Zircon and monazite U-Th-Pb and REE chemistry constraints on UHT metamorphism at Mather Peninsula, Rauer Islands, East Antarctica

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Zircon and monazite in ultrahigh temperature (UHT) metamorphic rocks and the related rocks at Mather Peninsula from the Rauer Islands of Prydz Bay in East Antarctica were investigated in terms of U-Th-Pb and REE chemistry. All analyzed samples yield c.522-517 Ma concordant zircon ages. Some of the UHT gneiss and the host orthogneiss preserve protolith/inherited zircon ages of c.3300 Ma and c.2800-2400 Ma along with highly discordant Mesoproterozoic to Neoproterozoic ages which confirm the Archaean protolith age for the Mather Peninsula. These data suggest that the Archaean and Mesoproterzoic components of the Rauer Islands were not amalgamated in the Rauer Tectonic Event at c.1030-990 Ma, and deposition of the Mather Paragneiss was considered at some time after the Rauer Tectonic Event. In contrast to the well-defined c.520 Ma ages obtained from the zircons in the UHT rocks, monazite grains measured by electron microprobe show a distinct internal zonation, from c.580-560 Ma dark-BSE cores enriched in MREE and HREE to c.550-520 Ma mid-BSE mantles and c.510-500 Ma bright-BSE rims. Based on the chemical and textural evidence we infer that the MREE-HREE-rich c.580-560 Ma monazite cores may have formed through the decomposition of garnet during decompression just after the UHT event, whereas the MREE-HREE-depleted c.550-500 Ma monazite grains/rims formed or recrystallized in reactions associated with subsequent extensive hydration during the upper-amphibolite to granulite-facies main Prydz Tectonic Event, which also caused marked recrystallization of zircon. The above data strongly support the interpretation that the UHT metamorphism occurred prior to c.590-580 Ma.