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# Early Neoproterozoic circum-Rodinia accretionary orogen in the South China revealed by detrital zircon and rutile records

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Detrital minerals are crucial archives supplementing the rock records in constraining the paleogeographic reconstruction of supercontinents and secular evolution of plate tectonics. Detrital zircon has been widely used to track magmatic events, whereas detrital rutile has only recently been applied to trace the timing and condition of metamorphism, which is more sensitive to orogenic processes. Here, we applied multi-mineral detrital geochronology analysis of zircon and rutile to the late Tonian–Cryogenian strata of the Yangtze Block (northern South China), to constrain paleogeographic reconstruction of Rodinia and the plate tectonic regime in early Neoproterozoic. Detrital zircon and rutile grains of late Tonian Liantuo Formation indicate source contributions from both Archean-Paleoproterozoic basements and Neoproterozoic orogens. Glacial deposits of the Cryogenian Nantuo Formation show unimodal zircon and rutile age distributions with similar peaks at ca. 820-790 Ma. The distinct detrital age patterns between the Cryogenian glacial deposits and fluvial late Tonian sandstones reflect deep erosion of Neoproterozoic orogens by continental glaciers that supplies more distal-source detrital materials. The absence of Grenvillian aged detrital minerals indicate negligible contributions from Grenville orogens that extensively exposed in central Rodinia, such as the Laurentia and Australia. Moreover, Tonian aged detrital rutile grains (900-750 Ma) yield bimodal distributed Zr-in-rutile temperatures of 600–420 °C and 970–630 °C, suggesting an accretionary orogenic source characterized by coeval low and high temperature/pressure metamorphisms. Thus, combined magmatic and metamorphic detrital mineral archive supports a peripheral position of South China in the Rodinia. The prolonged subduction-accretionary orogenesis of the northern Yangtze Block during the Tonian Period constitutes an important part of the circum-Rodinia subduction system, which may involve the 1200–735 Ma Avalonia arc magmatism along the eastern Baltica margin, the ca. 1030–710 Ma Valhalla accretionary orogen along the western Laurentia margin, and the ca. 1100–700 Ma magmatic and deformation events in western Greater India. Therefore, as an important complement to global detrital rutile records, the early Neoproterozoic detrital rutile data presented in this study suggest cold and sustained subduction processes were likely prevalent along the margins of the Rodinia supercontinent.