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Tracing the Sr isotopic evolution of the Paleoarchean ocean: Novel insights from *in situ* Sr & Ca isotopic analysis of pillow basalt hosted carbonate.

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The sparse, fragmented, and deformed nature of preserved Archean crust has resulted in significant debate and uncertainty regarding the rate and timing of continental crustal growth throughout the Archean. The stark contrast in the Sr isotopic evolution of primitive mafic crust and felsic continental crust, coupled with the globally uniform radiogenic isotope signature of Sr in seawater, means that exploring the isotopic evolution of this element in the Paleoarchean ocean should provide insight into the rate of continental crustal growth throughout this era. Unfortunately, Archean marine carbonates are often significantly affected by post depositional alteration, which can profoundly disturb primary isotopic compositions making the determination of initial Sr isotopic signatures of the Archean ocean challenging [1,2].

Here, we present coupled *in situ* Sr and Ca isotopic analysis of submarine pillow basalt hosted carbonate from the remarkably well-preserved Pilbara craton, that span a period of 200 million years (3.5 – 3.3 Ga). Despite the preservation and undeformed nature of the sampled pillow basalt flows, our results highlight the necessity for detailed sample characterisation, *in situ* trace elemental, and isotopic analysis to effectively identify recrystallised zones or alteration, and to target carbonate that preserves primary undisturbed radiogenic Sr isotopic signatures. The most pristine undisturbed carbonate samples record a progressive increase in initial $^{87}Sr/^{86}Sr$ ratios relative to the evolution of bulk silicate earth from 3.5 to 3.3 Ga, implying significant volumes of evolved continental crust had formed and stabilised by 3.3 Ga, and that weathering of this crust was providing an increasingly significant proportion of the Sr flux into seawater throughout the Paleoarchean. These results provide a novel insight into the timing of continental crustal growth and preservation in the Paleoarchean, and improve our understanding regarding the composition of the primordial ocean at a time in which microbial communities were beginning to flourish [3].

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