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Comment on se-2021-85

Sven Maerz (Referee)

Referee comment on "Structural diagenesis in ultra-deep tight sandstones in the Kuqa Depression, Tarim Basin, China" by Jin Lai et al., Solid Earth Discuss.,
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This publication addresses the role of fractures in influencing porosity and permeability development and distribution by tectonically-induced diagenetic modification of the Lower Cretaceous Bashijiqike Formation in the Kuqa depression, Tarim Basin, China.

The relationship between fracture generation and diagenetic alteration of pore space by dissolution and/or cementation has been analyzed by using different methodological approaches such as thin section and SEM observations, numerous well logs, and image logging.

However, the study only covers the mechanism of pore system alteration by fracture-induced diagenesis, but misses a comprehensive debate about the paragenetic diagenetic history of the studied rocks. This is critical, since it gives the impression that fracture generation is the only mechanism amplifying the diagenetic alteration of pore space and thus enhancing or decreasing petrophysical properties. However, even if fracture-induced diagenesis is the main diagenetic mechanism presented in this study, its processes and products are explained insufficiently. This is mirrored in "Chapter 4.5: Dissolution and cementation along the fracture surface".

Again, it is recommended to take into account all stages and mechanisms of diagenetic modification during pore system evolution in order to demonstrate that no other mechanisms other than fracture-generation is the main trigger for pore system alteration. Although the authors do mention different types of cements (i.e., calcite, dolomite, quartz, clay minerals) in the text, they do not deliver a detailed explanation about the origin of these cements. It would be interesting to know to which extent and volume fracture-induced cementation contributes to the total extent and volume of cementation, and if fracture-induced diagenesis is present only locally or if it is present throughout the entire formation. This is of highest importance, since according to the authors, the aim of this study is to better understand the structural and diagenetic processes, and to reduce the

uncertainty for reservoir quality prediction of the Bashijiqike Formation (as written in "Chapter 1: Introduction")".

Since the main focus of this study is the structural diagenesis of the Bashijiqike Formation, all diagenetic processes and its product should be better constrained to highlight the possible importance and dominance of fracture-induced diagenesis. This could have been included/integrated in "Chapter 5: Discussion". Usually, in this chapter, the methods applied, the concepts and new findings are critically discussed and compared to previous studies. Unfortunately, in this manuscript, most of the discussion is a repetition of findings already presented in "Chapter 4: Results" and a summary of the findings in respect to other wells. "Chapter 5: Discussion" needs therefore to be highly improved. It is also not clear how this study may contribute to previous work in the study area, and if it can be applied in other (analogous) settings.

Although the manuscript is very well structured, and the figures and their captions are very good, it includes numerous typing errors and inconsistencies in spelling and punctuation which results in difficulties in reading the text.

As a final comment, I would like to highlight the approach and the methods applied for the study. However, due to the very weakly constrained diagenetic history, and its processes and products, as well as the lack of a critical scientific discussion of the gained results and the high abundance of technical errors, I recommended to reconsidered this study for publication after major revision.