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Interactive comment on “Pore formation during dehydration of polycrystalline gypsum observed and quantified in a time-series synchrotron radiation based X-ray micro-tomography experiment” by F. Fuisseis et al.

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The manuscript present a X-ray micro-computed tomography in order to characterize the space-time evolution of pores formation during the dehydration process of the Volterra gypsum by using an experimental approach. The conclusion are that the dehydration proceeds in a non linear way by creating anisotropic pores derived from the preexisting fabric.

The topic of the paper is very interesting and not fully understood nowadays, although

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it has been studied from several authors in the past. The used approach is very interesting and novel in my knowledge and the results are consistent with the analyzed dataset. However my first order objection is related to the fact that in this paper only one experiment is presented and this is a very weak point for the future applicability of this paper. Anyway, once the editor accepts that just one experiment is presented, my second criticism mainly refers to the presentation of the dataset. In fact, there are several parts of the manuscript that need to be reorganized or explained in a better way through a major revision of the paper.

1. Explanation and choice of the figures. Figures should be the strongest point of this paper due to the good dataset and to their self-explaining power. On the contrary in this paper: they are a lot (14 figures plus 5 supplements), in several cases they seem to be useless and sometimes not well explained neither in the text nor in the caption and moreover most of the “supplement figures” are more clear and useful respect to the chosen figures, for example suppl fig 1 is the only figure showing a “real” image of the sample and suppl 4 shows very clearly how dehydration evolves.

2. Continuity of the paper. I think that in order to help the reader in following the paper is very useful to keep using, for example, the same units (for temperature, porosity. . .) or the same analyzed time steps. On the contrary through the paper, several times this changes driving the attention of the reader (at least mine) out from the main topic.

3. Laboratory data. This paper present just one sample in a single experiment. The conducted analysis are really good but the big question is: are these results suitable for the community or are they related just to that specific (and quite small) sample? A way to overcome this problem is to find some natural evidence that supports some of the results, I know this is difficult, but it could be a way.

In the following I'm going to explain point by point what I think could be useful to improve the paper:

Title: In my opinion the title should specify that all the dataset is related to just one

sample. . . just as a suggestion I was thinking to something like: Pore formation and evolution during dehydration of polycrystalline gypsum using synchrotron radiation based X-ray micro-tomography: insights from a sample of Volterra gypsum.

Organization of the paper: the paragraph 3.2 is subdivided in 2 subparagraphs without any clear needs. I suggest to rearrange as: 3.1 Dehydration initiation 3.2. Porosity evolution 3.3 Drainage architecture evolution

Paragraph 4.3 should be a discussion subparagraph, however the discussion of the results are limited to the last 3 rows. This looks more like a discussion on the methodology that, in my opinion is in the wrong position. Since from the adopted methodology derive all the results this discussion should be moved to the introduction paragraph in order to both explaining to the reader the strength of the adopted method and to avoid criticisms on the methodology.

The sentences immediately after par 4 (pp 874 #20-25) are inappropriate in that position. This is a sort of summary that maybe can be moved to the conclusion paragraph or deleted at all.

In the paper ° Kelvin are used whilst in the introduction ° Celsius are used (p 860 #13).

Par 2.3 (p864 #14) What “in situ” means? Did you performed your measurements in Volterra?

P865 #28 Here are first presented the “nine time steps” never mentioned before.

P869 #6-11 In this part you cite “supplement fig 3” three times whilst, for example fig. 5b is never cited along the whole paragraph. I strongly suggest to reorganize the order, the number and the choice of the figures.

P871#23 “the numerical expansion/shrinking experiment”..what are we talking about? Has this experiment ever mentioned before?

P872 #27 these observation look very speculative and they are hardly observable in

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fig 10. Moreover the main point is, why do you need to perform this kind of analysis?

P876 #9 “Figure 4 shows that 50% of the sample area in horizontal cross-section reacts within the first 17min” Fig 4 really shows this (maybe is suppl fig. 4)? Once again 17 minutes has never been used as a time step before.

Figures: Most of the figures are “time related”. So time steps must be well evident, but for example in fig 10 and fig 11, the different time steps are just mentioned in the captions

Fig 2 should be arranged in one column to avoid confusion with the further left/right side discussion and to better show the propagation of the front.

Fig 2 I can't see the stippled line mentioned in the caption.

Fig 5b is never cited in the text even if fig 5b caption recall text for explanations.

Fig 5b and c are unreadable due to the tiny font dimensions

Fig 5b has 2 x axis but no dimension are present in the above axis (maybe is time in seconds?)

Fig 6 the dimension of porosity is % in the text and PU in the figure, please keep the same units.

What fig 7 tells us more than fig 8? They look very similar to me I suggest to delete fig 7.

Fig. 9 I don't agree with the choice of showing a 3D figure that is for most of the people unreadable. Most of the readers (I guess) are not going to by a special glasses just to read this article. Moreover this figure is cited in the text to show interconnected pores, that are quite difficult to see. I suggest to change this in a 2D figure that show the pores before and after the dehydration with, importantly, a scale bar that is missed in this figure.

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Hope this helps

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