Magma Supply, Storage and Processing in the Central Aleutian Arc Calc-alkaline Hidden Bay Pluton

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Calc-alkaline plutons are major crustal building blocks of continental margins, but rare in oceanic island arcs. One of the most calc-alkaline I-type island arc plutons is the ~10 km wide Oligocene Hidden Bay pluton on Adak Island in the Aleutian arc, which intrudes the mafic volcanic-sedimentary rocks of the Eocene Finger Bay Formation. A comparion with continental plutons shows similarities in the compositions of intrusive units, mineralogy and chemistry (including a Daly gap) in line with common processes. A difference is the oceanic like isotopic ratios ($^{87}Sr/^{86}Sr$ = 0.703-0.7033; εNd = 9-7.8) and non-continent like LIL ratios in the Hidden Bay pluton. Ar/Ar ages of 16 gabbro, porphyritic diorite, diorite, granodiorite, leucogranodiorite and aplite samples range from 34.6 to 30.9 Ma with the ~4 Ma history apparently reflecting a time of magmatic waning as the arc front moved northward, possibly at a time of accelerated forearc subduction erosion. The chemistry of the homogenous gabbros is basically similar to the high Al basalts at young Adak Island volcanoes in the north suggesting little temporal evolution in the chemistry of the deep magma source. Instead, pluton formation seems to require a relatively closed system magma supply that favors an increase in K, Ti and OH compared to the volcanic stage and a sufficient crustal thickness (now ~37 km), fluid concentration and contractional stress that pargasitic hornblende is stabalized at depth. Fractionation models suggest the gabbroic to leucogranodioritic units evolved in the lower to mid-crust with more silicic magmas rising buoyantly to higher levels where final crystallization and segregation of aplites occurred. Most gabbroic and all mafic dioritic samples are crystal cumulates. The volumetrically dominant silicic diorite and granodiorite units (58-63% SiO_2) show the most mineral zoning and have compositions approaching those of melts. The leucogranodiorite (67-70% SiO_2) is the youngest. The plutonic units can be interpreted as deep-crustal differentiates of high-Al basalt. High Sm/Yb ratios in a few adakitic dike and porphyry samples require a garnet-bearing residue, which can be associated with forearc components removed by forearc subduction erosion.