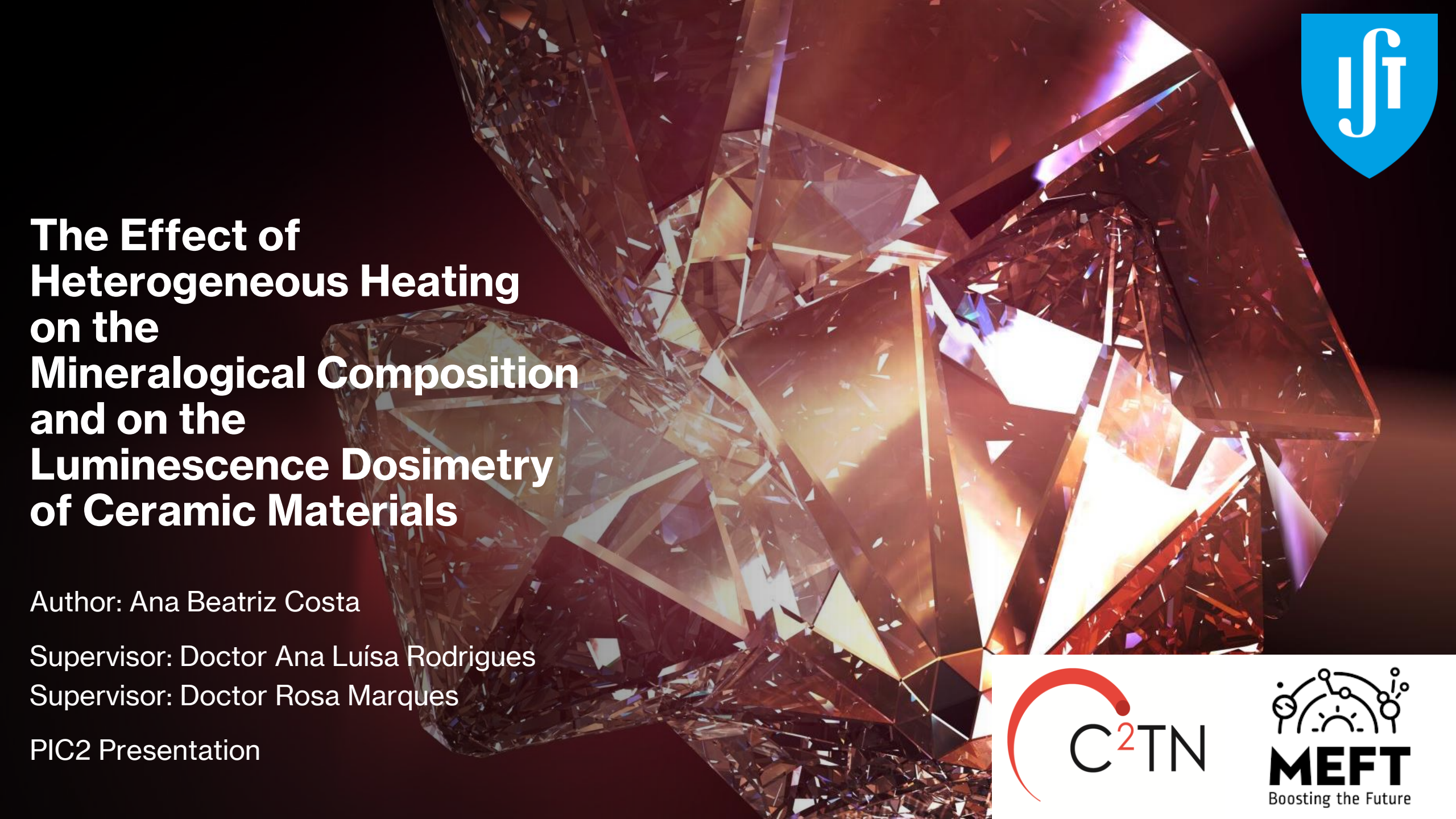

The Effect of Heterogeneous Heating on the Mineralogical Composition and on the Luminescence Dosimetry of Ceramic Materials

