

## **Dolomite and Dolomitization of the Late Permian Khuff-C Reservoir in Saudi Arabia: Origin, Controls, and Reservoir Quality Implications**

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### **ABSTRACT**

Detailed petrographic analysis of 217 dolostone thin sections, from the Late Permian Khuff-C reservoir in Eastern Saudi Arabia, revealed three main replacive dolomite types: (1) fabric-preserving mimetic (FPM) dolomite, (2) fabric-preserving non-mimetic (FPNM) dolomite, and (3) fabric-destructive (FD) dolomite. With the exception of saddle dolomite in a few samples, all of these fabrics are interpreted to have formed early by reflux of evaporated seawater within a marine-burial setting. Carbon isotopic compositions of dolostones dominated by each fabric are very similar. Average  $\delta^{18}\text{O}$ , however, gets progressively more negative from +0.4‰ for FPM dominated dolostones, to -0.3‰ for FPNM dominated dolostones, to -0.8‰ for FD dominated dolostones. The range in dolostone  $\delta^{18}\text{O}$  values is interpreted to reflect slight differences in temperature and degrees of seawater evaporation, with FD dominated dolostones formed, on average, from a less evaporated (less positive) fluid than did the FPM and FPNM dominated dolostones. Dolostones form better reservoir rocks than limestones but not all dolostones are porous or permeable. Hybrid dolostones, which have a mixture of the three dolomite fabrics and none of the fabrics exceeding 50% of the total, have the best covariance between porosity and permeability and are, on average, the most porous and permeable dolostone type. Controls on dolomite fabrics development and distribution include initial textures (microfacies), position within a depositional cycle, and the nature of the dolomitizing fluid.