Review: Deformation mechanisms and evolution of the microstructure of gouge in the Main Fault in Opalinus Clay in the Mont Terri rock laboratory (CH) by Laurich et al.

General comments

This is a well-documented, profound and useful paper. The figures are all well done. Many images are presented, which helps the reader to understand such nano-scale microstructures. The quantitative microstructural data are well performed and include high-end techniques. The bulk rock data are standard techniques and may have not an high impact on the discussion and conclusion of the paper. Some of these may also exclude.
I have no fundamental changes to the science of the manuscript.

Some detail comments:

Page 4, Line 16: You may delete "beautiful" (not scientific in this context).

Page 5, Line 25: What is DIA?

What is the control on segmentation? Due to only BSE contrast between different mineral-types, the GSD of the bulk aggregate may be biased by the type of used contrast? You may comment on this in the "Method"-section. You may include some additional reference for the relationship between the GSD and the particles classified as matrix (e.g., Heilbronner and Keulen 2006, Keulen et al. 2007). The relation between matrix and clasts is a known fabric parameter (see discussion in Hadizadeh and Johnson 2003)

Page 7, Line 1-5: Is this not better presented in the chapter "Methods"?

Line 11ff: The comparison of different methods (Mercury porosimetry, He-pycnometry and Image Analysis) are often not direct comparable (e.g., connected versus isolated pores, 2D versus 3D, etc). I propose to omit this sentence. Alternatively, you may write more in detail for this comparison.

Page 8, Line 22: Do you have other SiO2 modifications as quartz? You discuss this later, but should be mentioned before.

Page 10, Line 1: You may add: "… suggesting intracrystalline plasticity *or fracturing parallel (001)*."

You may combine chapter 3.3.1 and 3.3.4. These two processes are somehow connected. You produce smaller grain sizes by cataclasis, which allow in the following frictional flow. This would be easier to read.

Page 11, Line 28-29: The argument using the Sr-isotope data is not understandable. I would always expect different Sr-data in veins, water and protholith caused by fractionation between different minerals (i.e. calcite versus clay) and the main difference between protholith and vein is the mineralogy. You may explain better, what is the argument (or omit this argument).

Page 12, Line 28ff: Many studies indicate that amorphous SiO_2 is not stable over geological times above a certain temperature. Many arguments have been found, that amorphous SiO2 are precipitated and reorganized into quartz in geological time scale. Your findings, may discussed in this context: (1) is the amorphous SiO2 geological developed?; (2) what are T-t conditions to stay amorphous?

A personal comment:
The paper has many abbreviations (e.g., BIB_SEM, SAED, OPA, XRD, TOC, VR, DIA, GSD, etc.), which is sometimes difficult to read. This would be even more difficult, for a reader, which is not from the same scientific community.

Possible Additional references:

Hadizadeh and Johnson (2003), Estimating local strain due to comminution in experimental cataclastic textures. J. Struct. Geol. 25, 1973–1979.

Heilbronner, R., Keulen, N., (2006). Grain size and grain shape analysis of fault rocks. Tectonophysics 427, 199–216.

Keulen, N., R. Heilbronner, H. Stunitz, A.-M. Boullier, and H. Ito (2007), Grain size distributions of fault rocks: A comparison between experimentally and naturally deformed granitoids, J. Struct. Geol., 29(8), 1282–1300.