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Evaluating the relative roles of crustal growth and recycling through continental arc magmatism in the Ross orogen, Antarctica

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There remains much debate about the mechanisms of the growth and differentiation of continental crust over geologic time, although the geochemical resemblance between continental crust and arc magmatism around the world make subduction-related magmatism a conspicuous candidate. It's clear that both juvenile magmatism *and* crustal recycling occur at convergent margins, but is it difficult to quantify the roles of these two end-member processes. This is particularly challenging in continental arc settings, where magmas ascend through and interact with thick continental lithosphere of variable—and usually unknown—age and composition. We assess the relative magnitudes of crustal growth and recycling in a 500-km-long segment of the Ross orogen of Antarctica—an archetypal example of a long-lived "Cordilleran-style" continental arc—utilizing an extensive set of zircon Hf ($\sim$70 samples) and whole rock Nd and Sr (15 samples) isotopic data for igneous rocks ranging from gabbro to granite. Initial ϵNd and ^{87}Sr/^{86}Sr values range from +0.1 to –10.3 and $\sim$0.7044 to 0.7137, respectively. Initial ϵHf values (weighted means of individual analyses from each sample) are predominately negative—ranging from +3.5 to –12.3—potentially interpreted as reflecting a dominant crustal component in the source of the granitoids. However, inherited zircon domains provide evidence for significantly less radiogenic ancient crust in the unexposed basement of the orogen. Additionally, primitive samples (SiO_2 < 52 wt%; Mg# > 69) range in initial ϵHf from approximately +0.8 to –4.0, representing juvenile magmatism with enriched isotopic compositions. While a broader range and lower ϵHf values (+3.5 to –12.3) in more evolved samples from large granitic plutons likely reflect variable degrees of crustal assimilation during differentiation, overlap with the isotopic compositions of primitive samples permits differentiation with relatively minor degrees of crustal assimilation. This qualitative interpretation is corroborated by binary mixing and assimilation fractional-crystallization (AFC) models, suggesting that the large granitic (*sensu lato*) batholiths of the Ross orogen reflect significant additions of new, evolved continental crust with subordinate crustal reworking. Precise quantitative estimates of the end-member processes of crustal reworking versus closed-system fractionation from juvenile magmas are hampered by the numerous assumptions in the mixing and AFC models. Instead, the aim of this study is to explore a *permissible range* of crustal growth/recycling scenarios. Our extensive radiogenic isotope dataset also expands our knowledge of the Ross orogen in the greater context of tectono-magmatic processes along the margin of East Gondwana in the late Neoproterozoic through the early Paleozoic.