Protolith Ages and Timing of Metasomatism Related to the Formation of Whiteschists at Mautia Hill, Tanzania: Implications for the Assembly of Gondwana

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ABSTRACT

Mautia Hill, situated in the Mozambique Belt of East Africa, is a locality famous for its unique high-pressure whiteschist mineral assemblages. The rocks are located in a complex regional tectonic setting that is critical to understanding the amalgamation history of Gondwana.The timing of the Pan-African Gondwana collision in this region is still a topic of considerable debate, especially because the age of the Mautia high-pressure metamorphism/metasomatism has yet to be established. We have extracted detrital zircons with extensive low-U overgrowths and dated them using the U-Pb SHRIMP method. Detrital zircon cores indicate that the sediments came from a region identical to the adjacent Tanzania Craton and adjacent Western Mozambique Belt. One detrital grain has a $^{207}Pb/^{206}Pb$ age of ca. 3.5 Ga and is the oldest dated zircon in the region. The zircon rims provide 207-corrected $^{206}Pb/^{238}U$ and $^{208}Pb/^{232}Th$ weighted mean ages of 549 ± 41 and 535 ± 40 Ma, respectively, dating the age of collision between the Tanzania Craton and Madagascar-India during the assembly of Gondwana. This new age indicates that collisional orogenesis in this part of the East African Orogen occurred in a similar time frame as in many other parts of Gondwana, including South America, southern Africa, India, Australia, and Antarctica, but later than a ~640-Ma age previously attributed to the collision in this area by some authors.

Online enhancements: appendixes.

Introduction

New geological data from Mautia Hill in the western part of the Mozambique Belt in Tanzania are presented here and provide a critical new insight into the Pan-African Gondwana collision at the Neoproterozoic-Ediacarin-Cambrian transition, a crucial time period in Earth history, when the eastern margin of Africa collided with Madagascar, India, Australia, and eastern Antarctica. Recent research (Cutten 2004) identifies closure of the Mozambique Ocean by east-dipping subduction beneath Madagascar, with the final collision and thrusting of the continental arc as an imbricate stack of thrust sheets (the Eastern Granulites; Fritz et al. 2005) as the hanging wall of the orogen over the western Mozambique Belt footwall (the reworked margin of the Tanzania Craton). Most of the recent studies (especially since the 1980s) undertaken on the Pan-African rocks of Tanzania and Kenya have been conducted on the petrologically diverse, high-temperature Eastern Granulite hanging wall, largely because it contains mineral assemblages amenable to conventional and equilibrium thermodynamic geothermobarometry and also because high-temperature metamorphic conditions produced abundant metamorphic zircons for robust U-Pb dating. A peak metamorphic event at ca. 640 Ma is well documented for the Eastern Granulites and has been widely interpreted as dating the collisional event. In contrast, the footwall lithologies

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