

Solid Earth Discuss., author comment AC1
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Reply on RC1

Jin Lai et al.

Author comment on "Structural diagenesis in ultra-deep tight sandstones in the Kuqa Depression, Tarim Basin, China" by Jin Lai et al., Solid Earth Discuss.,
<https://doi.org/10.5194/se-2021-85-AC1>, 2021

Dear Dr. Maria Mutti, Dr. Federico Rossetti and reviewers:

Thank you very much for your constructive advices on my manuscript
SE-2021-85 (Structural diagenesis in ultra-deep tight sandstones in Kuqa depression, Tarim Basin, China) submitted to your journal "Solid Earth".

We have carefully revised the manuscript considering the remarks made by the two reviewers and the editors, and would like to re-submit it for your consideration. We have addressed the comments raised by the reviewers, and the amendments are highlighted in red or blue in the revised manuscript. We are indebted to you and the two anonymous reviewers for your constructive comments, which improve the manuscript significantly.

We also download some papers recently published in **Solid Earth**, and revised the references format carefully. Further some papers published recently in your journal have been cited in the revised manuscript (highlighted in blue in the references lists).

The point by point responses to the two reviewers' and Editor's comments are listed below.

Below, the original comments are in black, and our responses are in blue.

- Comments of Editor

Dear Authors,

When posting your author comments (ACs), you can choose between new comments or co-listing of existing ones. Please also consider replying to community comments (CCs) from the scientific community.

Reply:

Thank you for your constructive comments.

You - as the contact author - are requested to individually respond to all referee

comments (RCs) by posting final author comments (ACs) on behalf of all co-authors no later than 27 Dec 2021 (final response phase). We have provided detailed responses to the two reviewer's comments and revised the manuscript according to the reviewer's comments.

Thank you for handling my manuscript and tireless works.

Reviewer #1: Sven Maerz, 07 Nov 2021,

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.

Reply:

Dear Dr. Maerz,

Thank you for your constructive comments.

- 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".

Reply:

Thank you for your constructive comments.

We are sorry for this misunderstanding. Actually, this study only briefly describes the diagenesis type and degree, and the paragenetic diagenetic history of the studied rocks is also briefly mentioned. However, the diagenesis modifications, diagenetic evolution and porosity evolution histories are discussed in detailed in our previous studies Lai et al., 2017a (Lai J., Wang G., Chai Y., Xin Y., Wu Q., Zhang X., and Sun Y. 2017a. Deep burial diagenesis and reservoir quality evolution of high-temperature, high-pressure sandstones: Examples from Lower Cretaceous Bashijiqike Formation in Keshen area, Kuqa depression, Tarim basin of China. AAPG Bulletin, 101(6): 829–862).

Lai et al. (2017a) has discussed the diagenesis, diagenetic minerals as well as diagenetic evolution of the Bashijiqike Formation of Kuqa depression, and now it has got a total of 95 Google Scholar citations, and has been selected as an ESI highly cited paper.

Therefore in order to avoid repetition and redundancy, the diagenesis type and degree, and the paragenetic diagenetic history of the studied rocks are also briefly mentioned. However, in order to avoid this misunderstanding, we have added a sentence in the manuscript (Section 4.2 and 4.3) that for the paragenetic diagenetic history of the studied

rocks, please refer to our previous studies (Lai et al., 2017a). Thank you for your consideration.

Thank you for your constructive comments.

- 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") .

Reply:

Thank you for your constructive comments.

We are sorry for this misunderstanding again.

All stages and mechanisms of diagenetic modification during pore system evolution as well as the origin of these cements are also described in our previous studies Lai et al., 2017a.

As you can see from Figure 18 and other figures, the fracture-induced diagenesis is present only locally or if it is present throughout the entire formation.

In order to avoid this misunderstanding, we have added a sentence in the manuscript (In Section Introduction) for dominance of fracture-induced diagenesis in the whole formation, however, the impact of diagenesis and diagenetic minerals on reservoir quality are described in our previous studies (Lai et al., 2017a).

The impact of diagenesis and diagenetic minerals on reservoir quality are well described (Lai et al., 2017a), while little is known about the fracture-induced diagenesis, which is present throughout the entire Bashijiqike formation.

Thank you for your consideration.

Thank you for your constructive comments.

- 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.

Reply:

Thank you for your constructive comments.

In Results section, we mainly present the lithology, pore systems, type and degree of diagenesis, diagenetic minerals and their controls on porosity. Then the fractures are interpreted from core and image log interpretation, and fracture-diagenesis is discussed, and in addition the in situ stress magnitudes are calculated using well logs.

In Discussion section, we mainly discuss the impact of in situ stress on compaction, and links fracture with dissolution, and then the variations of diagenesis and fracture for various structure patterns are discussed.

About the improvements of Discussion section, we have added a sentence: In this section, we mainly discuss the impact of in situ stress on compaction, and links fracture with dissolution in single wells, and then the variations of fracture-diagenesis within various structure patterns are discussed.

The new findings include two parts, one is the integration of continuous well logs to unravel the in situ stress magnitudes in single wells, and describe the variations of compaction and presences of fracture controlled by in situ stress (Section 5.1). Then in Section 5.3, we have links the facture-diagenesis within structure patterns. Therefore the new findings in this study con contribute to previous work in the study area due to the integration of continuous petrophysical well log data, and if it may provide implications for similar sandstones. We have added these in the Conclusion parts.

Also, in Section 5.2, we have clarified that the Fractures are mainly encountered in fine-medium grained sandstones, while the conglomerates and mudstones have rare fractures. In addition, the dissolution pores are also commonly detected in the fine-medium grained sandstones. This new findings are different from Results section.

Thank you for your constructive comments.

- 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.

Reply:

Thank you for your approval of the structure of our manuscript.

About the mismatching of the figure caption and text as well as typing errors and inconsistencies in spelling and punctuation, we have doubled checked through the whole manuscript to avoid these mistakes.

Also we have asked a colleague who is fluent in English to improve the English grammar.

Thank you for your constructive comments.

- 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.

Reply:

Thank you for your approval of approach and the methods applied for the study.

We have revised the manuscript according to your constructive comments, and have provided detailed replies to your comments about the diagenetic modifications and paragenetic histories. The technical errors are eliminated by careful checking. The discussion is improved to improve the implications of your studies. We hope the revised manuscript can meet your approvals.

Thank you for your constructive comments.

Once again, thank you very much for your comments and suggestions which improve the manuscript significantly.

We hope that the revised manuscript is now acceptable for publication in your journal. We appreciate for Editors/Reviewers' warm work earnestly, and hope that the corrections will meet with approval.

We look forward to your information about my revised papers and thank you for your good comments.

With best wishes,

Yours sincerely,

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