Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.15353

Mississippian geodynamic evolution of the Variscan chain in the Morvan region (NE of the French Massif Central): insights on the origine of the post-subduction vaugnerites

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Following the N-S subduction of Rheic/Saxo Thuringian oceanic domains, the geodynamic evolution of the Variscan belt in the French Massif Central experienced a continental collision during the Mississippian and its magmatism has evolved from calc-alkaline to collisional. However, some of the magmatic occurrences yield complex geochemical signatures. Among them, the vaugnerites from the northern part of Morvan (NE of the FMC) illustrate processes that need to be better constrained. We conducted a petrologic, geochemical and dating study to better understand their origin. The mineralogical bimodality of vaugnerites displays two coeval components (basic and evolved) which interacted to generate MASH-type petrographic textures, suggesting crustal and deep sources involvements. The vaugnerites show continental, intraplate (OIB-type) and subduction-related geochemical signatures (calc-alkaline and adakitic), and their U-Pb ages on zircon obtained by LA-ICP-MS are between 332.2 ± 3.9 and 325.9 ± 2.8 Ma. The geochemical and temporal evolutions of these vaugnerites suggest that during the Visean and Serpukhovian, after the main collision event, the subducted oceanic slab underwent a roll-back, which triggered the upwelling of a deeper enriched asthenospheric mantle through the metasomatized one. This thermal anomaly upwelling (OIB-type signature) induced simultaneously the partial melting of both the subducted oceanic slab and the metasomatized mantle, which gradually has been delaminated (calc-alkaline and adakitic signatures). Both the trace element contents normalized to the upper continental crust with values close to 1, and the $^{87}Sr/^{86}Sr$ ratios vs. SiO_2 % confirm a crustal contribution.

Our new data also suggest that either (1) the subduction-related magmatism in the southern Morvan continued after the Middle-Late Devonian and vanished gradually during the main collision and then a subducted slab is preserved in the metasomatized mantle, or (2) that additional subduction systems existed and affected the continental crust of the NE portion of the French Massif Central. This scenario can perhaps be extended to a larger part of the chain because the vaugnerites of the Morvan are similar to those present in the Vosges Massif.