The Slyne & Erris Basins: exploring varied structural styles along strike in narrow rift-basins

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Abstract:

The Slyne and Erris Basins belong to a chain of basins extending from the Nowegian Atlantic Margin in the north to the Porcupine Basin in the south. They are narrow, elongate and interconnected sub-basins orientated NE-SW (Erris) and NNE-SSW (Slyne) that began forming in the Late Permian and Early Triassic.

The basins are sub-divided into small sub-basins which show remarkable variation in structural style along strike with switches in fault polarity and changing basin shape from half-grabens to grabens. Two evaporite-prone layers (Zechstein Group and Mercia Halite) provided regional detachment surfaces that play an important role in the structural evolution of these basins.

The variety of structural styles within individual sub-basins produces a range of potential petroleum plays and trapping structures, most of which remain untested. The change in structural style is linked to the nature of the transfer zones separating the sub-basins, likely inherited from the deeper structures that separate Caledonian terranes. Understanding these zones will inform the structural history of both the Slyne-Erris area and other basins along the Irish Atlantic Margin.

Regional Setting & Basin Geology:

The Slyne and Erris Basins belong to a family of basins along the Atlantic margin. Basin fill consists of Permian and Mesozoic sediment below a regional Base-Cenozoic Unconformity. Key reservoir intervals are found in the Lower Triassic (Sherwood Sandstone), Lower Jurassic (Suisnish, Scalpa Sandstones) and Middle Jurassic (Avonmore, Elgol Sandstone Members)

