

OCEAN SCIENCE AND ENGINEERING, INC.

OCEAN SCIENCE BUILDING
4905 DEL RAY AVENUE
WASHINGTON, D. C. 20014

July 3, 1968

File

Mr. David Crownover
Executive Secretary
University of Pennsylvania Museum
33rd and Spruce Streets
Philadelphia, Pennsylvania 19104

Dear Mr. Crownover:

Here is a note to confirm our appointment with you on Friday July 12 to discuss some of the ventures undertaken by your scientists, and some of the areas of strength of your museum. Willard Bascom and myself plan to arrive mid-to-late morning, perhaps 10:30 A.M. Briefly, Mr. Bascom is an ocean engineer and explorer and is President and Chairman of this Company.

The company is active in ocean engineering, surveying, mineral prospecting, ship design construction and repair, and many areas of ocean research. ALCOA, DuPont, Southern Natural Gas, the Anglo American Corporation (of the DeBeers group), Amerada Petroleum and the Fluor Corporation have all invested in the Company and are represented on the Board of Directors.

We look forward to seeing and speaking with you.

Very truly yours,

Will Bernardin

Will Bernardin
Assistant to the Vice-President

WB/njg

November 13, 1969

MEMORANDUM

To: Judge Biggs
Howard C. Petersen
Froelich Rainey

From: David Crownover

David O'Connor has been using computer programming to correlate masses of Egyptian material. He has a project currently with his Abydos findings, and requires \$1500 for a computer programmer to sort out and correlate the findings of two seasons of the work at Abydos.

On the enclosed card would you signify your approval of this expenditure from the Coxe Fund?

Thank you very much.

PRESERVATION COPY 3/17/2014

September 26, 1961

Mr. G/ M. O'Dell
317 N. W. 1st Ave.
Mineral Wells, Texas

Dear Mr. O'Dell:

In regard to your inquiry about a new device using the echo-sounding principle... being developed at the University of Pennsylvania Museum, I am writing to say that the instrument is not yet completed.

It is being designed under contract by an electronics engineer and many of the parts are being specially made by him. New applications of transistors and so forth are involved in the development of a portable instrument of this type. We expect a prototype to be completed within two months which will probably require revisions after extensive field testing.

During the past year, our staff has made various field tests with a standard instrument - namely, MD-1 Engineering Seismograph which is manufactured by Geophysical Specialties Company, 15409 Robinwood Drive, Hopkins, Minnesota.

For more information about our new instrument, which is being designed primarily for archaeological prospecting, I suggest that you write again in about one year.

Sincerely yours,

Elizabeth K. Ralph
Techniques Laboratory

EKR/lm

January 22, 1981

Elizabeth Ralph
Barbara Lawn
Radiocarbon Lab
Department of Physics
University of Pennsylvania
Philadelphia,
PA 19174

Dear Beth and Barbara,

I just wanted to thank you both for taking the time to talk with me and show me around the radiocarbon lab last week. After looking again at the BBC film I'm working with, I've concluded that the presentation of radiocarbon dating is adequate (if imperfect) for ODYSSEY's purposes, and so have decided not to do any additional filming. I will, however, be extending the sequence with discussion of tree-ring calibration, and will be filming an interview with Henry Michael early next week. I've tried to reach you on the telephone, but as I've been in and out of the office in the usual chaos of pre-production, I have been calling at times when I now realize that you're unlikely to be there--such as lunchtime or late afternoons. In any case, please feel free to come over and take a peek at the filming--we'll be interviewing Henry Michael late in the afternoon on Wednesday, and will continue on Thursday with a sequence on metallography with Vince Pigott. Please accept my apologies for not informing you of my plans sooner--and again, thank you for your time and help.

Best regards,

Kate

Kate Bernhardt
Producer

October 23, 1969

Dear Mr. Ogilvy:

I have your letter of October 14 regarding thermoluminescence dating of pottery samples from your place near Poitiers in France. There are now two laboratories, one here and one at Oxford, England, which can do this ~~dating~~ dating. However, we both are so completely involved in improving the system and in dating materials for our various expeditions abroad, that we are unable to do individual jobs such as you propose. Here our backlog material to be dated for our own research will occupy the laboratory for at least the next two years. At one point we offered to set up a separate lab here in order to analyze material for private collectors but we did not get enough financial support from those collectors to set up such additional laboratories, and therefore must limit all of our research to scientific purposes.

