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The Mantiqueira–Juiz de Fora Arc System: A Siderian-Orosirian Record of Crustal Growth and Reworking in the Southern Minas–Bahia Orogen, Brazil

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The Siderian–Orosirian interval records some of the most significant crustal growth episodes in South America, yet key Paleoproterozoic records are partially obscured by Neoproterozoic tectono-metamorphic reworking along craton margins. Here we present new whole-rock geochemistry, U–Pb and Lu-Hf zircon geochronology and whole-rock Sm–Nd and Sr isotopic data from orthogneisses (Mantiqueira Complex) and orthogranulites (Juiz de Fora Complex) that together constitute the Mantiqueira–Juiz de Fora Magmatic Arc System (MJFAS), a reworked segment of the southern Minas-Bahia Orogen preserved within the Central Ribeira Orogen, SE Brazil. Although these units were historically interpreted as distinct arcs due to contrasting Brasiliano metamorphic overprint (amphibolite vs. granulite facies), our integrated dataset indicates broadly comparable Paleoproterozoic protolith histories and shared petrogenetic affinities. The MJFAS comprises multiple felsic to intermediate suites, including TTG and TTG-like C-type adakitic compositions, sanukitoid-affinity rocks, K-rich high Ba–Sr suites, and late/post-collisional alkaline to A-type granitoids. Mafic members include island-arc tholeiites (IAT) and subordinate MORB- and OIB-like signatures, the latter potentially indicating transient slab-window or asthenospheric input. New U–Pb zircon data reveal (i) Archean inliers at ca. 2.86 Ga with Neoproterozoic Pb-loss/overprint, and (ii) dominant arc construction during ca. 2.26–2.09 Ga, with Brasiliano metamorphic disturbance recorded by lower intercepts mainly between ca. 0.60–0.51 Ga. Zircon εHf(t) values range from positive juvenile signatures in early arc rocks to dominantly negative values in many Rhyacian suites, consistent with variable mixing between juvenile mantle-derived melts and older crustal components. Whole-rock εNd(t) values (from ~+3.7 to ~−10) and TDM model ages (~2.05–3.4 Ga) similarly indicate heterogeneous magma sources and progressive incorporation of Archean material. Combining new and compiled datasets, we propose a comprehensive tectonic model for the southern Minas-Bahia Orogen involving diachronous development of multiple arc systems (Mineiro, Barbacena, and MJFAS) separating Archean blocks (São Francisco, Piedade, and internal slivers). The MJFAS records evolution from juvenile intra-oceanic to more evolved arc stages, followed by late Rhyacian collision and widespread late- to post-collisional bimodal and alkaline magmatism. These results refine crustal growth trajectories in the São Francisco–Congo paleocontinent margin and demonstrate how deep-crustal exposures within Brasiliano belts can preserve a detailed Paleoproterozoic arc-to-collision record despite intense Neoproterozoic reworking.