INFOMAR
Integrated Mapping for the Sustainable Development of Ireland's Marine Resource
An Roinn Aeráide, Fuinnimh agus Comhshaoil
Department of Climate, Energy and the Environment
Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann
Marine Institute
Foras na Mara

Marine Geoscience Report 004

Old Head of Kinsale

Overview

The Old Head of Kinsale is a prominent peninsula on the southern coast of County Cork, approximately 30 km south-west of Cork city. Extending nearly 5 km into the Atlantic Ocean, it has steep cliffs and a rugged coastline that expose the transition between Devonian and Carboniferous rocks. The geology of the peninsula records ancient depositional environments and the later tectonic processes that shaped the region.

The Old Head is recognised as a County Geological Site by the Geological Heritage Project and is also a Special Protection Area (SPA) under the EU Birds Directive, with Kittiwake and Guillemot listed as species of special conservation interest (National Parks & Wildlife Service, 2014).

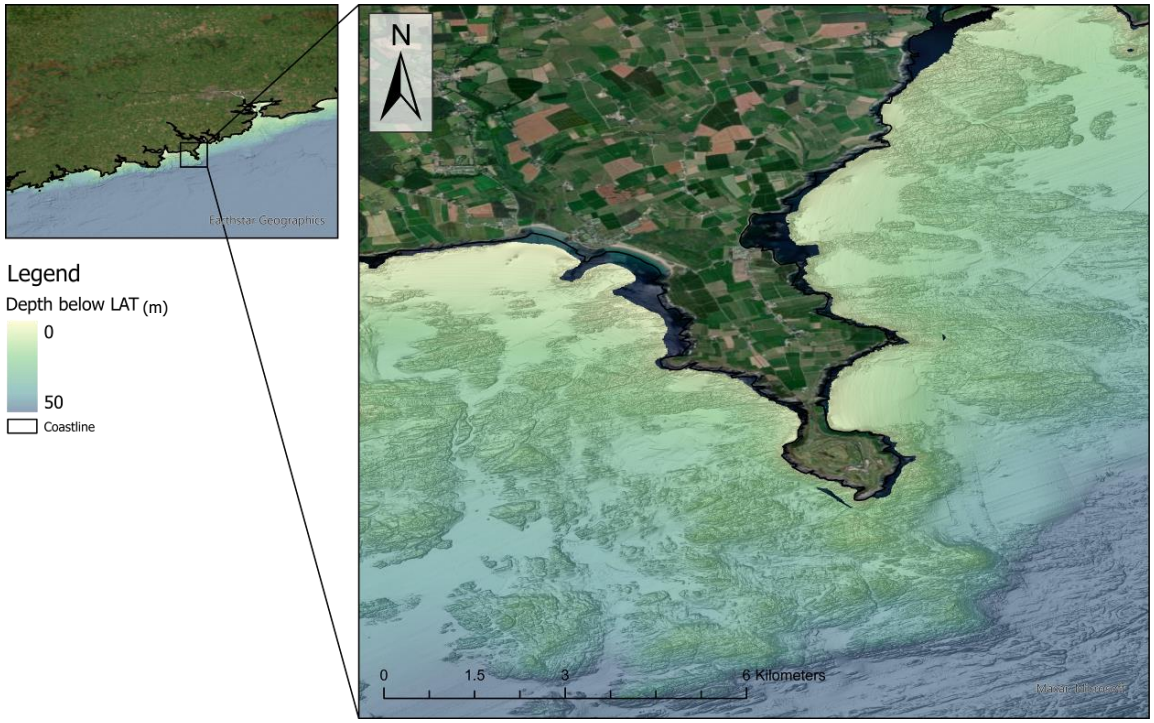

Figure 1: Bathymetry of the Old Head of Kinsale. Depths are referenced to Lowest Astronomical Tide (LAT).

Geology of Cork

The geology of County Cork is mainly composed of Devonian and Carboniferous sedimentary rocks, deposited between approximately 370 and 310 million years ago (Ma). These rocks record a transition from terrestrial to marine environments, with Devonian rocks reflecting semi-arid continental conditions and Carboniferous rocks marking the development of shallow marine environments in the South Munster Basin (Sleeman & Pracht, 1994).

