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Rheology of felsic lower/midle crust during burial and exhumation in a continental accretionnary wedge

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Flow of felsic rocks in Paleozoic continental accretionnary wedge in the eastern margin of the Bohemian Massif offers a possibility to examine in details rheology of granite protoliths deformed at different crustal levels. Combined structural, petrological and microstructural studies of porphyritic orthogneisses reveal three major deformation events that affect the polyphase deformed rocks as a function of their position in the wedge structure and variations of thermal regime across orogen. The first event is related to sub-horizontal influx of material into deep corner of the wedge (20kbar $\sim$ 60km depth) leading to the development of a layered crustal fabric. We identified three D1 deformation states ranging from augen orthogneiss to banded mylonitic gneiss preserved in mid-crustal levels and fully mixed ultramylonite orthogneiss located deep in the crust. The rocks appearing closer to the wedge corner (adjacent to rigid buttress) are associated with HP granulites, coarse recrystallized grain size and reveal high degree of partial melting developed in all deformation states. Rocks that are located further from the wedge corner are associated with LT eclogites, fine recrystallized grain size and absence of melting. The strain analysis of relics feldspar augens reveals plane strain symmetry and long axis of ellipsoid orientated parallel to the orogen axis. The second episode of deformation D2 is contemporaneous with major process of exhumation and important reworking of early fabrics. It results in development of zones of intense prolate fabric rimming the relic D1 domains culminating in zone of oblate vertical fabric in the wedge corner and close to the butress. This strain zoning is associated with increase of deformation intensity and it is interpreted as a result of deformation gradient related to the layer parallel horizontal shortening due to buttressing effect of adjacent rigid domain. This is confirmed by numerical strain modelling that reveals exponential increase of D2 strain intensity towards the buttress margin. The steep S2 foliation is finally heterogeneously reworked by horizontal fabric at shallow crustal levels. Quantitative microstructural analysis (EBSD, PolyLX, CIP method...) have been used to characterize three major processes responsible for the building of crustal wedge: 1) The influx of felsic crust into deep corner without and with the presence of melt is responsible for increasing grain size (decrease of differential stress) towards the corner. The final microstructure results from crystal plastic deformation of quartz and grain boundary sliding of feldspars assisted by interstitial melt or hydrous fluids. 2) The process of vertical outflow of deformed and layered crust from the corner zone is characterized by homogeneous reworking of a D1 fabric resulting in above described variations in strain symmetry. This event is associated with a modification of deformation mechanisms such as increasing contribution of crystalline plasticity of all minerals and variation of grain size at increasing differential stress.