



Trace element and oxygen isotope zoning in natural Alpine quartz crystals – Is there a link?

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Natural crystals of hydrothermal quartz from different Alpine fissures were investigated with the aim of determining whether there is a structural control on oxygen isotope fractionation between fluid and the growing crystals, in analogy to a possible crystallographic-structural control on trace element incorporation. The chosen crystals have different but well-characterised evolutions, with different growth rates and dynamics, different temperatures of precipitation (150 to 350°C) and different fluid chemistries. Preliminary studies revealed that the $\delta^{18}\text{O}$ values measured in different parts of a single crystal differ by close to 3‰.

Trace element measurements by electron microprobe and IMS3f ion probe in different sector and growth zones, revealed by differences in cathodoluminescence, indicate no zonation of element concentrations in quartz crystals with continuous growth zones. However, quartz with cyclic growth from the locality of Gigerwald clearly supports Al+Li substitution for Si, as well as element growth and sector zoning, with lowest Al content in prismatic faces. These sectors were analysed in parallel for oxygen isotope variations using an IMS1270 ion probe and CO₂-laser extraction line techniques. *In situ* oxygen isotope compositions measured with the ion probe vary by about 4‰, but variations within single zones are of the same magnitude as those between different zones (within error). Nevertheless, there is a tendency of somewhat higher $\delta^{18}\text{O}$ values in the Z-face compared to the R-face, which may reflect a negative relationship between growth rate and incorporation of ¹⁸O. Results obtained with the CO₂-laser method gave similar absolute values, but the lowest $\delta^{18}\text{O}$ value was measured for the outer part of the Z-face, which is exactly opposite to the results of the ion probe. This may be due to differences in sampled localities in the crystal or small-scale hetero-

geneities. No clear relationship between Al zoning and $\delta^{18}\text{O}$ values can be established.

Further investigations on additional samples, including also FTIR and *in situ* UV-laser analysis, and synthetic crystal growth experiments, would lead us to a better understanding of processes governing oxygen isotope fractionation between minerals and fluid at low temperatures in natural systems.