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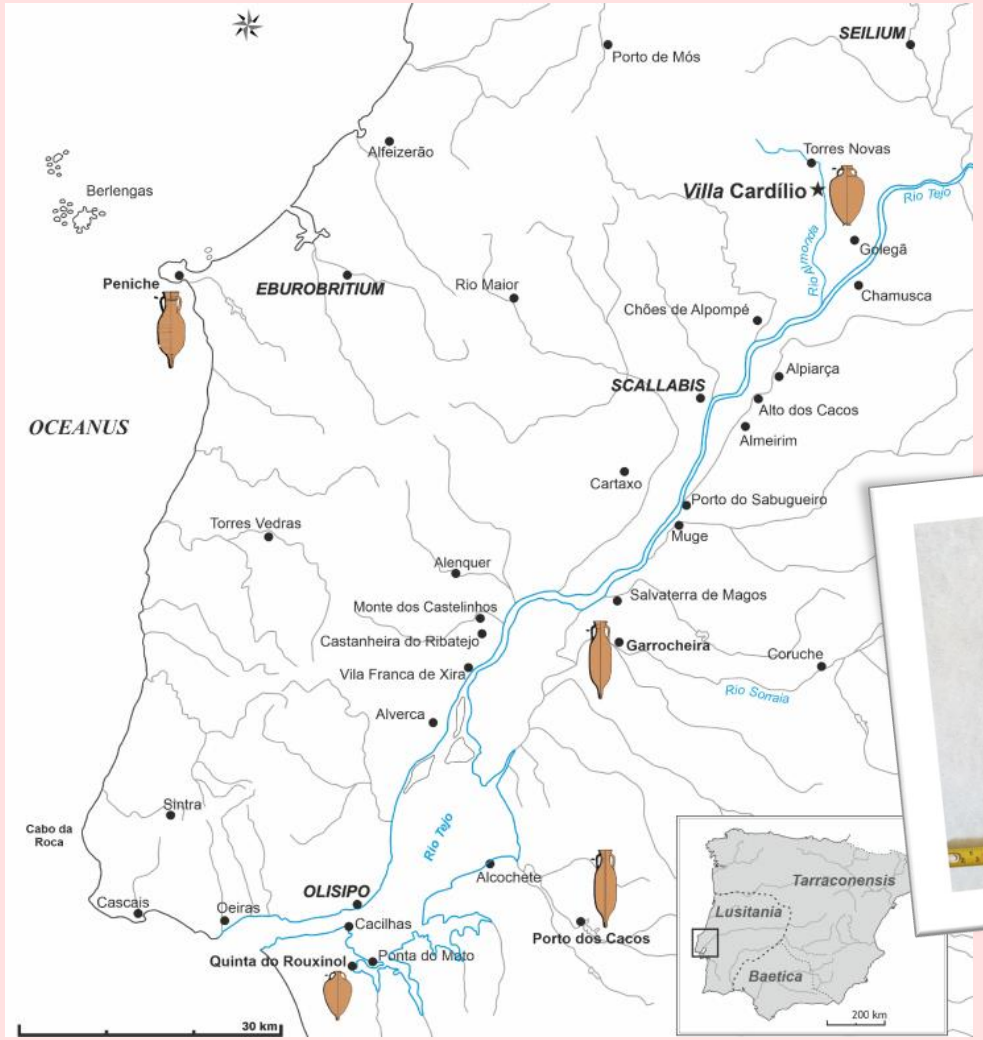
Supervisor: Doctor Rosa Marques