I am sorry we cannot help you with your project, but you may wish to try Dr. Martin Aiken at the Laboratory for Archaeology, Oxford.

Sincerely,

Froelich Rainey
Director

Mr. David Ogilvy
2 East 48th Street
New York, New York 10017

FR/j

October 14, 1969

Dear Mr. Rainey:

Can you help me date some pottery samples, by means of your thermoluminescent procedure?

On my property near Poitiers in France there are three circular mounds, about three feet high and twenty feet in diameter.

When I removed one of the mounds, I found three concentric circles of white stones, with irregular spokes.

I have dug down two feet below the stones, in the center of the circles. The only thing I have found, so far, is some unmarked pieces of pottery. At two feet I ran into what appears to be virgin clay.

Before I dig the rest of the area (it is hot work) I would very much like to find out how old the pottery is.

Two French archeologists think that these mounds are tombs of the iron age. On the other hand, a neighboring farmer thinks they are rabbit traps of fairly recent date.

If the pottery is found to be only two or three hundred years old, the farmer is probably right. If, on the other hand, the pottery is two thousand years old, the archeologists may well be right; in which case I shall continue to dig.

Nearby there are several other mounds, forty feet long and more. But only three round ones.

In addition to the three concentric circles, I found five blocked entrances on the outside ring. You can see all this in the photograph.

Yours sincerely,



Mr. Froelich Rainey
The University Museum
University of Pennsylvania
33rd & Spruce Streets
Philadelphia, Pa. 19104

cc: Dr. Marie Farnsworth



1956

215/3532

OKE
ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY
İNÖNÜ BULVARI - ANKARA - TURKEY

TELEFON : 23 21 20
TELEX : 42761

SAYI : F12-1144
REF

021490

4.11.1976

Dr.Elizabeth K.Ralph
The University Museum
University of Pennsylvania
33rd and Spruce Streets Fl
Philadelphia, Pennsylvania 19174
USA

Dear Dr.Ralph,

After a long summer in Europe I arrived in Ankara early September. I was hoping that we will see you here on your way back from Tehran but I suspect that your tight schedule did not allow this.

Our C¹⁴ and T.L. work is going on quite well. An increasing number of Turkish archeologists have started employing our services. At the present we have developed an interesting computer analysis program for C¹⁴ where we employ a multichannel pulse height output of the data and use a X² program to find the optimal age parameters; we intend to send this to Radiocarbon soon.

Our masters student working on obsidian hydration dating has decided to come to U.S.A. accompanying her husband who will do post-doctoral work at the Physics Department of Brandeis University (Dec.76 to Sept.77). I suggested to her that she should make good use of her time by working some place associated with archeometry, of course one place that came to mind was your laboratory at Univ. of Pennsylvania. Although it would be best if she could work some place that does obsidian hydration, I still think it would be beneficial for her to get a general experience as well. She is a physics graduate and she has had some working experience in the U.S. at Yale University where she was the coordinator of Freshman Chemistry Laboratories. She told me that she was quite willing to live any place that she could find interesting work related archeometry. She would need some money to support herself as her husband gets very little (\$500/month) from the Turkish Scientific Foundation. In case you have no possibility of employing her maybe you can suggest places to apply; preferably at the



ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY
İNÖNÜ BULVARI - ANKARA - TURKEY

TELEFON : 23 21 20
TELEX : 42761

SAYI :
REF

-2-

East Coast. I hope you do not mind this request of ours, any help you could offer will be very much appreciated.

I want to thank you again for your hospitality during my visit in June. Please extend my greetings to your colleagues.

I hope you will consider visiting Ankara in case you are in any country close by.

Sincerely yours,

Hakkı Ögelman

P.S. The Student's name is: Gülay Öke
Physics Department
Middle East Technical Univ.
O.D.T.Ü.
Ankara - TURKEY

October 27, 1961

Dr. Ingrid Olsson
Uppsala Universitets Fysiska Institution
Uppsala, Sweden

Dear Dr. Olsson:

It was good news to learn from Drs. Godwin and Willis that there may be a C-14 conference in Cambridge next summer. I am looking forward to meeting you again at that time.

In the meantime, I am particularly anxious to hear the results of your C-14 half-life determination, and should appreciate it if you will let me know them when your measurement is completed.

