QUARTZ CATHODOLUMINESCENCE: APPLICATIONS TO TIN GRANITE AND RHYOLITE OF THE ALTENBERG CALDERA, ERZGEBIRGE, GERMANY

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Cathodolumiescence (CL) combined with trace element analysis (EPMA, LA-ICPMS), FT-IR and ESR spectrometry have been applied to magmatic quartz of the Teplice rhyolite (308+-2 Ma) and the tin-bearing, Li-F-enriched Schellerhau monzogranite (300+-5 Ma) from the Erzgebirge (Germany) in order to determine the magma evolution and crystallisation conditions. We found clear correlation between CL characteristics, trace element contents and defect structures in quartz: eleven CL-emission bands in the visible light correspond in part with Fe^{3+} (1.7-1.73 eV)and with Ti contents (3.00 eV); H_2O-related defect centres in the form of 2SiO3-H2O-M+2M3+O4 (where M^{3+} is mostly Al^{3+} or Fe^{3+}; M^+ mostly Li^+, Na^+ or K^+) relate with CL-emission around 1.94-1.97 eV. The variation of the Ti content is the main factor responsible for the magmatic zonation in the quartz phenocrysts in the rhyolite as observed in CL. The highest Ti concentrations of about 150 ppm in the phenocrysts (corresponding to episodes of fast crystal growth) causes intensive blue CL and are indicative for crystallisation in a dry environment at mid-crustal pressures. Similar phenocrysts were found in the subvolcanic Schellerhau monzogranite which also point to early dry crystallisation at about 20 km depth; the matrix quartz in the granite however shows dominant red-brown CL and points to late crystallisation from a volatile-rich melt at shallow levels. Identical trace element signatures, growth zonation patterns and CL properties of the quartz phenocrysts of the Teplice rhyolite and the Schellerhau monzogranite indicate crystallisation in the same magma chamber during the early stage of magma evolution.