

## Auxiliary Material A2: Zircon U-Pb Geochronology Analytical Procedures

Zircon U-Pb geochronology was conducted at the University of Arizona LaserChron center by laser ablation multi-collector inductively coupled plasma mass spectrometry (LA-MC-ICP-MS). A New Wave DUV193 Excimer laser (operating at  $\lambda=193$  nm and 35  $\mu\text{m}$  spot diameter) was used to ablate material to  $\sim 15$   $\mu\text{m}$  depths, after which ablated material is transported in helium into a GVI isoprobe plasma source and simultaneously measured for  $^{238}\text{U}$ ,  $^{232}\text{Th}$  and  $^{206-208}\text{Pb}$  element concentrations in static mode using Faraday detectors, and an ion-counting channel for  $^{204}\text{Pb}$  (ion yields are  $\sim 1.0$  mv/ppm). Each analysis consists of one 20 s integration on peaks with the laser off for background, 20 s integrations with the laser firing, and a 30 s delay to purge the previous sample and prepare for the next analysis. Common Pb correction is made using the measured  $^{204}\text{Pb}$  and assuming initial composition reported by *Stacey and Kramers* [1975] (uncertainty is 1.0 for  $^{206}\text{Pb}/^{204}\text{Pb}$  and 0.3 for  $^{207}\text{Pb}/^{204}\text{Pb}$ ). The measurement of  $^{204}\text{Pb}$  is unaffected by the presence of  $^{204}\text{Hg}$ , as the background measurement is subtracted. Inter-element fractionation of Pb/U is generally 20% whereas fractionation of Pb isotopes is generally 2%; in-run analysis of fragments every fifth run of large crystals of known age is used to correct for this fractionation. Uncertainty resulting from calibration correction is generally 1-2% for both  $^{206}\text{Pb}/^{207}\text{Pb}$  and  $^{206}\text{Pb}/^{238}\text{U}$ . Analyses  $> 30\%$  discordant or  $> 5\%$  reverse discordant are excluded from the data table and not considered further. All uncertainties are reported at the  $2\sigma$  level. Ages reported are interpreted to be crystallization ages determined by weighted mean  $^{206}\text{Pb}/^{238}\text{Pb}$  age of the youngest age population; older ages are interpreted to be inherited. The reported uncertainty is the quadratic sum of the weighted mean error added to the total systematic error for each set of analyses, including contributions from the standard calibration, age of the calibration standard, composition of common Pb, and the  $^{238}\text{U}$  decay constant.

Stacey, J. T., & Kramers, J. D. (1975). Approximation of terrestrial lead isotope evolution by a two-stage model. *Earth and Planetary Science Letters*, 26(2), 207-221.