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The Paleoarchean record of the São Francisco craton from zircon U-Pb and Hf isotope systematics.

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The Paleoarchean (3.6-3.2 Ga) is a pivotal time in Earth's history. Major events, including large-scale craton formation, important crustal growth episodes, and the likely transition in tectonic modes from hot-stagnant lid to active lid, occurred during this period. Therefore, links to fundamental planetary processes in the evolving Earth are preserved in the crustal record of this crucial period. The oldest known rocks in South America are Paleoarchean gneisses in the Mairi complex in the São Francisco craton (SFC) in Brazil [1,2]. In this study we report new zircon U-Pb and Hf isotope data from gray gneisses, granites, and a leucosome from the Mairi complex. The U-Pb data from six samples yield well-defined populations with $^{207}Pb/^{206}Pb$ ages spanning from 3.60 to 3.59 Ga. One gneiss yields a $^{207}Pb/^{206}Pb$ age of 3.4 Ga with presence of 3.6 Ga inherited zircons. Zircon xenocrysts older than 3.6 Ga were not observed in any sample. The Hf isotopic compositions in all samples are consistently subchondritic with a narrow range of initial $\varepsilon_{Hf(3.6Ga)}$ between -1.7 and -3.7. The subchondritic initial compositions of the ~3.6-3.4 Ga gneisses in the SFC are consistent with derivation and reworking/assimilation of a pre-existing crust. There is no evidence of juvenile, mantle-derived material in the 3.6-3.4 Ga gneisses. Our interpretation contrasts with previous work that suggests Hadean to early Eoarchean precursors for these rocks based on the assumption of the derivation from a depleted mantle reservoir [1,2]. Rather we suggest that the Hf isotope data reported in this study for the 3.6-3.4 Ga Mairi complex gneisses are consistent with derivation from melting of a ~3.8 Ga precursor of broadly chondritic composition, in agreement with the dominant Hf isotope composition of other 3.8-3.6 Ga gneisses worldwide [3-6].

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