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# *Interactive comment on* "Granite micro-porosity changes due to fracturing and alteration: secondary mineral phases as proxies for porosity and permeability estimation" *by* Martin Staněk and Yves Géraud

**Anonymous Referee #2**

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This paper deals with the experimental and observational investigation of the impact of fracturing and alteration on porosity and transport properties of granite. Several facies of fractured granite have been selected and studied by means of mercury intrusion porosimetry, microscopy and chemical analyses. The paper is of potential interest to Solid Earth readers but a major bias is present in its current form which makes it unworthy for publication without major revision. After a short introduction, the various facies of the tested granite are presented as well as the methodology followed in the study. Focus is placed on the mercury injection porosimetry (MIP) which provides the



key data for all the analysis. In the results section, we travel through the extensive descriptions of microstructural and mineral optical properties, of the connected porosity structure, of the chemical composition of minerals. These three sections, although inherently interesting, are long maybe verbose and could be easily shortened by focusing on some key points. More crucial for the paper are the next sections concerning the MIP data and the derived permeability. Whereas the methodology for the porosimetry and thus the data seem to be sound, there is a big question concerning the acceptability of the permeability data. In fact the permeability of the various samples was never measured. Instead the authors use the Katz & Thompson model to infer an estimate of the permeability based on the MIP data. Whereas this model predicts permeabilities that are quite consistent with values measured on various sandstones or limestones with standard "spherical" or tube-like porosity, this consistency is more questionable for fractured rocks like the granite samples tested in the present study. A second drawback of this approach is that the Katz & Thompson model may be a good approximation for permeability if one excludes any interaction between fluid and minerals. This is obviously not the case when one looks at the water permeability of altered fissured granite. The presence of altered minerals or swelling clay particles may lead to a permeability to water quite different from the permeability to a non-interacting fluid like gas, which is assumed in the Katz & Thompson model. It follows that figure 11c that synthesizes the modelled permeability vs. porosity data has no experimental support. Since all remaining discussion is based on the results shown in this figure, there is a minimum requirement for authors to effectively measure the permeability to water of their samples, then maybe compare the results with the predictions of the Katz & Thompson model. However the discussion section should be based only on these experimental permeability data and not on theoretical values that have not been compared with measurements. To summarize, although this paper present new microstructural data of altered fissured granite, the fact that the discussion on the effect of fracturing and alteration on porosity and thus fluid flow is mainly based on estimated permeabilities without any experimental support, makes the paper in its present form unsuitable for

publication. I strongly encourage the authors to run these essential permeability measurements, to add them to the results section, thus basing the discussion part on real and not virtual data. A revised version of the manuscript incorporating these additional data would then be of great interest to Solid Earth readers.

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