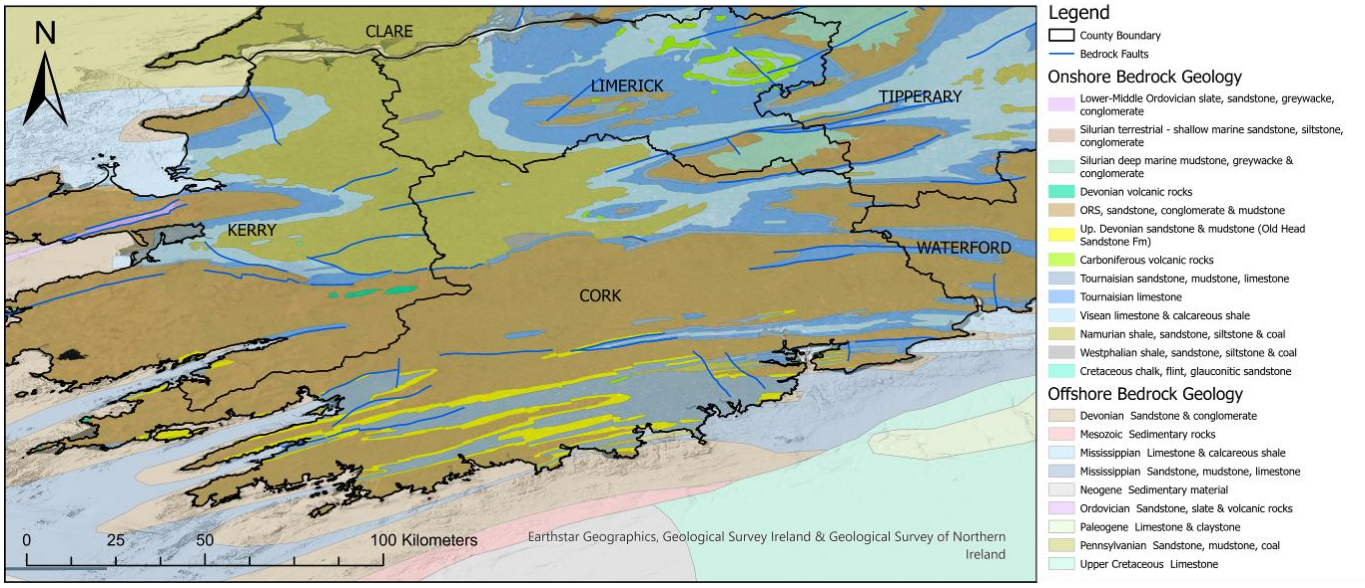

Figure 2: Geology of County Cork.

During the Devonian Period, 420 to 359 Ma, Ireland was part of a large desert-like continent known as Laurussia. Rapid erosion of mountains to the north led to the deposition of red sandstones, siltstones and mudstones in semi-arid conditions. These rocks are collectively known as the Old Red Sandstone (ORS). The sediments accumulated in a large trough known as the Munster Basin, including its southern part, the South Munster Basin (Sleeman & Pracht, 1994).

