An integrated O_2-Hf-U/Pb isotope study of zircon on crustal growth in the Yavapai Province of Colorado

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Nature and processes of continental crustal growth continue to be debated, with isotopic methods that shifted from whole rock to in situ single grain data. Zircon is one of the most robust geological recorders to assess juvenile vs. recycled crust, allowing to integrate in situ measurements of oxygen, Hf, and U-Pb isotopes on the same mineral growth zones. We present such integrated data from a N-S transect of 22 Paleoproterozoic orthogneisses from the Yavapai terrane in north-central Colorado (CO). The oldest magmatic rocks in N, central and S segments of the terrane are used to test 2 competing crustal growth models. Based on U-Pb zircon ages and Nd model ages one model proposed continuous southward accretion of arc crust, the other rifting in central CO with juvenile input from the mantle.

Most samples show limited scatter in $\delta^{18}O$ (4.8-6.6), mantle-like values typical for juvenile crustal provinces. Felsic rocks show a wider $\delta^{18}O$ range (4.3-6.6) than intermediate (5.2-6.2), but averages for both groups are within the mantle array. Only 3 felsic samples contain distinct subgroups. Unusually low $\delta^{18}O$ (3.1-4.4) resulted from hydrothermal fluid interaction.

Most U-Pb ages in the S are 20-30 Myrs younger than 1760-1785 Ma elsewhere. No age-$\delta^{18}O$ correlation is observed, negating increased crustal input into the source. N and S regions do not show distinct isotopic differences in Nd-Hf and Nd-δ18O are near mantle values. The central segment trends towards older crustal components in both Nd and Hf isotopic signatures, not a more juvenile as predicted, warranting more study.