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# Compositional zoning in dolomite from lawsonite-bearing eclogite (SW Tianshan, China): Evidence for prograde metamorphism during subduction of oceanic crust

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## Abstract

Dolomite with compositional zoning was discovered in carbonate-lawsonite-bearing eclogites in the Tianshan (ultra-)high-pressure/low-temperature metamorphic belt, northwestern China. The eclogite-facies dolomite occurs as matrix porphyroblast and as inclusion in garnet, both of which display the same chemical zoning pattern. The dolomite contains inclusions of calcite (probably after aragonite), magnesite, glaucophane, lawsonite (and its pseudomorphs), allanite, epidote, paragonite, phengite, and omphacite. The chemical zoning in dolomite is well defined by a continuous core-to-rim Mg increase and Fe-Mn decrease. The concentrations of transition metal elements, REE, and Y also decrease from core to rim of the dolomite. Thermodynamic modeling demonstrates that the Fe-Mg zoning of dolomite is largely temperature dependent and, thus, is interpreted as prograde growth zoning, which developed during subduction of carbonate-bearing oceanic crust. It is suggested that dolomite in equilibrium with garnet formed as a result of changing matrix compositions due to increasing temperatures. In addition, thermodynamic modeling demonstrates that during subduction at high-pressure conditions prograde-formed aragonite and dolomite were transformed to dolomite and magnesite. Furthermore, Fe-rich magnesite inclusions in matrix dolomite and in dolomite inclusions in garnet are shown to have formed during high-pressure conditions prior to peak metamorphic conditions and, therefore caution is warranted using Fe-bearing magnesite occurrences in eclogite-facies rocks as an unambiguous ultrahigh pressure indicator as previously suggested.

**Keywords:** Prograde zoning, dolomite, magnesite, eclogite, high pressure, Tianshan