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**HIGHLIGHTS AND BREAKTHROUGHS**

# Going small: Nanoscale geochronology using atom probe tomography

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**Abstract:** Leaps forward in analytical technology often stimulate major discoveries in geochemistry. In some cases, the improvements are in sensitivity and precision. For example, recent measurements of minute variations in $^{142}Nd$, $^{182}W$, and U-series (to name a few) have revolutionized our understanding of terrestrial and planetary geochemical evolution. In other cases, the improvements are in the spatial scale of the analysis. Isotopic analysis of individual melt inclusions, single shell layers in mollusks and zoning layers in zircons, all have provided fundamental insights into geologic processes. Historically, whenever we look more closely at the composition of materials, we find unexpected features. These variations often are mystifying at first (see all of the above) and often somewhat unwelcome (too much information!). But it is precisely such new, headache-producing details that provide new insights into geological processes. On page 1355, Valley and colleagues use a promising new analytical method called atom probe tomography (APT) to analyze one of the oldest materials on the planet [Jack Hills zircons (Wilde et al. 2001; Valley et al. 2014)]. APT has a unique combination of spatial and geochemical analytical capabilities, which Valley et al. use to confirm the Hadean age of the zircons, and to gain new insights into their thermochronologic history. This is one of the first geochemical studies to use APT, and offers an early glimpse of future research paths. **Keywords:** Atom probe, zircon, tomography, geochemical analysis

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