TARGET ERROR – A POSSIBLE PROBLEM IN HIGH PRECISION AMS $^{14}$C DATING

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A number of AMS labs have attempted to carry out high-precision AMS $^{14}$C dating and appear to have run up against a barrier in the 2% to 4% region. This can be attributed to uncertainties generated in the apparatus itself. This paper proposes that at least part of the problem may instead lie in the properties of the graphite target. In particular, the assumption is that every part of the graphite in the target has the same propensity to produce beam current.

It is well known that the various graphitization reactions used to convert CO$_2$ to graphite can have very large isotopic fractionation. In the data presented in this paper, the first 20% of the graphite produced from NBS OX-II carbon dioxide ($\delta^{13}$C = -17.8‰) showed $\delta^{13}$C = -33.1‰ and the last 20%, $\delta^{13}$C = +12.9‰. If, for example, the propensity of the graphite produced in the last part of the reaction to produce ion beam is not the same as the rest of the sample, we cannot make the necessary isotope corrections required for high precision $^{14}$C dating.

The assumption presently being made is that the isotope fractionation versus yield curve and the propensity to produce ion beam current versus yield curve are the same shape for both the samples and the NBS standards. The fact that real samples tend to give lower beam currents than graphite prepared from the NBS oxalic standards suggest that this assumption may not be valid.

Ways will be suggested as to how this problem may be circumvented.

AMS RADIOCARBON DATING OF ICE: PROGRESS AND NEW RESULTS

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New developments in the “Sublimation Technique” for the $^{14}$C dating of ice will be described, together with the application of the technique to a number of problems.

IMPURITIES ARISING DURING BENZENE SYNTHESIS FROM ACETYLENE ON VANADIUM AND CHROMIUM CATALYSTS

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Impurities generated during benzene synthesis can affect liquid scintillation counting in radiocarbon dating. Acetylene from a single (tank) source was purified cryogenically and introduced onto vanadium and chromium catalysts in varying proportions of gas and catalyst. We then analyzed benzene produced from this acetylene source by gas chromatography (GC) and gas chromatography-mass spectrometry (GC-MS). These analyses demonstrate that the synthesized benzene contains, at most, traces (<0.1% total) of substituted benzenes. These products are principally toluene and ethylbenzene together with smaller amounts of xylenes, cumene and phenol. In addition, we have analyzed by GC the tank acetylene source and acetylene generated in the laboratory as well as their benzene products. The results of these analyses show the presence of C$_1$-C$_6$ alkenes in the laboratory-produced acetylene. Preliminary results indicate that the amount