



Multianalytical study of glazed ceramics: technological and heritage applications

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Programa **Geo**
materiales
Conservación del Patrimonio



**CHAMBERI METRO STATION OF
MADRID, SPAIN**

OBJETIVE

MATERIALS & METHODS

RESULTS

CONCLUSIONS



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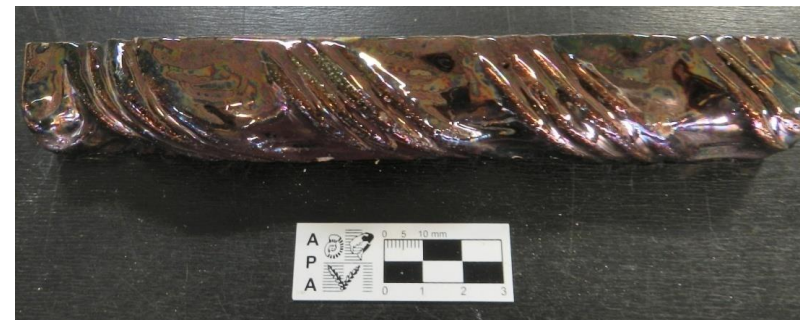
GROUP 1: Originals



GROUP 2: Originals



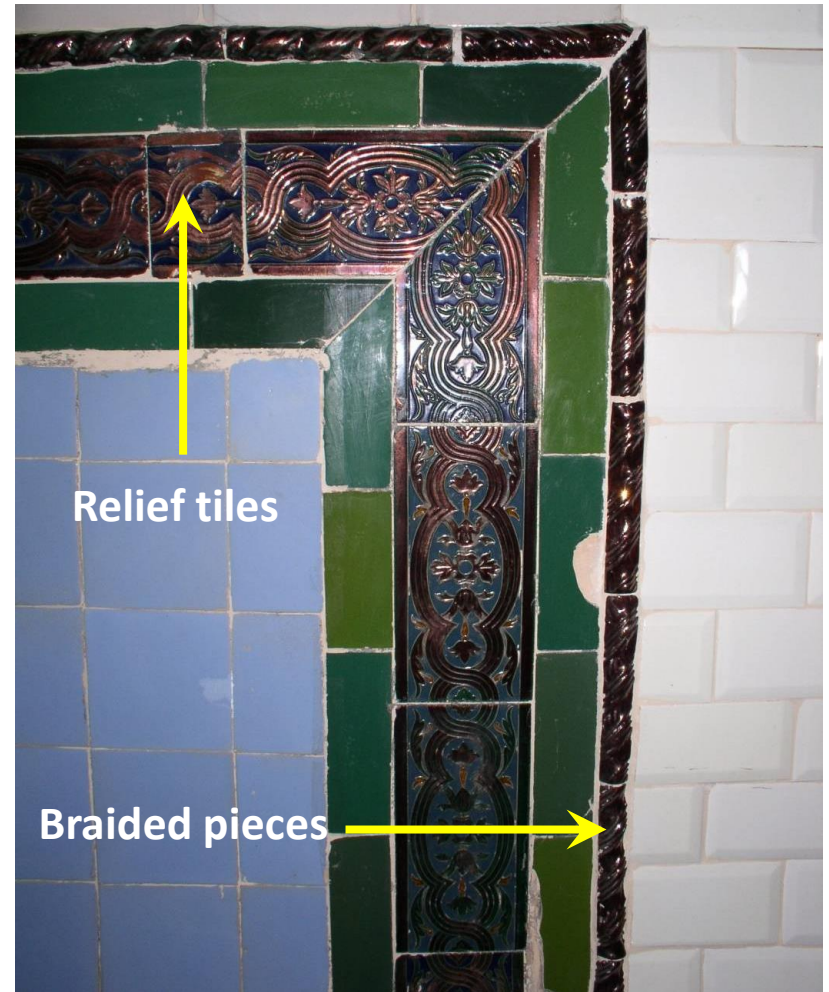
GROUP 3: Replacement



GROUP 1: ORIGINAL PIECES (functional)



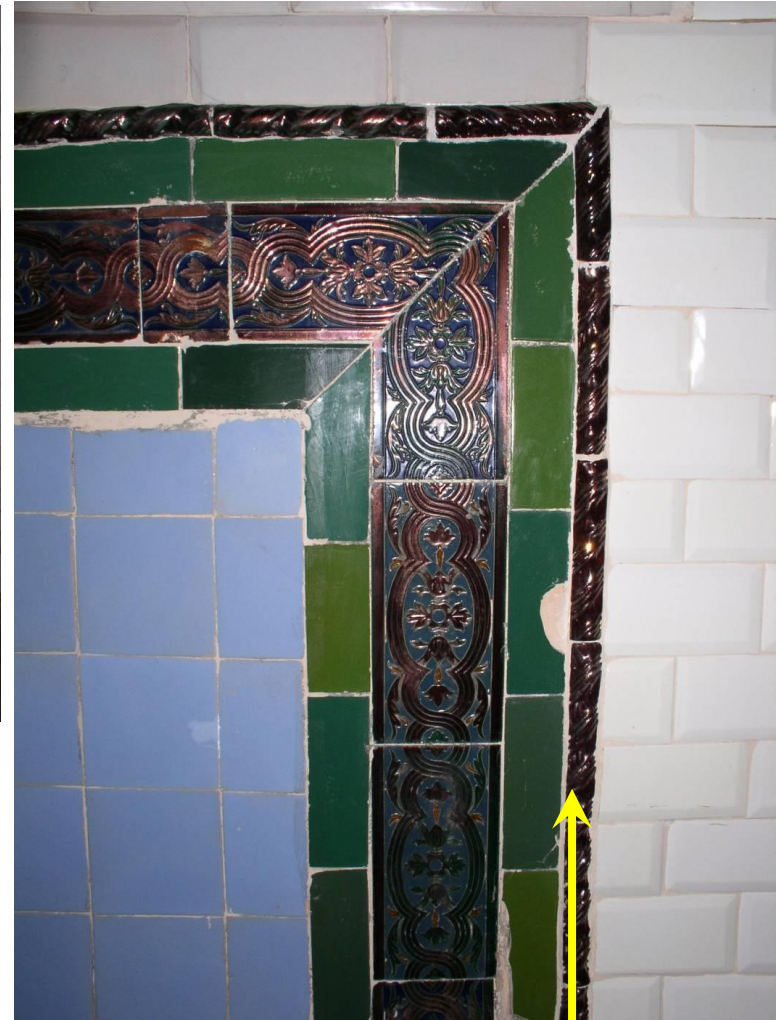
GROUP 2: ORIGINAL PIECES (decorative)



GROUPS 1 AND 2 (ORIGINAL PIECES)



GROUP 3 (REPLACEMENT PIECES)



