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INTERNATIONAL INSTITUTE OF FORENSIC EXPERTISE

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RADIOCARBON DATING (C14)

C14 Analysis Report

Radiocarbon dating of a tooth sample, including stable isotope results and a calibrated probability distribution.

Sample and analysis data

Material	**Tooth**	Internal identifier	**Sample A**
Sample received	**13 September 2024**	Analysis date	**4 October 2024**
Sample designation	**Female mummy 215, Thebes 1877**		

Instrumentation and method

Instrumentation: Single stage accelerator mass spectrometer (SSAMS, NEC, USA); Automated Graphitization Equipment AGE-3 (Ionplus AG, Zürich).

Sample preparation: Acid-base-acid treatment and collagen extraction protocol. NIST-OXII and phthalic anhydride were used as reference materials.

Analytical results

Sample	Radiocarbon age (BP)	pMC	$\delta^{13}C$ (‰) SD ±0.15 ‰	$\delta^{15}N$ (‰) SD ±0.2 ‰
Sample A	2517 ± 31	73.10 ± 0.28	-19.06	11.95

Results are reported in years before 1950 (radiocarbon age BP). The stated age uncertainty represents ± one standard deviation. Radiocarbon ages are corrected for isotopic fractionation using the measured $^{13}C/^{12}C$ ratio and must be converted into calibrated calendar ages.

Stable isotope results

CARBON ISOTOPE · $\delta^{13}C$

-19.06 ‰

Analytical SD ±0.15 ‰

Primarily informs dietary protein carbon sources and the relative contribution of C3, C4, and marine food webs.

NITROGEN ISOTOPE · $\delta^{15}N$

11.95 ‰

Analytical SD ±0.2 ‰

Primarily informs trophic position and the nitrogen baseline; it also varies with ecology, physiology, and food-web structure.

Interpretive limit. These are analytical measurements, not a stand-alone determination of geographic origin or a unique diet. Reliable interpretation requires appropriate human and faunal baselines and collagen preservation criteria, including atomic C:N ratio, collagen yield, and elemental carbon and nitrogen content. These quality-control parameters are not stated in the underlying record and cannot be assessed here.

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CALIBRATION

Calibrated radiocarbon dates

Single-date calibration in OxCal v4.4.4 using the IntCal20 Northern Hemisphere atmospheric curve. The source plot records r:5, OxCal's default five-year probability-distribution bin size. "Sample A" is the internal documentation identifier.

