

Integrated Zechstein Study

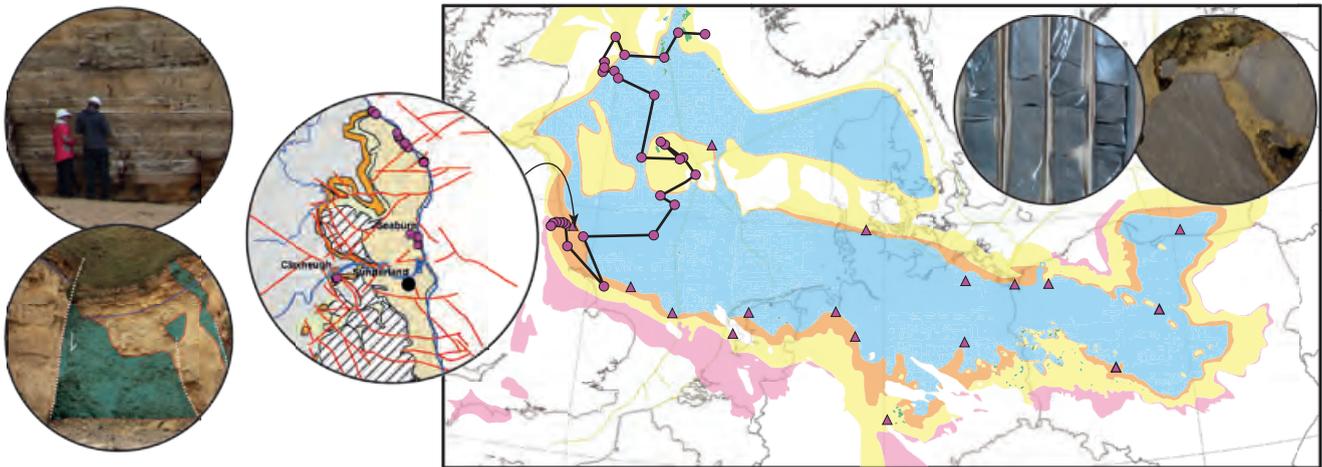
Susie Daniels, Jon Long, Maurice Tucker, Jon Gluyas, Bob Holdsworth, Michael Mawson

Summary

With a major focus on understanding connectivity within Zechstein carbonate reservoirs, this comprehensive new multi-client study brings unprecedented insight into the Permian Basin of NW Europe. The culmination of an extensive multi-disciplinary analysis of the world-class Zechstein carbonate outcrops in NE England, the study combines sedimentology, sequence stratigraphy, fracture network characterisation, structural analysis, and shallow geophysics. Results from outcrop are integrated with sub-surface data, including cored wells, well logs, and production data, to enhance understanding of reservoir performance.

Key deliverables address fracture connectivity and mechanical behaviour, basin-wide sequence stratigraphic correlation, complex multi-phase diagenesis, deformation associated with evaporite dissolution, geometry and properties of breccia bodies, and insights from production of Zechstein carbonate reservoirs.

The study builds upon the in-depth knowledge of Maurice Tucker and Michael Mawson on Zechstein carbonates, together with GRL's applied expertise in fracture network characterisation, Jon Gluyas' extensive experience of production from the Zechstein, and Bob Holdsworth's knowledge of complex fractured reservoirs.



Zechstein palaeogeographic map for the Z2 Main Dolomite (Ca2) (after Slowakiewicz et al 2015) with locations of sequence stratigraphic studies (triangles), correlation panel path (black line) and locations of field study sites (inset map). Examples of outcrops and cores are inset.

Product Components

1. Overview: the most significant processes for connectivity.
2. Sequence stratigraphy:
 - a. Review of sequences across the Southern Permian Basin.
 - b. Core study within Northern Permian Basin.
 - c. Correlation panel across Northern and Southern Permian Basins.
 - d. Ca2 (Z2) parasequence study.
3. Diagenetic framework for Zechstein depositional systems.
4. Fracture study of Z1 - Z3 from outcrops in NE England (main focus Z1 & Z2), organised by facies, tectonic setting and lithology.
5. Outcrop study of breccia bodies associated with evaporite dissolution.
6. Zechstein production data analysis from three fields: Auk & Ardmore (offshore UK) and Dalen (onshore NL).

To maximise insights from the study, additional customised field trips can be arranged.



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Product Pricing

Pricing available on request.

Contact Susie Daniels (susie@geospatial-research.co.uk) for further information.

Significance for Exploration

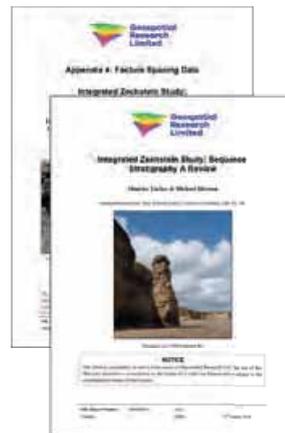
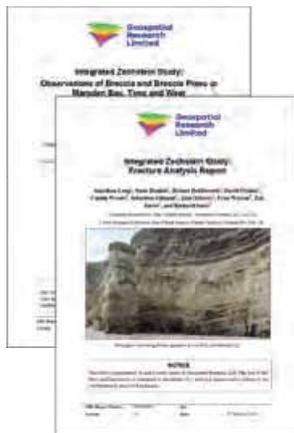
This study will provide you with:

- > Insight into how processes that have affected the Zechstein can impact hydrocarbon prospectivity and extraction: this can inform early exploration strategy.
- > Primary and secondary factors that affect connectivity - allowing risking during prospect evaluation.
- > Ranges of fracture properties constrained by quantitative outcrop studies and correlated to geological controls allowing application to the subsurface.
- > A revised sequence stratigraphic correlation across the Northern & Southern Permian Basins (NPB & SPB).
- > Improved understanding of the similarities and differences between the NPB and SPB.
- > Distinctive correlatable and widespread stratigraphic markers in the NPB.
- > Major mechanical stratigraphy within the Zechstein that governs the maximum fracture height (hence impacts connectivity, significant for risking water ingress).
- > Insight to help optimise well orientation to avoid under-sampling fractures.

Significance for Production

This study will provide you with:

- > Understanding of the most significant factors for reservoir connectivity.
- > Potential improvements in development strategy.
- > A predictive model for fracture properties, relating to formation, facies, faults and lithology.
- > Quantitative parameters suitable as direct inputs for Discrete Fracture Network (DFN) and other fracture modelling.
- > Improved understanding of reservoir performance.
- > Revised sequence stratigraphic correlation (including a revised facies assignment in NPB).
- > An understanding of the diagenetic framework for carbonate-evaporite systems.
- > An assessment of the effects that evaporite removal, non-deposition or presence can have upon the fracture system.
- > Better understanding of the structural effects of gravitational collapse following evaporite dissolution.
- > Interpreted, high resolution images of Zechstein carbonate outcrops, as potential analogues for the subsurface.
- > An analysis of the production behaviour of three fields.
- > A relationship between distance, permeability and time with regard to significant water breakthrough. This is useful to predict time to watering-out for wells with Rotliegend aquifer support.



Examples from the **9** reports, **10** appendices, **12** plates, and **5.5 GB** of digital data which includes data tables, photos, and spatial metadata.

