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140-10: DO MID-CRUSTAL CORDILLERAN BATHOLITHS RECORD ARC FLARE-UP TRIGGERING PROCESSES?

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Triggering mechanisms responsible for Cordilleran arc flare-ups are hotly debated and there is little consensus about whether magmatic surges are driven by upper-plate processes (e.g., underthrusting of fertile continental crust) or mantle processes (e.g., slab tears/break-off). Radiogenic and stable isotopes in shallow- to mid-crustal batholithic rocks are commonly employed to provide insights into flare-up processes; however, it is unclear whether these rocks accurately record triggering processes, versus intra-crustal processing during transport through the crust and/or deep-crustal remelting and mixing.

We compare and contrast isotopic signatures from both mid- and lower crustal batholithic rocks in the Early Cretaceous portion of the 260-105 Ma Median Batholith, Fiordland, New Zealand to provide insights into this debate. We find that zircons from mafic to intermediate rocks in the lower crustal Western Fiordland Orthogneiss record a narrow isotopic range, with pluton-average zircon $\delta^{18}O$ values ranging from 5.3 to 6.1‰, and εHf values ranging from +2.9 to +5.0. These zircons show no evidence for interaction with crust, and we interpret them as having equilibrated with an enriched, sub-arc, lithospheric mantle melt. By contrast, mid-crustal rocks have more complex isotopic systematics that reflect variable interaction with a hydrothermally altered source. Eastern Separation Point Suite zircons from the Titiroa and Takahe plutons give $\delta^{18}O$ zircon values ranging from 3.7 to 3.9‰, and εHf values ranging from +7.2 to +7.6. Western Separation Point Suite zircons from the Puteketeke, Refrigerator Orthogneiss and West Arm Leucogranite show a strong, E-W isotopic gradient with $\delta^{18}O$ values ranging from 4.7 to 5.9‰, and εHf values ranging from +6.0 to +4.4. Isotopic modeling indicates that mid-crustal zircons are well described by 0-30% mixing of average Largs terrane (hydrothermally altered) crust with an enriched mantle melt. We conclude that lower crustal zircons record a mantle-driven flare-up involving an enriched, sub-arc lithospheric mantle source. In contrast, mid-crustal zircons display significant intra-crustal remelting and mixing. The absence of this signal in lower crustal plutons indicates that this crustal source was not a key factor in igniting the Cretaceous arc flare-up.

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