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3D geological modeling of an outcrop analogue in the Trento Platform

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The study of outcrop analogues and particularly the reconstruction of 3D geological models starting from field data can help predicting fracturing state, facies distribution, and hence hydraulic properties in the subsurface, e.g. in hydrocarbon reservoirs. In this work we present a multidisciplinary approach combining traditional field mapping, remote sensing (airborne LIDAR and terrestrial photogrammetry), and 3D geological modelling.
We focused our attention on the Early Jurassic carbonate platform of the Calcari Grigi Group in the Trento Platform (Southern Alps, Italy). This platform was affected by two main tectonic events: extension during the Early Jurassic and Alpine compression in the Miocene. Mg-rich fluids where present during deformation and resulted in fault-related dolomitized bodies. The Monte Testo structure (Pasubio Plateau) provides a spectacular exposure of this tectonic-sedimentary and diagenetic evolution.
Detailed field work yielded a 1:25.000 geological map and several structural stations allowing to characterize fault kinematic and diagenetic evolution.
On the remote sensing side, we combined a larger-scale airborne LIDAR of the Provincia Autonoma di Trento with a local terrestrial photogrammetric survey of some key outcrops. This was necessary to increase the resolution in vertical or steep walls that are poorly imaged in nadir-looking airborne LIDAR.
Based on this dataset, a 3D geological model was reconstructed with Skua-gOcad and some custom scripts, developed in order to better deal with field data. Once the geological grid was obtained with the Structural and Stratigraphy workflow of Skua-gOcad, the dolomitized geobodies were modeled as regions of the geological grid. This allowed performing a geostatistical study of hydraulic properties in these high-porosity geobodies.