Seismic Structural Characterization of Fault Zones in Early Cretaceous Carbonates, Offshore Abu Dhabi

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Fault zones developed within Early Cretaceous reservoir facies and intervening dense limestones, due to predominantly wrench-reactivation activity on deep basement faults, are characterized by high linearity, small vertical offsets and anastomosing to en-echelon nature in offshore fields. Consideration of the vertical linkage of these faults, from seismic attribute data, display organized patterns of continuity, relaying to soft linkage and discontinuity, in response to the individual layering and alternating dense-reservoir heterogeneity of the reservoir sequence. Similar changes occur through seal sequences, highlighting distinct stratigraphic controls on fault propagation. Reservoir / dense limestone fault zones display differences in:

• Fault zone character

• Individual structural elements / internal structure

• Fault rock types

• Fault behaviour

• Reactivation susceptibility

• Cementation & structural accessed diagenetic reservoir degenerative effects

• Associated damage zone / fracture areole development

• Complexities inherent from juxtaposition of thin-layered reservoirs.

Such complexities, supported by dynamic characterization, result in both fracture dominated ‘conductive' fault-fracture zones and cemented/smeared ‘sealed' damage zones in the reservoirs, but particularly within the more thinly layered ones (metric to several metres thick sequences). Deformation style and fault continuity becomes less heterogeneous in thicker reservoirs where the array of effects is less diverse and fault behaviour and fracture zone effects are more limited and predictable.

Identification of the relevant kinematic affinity, predominantly wrench reactivation, fault linkages and tectonic model (repeated reactivated ‘shuffling' on deep faults propagating rheologically controlled fault segments into cover sequences) provide an improved framework for understanding fluid flow. Consequently, it is no surprise that on production thinner pays behave in contrasting fashion, with proportionately more fracturing and faulting and reservoir degenerative effects, to thicker zones on production.