Ancient TL

www.ancienttl.org · ISSN: 2693-0935

Mortlock, A., 1980. *Putting ancient rome to use.* Ancient TL 4(2): 10-12.
https://doi.org/10.26034/la.atl.1980.037

# PUTTING ANCIENT ROME TO USE

A. J. Mortlock

Physics Department
Australian National University
Canberra, A.C.T. 2600

The active TL-dating laboratory will commonly have a steady flow of work in classes ranging from simple authenticity measurements, through relatively straight-forward dating of archaeological potsherds etc., to forward-looking research measurements on new materials. There will also, hopefully, be research on improving the technique itself and coming to better terms with the basic physics which is involved. A description of a typical development of such activity in a university laboratory over a period of years has been given recently by Mortlock (1979).

Of great importance in this day-to-day activity is the periodic checking that there has been no drift in the physical standards which form essential reference points in the dating measurements. While this can be achieved by checking obvious things such as the calibrated radioactive sources used for in-laboratory irradiations, in the final analysis it is the ability to reproduce the age figure for a specific archaeological object which is important.

In order to monitor this, it is necessary to acquire a ceramic object of good age which has satisfactory thermoluminescence characteristics and which can be sampled separately a number of times. If it is of accurately known age, and this age is known by a method which does not involve physical measurement, than that is an added advantage because it further tests the ultimate validity of the procedures of the thermoluminescence dating laboratory. Such objects are surprisingly difficult to find.

An appropriate object was kindly made available to the laboratory by Dr. Ann Moffatt of the Department of Classics at the A.N.U. It was a fragment of fired clay wall brick found on the ground at Ostia near Rome. The evidence suggested it had recently fallen from a nearby wall. On its surface was an imprint or stamp which, when translated from the Latin, reads:

> From the brickworks of Aburnius Caldicianus, in the consulship of Paetinus and Apronianus.

As it is known that Paetius and Apronianus were consuls in A. D. 123, we can take the brick to be the same age, namely 1857 yrs. B. P. as consuls were normally appointed for one year.

A difficulty with the determination of the TL-age is the assignment of the environmental dose rate, $D_\gamma$, due to gamma rays. We could assume that the brick was located in the face of the wall and was relatively thin in relation to its height and length. Also it was surrounded on its inner side by bricks of the same composition as itself. Then, if the nearby ground is free of radioactivity, $D_\gamma$ can be calculated from Bell's (1979) Table 2 but must be reduced by a factor of two to obtain the true dose rate due in this case. In fact, there will be some gamma ray contribution from the nearby ground towards the wall-mounted brick. A simple shielding experiment with a Rad 21 dosimeter, Mortlock (1979), mounted on the outside wall of the Physics Department Building showed that the contribution due to the ground would be of the order of 10% of the total dose recorded by the Rad 21 unit under these conditions. This means that the effective $D_\gamma$ is approximately 55% of that calculated using Bell's Table 2. This result will not be fully accurate because the radioactivity of the nearby ground can be anticipated to be different from that of the wall both in Canberra and Ostia. Also at Ostia the wall was made of concrete and the brick, as has already been assumed, was simply a facing. However, the error is expected to be relatively small and constant at a particular site.

Utilizing this correction the following data were obtained by two different skilled laboratory workers studying the brick from Ostia and employing the fine grain dating method:

| Worker | Time | Archaeological Dose (rads) | A.D.R. (rads/yr) | Age (y B.P.) | Discrepancy (%) |
|---|---|---|---|---|---|
| J. D. | Nov., 1978 | 997 | 0.571 | 1746 | -6.0 |
| G. G. | Nov., 1979 | 1175 | 0.636 | 1848 | -0.5 |

Separate measurements were made of the amounts of the contributing long-lived radioactive isotopes present on both occasions and there were small shifts in these, perhaps due to inhomogeneity in the brick, perhaps due to scatter in the analytical techniques employed. This explains the change in the calculated annual dose rate (A. D. R.).

The observed variation here in the archaeological dose is consistent with the scatter noted in a separate series of measurements of the archaeological dose associated with a potsherd from Thailand (Code KKG2 DA (2)) supplied by Dr. Pam Gutman of the Department of Asian Civilisations at the A.N.U. The observations in that case were spread over a year and are presented in the figure. The ratio of sample standard deviation to the mean in the case of the Thai potsherd was 13.3% whereas that for the brick from Ostia was 11.6%. It is assumed here that, other things being equal, the fractional error rather than the absolute error is what remains constant in measurements of archaeological doses of different magnitudes.

Clearly further measurements on the fired clay brick from Ostia are required, and it is intended to carry these forward in due course. Both a series of measurements close together in time and a series spread out in time are required to distinguish the sources of the observed variation. However, it is apparent even at this early stage that repeated measurements of this nature on well-behaved objects of known age are a useful means of monitoring laboratory procedures.

