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Multiple episodes of fluid migration imprinted as veins and host rock dolomitization in the hanging wall of the Tellaro Detachment: results from the Punta Corvo subsidiary low-angle fault zone, Northern Apennines (Italy)

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Slip along low angle extensional fault zones is known to be unlikely in many conditions, mainly arising from high frictional conditions. Among factors controlling the kinematics of slip along these fault zones, pore fluid pressure and fluid flow has been accounted by number of researchers to play a critical role in controlling or promoting their slip. Therefore, investigating on the paleohydrology associated with low-angle fault zones is essential for better understanding the possible role of fluid flow in their formation or reactivation. The Tellaro Detachment is a regionally-sized low angle extensional fault system exposed along the Punta Bianca Promontory in the Tyrrhenian side of the Northern Apennines. It developed during mid-late Miocene times and dissected the Triassic to Lower Miocene Tuscan succession. In this contribution we present results of a structural diagenesis study performed on the Punta Corvo Fault, a synthetic low angle splay fault zone affecting the hanging wall of the Tellaro Detachment. Outstanding exposures of vein networks and host rock dolomitization within the fault damage zone testify to the significance of fluids circulation in the hanging wall of the Tellaro Detachment. Based on our preliminary results, three distinct vein generations interpreted to be associated with the progressive evolution of the Punta Corvo Fault were identified. The veins are generally mineralized by dolomite and/or calcite. The first two generations display stable isotopic values of +2.2‰ < δ13C V-PDB < +3.7‰ and -5.7‰ < δ18O V-PDB < -3.1‰ for dolomite, and +1.8‰ < δ13C V-PDB < +2.0‰ and -5.9‰ < δ18O V-PDB < -5.3‰ for calcite. However, the third generation of veins, which is dominantly cemented by calcite, demonstrates relatively depleted stable isotopic values of -4.4‰ < δ13C V-PDB < +2.2 ‰ and -7.6‰ δ18O V-PDB < -3.7‰.

The microthermometric data obtained for dolomite and calcite cements are characterized by broad ranges of precipitation temperature ($\leq$50-188°C) and salinity (0.7-26 wt. % NaCl), showing dominant circulation of high temperature, hypersaline fluids during the activity of the Punta Corvo Fault, and the influence of low temperature, low saline ones during the latest episode of deformation. This integrated diagenetic-structural study attempts to reconstruct the nature and source of the involved fluids, and their occurrence with respect to the evolution of the Tellaro Detachment and its burial history. Furthermore, it enables to understand the possible impact of fluid circulation on formation or behavior of low angle normal faults and vice versa.