Reflux Dolomitization and Recrystallization in the Upper Devonian of Central and West-Central Alberta

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Due to their importance as hydrocarbon reservoirs, much work has been conducted on the replacement dolomites of the Alberta Basin. Based on the stratigraphic distribution of dolomite and present day pore fluids (Potma and Wong, 1995), and on mass balance and stratigraphic arguments (Shields and Brady, 1996), it is concluded that the bulk of these dolomites formed in latest Frasnian time via seepage refluxion of sea-water derived brines. Petrographic observations and the heaviest oxygen isotope data are consistent with this model. Qualitatively, our and published isotopic data show the expected trend of depletion with depth beneath the Graminia Formation (latest Frasnian).

After formation, these replacement dolomites were buried to depths as great as 5-6 kilometres and exposed to temperatures greater than 150C, based on stratigraphic data and Th of published fluid inclusion data. Isotopic and petrographic data demonstrate that considerable recrystallization of the replacement dolomites resulted from this progressive burial. Evidence includes: a wide spread in oxygen isotopic composition (-1.5 to -12.5 per mill), considerable isotopic overlap with later burial cements, and a systematic depletion with burial depth. Depletion in oxygen isotopes correlates with increases in radiogenic Sr and is similar to the isotopic composition of the cements. Dolomites and cements often have similar petrographic properties (Kaufman et al., 1991). Replacement dolomite and the cores of dolomite cements both display similar blotchy red cathodoluminescence. Zoned overgrowths on euhedral dolomites may be correlatable with zonation in dolomite cements.