

**Institute of Physics
Quality Management System
SAMPLE DATATION REPORT AT C 14**

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DATE OF RECEIPT OF SAMPLES: 24/5/2017
OPERATOR OF THE SYSTEM EMA: FÍS. ARCADIO HUERTA HERNÁNDEZ
SAW AND APPROVED BY: DOCT. CORINA SOLÍS ROSALES

I - INTRODUCTION

Three skin samples and a mummy brain sample were received, for a 14 carbon dating and accelerator mass spectrometry (Table 1).

Table 1. Relationship of the samples received.

| Laboratory key | User key | Material |
|----------------|---------------------------------|----------|
| DEVISE 880 | Brain | Brain |
| DEVISE 894 | Hand 001 | Skin |
| DEVISE 895 | Marias (down) | Skin |
| DEVISE 897 | Hip medium sques 00-12 Victoria | Skin |

II – METHODOLOGY

2.1 Preparation

a) Skin: keratin extraction

The samples were subjected to ultrasonic bath cleaning with ultrapure water to remove salts and other attached pollutants. Then followed a protocol of ABA chemical cleaning (acid-base - acid: HClNaOH-HCl). Then was extracted using a solution of dithiothreitol (DTT), sodium dodecyl sulfate (SDS) and Trizma (Tris). Finally, keratin was precipitated by trichloroacetic acid (TCA) and sodium deoxicolato solution (ACD).

b) Brain

The sample was cleaned in an ultrasonic bath with ultrapure water to remove salts and other attached contaminants. Then followed a protocol of ABA chemical cleaning (acid-base - acid: HClNaOH-HCl).

2.2 Graphization

The samples were processed in AGEIII automated graphitization equipment from Ion Plus, to transform its carbon content in CO₂, then in pure graphite.

2.3 Mass spectrometry analysis with accelerator

C14, C13 and C12 analysis of graphite obtained by accelerator mass spectrometry. Europe Engineering High Voltage Tandetron Apparatus (HVVEE), with an acceleration of 1 MV of energy.

From the values obtained, the age was calculated radiocarbon or conventionally (14C), given in years before the present (aP), that is to say, before 1950. The radiocarbon age was corrected by fractionation $\delta^{13}C$ of the proportion of C13 / C12 in the sample. $\Delta^{13}C$ is a measured value in graphite and may have undergone further fractionation.

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2.4 Calibration

The age of calibration has been corrected at radiocarbon by changes in the C 14 content in the atmosphere, with the OxCal program (<https://c14.arch.ox.ac.uk/oxcal/OxCal.html>; v4.2.4 Bronk Ramsey, 2013), using the SHCal13 calibration curve (Hogg et al., 2013). Age was calibrated in years after Christ (DC). Probable intervals, with confidence levels of 68% were calculated for each of them (1 σ) and 95% (2 σ).

III - RESULTS

The results of the dated samples are shown in Table 2. In addition, known age standards were analyzed to verify reproducibility in our laboratory (Table 3).

Table 2. Results

| DEVISE key | Dated fragments | $\sigma^{13}C$ | C14 age Years (a.P. \pm 1 σ) | Calibrated age Trust Level | |
|-------------------|-----------------|----------------|--|-------------------------------|-----------------------|
| | | | | 1 σ (68%) | 2 σ (95%) |
| Devise 880.1.1 | Brain | -21 | 1052 \pm 30 | 991 d.C.- 1106 d.C. | 987 d.C. - 1145 d.C. |
| Devise 894.1.1 | Keratin | -12 | 1205 \pm 30 | 791 d.C.- 968 d.C. | 773 d.C. - 980 d.C. |
| Devise 895.1.1 | Keratin | -19 | 1771 \pm 30 | 250 d.C.- 357 d.C. | 240 d.C. - 383 d.C. |
| Devise 897.1.1 | Keratin | -18 | 791 \pm 30 | 1231 d.C.- 1287 d.C. | 1220 d.C. - 1295 d.C. |

Table 3. Reference Standards

| Samples | Material | Certified age (years a.p) | Age measurement |
|---------|----------|------------------------------|-----------------|
| VIRI F | collagen | 2513 \pm 40 | 2494 \pm 35 |
| VIRI H | collagen | 9528 \pm 200 | 9558 \pm 45 |

