

RC1: This manuscript investigates the petrophysical characteristics of rock samples collected in NW Greece, with special attention to their role in geological formations. Combining few structural analyses with laboratory measurements, the results of two-dimensional images and petrophysical analyses are synthesized to investigate various carbonate lithologies, calculate permeability values for different types of rocks, and compare them with experimental measurements. The results are discussed on the basis of direct observation of the connected pore space, and a scheme for the petrophysical analysis of carbonate rocks is proposed. The experimental part of the manuscript is well designed and supports the conclusions better, however, there are still some issues.

RE: Thanks for the positive assessment of our manuscript.

RC1: The first is the abstract section, which should begin with an introduction of the field to which this research belongs and highlight its importance in order to draw out the focus of this research. The current version is more oriented to what one did, which got some results, which will shed the interest of the general public and greatly reduce the impact of the manuscript. It is recommended that the authors that section be reorganized.

RE: Ok, we aimed to present the results found in the abstract as well, but we can reorganize it according to the reviewer suggestions.

RC1: Sample collection and testing is an important part. The authors should consider to further describe the sampling strategy, I didn't see enough justification for the sampling choices in the manuscript, whether the samples are representative or not is an important thing.

RE: The representativeness of the study samples is a key point to consider, for this reason we provide a synoptical 3D representation of the main structural domains assessed for the study fault zones (fig. 4). There, we report the location of single rock types within the aforementioned fault zone architecture. Since the samples were collected from a number of fault zones characterized by dissimilar attitude, kinematics, dimensional properties (ie., length, displacement, width of single structural domains, etc.), we do not consider the precise distance of single samples from main slip surfaces. As reported above in a reply to a comment provided by the reviewer 1 "This choice was meant to avoid any possible bias in the data interpretation provided by the intrinsic properties of single fault zones. For this reason, the 3D representation is scale-less, and does not include any reference related to the dimensional properties of single structural domains. However, as noted by the referees, we add information regarding the latitude/longitude of single samples in the appendix."

RC1: Also, the discussion section should be emphasized. The discussion section of the current manuscript has four short summaries, which seem to be very detailed, but may have some problems. First, some contents are said and left out, and the discussion is not deep enough, such as 6.1 Deformation mechanisms is a good direction, but the content is too simple. Secondly, the discussion is limited to the direct analysis or simple extension of the experimental results, and the overall discussion lacks the part of the actual impact, which mainly stays at the level of the results of this experiment, which is a little bit unfortunate. Consideration should be given to exploring the impact of the results on carbonate reservoirs, such as potential applications for geothermal energy development.

RE: The discussion direction indeed was oriented on the poro-permeability relationship and the different workflows adopted. The deformation mechanisms analysis is beyond our scope, but we can certainly integrate the discussion toward this direction as well as the impact for results on carbonate reservoirs and further applications.

RC1: Finally, there are some minor problems in the manuscript, such as problems with the citation format of the references. For example, line 100, MODIFIED FROM (Bourli et al., 2019). Please standardize the citation of references throughout the manuscript.

RE: We thank the reviewer for the comment and we have fixed the citation of the references.