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Granitoids in the Virgin Islands and implications for the growth of early-Earth-like continental crust

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The oldest continental crust is predominantly composed of sodic, plagioclase-rich, K-feldspar poor tonalite-trondhjemite-granodiorite (TTG) granitoid suites. These early-Earth TTG are considered to have relatively unique trace element contents symptomatic of (**1**) residual mineral phases during partial melting that retain certain elements (e.g., Sr in plagioclase, the heavy rare earth elements (HREE) in garnet and Nb-Ta-Ti in rutile), (**2**) the composition of the source region and (**3**) subsequent differentiation processes in ascending TTG magmas.

Both subduction-like and intracrustal tectonic settings have been suggested as possible early -Earth petrogenetic environments of formation. Geochemical studies have suggested that the TTG are derived from partial melting of metabasic source regions that have similar compositions to both Mesozoic Ocean plateaus and island arc basalts (IAB). However, investigating potential ancient TTG-like source regions is challenging due to the fragmentary record of crust-forming processes preserved in early Archaean terranes.

The modern Virgin Islands (VI) in the north-eastern Caribbean are underlain by (**1**) ~15–20 km thick Caribbean oceanic plateau (COP) crust and (**2**) volcanic and plutonic rocks with IAB affinities. Since ~60 Ma, north-directed underthrusting of the COP at the Muertos Trough has created two contrasting tectonic environment below the VI: (1) a shallow southern intraplate region (≤30 km) of stacked oceanic plateau and IAB crust, and (2) a deeper (≥30 km) northern oceanic plateau subduction region. In the Eocene, TTG plutons with early-Earth-like TTG compositions have intruded the VI in five main plutonic centres. Thus, the VI provide a unique setting to determine whether these early-Earth like TTGs were derived from metamorphosed IAB and/or oceanic plateau material from the southerly intraplate setting and/or the northerly subduction environment.

Here, I present field observations, initial whole rock major and trace element analyses and preliminary results from high pressure-temperature experiments designed to replicate the partial melting of oceanic plateau and IAB metabasic source regions and assess the stabilisation of residual plagioclase, garnet and rutile and their role in the formation of TTG in both the VI and on the early Earth.