A proposal for dealing with anomalous fading

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This proposal was inspired by variations in the scatter observed during measurements pertaining to anomalous fading. The anomalous fading results themselves are reported in Huntley and Clague (1996); some relevant details are given at the end of this note.

The basic idea is that the feldspar grains on a planchet are a highly inhomogeneous bunch with most of the luminescence arising from only a small fraction of the grains, these grains exhibiting differing amounts of anomalous fading. The proposal then is to make an equivalent dose determination with a very large number of planchets, say 200, using 20 or more planchets for each point. After this, anomalous fading measurements would be made on all the planchets, allowing the planchets then to be grouped by differing degrees of anomalous fading. The grouping would be somewhat arbitrary, but supposing that four groups were chosen then from the equivalent dose measurements four equivalent doses would be obtained. A plot would then be made of "equivalent dose" vs amount of fading, and extrapolated to zero fading to obtain the best estimate of the actual equivalent dose, as illustrated in Figure 1.

Apart from the labour involved there are two obvious difficulties. The spread in the amount of fading may be rather small, in which case the points shown in the figure would be rather clustered, thus precluding a usable fit and extrapolation; putting fewer grains on the planchets may help here. A second difficulty is that this may only deal with some of the fading; if there is a component which is unobservable on a time scale of weeks, but significant over the life of the sediment, this would not be allowed for in this method.

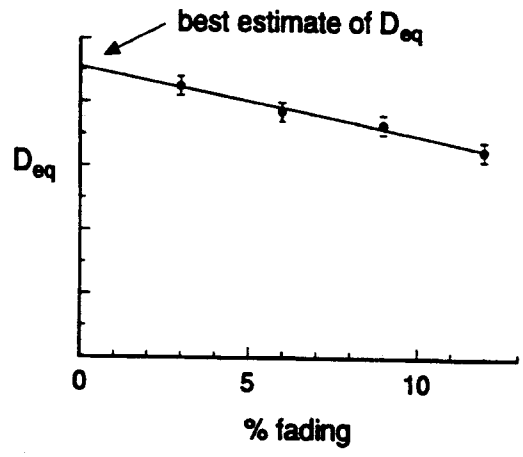

Figure 1.

This hypothetical result shows four equivalent doses, each one being obtained from a different group of planchets. The groups are formed on the basis of the amount of anomalous fading each planchet exhibits, the fading being made after the equivalent dose measurements. For the samples listed in the table there were not sufficient numbers of planchets to make such a graph.

The principal data that inspired the above were obtained as follows. For each sample twenty 8 mg planchets of separated "K-feldspar" grains were prepared. A short-shine measurement of each was made for later normalization. Two planchets were kept untreated and the remaining 18 given an infrared bleach. The latter were then given irradiation doses in 3 groups of 6 at different times, together given a 16 h 120°C preheat and the luminescence caused by 1.4 eV (IR) excitation measured. The delays between irradiation and measurement for the 3 groups were 3 days, 18 days and 7 months.

The 18 were then bleached, dosed, preheated and measured again, this time all

together. The delay between irradiation and measurement was 3 days. These data were taken for use as an alternative normalization.

Use of the second set of normalization data resulted in much less scatter and the figures below were obtained using it. For the groups of 6 planchets the scatter, expressed as a standard deviation, was as follows:

	Sample CBTS2	TTS3
Delay	Scatter	Scatter
3 days	1.3%	0.8%
18 days	2.4%	1.1%
7 months	6.4%	2.0%
	Fading ratio	Fading ratio
18 days/ 3 days	0.959 ± 0.013	0.967 ± 0.006
7 months/ 3 days	0.935 ± 0.028	0.890 ± 0.009

As can be seen the scatter systematically increases with the delay. There would appear to be enough data to rule this out as a statistical effect and the obvious explanation is that it is associated with variations in the extent of anomalous fading. For completeness the actual fading ratios are also shown in the table.

Reference

Huntley, D.J. and Clague, J.J. Optical dating of tsunami-laid sands, (1996). *Quaternary Research* **46**, 127-140.

Reviewer
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