

Crustal affinities of the Late Carboniferous calc-alkaline volcanism from the SW Massif Central (France)

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At the end of the Hercynian orogeny, the European Variscan chain is characterized by the development of Upper Carboniferous coal-bearing intramontaneous basins controlled by transcurrent faults. These basins are filled by clastic sediments with interbedded calc-alkaline and shoshonitic lavas. The origin of this post orogenic volcanism is still a matter of debate: mantle source metasomatized by previous subduction fluids or contaminated by continental crust. Thus, the natures of the sources involved in the genesis of this Late Carboniferous volcanism are important to depict the evolution of the continental lithosphere at the end of the

Carboniferous times and before the Permian rifting.

Volcanic rocks are located at the base (Decazeville) or interbedded (Figeac, La Capelle Marival, Capdenac) within the sedimentary pile, dated as Stephanian. The oldest lavas are composed of rhyolite (dated as $333 \text{ Ma} \pm 2$ by U/Pb on zircons; [Bruguier *et al.*, 1998]) opx + cpx \pm olivine phryic-basalt and mafic andesite which are calc-alkaline. The youngest lavas form two suites: basalt-trachyte and rhyolite which are petrographically similar to the oldest lavas, but geochemically different because they exhibit shoshonitic affinities (higher Th/Yb, Ta/Yb ratios).

Relative to N-MORB, the calc-alkaline and shoshonitic lavas are depleted in Nb, Ta and Ti. They have Light Rare Earth (*LREE*) enriched patterns relative to heavy (*HREE*) [(La/Yb)_{cn} = 5 and 13] but the rhyolites differ by lower *LREE* abundances.

All these rocks have Nb and Ta abundances similar to those of the lower continental crust while their Th contents fall in the range of the upper crust. Moreover, they have negative $\epsilon\text{Nd}_{(T = 300 \text{ Ma})}$ (between -2 and -6). These geochemical features suggest that this late-orogenic volcanism displays a crustal affinity.

This Late Carboniferous volcanism does not differ from the contemporaneous one present in the French External Alps and in the Pyrenees. Its emplacement at the end of the Hercynian orogeny in pull apart basins suggests that its origin is linked to the extension of the very thick Variscan continental crust which tends to restore its normal thickness.

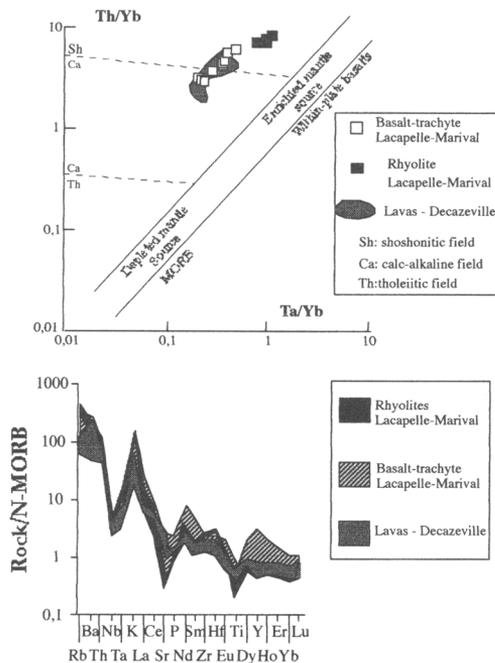


FIG. 1