Ancient TL

www.ancienttl.org · ISSN: 2693-0935

Readhead, M., 2002. *Addendum to "Absorbed dose fraction for 87Rb β particles".* Ancient TL 20(2): 47. https://doi.org/10.26034/la.atl.2002.347

Addendum to "Absorbed dose fraction for ^{87}Rb β particles"

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(Received 30 September 2002)

This recent paper (Readhead, 2002) calculated the absorbed dose fraction for β particles emitted by ^{87}Rb sources uniformly distributed in a spherical grain of quartz, when surrounded by a region not containing any ^{87}Rb sources. The converse situation, of ^{87}Rb-free quartz grains embedded in an medium uniformly emitting ^{87}Rb β particles, was considered by Adamiec and Aitken (1998). Thinking that an "approximate evaluation of this factor is not available", they "arbitrarily" took the attenuation factor for coarse-grain dating to be 0.75 (see the footnote to Table 8).

The two absorber-emitter situations are complimentary, and a more accurate attenuation factor for the latter case can be obtained from Readhead (2002) by simply replacing Equation 1 with $D_e = N_0 E_0 (1 - S_e)$. Table 1 can then be used to obtain the attenuation factor. For example, for 100 μm diameter grains the attenuation factor is $0.512\,(=1-0.488)$, leading to an absorbed dose of 0.0825×0.512 MeV/N_0 or 0.3580×0.512 μGy/a/(ppm Rb). Note that the attenuation factor differs substantially from the value used by Adamiec and Aitken (1998), although in most dating situations this difference will only have a minor affect on the age of the sample.

Acknowledgement

The author thanks Martin Aitken for bringing his attention to the approximation used in his 1998 paper, and for suggesting this addendum.

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