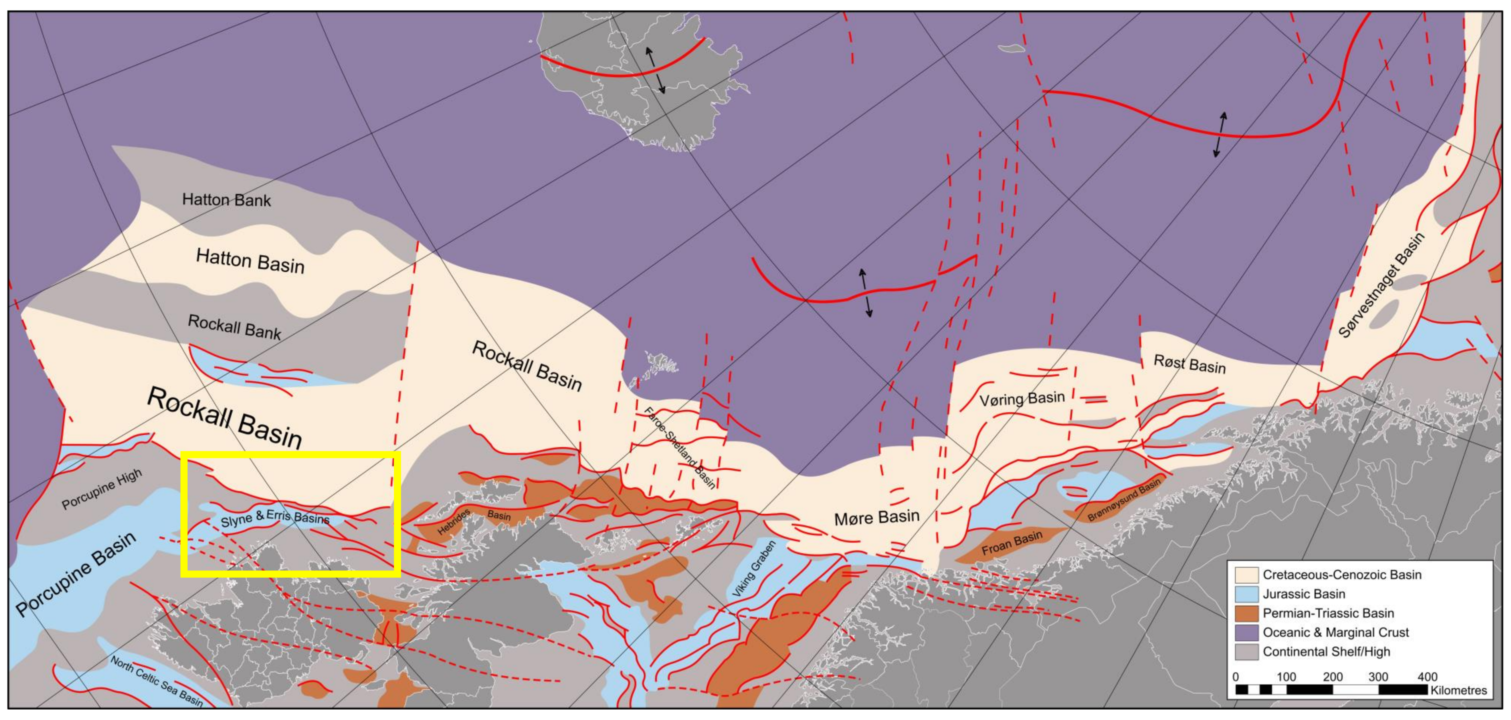


Figure 1: Structural map showing the major basins that make up the eastern margin of the Atlantic Ocean. The Slyne and Erris Basins are highlighted in yellow. (adapted from Dore et al., 1999)

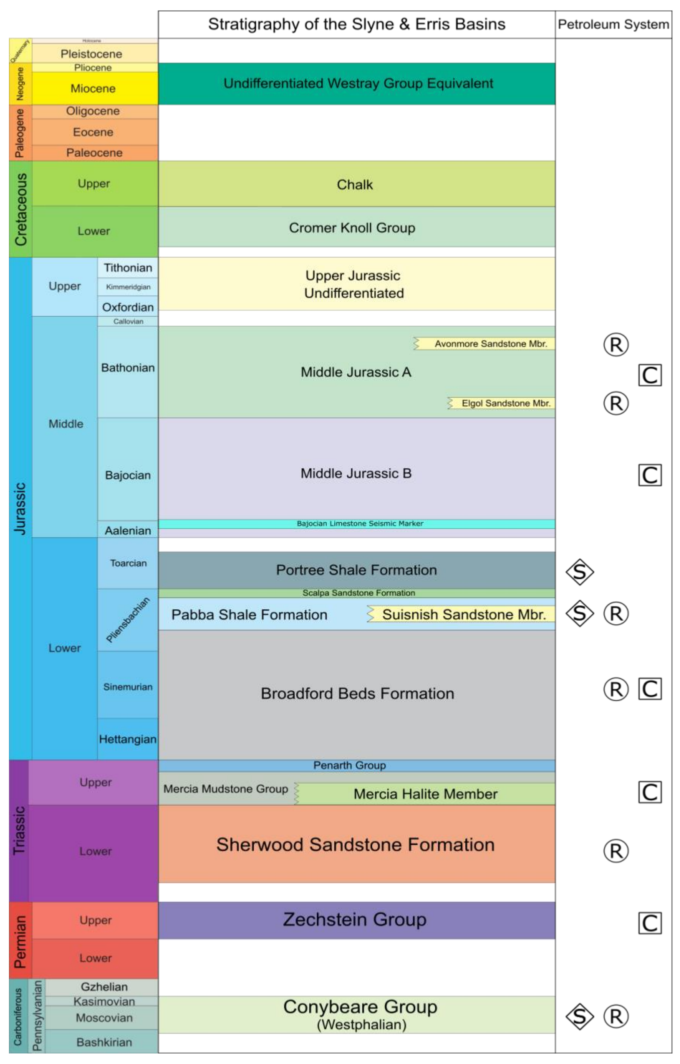


Figure 2: Simplified stratigraphic column for the Slyne & Erris Basins (adapted from PAD, 2005)

Structural Styles in the Slyne Basin:

Present-day structure of the Slyne Basin is presented below, created from initial regional seismic interpretation of 2D and 3D seismic datasets. Future detailed interpretation will refine this model.

