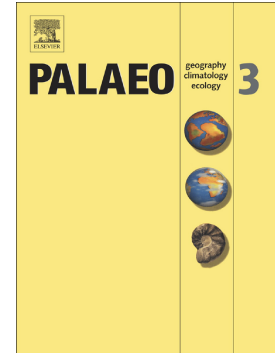


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Origin of dolomite in the Middle Devonian Guanwushan Formation of the western Sichuan Basin, western China

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Abstract The carbonates in the Middle Devonian Guanwushan Formation (D_{2g}) of the western Sichuan Basin are extensively dolomitized. Three types of replacement dolomite can be distinguished: (1) micritic-microcrystalline dolomite ($< 30 \mu\text{m}$) with some shale content (Type 1); (2) very fine crystalline dolomite ($30\text{-}100 \mu\text{m}$) with anhedral-subhedral dolomite crystals (Type 2); and (3) fine crystalline dolomite ($> 100 \mu\text{m}$) with anhedral-subhedral dolomite crystals (Type 3). The anhedral to subhedral fine crystalline crystals in Type 3 dolomite are truncated by a stylolite, which indicates that the formation of Type 3 dolomite most likely occurred simultaneously or predated the stylolite formation. Stratigraphic, petrographic and geochemical data indicate that the $^{87}\text{Sr}/^{86}\text{Sr}$ ratios (0.70839 to 0.71117) of the D_{2g} dolomites, which are higher than those of the contemporaneous seawater (0.70780-0.70830), were affected by the underlying siliciclastic rocks of the Jinbaoshi Formation (D_{2j}), Pingyipu Formation (D_{1p}) and Silurian strata. The dolomitizing fluids incorporated elemental Sr, which tends to be abundant in crustal fluids. The rare earth element (REE) compositions of the D_{2g} dolomites are characterized by enrichment in light REEs and depletion in heavy REEs, Ce, and Eu, indicating that the dolomites of the D_{2g} inherited the characteristics of the contemporaneous seawater and formed in a low-temperature, relatively oxic environment. The $\delta^{18}\text{O}$ values of Type 1 and Type 2 dolomites (-6.3‰ to $+0.43 \text{‰}$ and -7.2‰ to -1.69‰ , respectively) are slightly higher than those of seawater-derived dolomite, suggesting that these dolomites may be related to the evaporation of seawater during the penecontemporaneous stage. The $\delta^{18}\text{O}$ values of Type 3 dolomite (-8.32‰ to -0.83‰) are slightly lower than those of the seawater-derived dolomites, indicating that this dolomite may have formed at a higher temperature during shallow-moderate burial. Type 1 dolomite has higher $\delta^{18}\text{O}$ values, Sr^{2+} concentrations and total REE (ΣREE) concentrations and slightly lower Mn^{2+} concentrations than the other two types of dolomite, suggesting that Type 1 dolomite formed via capillary concentration dolomitization from

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