American Mineralogist, Volume 92, pages 1213–1224, 2007

Brittle fracturing and fracture healing of zircon: An integrated cathodoluminescence, EBSD, U-Th-Pb, and REE study

A. Rimša,[1,2,*] M.J. Whitehouse,[1] L. Johansson,[2] and S. Piazolo[3]

[1]Laboratory for Isotope Geology, Swedish Museum of Natural History, Box 50007, SE-10405 Stockholm, Sweden
[2]GeoBiosphere Science Centre/Lund University, Department of Lithosphere and Paleobiosphere Science, Sölvegatan 12, SE-22362 Lund, Sweden
[3]Department of Geology and Geochemistry, Stockholm University, SE-106 91, Sweden

Abstract

The entire population of magmatic oscillatory zoned zircons in a migmatitic granite from the Tjärnesjö intrusion, southwest Sweden, reveal fine-scale brittle fracturing. The oscillatory zoned fragments are rotated but not dispersed. Fractures between individual fragments are sealed by newly formed CL-bright zircon. Hydraulic fracturing is the most probable mechanism. The internal structure of fractured zircons and the LREE-enriched, low Th character of CL-bright zircon both suggest that cracks between oscillatory zoned zircon fragments were rapidly sealed after fracturing by CL-bright zircon, precipitated from hydrothermal fluids. Zircon fracturing and crack-sealing has been dated by SIMS ion-probe and U-Th-Pb isotopes to 920 ± 51 Ma (lower intercept age, 2σ, MSWD = 1.09) with a limit for the youngest possible age of 960 ± 16 Ma ($^{207}Pb/^{206}Pb$, 2σ, MSWD = 0.23) dated by sector-zoned rims forming overgrowths on the fractured cores.

Keywords: Zircon, hydrothermal, cathodoluminescence, U-Pb, Sveconorwegian, SIMS, EBSD, fracturing, hydraulic