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Water-assisted migmatization of metagreywackes in a Variscan shear-zone: scale dependence of chemical reequilibration in leucosomes (Aiguilles Rouges massif, western Alps)

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Migmatitic rocks developed in metagreywackes during the Variscan orogeny in the Aiguilles-Rouges Massif (western Alps). Partial melting occurred 320 Ma ago in a 500m-wide vertical shear-zone in response to decompression within a thickened crust. Three leucosome types have been distinguished on the basis of size and morphology criteria: (1) small leucosomes (thinner than 2 cm and shorter than 40 cm) with thin dark selvages (in stromatic migmatites); (2) large leucosomes with thick dark selvage (melanosome), wider than 2 cm and longer than 40 cm; (3) same as type 2 but lacking dark selvage and containing centimetric dark nodules. Partial melting occurred by dehydration of muscovite. Mineral assemblages and thermodynamic modeling using PERPLEX (J. Connolly, ETHZ) restrict partial fusion to about 650°C and 400 MPa. Calculated melt percentage without additional water is only a few percents, whereas it reaches the observed 20 percents with addition of only 1 percent external water. Restriction of widespread migmatization to a 500m-wide shear-zone, while neighboring lithologies recording similar P-T conditions should have melted as well, is interpreted as evidence for fluid circulation within the shear-zone. Type 1 leucosomes are highly evolved granitic melts (70-74 wt.percent SiO_2) compared to the mesosomes (67-70 percents). However, plagioclase composition (An20-30) is identical in the leucosomes and neighboring mesosomes, both in terms of major- and trace-elements compositions. Moreover, whole-rock REE concentrations in leucosomes are only slightly lower than those in the mesosomes, unlike predictions by partial melting experiments. These features result from (1) entrapment in the leucosomes of a few REE-rich re-

fractory accessory crystals (e.g. zircon) during melt segregation; (2) efficient mineral re-equilibration between leuco- and mesosomes, due to the small size and pervasive network of leucosomes in the rock; it was most probably enhanced by syn-anatectic deformation and fluid circulation. Type 2 and 3 leucosomes are also highly differentiated granitic melts. They have a local (type 2) or “allochtonous” (type 3) origin. They host a more sodic plagioclase (An20-0) than in the surrounding mesosomes and their bulk-leucosome trace-element content is an order of magnitude lower than that of the mesosome, in agreement with partial melting experiments. These leucosomes did not re-equilibrate with their mesosome matrix for one or several of the following reasons: large volume/surface ratio, shielding effect of the thick melanosomes (type 2), late injection in already consolidated migmatites (type 3).