Assembly and breakup of the core of the Rodinia supercontinent

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The Rodinia supercontinent has been linked to many essential changes in the broader Earth system from late Mesoproterozoic to Neoproterozoic time, yet debate remains regarding the suturing and fragmentation between the major continents (Australia-East Antarctica and Laurentia) near the center. The main goal of this study is to better understand Rodinia's assembly and breakup by placing the Greater Tarim Block (GTB) at the heart of the supercontinent. We report high-quality paleomagnetic poles from well-dated early to late Neoproterozoic rocks of the GTB and present a quantitative constraint for the central-missing-link position of the GTB within Rodinia. Combining with quality-filtered paleopoles of major cratons, a revised missing-link model of Rodinia is confirmed from ca. 900 to 720 Ma. Integrating the new results with compilations of tectonomagmatic activity and geochronology, we propose a novel model for Rodinia assembly and breakup. In our model, following initial extroversion-peripheral subduction, Rodinia ultimately assembled through mega-dextral suturing, including early-stage introversion of near-orthogonal collision between southern GTB-Australia and northern GTB-Laurentia, and then dextral shearing along the Tarimian orogen in the GTB. For the breakup, superplume-related magmatism was accompanied by coeval large-scale rotation and slab-retreat subduction. All these features imply a more complicated geodynamic process for the supercontinent cyclicity than previously proposed.