

Geochronology Discuss., author comment AC2  
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## Reply on RC2

Tibor János Dunai et al.

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Author comment on "In situ-produced cosmogenic krypton in zircon and its potential for Earth surface applications" by Tibor János Dunai et al., Geochronology Discuss.,  
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In our reply to RC 2 we list our replies (normal font) below the individual comments (italic).

**RC2:** *'Comment on gchron-2021-24', Michal Ben-Israel, 26 Oct 2021*

*In this manuscript, Dunai et al. examine the feasibility of in situ produced cosmogenic krypton in terrestrial zircon to study surface processes and demonstrate its applicability using a set of samples from the Vogtland region that experienced periglacial conditions during past glaciations. This work thoroughly examines the different Kr isotopes and their various production pathways recognize the most suitable isotopes for studying surface processes ( $^{78}\text{Kr}$ ,  $^{80}\text{Kr}$ ,  $^{81}\text{Kr}$ , and  $^{82}\text{Kr}$ ), and presents a  $^{10}\text{Be}$  cross-calibrated production rate that is close to the experimental rate.*

*Overall I think this is a thorough and well-written paper that could be published in something close to its present form. I think the authors present a new and potentially very valuable tool in cosmogenic nuclide geomorphology. I do have some minor comments that I think could improve the manuscript.*

*Line-by-line comments:*

*Line 17 (abstract): In situ is written here with a dash (in-situ), while it is written without a dash throughout the rest of the manuscript.*

Will be changed accordingly.

*Line 20 (abstract): please include more detail about the results reached (i.e., sediment production and storage dynamics in the study region during MIS 22-16).*

The goal of the manuscript is to show the feasibility of this new method, not necessarily the geological/climatological implications that emerge from the initial measurements. Therefore, we rather not include the geological results in the abstract.

*Figure 1: I had a bit of a hard time following this figure. Is the y-axis the normalized krypton abundances or the relative yield? If it is the normalized abundances, does the normalization factor change with the source? If so, please specify. Other than that, I found the color scheme to be hard to follow and not colorblind-friendly.*

The y-axis is the normalized krypton abundance (in air, atmospheric) or relative yields (fissionogenic, nucleogenic and spallogenic), all relative to the most abundant isotope in each of these components. All yields/abundances of Kr isotopes are divided by the yield or abundance of the most abundant/abundantly produced isotope of a given source. Thereby the relative yield or natural abundance of the most abundant isotope is set to 1, all others are <1. For the colourblind we intentionally used the different symbols that are connected by the coloured lines. We are open for suggestions for an alternative colour scheme.

*Lines 465-469: Could this be a result of Kr diffusion from zircon? While there is some discussion of the possible effects of diffusion on Kr in zircons under earth-surface temps, I think this should be considered, especially as it seems to be more pronounced in samples that might be less 'structurally intact'.*

No, the zircons from Mud Tank are structurally intact. "Mud Tank material represents an extremely low degree of radiation damage" (Guenther et al. 2013), resulting from a low dose received ( $\sim 10^{16}$  a/g; Guenther et al., 2013). See also Response to RC1.

*Lines 647-652: It would be interesting if you could include the % ratio of nucleogenic to cosmogenic Kr in your samples. It could give a better understanding of how negligible is nucleogenic Kr.*

Since fractionation may mimic effects of nucleogenic contribution in the  $^{80}\text{Kr}/^{82}\text{Kr}$  vs.  $^{78}\text{Kr}/^{82}\text{Kr}$  diagram (Fig. 6), which we use to identify possible contributions by nucleogenic Kr, we cannot quantify the contribution of nucleogenic krypton in the four samples that may contain it (i.e., the samples in Fig. 6 marked with an asterisk above the atmospheric – spallogenic mixing line). We excluded these samples from further discussion (see caption of Fig. 6). All other samples do not contain nucleogenic Kr at a level that is analytically resolvable (i.e., within the stated uncertainties), i.e. nucleogenic Kr is unimportant for these samples.