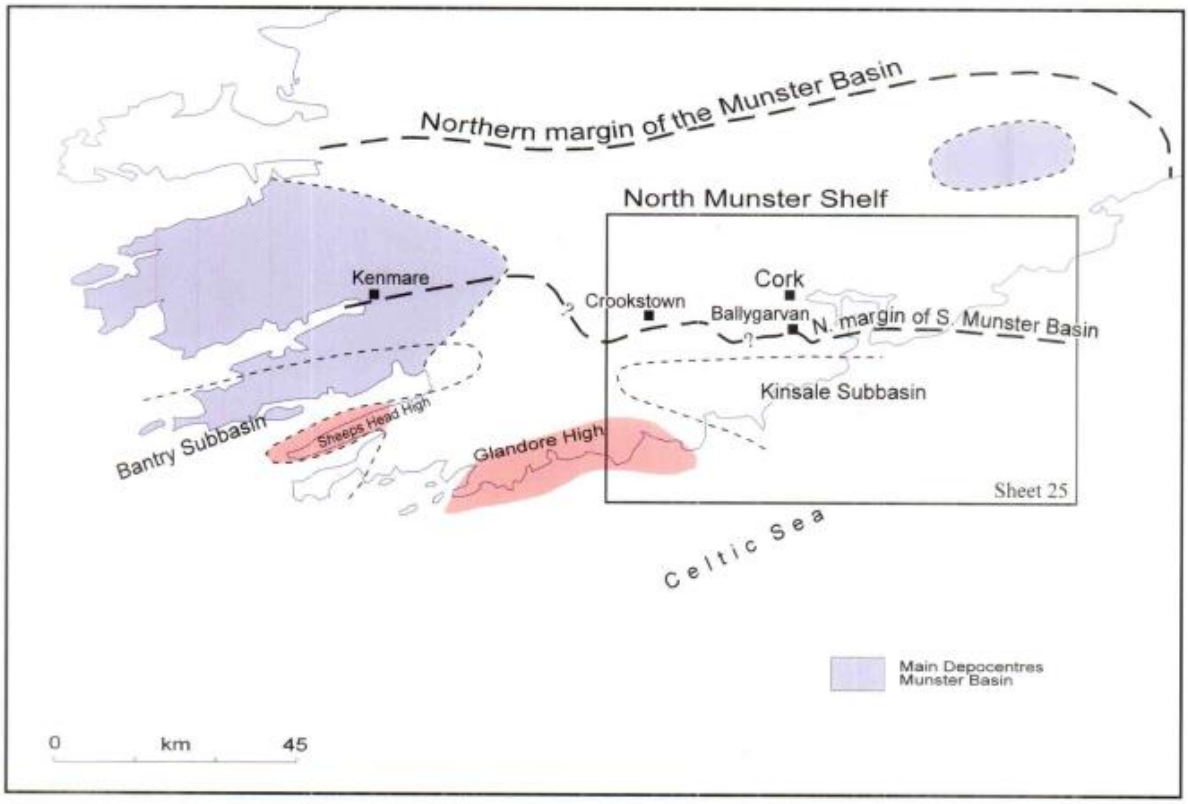

Figure 3: Structural framework of County Cork. Image from (Sleeman & Pracht, 1994).

The transition to the Carboniferous Period saw the South Munster Basin gradually deepen, leading to the deposition of marine sandstones and mudstones. Farther north, limestones were deposited on the North Munster Shelf in a shallow tropical sea. Towards the end of the Carboniferous Period, around 298 Ma, the region was affected by the Variscan Orogeny, a mountain-building event that uplifted, folded and faulted the rocks (Sleeman & Pracht, 1994). This event produced south-west to north-east-trending folds and faults, which are reflected in the peninsulas of south-west Ireland. More resistant Devonian ORS forms the ridges and headlands, while softer Carboniferous limestones, sandstones and mudstones have been preferentially eroded to form bays and valleys.

The region also experienced faulting, including many north-north-west to south-south-east-trending faults. Faults with this trend are mainly strike-slip faults with dextral shear (Sleeman & Pracht, 1994). A strike-slip fault involves mainly horizontal movement along the fault plane. In a dextral fault, the opposite side of the fault appears to move to the right, as illustrated in the image below (Panchuk, 2021).

