

**ANNOUNCEMENT OF A NEW COLLABORATIVE STUDY FOR  
INTERCALIBRATION OF  $^{14}\text{C}$  DATING LABORATORIES**

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**ABSTRACT.** A proposal for an international collaborative study to investigate and assess the existence of inter-laboratory variability is discussed. The proposed study would be conducted over two years and would investigate each stage of the dating process in turn.

INTRODUCTION

Approximately four years have now elapsed since the previous international collaborative study organized by the Glasgow  $^{14}\text{C}$  laboratory, was reported (ISG, 1982, 1983). A total of 20 laboratories participated in that project, each analyzing an identical set of 8 samples from a floating dendrochronologic sequence, of age ca 5000 yr BP. The results proved interesting, hinting at the common existence of systematic biases amongst laboratories and of excess variability in results as measured against quoted errors. Unfortunately, the experimental design of the study did not allow us to identify the sources of observed bias and variability. Thus, having concluded that there were difficulties in interpreting and comparing results from more than one laboratory, the authors could only speculate on the likely causes, while urging that such an inter-laboratory exercise should be performed regularly.

The need for further work has become ever more pressing because of continued changes in  $^{14}\text{C}$  dating experimentation. A new generation of accelerator laboratories has now been commissioned, and its first radiocarbon results have been published. In parallel, high precision and small sample counting laboratories have flourished. Thus, the diversity of laboratory techniques in existence makes it imperative that an objective monitoring, evaluation, and standardization operation be performed. In this note, then, we describe proposals for just such an operation to be organized jointly by the University of Glasgow and the Scottish Universities Research and Reactor Centre, and we invite participation in it. The aims of the study may be briefly summarized as follows.

First, we hope that, if the results again indicate a significant level of bias and variability amongst laboratories, we can make progress towards the breakdown and numerical assessment of the origins of such errors. In particular, the contributions to overall errors from three major sources (pretreatment, synthesis, and counting) will be assessed.

Secondly, the study will provide an important opportunity for cross-checking and verification of diverse laboratory operational procedures, including an assessment of each experimental approach.

Thirdly, the results will contribute to an understanding of the validity of routinely quoted errors; since there is no widely accepted prescription for error calculation, this aspect is particularly important. The introduction

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of duplicate samples at certain points in the study will assist in assessment of each laboratory's internal error structure.

Finally, the study will allow users of  $^{14}\text{C}$  dates to assess and interpret measurements from more than one laboratory in an objective and scientific manner.

#### DESIGN OF THE STUDY

It is envisaged that the study will comprise three stages; stages 1 and 2 to be completed and a summary of the results reported before the commencement of stage 3. The hierarchical nature of the study will help identification of the components of any analytical variations. The study will be run "blind" by the participating laboratories, *ie*, each laboratory will be assigned a unique sample code thus ensuring, *eg*, that the duplicate samples will be unknown and that no subconscious biasing of results will occur. Results will be reported in a standard format particular attention being focussed on the quoted errors. A schematic plan of the study is shown in Figure 1, and summarized as follows:

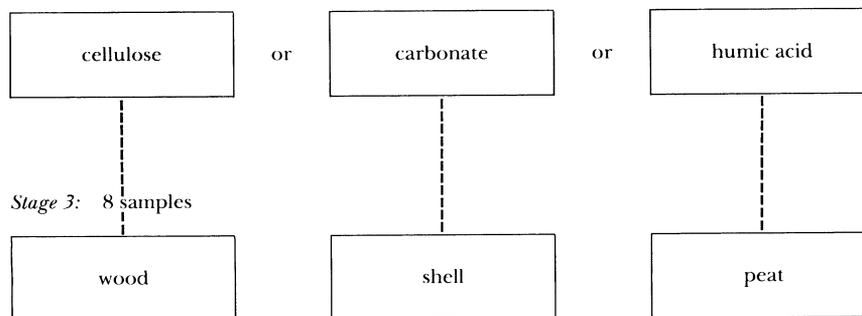
The first stage of the study will relate to the  $^{14}\text{C}$  counting process only (or as near to this as possible). Samples will require no or minimal pretreatment and synthesis. Sample material will most probably be benzene (for liquid scintillation laboratories) or laboratory-prepared carbonates (for gas counting and accelerator laboratories). Results from this stage will be used to identify the counting component in the overall variability in the results.

In the second stage, one further process will be introduced, namely sample synthesis. Quantities of homogenized, pretreated material will be

*Stage 1:* 4 samples



*Stage 2:* 4 samples, 2 materials from



*Stage 3:* 8 samples

Fig 1. Schematic plan of study

supplied to laboratories which by this point, will have been asked to select 2 from 3 materials on offer, these to comprise carbonate (prepared from shell), cellulose (prepared from wood), and humic acid (extracted from peat). The choice of material in this stage will also determine the samples to be dated in the third and final stage. Results from this stage will demonstrate the level of performance for the synthesis and counting operations.

The final round of analyses will hopefully permit the investigation of the variation arising in the entire dating procedure of pretreatment, synthesis, and counting. Laboratories will be sent typical samples of a combination of either known-age wood, shell or peat; extractants from these materials having been previously dated in stage 2.

Thus, in total the study will involve assay, by each laboratory, of typically 16 samples, 4 in each of stages 1 and 2, and 8 in stage 3. It is hoped that this announcement will underline the need for such a comparative study which is, after all, of a type quite frequently performed in other analytical sciences, and will alert the <sup>14</sup>C community to this particular new study which it is hoped will commence in 1986. Through informal correspondence, there has already been a very positive general response to the project and it is expected already that a high percentage of all <sup>14</sup>C dating laboratories will take part. Assistance with funding for the project has already been sought, however, should the application be unsuccessful, it is hoped that a revised study would still go ahead. It is our hope that no laboratory that wishes to take part should be excluded. Hence, this invitation to participate. Any laboratory that has not already committed itself to the project but that wishes to do so should contact the first author (EMS) immediately.

#### REFERENCES

- International Study Group, 1982, An inter-laboratory comparison of radiocarbon measurements in tree-rings: *Nature*, v 298, p 619-623.  
——— 1983, An international tree-ring replicate study, *in* <sup>14</sup>C and archaeology, Proc: Groningen, PACT 8, p 123-133.