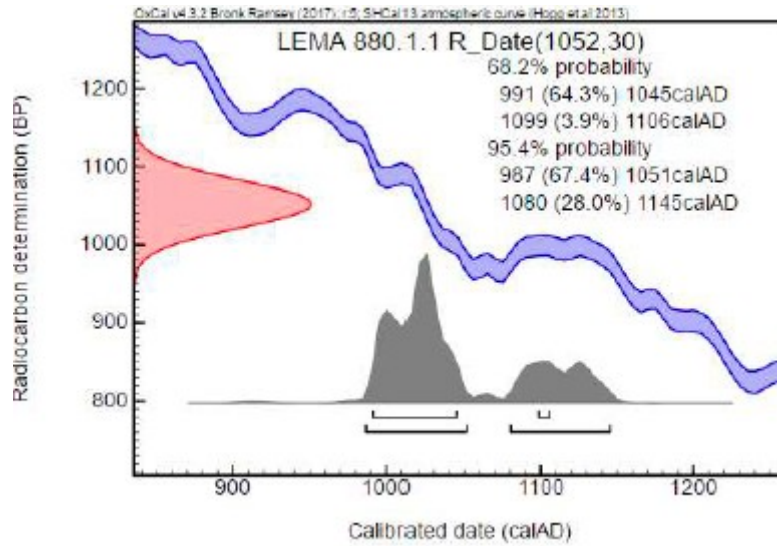
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CALIBRATION

1. – DEVISE 880 .1.1

Age : 1052 ± 30 a.P.

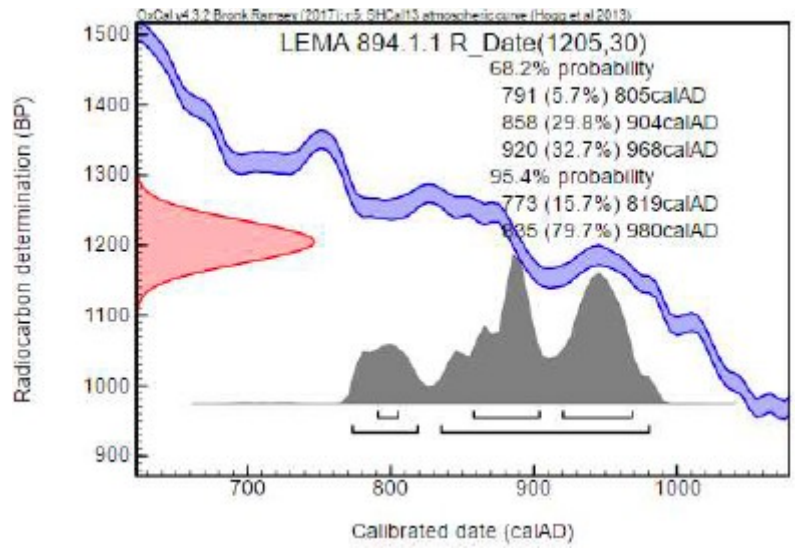
| Name | Unmodelled (BC/AD) | | | | Select | Page break | | |
|---------------------|--------------------|------|------|-----|--------|------------|---------------------------------------|--------------------------|
| | from | to | % | % | | | | |
| R_Date-LEMA 880.1.1 | 991 | 1106 | 68.2 | 987 | 1145 | 95.4 | <input checked="" type="checkbox"/> 2 | <input type="checkbox"/> |



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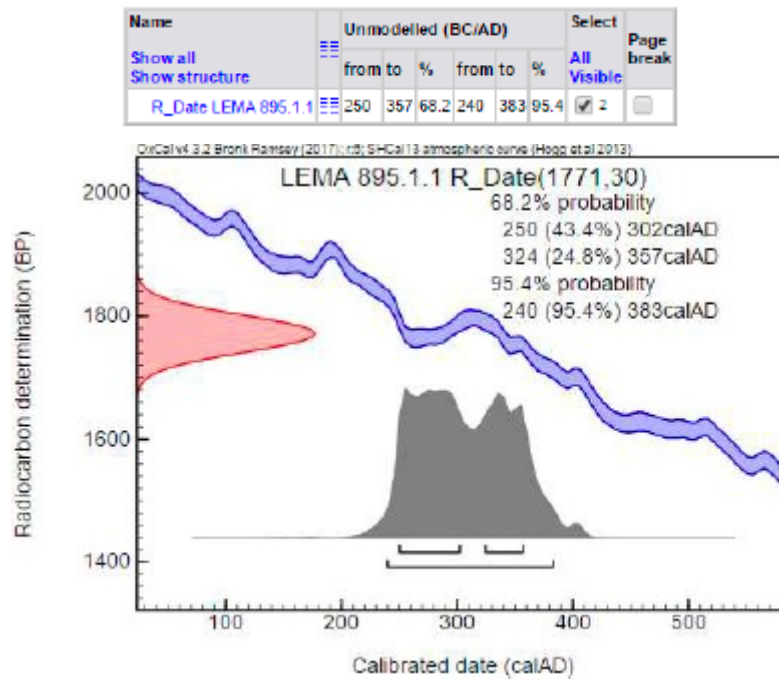
**2. – DEVISE 894 .1.1
Age : 1205 ± 30 a.P.**

| Name | Unmodelled (BC/AD) | | | | Select | Page break | | |
|---------------------|--------------------|-----|------|------|--------|------------|-------------------------------------|---|
| Show all | from | to | % | from | to | % | All Visible | |
| R_Date LEMA 894.1.1 | 791 | 968 | 68.2 | 773 | 900 | 95.4 | <input checked="" type="checkbox"/> | 2 |



