Geophysical Research Abstracts
Vol. 20, EGU2018-6334, 2018
EGU General Assembly 2018

Storage Properties of Outcropping, Tight, Fractured Limestones of the Inner Apulian Platform, Southern Italy

Vincenzo La Bruna (1), Alessandro Giuffrida (1), Paola Castelluccio (1), Andrea Rustichelli (2), Elisa Panza (3), Emanuele Tondi (2), Fabrizio Agosta (1,3)

(1) University of Basilicata, Italy (vincenzolabruna@gmail.com), (2) University of Camerino, Italy, (3) Geosmart Italia, Potenza, Italy

Results of a combined field and laboratory study of Lower Cretaceous limestones exposed along vertical cliffs of the Monte Alpi massif, southern Italy, are presented. Field analyses aimed at deciphering both stratigraphy and structural setting of the limestones, which include a wide spectrum of calcareous facies characteristic of inner-to-platform margin depositional environments. Although the calcareous facies differ in both stratal architecture and diagenetic products, they are all virtually non-porous (porosity $< 1\%$). The limestones are crosscut by major faults, characterized by throws greater than a few 10's of m, which bound km-wide limestone blocks crosscut by strata-bound joints, not-strata-bound sheared joints, and small high-angle faults. The two oldest fracture sets are cross-orthogonal, bed-perpendicular, N-S and E-W striking stratabound joints, which show mutual abutting relationships. Based upon their intensity, the E-W fracture set is interpreted as the main stratabound joint set, which likely formed during burial diagenesis of the limestones. Considering both cross-orthogonal joint sets, their computed Fracture Spacing Ratio varies between 0.8 and 11.45, the Fracture Spacing Index between ca. 0.4 and 0.75, whereas the Cv values between 0.6 and 1.9. All these values, together with the not homogeneous multi-scale spacing distribution of both joint sets, which varies from power law to exponential, are consistent with the two fracture sets being affected by multiple stages of formation during the several tectonic phases that characterized the study area. The two background joint sets are also present in the footwall damage zones of two surveyed high-angle faults, which respectively strike NNW-SSE and E-W. The former fault, which juxtaposes the limestones against Upper Messinian sandstones, is about 1,5 km-long, shows a maximum throw of ca. 60 m, and it is characterized by a footwall damage zone that includes small faults and NNW-SSE striking joints and sheared joints. The latter one juxtaposes the limestones against Triassic dolomites, is up to 4 km-long, shows ca. 400 m-throw in the study area, and it is made up of a footwall damage zone that includes small faults and E-W striking joints and sheared joints. According to the results of our quantitative field analysis, the two fault-related fracture sets are characterized by a multi-fractal spacing distribution, and Cv values ranging between 1.2 and 2.5. Results of ongoing DFN modelling of geocellular volumes representative of both footwall damage zones and the encompassing fractured volumes will likely shed light on the role exerted by individual fracture sets on the amount of computed fracture porosity. We envision that the latter property increases within the study fault zones due to the fault-related joint sets, likely enhancing connectivity of the fracture network, and hence profoundly affect the storage properties of the Lower Cretaceous limestones. Furthermore, results of DFN modelling will help to decipher possible variations of fracture porosity between the study fault damage zones, in order to provide an useful information to geologists dealing with management of subsurface geofluids hosted in fractured carbonates, as well as for those interested on CO_2 storage in tight limestones.