

TRONDHEIM RADIOCARBON DATING CONFERENCE

Thanks to the kindness of Dr. Richard Burleigh of the British Museum it is now possible to publish extracts from the important paper "An Intercomparison of some AMS and Small Gas Counter Laboratories", by Richard Burleigh, Morven Leese and Michael Tite, delivered at the 12th International Radiocarbon Dating Conference held in Trondheim, Norway in June 1985. The paper is being published in the scientific journal *Radiocarbon*.

According to the Introduction to the paper:

"The advent of successful techniques of radiocarbon dating using small samples has made possible, among many other applications, the direct dating of highly valuable or unique objects for which the use of conventional radiocarbon techniques would be too destructive. *In particular the dating of the Shroud of Turin would now be possible in principle although it is generally agreed that any such measurement ought not to be undertaken by a single laboratory, or even by the use of one technique alone.* Such an objective apart, there is an intrinsic scientific need to establish in a controlled way the variation among laboratories using small sample techniques, when the same, known-age, samples are measured blindfold.

With this in view (*and with particular relevance to any proposal for dating the Turin Shroud*) an intercomparison was planned in which two samples of textile of different age would be sent to four accelerator (AMS) and two small-counter laboratories by an independent laboratory whose role would also be to collate and report on the results, anonymity of the individual results being maintained. The British Museum was chosen to perform this task on the basis of impartiality, experience in radiocarbon dating, and ready access to suitable materials.

The six radiocarbon laboratories taking part in the exercise were Arizona, Bern (using the Zurich AMS facility), Brookhaven, Harwell, Oxford and Rochester, of which Brookhaven and Harwell were the two small-counter laboratories. Two samples, each weighing approximately 100 milligrams, one from Ancient Egypt (linen, 1st. Dynasty, circa 3000 BC) and one from Peru (cotton, Chimu style, circa AD 1200), labelled respectively Sample 1 and Sample 2, were sent to each of these laboratories in May 1983. The provenance of each sample was stated, but their historical ages were not disclosed. A time limit was set for return of the results by 31 December 1983 although later this was extended to 31 July 1984. One laboratory submitted results after this date.

First results received for Sample 2 suggested that the material was of much more recent date than expected and by agreement with all the participating laboratories a third sample (Sample 3: cotton, Peruvian, Late intermediate Period, circa AD 1000 - 1400) was issued under the same conditions as previously to replace Sample 2.

The Egyptian sample, originally from Tarkhan, came from the Petrie Collection at University College, London, and the Peruvian samples came from the collection of the Museum of Mankind (Department of Ethnography, the British Museum). These materials were chosen for their homogeneity, and typical state of preservation, as well as their respective historical ages, and the individual samples were cut from the same area of each textile, away from selvages or designs."

Perhaps more surprising to the layman than to the radiocarbon dating specialists, the readings obtained were not particularly uniform. In the case of the Egyptian sample, for instance, prior to calibration (routine adjustment according to known fluctuations in C14 decay), the following ages were obtained:

| | |
|-----------------|-----------------|
| 3,440 years old | 4,100 years old |
| 4,170 " | 4,230 " |
| 4,340 " | 4,350 " |
| 4,380 " | 4,517 " |

It is clear that the 3,440 year old reading is a substantial anomaly, referred to by the specialists as an "outlier", and excluded from final results for this reason. There were outliers in the case of both samples 1 and 3 (ascribed to faulty pretreatment techniques by one unnamed laboratory, rumoured to have been Bern), while as already noted, the readings from the second sample were in general substantially at variance with the age anticipated.

However after appropriate adjustments, and exclusion of the outliers, from an aggregate of the different laboratories' readings the following C14 dates were obtained:

| Sample | Non-adjusted age in years before present | C14 Date after calibration |
|-----------------------------------|--|----------------------------|
| No. 1 (Egypt) est. 3000 BC | 4138-4458 years old | 3255-2827 BC |
| No. 2 (Peru) est. 1200 AD | 174-550 years old | 1400-1668 AD |
| No. 3 (Peru) est. 1000-1400 AD | 454-722 years old | 1289-1438 AD |

Accordingly the Burleigh/Leese/Tite paper concludes:

"Overall there is good agreement between the results obtained and the expected historical dating of the samples, in particular as far as Samples 1 and 3 are concerned. There do not appear to be differences between the AMS and small-counter techniques although ... it was not possible to test this fully ... Most importantly perhaps, this intercomparison has shown that a coherent series of results can be obtained when several laboratories undertake separate blindfold measurements of the same sample. As expected there are no special difficulties in dating textiles by radiocarbon using small sample techniques, as the concordance of the calibrated radiocarbon and historical dates for two textiles separated in time by nearly 4,000 years clearly shows. Finally, the distribution of the results, containing as it does a number of outliers, *lends added emphasis to the need for the dating of any important relic such as the Shroud of Turin to be shared by several laboratories simultaneously, if the results are to have maximum credibility.* Possibly, also, as a further check, exchange of pre-treated samples by these laboratories might be desirable."

[all italics mine: Ed.]

It is clear from the above that the latest techniques of small-sample radiocarbon dating should now provide meaningful results on Shroud samples. But as mentioned in the last Newsletter, archaeologist Bill Meacham of the Hong Kong Museum of History has voiced some serious concerns which do need to be taken into account. These include (1) the inadvisability of taking samples only from areas charred in the 1532, and (2) the strong possibility that all the Shroud's linen may have been contaminated due to contact with later materials, such as the water thrown over it during the 1532 fire, and the sixteenth century Holland cloth sewn on as a backing in 1534. In a paper prepared for the Hong Kong Shroud Week Meacham has recommended the taking of at least five samples; (1) a single thread from the middle of the cloth, between dorsal and ventral images; (2) a small piece cut just in from the edge next to the site of Raes' piece I; (3) a piece from a charred area; (4) a piece from the side-strip next to Raes' piece II; a sample of the backing cloth sewn on in 1534. Of these (1) and (2) would be the most crucial.