Crystallographic and Compositional Aspects of *C*-Domains in Calcium-Rich Dolomite

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Early exposure cap microdolomites (<50˚C) and hydrothermal (<177˚C) calcian dolomite crystals from the Latemar buildup, Dolomites, are microstructurally heterogeneous. Selected-area electron-diffraction (SAED) patterns contain incommensurate superstructure reflections from quasiperiodic domains (c-domains) that are approximately 25 Å wide. Modulations of these quasiperiodic domains have wavelengths that range from approximately 50 to 200 Å. The scale of modulations varies with bulk crystal composition. Modulations have shorter wavelengths in crystals with less excess calcium.

Classic c-domain superstructures in dolomite are commensurate, with the *c*-reflections situated exactly halfway between the principal (*a* and *b*) reflections[1,2]. Individual c–domains are monoclinic and are interpreted to be more calcic than the host dolomite[1,2]. Incommensurate c-domains are distinct because they produce diffraction spots that are incommensurate with respect to those of the dolomite host[3]. The **c**-axes of the host and modulations are parallel, but the [110] directions are not always parallel. Lattice spacing $c^*_{dolomite} \approx c^*_{superstructure}$, but $d^{superstructure}_{110}$ is more than twice $d^{dolomite}_{110}$. The superstructure phase phase is metrically monoclinic and is interpreted to incorporate more calcium than dolomite. Excess calcium in the crystal structure may account for the more than doubling of the domains' *a*–dimension relative to that of dolomite.

Interest in c-domains centers on their role in processes such as growth of calcian dolomite at low temperature and the progressive ordering of calcian dolomite during diagenesis. Current work centers on determining relationships between: 1) crystal composition and domain orientation relative to the host crystal, 2) crystal composition and modulation wavelength, and 3) modulation sharpness and crystallographic orientation. In addition, c-domains in calcian dolomite are being studied in heating-stage experiments to investigate coarsening, disappearance and recrystallization of c-domains without primary crystal growth.

References

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The Chlorin-Index: A new parameter for organic matter freshness in sediments

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Total chlorins, degradation products of chlorophyll, have been used recently to reconstruct paleoproductivity from marine sediment cores. Here, we report on a new index, the Chlorin-Index (CI) that proofs to be a helpful tool for estimating organic matter freshness in marine sediments. The CI is a ratio between the fluorescence value of a sediment extract treated with hydrochloric acid and the original sediment extract. It therefore represents the amount of chlorophyll degradation products that could still be chemically transformed, with this amount being higher in sediments including freshly deposited phytoplankton material and being lower in older, highly degraded sediments. We evaluated this new parameter by using several short and a long sediment core from different oceanic settings including mainly high productivity regions. CI values vary from 0.36 for fresh material deposited on the shelf off Namibia and the German Wadden Sea to values around 0.7 in sediments off Chile and Peru to values higher than 0.9 of sediments in a deep core from the northeastern slope of the Arabian Sea. Sulfate reduction is responsible for up to 90 % of organic matter remineralization in the sediments off Namibia, Chile, and Peru. The rates of sulfate reduction in these sediments, among the highest ever measured in ocean settings, correlate very well with the CI supporting the relation between sulfate reduction rates and the "freshness" of organic material. We believe that the CI, beside chlorin concentrations which have been shown earlier to serve as a productivity indicator, is a reliable tool for the characterization of organic material in sediments in respect to its lability/degradability.