

## DATABASE MANAGEMENT SYSTEMS AND RADIOCARBON DATING

J.C. Moffett

Institute of Archaeology, 31-34 Gordon Square, London WC1H 0PY

R.E. Webb

Department of Extra-Mural Studies, 26 Russell Square, London WC1B 5DQ

### The Data (REW)

At the instigation initially of the late Prof. C.B.M. McBurney at the University of Cambridge, an annotated card index of radiocarbon dates directly relating to Old World cultural material of Palaeolithic and Mesolithic age (>50,000 - 7000BP), has been compiled since 1972. Over the last five years in response to changing research interests the index has been expanded to include both some other radiometric techniques and also radiocarbon dates on American PalaeoIndian and on all Australasian cultural material older than 7000BP.

The sources which have been consistently searched comprise Science and Nature in which the very earliest age determinations, usually on solid carbon, were published prior to the creation of Radiocarbon, which is the other major source of information. The general scientific and archaeological literature is too vast and inchoate to be searched adequately and comprehensively. Therefore a policy decision was taken that no date would be regarded as fully published unless it had appeared in Radiocarbon, where alone would be available the details of laboratory procedure and pretreatment, which are essential for the assessment of sample quality and age estimate reliability. This policy has not been adhered to consistently. Some age estimates published elsewhere, usually lacking some of the necessary information, have been included when brought to our attention. Where possible other published lists have been consulted. Where it has proved possible to check this type of information it has sometimes proved inaccurate and lacking in the vital details which permit assessment of age estimate reliability.

The original intention was merely to attempt to establish the range and reliability of age estimates available for sites of any given cultural attribution. It was hoped that by carefully checking the literature once it would be possible to provide an index which would then become available to any interested researcher and would prevent a needless duplication of effort when tackling problems of cultural chronology by drawing all the available information together in a form suitable for easy retrieval. Copies of the card index are lodged at the Universities of Cambridge and London. In this form the individual date records are simply listed alphabetically by site name. This system proved less than ideal in use. Therefore, advantage has been taken at the first available opportunity to transfer the data to computer file to facilitate updating and data retrieval. It will also now be possible to produce hard copy relevant to specific research problems upon request.

Radiometric age determinations are particularly suited to analysis by database retrieval systems since the necessary information can be broken down easily into a number of fields and therefore retrieved in different ways to answer specific research problems. Data are input into three files which are updated annually. The main file comprises the individual dates each of which, with its accompanying details, corresponds to one data record. The data records are broken down into the following fourteen fields for ease of retrieval: site name;

site layer; cultural attribution; quality of sample association; sample type; sample quality; age and error factor; <sup>13</sup>C; laboratory identifier and sample number; publication reference. For many sites some fields are inapplicable or the data are not available. If so a blank field is inserted.

Two separate library files are maintained. One lists full details of the site locations, with latitude and longitude where possible, and bibliographic references to published excavation reports. The other lists by identifier all the laboratories cited in the main file and gives full postal addresses plus details of their standard pretreatment techniques, counting medium, counting time and other relevant information.

#### The Database (JCM)

The radiocarbon data have been stored on to a Z80 4Mhz microcomputer with a 20 Mbyte hard disk, and a single 8inch double density, double sided floppy disk drive (capacity 1 Mbyte). This uses a CP/m 2.2 operating system and is capable of driving both a printer and a graph plotter. It is also possible to read non-CP/m formatted disks, such as DEC disks. Thus, both the data and the programs could be transferred to other systems.

The database has been set up using the MDBS database management package (M.D.B.S. 1980), which is specially designed for use on microcomputers. This incorporates: a data definition language; a data manipulation language, hosted on the above system in Pascal/Z; a query/report system; as well as database recovery and restructuring programs. It is based on the CODASYL database model (Gagle *et al.* 1981) and uses three basic concepts.

DATA ITEM TYPES: units of data which can take a range of values. The site name could be treated as a data item type.

RECORD TYPES: specific collections of zero or more data items called by a single name. The fourteen fields mentioned above have been split into the following five RECORD TYPES for the database:

RECORD Site	RECORD C14date
ITEM sname	ITEM date
	ITEM error
RECORD Culture	ITEM C13 value
ITEM cname	ITEM association
	ITEM quality
RECORD Sample	ITEM lab number
ITEM type	ITEM reference
	ITEM volume
RECORD Labdesc	ITEM pages
ITEM lcode	ITEM site level

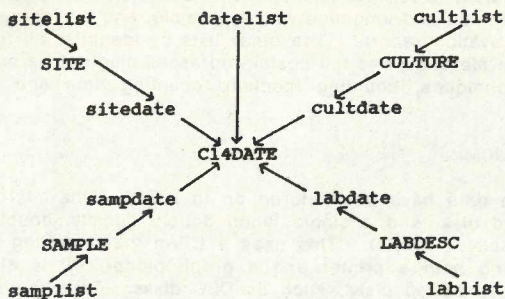
The site, culture, sample and laboratory fields have been made into single field records so that they occur only once for each site name, culture name, etc. The C14DATE record contains all the data which are specific to a particular date.

SET TYPES: named relationships between two or more record types, one is described as the OWNER, the other the MEMBER. There are four main set relationships allowed by MDBS (of which only two have been used here):

- 1:1 - one record owns only one other record
- 1:n - one record can own more than one other record
- n:1 - one record can be owned by many other records

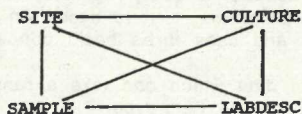
n:m - one record can own many records, which can likewise be owned by many owner records

The records are linked to each other and to the system by the following 1:n set relationships:



In this flowchart lower case lettering indicates set relationships and upper case lettering indicates RECORD TYPES.

The following six n:m set relationships have also been specified:



The above design minimises repetition, but allows subsidiary queries to be answered.

#### Data Manipulation Programs (JCM)

The query/report system (QRS) will allow many of the queries about the dates to be asked in English-like syntax. However, it is sometimes necessary to either manipulate the dates in various ways not allowed by the QRS, or to load blocks of dates. A subsidiary program has been written, in Pascal/Z, which has two levels of permitted access dependent upon the status of the user: LIST and INSERT. Both modes have optional prompts. In LIST mode, on open access, the database can be searched for all variations of any record type, for example sample materials. In INSERT mode, on restricted access, sets of dates can be loaded into the database from datafiles, or new datafiles can be generated. Both modes can also call up the subsidiary library files for the information which they contain. Another manipulation program is designed to display dates graphically on a graph plotting machine. Other manipulation programs may be written as and when they are required. The system is explained more fully in Moffett and Webb (forthcoming).

Gagle, M., Koehler, G.J. & Whinston, A. 1981 Data-Base Management Systems: powerful newcomers to microcomputers. Byte 6 (11), 97-122.

Moffett, J.C. & Webb, R.E. ---- Database management of radiocarbon dates. Proc. XXII Int. Symp. Archaeometry & Arch. Prospection, Bradford, 1982, (forthcoming).

M.D.B.S. 1980 MDBS data management system documentation. Micro Data Base Systems, Inc. P.O. Box 248, Lafayette, IN 47902.