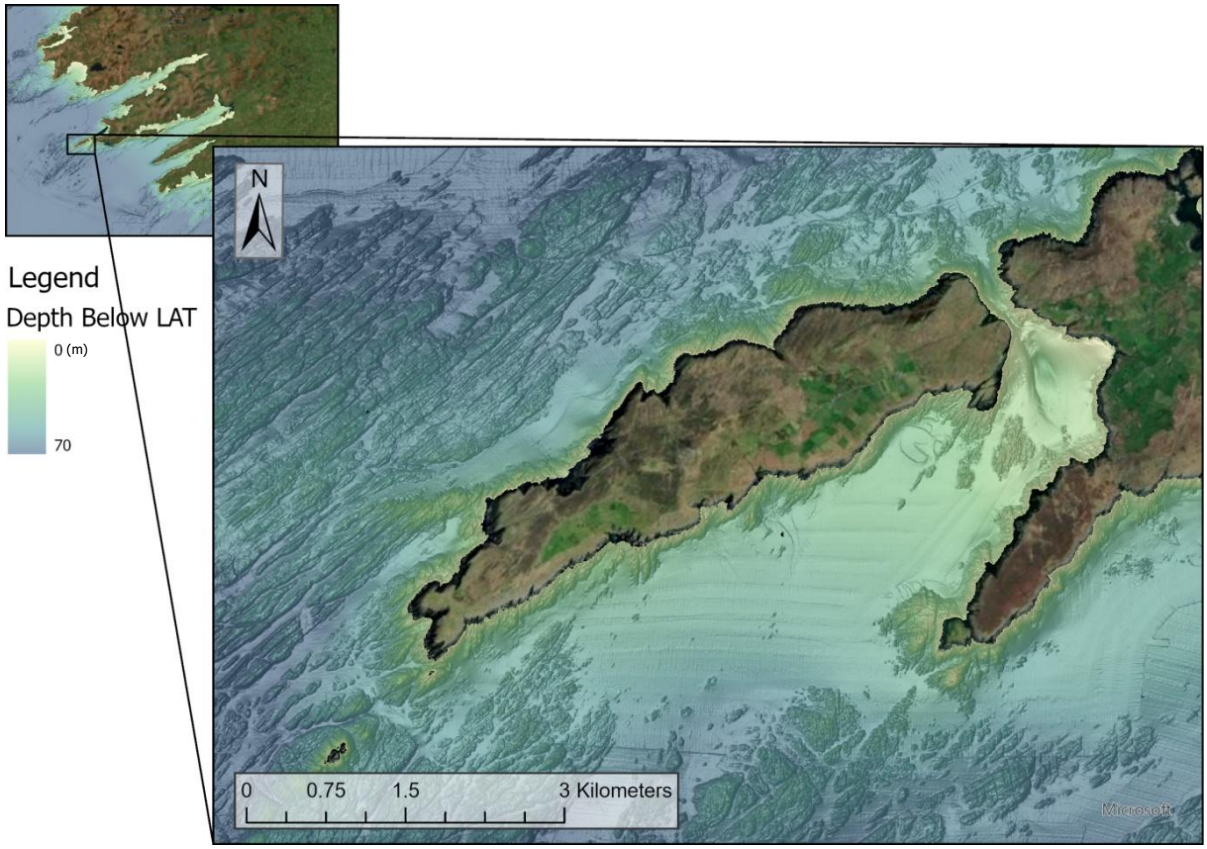

Figure 5: Bathymetry around Dursey Island.

