# Dolomite versus Mg-calcite: Combining micro-analytical techniques to identify poorly crystallized carbonates

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Using a skeleton of coralline algae as an example, we address the challenges involved in characterizing finely intergrown, poorly crystallized Ca-Mg carbonates, with focus on how to distinguish calcite (cation disorder) from dolomite (cation order). We suggest that using ordering peaks in X-ray diffraction patterns may be unreliable for determining ordering in poorly crystallized carbonates. These materials have weak, broad and overlapping peaks due to nano-scale grain sizes, high defect-density and chemical inhomogeneity (Ca/Mg). The relative intensity of ordering peaks in particular decreases with deviation from dolomite stoichiometry, or if cation order is only partial. Micron-scale intergrowth with other phases may exist, their peaks potentially obscuring the diagnostic ordering signals. These issues mean that even the biggest ordering peak 015 likely approaches the limits of detection, making it difficult to prove its presence or absence.

We propose that the change in unit-cell size that occurs with ordering is a more sensitive indicator for detecting partial cation order in such carbonates, since it can be more accurately measured by the position of the main carbonate peak $d_{104}$ [1]. Combining synchrotron micro-XRD with quantitative SEM-EDS analyses we show that modern coralline algae contain dolomite that is partially ordered.

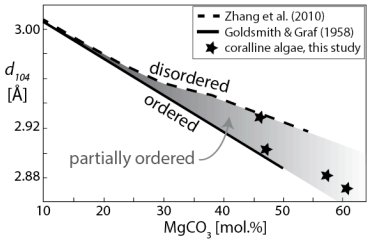


**Figure 1:** $d_{104}$ vs Mg-content (modified from Zhang et al. 2010) used to detect ordering in coralline algae carbonates.

[1] Zhang et al. (2010) *Amer Min* **95,** 1650-1656.
[2] Goldsmith and Graf (1958) *Amer Min* **43,** 84-101.