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DOES CHAMBER SIZE MATTER? DIFFERENTIAL BONE PRESERVATION IN THE ROMAN CATACOMB OF STS PETER AND MARCELLINUS (1ST-3RD c. AD)

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Two principal parameters control the preservation of skeletal tissues in archaeological contexts: time and burial environment. However, in exceptional cases, when the anthropic accumulation is particularly rapid, the parameter of time can be ignored and a focus on the influence of taphonomic process on the bone preservation can be undertaken.

INTRODUCTION & OBJECTIVE

Does size matter?

The central area of the catacomb of Sts Peter and Marcellinus is one of these rare sites allowing this kind of investigation since all individuals buried in the different chambers of this sector died more or less contemporaneously. Before performing stable isotope analysis ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$, $\delta^{18}\text{O}$) to reconstruct the life histories of these individuals, we have explored the diagenesis influence on bone preservation according to the size chambers via different approaches.

THE CATACOMB OF STS PETER & MARCELLINUS (ROME, 1ST-3RD c. AD)

CENTRAL AREA FEATURES

- ✓ 7 funeral chambers corresponding to probably 4 multiple graves and containing several hundreds of individuals (Fig. 1)
- ✓ Highly-developed funerary treatment (Fig. 1): recalling embalming => exogenous practices?
 - ✓ Presence of expensive grave goods: high socio-economic status for most individuals?



Fig. 1: General view of the burial deposits in the chambers X84 (left) and X80/T16 (right)

CHAMBER FEATURES

- ✓ Large chambers: X81, X83 and X84 (Fig. 2 & 3)
- ✓ Small chambers: X78/T15, X80/T16 and X82/T18 (Fig. 2)
- ✓ Floor levels of large chambers lower than those of small ones (Fig. 2)