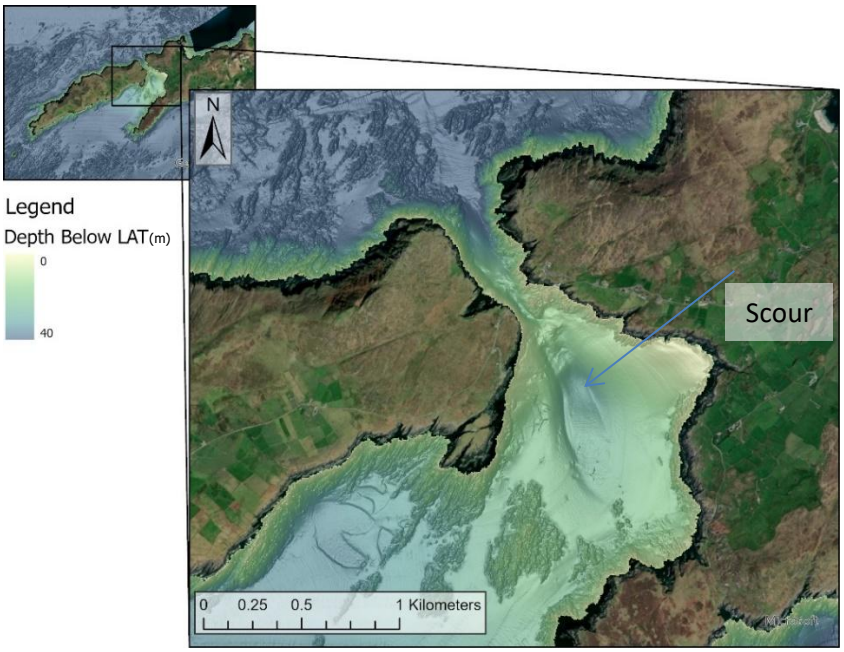

Figure 6: Bathymetry of Dursey Sound, with scour indicated.

One notable feature is Flag Rock, a submerged bedrock high that rises to drying heights near the centre of the channel. It is located south of a south-west to north-east trending fault, and east of an east-west trending igneous dyke. The proximity of these structures may have helped form the shoal by providing locally resistant rock. Flag Rock may also be a small intrusive shoal that is harder and less prone to erosion, with preferential erosion of the surrounding strata accentuating the feature. Strong tidal currents through the narrows maintain the rocky crest and organise adjacent sand and gravel veneers into ribbons and patches.

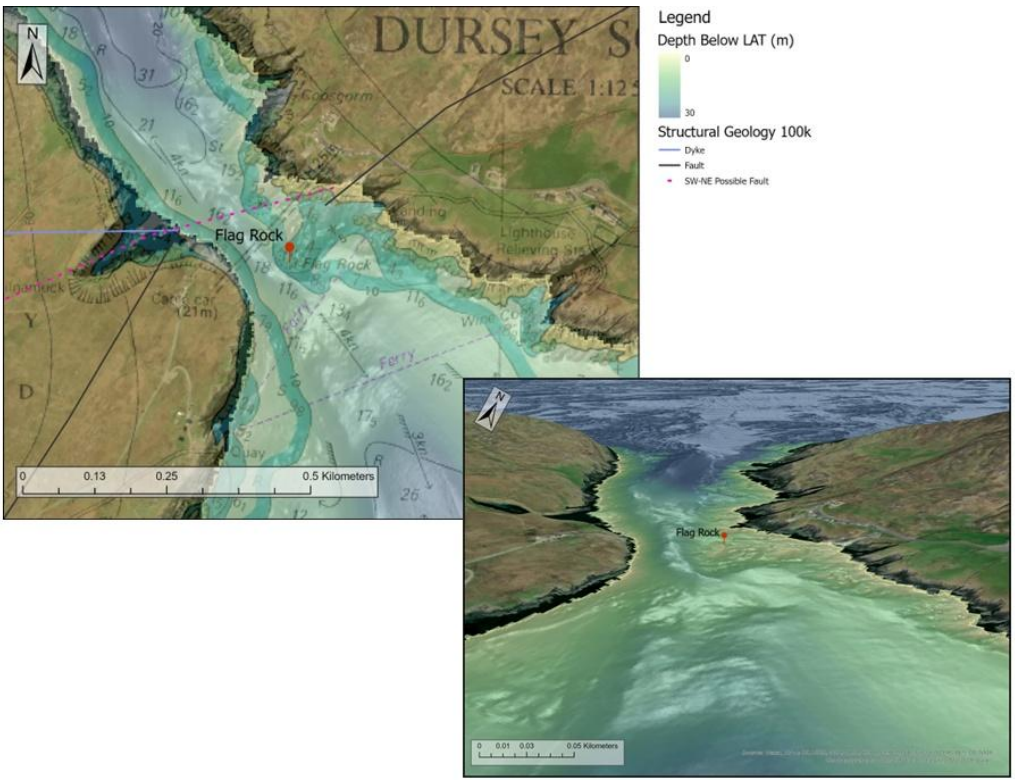

Figure 7: Nautical chart with bathymetry underlain and Flag Rock indicated (left), and 3D image looking north-west through the sound and Flag Rock indicated (right).