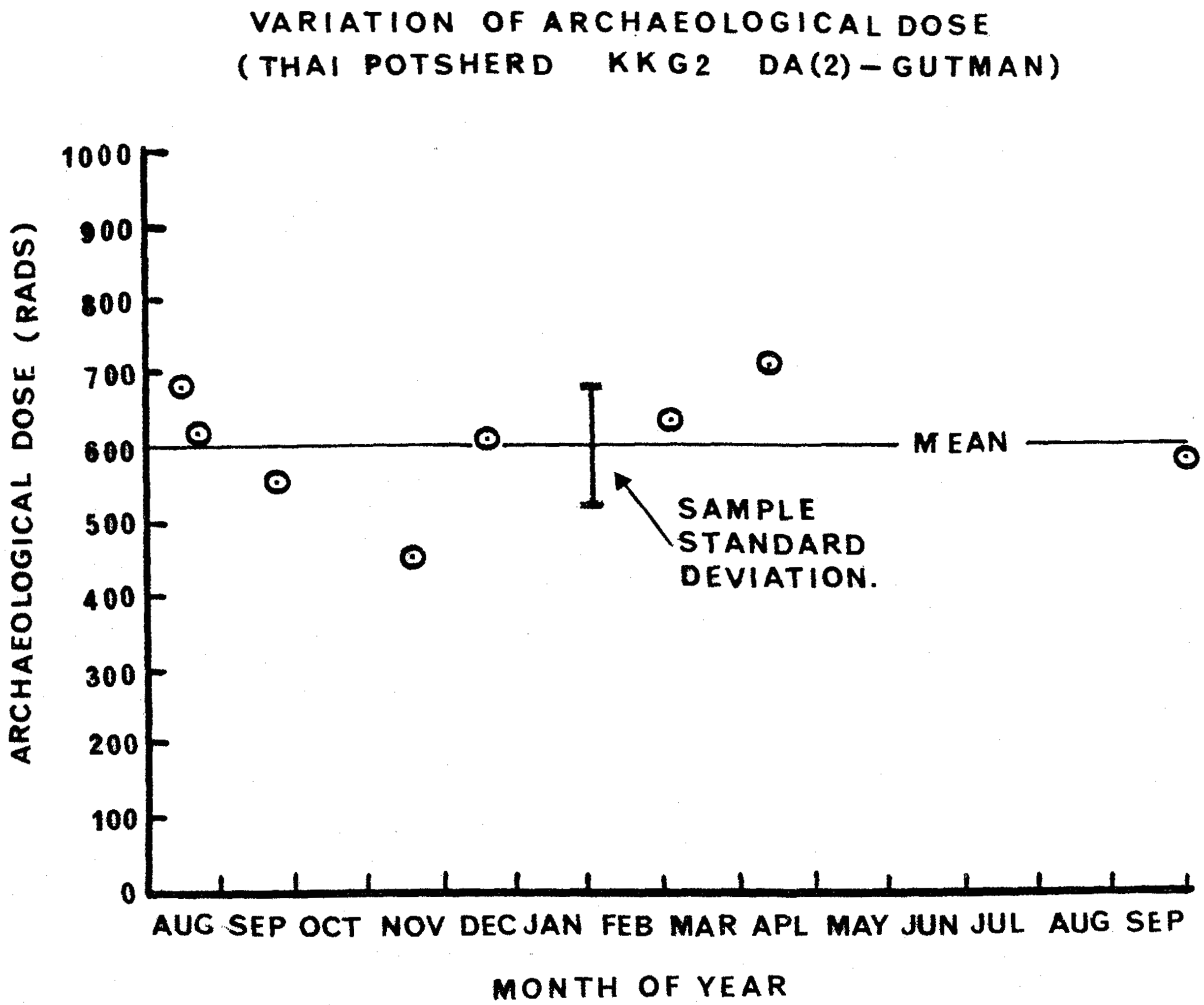
The help of Mrs. Jadwiga Duniec and Mrs. Glenys Gardner in carrying out the laboratory measurements is gratefully acknowledged. The fired clay brick from Ostia is listed in the description of the Classics Museum at the A.N.U., Antiquities, compiled by J. R. Green and Beryl Rawson and published by the Faculty of Arts, A.N.U., Canberra (1979), 119, item 7705.

## References

Mortlock, A. J., 1979, The Quartz Time Capsule, Australian Physicist 16, (9), 149.

Mortlock, A. J., 1979, A Convenient Dosimeter for Measuring the Environmental Dose Rate as it Applies to Thermoluminescence Dating, Ancient TL, No. 9, 6.

Bell, W. T., 1979, Thermoluminescence Dating: Radiation Dose-Rate Data, Archaeometry 21 (2), 243.




## READERS' CLUES AND QUERIES

### One Remedy for High Dark Counts in PMTs

Dark counts for our PMTs, normally between 50 and 100 cps, occasionally increase dramatically in the summertime. We have found that this is apparently caused by high humidity in the housings. The humidity can be high because the housings are not completely airtight and St. Louis summers are very humid. A simple remedy is to place a small amount of dessicant inside the housings to absorb the water vapor. The dark counts typically return to normal within a few minutes after introduction. In our case, the effective lifetime of the dessicant is on the order of a year at which time replacement is required.

S. R. Sutton, Washington University