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Supplementary Material

The Colour Palette of the Mosaics in the Roman Villa of Noheda (Spain)

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The PDF file includes:

Supplementary Materials

Other Supplementary Material for this manuscript:

Table S1 (Microsoft Excel format). Complete LA-ICP-MS data of 421 mosaic tesserae from Noheda (Cuenca, Spain).

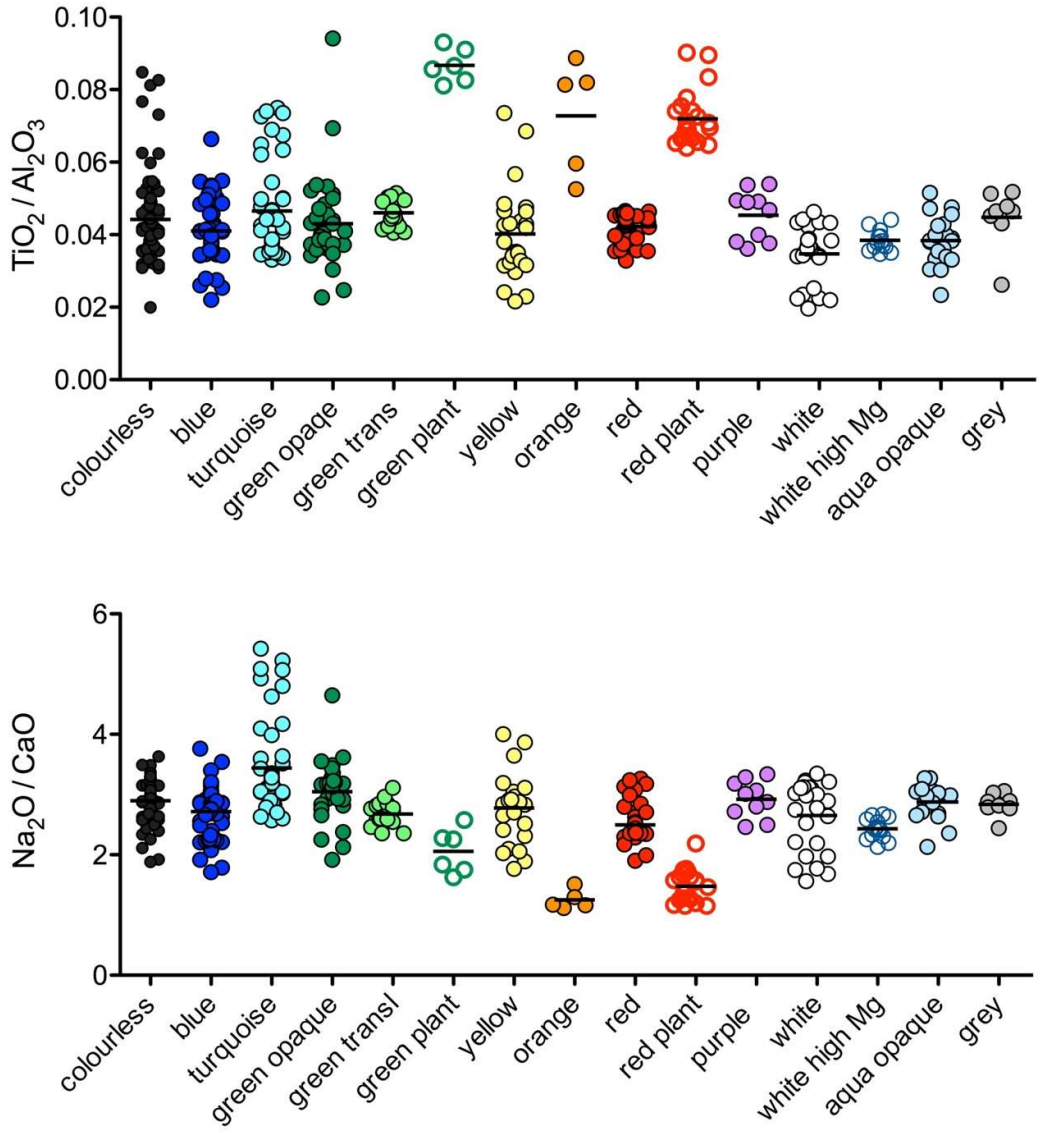

Figure 1. TiO_2/Al_2O_3 and Na_2O/CaO ratios of the different glass groups separated by colour and base glass type (natron and plant ash), showing the group means (indicated by a line) and individual data points. Note that the vast majority of the glasses are of the natron type (colourless, blue, turquoise, green opaque and green translucent, yellow, red, purple, white and white with high magnesia, aqua opaque, and grey); the plant ash glasses comprise the green (plant), orange, and red (plant) groups.

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Table S2. Average LA-ICP-MS data of glass standards in comparison with published values for Corning glass standards A, B, and NIST 612.

