Letters

Comment on ’ Non linear approach of TL response to dose: polynomial approximation. Ancient TL, 14, 7-14. (1996) Guibert, P., Vartanian, E., Bechtel, F., and Schvoerer, M. ‘

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The objective reader might be interested to learn of earlier development and application of polynomials to TL dose-response curves than those cited in the recent review and explanatory note by Guibert et al. (1996). These authors provide a useful outline of the data-processing procedures used by the laboratory in Bordeaux, including their version of the "Australian-slide method" (though not cited, as pointed out by the reviewer), but they fail to give proper credit to much earlier, and more original, work by Berger et al. (1987) on the use of both quadratic and cubic polynomials for many of the same purposes (except the slide method). My own development of the use of polynomials grew out of the efforts of Divigalpitiya (1982) to employ quadratic polynomials.

In the review part of their note, Guibert et al. also fail to mention any of the much earlier accurate applications by Berger of quadratic polynomials to both sublinear and supralinear TL dose responses in sediments (e.g., Berger, 1985; Berger and Mahaney, 1990; Berger et al., 1991). Furthermore, they fail to mention any of the much earlier applications of single-saturating exponentials of Berger, and of cubic polynomials (Berger, 1987; Berger et al., 1987). Finally, they fail to mention the earlier description and application of the single-saturating-exponential-plus-linear function, with error analysis (Berger, 1990, 1991), developed contemporaneously with the different approach of Grün (1990). Such shortcomings in accreditation of at least representative prior scientific literature are not appropriate in scientific publication.

In closing, the use of polynomials (especially of order three or higher) was discouraged by Berger et al. (1987), precisely because they seem at present to have no apparent basis in physical processes underlying luminescence dose responses, at least for sublinear responses. The introductory rationalizations of Guibert et al. (page 9) for their use of polynomials may therefore be questioned. For example, there appears to be no practical need to have a single function for representing all dose-response regions simultaneously. If the dose-response curve is saturating, then the error introduced by ignoring any low-dose departure from an exponential (or exponential-plus-line) model appears to be insignificant (as has been demonstrated in citations above). On the other hand, for very young samples (e.g., archeological material or geological samples less than 1 ka), there appears to be no need to reconstruct the high-dose region. For this reason, with such "young" samples, second-order polynomials appear to be acceptable under certain empirical conditions (e.g., relatively small extrapolations, or for supralinear fits), as demonstrated in the citations above (and others).

References

Berger, G.W. (1985) Thermoluminescence dating applied to a thin winter varve of the Late Glacial South Thompson Silt, south-central British Columbia. Can. J. Earth Sci. 22, 1736-1739.

Berger, G.W. (1987) Thermoluminescence dating of the Pleistocene Old Crow tephra and adjacent loess, near Fairbanks, Alaska. Can. J. Earth Sci. 24, 1975-1984.

Berger, G.W. (1990) Regression and error analysis for a saturating-exponential-plus-linear model. Ancient TL, 8, 23-25.

Berger, G.W. (1991) The use of glass for dating volcanic ash by thermoluminescence. J. Geophys. Res. 96, 19705-19720.

Berger, G.W. and W.C. Mahaney (1990) Test of thermoluminescence dating of buried soils from Mt. Kenya, Kenya. Sedimentary Geology. 66, 45-56.

Berger, G.W., R.A. Lockhart and J. Kuo (1987) Regression and error analysis applied to the dose response curves in thermoluminescence dating. Nuclear Tracks and Radiation Measurements, 13, 177-184.

Berger, G.W., R.M. Burke, G.A. Carver, and D.J. Easterbrook (1991) Test of thermoluminescence dating with coastal sediments from northern California. Chemical Geology (Isotope Geoscience), 87, 21-37.

Divigalpitiya, W.M.R. (1982) Thermoluminescence dating of sediments. Unpublished M.Sc. Thesis, Simon Fraser University, Burnaby, Canada, 93 p.

Grün, R. (1990) Dose response of the paramagnetic centre at g = 2.0007 in corals. Ancient TL, 8, 20-22.

Guibert, P., Vartanian, E., Bechtel, F., and Schvoerer, M. (1996) Non linear approach of TL response to dose: polynomial approximation. Ancient TL, 14, 7-14.