I have enclosed a copy of our most recent publication in which we have used an "effective" half-life value of 5800 years for age calculations.

With best regards

Elizabeth K. Ralph

EKR/ic
encls.



Fysiska Institutionen, Upsala , Sweden, November 8, 1961

Dr. Elizabeth K. Ralph
Dep. of Physics
Univ. of Pennsylvania
Philadelphia 4, Penn.
USA

Many thanks for your letter and reprint. We will of course tell all C14 laboratories about the result of our half-life determinations. The measurements are not yet ready. We hope to have reprints in April. We will discuss the problem at the conference.

With best regards

Ingrid Olsson

Ingrid Olsson

April 24, 1968

Dr. Ingrid V. Olsson
Fysiska Institutionen
Uppsala Universitet
Uppsala, Sweden

Dear Dr. Olsson:

Thank you very much for the reprints. I enjoyed reading, especially, about your experiments with shells.

I have enclosed some reprints of our Date Lists which you may already have. In a few weeks we expect to have reprints of a general article which is being published in Archaeometry, and we shall send you one when they arrive.

With best regards,

R/rs
Encl.

Beth Ralph

Uppsala Universitet
Fysiska institutionen

University of Uppsala
Institute of Physics

12.6.1969



Mr. Robert Stuckenrath
Dept. of Physics and Univ. Mus.
Univ. of Pennsylvania
Philadelphia 4, Pennsylvania
USA

I send one letter to each of you, one to Europe and one to USA to ask about one of your datings which was published in Radiocarbon Vol. 7, p. 195-196. It is P-725, Cheops boat. You have got a result which is surprisingly high since it agrees with the historical date even if we from the dendro-chronology and C^{14} would expect the sample to have been dated at too low an age (with a few hundreds of years). The sample is very interesting. I would like to ask if you have anything left and intend to repeat the dating, or if you have some sample left and are willing to give me those remains.

What did the sample look like when you got it? Small pieces or shavings or just one piece of each of the three tree species. What pretreatment did you give to the sample?

Sincerely yours,

Ingrid U. Olsson

Ingrid U. Olsson

c/c Miss Elizabeth Ralph c/o Dr. Alan Mc Pherson
Narodni muzej, Kragujevac, Jugoslavien.

22.10.1970

Miss Elizabeth Ralph
Mr. H.N. Michael
Museum Applied Science Center for
Archaeology
University of Pennsylvania
33rd & Spruce Streets
Philadelphia
Pennsylvania 19104
USA

Dear Beth and Mr. Michael,

The work with the so called "Egyptian C¹⁴ project" is going on, although slowly. As it is now, we hardly can think of getting any samples from there (Egypt) for the moment, but we have not given up. We thought that we should collect a few of the papers from Noble Symposium 12 in a small booklet to use when you, we, and others responsible in our project have negotiations with the authorities, especially in Egypt. The complete book is very expensive. Besides that, it should be published this week, so you can get yours before Christmas, I think. The publisher should send it when it is published, but I guess that will be done by surface mail. From the invitation you saw that the number of reprints will be 25 for each of you. We have asked the publisher to be allowed to reproduce a few papers to use for the joint Egyptian C¹⁴ project (Michael & Ralph, Säve-Söderbergh, Säve Söderbergh & Olsson, and the Resolution) and we got the permission. Now I ask you for the permission to reproduce your paper on Egyptian samples.

We are glad that you are so very interested in this project. I send a copy of this letter to Professor Säve-Söderbergh. He and I have agreed upon the booklet and that I should write to you.


I enclose my first suggestion of how to write the cover and the first page of the booklet. We must remember that "all rights are reserved" for the proceedings. Maybe you could read the draft and suggest changes. What name do you use for the project? Our present working name is "The Egyptian C¹⁴ project". Do you agree upon that? We intended to put the name on the cover of the booklet.

Sincerely yours,
Ingrid U. Olsson
Ingrid U. Olsson

The Egyptian C¹⁴ project

In this booklet the Resolution and three papers presented at Nobel Symposium 12, held in Uppsala in August 1969, are reproduced by due permission ^{of} from the authors and the publisher of the proceedings. To be used for the international Egyptian C¹⁴ project started 1969 in Uppsala.]

