

Detrital Footprint of the Mozambique Ocean: U/Pb SHRIMP and Pb Evaporation Zircon Geochronology of Metasedimentary Gneisses in Eastern Madagascar

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Abstract

The southern East African Orogen is a collisional belt where the identification of major suture zones has proved elusive. In this study we apply U-Pb isotopic techniques to date detrital zircons from a key part of the East African Orogen, analyse their possible source region and discuss how this information can help in unravelling the orogen.

U-Pb Sensitive High-mass Resolution Ion Microprobe (SHRIMP) and Pb evaporation analyses of detrital zircons from metasedimentary rocks in eastern Madagascar reveal that: 1) The protoliths of many of these rocks were deposited between ~800 and 550 Ma; 2) these rocks are sourced from regions with rocks that date back to over 3400 Ma, with dominant age populations of 3200-3000 Ma, ~2650 Ma, ~2500 Ma, and 800-700 Ma.

The Dharwar Craton of southern India is a potential source region for these sediments, as here rocks date back to over 3400 Ma and include abundant gneissic rocks with protoliths older than 3000 Ma, sedimentary rocks deposited at

3000-2600 Ma and granitoids that crystallised at 2513-2552 Ma. The 800-700 Ma zircons could potentially be sourced from elsewhere in India or from the Antananarivo Block of central Madagascar in the latter stages of closure of the Mozambique Ocean. The region of East Africa adjacent to Madagascar in Gondwana reconstructions (the Tanzania craton) is rejected as a potential source as there are no known rocks here older than 3000 Ma, and no detrital grains in our samples sourced from Mesoproterozoic and early Neoproterozoic rocks that are common throughout central east Africa. In contrast, coeval sediments 200 km west, in the Itremo sheet of central Madagascar, have detrital zircon age profiles consistent with a central East African source, suggesting that two late Neoproterozoic provenance fronts pass through east Madagascar at approximately the position of the Betsimisaraka suture. These observations support an interpretation that the Betsimisaraka suture separates rocks that were derived from different locations within, or at the margins of, the Mozambique Ocean basin and therefore, that the suture is the site of subduction of a strand of Mozambique Ocean crust.