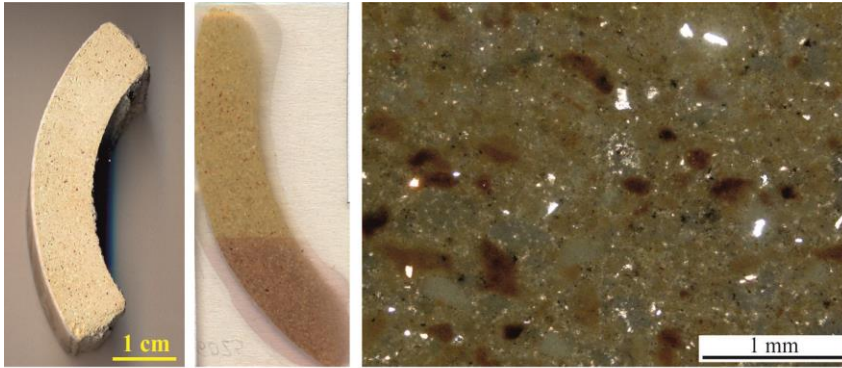
GROUP 3 (REPLACEMENT PIECES)



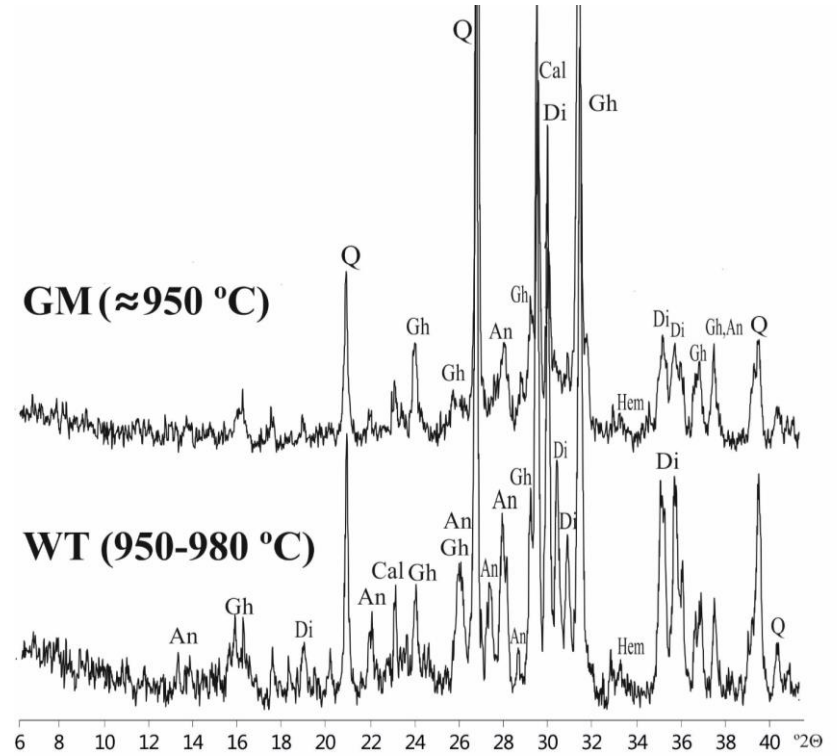
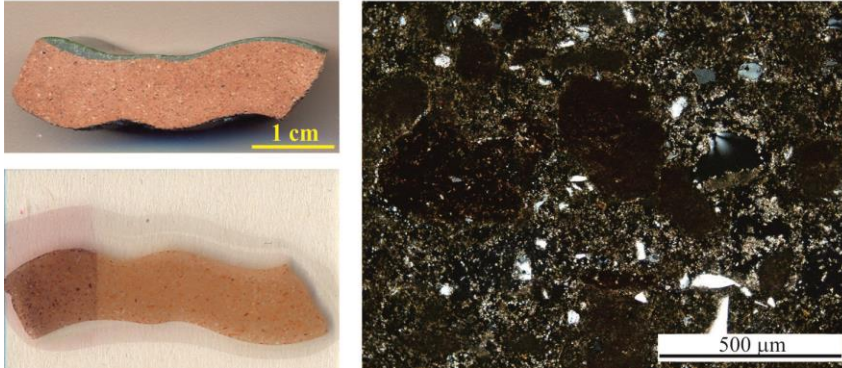
GROUP 1: ORIGINAL PIECES (white tiles and green moulding)

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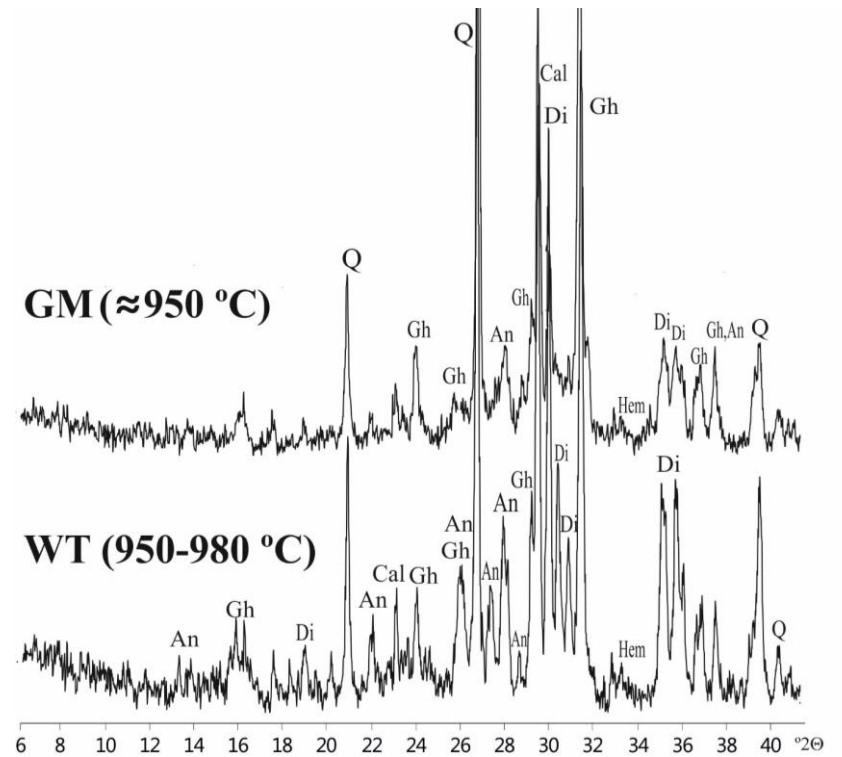
WT



