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Climate of the Past Discussions
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Interactive comment on “Lithium isotopes in dolostone as a palaeo-environmental proxy – An experimental approach” *by* Holly L. Taylor et al.

Anonymous Referee #1

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This manuscript presents new results from an experimental study of lithium isotope fractionation in dolostone along with leaching tests on dolomite and coral samples. The two main goals of the study were i) to quantify the Li isotope fractionation between inorganic dolomite and fluid from which it precipitates and ii) to determine the best leaching method to dissolve dolomite without contaminating with the detrital component of mixed dolomite-silicate samples. This work is important for reconstructing the past Li isotope composition of seawater using dolomites which are abundant in the deep time sedimentary record. They find that the Li isotope fractionation factor between the precipitated phase (a mixture of dolomite and magnesite) and the solution is a function of the temperature with a value of -5‰ at 220°C and -9‰ at 150°C. Extrapolating to low temperature (25°C), this gives a fractionation factor value of -23‰ which is significantly lower than the fractionation factor between inorganic calcite (-3‰ or aragonite (-11‰ and solution. For the leaching method, the authors demonstrate that the best protocol to dissolve dolomite without leaching silicate is to leach with 0.05N HCl for 60 minutes.

Altogether, the manuscript is well-written and straightforward. The conclusions of the study are relevant and important for future paleo reconstruction of marine Li isotope composition using dolomite. I suggest that this manuscript be published in Climate of the Past with minor revisions. The few minor points that should be clarified in order to improve the manuscript are discussed below. The authors should expand further the critical discussion on the applicability of their experiment results to natural samples (section 4.1). For example, is it justified (and why) to extrapolate the relation obtained (fractionation factor – temperature) from the high-temperature of the experiment to low temperature? (e.g. in Vigier et al., 2008, the fractionation factor between smectite and solution doesn't linearly increase with the inverse of the temperature). Regarding the form of the paper, I suggest improving the quality of the figures, especially adding units where they are missing. A table with leaching test trace elements data is missing in this version of the manuscript and should be included in the revised version.

Additional more specific comments:

- Line 85: you can cite here the paper of Bastian et al., (2018) in which more leaching tests have been done.

- Line 94: did you analyze the Li concentration and isotope composition of the speleothem aragonite used for the synthesis experiment?

- Line 107: replace "than" by "then"

- Line 114: please specify the age of the formation here

- Line 146 and 159: did you analyze any carbonate reference materials to validate the Li, Al, Ca and Mg measurements on solid carbonate samples?

- Line 202: which is similar to what is observed for calcite carbonates I think (see

Marriott et al., 2004a,b).

- Line 206: remove the “± 0.6 ‰ (1s; n=3)” here.

- Section 3.2. Please provide the units here, is it in mol/mol or g/g?

- Line 248: At what temperature?

- Note that this is the same HCl concentration (0.05N) and leaching time (1h) used for leaching modern biogenic carbonates in Dellinger et al., (2018).

- Figure 2: change the x axis to have ‘0’ at the origin ‘-5’ and ‘100’ in the end instead of ‘95’

- Figure 4: Why are the error bars smaller in this figure than in the figure 2?

- Figure 7: What is the unit of the acid concentration?

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Discussion paper