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Interaction between low-angle normal faults and hydrothermal circulation during Early Permian extensional tectonic in the central Southern Alps, N Italy

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At the end of the Variscan orogeny, several episodes of crustal extension starting in the Early Permian occurred in central Southern Alps (cSA), affecting the Adria passive margin (Handy et al., 1999). During this period, a megashear zone with dextral kinematics led to the transition from Pangea A to Pangea B configuration (Muttoni et al., 2003). The transtensional to extensional deformation regime led to the development of intra-continental basins infilled by Upper Carboniferous to Lower Permian sedimentary successions (Cadel et al., 1996). Crustal shortening related to Alpine compression was responsible for a partial or complete inversion of favourably oriented normal faults inherited from the Permian tectonics (Blom & Passchier, 1997). Despite this, SSE-dipping Early Permian Low-Angle Normal Faults (LANFs) are well-preserved because they exceptionally escaped most of the Alpine deformations. Their surfaces are within the Lower Permian sedimentary cover, or at the interface between the sedimentary cover and the Variscan basement, passing to intra-basement shear zones.
Two major Permian LANFs (Aga-Vedello and Masoni faults) are recorded in the Pizzo del Diavolo Fm. along the northern border of the Permian Orobic Basin (N Italy). They are “non-Andersonian” normal faults whose surfaces are characterized by cataclastic bands usually sealed by centimetric to metric layers of dark grey to black aphanitic tourmalinites (Zanchi et al., 2019). Tourmalinites indicate fluids circulation channelled along high permeability fault zones and are related to magmatic-hydrothermal fluids that produced metasomatic tourmalines with different compositions at different distances from the fluid source, i.e. the crystallizing intrusive bodies. In addition to Aga-Vedello and Masoni faults, further exposures of Permian LANFs occur in other sectors of the cSA and they are always associated with the presence of tourmalinites. Several authors (De Capitani et al., 1999; Slack et al., 1996; Cadel et al., 1996) link the cSA tourmalinites with the U mineralization of Novazza - Vedello district but this correlation could not be so direct and clear, due to the low concentration of Uranium in tourmalinites coming out from our whole-rock analyses.
The main purpose of this research is to better characterize the entity and the genesis of this regional hydrothermal event and relate it to the role played by the structural setting on hydrothermal circulation in intracontinental extensional settings. Fieldwork and observations combined with microstructural and geochemical analyses of tourmalinites coming from different

sectors of the cSA have been performed to reach this goal.

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