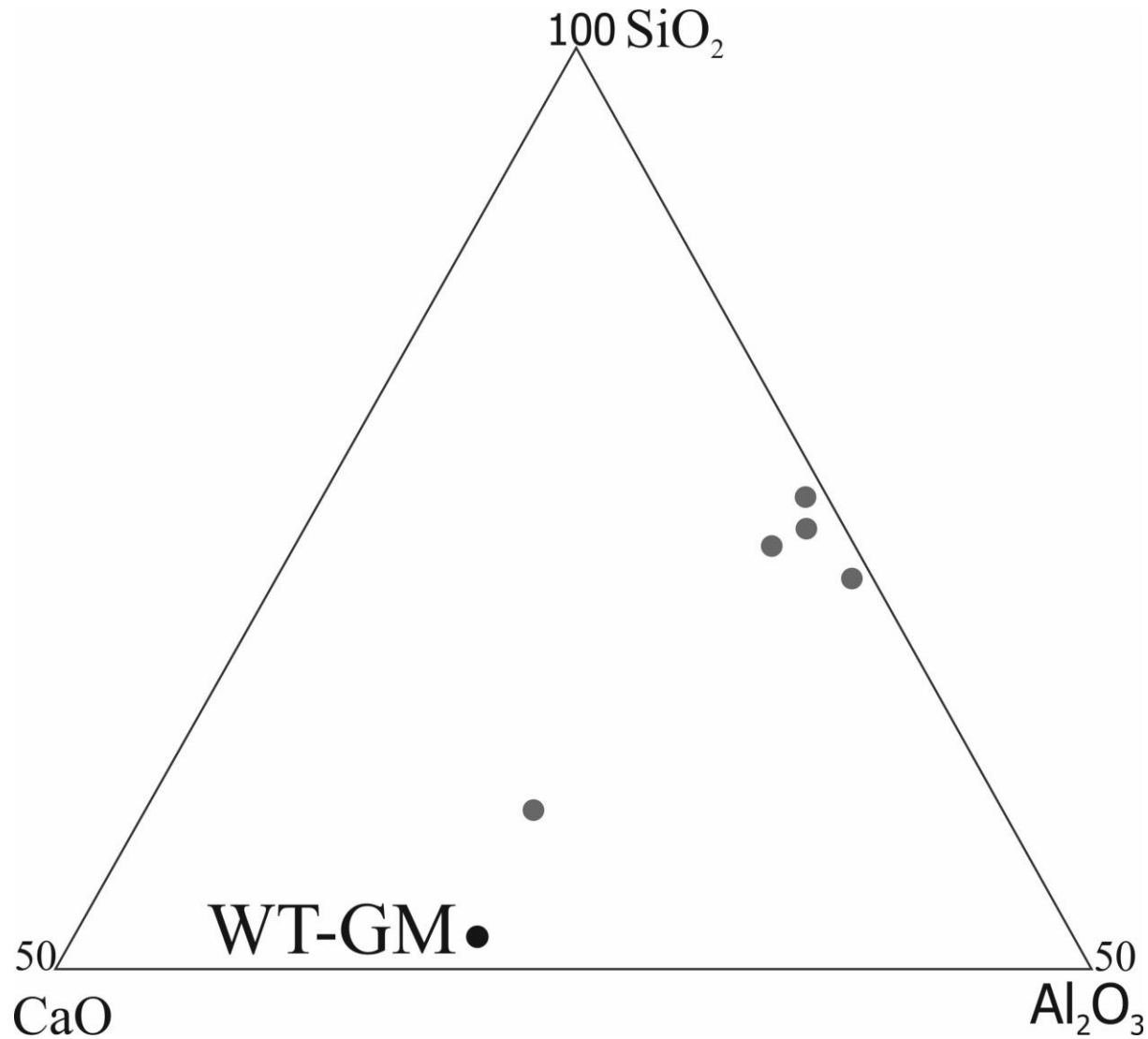
GM

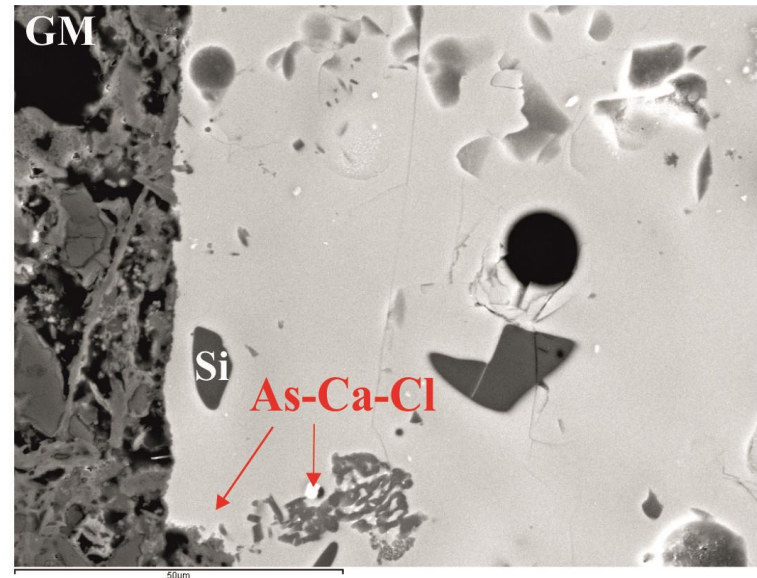
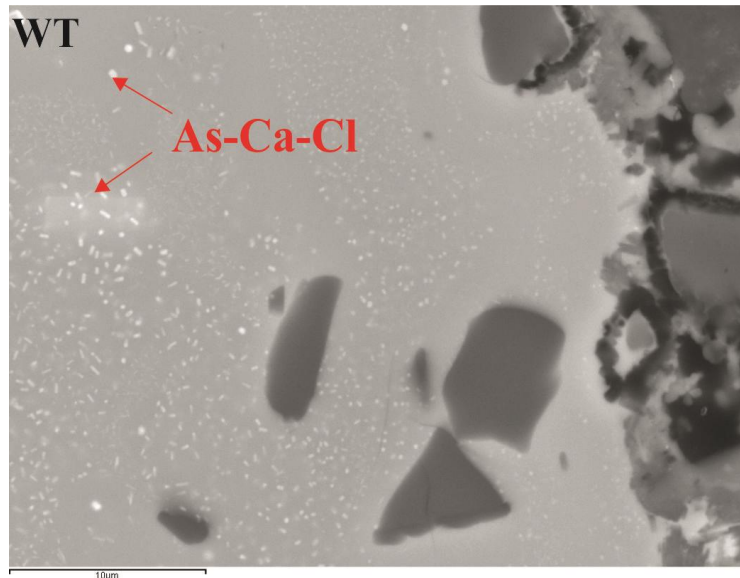
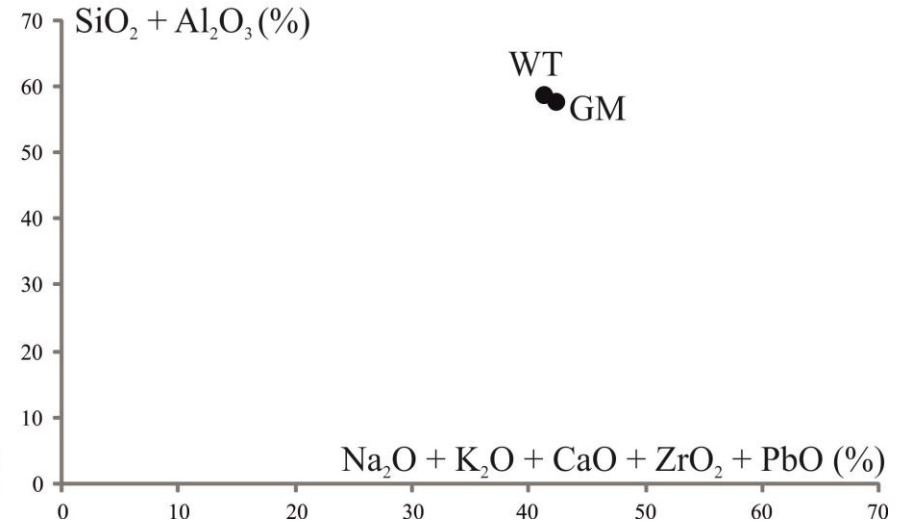
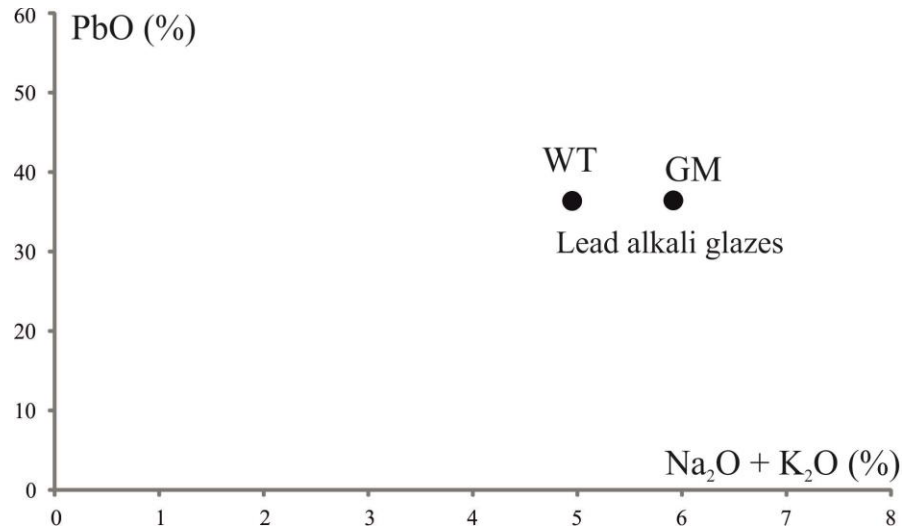