PIC2 Presentation

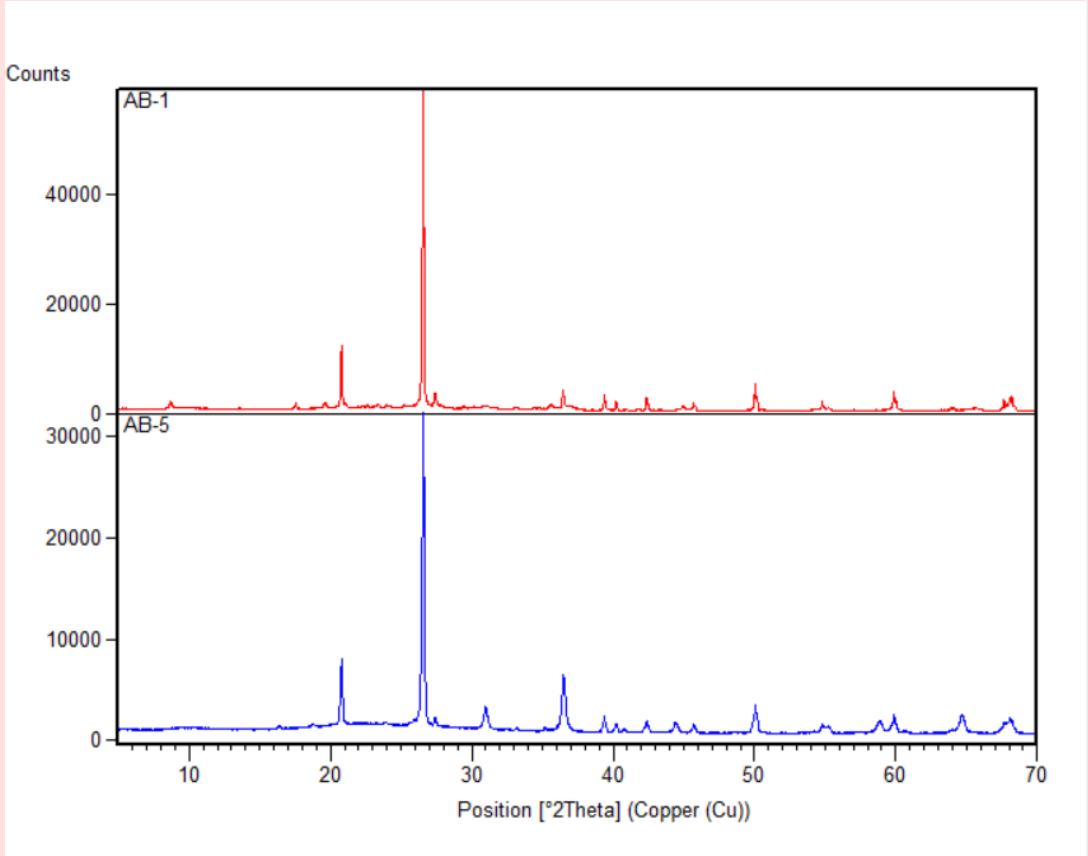
Samples - Observable characteristics



Samples taken from the unexcavated kiln area of *Villa* Cardílio – Roman amphorae production center in Torres Novas – Map adapted from V. Filipe, R. Marques, et. al, 2025, SPAL, https://dx.doi.org/10.12795/spal.2025.i34.19

Results and discussion: semi-quantification

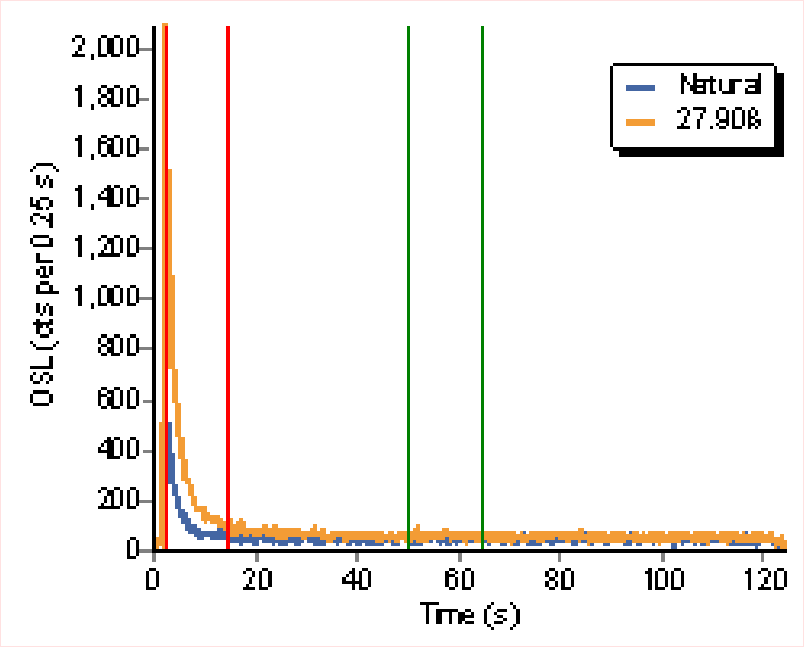
Sample	AB-1	AB-2	AB-3	AB-4	AB-5	AB-6	AB-7
Quartz	77%	52%	66%	57%	76%	74%	56%
Phyllosilicates	14%	42%	26%	38%	-	20%	38%
Alkali-Feldspars	7%	4%	6%	4%	12%	4%	4%
Plagioclase	traces	traces	-	-	-	-	-
Calcite	traces	traces	traces	traces	-	traces	traces
Haematite	traces	traces	traces	-	traces	traces	traces
Ti Oxides	-	traces	traces	traces	-	traces	-
Spinel	-	-	-	-	9%	-	-
Mullite	-	-	-	-	traces	-	-



