Oral Presentation

Insights from a multi-disciplinary fracture study of the Zechstein of NW Europe

Susie E. Daniels[1], Jonathan J. Long[1], Maurice E Tucker[2], Michael J Mawson[3], Jon G Gluyas[2], Robert E Holdsworth[2], Richard R. Jones[1]

[1]*Geospatial Research Ltd., Durham, UK (susie@geospatial-research.com)*
[2] *Dept. of Earth Sciences, Durham University, UK*
[3] *Independent*

Production from Zechstein carbonates in the UK, Norway, Poland and Netherlands is significant today and has been important since UK offshore oil production began in 1975. Fracture permeability is commonly significant for production from such Zechstein carbonate reservoirs. Sometimes fracture permeability is higher or lower than anticipated, with significant impact for well (and field) productivity. This can also be associated with early water production, a relatively common occurrence for Zechstein carbonate reservoirs. Understanding the fracture stratigraphy, in particular identifying any units which have pronounced fracture properties (either a tendency to retard fractures and act as a mechanical barrier, or units with a tendency to be highly fractured) will be useful in optimising development.

A study of fractures in Zechstein carbonates from outcrops in NE England was completed in 2016. The Zechstein carbonates are a complex reservoir, and have been subject to a multitude of complex processes that began during deposition, and continued through burial and exhumation. A simple structural study of the fractures would not have been sufficient to provide a useful understanding. To unravel the fracture stratigraphy it was necessary to have a comprehensive understanding of the processes that affected the study sites, before being able to clarify the impact they have on fracture behaviour. The study builds on extensive multi-disciplinary analysis of these world-class Zechstein carbonate outcrops, with collaboration across the disciplines of sedimentology, sequence stratigraphy, fracture network characterisation, and structural analysis.

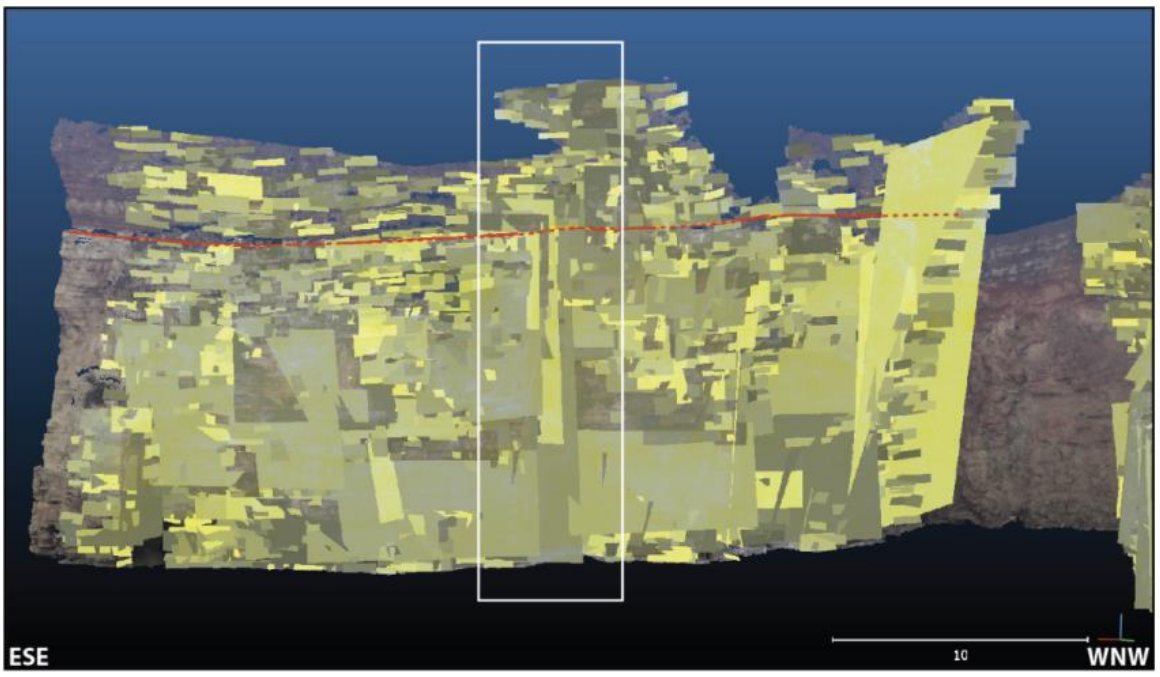

Fig.1 Lidar point cloud with interpreted fractures (auto-picked and manually validated). White box delineates the same area of outcrop as the box in Fig. 2.

