Thermoluminescence Dating of Loess Deposition in Normandy

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Wintle et al (1984) have reported fourteen dates obtained on a section of loess at Saint Romain, Normandy, by thermoluminescence (TL). These are seriously affected by the conclusions of a dating program I have carried out on sediments from N.W. Europe (Debenham, 1985), which shows the instability of the TL signal limits the age range of the technique. Figure 1 summarises the findings of this work, being a plot of sediment ages as measured by TL against the estimated dates of deposition. While the latter are in many cases questionable, there is little doubt that the measured ages are limited by decay of the TL signal, and that the instability has a mean life close to 100 ka.

The experimental technique practised by Wintle et al significantly differs from my own in three respects:

(i) she selected TL emissions in the wavelength range 330-380 nm (cf. my choice of 280-380 nm);

(ii) her samples were heated at 230^{o}C for 1 min before TL measurement; and

(iii) her method of date calculation neglected the fact that, while the alpha-induced TL intensity grows linearly with dose, the beta- and gamma-induced component shows non-linear growth (see Aitken, 1984 for discussion).

Since the maximum TL ages given in Wintle et al (1984) exceed the limiting value apparent in fig. 1, it was considered whether the different wavelength range and the pre-heat treatment used by Wintle had resulted in the selection of a more stable TL component. In order to test this possibility, four of the sediments from N.W. Europe, all older than 200 ka, were remeasured using the 330-380 nm wavelength selection and a variety of pre-heat treatments (150^{o}C for 16 hrs; 200°C for 1 min; 250°C for 1 min). In all cases, equivalent dose values were not measurably altered. It thus appears that the TL signal measured by Wintle has the same mean life as that used to derive the data shown in fig. 1.

The method of calculating the TL ages was next investigated. Wintle has kindly supplied me with the basic data regarding three of her loess samples. These have now been reanalysed allowing for the different growth forms for the TL induced by alphas and that due to betas and gammas. The effect on the TL ages is to reduce them: sample h by 17%, and samples i and n both by 12%. Assuming a mean life of 100 ka for the TL signal, sample n now appears to be of such an age that its TL has effectively reached dynamic equilibrium. The TL ages of the younger loesses from Saint Romain should be corrected for the effects of the instability.

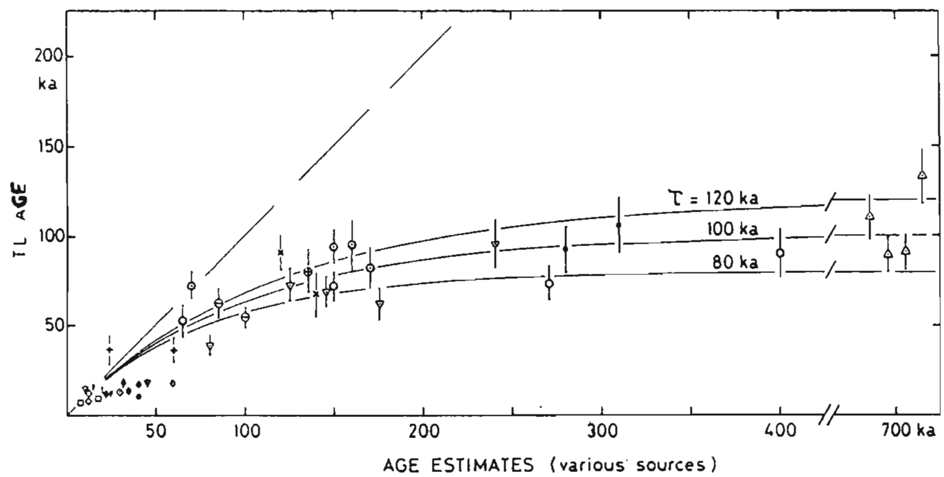

Figure 1

TL ages of sediments from N.W. Europe compared to expected dates based on various geological and archaeometric grounds. Symbols identify samples from different sites. Curves show expected TL ages, T, assuming a constant accumulation rate to an unstable signal of mean life, τ; T = τ (1-exp (t/τ)) for τ = 80ka, 100ka and 120 ka.

References

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