Photo: D. Gliksmann. Inside view of the chamber X83

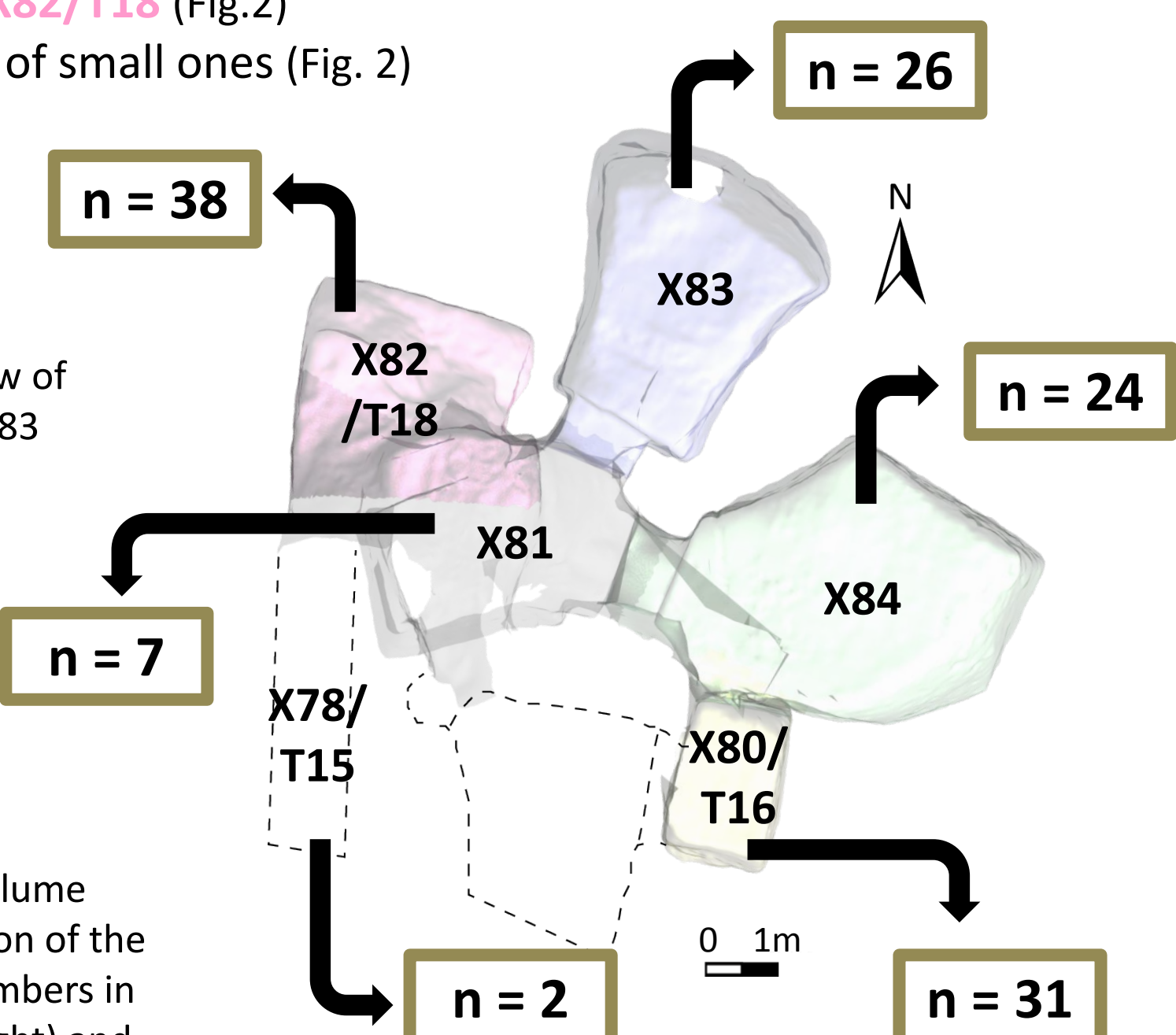


Fig. 2: Volume reconstruction of the funeral chambers in zenithal (right) and lateral (left)

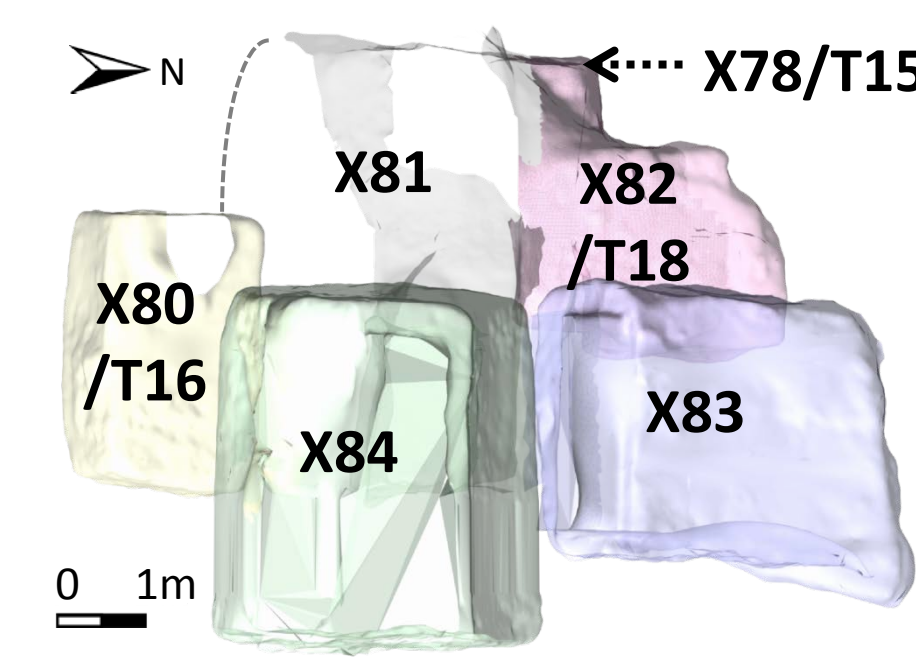


Fig. 3: Inside view of the chamber X83

CORPUS
A total of 128 individuals were sampled for stable isotope analysis ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$ & $\delta^{18}\text{O}$) on bone collagen and bone apatite (Fig. 2)

