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The last interglacial sea-level record of Aotearoa New Zealand

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Supplementary Material to: The last interglacial sea-level record of Aotearoa New Zealand

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Recommendations for Reporting Luminescence Method

1. Equivalent dose

Basic information required includes: mineral type; pre-treatment techniques including whether or not the samples were etched in hydrofluoric acid (HF) and, if so, at what concentration and for how long; machine and photomultiplier tube type; detection filters used; single grain or single aliquots used; if aliquots were used, the diameter size; De determination method used (e.g., single aliquot regenerative dose, single aliquot additive dose, multiple aliquot additive dose, etc.); and an outline of the rejection criteria used to screen the data.

It is well documented that luminescence dating of New Zealand sediments and determination of the equivalent dose (De) is not straight forward for either quartz or feldspar. Focusing on feldspar dating, the De measurement procedure used is particularly important as it comes in several variants (e.g., IRSL50, pIRIR270, pIRIR290, etc.), each with their own strengths and weaknesses. This procedure needs to be spelt out in full either in the main text or in the supplementary information and include the magnitude and duration of preheating, light stimulation duration, and sample temperature. Hand in hand with feldspar dating is an assessment of the rate of luminescence signal lost, known as anomalous fading. The method of assessment should be noted and the results presented fully (%/decade ± standard error), not just a statement saying that it was 'not significant' or similar. There should also be an assessment of the magnitude of the residual dose remaining after a period of either solar or artificial bleaching. Again, the methods should be written in full with the magnitude presented ± standard error. A dose recovery test should also be performed using a subsample of grains that have been bleached and given a laboratory dose to determine the most appropriate preheating parameters used during measurement. For quartz, reporting should include all of the above, except for the fading and residual dose as these are not applicable. This information can be reported in the main text; however, it is more common to include in a supplementary information section.

2. Dose rate determination

Basic required information includes: method/technique used to assess external alpha, beta and gamma dose rates (where applicable); measurement results and/or assumption made about internal uranium and thorium content for quartz, or both of these and internal potassium for feldspars; method/calculations used for assessing the cosmic ray dose rate; water content evaluation and an estimate of the long-term water content used in age calculations; dose rate conversion factors used to convert concentrations to Gy/ka; and attenuation factors associated with external beta dose rate and any consideration of the impact that HF-etching might have on this value.

Ideally, an assessment of whether or not there is any disequilibrium in the uranium and thorium decay chains should also be conducted. Although this is not essential, some consideration of disequilibrium should be mentioned.

3. Presentation of results

A summary of the De, dose rate, and age calculation results for each dated sample should be presented in a table in the main text. This table should include: Sample name; external dose rate values and their associated uncertainties (alpha (where applicable), beta, gamma, and cosmic); total dose rate; sample De; an estimate of overdispersion (the amount of spread within the data after all known and assumed sources of uncertainty have been considered); the age model or method used in combining individual De estimates in each sample; and the age estimate. Other optional columns would include: sample depth; 'as measured' water content; and the number of grains/aliquots used in final De determination. Ideally, a table should also be included in the supplementary information section showing the total number of grains/aliquots measured for each sample and where they failed to pass the established rejection criteria.

Most importantly, the spread within the De values for each sample needs to be displayed graphically. Although our preference is for the use of radial plots; abianco plots, and probability density function could also be used. It is on the basis of the distribution of De values in each sample that the sample's De is determined and used in the age calculation. In many cases, the patterns observed in De distributions directly relate to the syn- and post-depositional histories of the samples and, by extension, the appropriateness of the age models used to combine

them. We would recommend that an example of the observed De distributions be included in the main text, with all distributions reproduced in the supplementary information.

- Inclusion of dating reports

Although it is not recommended that you simply cut and paste a dating report into the supplementary information section, they are certainly a good place to start. Of the commercial firms that authors have used, most of these laboratory reports quickly off reference critical pieces of methodological information to sources that are either outdated or buried in hard-to-access journals or grey literature. However, any reputable dating laboratory should be able to provide you with the basic information outlined in our above response.