Solid Earth Discuss.,
https://doi.org/10.5194/se-2020-99-RC1, 2020

Solid Earth
Discussions
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Interactive comment on "Understanding controls on hydrothermal dolomitisation: insights from 3D Reactive Transport Modelling of geothermal convection" *by* Rungroj Benjakul et al.

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Received and published: 15 July 2020

The manuscript entitled "Understanding controls on hydrothermal dolomitization: insights from 3D RTM of geothermal convection" presents very interesting numerical simulation exercises that give light to the problem of dolomite formation and Mg budgets. The exercises constitute very simplified scenarios of an ample fault system cross-cutting from surface to a calcitic aquifer and basement, where the comparison between 2D and 3D models is of high significance. Although the results obtained are only descriptive of natural systems with the exact model settings, the authors rightly extrapolate some of the findings to general controls for hydrothermal dolomitization. The main contribution of the manuscript is to illustrate an alternative model of high temperature dolomitization where seawater provides the Mg and a basement fluid provides the heat for the chemical reaction to take place. The text is well structured and clear. The Introduction to the problem of hydrothermal dolomitization is very comprehensive. Similarly, the Methodology section is very detailed. Overall, this is a great preprint to read, well written and illustrated. However, there are some issues that could be considered to improve the scientific significance of the results and to make it easier for the reader to fully understand the models.

a. A justification of caprock porosity and permeability, as well as basement permeability would help in accepting the simplified model as realistic. The values used seem to be rather high.

b. Also, an explanation for the chemical composition of the basement fluid would be nice, as a quite alkaline and dilute fluid is being used for the simulations, which do not correspond to a usual warm and acidic brine.

c. Figure 1 illustrates very well most of the parameters of the system simulations. However, consider adding a figure 1b with the initial and boundary conditions of the simulations (temperature, fluxes, etc) so that we can easily visualize their influence over the simulation results.

d. The modelled system has a tall prismatic shape, which, together with the no-flow boundaries used, forces convection to form narrow vertical cells. I'm afraid this also constraints the shape and size of the resulting dolostone bodies.

e. Check figures 2b, f and j, which show vertical Darcy velocity fields, for the arrows superimposed. The arrows must correctly reflect the flow directions but are quite confusing where they appear to 'crash' (cap rock flow with convection in aquifer, basement flow with convective flow). Consider using flow lines or small velocity vectors instead.

f. The 3D model results of Fig 2 can hardly be observed in the plane perpendicular

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to the fault. The temperature variations, velocity field or dolomite formed cannot be appreciated there. Consider adding a 2D cross-cut of it or modifying the orientation of the 3D prism or enlarging the figure.

g. A thorough sensitivity analysis is important. I would like to see the results of simulations with lower basal temperature, an acidic brine as basal fluid, smaller permeabilities for caprock and basement and a much wider system.

Besides, here is a list of technical corrections that should also be taken into account.

1.Order the citations to references in the same sentence time-wise. Normally, the cites are organized from older to more recent. E.g. Introduction, lines 35-40, Discussion lines 350, 480, etc).

2. Consider not to include references that cannot be found by many researchers, such as Breislin et al., Robertson et al. 2015.

3.Correct the reference Almandine Les Landes et al. 2019, line 565: there's no volume number.

4.Some references are missing from the list, like Gòmez-Rivas et al. 2014.

5.First sentence of paragraph in lines 420: spare 'and'.

6.In paragraph of lines 245, is "mineral density" appropriate, or should it rather be 'molar volume"?

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