[RADIOCARBON, VOL. 6, 1964, P. 108-109]

SHARP LABORATORIES MEASUREMENTS I

JOHN G. ELLIS and RODMAN A. SHARP

Sharp Laboratories Division, Beckman Instruments, La Jolla, California

Radiocarbon measurements were begun at Sharp Laboratories in the spring of 1962 with the construction of a complete C^{14} dating laboratory. This first system used the method described by Fairhall, Schell, and Takashima (1961) for the conversion of CO_2 to methane via ruthenium catalyst. This system proved to be fast and reliable, giving overall yields of solid sample to counting gas of better than 90% for the total conversion and purification (the conversion yield of CO_2 to methane is quantitative). The detector in present use is 2 L, with construction materials consisting solely of O.F.H.C. copper, teflon, and epoxy resin. The shield consists of 4 in. of high purity lead (specially prepared), 4 in. of borated hydrogenous neutron moderator, a guard counter (cosmic ray detector), and 1 in. of ultra pure mercury. The gross to net ratio obtained with this system averages about 53. The background, for P in cm methane pressure, is:

$$\text{Background} = 3.95 \pm .008 + .00705P$$

To avoid radon and tritium contamination problems with methane, CO_2 and H_2, all gases are specially prepared for us by Victor Equipment Company with only new cylinders and petrochemical sources for CH_4 and H_2. Ruthenium catalyst used for CO_2 to methane conversion has sometimes been blamed by other workers for contamination problems in the final methane. However, this laboratory has investigated this possibility extensively and has never been able to trace contamination to this catalyst (Ellis and Sharp, unpub. ms.).

Presently under construction is a new system for C^{14} dating and low level tritium counting which will reduce the shield size and weight, reduce the background, and make available a rapid conversion to methane of both C^{14} labeled CO_2 and H^3 labeled H_2O (Anand and Lal, unpub. ms.).

This new system is based on the reaction:

$$4\,Zn + CO_2 + 2\,H_2O \rightarrow CH_4 + 4\,ZnO$$

This reaction is also quantitative and yields of better than 90% from solid sample to counting gas are obtained. At the present time we can measure 20 T.U. without enrichment, with an accuracy of 10%, and hopefully this will improve as more data is accumulated.

Measurements made by this laboratory are based on the value 5570 ± 30 yr for the half life of C^{14}, and 95% the activity of oxalic acid as the modern standard, in agreement with the decision of the Fifth Radiocarbon Dating Conference. The Heidelberg Na_2CO_3 standard solution with an absolute specific activity of 139.6 ± 1.3 DPM C^{14} per g of C gave a corrected counting rate of 128.1 ± .039 cpm. This gives a counting efficiency of 92% and a conversion factor to NBS oxalic acid of 9.65.

All samples dated by this laboratory so far have been measured for the purpose of intercomparison with other established laboratories. Two of these samples are 1710 wood and wood from the tomb of King Zoser.

SAMPLE DESCRIPTIONS

SL-3. Sequoia **239 ± 52**
A.D. 1711

Wood from between the 230th and 250th growth rings. Tree was cut 26 February 1961. Sample supplied by Scripps Inst. of Oceanography.

SL-8. Zoser's Tomb, Egypt **4020 ± 100**
2070 B.C.

Sycamore wood from roof of tomb of S enclosure, of the step pyramids of Sakkara, the time of King Zoser. Sample supplied by A. E. Bainbridge.
Comment: this sample (Kusumgar *et al.*, 1963) previously dated by:

(1) Bombay 3990 ± 110
(2) La Jolla 4080
(3) Arizona 4240 ± 150
(4) Chicago 3979 ± 350

References

Fairhall, A. W., Schell, W. R., and Takashima, Y., 1961, Apparatus for methane synthesis for radiocarbon dating: Rev. Sci. Instruments, v. 32, no. 3, p. 323-325.
Kusumgar, S., Lal, D., and Sarna, R. P., 1963, Tata Institute radiocarbon date list I: Radiocarbon, v. 5, p. 273-282.