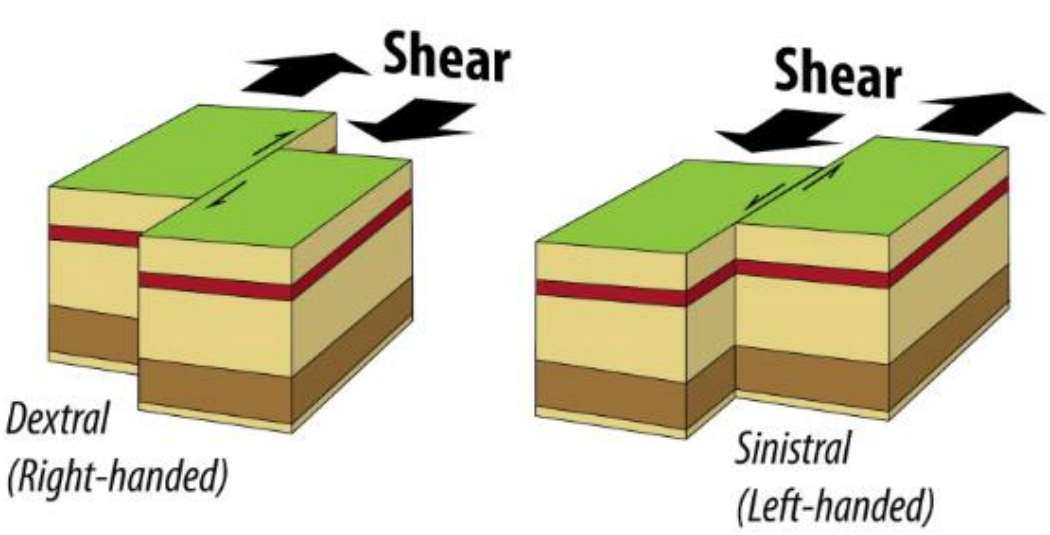

Figure 4: Block diagram of dextral and sinistral strike-slip faults. Image from (Panchuk, 2021).

INFOMAR bathymetry data show probable offshore expressions of these faults in exposed bedrock on the seabed, as shown in figure 5.

Following the Variscan Orogeny, there is little preserved geological evidence in South Cork from the end of the Carboniferous until the Quaternary, around 2.58 million years ago. This gap in the geological record is largely due to prolonged uplift and erosion, which removed much of the deposited material from this time (Hennessy, et al., 2023).

During the Quaternary, much of the region's bedrock was covered by glacial sediment, particularly in valleys and low-lying areas. These sediments were deposited either directly by glacier ice or through meltwater from retreating glaciers (Sleeman & Pracht, 1994). The glacial till is relatively fine-grained but contains angular blocks of sandstone (Corcoran, 1989).