Suggested changes
HNM & EKR



THE EGYPTIAN C¹⁴ PROJECT

RESOLUTION

and

THREE PAPERS

presented at

NOBEL SYMPOSIUM 12

Uppsala

AUGUST 1969

October 27, 1970

Dr. Ingrid U. Olsson
Institute of Physics, Box 530
S-751 21 Uppsala
Sweden

Dear Ingrid:

Henry Michael and I are pleased that you want to include our article in your book, and we are glad to send you permission to reproduce the article -- namely, "Correction Factors Applied to Egyptian Radiocarbon Dates from the B.C. Era" by H.N. Michael and E.K. Ralph.

As for the title of the book, we should prefer one of the following three suggestions:

- 1) The Chronology of Pharaonic Egypt and Radiocarbon Dating.
- 2) Egyptian Chronology and Radiocarbon Dating ~~is a New Book~~. Look.
- 3) A Comparative Review of Archaeological and Radiocarbon Dates Pertaining to Ancient Egypt.

For the title of the project in the future, we prefer something more comprehensive that would include the Minoan and other Mediterranean chronologies which we hope to study -- possibly, The Egyptian and Near Eastern C-14 Project. However, the proposed booklet covers only Egypt, so that title must be more limited.

Sincere we last corresponded on these matters, Lanny Bell has returned from Egypt with 14 samples -- both reeds and short-lived pieces of wood, representative of the 19th and possibly 20th Dynasties. The preliminary descriptions of these samples are given on the enclosed sheets. We have ample material for each one. We have prepared packets of 20 grams of each to send to you if you would like to have them. Please let us know if 20 grams is sufficient and if you do want them. In the meantime, we are sending small fractions to the Forest Products Lab. for species identification.

We anticipate that your new booklet will be extremely useful in getting permissions in Egypt and elsewhere.

With best regards,

E.K. Ralph and H.N. Michael

Martin Biddle, Director.

Dr. N. Oosterbaan,
Voorschoten, 23
Raadhuislaan 114
The Netherlands.

7 July 1978.

Dear Dr. Oosterbaan,

In reply to your letter of 16 June 1978, I have enclosed a copy of MASCA Newsletter, Vol. 9., No. 1, in which ^{14}C and dendrochronological data are compared.

About the Egyptian problems, my colleague Henry Michael could answer your questions better than I. He is now in California, but I shall give him your letter when he returns in about a month.

In brief, we are comparing ^{14}C dates with the new edition of C.A.H.. Most ^{14}C dates have to be corrected by tree-ring dates as explained in the Newsletter. However, this does not indicate that the value of the half-life, which has been measured independently, is necessarily wrong.

Sincerely yours,

Elizabeth K. Ralph.

N. OOSTERBAAN

Voorschoten, 23 January 1978
Raadhuislaan 114
The Netherlands

*delayed by
sickness*

16 June 78

Dr. Elizabeth Ralph,
University of Pennsylvania,
Pittsburgh, Pennsylvania 15213
U.S.A.

Dear Dr. Ralph,

Through the pages of David Wilson's book "The New Archaeology" I have learnt that in the Masca Newsletter you published your comparisons of radiocarbon dates and dendrochronological data (August 1973 issue).

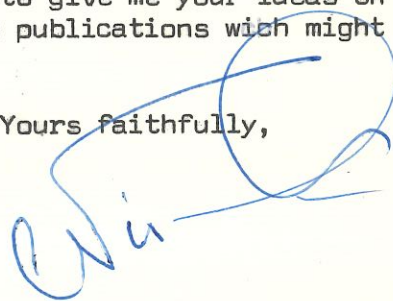
I am not a professional in archaeology - my academic training being limited to some years of Egyptology - and I find it somewhat difficult to get hold of the relevant literature as the Institute to which I have access is more of the literary and philological type. They do not have anything on radiocarbon dating.

I should very much like to see your article and also a reply to some questions which I venture to put to you:

1. Why is the position of the Egyptologists that their chronology is in good order taken for granted? Should this not be corroborated by outside evidence such as provided by radiocarbon dating?
2. Will this not be borne out by critically reading the chapter on Egyptian chronology in the new edition of the Cambridge Ancient History?
3. Were there any other grounds than the conflict with Egyptian history to attach a new value to C14 half-life? I presume there must have been laboratory measurements but never saw a publication quoted.
4. Is it true that radiocarbon datings of ancient Egyptian remains which were even more out of whack than Tutankhamun's tomb were suppressed?
5. Obviously the wood in this tomb must stem from trees which were dead before Tutankhamun himself died. Were his own remains ever r.c.-dated? Have there been experiments to establish whether they used fresh or mature wood for the tomb?