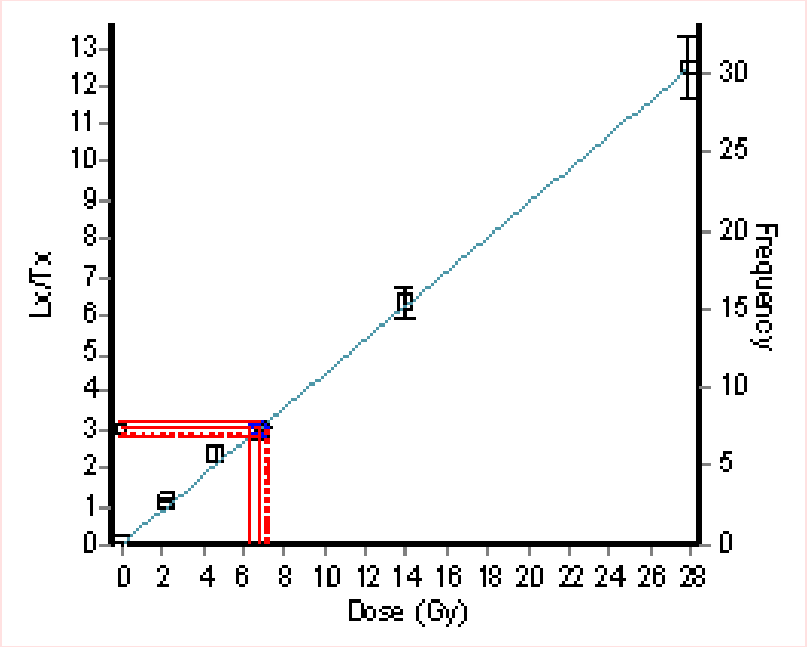
Diffractograms of AB-1 and AB-5

Results and discussion: OSL

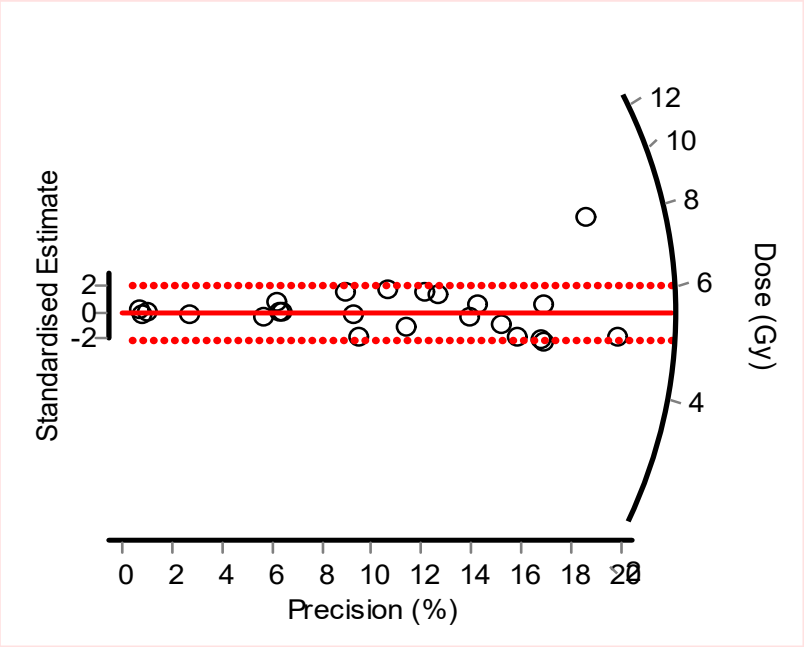
Sample	AB-1	AB-2	AB-3	AB-4	AB-5	AB-6	AB-7
Arithmetic average of D_e (Gy)	5.4 ± 0.2	7.1 ± 0.1	6.8 ± 0.4	6.8 ± 0.2	1.9 ± 0.2	6.0 ± 0.3	7.2 ± 0.1



