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Interactive comment on "Cataclastic deformation of triaxially deformed, cemented mudrock (Callovo Oxfordian Clay): an experimental study at the micro/nano scale using BIB-SEM" *by* Guillaume Desbois et al.

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Review of SE manuscript Cataclastic deformation of triaxially deformed, cemented mudrock (Callovo Oxfordian Clay): an experimental study at the micro/nano scale using BIB-SEM by Guillaume Desbois, Nadine Höhne, Janos L. Urai, Pierre Bésuelle, and Gioacchino Viggiani

The manuscript contains a detailed microstructural analysis of Bure clay samples that were previously subjected to different mechanical tests at confining pressures of 2 and 10 MPa. Sample deformation was recorded in situ using DIC and X-ray tomography,

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respectively. Samples for the microstructure analysis presented here were carefully chosen with reference to the recorded deformation, and the analytical techniques used for this analysis are state of the art. The paper is generally well written and organized and could be published with minor revision. I have just a few comments listed below:

1. Section 3: Samples were extracted with a diamond saw and surfaces first polished using SiC paper and then BIB polished. Is this procedure sufficient to erase potential surface damage introduced during sawing and SiC polishing?

2. Section 4.1: It did not become clear to what extent and by which arguments the mode I fractures in either sample could be attributed to deformation or rather to unloading, drying etc. The authors refer to Figure 4d,e to illustrate the rather dramatic changes in the microstructure that occured over time. Should one not expect that most of the fractures that initially formed during deformation experienced some later overprint?

3. Section 4.2 and Discussion: Type II fractures show damage zones that are suggested to be wider in samples deformed at 10 MPa although porosity there is supressed by shear-enhanced compaction. I would encourage the authors to elaborate on the micromechanisms forming the damage zones and involving cataclasis and pore collapse.

4. Section 4.2.2: Figure 8 is really busy and some arguments of the authors illustrated by this figure are hard to follow. For example, I find many chipped/angular non clay minerals also in the undeformed matrix (Figure 5, Figure 12a).

5. Figure 10: The epoxy impregnation indicating a damage zone is hard to see in this figure. Also, this is an image of a sample deformed at 10 MPa where porosity was suggested to be significantly reduced due to compaction. That would make it difficult for the epoxy to preferentially impregnate the damage zone, I would think.

6. Section 5.2: The authors consider the dominance of cataclastic deformation in these

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samples surprising. Why? Differential stresses exceed the confining pressures by a factor of 3-15, which would suggest empirically that dilatatant fracturing prevails over other mechanisms (e.g. Kohlstedt et al., 1995).

I hope my comments are useful to the authors.

Sincerely

Georg Dresen

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