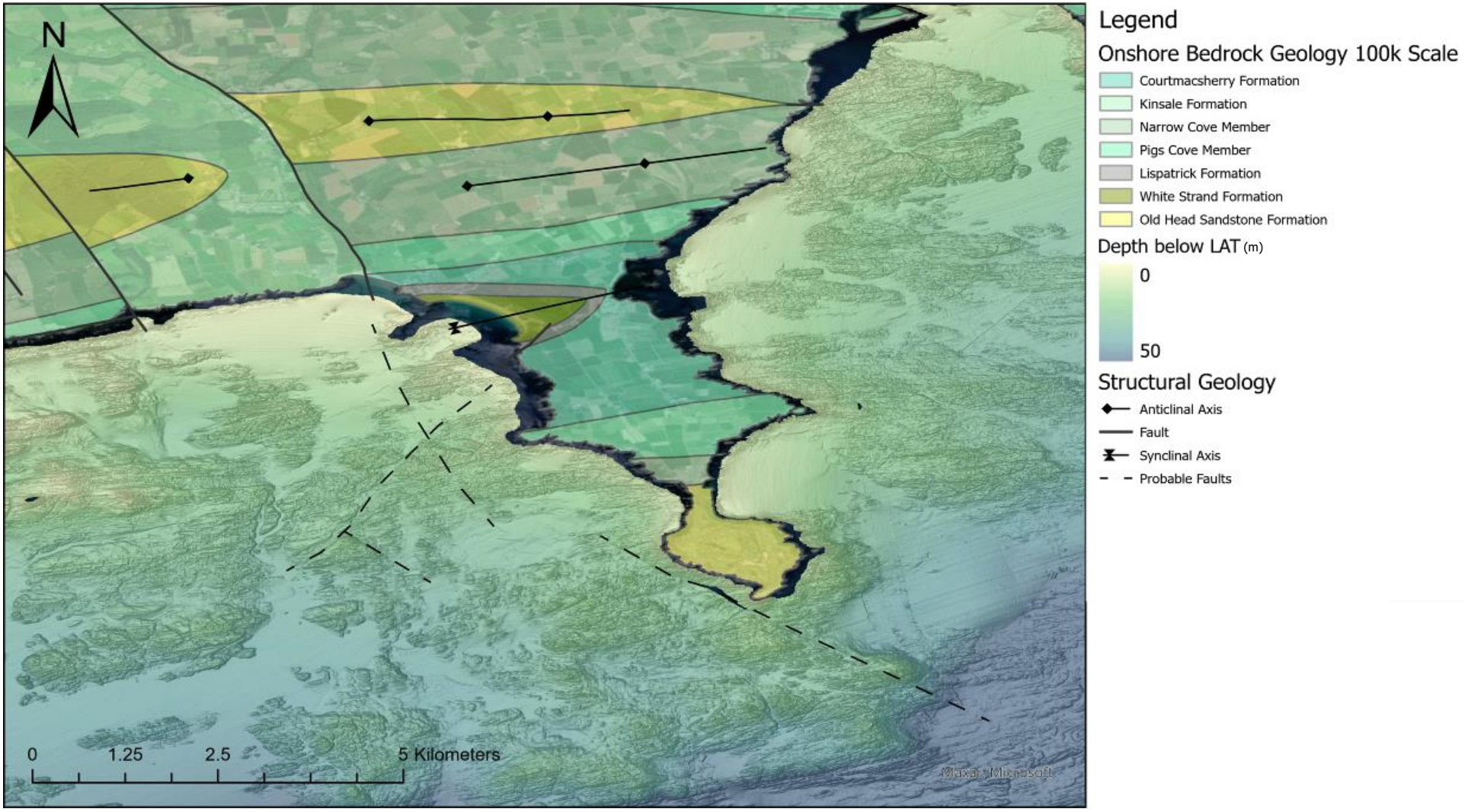

Figure 5: Probable offshore fault expressions visible in bedrock outcrop on the seabed.

Geology of the Old Head of Kinsale

The Old Head of Kinsale provides an exceptional cross-section through Upper Devonian to Lower Carboniferous rocks, exposing a sequence up to 2000 m thick of sedimentary strata that record major environmental change across this interval (Hennessy, et al., 2023).

The southern tip of the Old Head is composed of the Old Head Sandstone Formation, which dates to the uppermost Devonian period, over 355 Ma. These sandstones are characterised by ripple marks, mud streaks, and intertidal to subtidal deposits, indicating that the sediments were laid down in shallow coastal waters influenced by tidal currents (Sleeman & Pracht, 1994).

