Detrital zircon provenance of Paleozoic strata in the Falkland (Malvinas) Islands: Implications for basin evolution and Gondwanan reconstructions

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ABSTRACT

New U-Pb geochronological, Hf isotopic, heavy mineral, and sandstone petrographic results for Paleozoic strata of the Falkland (Malvinas) Islands help address renewed debates on the plate tectonic history, regional paleogeography, and basin evolution of this enigmatic feature prior to Mesozoic breakup of Gondwana. The Falkland (Malvinas) Islands are a fragment of continental crust in the southern Atlantic Ocean situated east of southernmost South America. Whereas the Falkland (Malvinas) fragment has long been considered an independent microplate that originated along the eastern Cape Fold Belt of southern Africa, recent geochronological, isotopic, and structural data allow the possibility of a fixed position within the broader submarine Falkland Plateau adjacent to eastern South America. This study integrates new geochronologic, isotopic and sandstone petrologic data coupled with heavy mineral data to reveal shifts in sediment provenance from the Silurian-Devonian West Falkland Group to the Carboniferous-Permian Lafonia Group. We report detrital zircon U-Pb results (n = 1306 LA-ICPMS ages) for 11 sandstone samples from the West Falkland Group (N=7 samples, n=837 grains) and Lafonia Group (N=4 samples, n=469 grains). Detrital zircon age distributions for the West Falkland Group point to similar contributions from Neoproterozoic-Cambrian (650-520 Ma) and Mesoproterozoic (1100-1000 Ma) sources. Heavy mineral assemblages and sandstone petrographic data from these samples indicate significant input from recycled sediments. A potential shift in sediment sources during Lafonia deposition is indicated by the appearance of late Paleozoic (350-250 Ma) and Proterozoic (2000-1200 Ma) age populations, decreased proportions of stable heavy minerals, and a shift to juvenile Hf values for <300 Ma zircons. The provenance change can be attributed to the onset of subduction-related arc magmatism and potential retroarc shortening and crustal thickening in southwestern Gondwana during Late Carboniferous to Early Permian time. The detrital zircon age distributions identified here reflect potential source regions in southern Africa and/or the Transantarctic Mountains in Antarctica, with southernmost South America (Patagonia) as a possible minor contributor during Paleozoic evolution of a passive margin that transitioned into a foreland basin that included the Malvinas (Falkland) Islands.

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