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Ca-Sr-Nd isotopic signatures of Neoproterozoic ultramafic alkaline complexs along NW margim of the South China carton and its tectonic implications

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Alkaline igneous suites have long been interested due to their special compositions and rare occurance. They are commonly found in large igneous provinces and their petrogenesis has been frequently served to probe the regional tectonic configuration connected with deep mantle. Here, we present an integrated study of mineralogy, U-Pb dating, Sr-Nd and Ca isotopes compositions, as well as elemental geochemistry for the alkaline intrusive suites in the Wangcang-Nanjiang area of the Micangshan terrane, northwestern Yangtze Block in South China. Zircon dating data reveal two group ages, ~870 Ma ultramafic intrusive complexs and ~760Ma ultramafic-mafic cumulates. Both petrographic observation and geochemistry suggest that they belong to disparate rock sequences. The ultramafic-mafic cumulates have a SiO_2 range of 40.5-53.0 wt.%, moderate $Mg^{\#}$ values (40-65). They are characterized by LILE enrichments but HFSE depletions, and exhibit OIB-like Sr-Nd isotopic compositions with initial Sr isotopic ratios and εNd values (t = 760 Ma) of 0.7033-0.7051 and −1.3 to +2.4, respectively. The ~870 Ma alkaline intrusive complexs have wide ranges in alkalinity (total alkalis of 0.84-21.6 wt.%) and SiO_2 (38.6-52.5 wt.%) with $Mg^{\#}$ values of 30-63. They are also relatively enriched in LILE and depleted in HFSE. Similarly, they show wide initial Sr ratios (0.7040~0.7082) and εNd (− 5.6 to + 4.7) values (t = 870 Ma), comprising a successive array between the OIB and EM-2 fields. The ~760 Ma ultramafic cumulates display $\delta^{44/40}Ca_{NIST915a}$ values of 0.63‰-1.12‰, which as a whole are lighter than the average mantle value (0.94 ± 0.05‰), whereas the ~870Ma intrusive complex display relatively heavier Ca isotope compositions with a $\delta^{44/40}Ca_{NIST915a}$ range of 0.43‰~1.38‰. It is noted that long-term and multistage activities characterise alkaline magmatic provinces worldwide. Our work thus suggests that: 1) recycled crust components variously involved in mantle source rocks of the alkaline magmatism; 2) regional tectonic switch from slab subduction to rift occurred at ~870 Ma; 3) successive alkaline igneous activities are indicative of a progressive separation of the South China craton from Rodinia supercontinent.