	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MnO	MgO	CaO	Na ₂ O	K ₂ O	TiO ₂	P ₂ O ₅	LOI
WT	42.8	15.1	5.2	0.05	2.0	23.0	1.1	2.3	0.5	0.13	7.3
GM	42.7	15.4	5.2	0.05	2.4	22.0	1.6	3.5	0.5	0.14	6.4

GROUP 1: ORIGINALS PIECES (white tiles and green moulding)

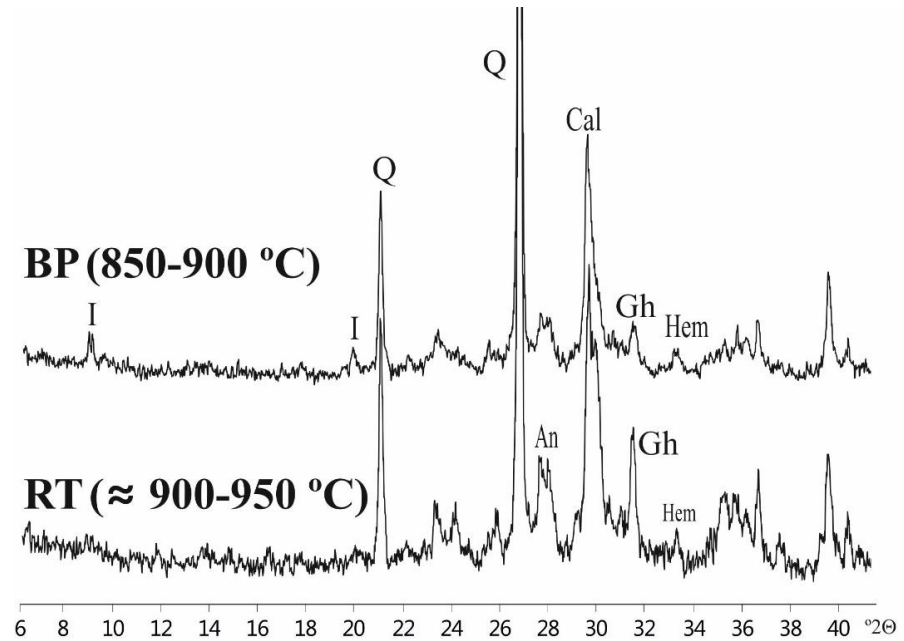
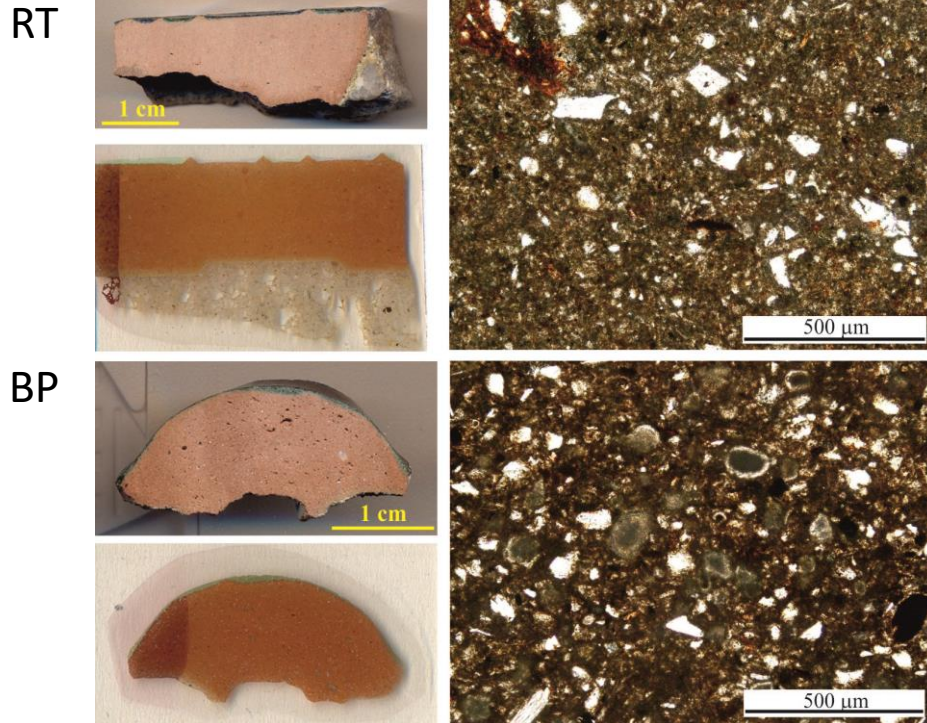
	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MnO	MgO	CaO	Na ₂ O	K ₂ O	TiO ₂	P ₂ O ₅	LOI
WT	42.8	15.1	5.2	0.05	2.0	23.0	1.1	2.3	0.5	0.13	7.3
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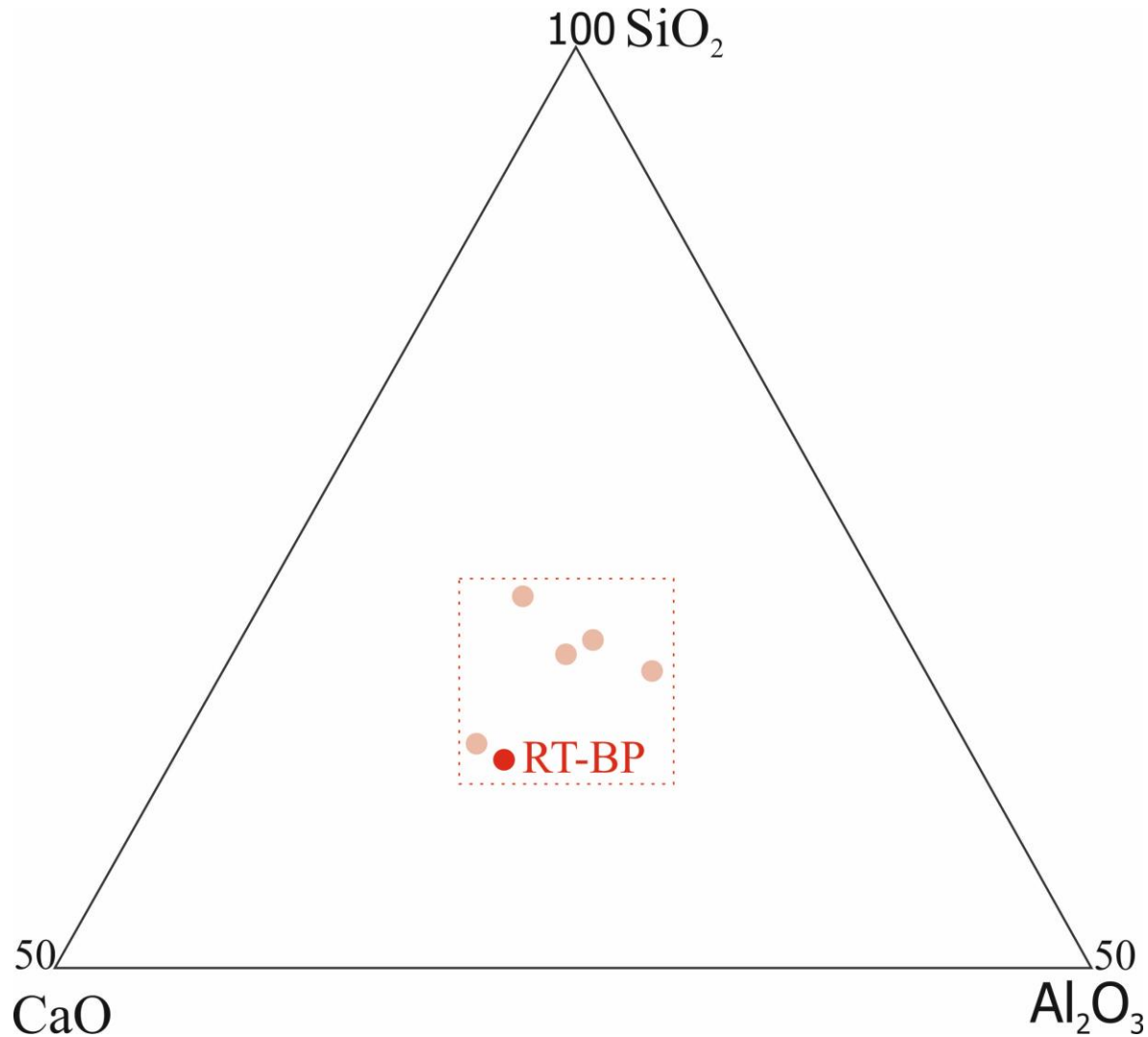
GROUP 1: ORIGINALS PIECES (white tiles and green moulding)

