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# Petrological and $^{40}\text{Ar}/^{39}\text{Ar}$ geochronological study of shear zones in the Cap de Creus massif (North-East Spain)

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## Résumé

An integrated petrological and geochronological  $^{40}\text{Ar}/^{39}\text{Ar}$  study has been conducted on NW-SE striking shear zones of the Cap de Creus Variscan massif, at the eastern end of the Pyrenean Axial Zone. Petrological and mineralogical observations suggest that shearing occurred at  $\sim 450\text{--}500^\circ\text{C}$  under low pressure conditions. Step-heating and in situ laser probe dating of micas from unsheared to ultramylonitic rocks show a conspicuous relationship between the deformation gradient, the amount of syntectonic (re-)crystallization, the resetting of Variscan mica chronometers and the record of Eocene crystallization ages by newly formed synkinematic micas. In the unsheared high-grade metamorphic rocks, Variscan micas yield meaningless Triassic  $^{40}\text{Ar}/^{39}\text{Ar}$  ages that appear to result from metasomatic overprinting prior to the upper greenschist-facies mylonitisation. Two belts have been studied, the Northern Shear Belt (NSB), and the Southern Shear Belt (SSB). In the ultramylonites from the NSB, synkinematic fine-grained muscovite provides a crystallization age of 42–44 Ma while inherited clastic muscovite has ages between 100 and 175 Ma depending on grain size. In the SSB, mylonitic deformation developed within a Variscan granodiorite emplaced at high crustal level. Magmatic biotite from protomylonite preserves a significant amount of inherited argon while synkinematic metamorphic micas from mylonites and ultramylonites have crystallization ages between 44 and 39 Ma, in agreement with the ages reported in the NSB. These Lutetian-Bartonian ages suggest that shear zones in the Cap de Creus massif were active during the main period of convergence of the Iberia and Europe plates and emplacement of the south-verging nappes. We propose that such NW-SE mylonitic structures developed as Riedel faults within a large-scale system of NE-SW trending faults and that they represent onshore precursors of offshore transfer faults related to the first opening stages of the Gulf of Lion.

**Mots-Clés:** Cap de Creus, shear zones, dating, Eocene

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