It would help me a great deal if you were to give me your ideas on this subject and even more if you could refer me to the publications which might be of special relevance.

Yours faithfully,



*Henry, Do you want to
answer the Egyptian questions?
EKR*

A SCA



CALIFORNIA STATE COLLEGE, LONG BEACH
90801

October 11, 1972

*Mark Ham -
Could we handle
this?
As I'll write
about cost
etc.
JHO*

Dr. Froelich Rainey
Applied Center for Archaeology
University of Pennsylvania
Philadelphia, Pennsylvania 19104

Dear Dr. Rainey:

This is an inquiry regarding the status of your thermoluminescence project and, of course, of the possibility of using it. I have samples of sherds from excavations made in the Palau islands, 1968-9 (NSF-GS 1963). I have attempted, and am still attempting, to get C14 dating completed at the UCLA isotope lab. Part of this work has been done but the difficult part of it, involving the use of sherd collections from various excavation units, has not been completed. And it is a chancy thing at that; there is always the possibility that a sherd collection will not have been large enough to yield enough carbon.

Therefore, I would like very much to see some of my sherds subjected to thermoluminescent study. I have a few charcoal dates now and would select sherds from the same strata as came the dated samples, for a check. And, hopefully, I shall get some dates from my pottery. As is always true, I need more dates than I can get via the C14 methods.

My funds are dwindling but, I should be able to use some of them in this way, if the costs per sherd-date are not overly great.

The general pattern of Palau archaeology is described in my survey report, published in 1966 as Bulletin 230 of the Bernice P. Bishop Museum.

I'll be interested in hearing from you.

Sincerely,

Douglas Osborne
Department of Anthropology

jb

November 16, 1962

Dr. J. Gordon Ogden III
Bigelow Rice Science Bldg., Henry St.
Ohio Wesleyan University
Delaware, Ohio

Dear Dr. Ogden:

When Mr. Marchbanks from the Sharp Laboratories was here, he told us that you had installed one of their CDL-14 Carbon Dating assemblies.

I am planning to be in Delaware to see part of the women's field hockey tournament on Thanksgiving and the following two days. I am wondering if it would be possible for me to visit your laboratory on either Friday or Saturday, November 23 or 24th.

I'll telephone your lab on Friday morning. If you are planning to be away during the holiday, I'll hope for better luck next time.

Sincerely yours,

Elizabeth K. Ralph

EKR:dml



✓ ROYAL ONTARIO MUSEUM

UNIVERSITY OF TORONTO

100 Queen's Park, Toronto 5, Canada. 928-2011 Cables: ROMA—Toronto

Myasche

16th November 1965.

Dr. F. Rainey,
Director,
The University Museum,
University of Pennsylvania,
Thirty-third & Spruce Streets,
Philadelphia, Pa. 19104.

Dear Dr. Rainey:

Thank you for agreeing to my visit for the purpose of looking at the files of the Applied Science Center. Unfortunately I shall be unable to come after all on the 16th November because on that day I have to attend a meeting that has been arranged unexpectedly. However, I shall seize my next opportunity to call at Philadelphia.

Yours sincerely,

Robert M. Organ

R. M. Organ,
Curator of Conservation.

RMO:pb

Your reference

Our reference G1/3a

25th May 1976

Dr. E.K. Ralph
Department of Physics
University of Pennsylvania
Philadelphia 19104
U.S.A.

Dear Dr. Ralph,

Thank you for your letter indicating that Mr. Radnell and I may visit your laboratory on 11th June. I am sorry that this date is not very convenient for your student Jeffrey Klein as, of course, we do not want to disturb him so close to his exams.

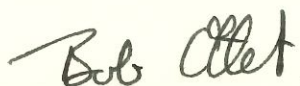
Unfortunately, although we have time available after the conference, our flight bookings (charter) do not allow us the flexibility of making alterations. If, therefore, we could keep to the arrangement of visiting you on the 11th perhaps we shall have further opportunity ~~after~~^{for} discussions during the conference period?

Thank you also for the route directions. We are planning to hire a car in New York so we will be coming to Philadelphia by road on Thursday. It is going to be a very hair-raising experience being let loose in the New York traffic on the other side of the road to the one we are used to driving along! If all goes well, however, we will come to your laboratory sometime between 10.00 and 11.00 on Friday morning.

