

# Radiocarbon

1989

## **RADIOCARBON DATA BASE: Q&A—AN ARTIFICIAL INTELLIGENCE DATA FILE MANAGEMENT PROGRAM**

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**ABSTRACT.** The “C14” data base, designed and implemented at the University of Arizona Radiocarbon Dating Laboratory, uses Q&A, an artificial intelligence data file management program. The data entered into this data base are easily retrievable and exportable for submission to *RADIOCARBON*, and to the International Radiocarbon Data Base (IRDB). The use of artificial intelligence allows both novice and experienced computer operators to search and retrieve data with few key strokes and normal English sentences.

### HARDWARE AND SOFTWARE

The Radiocarbon Laboratory at the University of Arizona uses Q&A, version 2.1 by Symantec Corporation, on an IBM-compatible AT computer with a 30 megabyte fixed disk. Q&A can be used on any PC, XT or AT compatible with at least 512K RAM, though a hard disk and fast clock speed are much more convenient.

Q&A is a very simple and straightforward data file management system. The program is menu driven with function keys for important operations, such as the excellent HELP function. Q&A incorporates the data base with a report-generation subsection, a quick and easy-to-use word processor (on which this paper was written), the artificial intelligence subsection, utilities, and the ability to run any outside program such as LOTUS 1-2-3. The word-processor module of Q&A easily merges with information stored in the data base. Correspondence and bookkeeping forms can easily retrieve information in the data base for insertion in the text.

The computer knowledge needed to set up a data base with Q&A is minimal. Our data base was created in full within two days of receipt of the program, and very few bugs needed to be “flushed out.” Persons with no prior programming or database experience will find this program simple and flexible, and a relief from the complexities of other database programs.

Database forms within Q&A can extend in length to 10 screen pages of 21 lines each and contain as many fields as will fit into this space. Q&A has programming capabilities within the data base which are much simpler to use than those of other systems.

Reports or printouts from Q&A can be routed to the screen for viewing, to serial or parallel ports or to an ASCII disk file. This ASCII data file can be written on the appropriate removable disk and transferred to other programs or to the IRDB. Information can be imported directly and easily to a Q&A database file created from PFS:File, IBM Filing Assistant,

University of Arizona, Radiocarbon Dating Lab, Information Sheet

Lab Number: 4755                      Date Received: 8 Apr 1987                      Priority: Normal

Submitted by: Dr. C. Vance Haynes                      Date Submitted: 8 Apr 1987  
 Affiliation: University of Arizona  
 Address: Dept. of Geosciences, Univ. of Ariz  
 City: Tucson                      State: Az                      Country: USA  
 Zip: 85721                      Phone:

Collected by: C.V.Haynes                      Date Collected: 10 Feb 1986  
 Affiliation: University of Arizona                      Sample ID: 78A EG 86

Discipline Represented (use F1 for number): Archaeology

Field Packaging and Preservatives: Polyethylene ziplock bag

Latitude: 21.29.2 N                      Longitude: 28.9.2 E  
 Name: Addax site  
 County: Mokhtafi line  
 Province: Northern  
 State:  
 Country: Sudan  
 Description of site location: Truncated addax skull with decayed  
 wood and flakes 219m NW of sta. E, Mokhtafi trench line survey.  
 Field Book, p.99

Cultural and/or time ranges of site: Late Neolithic

Previous dates from this site (stratigraphic position and reference):

Sample Material: Wood                      Sample Weight: 8.31  
 Genus and Species:                      Identified by:

Further remarks on nature of sample and its matrix:

Depth below surface: Exposed in stage 2-3 sand sheet by wind  
 Excavation Coordinates: 219m NW of Sta. E, Mokhtafi line

Associated Cultural, paleontological or paleobotanical material: This  
 site has hunting tools in association with an Addax kill.

Expected Age (what basis): 3000-5000 BP (soil)

Importance of this date: The artifacts at this site point to late  
 neolithic occupation of the area during a transition from pluvial to  
 hyper arid climate.

Payment Arrangements:

Analysis by Gas Proportional: N                      Liquid Scintillation: Y                      Accelerator: N

Completed by: K. Katzer                      Date: 9 Apr 1987

Special instructions Sample is uncarbonized wood fragments

Describe Pretreatment 3M HCl/ rinse / NaOH / rinse / re-acidify /  
 rinse to pH neutral.

Results of pretreatment (Humates, Rootlets, grain size, etc ): Humates  
 approximately 60% of sample, extremely black, very slight effervescence,  
 originally mixed with bones. Split into uncarbonized wood 78A EG 86A, 78A  
 EG 86B = Humates, and 78B EG 86 = bone.