Decay Curve



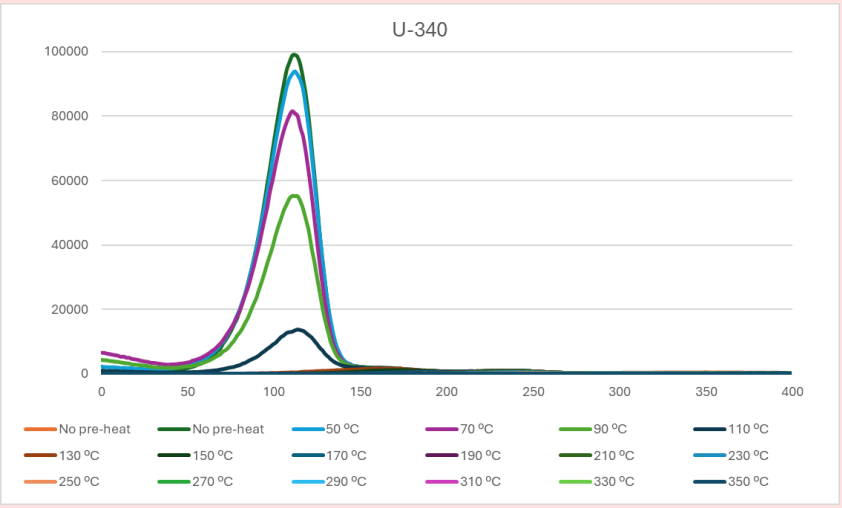
SAR - OLS dose-response curve

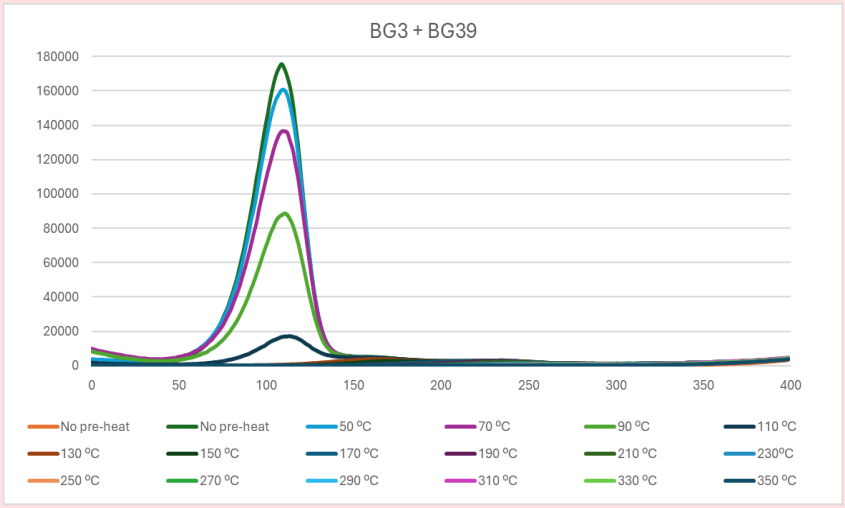


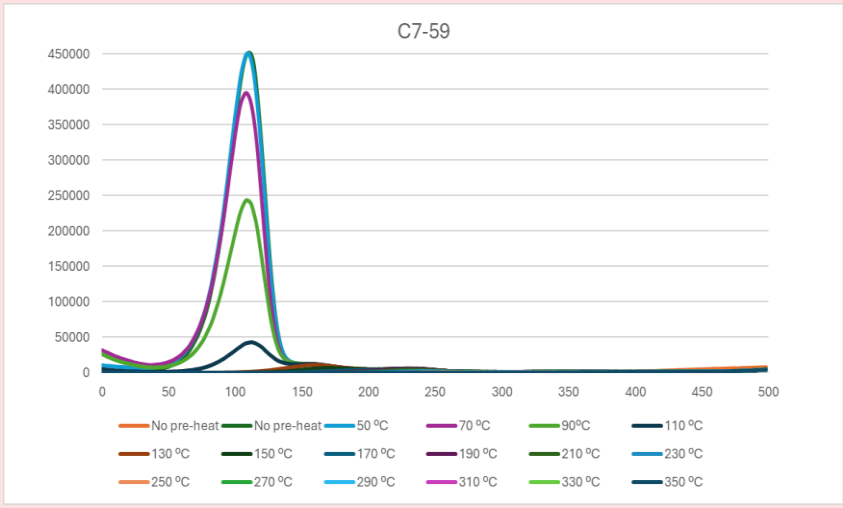
Radial plot of the equivalent dose

Graphs obtained using the software *Risø Analyst*

Results and discussion: TL







Glow curves obtained for one aliquot of sample AB-1
Graphs obtained using the software *Excel*

Conclusions and Future Work

- Do an in-depth analysis of the aliquots of the remaining samples
- Study and compare different methods and conditions to conclude which one is the most suitable
- Apply the methodological approach to samples with different chronologies and production technologies
- In the context of cultural heritage preservation, it is important to test different methods depending on the samples and update methodology

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ORAL / POSTER

THE EFFECT OF HEATING ON THE MINERALOGICAL COMPOSITION AND ON THE LUMINESCENCE DOSIMETRY OF CERAMIC MATERIALS – FIRST APPROACH ON ROMAN CERAMICS

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Luminescence dating estimates the time elapsed since a sample (e.g. sediment or ceramic) was last exposed to heat or sunlight by measuring its absorbed dose and dose rates [1]. In the case of ceramics, it is also possible to infer the maximum temperature achieved during their production process [2]. Ceramic sherds collected on a surface survey in an unexcavated kiln area of *Villa Cardílio*, a Roman amphora production