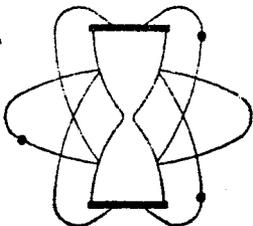


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# KRUEGER ENTERPRISES, INC.

GEOCHRON LABORATORIES DIVISION

24 BLACKSTONE STREET • CAMBRIDGE, MASSACHUSETTS 02139 • (617) 876-3691

31 December 1973

M. Rogers/Henderson  
University of Calif.  
Los Alamos Scientific Lab.  
Box 990  
Los Alamos, New Mexico 87544

Dear Ms. Rogers and Henderson:

Enclosed are four (4) of the five (5) sample reports on the roots described in P.O. LG4-40233-1.

Reported below are the results on the four samples, the same ones that I discussed with you on the telephone. Due to an electronic malfunction, the results for the last sample, PIT 24, GX3302, will be delayed for a few days. For bookkeeping purposes I am billing you for these four samples now. The other sample will be analyzed and reported before January 7, 1974.

The results are expressed in terms of  $\delta C^{14}$  where:

$$\delta C^{14} = \frac{A_{\text{samp}} - A_{0.95 \text{ ox}}}{A_{0.95 \text{ ox}}} \times 1000$$

where  $A_{\text{samp}}$  and  $A_{0.95 \text{ ox}}$  oxalic are the measured net activities of the sample and standard respectively. This is the way of expressing results of geo-physical interest.

Geochron #	Your I.D.	$\delta C^{14} \pm 1\sigma$
GX3298	Pit 7 Joint 8	225 $\pm$ 20
GX3299	" 7 " 43	67 $\pm$ 20
GX3300	" 7 " 54	64 $\pm$ 20
GX3301	" 7 " 65	132 $\pm$ 20

As I stated to you on the phone, results such as these are usually corrected for isotopic fractionation by measuring the  $C^{13}/C^{12}$ . The final result is expressed as  $C^{14}$  where

$$C^{14} = \delta C^{14} - (2\delta C^{13} + 50) \left(1 + \frac{\delta C^{14}}{1000}\right)$$

I would only expect a small shift between  $\delta C^{14}$  and  $C^{14}$  if we proceed with

continued/2



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31 December 1973

Rogers/Henderson  
Los Alamos Lab.

the  $C^{13}$  analysis, say on the order of 10-20%. The cost of the  $C^{13}$  analysis is \$20.00 per sample.

Enclosed is a graph of the  $C^{14}$  of the atmosphere for the last two decades since the atom bomb tests. You can see that one could assign a very specific year to each sample, however, if the samples are composites of roots growing over a few years time, there are an infinite number of combinations which would yield the sample result. I'm afraid all one can say is that the samples probably grew after 1950, but you will have to ask a statistician exactly how probable that is for each sample. For example, one could take one part + 100% roots and one part 0% roots (AD1950) and arrive at +500%, or take four parts +600 % and one part -100% (AD1540) and get the same result, etc. etc.

If you should have any questions, please do not hesitate to contact me. In the meantime, I am enclosing our invoice for this work. We look forward to serving you again in the near future.

Sincerely,



Richard R. Pardi  
General Manager - Radiocarbon Section

RHR/dm

encl: 4 reports & invoice #4297

J. C. VOGEL, "RADIOCARBON IN THE SURFACE WATERS OF THE ATLANTIC OCEAN", 8TH INT. CONF. ON RADIOCARBON DATING, 1964

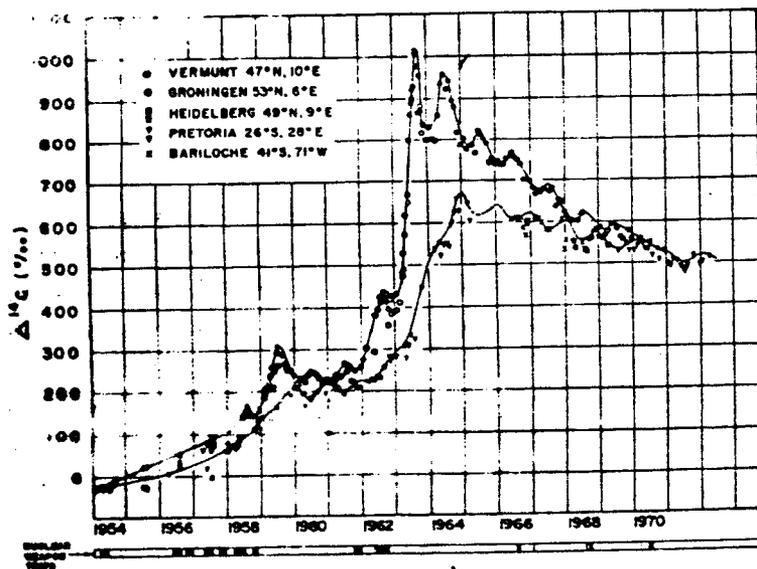
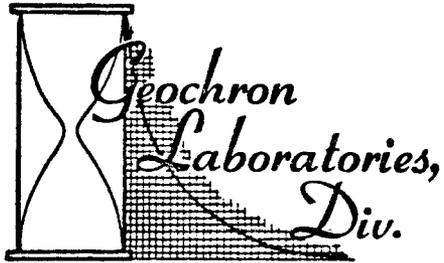


