Relict zircon tracking the source nature of peraluminous granite

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Peraluminous granites derived from partial melting of metasedimentary rocks are generally characterized by high $\delta^{18}O$ values and abundant relict zircons. Such relict zircons are valuable in tracking the source nature of granites and the history of crustal anatexis. Here we report in-situ U-Pb, O isotope and trace element analyses of zircons from Triassic granites at Zhuguangshan and Darongshan in South China.

Triassic syn-magmatic zircons are characterized by high $\delta^{18}O$ values of 10.1-11.9‰ for Zhuguangshan and 8.5-13.5‰ for Darongshan. Relict zircons show highly variable U-Pb ages, ranging from 315 to 2185 Ma and from 304 to 3121 Ma for the Zhuguangshan and Darongshan granites, respectively. Among them, the post-500 Ma relict zircons from Zhuguangshan and the post-400 Ma ones from Darongshan have similar $\delta^{18}O$ values to their corresponding Triassic syn-magmatic zircons, whereas the older relict zircons differ from them by showing both high and low $\delta^{18}O$ values. This feature is confirmed by examining the previously published data.

The younger relict zircons are interpreted as the peritectic mineral grown during incipient anataxis of the metasedimentary rocks after their burial to depths that meets the wet solidus of these rocks in the orogenic crust. Excluding such zircons, the remaining older relict zircons yield a main age peak at 700-1000 Ma for both granites. Through a comparison with detrital zircons from local sedimentary and metasedimentary rocks, which range from Neoproterozoic to Permian in ages, Neoproterozoic sedimentary rocks, together with minor Late Paleozoic sedimentary rocks, are the most appropriate source rocks for the Triassic granites. These crustal rocks were buried to appropriate depths for the significant anatexis in the Early Paleozoic when another strongly tectonothermal event took place in South China. This study highlights the significance of relict zircons in tracking the source nature of peraluminous granites and the history of crustal anatexis after correctly discriminating different origins of relict zircons.