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Significance of Dauphiné twins in crystallographic fabrics of quartz tectonites

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Dauphine twins are commonly found in quartz tectonites, however their role in deformation processes are not completely understood. This study represents a new attempt to understand the interaction between slip systems and Dauphine twins in deforming quartz-rich rocks at different temperatures.
There is no doubt that Dauphine twins are mobilized under stress as this has been shown by experiments for single crystals and in polycrystalline aggregates where distinct crystallographic fabrics develop in previously randomly oriented aggregates related to minimization of elastic energy (Tullis 1972).
However in quartz tectonites the Dauphine twin process is a part of interplay between plastic deformation and recovery processes which depends on PT, strain-rate and fluid composition and availability.
In quartz tectonites with Y-girdle C-axis (GBM-regime) fabrics Dauphiné twins are abundant, relating different parts of r- and z rhomb "comet" distributions. This is interpreted as completion between prism <a> slip and Dauphiné twinning. Slip rotates grains such that CRSS is low on the prism planes, but then Dauphiné twin boundaries sweeps through the grain back to the orientation giving lower stored elastic energy. The faster recovery at higher temperatures gives subgrain walls slowing down twin movement across the mm-sized grain of the GBM regime.
At lower temperatures in the SGR-regime grain-size is reduced and different rotations of the grains are happening due to the domination of rhomb and basal <a> slip. Because recrystallization is effective relative to grain-size the grains are commonly free of internal strain and subgrain walls, allowing the favorably oriented Dauphiné twin member to sweep across the whole grain overwhelming the unfavorably oriented Dauphiné twin member. As a consequence high strain reduces the number of Dauphiné twins and quartz rhomb fabrics appear trigonal, missing the "comet" shape of the GBM regime rhomb fabrics.
Since Dauphiné twinning is also efficient at low temperatures rocks deformed in the brittle regime may also display stress-induced movement of Dauphiné twins. Though still highly debated Dauphiné twins and quartz rhombs fabrics may evolve as critical tools for determining paleostress orientation.
Tullis, J. and Tullis, T. E., 1972, Preferred orientation of quartz produced by mechanical Dauphine twinning: thermodynamics and axial experiments in H. Heard et al., eds., Flow and Fracture of Rocks, Am. Geophys. Union Monograph 16, 67-82.