Figure 2. Radiocarbon content of the troposphere since 1954. The lower curve represents the situation in the southern hemisphere while the upper curve corresponds to mid latitudes in the northern hemisphere and is based mainly on Heidelberg measurements (Münnich and Vogel, 1963; Münnich and Roether, 1967; extended by courtesy K.O.Münnich). Results adjusted to  $\delta^{13}C = -25\text{‰}$  according to the Lamont normalization. Open squares and triangles are samples of plant material, the rest are direct measurements on atmospheric carbon dioxide. See also Vogel and Marais (1971).

same rate as a. The only unknown in the above equation is  $k_m$  or, more precisely,  $\tau_{md}$ . On the basis of the steady state distribution of radiocarbon, Revelle and Suess (1957) and Craig (1957) calculated  $\tau_{tm}$  to be 7 years. This figure was



REMIT TO: *Krueger Enterprises, Inc.*  
24 Blackstone Street, Cambridge, Mass. 02139  
Telephone 617-876-3691

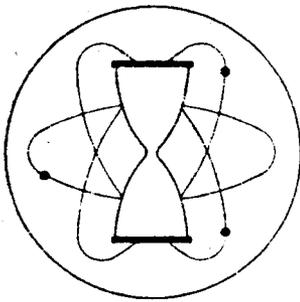
Date

Invoice No.

Customer Order No.

*[Faint, illegible text, possibly a return address or contact information]*





**KRUEGER ENTERPRISES, INC.**  
**GEOCHRON LABORATORIES DIVISION**

24 BLACKSTONE STREET • CAMBRIDGE, MA. 02139 • (617)-876-3691

**RADIOCARBON AGE DETERMINATION**

**REPORT OF ANALYTICAL WORK**

**Our Sample No.** GX3298

**Date Received:** 26 November 1973

**Your Reference:** Pit #7 Joint #8

**Date Reported:** 31 December 1973

**Submitted by:** Henderson/Rogers  
University of California  
Los Alamos Scientific Lab.  
P.O. Box 990  
Los Alamos, New Mexico 87544

**Sample Name:** PIT#7 JOINT#8 N. Wall Area G SR-11259-B

**AGE =**  $\delta C^{14} = +225 \pm 20$  ‰ wrt 0.95 NBS Oxalic Acid Standard

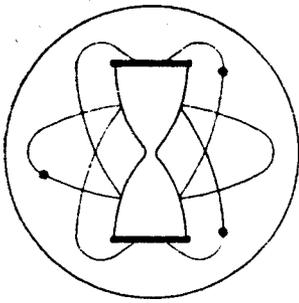
**Description:** Roots

**Pretreatment:** Selected pieces of wood were cleaned of foreign material, including rootlets or other contaminating material that could be observed. They were then digested in hot dilute HCl and in hot dilute NaOH to remove chemical contaminants prior to combustion and analysis.

**Comment:**

**Notes:** This date is based upon the Libby half life (5570 years) for  $C^{14}$ . The error stated is  $\pm 1 \sigma$  as judged by the analytical data alone. Our modern standard is 95% of the activity of N.B.S. Oxalic Acid.

The age is referenced to the year A.D. 1950.



