

## ***Interactive comment on “Diagenetic evolution of fault zones in Urgonian microporous carbonates, impact on reservoir properties (Provence – SE France)” by Irène Aubert et al.***

### **Anonymous Referee #1**

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The present study presents original structural, mineralogical, geochemical, and petro-physical data on the control exerted by faults on reservoir properties in microporous carbonates. It is a research article dealing with the structural diagenesis of two high-angle fault zones exposed in a surface analogue of SE France. The studied faults are characterized by a heterogeneous architecture, which includes fractured and fragmented host rocks, cataclastic fault rocks, and main slip surfaces, and underwent to three distinct deformation stages. The authors were able to assess the main diagenetic processes associated to each of the aforementioned stages by performing a multi-disciplinary analysis. They tackled a very difficult problem: the unravel of the role played by single deformation and diagenetic processes on the fluid flow properties of

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fractured carbonate reservoirs. The authors were able to document how the studied faults first behave as localized fluid conduits for low temperature fluids, and then as localized fluid barriers after two separate stages of calcite precipitation. The manuscript is well written (although some modifications can be made throughout the text, see the Specific Comments below), both aims and results of the work are clearly reported, the methods robust and convincing, and data interpretation very convincing. A slight improvement of the manuscript can be made by considering the following three points: 1. Authors should better illustrate the crosscutting relations among the different structural elements (dilatational bands, open fractures, shear fractures, etc.) measured both within and outside the study fault zones. 2. Rename section IV as “Discussion”, and shorten the single chapters it includes (mainly, the chapter on the fault-related diagenesis). 3. Expand data discussion on the impact of fault zones on reservoir properties by adding references to other surface analogues worldwide. In conclusion, the work done by the authors is intriguing, the topic interesting, the employed methods appropriated, and data interpretation convincing. For this reason, based upon the aforementioned comments, and taking into account the overall quality of the paper, I recommend to accept with minor revisions the submitted manuscript. Specific Comments are reported below.

Specific Comments Abstract: please check for wrong punctuation marks, grammar, and syntax. Introduction: please remove the final sentence. Geological context: check for grammar; remove lines 110-124 (out of place). Methods: please double check the standards used for stable isotope analyses. Results: please check both grammar and syntax. Diagenetic Evolution: please shorten the whole section, and rename it (cf. comment above); re-consider dilation as an incipient faulting mechanisms; please separate data interpretation for granular media from that inferred for a cohesive rock; please state all assumptions required for temperature calculation based upon oxygen isotope data and well-known fractionation curves.