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Reactive porous flow and formation of infiltration migmatites : microstructural and petrological approach

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The studied felsic migmatites in a Variscan high-grade belt originated by melt infiltration and contemporaneous shearing of a banded orthogneiss in a crustal scale shear zone. They are marked by gradual transition from high-grade solid state banded orthogneiss via stromatitic migmatite, schlieren migmatite to sheeted, foliation-parallel bodies of nebulitic migmatite. The disintegration sequence is characterized by: 1) progressive destruction of well-equilibrated banded microstructure of the high-grade orthogneiss by crystallization of new interstitial phases (Kfs, Plg and Qtz) along feldspar boundaries and by resorption of relict feldspars and biotite; 2) variations of modal proportion of felsic phases reflecting the increasing amount of melt in the originally mono-mineralic aggregates; 3) systematic grain size decrease of all felsic phases. Crystal size distribution curves (CSD) reflect increase of the nucleation rate coupled with preferential removal of large grains for all felsic phases with the increasing melt proportion. This evolutionary trend is connected with a decrease in grain shape preferred orientation (SPO) of all felsic phases, an increase of the proportion of unlike boundaries and a decrease of grain boundary preferred orientation (GBPO) of unlike boundaries. Melt topology reveals well oriented melt seems and pools at low melt fraction consistent with diffusion creep regimes. At high melt fractions the absence of preferred orientation of melt patches corresponds to the distributed granular flow associated with a breakdown of rigid skeleton close to rheological critical melt percentage (RCMP). Continuous increase of Na content in plagioclase, increase of XFe in biotite and garnet coupled with decreasing Ti content in biotite indicate that the melt infiltration is connected with crustal exhumation. This mineral evolution is compatible with

decrease in equilibration temperature and pressure (800=>650˚C/6.5=>3.5 kbar) in an AFM diagram and in pseudosections. The whole rock analysis exhibit also systematic compositional changes, that indicate open system behaviour interpreted as a result of melt percolation on grain boundaries. We suggest that the diatexite structure may form through percolation on grain boundaries at significantly lower melt proportion than currently accepted and we introduce a new model of melt transport in the crust called reactive porous melt flow, according to similar process known from the mantle.