The outcrop fracture study of Zechstein carbonates (Z1 - Z3) from was organised by facies, diagenetic history, tectonic setting and lithology. Understanding the facies within the sequence stratigraphic context enables application of the predictive fracture model across the basin. Outcrop fracture characteristics were evaluated alongside subsurface core and production performance to better understand how these factors impact permeability and well performance.

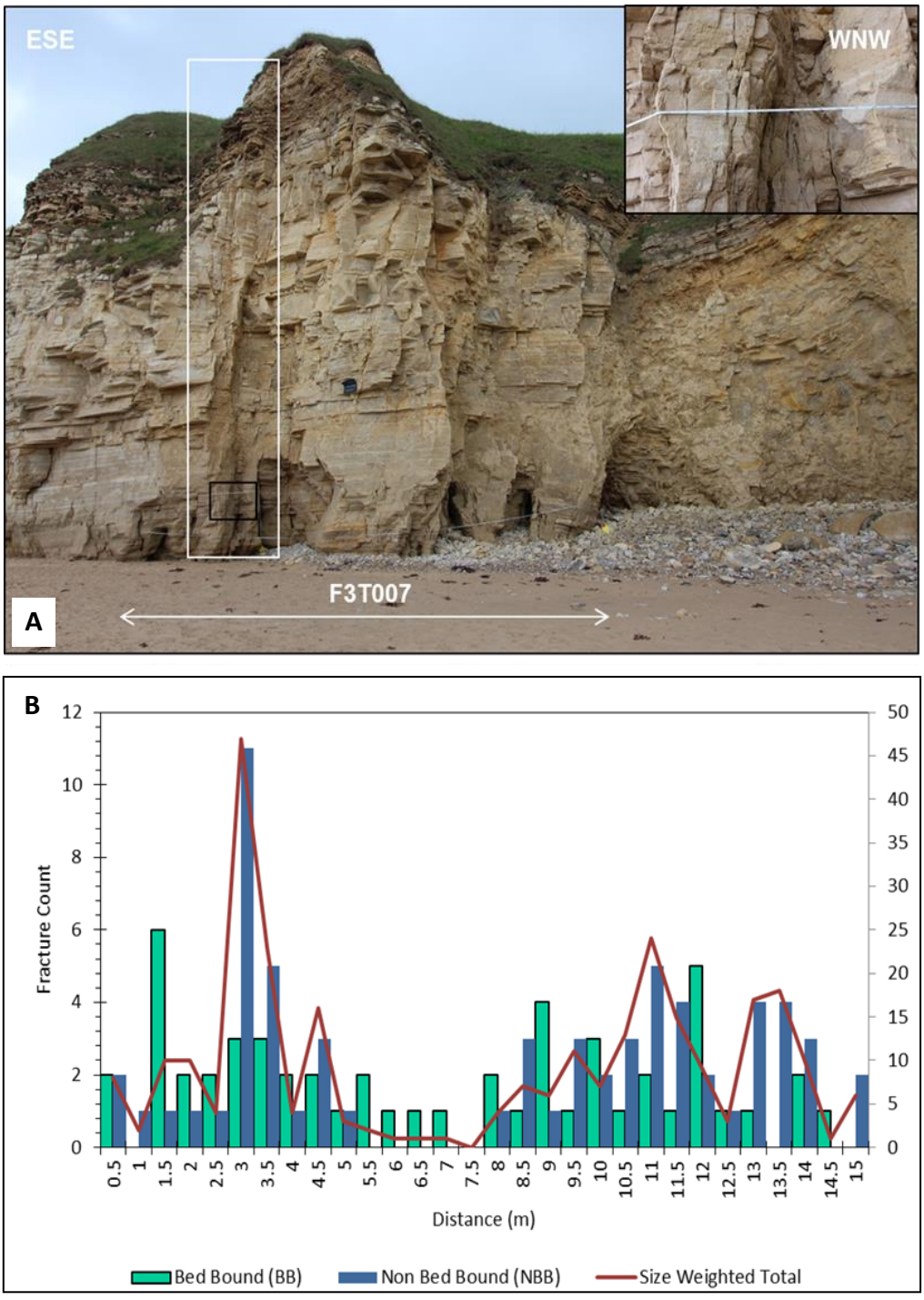

Fig.2 Fracture corridor within the Roker slope facies. **A** white box shows area of vertically persistent fractures. Black box shows the location of the inset image. **B** Fracture density per 0.5 m bin (along transect 'F3T007'). A peak in intensity of non-bed-bound fractures occurs at the point at which the inferred fracture corridor intersects the transect at 3 m.