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Zircon chemistry-geochronology and melt inclusion constraints on the origin and critical metal endowment of late Devonian granitoid in the Port Mouton Pluton, Meguma Lithotectonic Zone, Nova Scotia, Canadian Appalachians

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Late Devonian satellite plutons (Shelburne, Barrington Passage, Port Mouton 'PMP') in SW Nova Scotia, coeval with the much larger South Mountain Batholith, show interaction between coeval felsic and mafic magmas. In the PMP, field and petrographic observations, bulk rock geochemistry, and EPMA were used to characterize mafic "enclaves" and constrain the conditions during interaction of mafic and felsic magmas, and their influence on the critical metal endowment of the granitoid magmas. Oxythermobarometric data from peritectic amphibole (after pyroxene) indicate that values of fO_2 in the mafic magmas shifted from FMQ+4 to FMQ+1 over a cooling window from ~850-700°C during this interaction, at P of up to ~390 MPa (14.7 km), much deeper than that of final magma emplacement. Zircon geochemistry and U-Pb dating based on LA-ICPMS analysis show that PMP zircon populations shift in predominant age populations across lithologies. Zircons from mafic lithologies (rounded, corroded, inherited or xenocrystic) returned exclusively Neoproterozoic ages (~550 Ma), whereas early granodiorites show predominantly Neoproterozoic ages (~560-620 Ma) and rare late-Devonian (~373 Ma) ages (consistent with PMP emplacement), with the balance shifting almost entirely to 370-390 Ma zircons in late-stage granodiorites and hybrid tonalites (formed by mixing of mafic and felsic magmas). PMP-coeval zircon from the felsic-intermediate rocks yield: (i) REE-HFSE ratios that diverge from typical magma fractionation trends, and (ii) values of fO_2 are widely variable in PMP-coeval zircon ranging from FMQ+1 to FMQ-5, decreasing with progressive fractionation. These findings suggest re-equilibration and thermal disturbance of small volumes of crystallizing felsic magmas by mafic magmas and strongly reducing wall-rock lithologies during deep magma gestation. Melt inclusions in zircon in the tonalite have low granophile critical metal (Sn, W, Mo) concentrations, comparable to average upper crust. The dominant Neoproterozoic ages in mafic rocks and early granodiorites in the PMP sparks new questions about the timing and source of mafic endmember magmas.