Pegmatite fields of French Variscan Massifs : proximal markers of a partial melting front

Eric Gloaguen, Charles Gumiaux, Romain Millot, Catherine Guerrot, Floriane Leopold Dit Offite, Melanie Lete, Julie Michaud, Sarah Deveaud, Jérémie Melleton, Blandine Gourcerol, et al.

Geophysical Research Abstracts
Vol. 21, EGU2019-15935, 2019
EGU General Assembly 2019

Pegmatite fields of French Variscan Massifs : proximal markers of a partial melting front

Eric Gloaguen (1,2), Charles Gumiaux (2), Romain Millot (1), Catherine Guerrot (1), Floriane Leopold dit Offite (1,2), Melanie Lete (1,2), Julie Michaud (2), Sarah Deveaud (1,2), Jérémie Melleton (1), Blandine Gourcerol (1), Laurent Guillou-Frottier (1,2)

(1) Bureau de Recherches Géologiques et Minières, Georesources Division, Orléans Cedex, France (e.gloaguen@brgm.fr), (2) Université d'Orléans/CNRS/ISTO/BRGM, UMR 7327, 1A rue de la Férollerie, 45071 Orléans, France

Geological processes that lead to lithium-caesium-tantalum-rich pegmatites remains poorly constrained and understood. This type of rare-metal pegmatites, which sometimes constitutes economic Li±Sn±Ta±Be deposits, are generally encountered in the vicinity of large pegmatite fields frequently focused on migmatitic areas. Two distinct models for pegmatitic melt generation are proposed: 1- products of the end-of-crystallization melts of fractionated granites; or 2- products of low-rate partial melting of metasedimentary rocks.
In order to constrain geological processes related to pegmatitic melt generation, we applied several approaches (field work, statistical spatial analyses, mineralogical, geochemical and isotopic studies) on two well-known areas hosting rare-metal and barren pegmatite fields: 1) the Montagne Noire migmatitic dome; and 2) the Ambazac Mounts. In the Montagne Noire migmatitic area, the mineralogy of pegmatite clusters mimics the host-rocks with biotite-bearing pegmatites mainly hosted by migmatitic paragneisses and muscovite-bearing pegmatites mainly hosted by migmatitic orthogneisses. statistical spatial analyses studies demonstrate that pegmatite clusters are scattered in the center of the dome and do not appear randomly. Lithium isotopes show that the mineralized pegmatites are not fractionated and have likely a crustal signature. Rb/Sr dating on lepidolites shows that pegmatite emplacements are synchronous with the regional partial melting. Secondly, in the Ambazac mounts area, structural studies and 3D modelling suggest that this area may correspond to an anatectic dome masked by a granite, where pegmatite clusters are hosted by the Saint-Sylvestre granite. This granite crops on the border of the dome. Statistical spatial analyses studies demonstrate that emplacement of pegmatite clusters are controlled by normal faulting. Lithium isotopes show that the mineralized pegmatites are not fractionated and have also a crustal signature. Rb/Sr dating on lepidolites shows that pegmatite emplacement postdates the granite emplacement and is coeval with a late regional partial melting event.
Following this, a compilation of the geology of rare-metal pegmatites fields of France has been conducted. This compilation underlines several common features between the distinct pegmatites fields: i) they are usually located in or along antiformal structures; ii) the core of antiformal structures consists of migmatites if erosion level is sufficient, otherwise the core consists of metasedimentary rocks or is occupied by anatectic granites; iii) the highest density of pegmatites occurs mainly in migmatites; iv) rare-metal pegmatites seem to be absent in the case of LP-HT partial melting.
Thus, these results point to an anatectic origin of pegmatite fields with a strong tectonic control of pegmatite cluster emplacements above migmatitic domes. Then, the presence of pegmatite indicates presence of an underlying partial melting zone. Moreover, the absence of mineralized pegmatites in the case of low-pressure melting conditions suggests that pressure has a key role in magma enrichment processes during partial melting.