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Provenance analysis of Paleozoic strata in the Falkland/Malvinas Islands: Implications for paleogeography and Gondwanan reconstructions

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Abstract

New U-Pb geochronological, Hf isotopic, heavy mineral, and sandstone petrographic results for Paleozoic clastic deposits of the Falkland/Malvinas Islands help address renewed debates on the plate tectonic history, regional paleogeography, and basin evolution of this geologic enigma prior to Mesozoic breakup of Gondwana. The Falkland/Malvinas Islands have been considered either an autochthonous part of the South American continent or part of an independent microplate displaced from the southeastern corner of Africa. We report detrital zircon U-Pb results (n = 1306 LA-ICPMS ages) for 11 sandstone samples from the Silurian-Devonian West Falkland Group (N=7 samples, n=837 grains) and Carboniferous-Permian Lafonia Group (N=4 samples, n=469 grains). Detrital zircon age distributions for the West Falkland Group point to consistent 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 deposition of the Lafonia Group 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 regional shortening and crustal thickening in southwestern Gondwana during the Permian transition of a passive margin into an active, retro-arc foreland basin. The detrital zircon age distributions identified here reflect potential source regions in southern Africa and/or the Transantarctic Mountains in Antarctica. These results are most readily accommodated within a Gondwana reconstruction that includes the Falkland/Malvinas Islands as a rotated microplate originating on the eastern side of southern Africa as part of the Gondwanide fold-thrust belt spanning from the Ventania region of Argentina through the Cape region of South Africa and into the Ellsworth and Pensacola mountains of Antarctica.