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Detrital zircon U-Pb and (U-Th)/He geochronology of the central Morondava Basin, Madagascar

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Formation of the Phanerozoic basins of Madagascar coincided with the initial stages of Permian break-up of Gondwana. The sources of the sediments in these basins are from the seven major Precambrian terranes that border them. The tectonic history of rifting, drifting, and uplift of the Madagascan terrane over the last 300 million years is recorded within the sedimentary strata that comprise the Morondava Basin, the largest of these basins located along the west coast. In this study, we have applied detrital zircon U-Pb geochronology and (U-Th)/He low-temperature thermochronology to resolve the sedimentation patterns and thermal history of the Morondava Basin as Madagascar separated from Africa and subsequently India. Nine coarse-grained siliciclastic samples were taken along two transects parallel to the Morondava River in the central Morondava Basin. Karoo sandstones and shales were deposited directly atop the basement during Permo-Triassic rifting. Two samples from each transect were taken in the uppermost Jurassic Karoo sandstones. Overlying the Karoo are carbonates that were deposited as part of a carbonate platform as the basin experienced Middle Jurassic subsidence due to successful rifting during the separation of Madagascar and Africa. A Late Jurassic unconformity suggests tectonic quiescence. As the passive margin subsidence renewed, changes in eustatic sea level resulted in several cycles of sedimentation, and two Cretaceous samples in each transect were collected from this interval. Separation of India from Madagascar during the Turonian resulted in uplift of the central highlands and tilting of the Morondava Basin accompanied by extensive volcanic activity throughout the basin. Previously published apatite fission track studies mark this as the final stage of cooling. Above a Paleocene unconformity, deposition occurred in the Eocene with a package of sandstones and shales represented by a single sample in the southern transect. The detrital zircon U-Pb age distributions include common Neoproterozoic and Neoproterozoic populations which suggests input from the basement terranes of the Madagascan central highlands (Antananarivo domain). A subset of samples contain a Paleo- to Mesoproterozoic population linked to the metasedimentary Anosy domain and a Cambrian population associated with metamorphic zircon formed during the Pan-African Orogeny the source of which occurs in the southwestern basement terranes. Spatial variations within the detrital zircon U-Pb age populations indicate two distinct sedimentation patterns separating the north and south parts of the basin and a likely post-

Jurassic sediment recycling history within the Morondava Basin. Initial zircon (U-Th)/He ages range from 500 to 80 Ma with effective uranium (eU) values ranging from 35 to 1760, which exhibit a strong negative eU-age relationship and indicate partial resetting of zircon throughout the basin. The combined data will be utilized to construct the low-temperature thermal history of the basin.