COLLAGEN PRESERVATION – DIAGENESIS INDICATORS

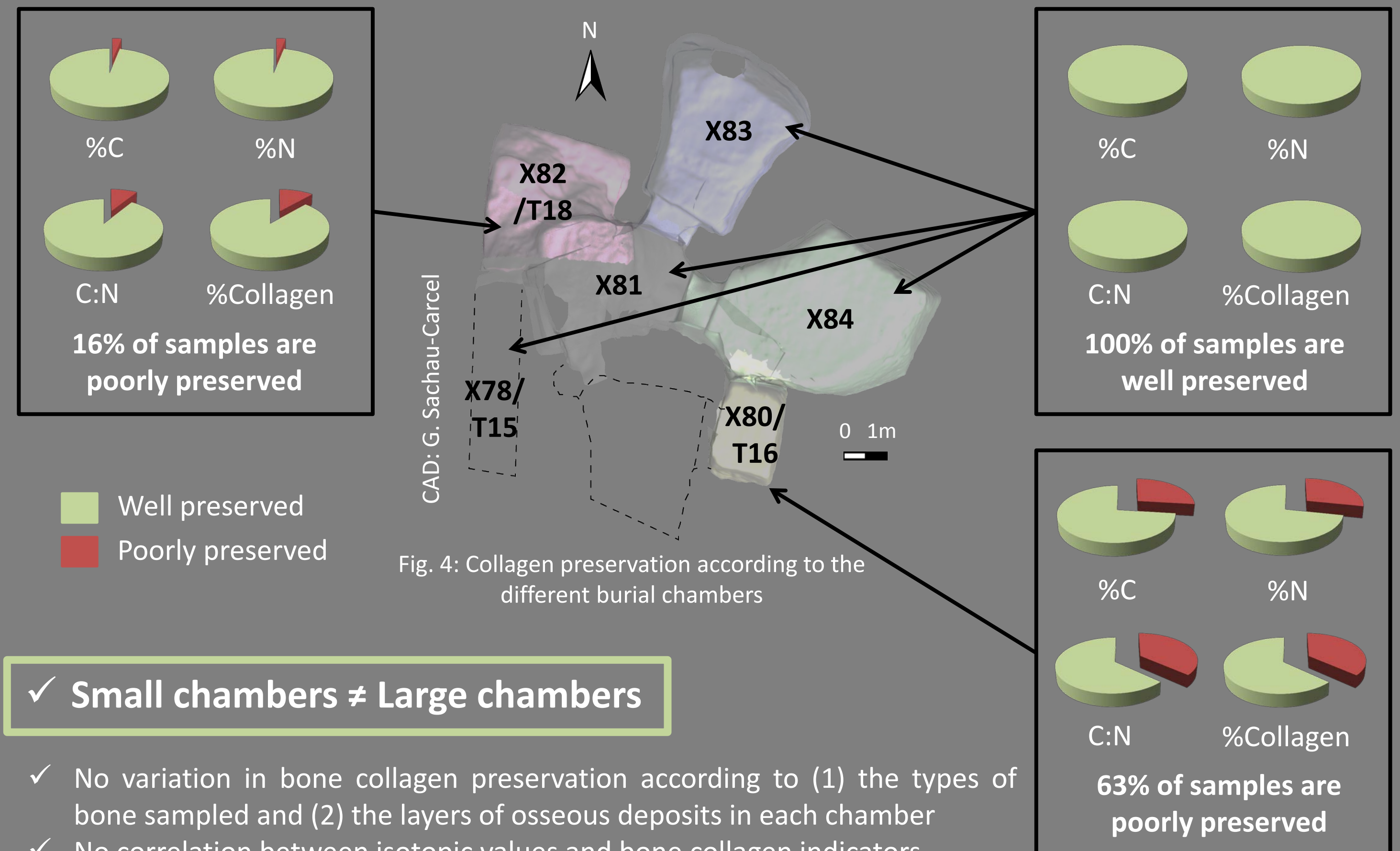


Fig. 4: Collagen preservation according to the different burial chambers

Small chambers ≠ Large chambers

- ✓ No variation in bone collagen preservation according to (1) the types of bone sampled and (2) the layers of osseous deposits in each chamber
- ✓ No correlation between isotopic values and bone collagen indicators