The Calf, the Cow and the Bull Rocks

To the south-west of Dursey Island, the Calf, Cow, and Bull Rocks are small offshore islets of Devonian sandstone and breccia. These islets are structurally elevated blocks that sit at or near the hinges (cores) of south-west to north-east trending Variscan folds. Their persistence above sea level reflects a combination of resistant lithology in the hinge zones and preferential erosion of adjacent, more fractured beds. The geometry and orientation of the islets mirror the regional Variscan fabric, including south-west plunging fold axes and a pervasive cleavage in finer sedimentary units (Sleeman & Pracht, 2002). These structures have guided both onshore topography and the distribution of offshore rocky islets.

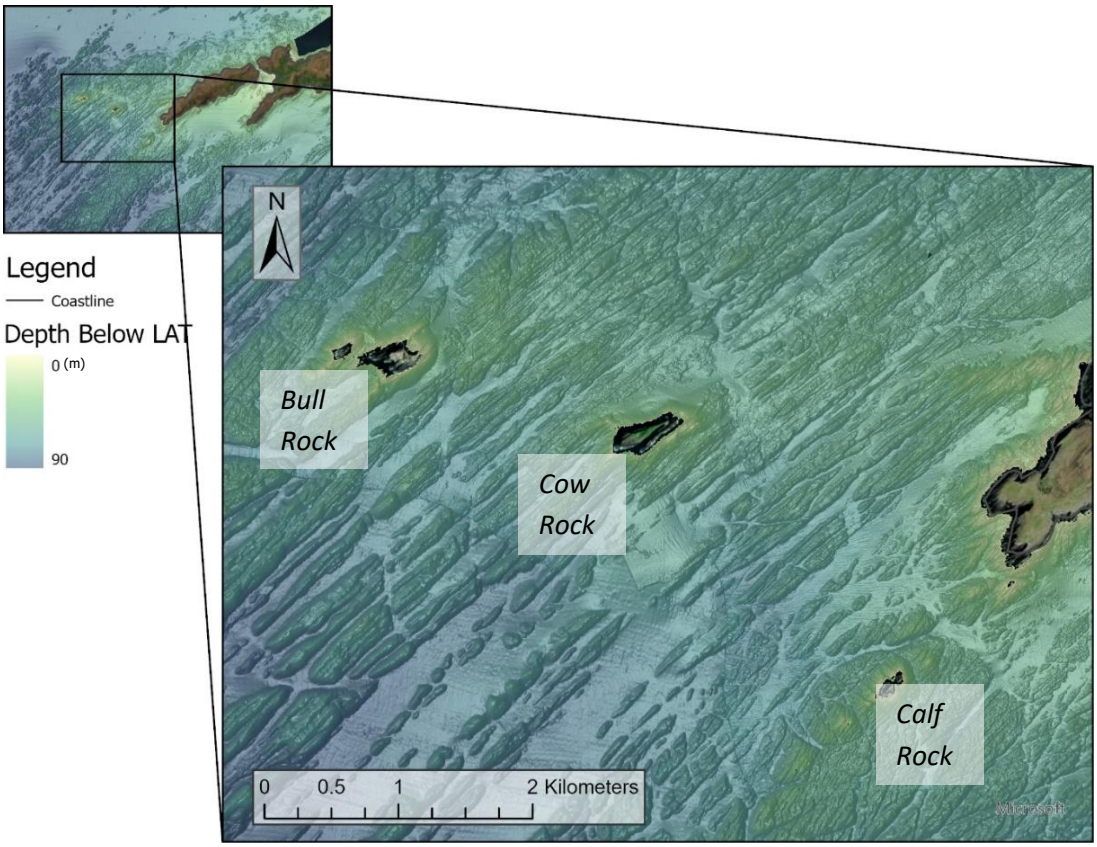

Figure 8: Bathymetry surrounding the Calf, Cow and Bull Rock.

Figure 9: Google Street View image of the Calf (left), the Cow and Bull Rock (right) from Dursey Island.

The Calf

The Calf, located to the south-west of Dursey Island, consists of ORS. Structurally, it appears to lie east of the axis of a broad anticline plunging to the south-west, and may be associated with a similar anticlinal fold to the south-west. It is known for the remains of a lighthouse built in 1866 and destroyed in a storm in 1881 (Commissioners of Irish Lights, n.d.). Its precise stratigraphy is uncertain but likely correlates with younger formations exposed on Dursey.

