Tectonic evolution of shallow water carbonates: the Lastoni di Formin platform (Dolomites - Italy)

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Carbonate rocks are among the most important targets for hydrocarbon exploration, and are considered of particular interest also for gas storage and carbon dioxide sequestration. The development of complex fracture networks in carbonates have a significant influence in fluid circulation, enhancing porosity and permeability and, therefore, modifying their storage capacity. The middle-Triassic Lastoni di Formin platform (Italian Dolomites) was studied by combining field measurements and photogrammetric techniques. The reconstruction of the Digital Model of the buildup allowed the analysis at the outcrop scale with a resolution of 5-10 cm, and gave the opportunity to focus on the behavior of sub-seismic (<10 m) structural elements. Even though their influence on the reservoir quality has been documented, heterogeneities of this order of dimensions are considered as part of the matrix properties in reservoir modeling: outcrop analogues represents a very good source of data that can help to fill this resolution gap. Many generations of fractures and faults can be distinguished at seismic and sub-seismic scale in the present-day fracture pattern of Lastoni di Formin, that is the result of different successive deformational events. In particular, the outcrop records the presence of two different tectonic phases: an E-W extension (Jurassic), that generate N-S trending joints and normal faults, and the Alpine compression (Neogene), that forms conjugate strike slip faults and flower structures. Moreover, an early fracturing gravitational event can be observed: is represented by opening-mode fractures and extensional faults sub-orthogonal to the direction of progradation of the buildup. The presence of platform-derived materials (oncoids) in the fracture fills allows to time-constrain the genesis of these fractures shortly after the deposition. Bed-perpendicular diffuse fractures, which are often strata-bound or terminate on bed-parallel stilolythes, were also detected. Both the margin-parallel early fractures and the Jurassic structures underwent strike-slip reactivations during the Alpine orogeny, which indicates a N-S to NNW-SSE shortening. Evidence of these movements can be inferred from riedel structures, en-chelon arrays, splays and fault jogs that can be observed at different scale. Reactivation of early structures can indicate that they influenced the distribution of subsequent faults and fractures affecting the platform.