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LETTER

**Ion microprobe analysis of  $(^{231}\text{Pa})/(^{235}\text{U})$  and an appraisal of protactinium partitioning in igneous zircon**

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**ABSTRACT**

Ion microprobe U-Pa measurements in zircon crystals from a Holocene rhyolite (Salton Buttes, California) are utilized to assess the partitioning of Pa and U between zircon and melt. The relative sensitivity factor (RSF) for ion microprobe U-Pa zircon analysis was calibrated on a natural high-U secular equilibrium zircon from Buff Peak (Nevada). Zircon crystals from Salton Buttes rhyolite show evidence for excess  $^{231}\text{Pa}$  with a weighted average  $(^{231}\text{Pa})/(^{235}\text{U})$  activity ratio of 1.9. From this ratio, model zircon-melt partition coefficient ratios  $D_{\text{Pa}}/D_{\text{U}} = 0.9\text{--}2.2$  are obtained, assuming plausible limits for  $(^{231}\text{Pa})/(^{235}\text{U})_{\text{melt}}$  and correcting for the age of zircon crystallization ( $\sim 15$  ka). These values roughly fit lattice strain models for tetravalent cations, but are more than one order of magnitude lower than predictions for pentavalent Pa. Based on this appraisal of Pa partitioning, initial  $^{231}\text{Pa}$  disequilibrium caused by zircon-melt fractionation alone can produce minor discordance or excess  $^{207}\text{Pb}$  in Late Cenozoic zircon, but is insignificant for older U-Pb zircon ages.

**Keywords:** Pa-231, zircon, partition coefficients, uranium disequilibrium, rhyolites