Our next stop will be with Joe Pearson, United States Department of the Interior at Reston Virginia, an old friend who has been to our laboratory several times. He has invited us to spend the weekend with him before visiting his laboratory on the Monday so I expect we will leave for there on Saturday the 12th.

Looking forward to meeting you - please do not disturb Jeffrey Klein on our account.

Yours sincerely,



R.L. Otlet

Hilton EV 7-8333

D = \$ 38.00

Beth:

a Tom Elsworth
British Embassy
202-462-1340
EXT. 2254

HARWELL

**Carbon-14/Tritium
Measurements Laboratory**
Bldg. 10.46, AERE Harwell, Oxfordshire
OX11 0RA
Tel: Abingdon (0235) 24141 Ext 2336
Telegrams: Aten, Abingdon
Telex 83135

Your reference

Our reference

26th April 1976

Dr. E.K. Ralph
Department of Physics
University of Pennsylvania
Philadelphia
Pennsylvania 19174
U.S.A.

Dear Dr. Ralph,

My colleague C. Radnell and I are planning to visit the USA this coming June to attend the 9th International Radiocarbon Conference at Los Angeles and San Diego.

As the opportunity to travel such distances seldom occurs these days we want to try to include visits to other USA radiocarbon laboratories during our stay if they can possibly receive us.

We are planning to arrive in New York on 8th June and we are hoping to make a circular tour on the eastside (including Philadelphia and Washington) between 8th and 20th June when we move on to Los Angeles. We should very much like to visit your laboratory during this time and wondered if you would agree to our coming to you on Friday, 11th June after travelling down from New York. If it is not convenient we will of course understand but very much hope the answer will be in the affirmative.

Yours sincerely,



R.L. Otlet

UNIVERSITY of PENNSYLVANIA

PHILADELPHIA 19104

The College

May 4, 1976

DEPARTMENT OF PHYSICS

Dr. R.L. Otlet
Carbon-14/Tritium Measurements Laboratory
Bldg. 10.46, Aere Harwell, Oxfordshire
ENGLAND

Dear Dr. Otlet:

It will be a pleasure to have you and Dr. Radnell visit our ¹⁴C lab. Friday, June 11th is all right, but if you could possibly visit us after the International Conference, it would suit us better.

The main reason is that Jeffrey Klein, our graduate student ~~is~~ in Physics, and I want to discuss various new experiments with you. Unfortunately, Jeff has to take his major exams about June 14th and I hesitate to interrupt his studies until after that time.

If it is not possible to come after the conference, please come on June 11th.

Our lab (Rm. BW4, David Rittenhouse Laboratory, on 33rd Street near the corner of Walnut Street) is a short distance (15 minutes walking time) from the Amtrak railroad station (30th Street), or a 20 minute drive from Philadelphia International Airport. However, unless you are on Long Island in New York, it would take you more time to go to an airport than it would to take the train from New York City to Philadelphia.

Sincerely yours,

Elizabeth K. Ralph

EKR:ks

Tch

Radiocarbon Laboratory
 University of Penna. DRL/E1
 209 S. 33rd Street
 Philadelphia, PA. 19104
 December 12, 1977

Bob Otlet
 Carbon-14/Tritium Measurements Laboratory
 Building 10.46, AERE Harwell
 Oxfordshire OX11 0RA

Dear Bob,

Martin Biddle has informed me that you are in the final stages of dating "King Arthur's" Table, and would be interested in seeing the new MASCA corrections for the period. I've enclosed a table (sorry it's only hand written) which differs slightly in format from the 1973 MASCA tables. The first two columns correspond to those in the newsletter publication. The next two, marked σ_+ and σ_- , represent the one-sigma uncertainty (in calendric years) in the regression of the radiocarbon date being corrected. To calculate a radiocarbon date, including the uncertainty, I recommend the following method. First look-up the radiocarbon date in the usual fashion. Then look-up the date which corresponds to the radiocarbon age plus one sigma as estimated by the total counting uncertainty. Subtract one from the other and square. To this, add the square of σ_+ , found in the column opposite the radiocarbon date plus one sigma. Take the square root of the sum. This is the corrected date positive one sigma uncertainty. The negative one sigma uncertainty is calculated analogously. Subtract the counting uncertainty from the radiocarbon date, look-up the corresponding corrected date, subtract this date from the corrected radiocarbon "midpoint," square and add to the square of the σ_- corresponding to the radiocarbon date minus one sigma counting uncertainty. The square root of this is the negative one sigma uncertainty for the corrected date.