center in Torres Novas, were analyzed [3]. The study aims to explore past firing techniques, how the quartz grains extracted from these ceramics act as a luminescence dosimeter, and the influence of heating process in ceramic mineralogy and in luminescence signals used for dating.

X-ray diffraction (XRD) was applied to identify and semi-quantify the mineralogical assemblage of ceramic paste. Thermally/optically stimulated luminescence (TL/OSL) dosimetry on coarse quartz grains (160-250 µm) from ceramics were used to: (i) determine the absorbed dose; (ii) explore quartz dosimetric properties performed under different conditions, and (iii) investigate which method is the most appropriate for assessing firing temperatures.

Overall, the samples are mostly composed of quartz, phyllosilicates, plagioclase, feldspar, and small proportion of calcite and Fe and/or Ti oxides. Mullite and spinel were detected in some samples. This mineralogical association points to firing temperatures around 700-800 °C for most samples and to high temperatures (typically above 1000 °C) in which mullite occurs. The TL/OSL analyses are currently in progress.

References

[1] M. Aitken, Archaeological dating using physical phenomena. Reports on Progress in Physics, IOP Publishing, United Kingdom, 1999 (62), 1333-1376.
[2] J. Sanjurjo-Sánchez, et al, 2016, Arch. Anthropol. Sci., http://dx.doi.org/10.1007/s12520-016-0409-x
[3] V. Filipe, R. Marques, et. al, 2025, SPAL, https://dx.doi.org/10.12795/spal.2025.i34.19