

## **Microbial Carbonate Reservoirs of the Argyll and Auk Fields Reinterpreted in a Sequence Stratigraphic Context**

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### **ABSTRACT**

The shift of focus to basin margin areas, prompted by the UK 29th Licensing Round, has led to re-evaluation of the Palaeozoic, including the Zechstein. The Zechstein reservoir interval in the Northern Permian Basin (NPB) is encompassed by the Halibut Carbonate Fm., equivalent to the entire Z1 (highstand and lowstand systems tracts) and lower part of the Z2 (highstand systems tract) cycles of the Southern Permian Basin (SPB). However, previously, little attempt has been made to extend the SPB sequence stratigraphic understanding into the NPB. The Zechstein is a major reservoir in the Argyll and Auk fields. Historically, opinions have varied as to the interpretation of the Zechstein reservoir facies in these fields. Some former interpretations suggest deposition on a shallow carbonate shelf, with the main reservoir consisting of peritidal stromatolites. However, after re-examination of the core from these fields within the context of a regional study, it has been concluded that deposition took place in a basinal position. The main reservoir of the Auk and Argyll fields is interpreted as a lowstand deposit. Its microbial nature is a reflection of the hypersalinity that characterised lowstand deposition in the Zechstein. This microbial facies can be recognised regionally and is present under thick Zechstein salt (again indicative of a basin centre position) in a well in the northern part of the Central Graben, where the upwards change to microbial facies is abrupt and associated with the immediate cessation of clastic input, indicating a major change in basin hydrology. Analogous lowstand carbonates are similarly recorded in the centre of the SPB, developed offshore from anhydrite platforms. A possible small scale modern analogue is Great Salt Lake, Utah, where microbialites cover >1200 km<sup>2</sup> of the lake floor. This study shows that it is possible to extend a unified Zechstein sequence stratigraphic model across both the SPB and NPB. This has shed new light on the depositional architecture of the Zechstein system, leading to revised interpretations of the origin and distribution of microbial reservoir facies. Additionally, it highlights the dangers of only considering highstand depositional models when searching for reservoir analogues. Recent results from the 38/02-1Z exploration well are interpreted in the light of this new sequence stratigraphic study, resulting in further insights into the palaeogeography of early Zechstein deposition.