Bibliography

Berger, G.W. (1993) Reply to Wintle et al, *Geology*, June, 569.

Berger, G.W. and Hanson, K.L. (1992) Thermoluminescence ages of estuarine deposits associated with Quaternary marine terraces, south-central California. In Quaternary Coasts of the United States: Marine and Lacustrine Systems. *SEPM Special Publication No.* 48, 303-308.

Goedicke, C., Henschel, S. and Wagner, U. (1992) Thermolumineszenzdatierung und neutron-enaktivierungsanalyse von urnengefassen aus Oaxaca. BaesslerArchiv, Neue Folge, Band XL, 65-86.

Huntley, D.J., Hutton, J.T. and Prescott, J.R. (1993) The stranded beach dune sequence of south-east south Australia: a test of thermoluminescence dating, 0-800 ka, *Quaternary Science Reviews* **12**, 1-20.

Kamaludin, B.H., Nakamura, T., Price, D.M., Woodroffe, C.D. and Fuji, S. (1993) Radiocarbon and thermoluminescence dating of the Old Alluvium from a coastal site in Perak, Malaysia. *Sedimentary Geology* **83,** 199-210.

Mercier, N., Valladas, H., Bar-Yosef, O., Vandermeersch, B., Stringer, C. and Joron, J.L. (1993) Thermoluminescence date for the Mousterian burial site of Es-Skhul, Mt.Carmel. *Journal of Archaeological Science* **20**, 169-174.

Rendell, H.M., Yair, A. and Tsoar, H. (1993) Thermoluminescence dating of periods of sand movement and linear dune formation in the northern Negev, Israel. In Pye, K. (ed). The Dynamics and Environmental Context of Aeolian sedimentary Systems. *Geological Society Special Publication No.* 72, 69-74.

Shlukov, A.I., Shakhovets, S.A., Voskovskaya, L.T. and Lyashenko, M.G. (1993) A criticism of standard TL dating technology. Nuclear Instruments and Methods in Physics Research, **73**, 373-381. (*published with comments by Mejdahl and a reply by Schukov*).

Stokes S. and Breed, C. S. (1993) A chrono-stratigraphic re-evaluation of the Tusayan Dunes, Moenkopi Plateau and southern Ward Terrace, Northeastern Arizona. In Pye, K. (ed). The Dynamics and Environmental Context of Aeolian sedimentary Systems. *Geological Society Special Publication No.* 72, 75-90.

Stokes, S. and Gaylord, D.R. (1993). Optical dating of Holocene dune sands in the Ferris Dune Field, Wyoming, *Quaternary Research* **39**, 274-281.

Visocekas, R. (1993) Tunnelling radiative recombin-ation in K-feldspar sanidine. Nuclear Tracks and Radiation Measurements **21**, 175-178.

Wintle, A.G. (1993) Dating sediments using luminescence signals. *Environmental Science and Technology* **27**, 803-805.

Wintle, A.G., Li, S.H. and Botha, G.A. (1993). Luminescence dating of colluvial deposits from Natal, South Africa. *South African Journal of Science* **89**, 77-82.

Wintle, A.G., Questiaux, S.G., Roberts, R.G. and Spooner, N.A. (1993) Comment on "Dating loess up to 800 ka by thermoluminescence", *Geology,* June, 568.

TL dates in

Li, P.Y. and Zhou, L.P. (1993) Occurrence and palaeoenvironmental implications of the Late Pleistocene loess along the eastern coasts of the Bohai Sea, China. In Pye, K. (ed). The Dynamics and Environmental Context of Aeolian sedimentary Systems. *Geological Society Special Publications No.* **72**, 293-309.

A series of papers in the Proceedings of the 10th International Conference on Solid State Dosimetry, Washington, DC held in July 1992 were published in 1993 in Radiation Protection Dosimetry, 47, Nos. 1-4.

Wintle, A.G. Recent developments in optical dating of sediments, 627-635.

Morris, M.F. and McKeever, S.W.S. Further developments of a model for describing the optical bleaching of thermoluminescence from quartz as applied to sediment dating, 637-641.

Compiled by Ann Wntle

Letters

° *From G. Hutt and I. Jaek , Institute of Geology, Estonian Academy of Science, EE0105 Tallinn, Estonia.*
The effect of shallow traps: a possible source of error in TL dating of sediments. *Ancient TL*, 10(2) 1992.

Comments to dating technique, proposed by Shlukov and Shakovets (1987).

