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Recrystallization textures of high-pressure calcite marble

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The conditions and mechanisms of deformation and metamorphism of subducted sedimentary rocks influence the physical and chemical evolution of convergent plate margins. However, the high-pressure (HP) grain-scale deformation mechanisms of major crustal minerals (e.g. quartz, calcite) are not as well known as those of minerals in HP meta-mafic and ultramafic rocks, in part because of the lack of field examples in which fabrics can be definitively linked to HP conditions (as opposed to exhumation processes). Interlayered lawsonite eclogite, glaucophane + lawsonite + phengite-bearing quartzite, and calcite marble in the Sivrihisar (SV) Massif, Turkey, preserve textural evidence for HP assemblages and textures and can be studied to identify HP microstructures. In addition, a blueschist-to-Barrovian sequence in the southern part of the SV Massif can be used to understand the processes by which HP assemblages and textures are overprinted during exhumation and subsequent tectonic events. In the SV Massif, HP marble is characterized by rod-shaped calcite pseudomorphs after aragonite; the long axis of the rods is oblique to compositional layering and the obliquity varies from 45 degrees to nearly parallel. In a narrow (200 m thick) transition zone between the HP and Barrovian domains, this texture is partially overprinted by chains of small, equant, recrystallized grains that preserve the crystallographic orientation of relict rod-shaped calcite, as revealed by electron back-scattered diffraction. In a 100 m thick section of the Barrovian zone adjacent to the HP domain, equant calcite grains have a crystallographic preferred orientation related to strain localization along the tectonic boundary between the domains. Further from the tectonic contact, within the Barrovian zone, recrystallized marble contains randomly oriented equant calcite. Thermal and structural effects of the emplacement of the Barrovian slice beneath the HP slice 30 million years after exhumation of the HP rocks created a recrystallization front that can be observed in calcite microstructures from a zone of complete recrystallization, through varying stages of partial recrystallization, to pristine HP textures.