Ancient TL

www.ancienttl.org · ISSN: 2693-0935

Huntley, D., 1978. *The effect of sample reflectance in alpha counting.* Ancient TL 2(3): 2-3.
https://doi.org/10.26034/la.atl.1978.009

THE EFFECT OF SAMPLE REFLECTANCE IN ALPHA COUNTING

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It has been known for some time that the procedure for determining the correct discriminator setting for an alpha counter yields a setting which depends on which standard material is used. Aitken found that the average pulse height for a white sample could be up to twice as large as that for a black one, and this was attributed to different sample reflectivities (Bowman, 1976). The pulse height analyses given by Huntley (1977) show variations attributed to the same effect. Here I have attempted a more quantitative experiment to see how accurately the effect can be predicted and corrected for.

We have measured the reflectances of six counting standards using a Pye Unicam SP-8000 Spectrophotometer, and determined the discriminator setting for each (82% threshold uranium, 85% threshold thorium); the results are shown in the figure. (The samples and sources are described in Huntley, 1977 except for NBL-106 and 108 which are 1.00 and 0.052% Th obtained from ERDA, and DH-1 which is a Canadian Certified Reference Material containing 0.177% U and 0.104% Th.

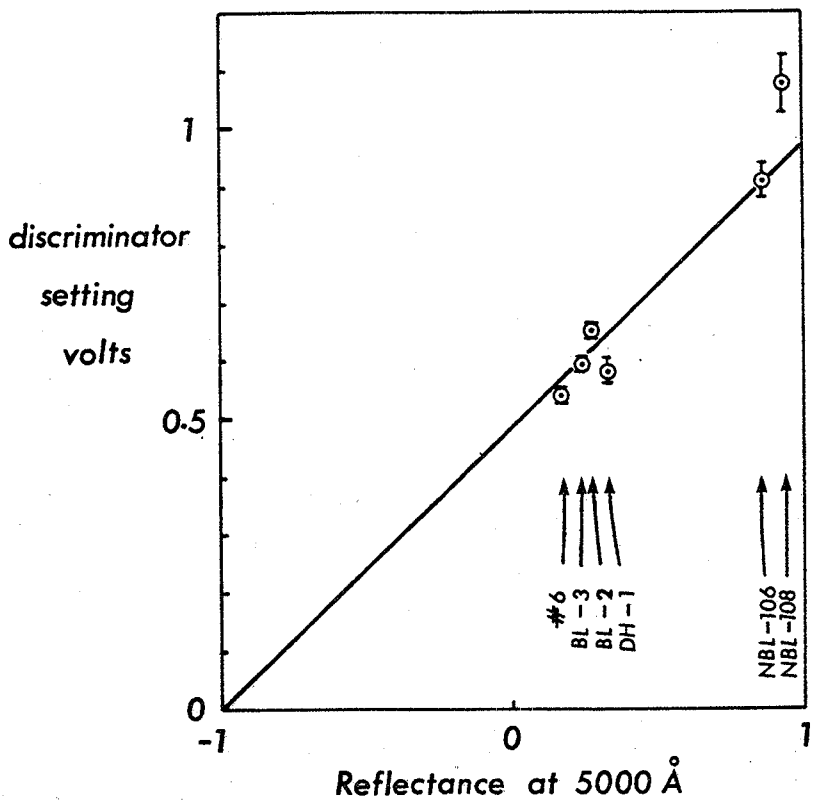
A simple model for the reflectance effect is to consider that the size of the light pulse is proportional to (1 + R), where R is the reflectance; complete reflection thus doubles the light intensity. The straight line drawn in the figure is a fit of this relation to the data. Although the scatter in the data is a little larger than is desirable the relation appears to be a reasonable fit. It is also worthwhile noting that the two thorium standards, with reflectances of about 0.9, are white, while the remaining samples are brown or gray.

It is apparent from this that if one sets the discriminator using a highly reflecting thorium standard and then uses the alpha counter to measure a gray sample, the resulting count rate will be about 20% too low. Errors of the order of 5% or more are thus probably quite common.

A possible reason for the scatter of the data in the figure is that the sample reflectance will depend on the fraction of it that is in optical contact with the ZnS; this in turn will depend on whether the powder was spread out and pressed with a spatula or simply poured on. The surface roughness of both the sample and the ZnS may also affect the reflectance. It is difficult to see how to measure or calculate these effects in a precise way, however a simple reflectance measurement will clearly be better than none at all and a simple device for measuring sample reflectivities would be most useful.

I wish to thank Mr. Falko Tilgner for making the reflectivity measurements and J.C. Irwin for clarification of the optical effects.

Bowman, S.G.E., D. Phil. Thesis, Oxford, p. 28, 1976.
Huntley, D.J., Ancient TL No. 1, pp 3-6, 1977.



THE 1978 TL SEMINAR - OXFORD

The TL seminar 3-8 July at Oxford was the largest meeting ever on TL dating, both in length and number of papers, exceeding, for example, previous TL sessions at the Archaeometry Symposia by more than a factor of two. The over 80 participants from 23 countries, nearly all of whom contributed papers, reflects the rapid increase in worldwide development of TL dating. All aspects of TL dating were covered. There were theme lectures on:

- basic TL measurements and sample preparation
- fine-grain, quartz inclusion and predose techniques
- beta and gamma dosimetry
- dose-rate evaluation
- rare earth impurities
- authentication
- phototransfer
- TL kinetics
- defects in quartz
- anamolous fading

Research papers covered the above topics as well as many others, in particular:

- radon and Ra-226 disequilibrium
- TL dependence on dose-rate and temperature
- dating techniques for flint, calcite, ocean sediments, zircons, volcanic rocks, heated rocks and meteorites
- electron spin resonance
- new apparatus
- pottery dating applications
- supralinearity
- emission spectra
- alpha dosimetry

The proceedings of the seminar will be published as Volume 3 of the Council of Europe's PACT Journal, and should be available by early 1979 (contact Dr. Vagn Mejdahl, Atomic Energy Commission, Research Establishment Risø, Roskilde, Denmark, for further details).