

OH-DEFECTS IN QUARTZ AS MONITOR FOR PROVENANCE

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OH-defects of more than 500 quartz grains from siliciclastic sediments and their potential source rocks were studied by FTIR-spectroscopy. Sediment samples were derived from the Rhine River at Rhöndorf and from the Baltic Sea coast at Darß. As potential source rocks Hercynian granites from the Black Forest and Proterozoic granites from Sweden were investigated, respectively. Prior to analysis, all quartz grains were manually aligned parallel to the crystallographic c-axis, and polarised measurements were performed in two perpendicular directions in order to erase the IR-signal of fluid and melt inclusions and to minimize the contribution of mica inclusions. IR-absorptions of the hydrous defects were converted into concentrations for water equivalents.

Results show that quartz grains from Darß and Rhöndorf exhibit fundamentally different defect water contents, where quartz grains from Darß are generally low in defect water (in average 4 wt ppm, most grains below 2 wt ppm) compared to grains from Rhöndorf (in average 20 wt ppm with significant populations at 10, 20 and 50 wt ppm). Most granites from Sweden have defect water concentrations around 2 wt ppm water, no grains >20 wt ppm water were observed, and the average value of all analysed grains (N=120) is around 4 wt ppm. Quartz grains from the Black Forest granites cluster around 24 wt ppm water. In addition to the defect water content, IR spectra bear information concerning the OH-speciation of the hydrous defects that occur as characteristic absorption band at 3378 cm⁻¹, 3470 cm⁻¹, and 3595 cm⁻¹, depending on the charge balancing cation (Al, Li, or B, respectively) during H-incorporation. If spectral characteristics are parametrised with respect to absorption band ratios, IR spectra can be used to identify grain cluster from distinct source rocks in their siliciclastic counterparts.

Based on the current data set it can be concluded that detrital quartz derived from the Proterozoic Scandinavian Shield is in average by far less rich in OH-defects than detrital quartz derived from the Hercynian orogeny and may thus be used as tool for provenance analysis in sedimentary basins, where both sources are mixed.