

Repeated granitic magmatism during Variscan collapse

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Partial melting in the continental crust is widespread in the late stages of orogenic evolution, particularly during gravitational collapse stages. This is well documented in the Variscan crust of France, in both the Massif Central and south Armorican domain. In the latter, the late Variscan evolution is marked by exhumation of lower continental crust (migmatitic unit), the working of large crustal-scale strike-slip and extensional shear zones, which accommodate exhumation of the lower crust, and the emplacement of syntectonic granites along them. Migmatites and granites are cut by granitic aplites and pegmatites which, at first glance, could be seen as late magmatic emplacement related to final crystallisation stages of parental granites.

We have performed high-resolution geochronological dating of one of these granites (the Quiberon granite) and of the dykes that cut through. The Quiberon granite emplaced within a detachment zone accommodating east-west extension. We found three periods of magmatism separated by about 10 to 15 millions years. The three stages of granitic emplacements relates to three distinct episodes of partial melting in the deep, exhuming continental crust. The late magmas (aplites and pegmatites) likely formed through biotite-out dehydration-melting reactions during lower crust exhumation, whereas the former main granitic body formed through muscovite-out dehydration-melting reactions, comparable with the ones recorded in the migmatites units now exposed underneath the granites. This repeated magmatism provides clues to understand the genesis of late orogenic rare-metal granites.

In the underlying migmatites, vertical granitic dykes display orientations compatible with the regional horizontal east-west extension. The age of these dykes is similar to the age of one of the three episodes of the granitic magmatism in the overlying Quiberon granite. Thus, this system offers a unique opportunity to characterize differentiation of crustal granites during their migration towards the surface. Actually, fractional crystallisation occurs during vertical migration.