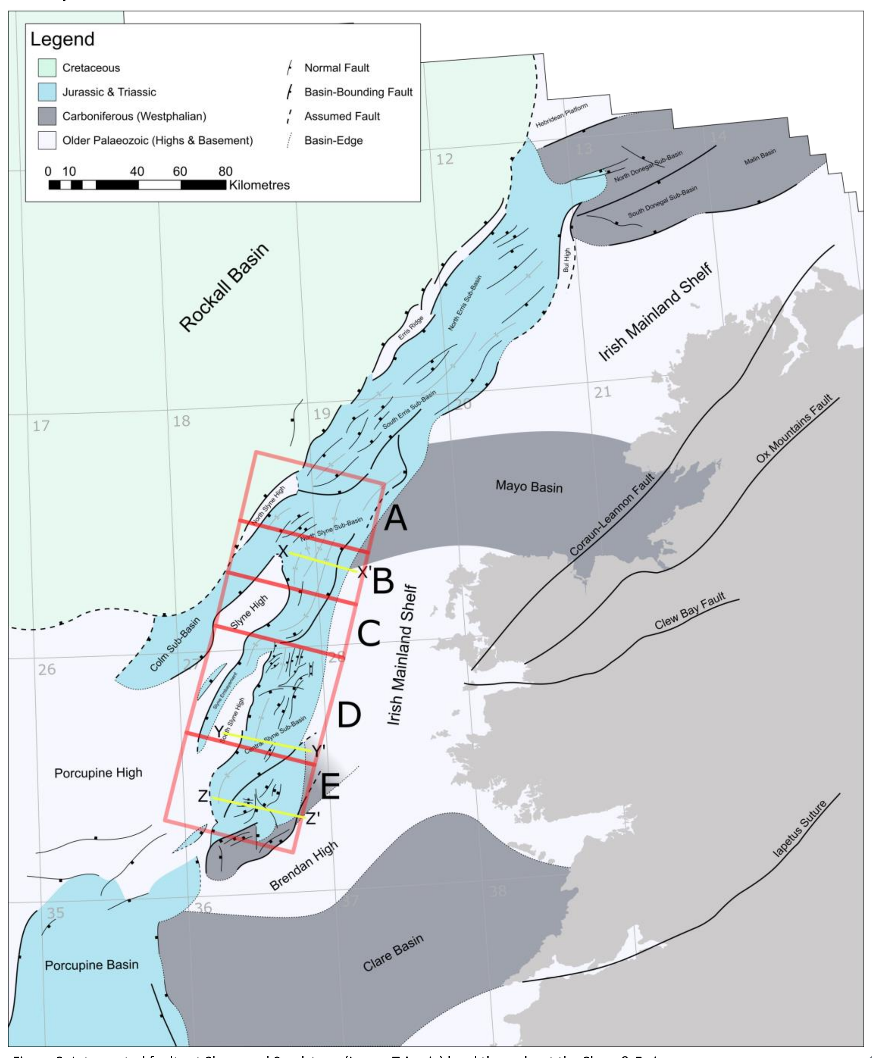