	Radiocarbon, \pm uncertainty	corrected date	difference	
e.g.	1040	1065	25	σ_+ at 1040
	990 \pm 50	1040		$\sqrt{(25)^2 + (12)^2} = 28$
	940	1006	34	$\sqrt{(34)^2 + (12)^2} = 36$
				1040 ± 28 σ_- at 940

See attached
 sheet.

i.e. the one-sigma range is AD 1004 to AD 1068.

Bob, I'm sorry that the procedure is so complicated. I'm working on simplifying the process, but as yet, I've not prepared tables using any of the simpler methods. It's been the feeling that the correction procedure is too complicated, and a wish to try things out a bit with new dates, that has held-up publication. I would be very interested in hearing your reactions. If you like I could also send you the correction tables to 5000 BC.

The philosophy behind this method can be summarized as follows:

i) To correct a radiocarbon date with its associated uncertainty, it is not only necessary to find the calendric date which corresponds to the radiocarbon date, but also to determine how rapidly this date changes with changes in the radiocarbon date. If you will, the counting uncertainty is in terms of radiocarbon years. We are interested in dates in terms of calendric years. The relationship between calendric years and radiocarbon years is not always one-to-one. The relationship is constantly revalued by variations in the quantity of atmospheric C-14. Therefore, it is not only necessary to map the "most likely" value of the radiocarbon age into its calendric equivalent, but also the entire probability distribution. During times of enrichment of atmospheric C-14, counting uncertainties

(radiocarbon year uncertainties) map into smaller calendric uncertainties. During periods of depletion, the calendric uncertainties are larger than the radiocarbon uncertainties. The local "slope" in a plot of calendric vs. radiocarbon age, gives the multiplicative factor relating the two time scales.

ii) If the calibration were exact, after the above considerations, one would be done. But the calibration is only estimated, so it too has its own uncertainty. This uncertainty arises from the variation in the functional relationship between the radiocarbon and calendric dates which are possible within the one-sigma estimation domain of the regression parameters. It is consequently a continuously varying function of the date. It could be expressed either in terms of radiocarbon years or calendric years. On the tables, the uncertainty is in calendric years.

iii) In the usual fashion when one adds two numbers from two populations of independently distributed random variables, the total uncertainty is the square root of the sum of the squares of their uncertainties.

These considerations result in the method detailed above.

Let me just add a few additional notes about the method.

i) You will notice from the tables that the new method never maps to a range of dates. It always maps to a single (or at most three, cf. AD 1080) calendric date(s). Many of the intervals in the MASCA-1973 tables are gone altogether, (cf. AD 1680, 1670, 1660, ..., 490). Other intervals result in large and usually asymmetrical uncertainties (cf. AD 1630, 1610, ..., 400, 390). The large uncertainties imply that the calibration regression is sensitive in these regions to small variations in its parameters, a function of the flatness of the slope (tree-ring vs. C-14), i.e. a period of atmospheric C-14 depletion. More data are necessary to reduce this uncertainty. Note, that though the ratio of calendric uncertainty to radiocarbon uncertainty is proportional to the slope, the sensitivity of the calibration to variations in the parameters is inversely proportional to the slope.

ii) Two sigma ranges for dates are only approximately twice as large as one sigma ranges, depending upon the linearity of the calibration over the region of interest. The best way of determining a two sigma confidence region is to double the counting uncertainty, look-up the corresponding dates, and σ_+ , σ_- . Use the square root of the sum of the squares of the differences plus four times either σ_+ or σ_- -square.

iii) With all these machinations, the radiocarbon dates appear to be distributed roughly normally. Perhaps we are on the right track!

As far as news over here, the Micro-Mass is really grand. It works well and we are consistently getting reproducibility in the range of $\pm 1\%$. Our laser experiments are proceeding, though slowly. We've taken spectra in the 330nm range in a number of different configurations. Sometime within the next three months we should be ready to do our first actual enrichment experiments. What do you know of Ron Hedges' progress? I've heard from Ted Hall that he has abandoned lasers for a Tandem. Tandem work in this country is proceeding at a rapid clip. We're kept informed by Roy Middleton, here at Penn, who is a good friend of Litherland, et al. Roy has been running some experiments of his own. It might well be the way to go in terms of smaller samples and longer ranges. Other aspects of the lab function as always. Beth has continued her siege of bad luck, but sends her best regards.

