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Hybridization of magmas by break down of partially molten granitic rock and its assimilation

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During orogenic processes continental crust experiences significant partial melting. Repeated thermal pulses or fluctuation in fluid content can even cause multiple anatectic events that result in complex intrusion suits. The Vosges Mountains (NE France) reveal two chronologically and geochemically distinct tectono-magmatic events. An early major pulse of Mg□K magmatism was followed ten millions years later by development of a magma-rich detachment zone and intrusion of Central Vosges Granite forming a felsic MASH zone. This MASH zone is characterized by the production of a large quantity of anatectic melts that interacted with the older Mg□K granites and surrounding granulites and metasedimentary rocks. We aim to understand how such hybridization processes impact on the crustal rocks rheology, deformation as well as its geochemistry and geochronology. Three different granite varieties were distinguished: (i) the older Mg□K granite end-member that is coarse-grained with a high proportion of feldspar phenocrysts, zircon U-Pb ages of 340 Ma and specific geochemical signature; (ii) Medium-grained type has a smaller amount of phenocrysts and shows advanced brecciation where fine-grained Pl+Kfs+Qtz form discontinuous corridors to an interconnected network surrounding fractured phenocrysts. Its geochemical signature suggests that this represents a mixing of Mg−K and Central Vosges granites, as confirmed by the presence of both inherited (340 Ma) and younger (330□310 Ma) zircon domains; (iii) Isotropic medium-grained granite that shows geochemical signature typical for the Central Vosges Granite in which younger zircon domains (310□320 Ma) dominate over inherited xenocrysts (340 Ma). These three granite varieties represent different stages of magma hybridization by the break up of the older Mg□K granite by the younger Central Vosges Granite magmas. The interaction between new melt and previously crystallized granitoids results in variety of granite textures, fabrics, chemical compositions, isotopic signatures and deformational behavior. In summary, the resulting signature is result of interplay of melt transfer and interaction in the MASH zone.