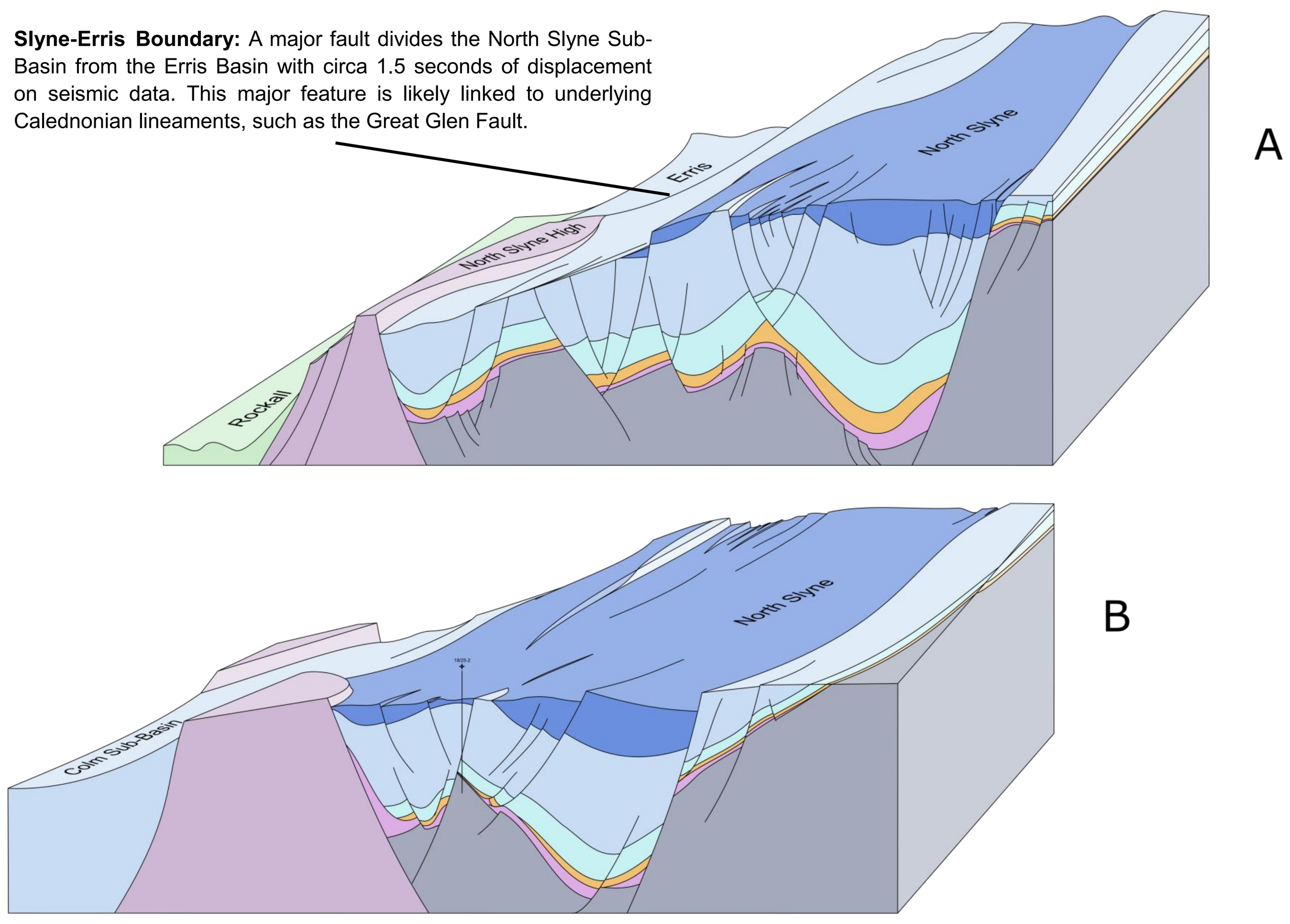


