Fractal and Spatial Analysis of Polygonal Fault Systems Case Study: Shallow Slope Section Offshore Angola West Africa

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Polygonal faults occur in many passive margins worldwide and the results of previous studies shows that they are usually layer bound in stratigraphic sequences containing them. Previous studies have investigated the control of mechanical layer thickness on the spatial distribution of normal faults within a single layer and demonstrate that mechanical layer thickness exerts a first order control on the spatial distribution of the fault population. In this study, this understanding is extended to small extensional faults (maximum offset ~ 20 ms) characterised by polygonal morphological planform, in a well constrained system where the mechanical layer thickness changes laterally making it possible to investigate the systematic distribution of polygonal faults contained within it. The results of fractal analysis using the box dimension estimation method shows that the distribution of the polygonal faults changes as the mechanical layer thickness varies. In the thinnest region, the spatial distribution of the polygonal faults is fairly constant whereas as the mechanical layer thickens, a significant variation in the spatial distribution of the faults with depth is observed such that only the largest faults span the entire layer and smaller faults are constrained by proximity to a mid-layer tier boundary. The results of the study also reveal the importance of other factors that coupled with layer thickness control the distribution of the analysed faults which include proximity to growth folds, the presence of a salt dome and the stress reduction shadows around neighbouring growth faults.

There are implications for fluid flow or reservoir condition from this work where uniform fluid movement is likely where the distribution of the faults is fairly constant in the thinner part of the mechanical layer containing the polygonal faults, and tortuous fluid migration is more likely where significant variations in fault distribution are present as the layer thickness increases and compartmentalisation of the polygonal faults occurs.