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Low- d18O shallow-level Neoproterozoic A-type granites from the Florianópolis Batholith, south Brazil

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Large portions of the extensive Florianópolis Batholith in south Brazil are dominated by post-orogenic ~590 Ma A-type granites emplaced at shallow crustal levels. Several distinct granite units (e.g., Ilha, Vila da Penha, Serra do Tabuleiro, Cambirela) are recognized from their mineralogical and textural features, but all share some key geochemical characteristics, in particular a strongly fractionated character, as indicated by very high SiO_2 (75-78%), low MgO (<0.10%), Sr (usually < 50 ppm) and high Rb/Sr (3-9, but up to 180). Such high-silica compositions require the operation of low-pressure evolution processes, either fractionation in shallow magma chambers or partial melting at upper crust. Absence or rarity of enclaves is another remarkable feature common to many of these granitic suites.

A pioneering study of in situ oxygen isotope determinations by SIMS in zircons from representative samples of the main A-type granite suites from the batholith reveals a wide range of $\delta^{18}O_{VSMOW}$ (+7.3 to +3.4‰). Intra-sample variations are often wider than typical uncertainties in individual analyses (±0.2‰), revealing the presence of zircon crystals and/or zones crystallized from distinct melts, i.e., reflecting open-system processes as magma mixing or contamination. An extreme case is an ignimbrite sample from the Cambirela suite at the Matadeiro Beach in Florianópolis, with a bimodal population of low (+3.4±0.4‰) and high (+6.9±0.2‰) $\delta^{18}O$ zircon crystals, suggestive of co-eruption of two acidic melts.

Of particular significance for the petrogenesis of the batholith is the identification of granites with low $\delta^{18}O$ zircon (e.g., Ilha Granite sample REF-04U: +3.5‰). Such sub-mantle values are interpreted in the literature as indicative of shallow-level remelting of hydrothermally altered crustal material, for example in the Yellowstone rhyolites.

Taken together with other evidence (e.g., similar weakly negative εNd(t); major and trace-element modeling), our results indicate that the Florianópolis A-type granites are products of shallow-level melting of recently crystallized, in part hydrothermally altered, calc-alkaline granites that may form the bulk of the deeper portions of the batholith.