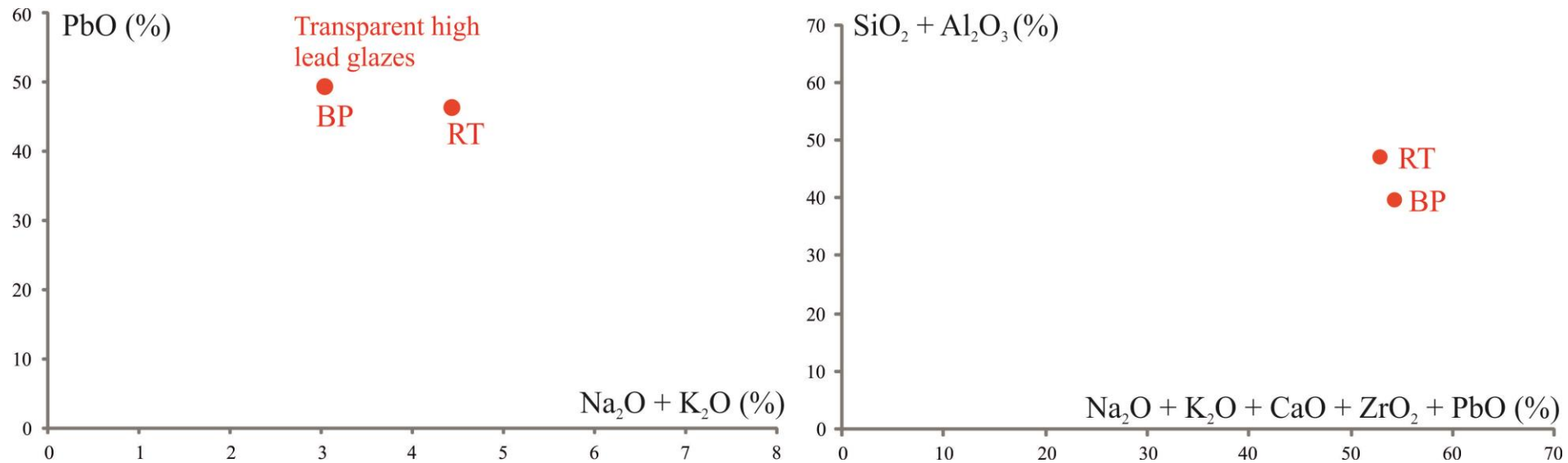
GROUP 2: ORIGINAL PIECES (relief tiles and braided pieces)



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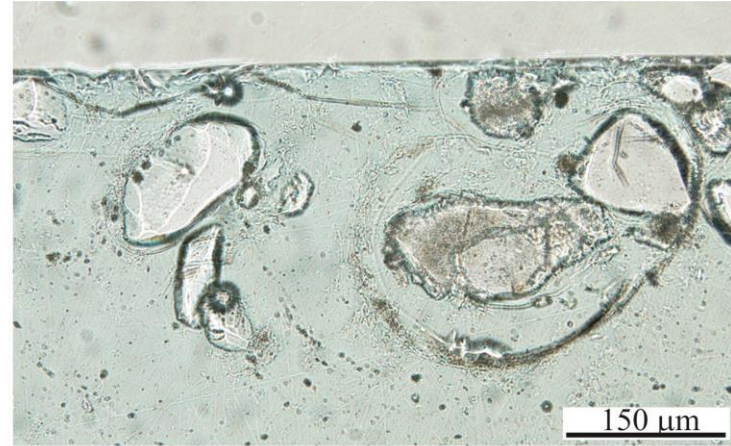
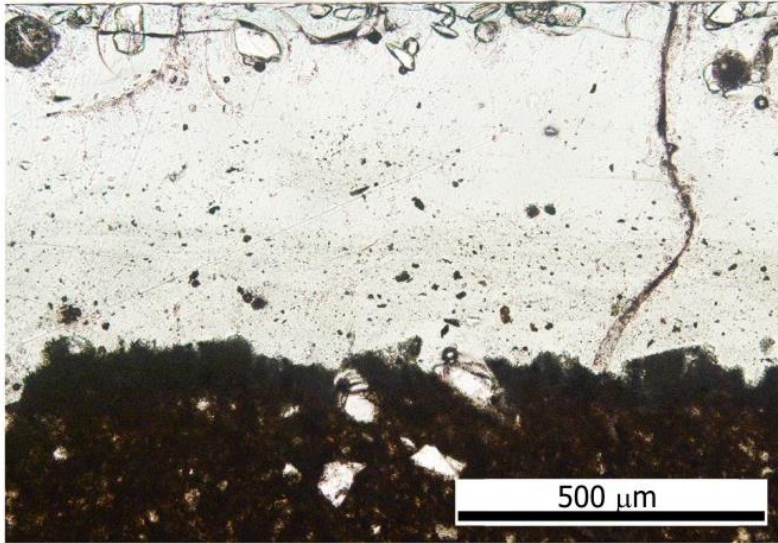
	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MnO	MgO	CaO	Na ₂ O	K ₂ O	TiO ₂	P ₂ O ₅	LOI
RT	47.9	12.0	4.9	0.09	2.9	17.5	1.6	3.3	0.6	0.16	8.3
BP	49.3	10.5	4.3	0.08	2.7	16.7	1.7	2.9	0.6	0.15	11.0

