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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.

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General Comments: This is an interesting and excellent study that uses the correlation observed between the cave calcite $\delta$234Ui and stable isotopes in the core from Devis Hole 2 to establish a multilinear model for prediction of the $\delta$234Ui. This model allows the authors to predict much precisely a value of $\delta$234Ui and thus to improve the precision of 234U-238U dating method.

We greatly appreciate the valuable comments from the reviewers of our work. We revised our manuscript, according to the reviewers' comments, questions, and suggestions. We believe that the manuscript has been further improved

Major Comments:



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Discussion paper

1) It lacks a figure in the MS to show the $\delta$234Ui, $\delta$18O and $\delta$13C time-series.

We added the plots in the figure 1 in the MS. Please see the attached Figure 1.

2) For the regression analysis, the authors split the observed $\delta$234Ui into three groups according to the age range and the precision. However, it will be better to find a weighting method, which can help to take into account all of the observed values of $\delta$234Ui over the past 590 ka.

We calculated the regression models with the instrumental weighting method (weighting=1/square of error) for $\delta$234Ui in terms of the three groups, and all the three models were closely consistent with each other. Thus, it is feasible to establish the model by using the dataset over the past 309 ka period, even better on account of less uncertainty of $\delta$234Ui. Then by comparing between the regression model used in the MS and the one with weighting method over the same period, we found both models are significantly consistent with a much higher linear correlation coefficient of r=0.98 (n=66, p<0.05). Furthermore, significant correlation of d234U (no weighting) with both d13C and d18O supported us to establish the model without weighting, which also benefited us to express the model in a simpler way. Also, the residual analysis showed that the model in the MS had a little smaller variance of residual, although the adjusted R2 value seems a little bit higher in the model with the weighting method.

Based on the discussion above, we will keep the model used in the MS but with more confidence. Please find the supplementary file attached about the models and residual analysis.

3) The figure 3 shows the variability of the residual and $\delta$18O versus 230Th age, but its significance was poorly explained.

Currently we have little knowledge about the variability of residual and it has very poor relationship with the d18O record, which makes us difficult to work out a good explanation. In the following research, we would expect to understand the underlying possible

mechanism by more investigation and modelling work in this region.

Minor Comments:

1) It will be better to add some information about the relationship between U-concentration and $\delta$234Ui in the results.

We will add this information and the corresponding figure in the supplementary material. By the way the correlation analysis showed that the linear relationship between 238U concentration and d234Ui are statistically insignificant (please find the plot in the supplementary file attached).

2) It is difficult to identify the difference in precision between the 234U ages and the 230Th ages from the figure 4. It will be better to provide some detailed comparisons of the two dating ages in terms of precision.

We revised this figure by deepening the color of the error bars and enlarging the inconsistent points to the level of precision. Please see the Fig. 2 attached.

3) In the conclusions, the authors should acknowledge that the conclusions are based on the regression analysis of the $\delta$234Ui, $\delta$18O and $\delta$13C datasets over the past 309 ka, but not over the past 590 ka.

We will clarify this in our conclusions.

Please also note the supplement to this comment:
https://gchron.copernicus.org/preprints/gchron-2020-26/gchron-2020-26-AC1-supplement.pdf

Interactive comment on Geochronology Discuss., https://doi.org/10.5194/gchron-2020-26, 2020.