1. The technique is based on a number of assumptions which may not be well founded:

1(a). Sediments of different genesis, laid with different rates of sedimentation, where the residual may be far from being in minimum.

1(b). Palaeodose reconstruction on the basis of minerals which have undergone strong light bleaching, especially in the case of quartz, is not valid because of sensitivity changes.

1(c). Correlation with ^{14}C dates is only seldom possible. So this technique may give only stratigrafic information of homogeneous profiles, but not absolute dates.

2. Concerning laboratory calibration procedures we would like to make the following remarks:

2(a). Trap competition is well-known. Deeper traps commonly provide greater competition and the effective cross section of traps is the result of the charge and quantity of defects. Moreover deep traps are usually the first to saturate.

If shallow traps can provide greater competition, which we doubt, deep traps will reach their saturation level at a considerably slower rate (see fig.1, of paper).

2(b). The decrease of the equilibrium level of charge carriers concentration (fig. 2 in paper) is plausible only if special factors apply, including the following:

- fading at elevated temperature of irradiation.
- radiation fading or bleaching as a result of complicated interaction of radiative factors with mineral defects: formation of different channels of recombination, causing loss of information. At elevated temperature, thermally dependent processes may exist. For example, some centres that were are an excited state after stimulation may need

additional thermal activation energy to be included in the recombination processes (like "infrared" mechanism of optical response).

- quenching, caused by hole recombination processes: at elevated temperature holes may be released from valence band or from shallow hole traps with the following recombination at electron deep traps. All these mechanisms (and others) may be responsible for the experimental results obtained in the paper. A more specific model needs additional experimentals results.

The conclusion concerning the simulation of natural processes at elevated temperature is quite questionable, because a lot of possible thermally dependent effects may also be activated.

Reply by Vagn Mejdahl

I am grateful to Ian Bailiff for giving me the opportunity of an immediate reply to the comments by G. Hütt and I. Jaek. I shall reply to the various points in turn.

1(a). Incomplete zeroing. This objection can be raised against all luminescence dating methods except those designed especially to cope with partially bleached sediments. The situation is no different from that applying to the added dose technique which I believe GH and IJ are using. The technique of Shlukov et al. can be used for partially bleached sediments provided that an estimate of the residual dose at the time of deposition can be obtained.

1(b). I am not sure what is meant by "strong light bleaching", but it can hardly be relevant for Shlukov's technique. Unlike the commonly used regeneration technique, Shlukov's method uses no laboratory bleaching; therefore, the only bleaching involved is that occurring in nature and this is common for all luminescence dating techniques.

1(c). Provided that the TL growth curve for a particular mineral from a certain region can be approximated by a single exponential function with its two parameters then only one ^{14}C date is needed for each region, the other parameter being the saturation level.

I think it might be well worth while to look into Shlukov's method, perhaps using feldspars, because it avoids a number of problems, including those of long-term thermal fading and the possible effect of dose rate differences in nature and in laboratory irradiation.

2(a). I am not sure which dosimetry practice GH and IJ are referring to and I find it difficult to see the relevance for the minerals used in dating. My opinion is that if one wants to know the properties of say K-feldspars, one has to study K-feldspars. Doing this it is easy to verify that the signal relating to the 150°C peak reaches saturation at a lower dose than those relating to the peaks at 220 and 320°C (heating rate 8°C/s).

It may be true that trap competition is a well-known fact, but I know of only two earlier studies that have addressed the particular problem associated with the presence of a shallow trap: Aitken et al. (1974) and Wintle and Packman (1988) and these seem to have gone largely unnoticed. I think, therefore, that Shlukov et al. (1992) are to be congratulated for having pointed out this potential problem so clearly.

2(b). I agree that a number of thermally conditioned processes might occur as a result of the procedure described by VM et al., but the main point is that the response of the 320°C peak in K-feldspar is not affected by merely heating the sample to 130°C; this was verified by heating natural and laboratory irradiated samples at 130°C in an oven for the length of time required for irradiation (a few minutes).

I might add that preheating, which is commonly used in TL and OSL dating, would not be possible if the heating caused adverse effects. We use preheating at 290°C for 10 s for TL dating of archaeological samples and 260°C for 100 s for IRSL. Duller (1991) used a preheat of 260°C for 10 min for OSL dating.

I agree with GH and IJ that more studies might be required, but from a practical point of view the main thing is that the procedure (heating to 130°C during laboratory irradiation) seems to work and removes the underestimates seen in earlier studies, e.g. Kronborg and Mejdahl (1989).