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Model for local fluid circulation in the upper brittle crust: insights from veins' thickness distribution

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Migration of fluids in the crust is basilar for geologic processes such as regional metamorphism and formation of hydrothermal, magmatic, volcanic systems and ore deposits. The bulk permeability of rocks is greatly enhanced by fractures, where their geometric properties (attitude, length, density and aperture) are important to define the hydraulic behaviour of the network (e.g. Bonnet et al., 2001). Veins record fluids' circulation in fractures at depth in the crust and fluid/rock interaction during regional metamorphism (Oliver, 1996) and also in geothermal systems (e.g. Bertini et al., 2006). In southern Tuscany (Italy), well-exposed Oligocene-Early Miocene sandstones hosting vein systems provide insight into the role of pore fluid and the stress state at the time of vein formation (Mazzarini et al., 2004; Mazzarini and Isola, 2007). In particular, the analysis of veins' thickness (t) allowed us to compute the average transmissivity of the veins in two different sites characterised by different veins' thickness distributions (power-law and negative exponential). The computed transmissivity for the veins is in the range $10^{-3} - 10^{-1} m^2 s^{-1}$, with higher values attained by the veins having power-law thickness distribution.

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