Ferrodoleritic dykes in the Tarim Craton signal Neoproterozoic breakup of Rodinia supercontinent

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Mafic dyke swarms are important bar codes for the rifting and breakup of supercontinents. Here we report a Neoproterozoic mafic (ferrodoleritic) dyke swarm from the Aksu area along the northern margin of the Tarim Craton, NW China. Zircon U-Pb analyses of two dyke samples yield ages of 801 ± 9 Ma and 804 ± 13 Ma. The ferrodoleritic dykes show high total FeO (11.55–14.55 wt%) and TiO_2 contents (2.84–3.26 wt%) and variable SiO_2 (47.90–52.74 wt%). They display positive anomalies of Rb, Ba, K and negative anomalies of Nb, Ta, Ti and the enrichment of light rare earth elements relative to heavy rare earth elements. The ~800 Ma zircon grains have variable εHf (t) values of –3.2 to –16.8, indicating a heterogeneous and enriched magma source. Trace element modelling suggests that the ferrodoleritic dykes were generated by low degree of partial melting (garnet lherzolite 3–5%, pyroxenite 5–10%) of a mixed mantle source (60% garnet lherzolite and 40% pyroxenite). The results from our study suggest two major mafic magma pulses at ca. 830–800 Ma and ca. 780–750 Ma during the Neoproterozoic, which we correlate to be response to the onset of Rodinia supercontinent breakup.