Geophysical Research Abstracts
Vol. 12, EGU2010-12898, 2010
EGU General Assembly 2010

Preliminary results of a multi-scale structural analisys in an analogue carbonate reservoir (Hyblean Plateau, Sicily, Italy)

Antonino Cilona (1), Fabrizio Agosta (1), Alessandro Criscenti (2), Mario Dipasquale (2), Giuseppe Giunta (2), Giuseppe Napoli (2), Rosario Occhipinti (3), Pietro Renda (2), and Emanuele Tondi ()

(1) Geology Division, School of Science and Technology, University of Camerino, 62032, Camerino, MC, Italy(antonino.cilona@unicam.it), (2) Department of Geology and Geodesy, University of Palermo, (3) Corso Vittorio Veneto n°570 – 97100- Ragusa Italy

With the aim of studying the multi-scale fault architecture and permeability in hydrocarbon-rich porous carbonate rocks, we are currently involved in a project focused on the structural analysis of fractured and faulted platform-to-ramp carbonates cropping out in the Hyblean Plateau (Sicily, Italy). The Hyblean Plateau is part of the Maghrebian foreland and forms the northern portion of the African plate. The plateau is a NE-oriented structural high crosscut by a large-scale N10°-20°E oriented strike-slip fault system, named Scicli-Ragusa, which was affected by right-lateral kinematics during the Upper Miocene-Lower Pliocene. Some authors documented a recent activity of the Scicli-Ragusa fault system, during the Quaternary, characterized by left-lateral kinematics. The portion of the Hyblean Plateau crosscut by this fault system represents an excellent example of an outcropping analogue of a fractured carbonate reservoir. By taking advantage of the several oil shows located along the Scicli-Ragusa fault system, we combine stratigraphic-structural analyses, both at outcrop and microscopic scales, to assess the structural control exerted by faults and fractures on hydrocarbon migration and storage.

The field work focused on the geological mapping, at 1:10.000 scale, on detailed stratigraphic characterization of the outcropping layered carbonates (Ragusa Fm.) and on traditional faults and fractures analysis. Sample collection was also performed in order to conduct, in the laboratory, optical microscope and image analyses. The Oligo-Miocenic Ragusa Fm. is comprised of two main members: i) the lower Leonardo Member, which is characterised by well-cemented carbonate packstones intercalated with marl-rich levels; ii) the upper Irminio Member, characterised by an alternation of well-cemented and poorly-cemented grainstones/packstones. According to both orientations and kinematics, we grouped the fault segments of the Scicli-Ragusa fault system into three major sets: (i) NNE-striking faults with predominant right-lateral kinematics, (ii) ENE-striking faults with left-lateral kinematics, and (iii) NE-striking faults characterized by normal slip. Conversely, based on the fault attributes we subdivided the outcropping faults into four main categories: (i) Major faults, comprised of well-developed fault cores (made up of cataclastic rocks and main slip surfaces) flanked by thicker fault damage zones, which are up to 18 km-long and have throws in the order of 100's of meters. (ii) Medium faults containing thin and discontinuous fault cores of brecciated and cataclastic fault rocks and through-going slip surfaces encompassed within the fault damage zones, which are long up to several 100's of meters and have throws up to 10's of meters. (iii) Small faults made up of isolated and discontinuous fault cores of faults breccias and through-going slip surfaces, which are up to a few m-long and have throws in order of several 10's of cm and a few meters. (iv) Incipient faults consist, predominantly, of sheared pre-existing fractures confined within the individual carbonate beds; the maximum throw < 10 cm.

The meso-structural analysis performed to define the background deformation allowed us to identify mainly three different typology of structures: i) joints, ii) stylolites, and iii) shear bands. On the basis of their abutting relationships first originated bed-parallel stylolites and then two coeval sets of bed perpendicular joints. Shear bands nucleated by shearing of previously formed bed-parallel and bed-perpendicular structures. Another important data came out from preliminary microscope analysis carried out within mines of tar rich carbonates. Here, shear bands within porous layers behaved as a seal for oil migration whereas joints, localized in well cemented layers, acted as conduct for hydrocarbons.

Finally, as planned work, we are going to combine fault architecture data with petrophysical analyses conducted on samples belonging to different structural domains in order to define hydraulic behaviours of the studied faults.