GROUP 2: ORIGINAL PIECES (relief tiles and braided pieces)

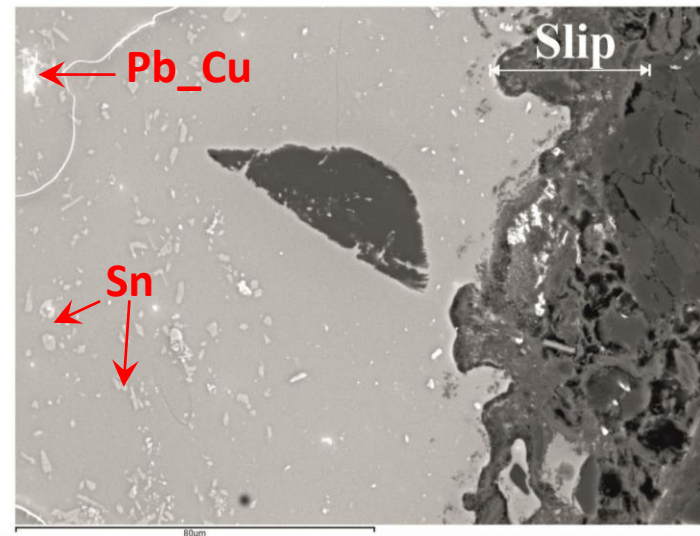
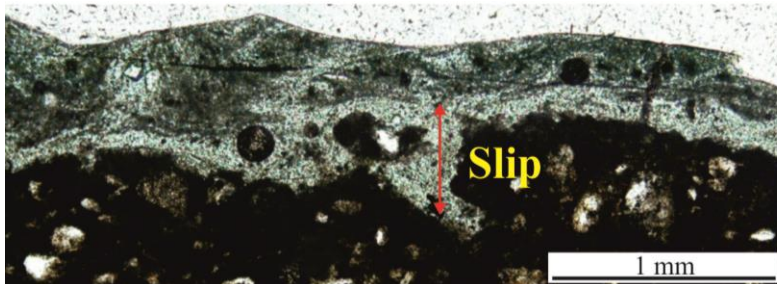
GROUP 2: ORIGINAL PIECES (relief tiles and braided pieces)

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RT



BP



GROUP 3: REPLACEMENT PIECES

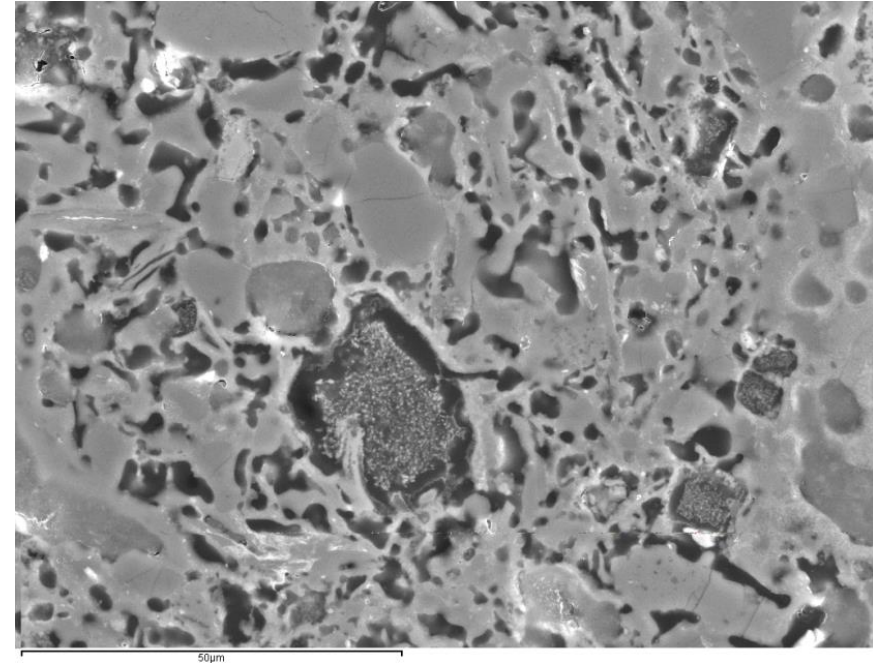
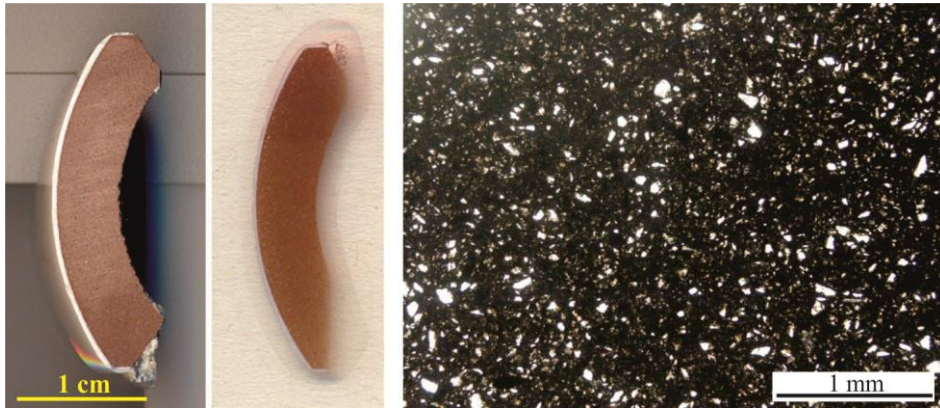
White tiles



