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Post-deformational relocation of mica grains in calcite-dolomite marbles identified by cathodoluminescence microscopy

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Hot-cathodoluminescence-microscopy (CL) reveals micas which are rotated or shifted within a calcite fabric from a foliation parallel to a random orientation. This feature has been recognized in calcite-dolomite marble samples from the locations Hammerunterwiesenthal, Erzgebirge, Germany and the Alpi Apuane, Italy.
As obtained from petrographic thin section analysis, the micas either moved totally within a single calcite grain or from a grain boundary position, and then the calcite grain growth was dragged with the movement of the mica grain. In the moved-through grain, features like fluid-inclusions, twins or cleavage faces are erased and a new, clear calcite phase developed. This indicates dissolution-precipitation as process which led to the new calcite phase. As former deformation features are erased it can be assumed that the mica relocation is a fluid-driven, post-deformational equilibration process. In CL the new calcite mineral phase shows a zonation indicating a polycyclic process. Calcite CL gradually changes from a very dark purple, exactly as the surrounding grains, to a bright orange CL and supports the idea of fluid-induced deformation relocation.
We suppose a specific lattice relationship between mica and calcite as initial driving factor for mica relocation. This recrystallization mechanism is probably supported by fluids - either from an external source or developed during retrograde metamorphosis fluid inclusion studies shall identify formation temperatures and origin of involved fluids and thereby clarify the timing of the post-deformational mica rotation. EBSD analysis of involved calcite and mica grains shall reveal a possible systematic relationship between the orientation of the hosting grains, the orientation of the mica and the final position of the mica. It will be interesting to learn in the future, if this kind of calcite-mica microstructure is a general phenomenon and how it can contribute to the understanding of fabric development.