BONE APATITE PRESERVATION – CONVENTIONAL INDICATORS

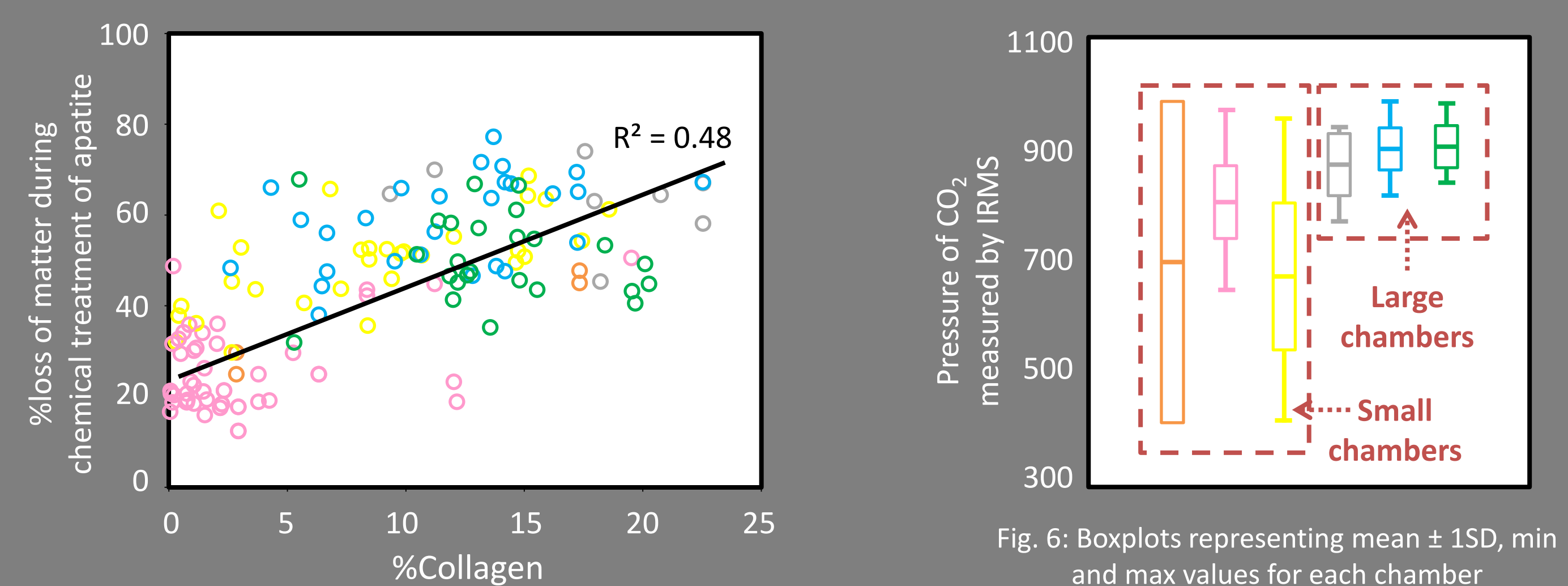


Fig. 5: Scatterplot of %Collagen versus %loss of matter during chemical treatment of apatite for all individuals

