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Formation of parting in quartz

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This paper presents hydrothermal quartz with macroscopic planar parting from the Mesoproterozoic Modum complex in southern Norway. Similar macroscopic parting in hydrothermal quartz with macroscopic planar structures has only been described from two localities in the world; Madagascar (Flörke et al., 1981) and Southern California (Murdoch et al., 1938). The study area consists of well foliated and banded sillimanite- garnet- amphibolite- mica gneiss that is cut at high angle by hydrothermal veins containing albite, chlinoclore, hornblende, hydroxyl apatite and quartz.

The rim of the veins is generally made up of almost pure end-member euhedral albite. Then there is vugs with euhedral hornblende (10-25cm long) and euhedral hydroxyl apatite with size ranging from mm scale to several cm. Some places the quartz encloses apatite and hornblende.
The quartz is anhedral, inequigranular with undulose extinction bordering sub grain rotation. It has large planar penetrative parting faces with pearly luster; however this is not consistent throughout the outcrop and some places the penetrative faces disappears and the quartz has a conchoidal fracture. The planar faces continue throughout the specimens with a few mm spacing. Thin sections oriented perpendicular to the most pronounced planar structure show lamellas that extinguishes at small angles (2 degrees) to each other.

EBSD mapping of the planar faces shows two orientations {0-111} and {1-101}, corresponding to the r- and z-faces respectively, separated by irregular boundaries. The misorientation between these two crystallographic orientations on the parting is a 60 degree rotation on [0 0 1] in correspondence to the dauphiné twin law. Investigations conducted on thin sections cut orthogonal to the parting shows that the parting cuts and offsets the dauphiné twins, indicating a late genesis of the parting. However some internal stress induced movement of the twins are visible.

SEM-CL documents three generations of quartz and two, possibly three, planar structures; two evident, one more obscure. The most prominent of the three appears to cut across the recrystallization, offsetting the recrystallization textures with varying distances.

We propose a very late formation of the parting due to its crosscutting relationship with all features, such as recrystallized quartz, secondary fluid inclusion trails and twins. The parting develops in crystals that are optimally oriented with respect to $\sigma 1$ in a fast, low temperature deformation event.