By: R. Kalin                      Date: 6 May 1987                      By: N/A                      Date:  
 Dry weight before: 3.06                      Carbonate weight: 0.0  
 Ash weight after: 0.92                      Residue weight: 0.0  
 Volume CO2 gas: 2.8                      Volume CO2 gas: 0.0

University of Arizona, Radiocarbon Dating Lab, Information Sheet

Notes: Clean burn

Sample for C-13 analysed by: R. Kalin      Date: 6 May 1987      C-13 Value: -24.5

Benzene Synthesis by: Kris Law      Date: 7 May 1987  
 Lithium: 4.6      Notes OK  
 CO2 Volume #: 3  
 CO2 Pressure: 327  
 C2H2 Pressure: 167  
 C6H6 weight: 0.8405  
 Yield: 93.2

Reported Age: 4450      +: 100      -: 100

B.P. (t 1/2 = 5568): Y  
 B.P. (t 1/2 = 5570): N  
 P.M.C.: N  
 C-13 Normalized: N

Comments Calibration information:

One Sigma : cal BC 3340-3010(5289-4959) 3008-2924(4957-4873)  
 Two Sigma : cal BC 3491-3487(5440-5436) 3380-2900(5329-4849)

References for data sets

Stuiver, M. and Pearson, G.W., 1986, Radiocarbon, 28, 805-838  
 Pearson, G.W., Pilcher, J.R., Baille, M.G., Corbett, D.M.,  
 and Qua, F., 1986, Radiocarbon, 28, 911-934

Fig 1. Sample provenience data information printed from database print specification which duplicates the original sample provenience sheet

LOTUS and Symphony, DIF format files, dBASE II and III, Fixed ASCII and Standard ASCII.

#### STRUCTURE OF THE DATA BASE

The database forms follow the entries found on the sample information sheet filled out for each sample submitted to the University of Arizona Radiocarbon Dating Laboratory (Fig 1). Information about each phase of pretreatment, combustion, benzene synthesis and counting is stored in the data base as well. Each form has 78 fields which comprise a total of 7 screens of information, easily scrolled through with cursor-pad control.

We have designed a series of print specifications for the data, which list the information selected, *ie*, sample types, sample disciplines, names and addresses, etc. Figure 2 shows a sample print specification for production of date lists for *RADIOCARBON*.

We have also designed a number of report specifications. A report differs from a print specification in that a report can print out any information in the data base to a form. The information to be reported can easily be sorted by any number of fields, and retrieved from any section of samples in the data base. Figure 3 shows part of a report that lists a log of the reported ages of samples submitted to our lab. A report will be written to print an ASCII file which contains sample information in IRDB format to transfer our lab information to the IRDB.

## University of Arizona, Radiocarbon Date List

Discipline Represented (use F1 for number): Archaeology

Name: Addax site                      Latitude: 21.29.2 N Longitude: 28.9.2 E  
 County: Mokhtafi line  
 Province: Northern                      Submitted by: Dr. C. Vance Haynes  
 State:                                      Collected by: C.V.Haynes  
 Country: Sudan

Description of site location: Truncated addax skull with decayed  
 wood and flakes 219m NW of sta. E, Mokhtafi trench line survey.  
 Field Book, p.99

Lab Number: 4755                      Sample Material: Wood                      Genus and Species:  
 C-13 Value: -24.5                      Identified by:                      Reported Age: 4450                      +/- 100                      -: 100

Further remarks on nature of sample and its matrix:

Depth below surface: Exposed in stage 2-3 sand sheet by wind  
 Excavation Coordinates: 219m NW of Sta. E, Mokhtafi line

Importance of this date: The artifacts at this site point to late  
 neolithic occupation of the area during a transition from pluvial to  
 hyper arid climate.

Associated Cultural, paleontological or paleobotanical material: This  
 site has hunting tools in association with an Addax kill.

Cultural and/or time ranges of site: Late Neolithic

Field Packaging and Preservatives: Polyethylene ziplock bag

Previous dates from this site (stratigraphic position and reference):

## Comments Calibration information:

One Sigma : cal BC 3340-3010(5289-4959) 3000-2924(4957-4873)  
 Two Sigma : cal BC 3491-3487(5440-5436) 3380-2900(5329-4849)

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 and Qua, F., 1986, Radiocarbon, 28, 911-934

Fig 2. Print specification of information which can be printed to a word-processing file  
 for incorporation into date lists