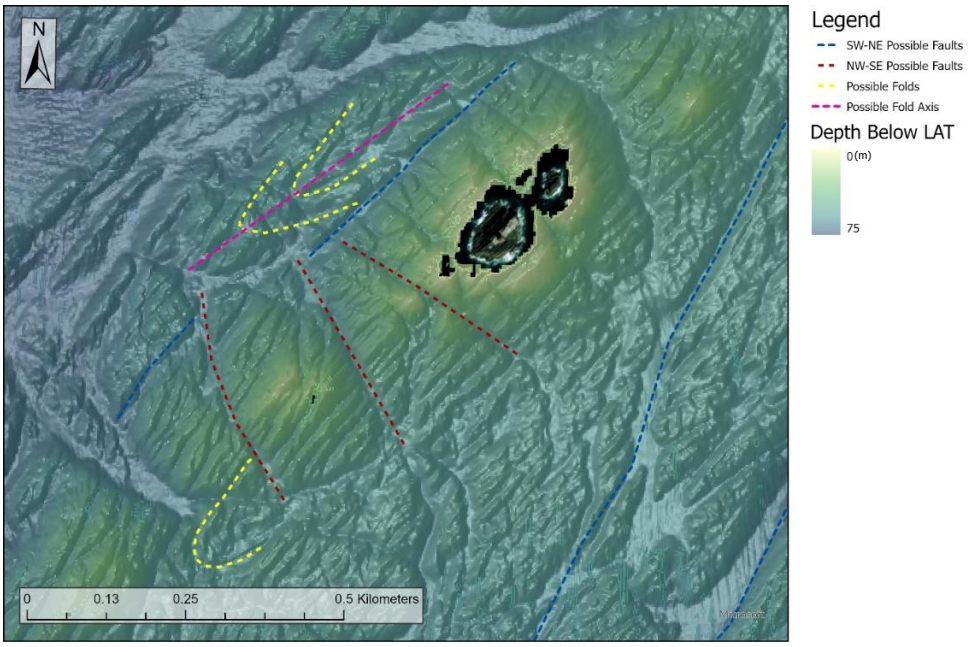

Figure 10: Bathymetry of Calf Rock with possible structural interpretation.

The Cow

The Cow, also called the Elephant Trunk, lies west of Calf Rock and is composed of undifferentiated ORS, probably part of the Caha Mountain Formation. Structurally, it appears to lie along the axis of a broad anticline plunging to the south-west.

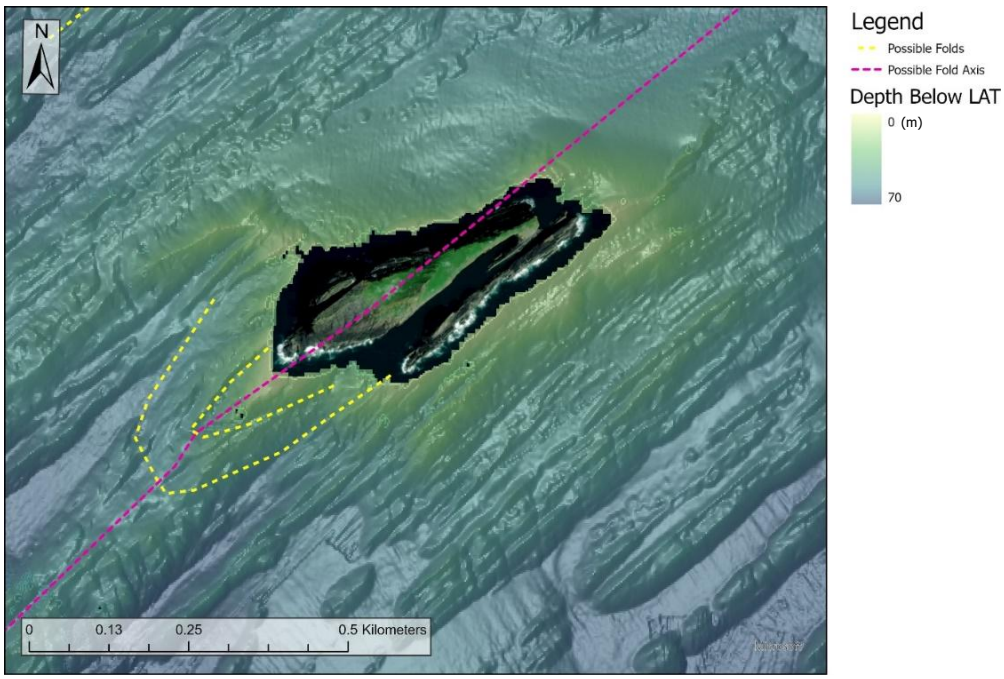

Figure 11: Bathymetry of Cow Rock with possible structural interpretation.