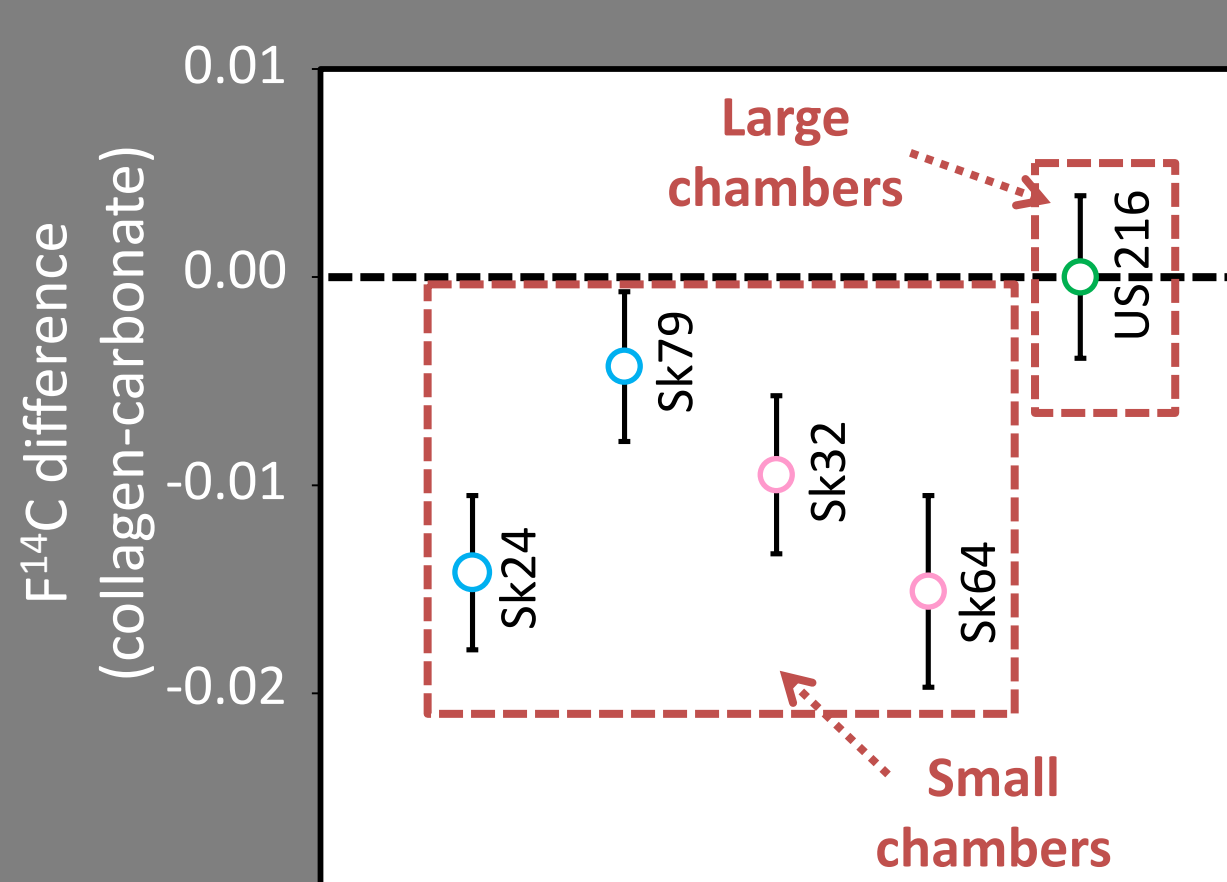
Fig. 6: Boxplots representing mean \pm 1SD, min and max values for each chamber

Small chambers ≠ Large chambers

- ✓ No variation in bone apatite preservation according to (1) the types of anatomical part sampled and (2) the layers of osseous deposits in each chamber
- ✓ No correlation between isotopic values and bone apatite diagenesis indicators

BONE APATITE PRESERVATION – ¹⁴C DATING

Inter-chamber comparison – Dating of collagen-carbonate pairs



Small chambers ≠ Large chambers

- ✓ Small chambers: ¹⁴C dates of bone apatite are systematically younger indicating a possible contamination of the mineral phase
- ✓ Large chambers: no difference between ¹⁴C dates of bone collagen and apatite are observed