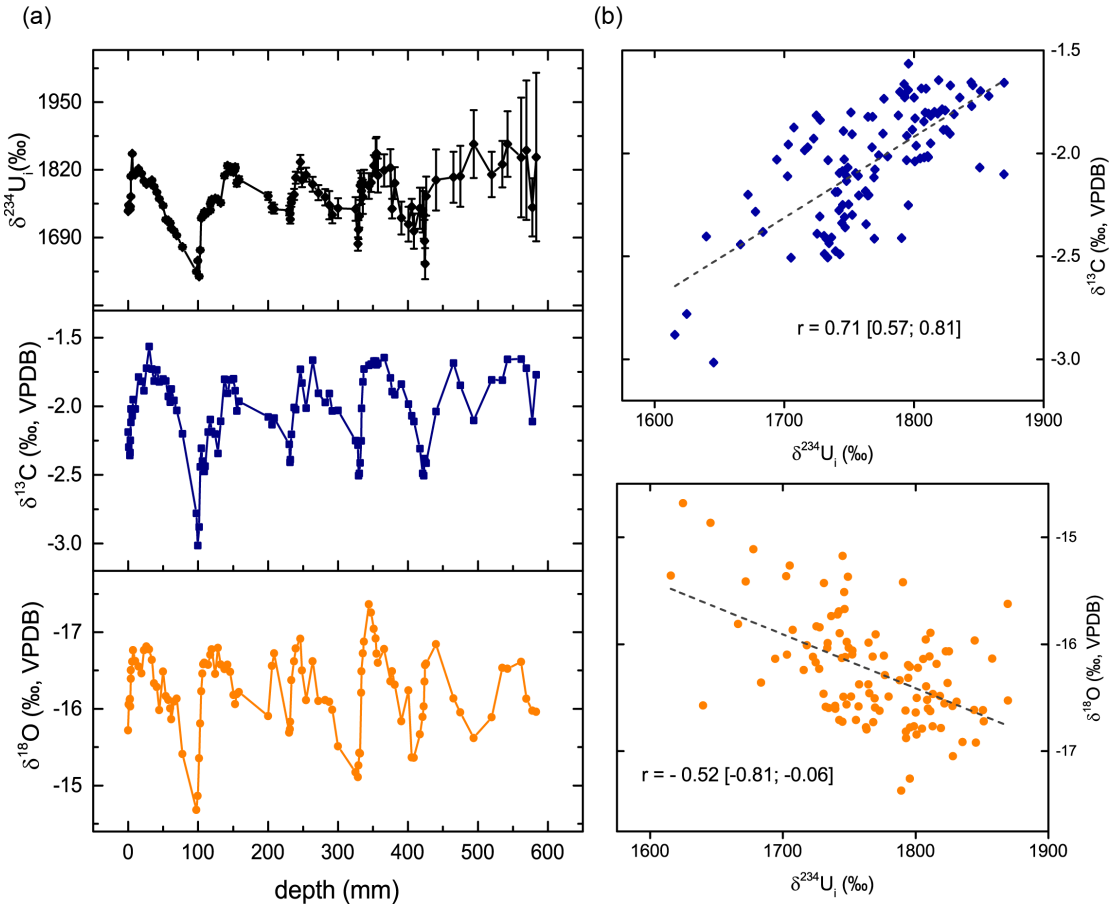


**Fig. 1.** Plots of the d234Ui, d13C and d18O curves versus the depth over the past 590 ka BP (left) and the scatter plots between d13C and d234Ui, and d18O and d234Ui with the linear regression lines (right).



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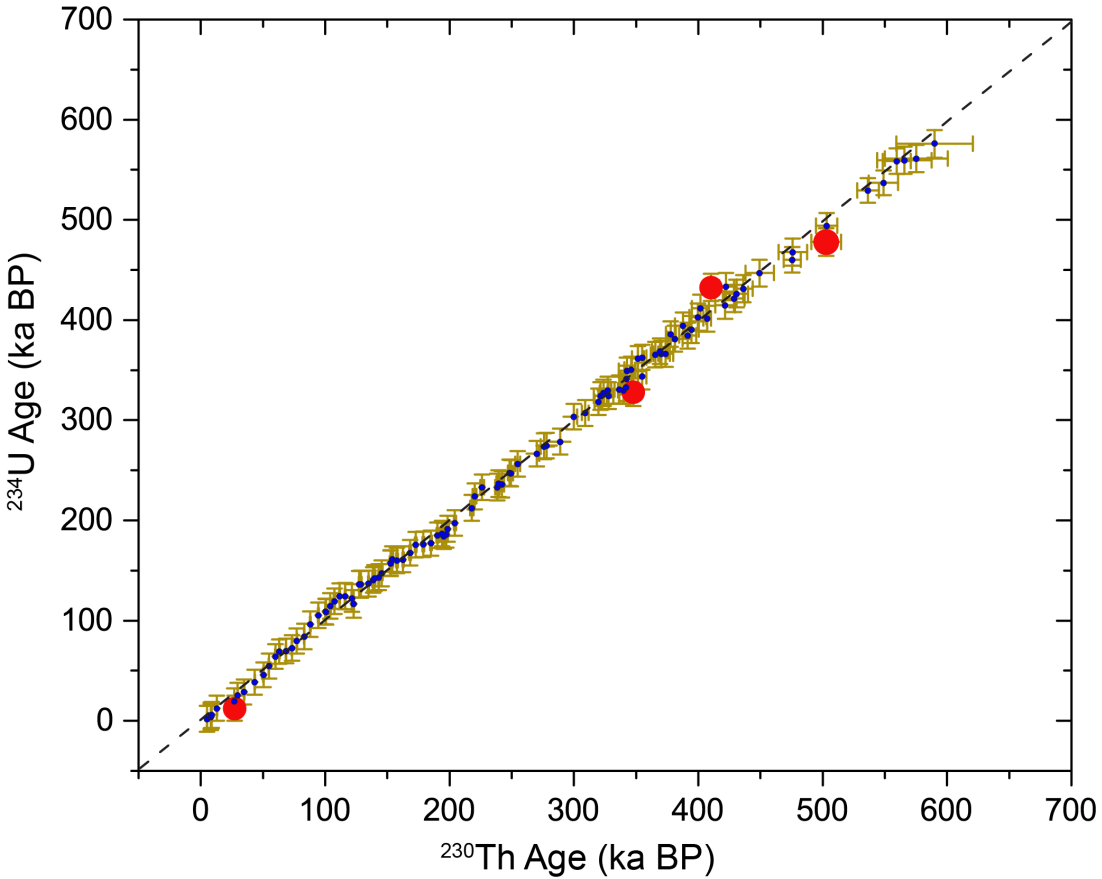


**Fig. 2.** Scatter plot in the 234U ages vs 230Th ages between 4 to 590 ka BP with the corresponding 2s uncertainty. The 1:1 line and the inconsistent points (red dots) between two kinds of age are shown