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The Pietra Grande thrust (Brenta Dolomites, Italy): looking for co-seismic indicators along a main fault in carbonate sequences

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At present, pseudotachylytes (i.e. solidified frictional melts) are the only unambiguous geological record of seismic faulting. Even if pseudotachylytes are frequently observed along faults within crystalline rocks they are discovered along carbonate faults in very few cases only, suggesting that other chemico-physical processes than melting could occur (e.g. thermal decomposition). In order to investigate possible co-seismic indicators we study the Pietra Grande thrust, a carbonate fault in the Brenta Dolomites (Trentino, NE Italy), to analyse field structure, microtextures and composition of rocks from the principal slip plane, the fault core and the damage zone.
The Pietra Grande thrust is developed within limestones and dolomitic limestones of Late Triassic-Early Jurassic age ($Calcari\ di\ Zu$ and $Monte\ Zugna$ Formations). The thrust, interpreted as a north-vergent décollement deeply connected with the major Cima Tosa thrust, is a sub-horizontal fault plane gently dipping to the North that mainly separates the massive $Monte\ Zugna$ Fm. limestones (upper side) from the stratified $Calcari\ di\ Zu$ Fm. limestones with intercalated marls (lower side). On the western face of the Pietra Grande klippe the thrust is continuously well-exposed for about 1 km.
The main fault plane shows reddish infillings, which form veins with thicknesses between few millimetres to several decimetres. These red veins lie parallel to the thrust plane or in same cases inject lateral fractures and minor high-angle faults departing from the main fault plane. Veins have carbonate composition and show textures characterized by fine-grained reddish matrix with embedded carbonate clasts of different size (from few millimetres to centimetres). In some portions carbonate boulders (dimension of some decimetres) are embedded in the red matrix, while clast content generally significantly decreases at the vein borders (chilled margins).
Red veins are typically associated with cohesive cataclasites and/or breccias of the fault zone. Host and fault rocks are locally folded, with fold axes having a rough E-W direction compatible with simultaneous thrust activation, suggesting deformation under brittle-ductile conditions. A late brittle deformation is testified by near-vertical fractures and strike-slip faults (WNW-directed) intersecting the whole thrust system.
Field structure, microtextures, chemical and mineralogical compositions of host rocks, cataclasites and breccias are analysed. In particular, red veins are carefully compared with the very similar Grigne carbonate pseudotachylytes (Viganò et al. 2011, Terra Nova, vol. 23, pp.187–194), in order to evaluate if they could represent a certain geological record of seismic faulting of the Pietra Grande thrust.