Fig. 8: ¹⁴C differences measured on collagen-carbonate pairs

Intra-chamber comparison – Example of X80/T16

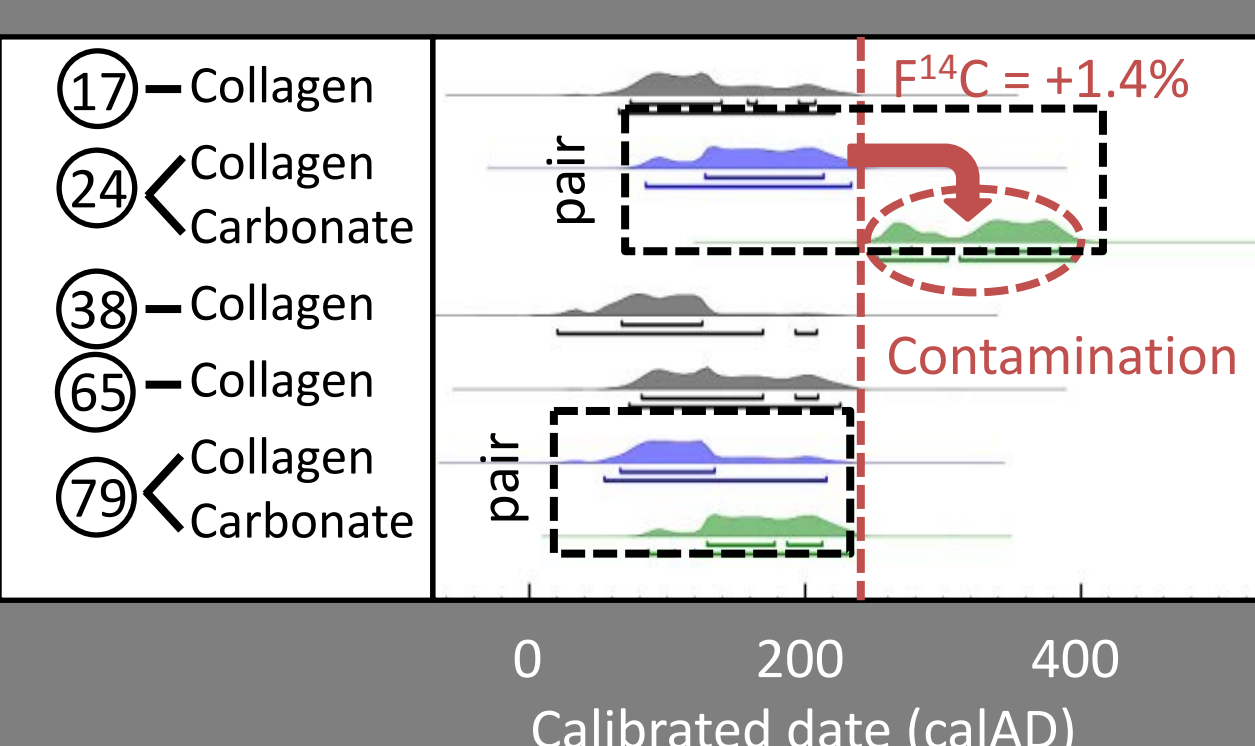
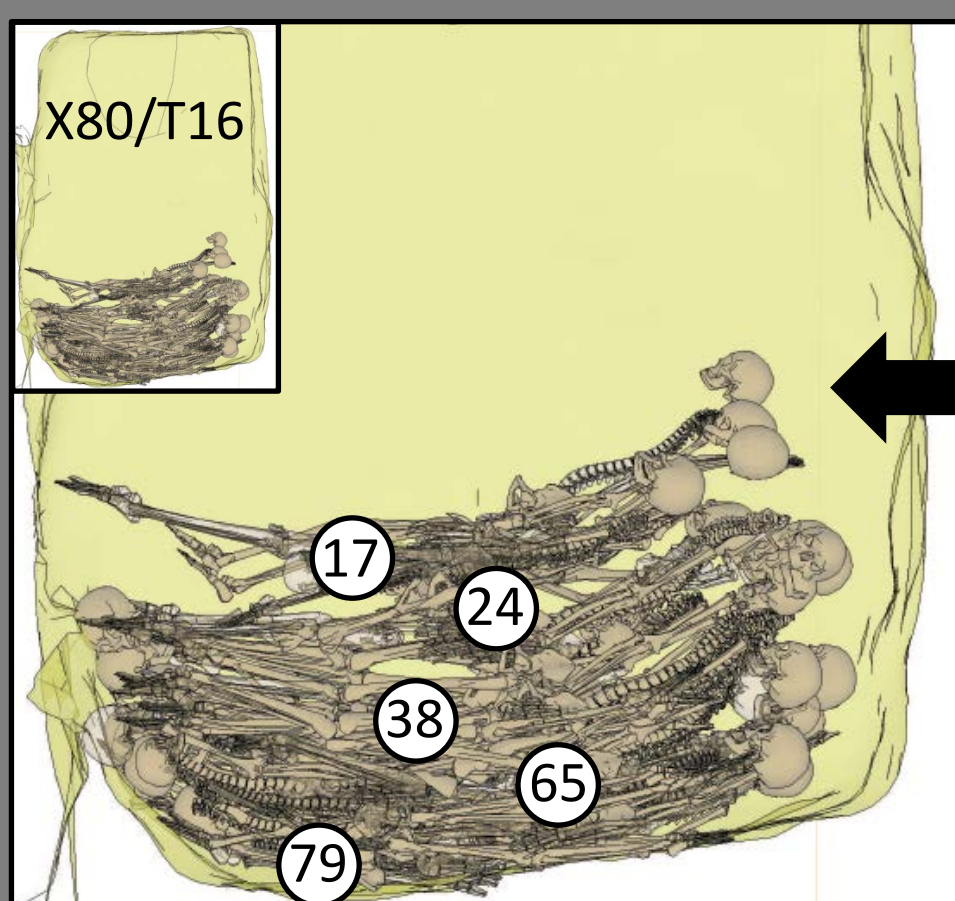
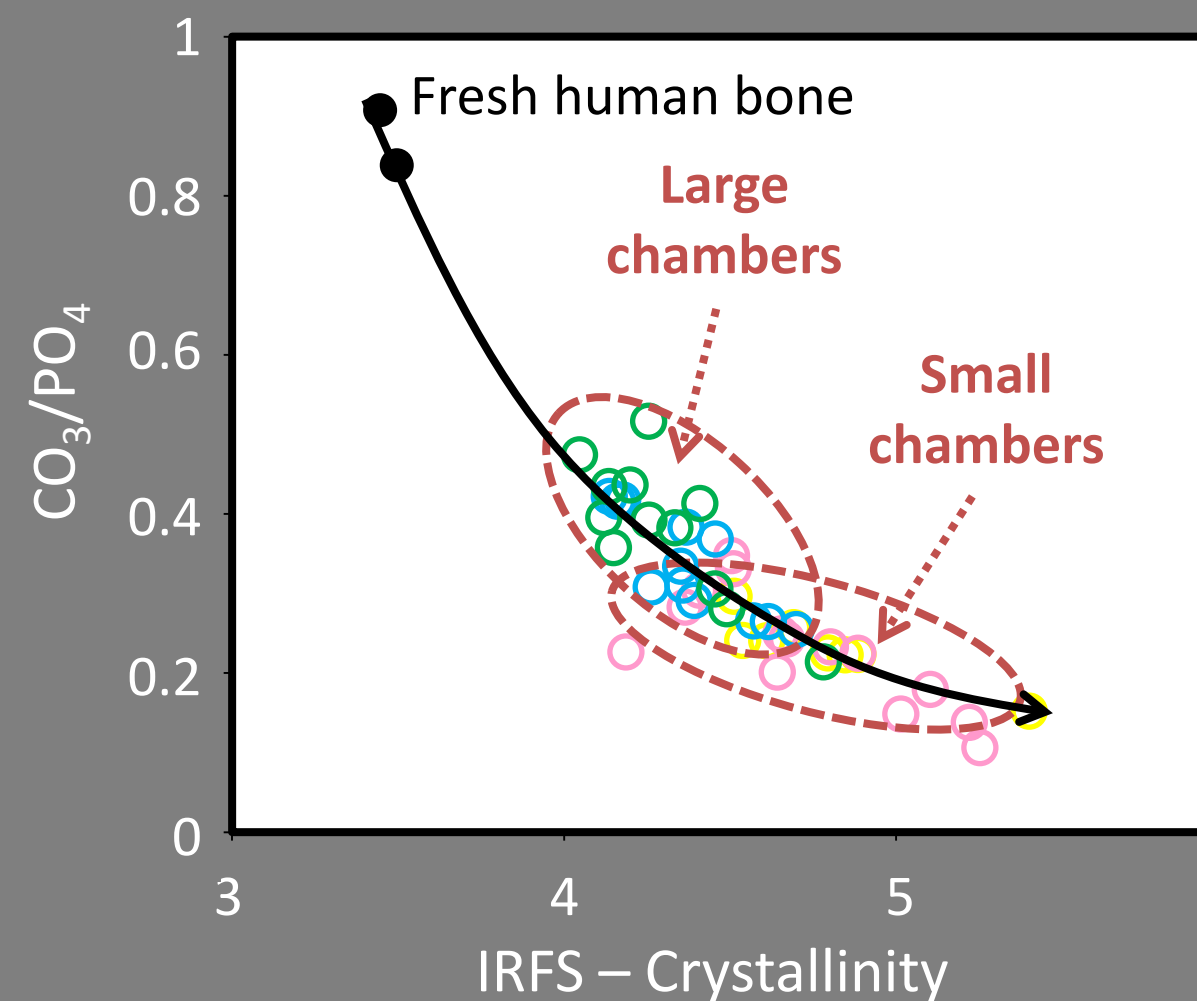