## University of Arizona, Carbon-14 Laboratory, Log of Samples Analyzed

Lab Number	Date Received	Submitted by	Sample Material	Reported Age	+	-	C-13
3505	28 Jun 1983	Robert H. Webb	charcoal	114.2	1.4	1.4	-24.60
3506	28 Jun 1983	T. Van Devender	fecal pellets	5860.0	60.0	60.0	-24.00
3507	28 Jun 1983	T. Van Devender	fecal pellets	5940.0	70.0	70.0	-24.50
3508	28 Jun 1983	Ken Cole	pellets	4800.0	80.0	80.0	-23.90
3510	23 Jun 1983	Joel C. Janetski	plant fragments	1190.0	110.0	110.0	-11.02
3511	28 Jun 1983	Joel C. Janetski	sandal frag	1160.0	100.0	100.0	-11.37
3512	28 Jun 1983	Martin Mead Agenbrood Davis	wood	14730.0	320.0	320.0	-26.50
3513	28 Jun 1983	Martin Mead Agenbrood Davis	charcoal	5500.0	80.0	80.0	-26.50
3514	28 Jun 1983	Martin Mead Agenbrood Davis	wood	16700.0	250.0	250.0	-25.40
3515	28 Jun 1983	Martin Mead Agenbrood Davis	dung	11210.0	170.0	170.0	-19.60
3516	28 Jun 1983	Martin Mead Agenbrood Davis	charcoal	2640.0	50.0	50.0	-26.00
3517	28 Jun 1983	T. R. Van Devender & Martin	fecal pellets	3820.0	70.0	70.0	-23.60
3518	13 Jun 1983	Geocon Inc.	charcoal	28200.0	1300.0	1300.0	-24.80
3519	13 Jul 1983	Van Devender & Toolin	other ? pellets	2370.0	60.0	60.0	-20.50
3520	13 Jul 1983	T. R. Van Devender & Martin	turds	8910.0	80.0	80.0	-24.10
3521	13 Jul 1983	T. R. Van Devender & Martin	turds	7860.0	100.0	100.0	-24.50
3522	13 Jul 1983	Lynn Teague	charcoal	480.0	50.0	50.0	-25.60
3523	13 Jul 1983	Lynn Teague	charcoal	117.8	0.7	0.7	-25.10
3524	13 Jul 1983	Lynn Teague	charcoal	111.4	1.0	1.0	-27.10
3525	13 Jul 1983	Lynn Teague	charcoal	140.8	1.5	1.5	-25.80
3526	13 Jul 1983	Lynn Teague	charcoal	430.0	60.0	60.0	-23.40
3527	13 Jul 1983	Lynn Teague	charcoal	680.0	110.0	110.0	-24.60
3528	13 Jul 1983	Lynn Teague	charcoal	370.0	60.0	60.0	-10.40
3529	13 Jul 1983	Lynn Teague	charcoal	390.0	70.0	70.0	-23.70
3530	13 Jul 1983	Lynn Teague	charcoal	104.8	0.8	0.8	-23.60
3531	13 Jul 1983	C.V. Haynes	charcoal	7120.0	140.0	140.0	-28.70
3533	13 Jul 1983	Glenn Roberts	water	12.6	0.8	0.8	-12.80
3534	13 Jul 1983	Glenn Roberts	water	43.0	0.8	0.8	-13.00
3535	19 Jul 1983	T. R. Van Devender & Martin	turds	4010.0	70.0	70.0	-24.10

Fig 3. Printout of a summary of reported ages to be included in a lab log book, using the report-generation section

Our database system also incorporates macros, which are series of stored keystrokes that are initiated with one keystroke. We have written macros to write form letters for billings, requests for more sample information and other frequent correspondence. A single keystroke will write out the letter, pausing for user entry of unique information, merge the letter with data stored in the data base, and print out the letter and envelope.

The most useful feature of Q&A for the radiocarbon laboratory is the artificial intelligence (AI) module. To date, ca 2000 sheets of provenience information have been entered into one database file. Searching through the forms is simple with AI. For example, if we are interested in finding if any samples submitted by C Vance Haynes, Anthropology Department, University of Arizona, collected in the Sudan during 1986, had a reported age of <10,000 but >3000 years, the query entry to the artificial intelligence module would be as follows:

List samples submitted by C Vance Haynes, collected during the year 1986, which are younger than 10,000 years but greater than 3000 years.

The AI module would list a summary of the information we requested and create a report on the screen. This information can be printed out, or supplemental questions can be asked, such as:

Which of these were collected on 10 Feb 1986?

This ability to retrieve data quickly and in English sentence form makes our data base, designed with Q&A, very helpful in the lab.

#### CONCLUSION

Q&A, a powerful database program, is in use for storage and retrieval of radiocarbon information at the University of Arizona. This program is quite versatile and simple to use. The database system of Q&A, including word processor, report generator, information import capabilities and artificial intelligence is a good choice for lab database use. Information stored in the Q&A data base can be transferred to other systems and will transfer data for use in *RADIOCARBON* and the IRDB.

#### ACKNOWLEDGMENTS

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#### REFERENCE

Q&A Manual, v 2.1, Symantec Corp.