

# Radiocarbon

1996

## <sup>14</sup>C AND SOIL DYNAMICS

### INTRODUCTION: CHALLENGES IN THE SOIL

The decision to proceed with compilation of a special Soils Issue was taken in June 1992 during a planning workshop hosted in Tucson by the editors of *RADIOCARBON*. The undertaking was intended as a prelude to a wider and more far-reaching initiative to establish the International Radiocarbon Soils Database (IRSDB). In concept, this electronic archive, to be serviced by a worldwide cooperative of soil scientists and managed *via* the established expertise at the University of Arizona Department of Geosciences, would provide the international scientific community with a comprehensive, freely accessible and routinely updated source of unambiguously defined carbon isotope data. Justification for the database seemed well founded in the growing public concern and political awareness over the possible environmental impacts from steadily increasing global temperatures due to the so-called “greenhouse effect”. Geoscientists had recognized a moral and/or professional responsibility to respond; in the first instance with the input necessary to understand and quantify the natural system, as the basis for both predictive climate modeling and immediate management of the natural carbon cycle. For this exercise it was already apparent, however, that a major constraint in objective modeling lay in defining the extent to which the pool of carbon stored in soils can influence concentrations of the carbonaceous gases (CO<sub>2</sub> and CH<sub>4</sub>) in the Earth’s atmosphere. While it could be accepted that soils would function as either a carbon source or a carbon sink in relation to the atmosphere and in response to prevalent climate, insufficient information was available concerning the precise inventory, global distribution or mean residence times for the several forms of carbon retained in soils. Previous enquiries among the several <sup>14</sup>C laboratories known to have had a direct involvement in the measurement of <sup>14</sup>C in soils were encouraging in this respect. A wealth of essential data does exist but a significant proportion is latent due to either its diverse publication throughout the scientific literature and including foreign (non-English) language text or its retention unpublished in laboratory archives. It was particularly encouraging that positive responses as to the potential availability of essential data were received from a number of scientific colleagues in Eastern Europe, the states of the former Soviet Union and China. Given the established role of the journal *RADIOCARBON* as the focus for international consensus and collaboration in applied <sup>14</sup>C measurement, it was considered opportune that work towards the benefits of a soils database should proceed using existing facilities for the collection and collation of appropriate carbon isotope values and related data.

Advantage was taken of the collective expertise of the Workshop participants in drawing up the detailed blueprint for a database that would attract input and facilitate access across the broad community of “environmental sciences”. The agenda for that exercise and its agreed outcome are reported by Peter Becker-Heidmann in his paper entitled “Requirements for an International Radiocarbon Soils Database” (see pages 177 to 180 of this issue).

In the event the IRSDB proposal failed to attract the necessary funding and, for various reasons, this volume has suffered an unduly long gestation. However, these factors do not reflect any diminution of the original objectives. Scientific publications over the past decade bear witness to a steady increase in the volume and diversity of academic study aimed at our better understanding of the glo-

bal distribution, composition, geochemistry and residence times of the carbon retained in organic and mineral rich soils. Likewise, the concern over man-made changes to the global environment has not abated; in its most recent report (IPCC 1996) the Intergovernmental Panel on Climate Change dispels any previous uncertainty by stating that, "... the balance of evidence suggests that there is a discernible human influence on the global climate." However, even faced with the various threats to economic stability and quality of life, there remains continuing debate over such fundamental issues as the possibility of a substantial "missing sink" of carbon associated with the plant/soil regime of the northern hemisphere temperate zone. The scientific challenge to researchers working within or in collaboration with  $^{14}\text{C}$  laboratories is clear. It remains twofold, viz. 1) to ensure that existing information is made readily available for multidisciplinary access, and 2) to exploit and publicize advances in the technology of natural  $^{14}\text{C}$  measurement that are particularly relevant to the study of soil carbon.

The specific role of the naturally occurring isotopes of carbon as quantitative tracers was highlighted further in the proceedings of a Soils Workshop session convened during the 15th International Radiocarbon Conference (Glasgow 1994). From a lively discussion forum (summarized in Becker-Heidmann and Harkness (1995)) it was evident that such diverse interests as paleoenvironment reconstruction and modern land management priorities, when allied with new technological opportunities, in particular  $^{14}\text{C}$ -AMS, were stimulating exciting new approaches in soil-based research. Nevertheless, and by way of general warning, it was agreed that even with the experience of over 30 years, several of the fundamental questions posed in those early days remained unanswered or at best only partly resolved. The immediate call was for the promotion of *RADIOCARBON* as the most suitable and internationally recognized platform for the reporting and discussion of advances and project priorities in the applied carbon isotope geochemistry of soils.

In the absence of the intended IRSDB, the old specter of ready access to data seemed set to persist and compound. However, a recent revision of policy by the editors of *RADIOCARBON* offers a welcome and best possible alternative, viz. the launch in electronic format of the new on-line journal *Radiocarbon Date Lists*, backed by the decision to reserve the established *RADIOCARBON* format for the publication of research articles. As highlighted by the Editor (Long 1995) the new arrangement is now available for the positive benefit of all  $^{14}\text{C}$  laboratories and their users. However, the onus for success, perhaps the greatest challenge, is on practicing  $^{14}\text{C}$  laboratories to publicize and take full advantage of these facilities in making their work generally known and readily available to the international science community. We hope that the research papers contained in this dedicated issue will be both a stimulus for and a herald of improved dialogue among geochemists and other research disciplines who find an intellectual challenge in the soil. At least one major listing of  $^{14}\text{C}$  measurements and related pedagogical data ("NERC Soil Organic Matter Studies; 1977 till 1997") is being prepared currently for presentation in the *Radiocarbon Date Lists* format.

The community will meet soon (June 1997) in Groningen to convene the 16th International Radiocarbon Conference. The provisional program has a slot reserved for the consideration of  $^{14}\text{C}$  in soils—let us hope that progress in the reporting of results, old and new, can feature as positive feedback in the general discussion.

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#### REFERENCES

- Becker-Heidmann, P. and Harkness, D. 1995 Report of the Radiocarbon in Soils Workshop, Saturday 13 August 1994. In Long, A. and Kra, R. S., eds., Proceedings of the 15th International  $^{14}\text{C}$  Conference. *Radiocarbon* 37(2): 818–819.
- Long, A. 1995 From the Editor. *Radiocarbon* 37(3): iii.