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Structurally-Controlled Hydrothermal Dolomite Reservoirs: Characteristics and Rock Fabrics

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Hydrothermal dolomite (HTD) reservoirs are major producers in the Ordovician, Devonian and Mississippian of North America, and are receiving increased global attention. HTD is formed under burial conditions (often less than 500m) from Mg-charged brines emplaced *via* structural conduits into a carbonate host, typically limestone, at temperature and pressure greater than the **ambient** T and P of the host formation. Original limestone facies and permeability play a major role in lateral extent of dolomitization, replacement textures, pore type, and pore volume. Associated leached limestones may also be productive. Saddle dolomite in both matrix-replacive and void fill phases is characteristic but not necessarily diagnostic of an HTD system. Transient, short term but high temperature (tTI) hydrothermal events may result in ‘forced maturation' of kerogens in this setting.

Extensional and strike-slip (wrench) faults are the preferred structural locations for hydrothermal dolomitization, with a bias toward the upper hanging wall site. Transtensional or dilational bends, offsets and shears along wrench faults, often in *en-echelon* arrays, are common loci for fluid upflow, but with transpressional structures adding complexity. The seismic signature for dilational or pull-apart sites is a structural ‘sag', often with high positive correlation to HTD distribution. Underlying sandstone aquifers, basement highs, and shale top seals and internal aquitards are other variables in localization of HTD facies.

Rock fabrics in an HTD system record short-term (‘instantaneous') shear stress and pore fluid pressure transients. They include dilational ‘floating clast' breccias, rimmed microfractures in shear sets, boxwork vugs and zebra fabrics compartmentalized by shear microfractures, and hydrofracturing of low-permeability hosts. Younger tectonic fracturing may be a critical factor in economic production and high flow rates.