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# Comment on gchron-2021-17

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Community comment on "Attenuation of beta radiation in granular matrices: implications for trapped-charge dating" by Alastair C. Cunningham et al., Geochronology Discuss., https://doi.org/10.5194/gchron-2021-17-CC1, 2021

With extending the luminescence dating practice towards heterogeneous materials and changing measurement geometry accordingly, microdosimetry has become important. This study is therefore highly appreciated. My comment is mainly about the conceptual approach illustrated in Fig. 1 and the grain-size dependence of radioactivity.

A new approach may well be introduced by way of a first order approximation, but Fig. 1A does not look like a first order approximation or I am missing something here. Fig. 1A illustrates a giant source (red region) hosting a small dosimeter. In nature this would be, for instance, the lattice of a pyroxene mineral (e.g., zircon, olivine, etc) in which a quartz grain is embedded or, as illustrated in Fig. 1B and 1C the pyroxene host carries a quartz grain together with a number of inert grains. In nature, however, quartz and pyroxene are not mixed and a re-melting of a pyroxene-bearing rock in the way that quartz and zircon get in contact as illustrated in Fig 1A can be ruled out. In contrast, Fig 1D looks realistic: the quartz dosimeter is surrounded by active and inactive grains of variable size. In the text the use of the term 'matrix' was puzzling: the matrix is composed of quartz and feldspar grains hence granular as illustrated in Fig 1D. Elsewhere it says the matrix is (or is not) homogeneous or it is a 'bulk matrix' for which the 1-φ approach should be used. Is the bulk matrix assumed to be inert, hence the opposite of Fig. 1A? Equally, "sources that are held on grain surfaces" is not illustrated in Fig. 1 and only briefly mentioned in the text as "secondary mineral coatings formed on grain surfaces". What is a secondary mineral coating and how likely is it that it includes radioisotopes? Last, what is the relationship between Fig. 1 and the geometries depicted in Fig. 3 and what is a source distribution that equals sediment distribution in geometries B and C?

The dependence of radionuclide concentration on grain size is tested using gamma spectrometry. If the samples were wet sieved and settled in distilled water with the aid of a dispersing agent, then the secondary mineral coating on grain surfaces is altered or it has disappeared completely. The data shown in Fig. 5 would then reflect the grain size of the radioisotope-bearing mineral.

In sec. 6 there are typos regarding the daughters of Ra-226. With Murray et al. (2015; 2018) in mind, I suggest to indicate (a) the energy line with which the respective radioisotope was determined, the measurement geometry and (c) the reference material used to ensure reliability of the estimate.

I suggest to re-write the text by first illustrating the Mejdahl approach using figure, text

and equation and then add one after the other element of complexity, e.g. sources held on grain surfaces, each time keeping nomenclature and notations constant.