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Neoproterozoic Magmatism in the Northern Margin of the Tarim Craton: Implications for Rodinia Reconstruction

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The geodynamic processes for the Neoproterozoic mafic-ultramafic intrusions and dykes in the Kuluketage region, Tarim Craton has also been debated for some time. Some researchers suggested that the Neoproterozoic intrusive rocks in this region are the products of the so-called South China mantle plume (Zhang et al., 2011) or an independent mantle plume (Ye et al., 2013). Recently, Zhang et al. (2012) changed their original view and suggested that in addition to mantle plume activity, subduction related basaltic magmatism also contributed to the formation of these mafic-ultramafic intrusive rocks. Since the various geodynamic models have different implications for Rodinia reconstruction, an independent study to evaluate the validity of the competing geodynamic models is needed. We have carried out such a study. We use our new results and existing geochronological data from the literatures to investigate whether or not the distribution of these intrusive rocks in time and space is consistent with a mantle plume origin. This is then followed by a more robust petrogenetic model that can well explain the observed variations of trace elements and Sr-Nd isotopes in these rocks. Finally, we provide the implications of our new results for Rodinia reconstruction

The mantle plume model for the Neoproterozoic mafic-ultramafic intrusive rocks (760–820 Ma) in the northern rim of the Tarim Craton (Kuluketage, Xinjiang, China) is a fallacy, because their temporal spatial distribution does not show a hotspot track that is expected for a mantle-plume origin. New and existing zircon U-Pb age data show an age difference of up to 11 Ma for a single mafic-ultramafic intrusive complex and an age difference of up to 25 Ma for two mafic-ultramafic intrusive complexes separated by only ~10 km. In addition, the age change occurs in different directions. The protracted Neoproterozoic mafic-ultramafic intrusive rocks in the Kuluketage mountain range are all characterized by moderate light rare earth element enrichments, pronounced negative Nb-Ta anomalies and low $\varepsilon Nd(t)$ values (1 to -11) coupled with elevated initial $^{87}Sr/^{86}Sr$ ratios (0.706 to 0.71), which are consistent with the products of arc basalts contaminated with crustal materials. The results support the notion that the northern margin of the Tarim Craton was part of the Neoproterozoic Circum-Rodinia Subduction System.

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