P-T-t EVOLVING PATH OF THE VILARIÇA STRIKE-SLIP FAULT (NE PORTUGAL): FLUIDS AND DEFORMATION REGIMES.

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The Vilariça Fault Zone (**VFZ**) is one of the major NNE-SSW elements of the late-hercynian strike-slip fault network in the NW sector of the Iberian Peninsula. The displacements along individual faults are mainly left-lateral; total displacement as evidenced by cartographic analysis is actually the result of polyphasic and heterogeneous seismic activity along different fault segments, since the end of Hercynian Orogeny until the present.

Considered as a whole, the fault zone trace has an evident geomorphological expression, is quite straight, and reveals strong continuity. More or less pronounced inflections in strike and branch development at different scales reflect, however, the importance of the geometrical constraints imposed either by the coalescence of en echelon strike-slip fault segments or by structural anisotropies of Westphallian (or earlier) age, on the mechanisms responsible for the **VFZ** nucleation and propagation. This structural influence, which explains the local and polyphasic development of discontinuous hydrothermal quartz fillings along the fault zone, is particularly evident in the N domain of the **VFZ**.

Five key segments of the **VFZ**, with abundant quartz fillings, were mapped and studied in detail. Comprehensive mineral chemistry studies enable the characterisation of the mineralogical and microstructural modifications developed during the successive deformation events that uphold the **VFZ** evolving path. These events, coupled and/or followed by the circulation of large volumes of hydrothermal fluids, are part of the main seismic cycles induced by the regional stress field of late-D_3 and D_4 hercynian deformation phases. In general, the P-T-t path obtained for the five fault-segments studied are similar to one another, although significant variations on the hydrothermal alteration are detected, reflecting the: (i) influence of host lithologies; (ii) variable fracture density; (iii) distinct fluid/rock interactions; and/or (iv) different fluid compositions, as put in evidence via microthermometry/Raman spectrometry analyses of fluid inclusions within fault siliceous precipitates. Also, strong heterogeneities of the pattern and deformation style correlative of certain evolving steps can be shown to exist in the above mentioned fault segments. However, in a general perspective, one may conclude the following: (**a**) The earlier seismic events occurred in a semi-ductile regime under average temperatures ranging from 300 to 350°C and global pressures lower than 3 kbar. The metasomatic processes contemporaneous of this deformation cycle denote the circulation of aquo-carbonic, reduced and acidic fluids with low-moderate salinity of probable metamorphic origin; (**b**) The seismic events in semi-brittle regime took place at P-T conditions of the order of 1-2 kbar and 250-300°C. The deformation/alteration pattern correlative of this important cycle suggests that acidic, and reducing metamorphic aquo-carbonic fluids with low salinity were present; (**c**) The transition to the deformation cycles in brittle regime is underlined by significant decrease of fluid pressures and gradual increase of deviatoric stress under P-T values near 1-1.5 kbar and 200°C. Fluids pumped to the fault zone include typically aqueous and acidic solutions of low salinity with a low density carbonic phase; (**d**) Temperatures below 200°C and global pressures not above 1 kbar characterise the deformation cycles that occurred in near superficial crustal levels. The mineralogical record of the fluid/rock interaction contemporaneous of this evolving step suggests the percolation of aqueous, oxidising, and relatively acidic fluids of probable meteoric origin.