Bull Rock

The Bull Rock, the westernmost islet, is notable for its through-running sea tunnel and the active lighthouse first lit in 1888 (Commissioners of Irish Lights). It supports a large gannet colony, which is regarded as one of Ireland's more significant gannetries (MacCarthy, 2018).

Structurally, the islet sits close to the hinge of a south-west plunging Variscan fold. The natural tunnel and adjoining cliffs exploit steep joints and small faults that intersect the bedding, concentrating wave erosion and progressive roof collapse to create the arch. Bathymetric data show fold- and fault-parallel lineaments continuing offshore, with seabed ridges and scarps aligned to the regional structural fabric. The through-channel is locally about 14 m deep, and small craft can pass through in settled conditions. Strong swell and tidal jets commonly drive scour within the passage.

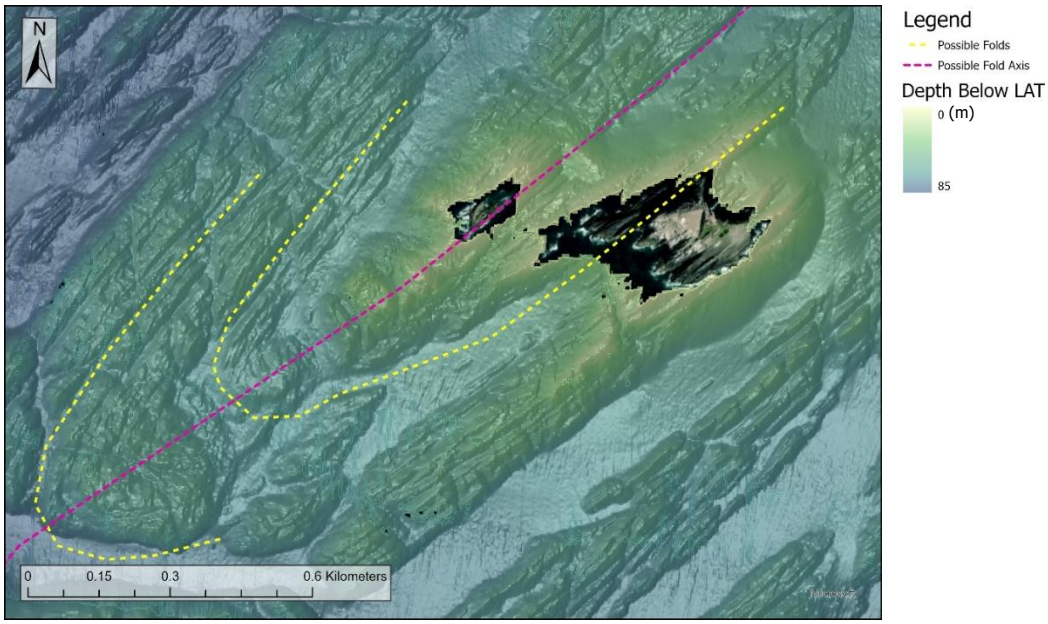

Figure 12: Bathymetry of Bull Rock with possible structural interpretation.

In local tradition the rock is known as *Teach Duinn*, "House of the Dark One," a place where the souls of the dead gather, with the tunnel viewed as an entrance to the underworld (MacCarthy, 2018).

Figure 13: Image of the Bull Rock/ Teach Duinn. Image from (Dursey Boat Trips, n.d.).

Conclusion

Dursey Island and the Cow, Calf, and Bull Rocks form a geologically and geomorphologically complex setting shaped by Devonian fluvial sedimentation, Carboniferous marine transgression, Variscan deformation, and later uplift and erosion. Both the terrestrial and submarine landscapes are strongly influenced by the underlying bedrock and structural controls. Bathymetric and geological data show that these controls extend offshore, where they help define seabed features such as outcropping bedrock, channels, and scour. These features record the region's tectonic and depositional history and provide important ecological habitat, including seabird nesting sites.

Bibliography

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