Photoluminescence imaging of zircon by conventional and laser excitation: geochronologic and thermochronologic applications

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Zircon grain selection for geochronology and thermochronology is typically done on a binocular microscope under incident or transmitted white light and/or on a petrographic scope in polarized light. In many techniques (e.g., SIMS, LA-ICPMS) the grains are then cross-sectioned and imaged with backscattered electrons (BSE) and cathodoluminescence (CL), commonly revealing intricate and complex zoning patterns that guide analytical spot placement and age interpretation. Unfortunately, this complex zoning is often imperceptible using existing grain-picking methods and so selection of grains that record the most significant geochronologic information is left to chance.

It is now fairly well established that the broad yellow band in the photoluminescent (PL) response of zircon is due to radiation-induced centers.[1] In geologic samples, the yellow response is therefore a rough proxy for U+Th concentration. Our new SIMS U and Th concentration data coupled with spectroscopic intensities on polished grains further confirm this is the case. Additionally, imaging of whole zircon grains with a petrographic microscope fitted with a tin-halide bulb and a long UV (365 nm) filter demonstrate that qualititative variations in this yellow response are readily observable, both among grains in a population of zircons and within single grains. In other words, PL imaging provides a practical means to assess the geochronologically critical parameters U+Th concentration and zoning *prior to* isotopic dating. Examples of picking based on PL response for geochronologic and thermochronologic applications will be given.

[1] Gaft et al., (2002). *Mineralogy and Petrology*, 76, 235-246.