	Major and minor elements [wt %]																				
	Na_2O	MgO	Al_2O_3	SiO_2	P_2O_5	Cl	K_2O	CaO	TiO_2	MnO	Fe_2O_3	CoO	CuO	Rb_2O	SrO	ZrO2	SnO_2	Sb_2O_3	BaO	PbO	Bi
Corning A (n = 44)	13.9	2.53	0.92	66.9	0.11	0.13	2.85	5.77	0.78	1.02	1.11	0.17	1.16	0.01	0.10	0.01	0.17	1.62	0.46	0.06	0.00
SD	0.2	0.06	0.04	0.4	0.01	0.01	0.04	0.15	0.03	0.02	0.02	0.00	0.02	0.00	0.00	0.00	0.00	0.05	0.01	0.00	0.00
Vicenzi et al. 2002	14.3	2.66	1.00	66.6	0.13	0.10	2.87	5.03	0.79	1.00	1.09	0.17	1.17	0.01	0.10	0.01	0.19	1.58	0.46	0.073	0.00
Wagner et al. 2012	0.4	0.13	0.08	-0.3	0.02	-0.03	0.02	-0.74	0.01	-0.02	-0.02	0.00	0.01	0.00	0.00	0.00	0.02	-0.05	0.00	0.01	0.00
accuracy	3.1	5.04	7.56	-0.5	12.95	-29.78	0.80	-14.68	1.88	-1.62	-1.98	-0.19	1.15	4.48	-4.18	-9.03	12.76	-2.91	0.64	14.47	13.60
Corning B (n = 19)	16.7	1.01	4.46	62.4	0.81	0.21	1.01	8.61	0.10	0.24	0.34	0.04	2.65	0.00	0.02	0.02	0.02	0.43	0.08	0.42	0.00
SD	0.2	0.02	0.10	0.3	0.03	0.01	0.01	0.13	0.00	0.00	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00
Vicenzi et al. 2002	17.0	1.03	4.36	61.6	0.82	0.20	1.00	8.56	0.09	0.25	0.34	0.05	2.66	0.00	0.02	0.03	0.04	0.41	0.08	0.61	0.01
Wagner et al. 2012	0.3	0.02	-0.10	-0.9	0.01	-0.01	-0.01	-0.05	-0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.02	-0.01	0.00	0.19	0.00
accuracy	1.9	2.09	-2.28	-1.4	1.47	-3.31	-0.80	-0.56	-13.30	2.08	-1.16	4.18	0.24	-24.79	5.87	5.80	40.89	-3.55	1.36	31.49	20.24
NIST 612 (n = 41)	13.5	0.01	2.02	72.8	0.02	0.05	0.01	11.4	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
SD	0.2	0.00	0.12	0.4	0.01	0.05	0.01	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jochum et al. 2011	13.7		2.03	72.1				11.9													
	0.2		0.01	-0.7				0.5													
accuracy	1.7		0.27	-1.0				4.3													

	Trace elements [ppm]																						
	Li	B	V	Cr	Co	Ni	Cu	Zn	Ga	As	Rb	Sr	Y	Zr	Nb	Mo	Ag	Cd	In	Sn	Sb	Cs	Ba
NIST 612 (n = 42)	41.7	34.9	37.7	38.1	35.0	37.7	36.1	38.0	36.1	33.7	32.2	75.4	36.9	36.7	34.6	32.8	20.7	42.7	37.3	34.1	37.1	41.1	36.1
SD	1.9	2.6	1.1	6.7	0.9	1.8	1.0	3.8	0.7	2.7	0.5	2.9	1.6	1.7	1.2	1.3	1.5	2.3	0.6	0.8	7.2	1.0	1.0
Jochum et al. 2011	40.2	34.3	38.8	36.4	35.5	38.8	37.8	39.1	36.9	35.7	31.4	78.4	38.3	37.9	38.9	35.8	22.0	28.1	38.9	38.6	34.7	42.7	39.3
Table 7	-1.5	-0.6	1.1	-1.7	0.5	1.1	1.7	1.1	0.8	2.0	-0.8	3.0	1.4	1.2	4.3	3.0	1.3	-14.6	1.6	4.5	-2.4	1.6	3.2
accuracy	-3.7	-1.7	2.9	-4.7	1.4	2.8	4.5	2.9	2.1	5.6	-2.5	3.8	3.7	3.2	10.9	8.5	6.1	-52.1	4.1	11.7	-6.8	3.7	8.2

	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W	Pt	Au	Pb	Bi	Th	U
NIST 612 (n = 42)	38.0	38.7	36.8	34.9	36.7	36.0	33.7	36.8	33.6	37.6	34.5	35.2	37.6	36.3	34.6	30.9	30.3	2.39	4.40	33.1	30.8	37.2	38.3
SD	2.3	2.2	1.5	1.2	1.3	1.1	2.1	1.3	1.2	1.3	1.4	1.1	1.5	1.3	1.4	0.9	2.2	0.13	0.45	2.4	0.6	2.2	1.8
Jochum et al. 2011	36.0	38.4	37.9	35.5	37.7	35.6	37.3	37.6	35.5	38.3	38.0	36.8	39.2	37.0	36.7	37.6	38.0	2.51	4.77	38.6	30.2	37.8	37.4
	-2.0	-0.3	1.1	0.6	1.0	-0.4	3.6	0.8	1.9	0.7	3.5	1.6	1.6	0.7	2.1	6.7	7.7	0.12	0.37	5.5	-0.6	0.6	-0.9
accuracy	-5.7	-0.7	2.8	1.6	2.6	-1.3	9.6	2.0	5.5	1.9	9.1	4.2	4.0	2.0	5.7	17.7	20.4	4.69	7.67	14.3	-1.9	1.6	-2.4

Jochum et al. Determination of reference values for NIST SRM 610–617 glasses following ISO guidelines. Geostandards and Geoanalytical Research 35397-429 (2011).

