Burial Dolomitization, Devonian of Western Canada Sedimentary Basin: what were the Mg-Bearing Fluids, Heat Sources, and Driving Mechanisms?

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The Western Canada Sedimentary Basin contains more dolomites and evaporites than other Devonian basins in Australia, China, and Europe. Most dolomites occur in two main episodes; 1) massive replacement matrix dolomites which form 50 to 90% of the dolomites, and 2) one or more stages of deeper burial, late-stage coarse crystalline and saddle dolomite cements in vug and fracture fillings.

Replacement matrix dolomites are texturally destructive. Significant calcite dissolution is often coincident with, or postdates, matrix dolomitization. These dolomites formed between 40 and 75EC in the shallow to intermediate subsurface (Late Devonian to Early Carboniferous), based on O isotopes. Strontium isotopic compositions are slightly more radiogenic than Devonian seawater. Similar textural and geochemical characteristics, regardless of present burial depths (1000 to 4000m) rule out significant recrystallization during burial.

Late-stage, deeper burial, coarse-crystalline dolomite cements, including saddle dolomites, are minor but laterally and vertically widespread. Fluid inclusion temperatures for late saddle dolomites and calcites range from 90 to 180EC, temperatures expected near maximum burial.

A few Pb-Zn deposits are locally associated with saddle dolomites. Zones of more extensive solution and brecciation form narrow linear zones that appear to be fault controlled, and probably formed vertical conduits along which deep-basin brines moved upwards, overprinting some earlier replacement dolomites. Some late calcites and dolomites have the most radiogenic Sr compositions, presumably from interactions of pore fluids with the underlying Precambrian basement.