

Hydrothermal-Seawater Mixing Zone Dolomite: A Hypothetical Model for Widespread, Pervasive Dolomitization

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There is significant potential for dolomitization in hydrothermal-seawater (or modified seawater) mixing zones. Seawater has high Mg/Ca ratios but does not readily precipitate dolomite due to kinetic barriers to formation at low temperatures. Supersaturated hydrothermal fluids > 60 °C readily precipitate dolomite, but there is a question of the source of the magnesium necessary to make large volumes of dolomite. A hydrothermal-seawater mixing zone dolomitization model might help to overcome these kinetic and mass balance problems. Hot fluids (up to 200 °C or warmer) might flow up faults, mix with in situ magnesium-rich seawater and precipitate dolomite. Hydrothermal dolomitization appears to occur very near the surface – commonly within the first 500 meters of burial. One of the reasons it may preferentially occur at these shallow depths is that is where hydrothermal fluids might most easily mix with seawater. Fluid inclusion and geochemistry results suggest that in many cases both matrix and later pore-filling saddle dolomite form at temperatures greater than the ambient burial temperature. Matrix dolomite might form in the hydrothermal-seawater mixing zone, while the later saddle dolomite might be precipitated from hydrothermal fluids alone after continued burial and compaction of overlying seals has cut off the supply of seawater. There is a common spread in homogenization temperatures and salinities in fluid inclusion data from these dolomites that might be explained by different degrees of mixing. This is a hypothetical model that requires further analysis but it could eventually be applied to the Trenton Black River and many other dolomitized reservoirs worldwide.