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Interactive comment on "Novel method for determining ^{234}U-^{238}U ages of Devils Hole 2 cave calcite" *by* Xianglei Li et al.

Anonymous Referee #2

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Li et al. present a method to extend the 230Th-234U-dated chronology of Devils Hole 2 calcite. The approach uses multi-linear regressions between calcite δ234U , δ28O and δ13C values to predict initial δ234U variability, which allows to calculate 234U-238U-ages until 731ka BP with an average age precision of about 2%.

General comments:

Based on sound analytical methods the authors present an impressive data set and an innovative approach which definitely deserves publication in this journal. However, prior acceptance, I would suggest that the authors clarify some of their statistical methods and the estimation of their uncertainties. One major point is that most paleo climate time series are impacted by autocorrelation (e.g. Macias-Fauria et al. (2012);Hu et al. (2017), and others). Serial correlation is known to reduce the degrees of freedom

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of the time series and has to be taken into account, by, e.g. adjusting the p-value or estimating appropriate confidence intervals (Olafsdottir and Mudelsee, 2014; Zwiers and von Storch, 1995;Mudelsee, 2003). I strongly recommend that the authors discuss this issue, such as to which extent their data is affected by autocorrelation, and how this influences their results. I would further recommend to show some evidence that the derived correlation and the regression model are not dependent on single values (such as the few data points with the lowest δ234U in Fig. 1) and/or the choice of the calibration interval.

Minor comments:

L108ff: It is unclear which statistical method and/or settings of OriginPro have been used and how the analytical uncertainties are propagated to the predicted δ234U values. OriginPro does not automatically include the uncertainties of both the y and x values in correlation and regression analyses. However, it also allows to calculate confidence as well as prediction intervals. So please clarify. . .

L132-134: In my opinion, the manuscript would be of even more value for the broader scientific community, if the main points of the proxy interpretation from the Devils Hole calcite deposits would be summarized in 1-2 more sentences. In my opinion, the description of the mechanistic understanding of the underlying processes is too short, and the authors focus mainly on the statistics. I understand that this is not the scope of the manuscript, but to support the statistical model, a proper mechanistic understanding of the underlying processes is essential. In the current version, however, one is referred to the numerous previous DH publications, which are probably not familiar to potential readers.

L136-138: See previous comment. A bit more explanation of the processes would be very helpful.

L145/Figure 1: Please visualize the applied linear regression model and its uncertainties

L148: Compare previous comments, please state if the r and p values are corrected for autocorrelation

L156-157: Again, does the adjustment of R^2 already take autocorrelation into account?

L168: What is the critical value of the F-test when adjusting the DF for an autocorrelated time series?

L175-176: Which part of the data is treated in this part? The whole 590ka interval? Please clarify which values are used here for the validation of the regression model.

L178-179: According to Table 4, the standard errors of the model coefficients are in the order of 15-20%, so how does the estimate of the residual uncertainty stated here compare to the uncertainty of the regression model itself? Does the width of the histogram change when taking into account the uncertainty of the regression model?

L194-195: The variability of the residuals may originate in the method used for calibration. When calibrating using linear regression, the variance of the proxy time series is always less than that of the calibration data set, since the resulting amplitude reductions are dependent on the correlation between the proxy and the calibration data set (Esper et al., 2005).

L296: Reference not in alphabetical order.

Supplementary material:

L20: Derived

References:

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