Carboniferous HP metamorphism and flow of the lower crust from the hinterland towards the northern and southern forelands of the French Massif Central.

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Résumé

The French Massif Central (FMC) exposes portions of the deep orogenic crust in the Variscan hinterland and also in parts of foreland regions. In the eastern FMC (east of the Sillon Houiller Fault), most of the deep crust units contain variably retrogressed eclogites, either embedded in migmatites or located in the leptyno-amphibolitic complexes (LAC). Recently, the Silurian age of high-pressure (HP) metamorphism has been questioned; several studies propose Devonian or Carboniferous ages for eclogitization. In addition, the eclogites from the Montagne Noire massif have been used to discuss the flow of the partially molten crust from the hot orogenic hinterland toward the southern foreland.
In order to evaluate the origin of eclogite protoliths in migmatite and the LAC, we sampled 33 eclogites and 10 amphibolites along a north-south transect from the Morvan to the Montagne Noire, through the Monts du Lyonnais, Vivarais, Haut-Allier, Marvejols, and Lévézou massifs. We obtained major- and trace-element as well as isotopic geochemical data for each locality on the transect. We have also performed LASS-ICPMS U-Pb geochronology and trace-element geochemistry on zircon and rutile, as well as phase diagram modeling and trace-element thermometry to decipher the Variscan pressure-temperature-time paths.
Our results document the geochemical signatures associated with distinct magmatic ages, suggesting multiple different pre-Variscan origins for the eclogite protoliths. Our petrochronological results define a HP metamorphism at ca. 340 Ma associated with high-temperature

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conditions (_˜750-850 ∘C) in the core of the FCM, and younger ages at ca. 320-310 Ma and lower temperatures (_˜700-750 ∘C) near the northern and southern edges of the FMC. We propose that these preliminary results indicate Carboniferous flow of the partially molten deep crust from the orogenic hinterland toward both the northern and southern forelands during the Variscan orogeny. Ongoing analyses will provide new data to test this hypothesis further.

Mots-Clés: French Massif Central, Eclogites, Deep crustal flow, LASS, ICPMS U, Pb geochronology, Geochemistry, Phase diagram.