



Time-evolution and strain distribution of a major shear zone (SASZ, Brittany, France)

Romain Augier (1,2,3), Hugues Raimbourg (1,2,3), Mathieu Bellanger (1,2,3), Paul Turrillot (1,2,3), and Patrick Monié (4)

(1) Université d'Orléans, ISTO, UMR 7327, 45071, Orléans, France 9 , (2)

CNRS/INSU, ISTO, UMR 7327, 45071 Orléans, France 10 , (3)

BRGM, ISTO, UMR 7327, BP 36009, 45060 Orléans, France (romain.augier@univ-orleans.fr), (4) Géosciences Montpellier UMR 5243 - CC 60, Université Montpellier 2 Place E. Bataillon 34095 Montpellier cedex 5

Mylonite-bearing crustal shear zones are exhumed extensions at depth of (potentially seismogenic) brittle faults at shallow structural level. By concentrating deformation, shear zones play a major role in the rheology and mechanical behavior of the continental crust. Analysis of shear zone geometry and microstructures is a useful tool to decipher deformation kinematics, though finite strain estimation is still relatively qualitative. Timing of the deformation has also been the focus of numerous studies using the complete spectrum of geochronometers. However, only rare examples provide geochronological data that can be unambiguously linked with deformation. Thus, time-scales over which major mylonite zones develop and remain active under ductile conditions as well as their strain rates often remain poorly documented. Several sections across the South Armorican Shear Zone (SASZ), a crustal-scale, several km-thick dextral shear zone were investigated by structural, petrological and Ar/Ar radiochronological methods. Finite strain profiles on these sections showed a strong deformation partitioning towards the ultramylonite core of the SASZ, with a decrease, of both the C'/S mean angle (from ca. 45° to less than 5°) and the Quartz grain-size (from ca. 150 to 5 μm). In parallel, conventional and in-situ Ar/Ar datings on the fabric-forming white micas were performed on compositionally complex white-micas. Inherited magmatic muscovites carried by the foliation and newly-formed, syn-tectonic substituted phengites located along the shear bands yielded 2 age groups for the less deformed samples. Along the shear zone cross-section, the difference between these two ages evolves from 10-15 Ma in weakly deformed domains to zero toward the SASZ core. In addition, the very fine-grained syn-tectonic phengites yielded the same ca. 300-298 Ma age irrespectively of their distance to the core of the shear zone, even in slightly deformed rocks distant by several km. These results support a new model of crustal-scale shear zone activity, where the whole body of the shear zone is active throughout its history, i.e. the actively deforming zone does not get progressively narrower. The strain distribution nevertheless evolves with time, with an increasingly larger fraction partitioned in the ultramylonitic core. Besides, combination of the finite strain estimations and the Ar/Ar ages enables us to assess the range of strain rates associated with mylonitization.