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Characterization of an early metamorphic stage through inclusions in zircon of a diamondiferous quartzofeldspathic rock from the Erzgebirge, Germany

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ABSTRACT

About 1000 zircon grains from a diamondiferous quartzofeldspathic rock of the Saxonian Erzgebirge were investigated for inclusions using optical microscopy and confocal laser-Raman spectroscopy. Cathodoluminescence imagery was applied to characterize the growth zone of zircon where the inclusions occurred. The most abundant inclusion minerals are microdiamonds. Coesite was not detected. However, garnet and jadeite occur as rare inclusions in zircon cores where diamonds are lacking. Jadeite was detected for the first time in quartzofeldspathic rocks from the crystalline complex of the Erzgebirge. The compositions of the pristine garnets in the zircons are similar to those of core areas of millimeter-sized garnets but the original garnet composition of the early metamorphic stage is only preserved in zircon. Intracrystalline diffusion at temperatures as high as 1000 °C resulted, for instance, in higher Ti concentrations in garnet cores compared with garnet enclosed in zircon. Rutile, quartz, and the compositions of jadeite and garnet inclusions in zircon and of phengite inclusions in cores of large garnets were applied for geothermobarometry. The results, related to an early metamorphic stage, are 650 °C and 18 kbar, which represent conditions at the base of a thickened continental crust before deeper subduction.