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Early Permian syndepositional tectonics in the Orobic Basin, Southern Alps, Italy

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The occurrence of synsedimentary tectonics during the beginning of the Permian has been largely documented all cross the present-day region of the central Southern Alps. Evidence of active faults has been generally established based on facies variations often associated to coarse-grained deposits, a characteristic feature of the Laghi Gemelli Group, which was deposited during the Early Permian. Nevertheless, poor attention has been devoted to the reconnaissance and description of the mesoscopic fault record developed during the deposition of the Lower Permian successions, except for a few works (Berra et al., 2011) describing local synsedimentary features such as liquefaction or slumping due to seismic shaking.

Working across the Orobic Alps, we identified several key areas where the occurrence of dewatering structures testify to the activity of synsedimenary faults together with sedimentary dikes, ball and pillars, and small slumps occurring along hundreds of mesoscopic faults showing meter-scale displacement along high-angle conjugate systems as well as domino-style faults, often accompanied by growth structures. These faults mainly affect the Pizzo del Diavolo Formation, which was deposited on top of the volcaniclastic succession of the Ca' Bianca Volcanite.

According to our structural observations, these high-angle Andersonian normal faults are often associated with low-angle normal faults, which developed along the interface between the Permian cover and the Variscan basement (Bloom & Passchier, 1997; Zanchi et al., 2019). LANF systems are responsible for significant tectonic elision of the volcaniclastic lower successions and for diffuse hydrothermal circulation, resulting in widespread tourmaline deposition along the fault surfaces.

Our analyses point to the definition of tectonic setting characterized by pure extension dominated by ENE-WSW striking normal faults all across the central Southern Alps, which were later inverted during the Alpine shortening as high-angle reverse faults (Zanchetta et al., 2015). It is important to stress that in the considered area the strikes of the Early Permian structure are at odds with the Early Jurassic normal faults which generally show a N-S strike and were reactivated as strike-slip faults, pointing to an independent tectonic extensional event occurring 80 My after the Permian extension.

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