# KRUEGER ENTERPRISES, INC.

## GEOCHRON LABORATORIES DIVISION

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### RADIOCARBON AGE DETERMINATION

### REPORT OF ANALYTICAL WORK

Our Sample No. GX3299

Date Received: 26 November 1973

Your Reference: Pit #7 Joint #43

Date Reported: 31 December 1973

Submitted by: Henderson/Rogers  
University of California  
Los Alamos Scientific Lab.  
P.O. Box 990  
Los Alamos, New Mexico 87544

Sample Name: PIT# 7 N. WALL Area G JOINT #43 SR-11259-B

AGE =  $\delta C^{14} = +67 \pm 20$  ‰ wrt 0.95 NBS Oxalic Acid Standard

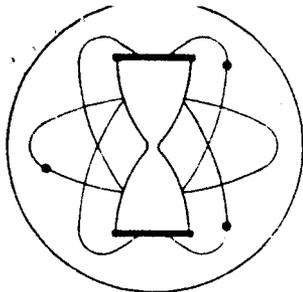
Description: roots

Pretreatment: Selected pieces of wood were cleaned of foreign material, including rootlets or other contaminating material that could be observed. They were then digested in hot dilute HCl and in hot dilute NaOH to remove chemical contaminants prior to combustion and analysis.

Comment:

Notes: This date is based upon the Libby half life (5570 years) for  $C^{14}$ . The error stated is  $\pm 1 \sigma$  as judged by the analytical data alone. Our modern standard is 95% of the activity of N.B.S. Oxalic Acid.

The age is referenced to the year A.D. 1950.



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**RADIOCARBON AGE DETERMINATION**

**REPORT OF ANALYTICAL WORK**

**Our Sample No.** GX3300

**Date Received:** 26 November 1973

**Your Reference:** Pit #7 Joint 54

**Date Reported:** 31 December 1973

**Submitted by:** Henderson/Rogers  
University of California  
Los Alamos Scientific Lab.  
P.O. Box 990  
Los Alamos, New Mexico 87544

**Sample Name:** PIT# 7 JOINT# 54 N. Wall Area G SR-11259-B

**AGE =**  $dC^{14} = +64 \pm 20$  % wrt 0.95 NBS Oxalic Acid Standard

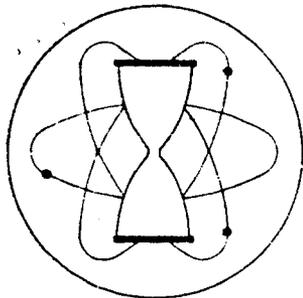
**Description:** roots

**Pretreatment:** Selected pieces of wood were cleaned of foreign material, including rootlets or other contaminating material that could be observed. They were then digested in hot dilute HCl and in hot dilute NaOH to remove chemical contaminants prior to combustion and analysis.

**Comment:**

**Notes:** This date is based upon the Libby half life (5570 years) for  $C^{14}$ . The error stated is  $\pm 1 \sigma$  as judged by the analytical data alone. Our modern standard is 95% of the activity of N.B.S. Oxalic Acid.

The age is referenced to the year A.D. 1950.



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**RADIOCARBON AGE DETERMINATION**

**REPORT OF ANALYTICAL WORK**

**Our Sample No.** GX3301

**Date Received:** 26 November 1973

**Your Reference:** Pit #7 Joint #65

**Date Reported:** 31 December 1973

**Submitted by:** Henderson/Rogers  
University of California  
Los Alamos Scientific Lab.  
P.O. Box 990  
Los Alamos, New Mexico 87544

**Sample Name:** PIT# 7 JOINT# 65

**AGE =**  $\delta C^{14} = +132 \pm 20$  ‰ wrt 0.95 NBS Oxalic Acid Standard

**Description:** roots

**Pretreatment:** Selected pieces of wood were cleaned of foreign material, including rootlets or other contaminating material that could be observed. They were then digested in hot dilute HCl and in hot dilute NaOH to remove chemical contaminants prior to combustion and analysis.

**Comment:**

**Notes:** This date is based upon the Libby half life (5570 years) for  $C^{14}$ . The error stated is  $\pm 1 \sigma$  as judged by the analytical data alone. Our modern standard is 95% of the activity of N.B.S. Oxalic Acid.

The age is referenced to the year A.D. 1950.

**INTEROFFICE ROUTING SLIP**  
**LOS ALAMOS SCIENTIFIC LABORATORY**

FROM NEWBY ELLINGTON DATE 1-7-74 TELEPHONE 5026

	Initials	Date
1. C. HENDERSON, H-DO, HRL	<i>[Handwritten Initials]</i>	<i>1-8-74</i>
2. MARGARET ROGERS, H-8, TA-50		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		

- Immediate Action                       Necessary Action                       For Your Information
- Comment                                       See Me                                       Signature
- Prepare Reply                               For Approval                               Note, Initial and Return

Comments REF: LG4-40233

HERE ARE FOUR OF THE FIVE SAMPLE REPORTS ON THE ROOTS ON REFERENCED ORDER.

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