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RADIOCARBON DATING AT THE UNIVERSITY OF WASHINGTON. II*

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The radiocarbon dating equipment previously used (Dorn, Fairhall, Schell and Takashima, 1962) has been moved to a different location. During the resulting hiatus in our dating program we have constructed a new counter with a few novel features. It is similar in concept to the Houtermans-Oeschger counter (Houtermans and Oeschger, 1958), but two changes have been made in the design: (1) The inner counter, constructed of thin, metallized plastic foil of thickness 4.2 mg/cm^2, is leak-tight relative to the outer counter. By means of two solenoid valves actuated by a simple differential mercury manometer the outer and inner counters can be filled separately with a pressure differential on the partition of less than 0.5 cm Hg. Thus all of the sample can be introduced into the inner counter while inert gas is fed into the outer counter. As the sample gas is not needed for anti-coincidence filling efficiency increases ca. 30%; (2) The metallic parts are made of commercially available high-purity nickel which is easier to procure than O.F.H.C. copper; nylon is used for the other parts. The outer counter appears to have a very low radioactivity, its α activity being 5 pulses/hr/100 cm^2.

Methane continues to be used as the counting gas. The new system has now been in operation for four months and is remarkably stable. Counts of NBS oxalic acid (as CH_4) are reproducible within the statistics of counting, which on occasion we have carried to 0.5‰. The gross counting rate of the oxalic-acid standard in counts/min, for pressures P above 1 atmosphere, is gross NBS std. $= (7.084 \pm 0.004)\ P - 0.30$.

The counter is housed in a meter-long piece of 16-in. gun barrel from a battleship; the steel walls are 8 in. thick. The counter rests inside a mercury shield and the remaining space is packed with boron and paraffin. The background counting rate, also reproducible within statistics, is

$$\text{bkgd} = 0.675 \pm 0.010 + 0.475\ p$$

The useful pressure range for operation is 15 to 100 in. Hg, the limit of the Bourdon gauge presently in use. The pressure-voltage relationship is

$$\text{operating voltage} = 1900 + 975\ p$$

One difficulty is worth reporting: when C.P. grade tank methane was used in preliminary tests there was a most discouraging downward drift in the anti-coincidence counting rate. We finally were able to attribute this to radon, which must be maintained by radium, somehow present inside the methane tank.† Radon has been observed in tank methane by others (De Voe, 1961). We now store aliquots of tank gas in separate, clean cylinders before use.

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† Note added in proof: This difficulty, evidently due to accumulated calcium deposits from lime scrubbers used to purify the gas, has been overcome by specifying that the methane be supplied in new cylinders.

One further modification will be made. The wall of the inner counter is constructed of two layers of aluminum foil bonded to Mylar. Aluminum, notoriously impure, no doubt accounts for some of the observed background. We plan to replace it with high-purity, pinhole-free nickel foil.

Further details may be obtained by writing to the authors.

References

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