

We thank Dr. Philip Benson for his constructive and detailed review. In this author comments letter, we addressed each comment separately. The reviewer's comments are italicized, followed by our point-by-point response to the reviewer.

This paper presents an innovative suite of experiments investigating the link between creep in basalts in the presence of pore fluids and dissolved CO₂. It is a novel contribution to the literature and pertinent to the study of CO₂ sequestration within basalt via chemical (carbonation) reactions. The paper is well written, comprehensive in scope, and a pleasure to read. I have only a small number of minor, mostly technical, queries:

- *Line 72: Maybe reference Heap (2011) here as well? (it is in the reference list) as I don't think creep in volcanic rock is a particularly common laboratory case study.*

We have added the reference here following the suggestion. (Line 71)

- *Line 167: Small edit required, Load is measured in kN, whereas MPa is stress, so I suggest a minor edit to used either one or the other.*

Thanks for pointing this out, we have revised the statement to 'the differential stress was increased at a rate of ~2 MPa/min'. (Line 177)

- *Line 199, figure 3 (and line 214). I panel (e) it would help me (and I hope the reader in general) with an annotation or two? Especially as some of those colours are similar – the fluid and conditions could usefully be added as a note on the plot.*

Thanks for the suggestion, we annotated the fitting lines with the experimental conditions. We kept the same color code for the plot in panel e) as panel a) to d) and added a statement in the caption of figure 3 to clarify this. (Line 216-220)

- *Section 3.3, in addition to the changes in permeability with effective pressure for the three samples (fig 6a-6c) can the authors say anything about the change in the initial permeability (at 0 MPa), which also seems to decrease as we move from 23C with just water, to water/CO₂ (closed) and then to water/CO₂ (open)?*

The variation in the initial permeability is likely caused by the sample-to-sample variation. We have conducted other experiment on the Iceland basalt which is not presented in this paper. And the initial permeability shows similar range of fluctuation.

- *Section 3.4.2 and figure 9: the seismic -b value data is interesting, but with only a few data points per experiment for fitting the line of best fit, I do have a concern regarding the scatter and fit (in figure 9). Do the authors have any sense for the error of the -b value trends presented here? If so, they ought to be discussed as there seems visually to be some degree of overlap between the experiments.*

The fitting of b-value is shown in Appendix Figure A7. We also added an error analysis in the fitting of the b-value to show the variations. The error bar shows the 95% confidence interval in the b-value fitting. (Line 306)

- *Line 425: The text references figure 14, but I think this refers to fig 13 on page 16?*

Thanks for pointing this out. We have corrected this in the revised manuscript.