Vicenzi et al. Microbeam characterization of Corning archeological reference glasses: new additions to the Smithsonian microbeam standard collection. Journal of Research of the National Institute of Standards and technology, 107, 719 (2002).

Wagner et al. Critical assessment of the elemental composition of Corning archeological reference glasses by LA-ICP-MS. Analytical and bioanalytical chemistry, 402, 1667-1677 (2012).

Table S3. Statistical comparison of group data. Kruskal-Wallis with post-hoc Dunn's test was carried out on the TiO_2/Al_2O_3 and Na_2O/CaO ratios (in black). However, since the data show some heteroscedasticity, we also performed Welch's ANOVA with post-hoc Games-Howell test (in red). The majority of the natron-type glass groups separated by colour do not show statistically significant differences (ns), with the exception of the turquoise, red and white tesserae. The tests systematically identified significant differences between the natron-type glass groups and the red and green samples with a plant ash component (highlighted in grey) (* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$).

TiO_2/Al_2O_3	Colorless (n=70)	Blue (n=61)	Turquoise (n=49)	Green opaque (n=33)	Green transl. (n=18)	Green ash (n=6)	Yellow (n=25)	Orange (n=5)	Red (n=48)	Red ash (n=22)	Purple (n=10)	White (n=25)	White high Mg (n=14)	Aqua opaque (n=20)
Blue	ns, ns													
Turquoise	ns, ns	ns, ns												
Green op	ns, ns	ns, ns	ns, ns											
Green tr.	ns, ns	ns, *	ns, ns	ns, ns										
Green ash	**, *	***, *	*, *	**, *	ns, *									
Yellow	ns, ns	ns, ns	ns, ns	ns, ns	ns, ns	***, *								
Orange	ns, ns	*, ns	ns, ns	ns, ns	ns, ns	ns, ns	*, ns							
Red	ns, ns	ns, ns	ns, ns	ns, ns	ns, *	*, *	ns, ns	ns, ns						
Red ash	***, *	***, *	***, *	***, *	ns, *	ns, *	***, *	ns, ns	***, *					
Purple	ns, ns	ns, ns	ns, ns	ns, ns	ns, ns	ns, *	ns, ns	ns, ns	ns, ns	ns, *				
White	ns, *	ns, ns	**, *	ns, ns	**, *	***, *	ns, ns	***, ns	ns, *	***, *	ns, *			
White Mg	ns, ns	ns, ns	ns, *	ns, ns	ns, *	***, *	ns, ns	**, ns	ns, *	***, *	ns, ns	ns, ns		
Aqua op	ns, ns	ns, ns	ns, *	ns, ns	ns, *	***, *	ns, ns	**, ns	ns, ns	***, *	ns, ns	ns, ns	ns, ns	
Grey	ns, ns	ns, ns	ns, ns	ns, ns	ns, ns	ns, *	ns, ns	ns, ns	ns, ns	ns, *	ns, ns	ns, ns	ns, ns	ns, ns
Na_2O/CaO														
Blue	ns, ns													
Turquoise	*, *	***, *												
Green op	ns, ns	ns, ns	ns, ns											
Green tr.	ns, ns	ns, ns	***, *	ns, *										
Green ash	*, *	ns, ns	***, *	**, *	ns, ns									
Yellow	ns, ns	ns, ns	**, *	ns, ns	ns, ns	ns, ns								
Orange	**, *	ns, *	***, *	***, *	ns, *	ns, *	ns, *							
Red	***, *	ns, ns	***, *	***, *	ns, ns	ns, ns	ns, ns	ns, *						
Red ash	***, *	***, *	***, *	***, *	**, *	ns, ns	***, *	ns, ns	*, *					
Purple	ns, ns	ns, ns	ns, ns	ns, ns	ns, ns	ns, *	ns, ns	*, *	ns, ns	***, *				
White	ns, ns	ns, ns	**, *	ns, ns	ns, ns	ns, ns	ns, ns	ns, *	ns, ns	***, *	ns, ns			
White Mg	**, *	ns, *	***, *	***, *	ns, *	ns, ns	ns, ns	ns, *	ns, ns	ns, *	ns, *	ns, ns		
Aqua op	ns, ns	ns, ns	ns, *	ns, ns	ns, ns	ns, *	ns, ns	**, *	ns, *	***, *	ns, ns	ns, ns	ns, *	
Grey	ns, ns	ns, ns	ns, *	ns, ns	ns, ns	ns, ns	ns, ns	ns, *	ns, *	**, *	ns, ns	ns, ns	ns, *	ns, ns