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Comment on egusphere-2022-655

Hans de Bresser (Referee)

Referee comment on "Large grain-size-dependent rheology contrasts of halite at low differential stress: evidence from microstructural study of naturally deformed gneissic Zechstein 2 rock salt (Kristallbrockensalz) from the northern Netherlands" by Jessica Barabasch et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-655-RC2, 2022

This is well written paper with a thorough, detailed, and very welcome description of salt microstructures. The main message, the role of grain size, comes across well. I have added comments and suggestions directly in the attached document.

There is one general point that requires clarification, to my opinion.

On the one hand, it is indicated that the matrix is dynamically recrystallized (e.g. lines 35, 129, 396), what I interpret as driven by differences in strain energy related to dislocations (there are subgrains in the matrix), on the other hand, the fraction of rex grains is interpreted to be low (line 359) and the fine grains are thought to have been present already before deformation (line 323). So the conclusion is that the matrix deformed by grain size dependent pressure solution creep, and not by disloc mechanisms. I propose that the authors are more clear on the observations regarding rex in the matrix and better underpin their interpretation that the small grain size in the matrix is pre-deformation.

Related to this point: data on the grain size of the matrix are presented in Fig. 7, but these data seem hardly been used (and there is no reference to the Figure in the text). Importantly, if one would assume that the matrix grains are recrystallized grains, and then apply the rex grain size piezometer from Ter Heege et al. (2005), one would get unrealistically high stresses. This supports the interpretation of the paper that the matrix did not deform by dislocation creep.

Please also note the supplement to this comment:
https://egusphere.copernicus.org/preprints/2022/egusphere-2022-655/egusphere-2022-655-RC2-supplement.pdf