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Diagenetic Evolution and Subsequent Implications on Reservoir Qualities, Khartam Member, Permo-Triassic Khuff Formation, Central Saudi Arabia

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The Permian-Triassic Khuff reservoirs in the Middle East are estimated to contain about 15-20 % of the world's gas reserves. The exposed Permian-Triassic outcropping strata of Khuff Formation in central Saudi Arabia provide excellently analog to the subsurface Khuff reservoir. Generally, diagenesis has enormous implications on carbonate reservoir qualities. This study aims to delineate the major diagenetic features and subsequently to determine their implications on critical reservoir quality of Khartam Member, Khuff Formation. A total of three boreholes data were used to accomplish the objective of this paper. Petrographical and poro-perm results were integrated to delineate the prominent diagenetic features and hence to subdivide the vertical sequence of the reservoir into diagenetic zones. As a result, seven diagenetic zones were clearly defined. Zone1, dominantly consist of extensively dolomitized mudstone. It is believed that, the dolomitization has enhanced the total porosity and permeability of this zone to about 10pu and 0.5mD respectively. Zone2 composed of moderately dissolved oolitic grainstone. Dissolution has resulted in a relative increase in the total porosity and permeability to about 10pu and 0.6mD respectively. Zone3 is a thinly laminate to massive mudstone with very low porosity and permeability of about 4pu and 0.1mD. Thinly localized dolomitization events were observed in this Zone, this might give an explanation to the relatively fair porosity. Zone4 composed of oolitic grainstone. Two major diagenetic features were observed in this Zone, extensive grain dissolution and calcitic cements. The extensive grain dissolution was intensively enhanced the total porosity and permeability to about 25pu and 146mD (very high porosity and permeability). However the calcitic cements were locally blocked the intergranular porosity but it has a minor influence on porosity and permeability. Zone5 composes of skeletal massive mudstone, with fair porosity and permeability of about 5pu and 0.09mD respectively. Zone 6, composes of skeletal and oolitic grainstone. Prominent grains dissolution was observed in this zone, this has intensively enhanced the porosity and permeability to about 19pu and 1mD respectively. Zone7 composed of massive skeletal wakestone with a relatively good porosity and fair permeability of about 14pu and 1mD respectively. Micro-fractures were characteristic diagenetic features of this zone, and this might give an explanation to the relatively good porosity and fair permeability. Generally, dolomitization was the prominent diagenetic feature of the muddy Zones, whereas grains dissolution were the dominant diagenetic feature of the grainy zones. It is very clear that diagenetic evolution of Khartam Member has played a major role in enhancing total porosities and permeability and hence improving reservoir quality.