

## **Raman spectroscopy-based screening of zircon for reliable water content and oxygen isotope measurements**

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### **ABSTRACT**

Water content and oxygen isotopes in zircon provide crucial constraints on magma source and process, yet they can be significantly modified by zircon metamictization, which causes secondary water absorption into the zircon crystal and the concomitant oxygen isotope changes. Therefore, it is imperative to develop a screening scheme to select the least-metamict zircons for the analyses. We propose a screening scheme based on our study on the Suzhou A-type granite (South China) through integrating Raman spectroscopy, water and trace element measurements, and oxygen isotope analysis. The results show that the primary water content is retained in zircon when the full-width at half maximum (FWHM) is  $<8\text{ cm}^{-1}$  or the Raman shift is  $>1007\text{ cm}^{-1}$  of  $\nu_3(\text{SiO}_4)$  vibration band, while the primary  $\delta^{18}\text{O}$  is preserved at  $<10\text{ cm}^{-1}$  FWHM or  $>1005.5\text{ cm}^{-1}$  Raman shift. Changes in trace element concentrations in Suzhou zircons are different from previous observations in metamict zircons but most likely related to magma evolution, which implies that trace elements are insensitive to metamictization. Primary  $\delta^{18}\text{O}$  in Suzhou zircons (4.5–6.0‰) fall into the mantle range, indicating a dominant mantle contribution to Suzhou granites. Primary water content was estimated at ca. 650–1400 ppm, significantly higher than those of typical I-type granite (400–736 ppm) and upper mantle-derived zircons (81–177 ppm). The high primary zircon water content was not controlled by the sub-solidus process, temperature, pressure, and cation charge balance but considered to reflect the high-water content in melts. This suggests a hydrous origin for the Suzhou A-type granite, which challenges the conventional view of anhydrous petrogenesis for A-type granites.

**Keyword:** Zircon water content, A-type granite, Raman spectroscopy, full-width at half maximum (FWHM), Raman shift, SIMS, trace element