Figure 3: Interpreted faults at Sherwood Sandstone (Lower Triassic) level throughout the Slyne & Erris area



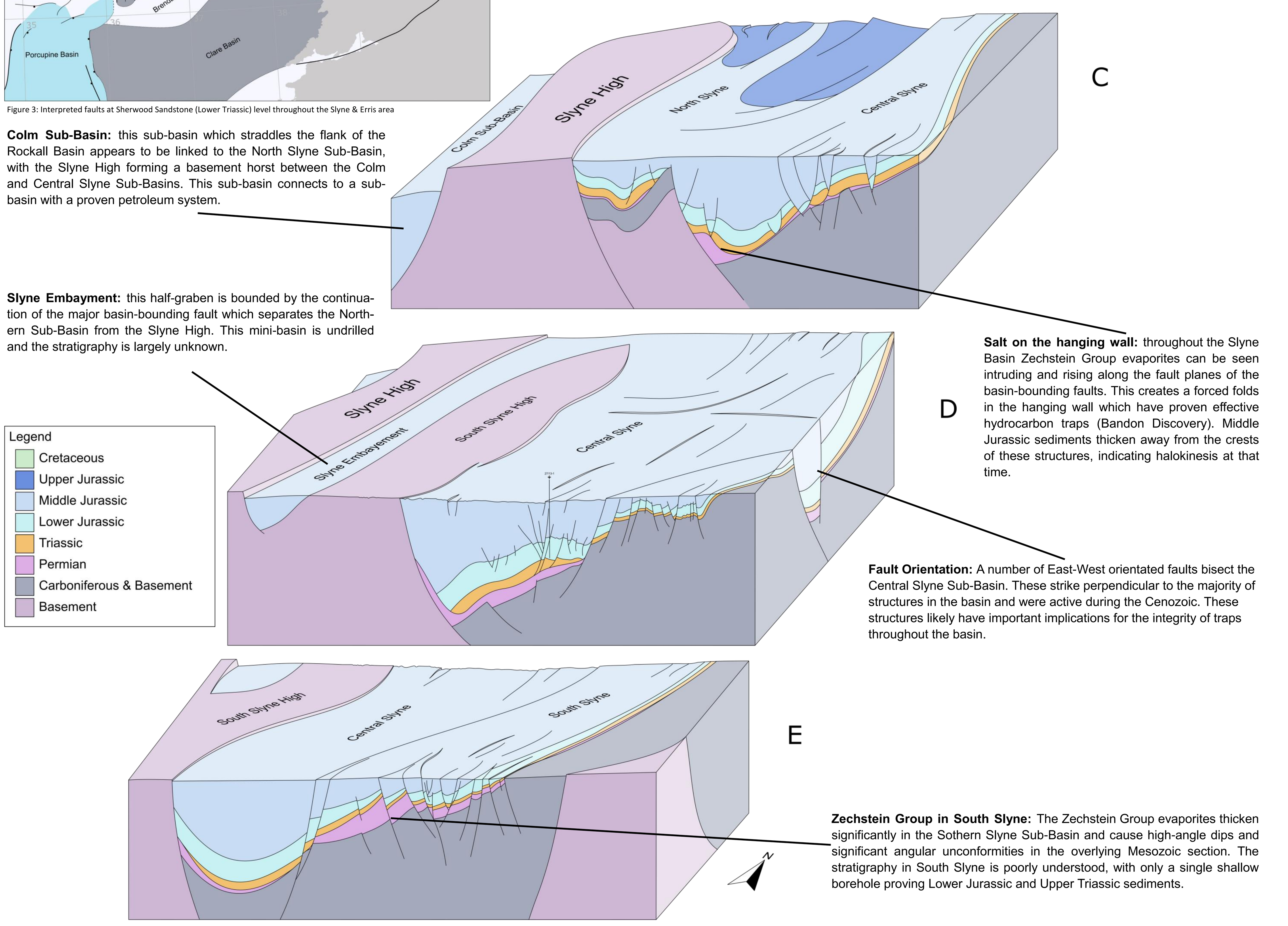


Figure 4: Block diagram showing the present-day structure of the Slyne Basin along strike, below the composite Base-Cretaceous and Base-Cenozoic Unconformities

Seismic Sections:

North Slyne Sub-Basin (Blocks A&B):

The northern sub-basin is a large graben with major NE-SW trending basin-bounding faults to the east and west, with considerable influence from salt-layers. The Corrib gas field and nearby structures are heavily influenced by these, forming forced anticlinal folds over Triassic-Jurassic normal faults in the pre-salt.

