Temperatures (Ti) and Compositional Characteristics of Zircon: Early Observations Using High Mass Resolution on the USGS-Stanford SHRIMP-RG

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The high mass resolution of the SHRIMP-RG allows the measurement of a fairly complete set of trace elements for zircon including ^{48}Ti, Sc, and all the REE. Using a spot size of 15-20 microns allows analysis of numerous discrete CL zones from a single zircon with minimal contributions from unknown material below the exposed surface. Suites of zircons from individual granitoid samples suggest several general observations. Temperatures (T) from individual zircons and suites of zircons can vary by 150-200 ^{o}C and may be normal (high to low, core to rim), reverse (low to high) or complex with sharp changes (high and/or low). Many elements and element ratios show a co-variation with T. Increasing Hf concentrations and a decrease in Th/U and Er/Yb with decreasing T is common. Decreasing REE, esp. LREE, and increasing positive Ce anomaly with decreasing T is a strong tendency. Hf concentrations can continue to increase after a minimum T is reached (eutectic?) indicating continuing zircon separation from the remaining melt. These trends and tendencies may result from co-fractionation of accessory minerals and/or be driven by the thermodynamics of crystal growth (like Ti). Process interpretations should be based on trends in individual samples as many samples have characteristics distinctive from general trends. Hydrothermal zircon as described by Hoskin is not unusual as a rim zone and may reflect a fine intergrowth of other minerals (i.e. apatite, titanite, oxides). Ti temperatures from these zones are often unreliable, and all analyses for Ti should include some screen (i.e. Ca, Fe) for Ti bearing minerals in addition to zircon. Molar ratios of total 3+ ions over P range from < 1 to > 5 with the majority >1 suggesting the general need for charge compensation other than the xenotime substitution. While trace element concentrations of zircons may not be diagnostic of rock type in general, careful analyses as described above provide valuable information about processes in igneous as well as metamorphic petrology.