MEASURED RADIOCARBON AGE

2517 ± 31 BP

One standard deviation

95.4% CALIBRATED PROBABILITY

Three intervals

788-720 · 708-662 · 653-543 calBC

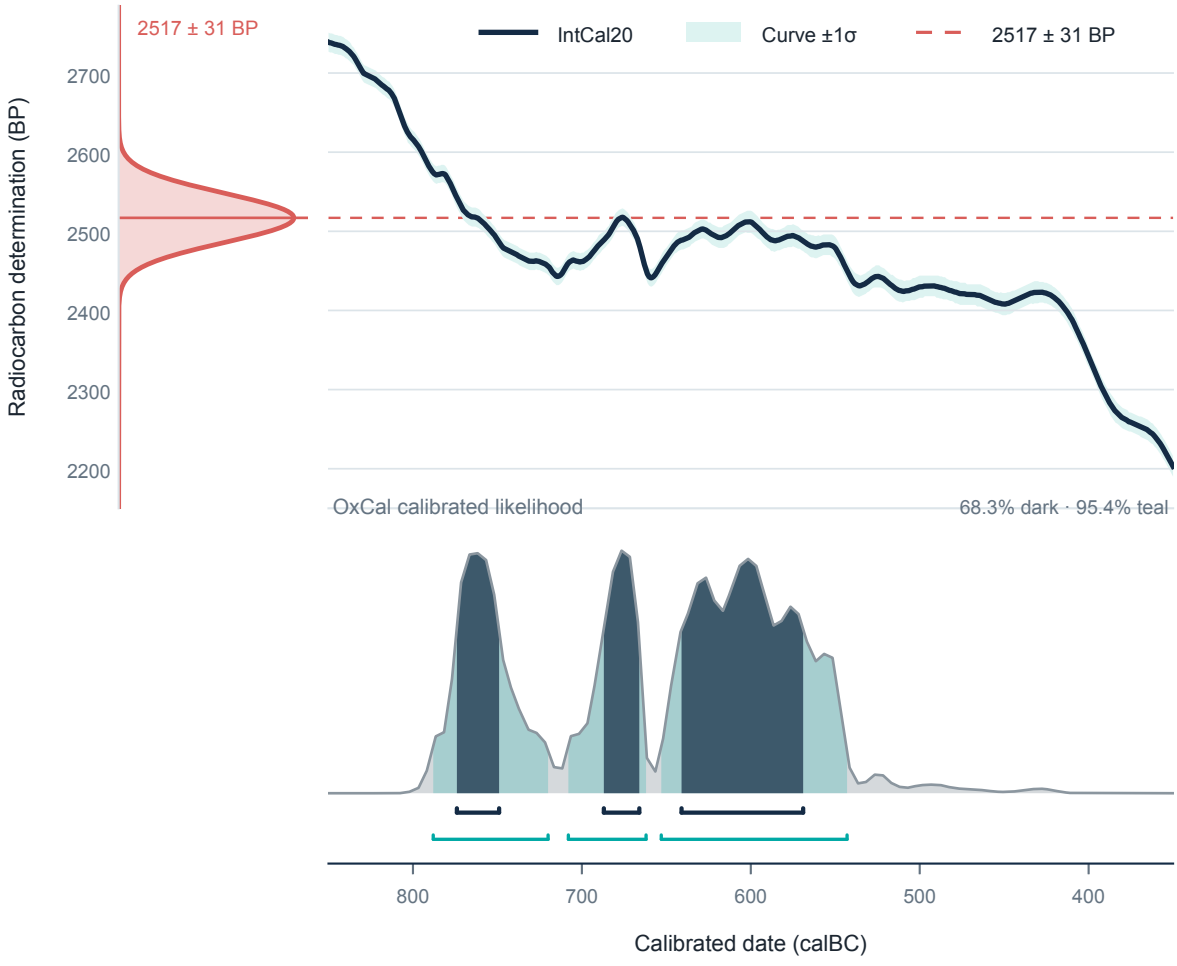

Fig. 1. IntCal20 calibration curve, measured radiocarbon likelihood (2517 ± 31 BP), and the calibrated likelihood distribution reproduced from the OxCal v4.4.4 numerical output. Dark brackets mark the 68.3% ranges; teal brackets mark the 95.4% ranges.

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CALIBRATION DATA

Intervals and calibration specification

Exact reported intervals are retained separately from the figure so that rounding, probability assignments, and discontinuous ranges remain explicit.

Calibrated intervals

Probability	Calibrated ranges (calBC)
68.3 %	774-749 (15.5 %) · 687-666 (12.5 %) · 641-569 (40.3 %)
95.4 %	788-720 (25.1 %) · 708-662 (18.6 %) · 653-543 (51.7 %)

Calibration specification

Parameter	Specification
Calibration software	OxCal v4.4.4
OxCal command	R_Date("Sample A", 2517, 31)
Calibration curve	IntCal20 · Northern Hemisphere atmospheric
Distribution	Unmodelled single-date calibrated likelihood
Probability bin size	5 years · OxCal default · source output r:5
Additional model	No Bayesian sequence prior, reservoir correction, or ΔR offset
Reported ranges	Discontinuous 68.3 % and 95.4 % highest-probability-density ranges

Scientific interpretation

Internal consistency. Using the conventional radiocarbon relation t = -8033 ln(pMC/100), the reported value of 73.10 ± 0.28 pMC corresponds to approximately 2517 ± 31 BP after rounding. The pMC result and the reported conventional radiocarbon determination are therefore internally consistent.

The calibrated distribution is multimodal because the measurement likelihood, together with calibration-curve uncertainty, maps across a non-monotonic section of IntCal20. The three disjoint ranges at each probability level are components of a single calibrated likelihood distribution and must not be combined into one continuous interval.

Numerical resolution. In OxCal, r:5 denotes a five-year bin size for the calculated probability distribution; it is not a software revision and does not require reported calendar limits to be divisible by five. Range rounding is controlled separately by the OxCal analysis options Round (default FALSE) and RoundBy (default 0, meaning automatic rounding granularity if rounding is enabled). The likelihood is evaluated in five-year increments on OxCal's internally defined continuous time scale, whose grid is not anchored to calendar years ending in 0 or 5. The resulting highest-probability-density limits are then expressed as BC/AD calendar labels. Consequently, source-reported limits such as 774, 749, 687, and 666 calBC are compatible with an r:5 calculation.

IntCal20 is the standard Northern Hemisphere atmospheric calibration curve and is appropriate under a terrestrial atmospheric-carbon assumption. This reproduction applies no regional offset, dietary reservoir correction, mixed calibration curve, or archaeological prior because none is specified in the underlying record.

Forensic limitations. The determination estimates the calendar-age distribution of the biogenic carbon retained in the analysed tooth collagen. Depending on the dental tissue sampled and its formation and remodelling history, this age need not be identical to the individual's date of death. The result does not independently establish sample identity, biological sex, collection history, chain of custody, or archaeological provenance. No replicate determination or supporting process-quality data—such as collagen yield, atomic C:N ratio, elemental carbon and nitrogen content, or procedural-blank results—are reported in the underlying record. The reported $\delta^{13}C$ and $\delta^{15}N$ values alone cannot exclude or quantify a dietary reservoir effect; such an assessment would require appropriate local isotopic baselines, dietary context, and, where applicable, a suitable mixed-source calibration model.

References

Bronk Ramsey, C. (2009). Bayesian analysis of radiocarbon dates. Radiocarbon, 51(1), 337–360. doi:10.1017/S0033822200033865.

Reimer, P. J. et al. (2020). The IntCal20 Northern Hemisphere radiocarbon age calibration curve (0–55 cal kBP). Radiocarbon, 62(4), 725–757. doi:10.1017/RDC.2020.41.