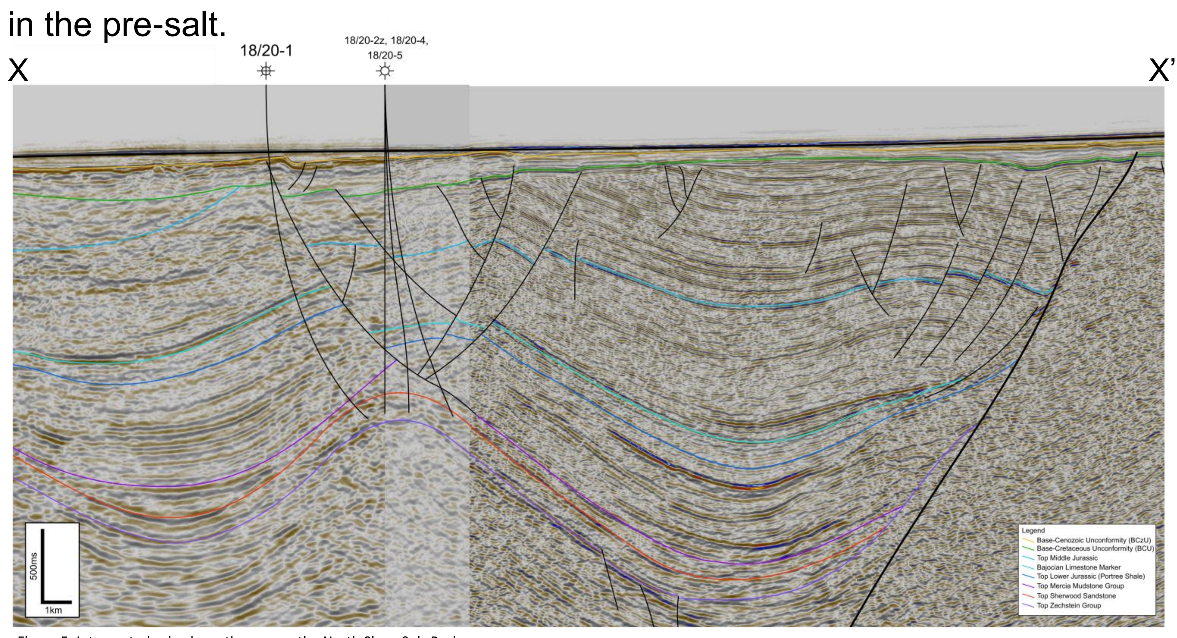


Figure 5: Interpreted seismic section across the North Slyne Sub-Basin

Central Slyne Sub-Basin (Blocks C&D):

The central sub-basin is a steeply dipping half-graben with a major fault along its western margin and significant detachment along Permian salt producing many distinct horst blocks. Permian salt also intrudes diapirically up the basin-bounding fault, creating forced folds in the Triassic and Jurassic hanging-wall stratigraphy.

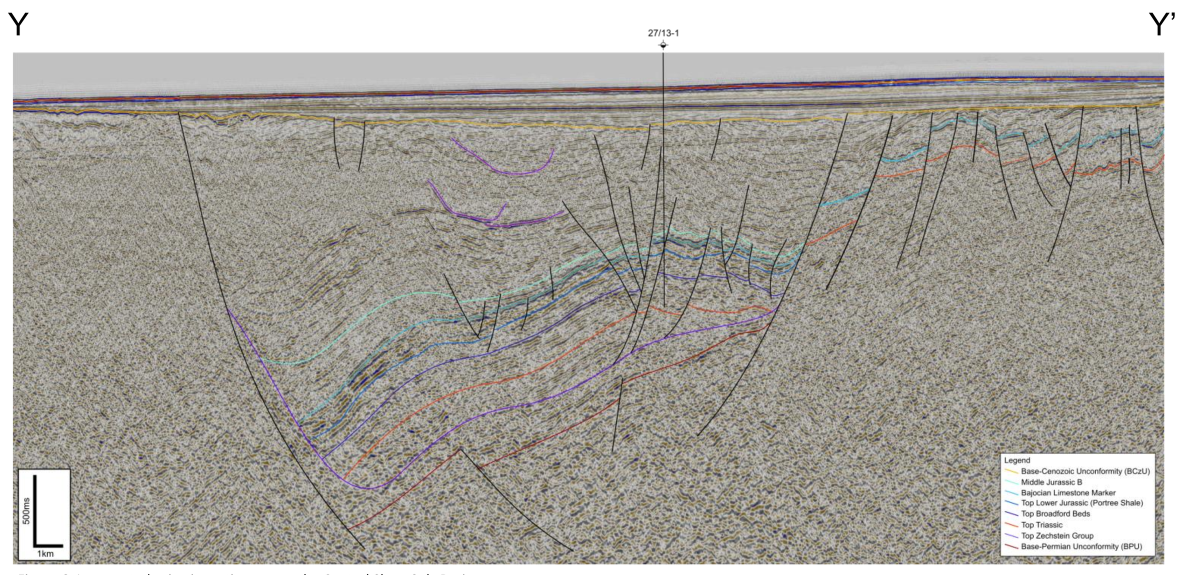


Figure 6: Interpreted seismic section across the Central Slyne Sub-Basin

Southern Slyne Sub-Basin (Block E):

The southern Slyne sub-basin is a large graben cut by major, long-lived faults that also divide it from the Northern Porcupine Basin. Data quality is very poor in this area.