Let me know how you make out using the correction tables. I've included a sheet with a few more worked examples. In addition, I've included a graph showing the difference in the date obtained from the MASCA-1973 corrections and that obtained from the local fit method. The grey areas represent the regional corrections in the MASCA-1973 fit. The other variations are a function of frequency averaging in the nine-sample floating average.

encl: Table (5 pages)
Graph, work sheet

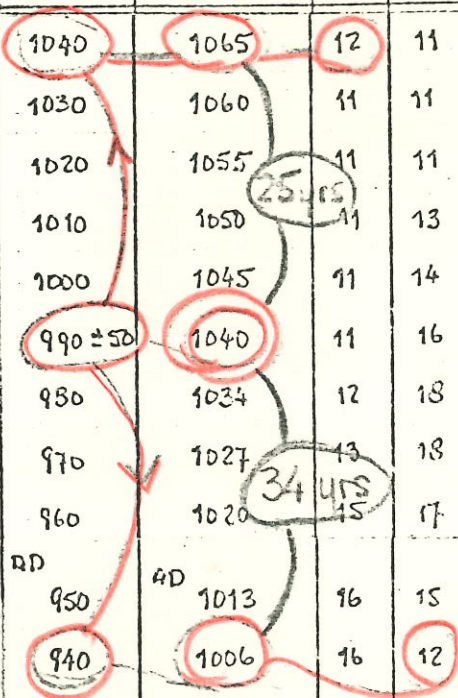
Looking forward to hearing from you soon,

Jeff Klein

¹⁴ C-DATE (5730)	LOCAL FIT CORRECTED	σ_+	σ_-	MASCA-	MASCA- LOCAL
1040	1065	12	11	1080	15
1030	1060	11	11	1070	10
1020	1055	11	11	1060	5
1010	1050	11	13	1050	0
1000	1045	11	14	1040	-5
990 ± 50	1040	11	16	1030	-10
980	1034	12	18	1030	-4
970	1027	13	18	1020	-7
960	1020	15	17	1020	0
RD 950	AD 1013	16	15	1010	-3
940	1006	16	12	1000	-6
930	999	19	7	1000-980	19 1
920	993	18	16	980	-13
910	987	18	18	970	-17
900	981	19	22	960	-21

25.12

34.15



April 28, 1972

Mr. Donald T. Ower
Exploration Logging Services
9837-70 Avenue
Edmonton, Alberta T6E 0V6
Canada

Dear Mr. Ower:

Mrs. Bell has not worked here for about 3 years, so I am answering your letter of April 24th.

In the third week of May, those of us who are familiar with geophysical prospecting methods and instruments will probably be away on field trips.

I have enclosed copies of Vol. 7 of our Newsletter and will put your name on our mailing list.

Sincerely yours,

Elizabeth K. Ralph

EKR/ek

attach?
MASCA
Jee

February 21, 1973

Mr. Gerald H. Grosso
Conservator
✓ Ozette Archaeological Project
Neah Bay Laboratory
P. O. Box 194
Neah Bay, Washington 98357

Dear Mr. Grosso:

The ferrous blades appear to have emerged from meteoric iron, judging from a fairly high percentage of nickel. On the other hand, the second artifact appears to be a fairly pure cast iron, most likely smelted from a relatively good iron-ore with charcoal as a reducing agent. I judge these from the analysis supplied in your letter to Dr. Froelich Rainey.

There has not been much analysis made on relatively old Western Hemisphere irons. A great deal is known and a large number of analyses have been provided for Middle East irons. I suggest as one source that you consult Leslie Aitchison, A History of Metals, 2 Vols., Interscience, N. Y., 1960

To my knowledge, I know of no reports with terrestrial native iron. It is unlikely that terrestrial native iron would persist as iron for any length of time; it would most likely oxidize, and relatively quickly. Meteoric iron with relatively high concentrations of nickel constitutes, in essence, a type of stainless steel and would exist for very long periods.

If there is any way in which I might help, please do not hesitate to write.

Sincerely yours,

Robert Maddin

RM/ims

cc: Dr. Froelich Rainey ←