



## **Rejuvenation of deeper magma reservoirs during differentiation: an example recorded in a post-plutonic dyke swarm S-Adamello (N-Italy)**

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The Adamello Batholith (42-29 Ma) is located in the Northern Italian Alps. It intruded into the Southern Alpine basement and its Permo-Triassic cover. In the Southern part a series of late dykes intruded into gabbroic and mainly tonalitic plutonic bodies. Models for volcanic eruptions of intermediate to silicic magmas are associated with the intrusion of fresh mafic magma into a magma reservoir, triggering eruption of the resident more evolved magma. Here we present an example of a series of post-plutonic dykes ranging from picro-basalts to dacites that indicates rejuvenation processes.

Distinct phases of magma intrusion are documented by compositionally distinct dykes. Various degrees of magma mingling are widespread in this sequence. Primitive primary magmas occur as picro-basaltic dykes that are consistent with mantle-separation conditions of 28 kbar and 1370°C constrained, by multiple saturation experiments (Ulmer 1988). More evolved magmas in the same dyke swarm are homogeneous amphibole-plagioclase-phyric basaltic-andesites to dacites, which are almost devoid of mingling textures. Textures and mineral zoning patterns indicate a continuous differentiation process for these intermediate magmas at mid-crustal depth. In contrary, the mingled magmas display amphibole textures from pristine to complete pseudomorphs now present as clinopyroxene. Plagioclase and amphibole show reverse zoning and the common occurrence of bands or cores with sieve textures, indicating resorption processes of crystals related to the interaction with high-temperature mafic magma.

Chilled margins and liquid apophyses of the mingled basalts and basaltic-andesites show crystallization of microphenocrysts of olivine+clinopyroxene+plagioclase at the emplacement level. In strongly mingled parts of the dykes resorbed amphibole is overgrown by fresh amphibole corresponding in composition to the microphenocrysts. Trace-element partition-coefficients between the cryptocrystalline matrix and these microphenocrysts in the chilled margins of the same conduits were determined resulting in  $K_d$ 's that are consistent with conditions close to the upper temperature stability of amphibole as constrained by experimentally determined partition coefficients ( $\sim 1020^\circ\text{C}$ ). In contrast, amphibole-plagioclase thermometry of the quenched matrix of more evolved basaltic-andesites/andesites reveals temperatures of  $920\pm 35^\circ\text{C}$ . Textures and mineral-chemistry of mingled magmas imply rejuvenation of an evolved magma reservoir by interaction with a replenishing hotter mafic magma.

On a regional scale the occurrence of basaltic-andesites/andesites is confined to the NE part of the entire dyke swarm within the S-Adamello and vanishes northwards. This pattern appears to define a zone at mid-crustal depth where sustained fractionation and/or assimilation is more widespread, leading to a more evolved composition of the mingled products and a potential source for feeding the dyke swarm located in the SW.

### References:

Ulmer, P., High pressure phase equilibria of a calc-alkaline picro-basalt: Implications for the genesis of calc-alkaline magmas. Carnegie Institution of Washington Yearbook, Annual Report of the Director of the Geophysical Laboratory, 88, 28-35 (1988).