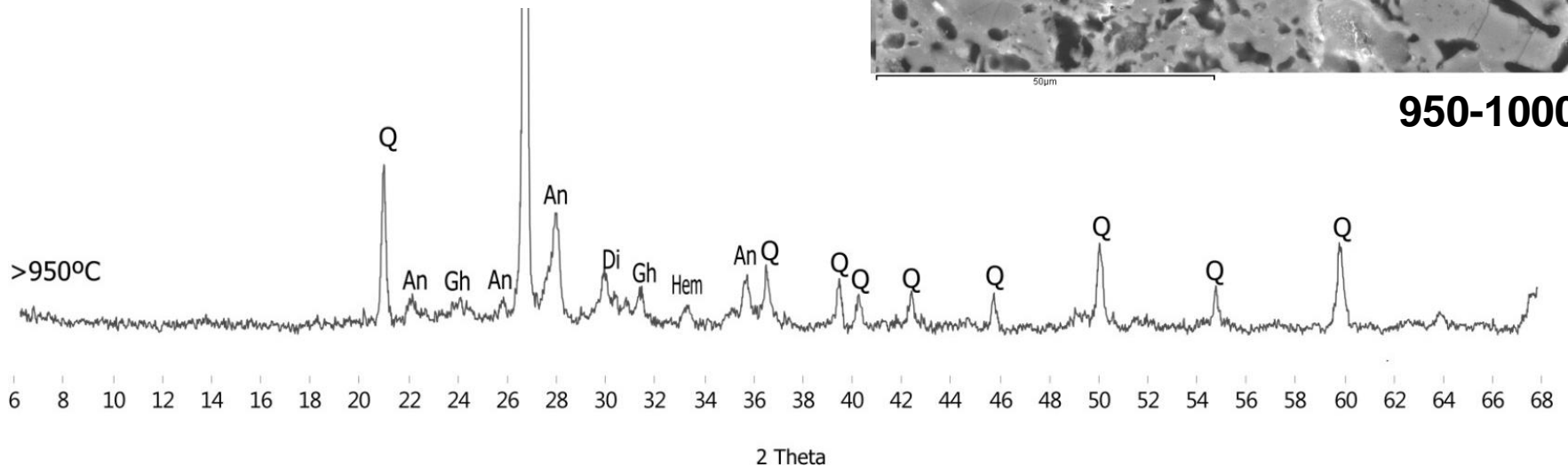
Braided pieces

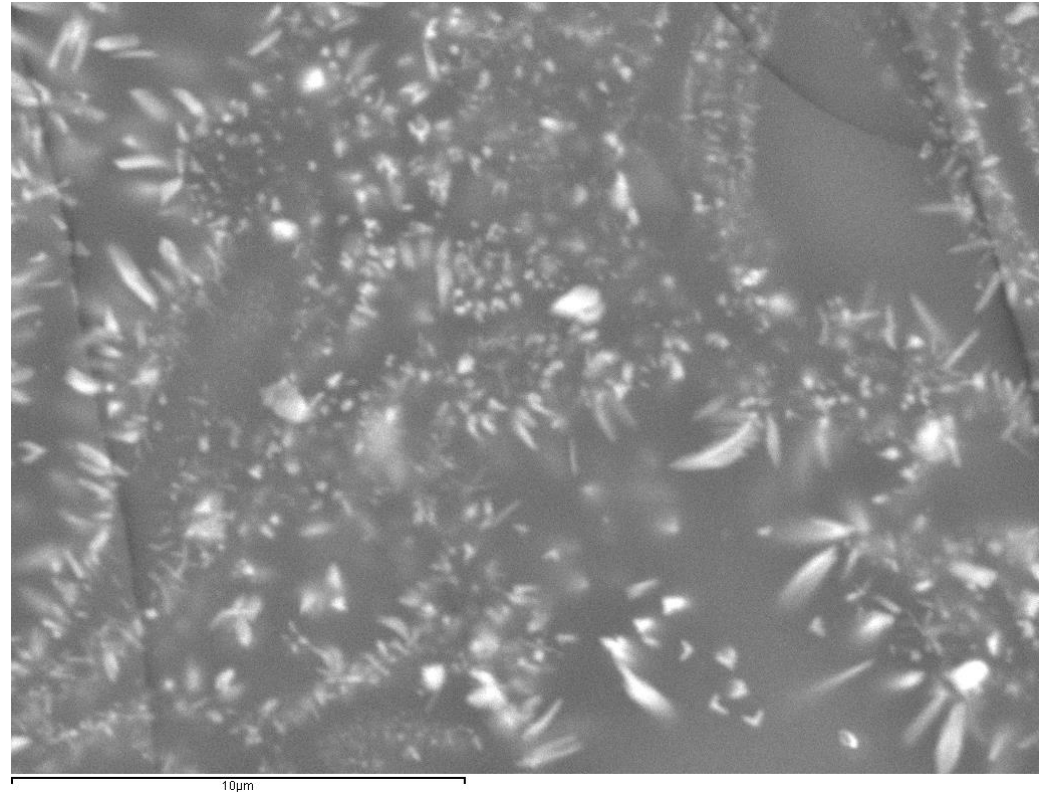
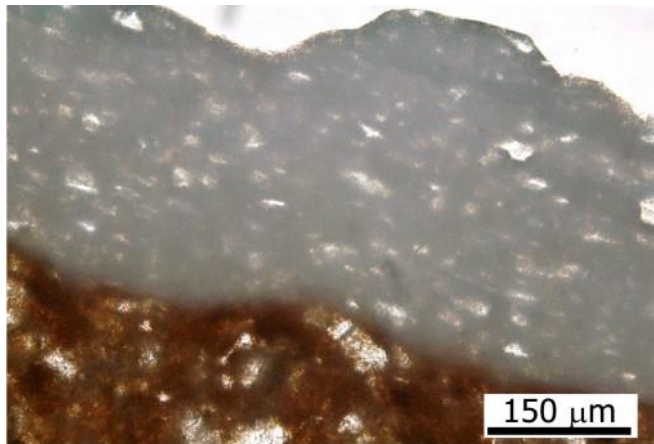


GROUP 3: REPLACEMENT PIECES, White tiles



950-1000° C

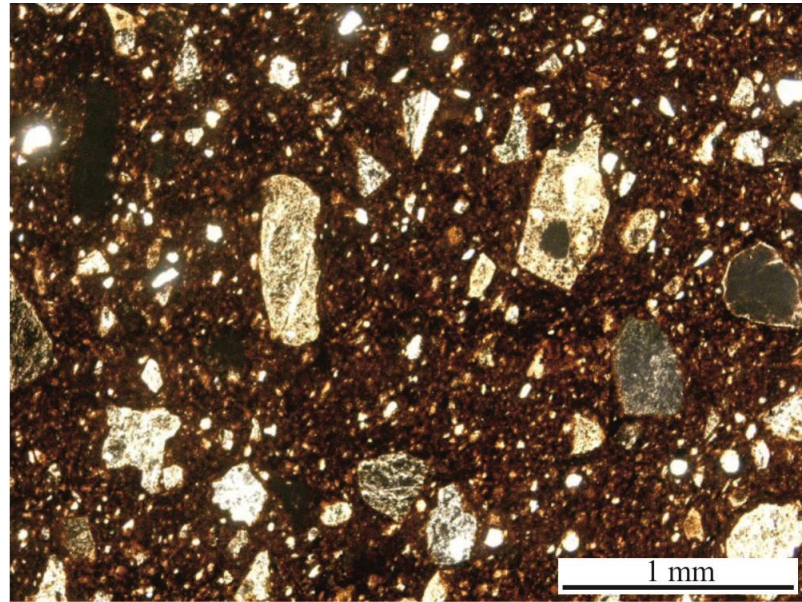
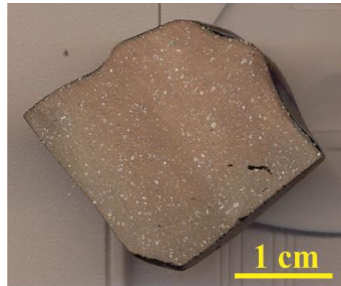


