Fluids in the South Armorican Shear Zone, France

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The South Armorican Shear Zone (SASZ) is a lithsopheric-scale shear zone from western Europe that was active during Variscan times. U–Pb analyses on zircon and monazite and ^{40}Ar-^{39}Ar analyses on muscovite from mylonites and syntectonic granites define a minimum duration of 20 Ma for the deformation and magmato-hydrothermal history along the SASZ, between 320 Ma and 300 Ma. Giant quartz veins associated with the deformed zones record important crustal-scale fluid circulations. Most quartz veins have $\delta^{18}O$ values between 10 and 16‰, indicating a crustal origin for the fluids. Microthermometry on fluid inclusions from euhedral quartz indicates that late fluids were mostly aqueous with very low salinity (0–1.7 wt% eq.) and with homogenization temperatures ranging between 150 and 270 °C. Together with very low $\delta^{18}O$ values of some euhedral quartz down to -2‰, these features argue for a surface origin for these fluids. Calculated $\delta^{18}O_{fluid}$ values of about -11‰ reflect surface-derived fluids sourced at high elevation. Independantly, some mylonites from the SASZ have low $\delta^{18}O$ silicate values compared to their undeformed protolith, which has to be related to the influx of surface-derived waters. The heat source necessary for this crustal scale downward fluid infiltration followed by upward motion was likely provided by the exhumation of lower crustal units in the South Armorican domain. New investigations are currently in progress, notably δD measurements on micas from mylonites from both the SASZ and associated detachments to better constrain the paleo-altitude reached during the orogeny. Various ore deposits were formed during these events, so that this integrated study should help to draw the metallogenic crustal landscape of this region.