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3D characterization of fracture networks in carbonates of the Gozo Island

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Fracture distribution and properties exerts a primary role in the control of fluid flow in hydrocarbon reservoirs. However, fracture parameters are difficult to collect in the subsurface from seismic and borehole data. Quantitative studies on outcrop analogues of hydrocarbon reservoirs allow to better characterize the fracture patterns in relation with tectonic history and mechanical stratigraphy. In this contribution we present preliminary results from our project in the Gozo Island (Maltese Archipelago). Here a Late Oligocene-Early Messinian carbonatic sequence is continuously exposed, particularly along coastal cliffs. The sequence, composed by different types of carbonate rocks going from bioclastic limestone to marly limestone, was affected in the Miocene by a N-S extension that lead to the formation of two sets of normal faults trending N50° and N120°, with fault throw up to 150 m. We selected key outcrops in different units to quantitatively characterize the fracture pattern and its variability within different mechanical/stratigraphic units and in different structural settings (e.g. different distance from faults, relay ramps, etc.). We collected fracture data using 3D Digital Outcrop Models (DOM) based on photogrammetric drone surveys; traditional field surveys allowed to integrate the DOM data with kinematic data to better constrain the tectonic history and kinematics of each fracture set. All this information is being used to reconstruct the fracture pattern variability at the scale of the whole island and to create a 3D geomodel populated with fracture properties using different geostatistical approaches.