Fracture-Controlled High Temperature Dolomites in the Cretaceous Ramales Formation (Cantabrian Mountain Chain, NW Spain): Implications for Reservoir Characterization

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This contribution aims to investigate the impact of fracture-controlled, high temperature dolomites on reservoir heterogeneities. Such type of dolomites are important because they are related to faults/fractures, which upon reactivation can enhance the porosity and permeability (vertical connectivity) of these dolomites, which in turn facilitate the movement of fluids towards these dolomites to make them good reservoirs. The study area comprised of about 8Km2, E-W extended carbonate build-ups (Ramales Formation), which contain excellent dolomite bodies oriented along the NW-SE, N-S, E-W and NE-SW directed faults and/or fractures. Besides these, irregular dolomites also occur mostly on platform and occasionally on the slope as well. The dolomite bodies represent about 20 - 25% (2000m2) of the total carbonates in the study area.

Petrographic studies revealed various dolomite facies (nonplanar, zebra and planar dolomite) along with their alteration products (dissolution/precipitation influenced dolomite and cataclastically deformed dolomite). Petrophysical analyses indicate that most of the studied sections represent nonplanar dolomite, which contains low porosity values (2 -7%) as compared to zebra (3 -11%) and planar dolomite (1 - 10%), while the permeability values remain low (< 5mD) for all the dolomite facies. Accordingly, cataclastic dolomites have also low porosity and permeability values (1.6 - 3.8%; 0.16 - 0.21mD) as most of the pore spaces are occluded by late stage calcite cementation. By applying the porosity correction technique, to determine the true porosity at the time of formation of these dolomites, it is observed that cataclastic dolomite (15 - 17%) and dissolution /precipitation influenced dolomites (15 - 28%) represent high porosity values. The stable isotope composition (δ18O values ranging mainly between -18 and -11‰; δ13C values ranges from -1 to +3‰) and microthermometry studies (TH = 120 - 200°C & Salinity = 10 - 24 eq. wt. % NaCl) indicate hot, saline and multiphase dolomite formation.

Dolomite facies variation does not effect too much in the increase of porosity and permeability values but multiple stages of tectonic events resulted in dolomite alteration products are responsible for the enhancement of these petrophysical properties. Considerably small volume, mostly interlocking nature of dolomite facies and lesser porosity and/or permeability values may be responsible for hindering this as a good reservoir in the area.