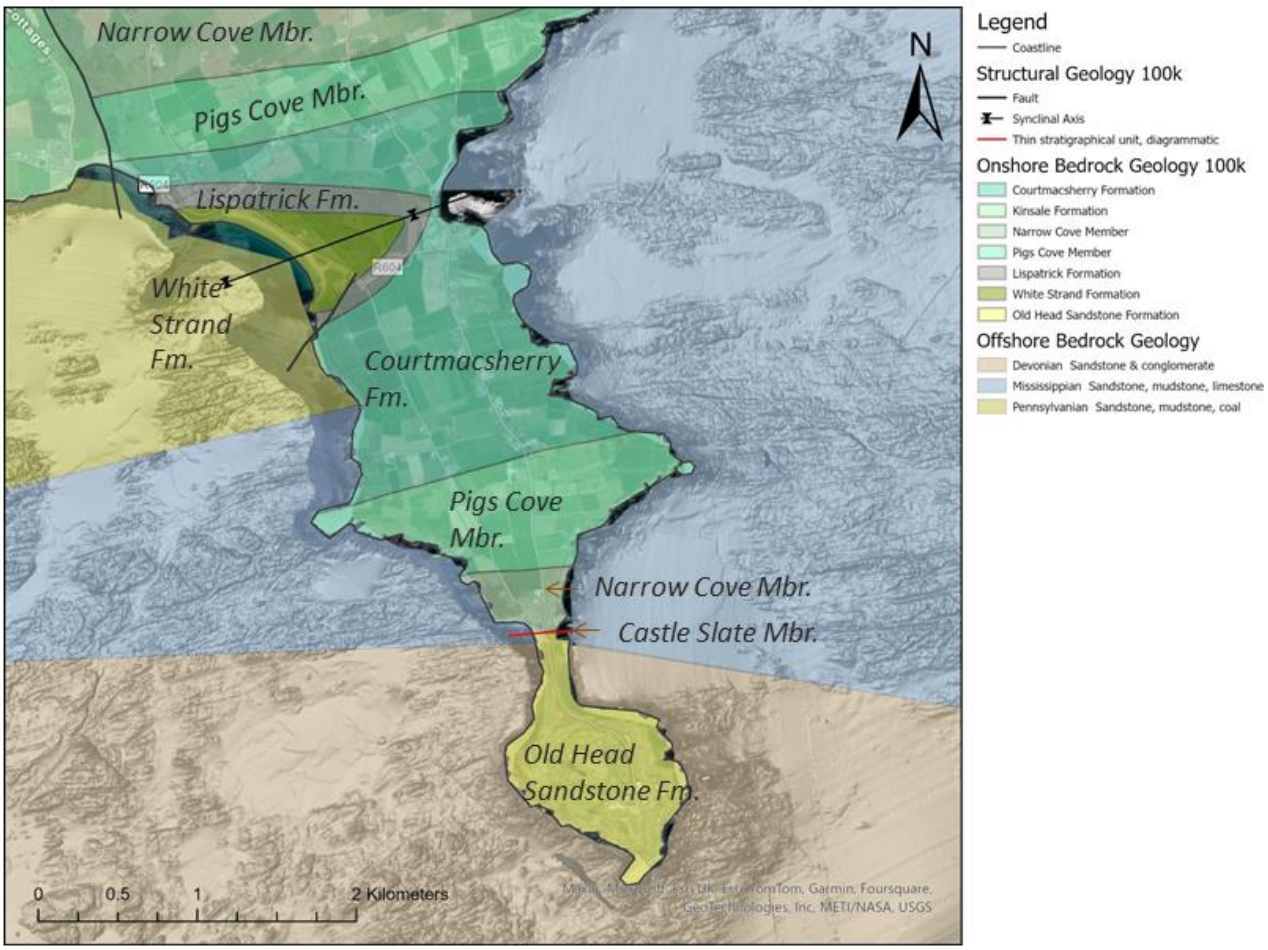

Figure 6: Onshore and offshore geology of the Old Head of Kinsale with formations and members labelled.

North of the Old Head Sandstone Formation, the Kinsale Formation becomes the dominant rock unit. The formation is subdivided into three members: the Castle Slate Member, the Narrow Cove Member and the Pigs Cove Member (Corcoran, 1989). This formation is significant because it marks the Devonian-Carboniferous boundary (Hennessy, et al., 2023). At the transition between the Old Head Sandstone Formation and the Kinsale Formation, the peninsula narrows dramatically, exposing a sequence of easily eroded soft shales, comprising the Castle Slate Member. The Castle Slate Member marks the start of the Carboniferous Period (Sleeman & Pracht, 1994). The Kinsale Formation consists mainly of mudstones interspersed with sand lenses, deposited in a shallow marine shelf environment.

Figure 7: Contact between the Old Head Sandstone Formation (lighter rock to the right) and the Kinsale Formation (darker rock to the left) marking the Devonian-Carboniferous boundary. Image from Hennessy et al (2023).

The transition from the Kinsale Formation to the overlying White Strand Formation marks a further change in depositional environment. The White Strand Formation consists of interbedded sandstones and mudstones, with evidence of slumping, suggesting deposition on steep slopes in a deepening marine environment (Sleeman & Pracht, 1994).

Fold structures affecting this formation reflect the intense deformation associated with the Variscan Orogeny (Sleeman & Pracht, 1994). The image below shows the Courtmacsherry Syncline and its expression on the seabed. A syncline is a concave-upwards fold in which younger rocks lie in the core and are flanked by older rocks. In the Courtmacsherry Syncline, the younger White Strand Formation is flanked to the north, south and east by the older Lispatrick and Courtmacsherry formations.