GROUP 3: REPLACEMENT PIECES, White tiles

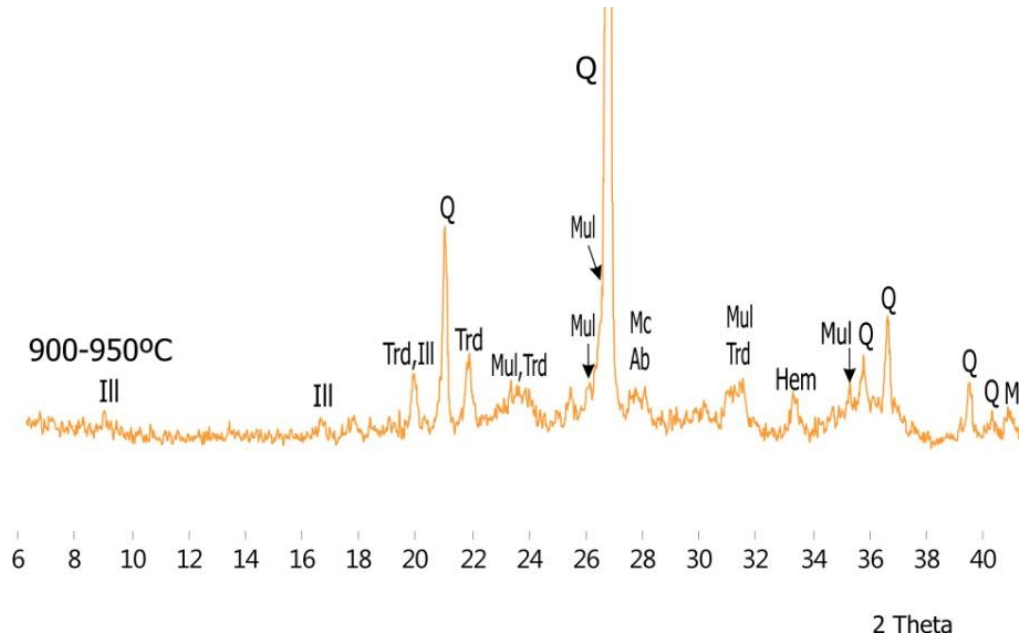
Na ₂ O	MgO	Al ₂ O ₃	SiO ₂	K ₂ O	CaO	Fe ₂ O ₃	CuO	ZrO ₂	PbO
3.7	2.9	6.8	62.3	3.8	8.9	0.0	0.0	11.6	0.0

GROUP 3: REPLACEMENT PIECES, braided pieces

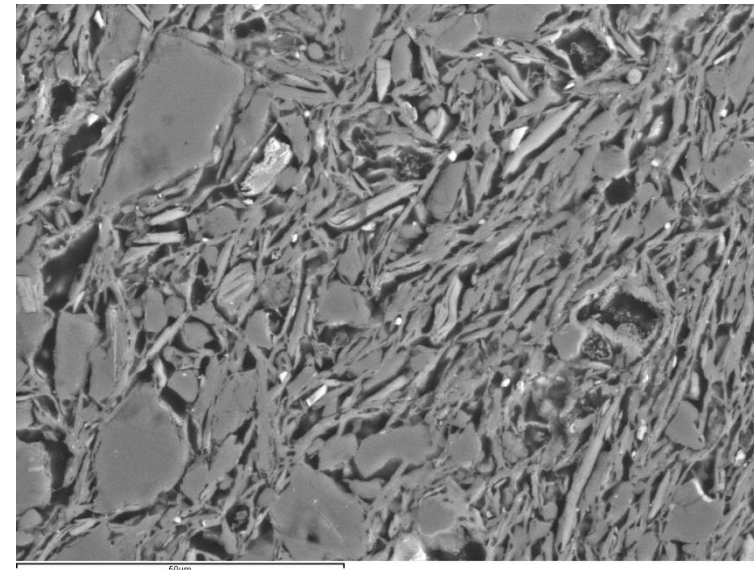
SiO_2	Al_2O_3	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	LOI
56.6	25.1	6.1	0.10	2.4	3.9	0.3	3.4	1.2	0.15	0.5



GROUP 3: REPLACEMENT PIECES, braided pieces

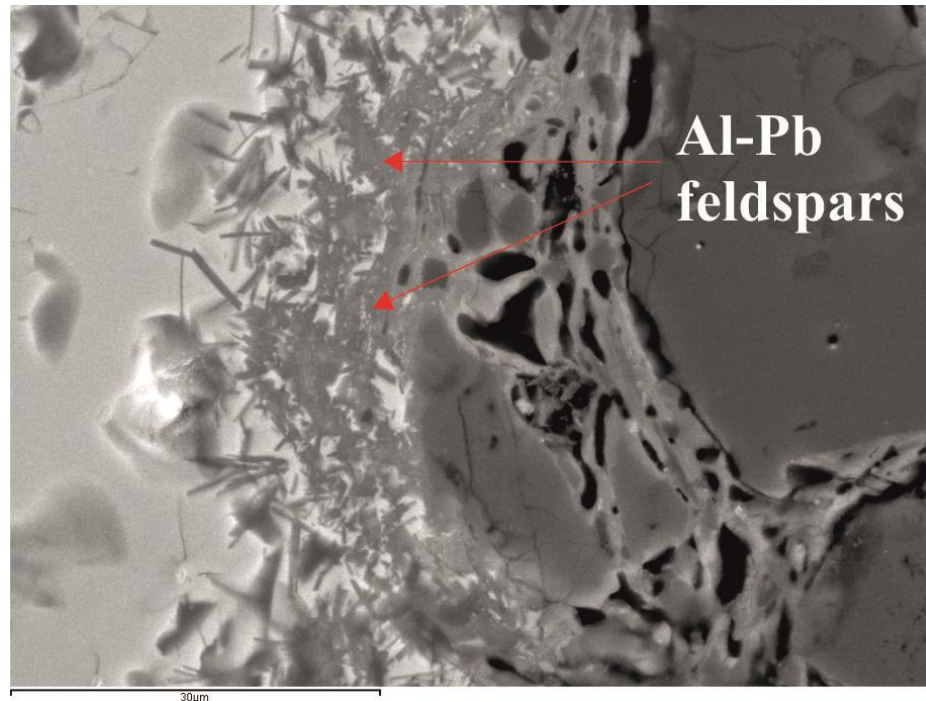


<850°C



GROUP 3: REPLACEMENT PIECES, braided pieces

Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	Fe_2O_3	CuO	ZrO_2	PbO
0.0	0.0	7.4	44.4	1.6	3.8	1.6	4.4	0.0	36.8



GROUP 1: original pieces (white tiles and green mouldings)

Very calcareous clays fired ≈ 950 °C

Coated with lead alkali-glazes

Green moulding made in Onda (Castellon, Spain)

GROUP 2: original pieces (relief tiles and braided pieces) made in Triana (Sevilla, Spain)

Calcareous and illitic clays fired between 850 - 950 °C

Coated with transparent lead glazed and metallic sheen

Relief tiles: ground opaline

Braided pieces: slip

GROUP 3: replacement pieces, made in Madrid (Spain)

White tiles: anorthitic ceramic bodies rich in Q (≈ 950 °C) + alkali glaze rich Zr and Al

Braided pieces: Al-rich refractory bodies with the addition of highly refractory grog

Grazie mille per la sua attenzione!

