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Shearing and mechanical mobility of diatexites: example from the Almansor stream (Ossa-Morena zone, Portugal)

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As a result of shearing developed under high-grade metamorphic conditions, fertile sedimentary and volcano-sedimentary Ediacaran-Cambrian rocks from the Évora Massif (Ossa-Morena Zone, SW Iberia, Portugal) were partially molten and plastically deformed. This dynamic process conditioned the activity of anatesis-related, multiple vein production processes within diatexites, that interacted with melts from other sources following a complex structural pattern of channels and sinks, inheriting the geometry of former melt-filled dilatant structures. The recognizable occurrence and distribution of melt veins and their relationships with other flow structures (rotated and streched rock fragments, shear driven folds, c´-type extensional shear planes, boudinage) are indicative of an important structural control (orientation of the stress field in relation to pre-existing anisotropies) and a relevant influence of rheological contrasts (distribution of fertile and/or more competent host rocks). Due to progressive non-coaxial deformation in high strain zones, contractional and extensional structures may rotate into parallelism with the main foliation permitting parallelism between folds and boudinaged layers. In the studied field example the principal shortening direction, that trends between N260º-270º, is related to sinistral displacement along N310º-330º-trending shear planes (sub-parallel to the main foliation and the compositional

layering). Mechanical conditions for melt flow appeared with the development of both dilatant structures controlled by c’-type extensional shear planes and stretched layers, boudins and rock fragments. These extensional structures, where melt flow occurred, were consequently affected by shortening and folding, and sometimes followed by new extensional conditions due to rotation of the earlier structures. Therefore, field observations, statistics and data analysis suggest a close spatial and temporal relationship between melt flow and shearing. Temperature rise favoured shearing and increase of the melt fraction together with generation of dilatant structures that allowed melt flow. New melt channels formed progressively: (1) sub-parallel to the foliation, (2) along c’-type extensional shear planes (developed oblique to foliation), (3) at the intersections of conjugate sets of extensional shear planes associated with boudinaged layers and, (4) embracing boudins and filling fractures or strain shadows in boudins. Extensional shear bands and inter-boudin partition are examples of sites (shearing-related dilatant strucutures) where melt tend to flow as a result of pressure gradients. This study reinforces the idea that the mechanical mobility on diatexites when influenced by shearing contributes to a self-organization of different flow structures, contrary to the image of an extreme structural complexity characterized by turbulent and chaotic flow.