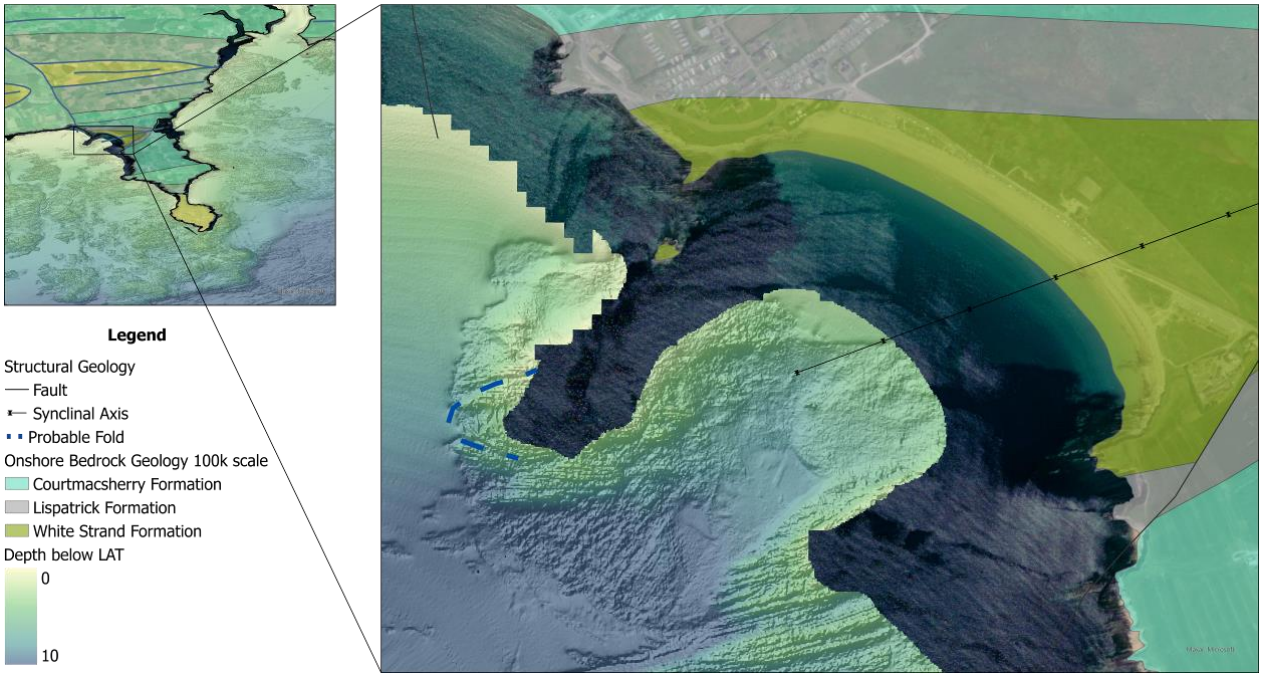

Figure 8: Folded bedrock associated with the Courtmacsherry Syncline, visible in bedrock outcrop on the seafloor.

Conclusion

The Old Head of Kinsale is a geologically important site that records the transition from Devonian terrestrial conditions to Carboniferous marine sedimentation. The peninsula's landscape and seabed are strongly shaped by the underlying bedrock, with resistant sandstones forming steep cliffs and headlands, and softer units influencing areas of erosion and narrowing along the peninsula.

Variscan folding and faulting are central to the structure of the Old Head and the surrounding seabed. Bathymetry shows that these structural controls continue offshore, where probable fault expressions and folded bedrock are visible in exposed seabed outcrop. Later uplift, erosion and Quaternary glaciation further modified this bedrock framework.

Together, the cliffs, folded strata and offshore bedrock features provide a clear record of the geological development of south Cork. The site is also important for coastal habitats and seabirds, linking its geological character with its wider environmental value.

Bibliography

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