Fig. 9: Probability distribution (95.4%) of calibrated ¹⁴C dates obtained for skeletons from different layers of the small chamber X80/T16

- ✓ Maximal ¹⁴C difference (collagen-carbonate) \approx 1.4%
- ✓ Contamination of $\delta^{13}\text{C}$ values of the bone apatite samples varying from 0 to 0.3‰ (estimated from diagenetic pool)

CAD: G. Sachau-Carcel

BONE APATITE PRESERVATION – FTIR ANALYSIS



Small chambers ≠ Large chambers

- ✓ Small chambers: bone samples have undergone an intense recrystallization and carbonate loss
- ✓ Large chambers: bone samples have undergone an important recrystallization and carbonate loss (less than small ones)

Fig. 7: IRFS versus CO_3/PO_4 measured on pretreated bone apatite

The different analyses performed showed that:

- ✓ Bone samples have undergone diagenetic alteration but diagenesis influence remains limited
- ✓ The difference in bone preservation are not related to the type of anatomical part or the stratigraphic layer

Despite a differential bone preservation according to the size chambers, no significant changes of biogenic isotopic signature was observed. Stable isotopic values can be used to reconstruct the diet and mobility patterns

DISCUSSION & CONCLUSION

Yes, size does matter!

- Human bone degradation in the central area was possibly accelerated by:
 - ✓ streaming on the wall (condensation, rains, etc.)
- ✓ trampling by grave diggers, families of deceases and/or pilgrims particularly along the catacomb walls

These processes could result in differential preservation according to the size chambers, affecting the overall chamber in the small chambers and only the periphery (along the walls) in the large ones