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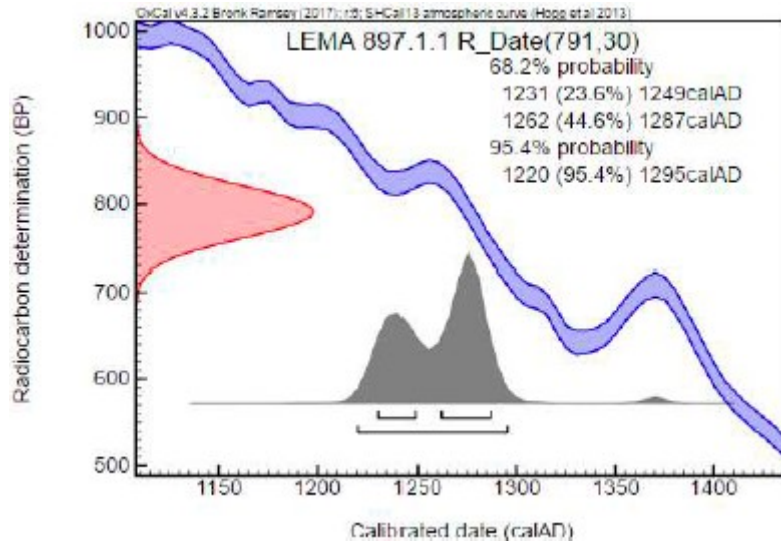
**3. – DEVISE 895 .1.1
Age : 1771 ± 30 a.P.**



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4. – DEVISE 897 .1.1
Age : 791 ± 30 a.P.

| Name | Unmodelled (BC/AD) | | | | Select | Page break | | |
|----------------------|--------------------|------|------|------|--------|------------|---------------------------------------|--------------------------|
| | from | to | % | % | | | | |
| R_Date: LEMA 897.1.1 | 1231 | 1287 | 68.2 | 1220 | 1295 | 95.4 | <input checked="" type="checkbox"/> 2 | <input type="checkbox"/> |

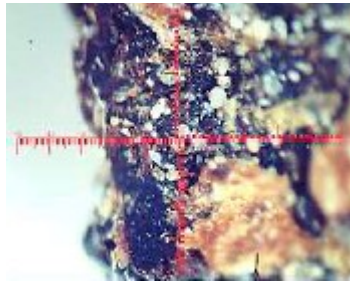


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IV - Annexes: photographs
DEVISE 880

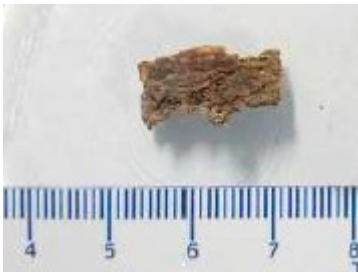


a) Without magnification



b) With magnification 45 X maximum

DEVISE 894



a) Without magnification



b) With magnification 45 X maximum

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DEVISE 895



a) Without magnification

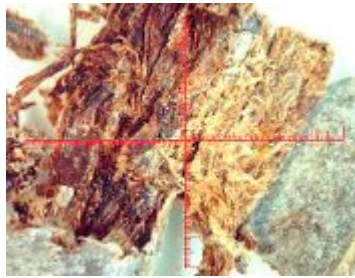


b) With magnification 45 X maximum

DEVISE 897



a) Without magnification



b) With magnification 45 X maximum

V - REFERENCES

Radiocarbon dating report: Stuiver and Polach (1977).

1. Bronk Ramsey, C., & Lee, s. (2013). Recent and planned developments of the OxCal program. Radiocarbon dating, 55 (2-3), 720-730.
2. Hogg A., Q. Hua, Blackwell, P., Niu M., Buck C., T. Guilderson, Heaton T., Palmer J., Reimer, P., R. de Reimer C. Turney, Zimmerman art. 2013. Calibration of the southern hemisphere of Shcal13, 0 - 50 000 years BP Cal. Radiocarbon, vol. 55, N. 4, 2013, pp 1889-1903.
3. Stuiver, M. y Polach, H.A. 1977. Discussion: Reporting data from 14C. Radiocarbon 19; 355-63