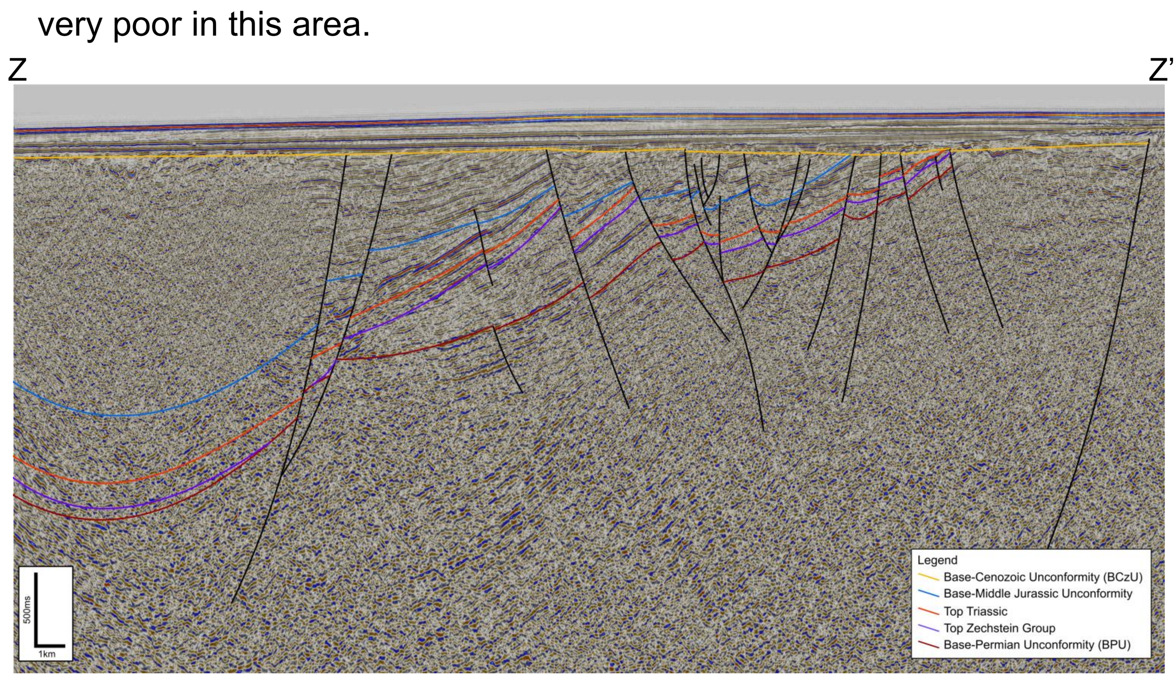


Figure 7: Interpreted seismic section across the Southern Slyne Sub-Basin

Geological Evolution:

A broad summary geological evolution of the Slyne & Erris area is presented below:

- Early Permian extension with evaporites deposited in hanging walls
- Late Triassic to Early Jurassic extension
- Early-Middle Jurassic non-deposition and local erosion
- Middle-Upper Jurassic extension with significant thickness of sediments deposited
- Early Cretaceous uplift and erosion followed by deposition (significantly more in Erris)
- Early-Late Cretaceous extension and reactivation of Triassic and Jurassic faults
- Cenozoic uplift, erosion and regional volcanic activity, minor localised inversion of older faults

Future Work:

- Detailed seismic interpretation to refine the initial structural model built from regional interpretation.
- Detailed analysis of transfer zones that divide sub-basins using additional seismic, gravity and magnetic data.

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