Appendix D

Some technical observations on the painted plaster from the Menelaion

by R. E. Jones

Following the macroscopic examination of the (large) majority of the plaster, it proved possible to identify two broad groups:

Group	***Frequency***	***Characteristics***
1: white lime plasters	50–75% of assemblage	Rather hard white plaster, some grit (occasional pebbles), some impressions of thin ?reeds. Generally uniform calcined lime but occasional large chunks of partially or totally untreated limestone. Majority of Group I plasters show signs of burning. Smooth outer surface but not obviously polished. Rough backing of lime plaster where it bound to mud substrate. Plaster thickness average 2.5 cm, varying from 1.5 to 3.5 cm. Some variants: (a) a white, crumbly plaster of variable quality and thickness. In 8 examples the layer is less than 1 cm, the surface smooth and polished. (b) Coarser, thicker version, with rough, poorly finished surface.
2: mud plasters	?25%	Mud plaster: red in colour but usually burnt to dark-grey. Variable quality.

Seven examples of Group 1 and three of Group 2 were analysed chemically by optical emission spectroscopy for the determination of some of the major elements apart from silica. The methodology was the same as that adopted in the Fitch Laboratory in the corresponding study of painted wall plasters from Knossos by Cameron *et al.* (1977). From the calcium oxide determination the equivalent lime (calcium carbonate) concentration was calculated. From the results shown in TABLE D.1 below, it is readily apparent that most of the Group 1 examples are high quality lime plasters; their compositions are similar to those obtained from painted plaster at Mycenae, Tiryns and elsewhere on the Mycenaean Mainland (Jones in press). **3** and **4** are less pure lime plasters. As expected, the mud plasters are of variable composition: **8** can be regarded as a calcareous earth, while **9** and **10** are non calcareous earths.

TABLE D.1: Partial chemical compositions of some plasters. 1–7 lime plasters, and 8–10 mud plasters. Calcium expressed as (equivalent) percentage calcium carbonate, aluminium, magnesium and iron expressed as percentage element oxides.

Sample	***Ca***	***Al***	***Mg***	***Fe***
1	>95	<0.5	<0.1	<0.1
2	>95	<0.5	0.5	<0.1
3	60	<0.5	0.4	<0.1
4	53	<0.5	<0.1	0.2
5	>95	<0.5	0.2	1
6	>95	<0.5	<0.1	<0.1
7	>95	<0.5	<0.1	<0.1
8	60	5.3	1.5	2
9	5	10.7	0.5	5
10	3	7.3	0.2	4

The *painted* plaster was first examined under the stereomagnifier, and then, following the experience recently gained with the study of fresco material at Knossos (Cameron *et al.*) 1977, a qualitative assessment of the nature of the different pigments, particularly the blues, was made on a number of specimens by non-destructive X-ray fluorescence (XF); the painted surface and in many cases the plaster were analysed. Like the work on the bronzes from the Menelaion, whose results are reported elsewhere in this volume, the analyses were carried out in the *apothiki* at Aphyssou. This proved a quick and most effective means of identifying unusual or problematic pigments, some of which in the event were subsequently investigated by X-ray diffraction (XRD) by Dr S. E. Philippakis (at NSCR Demokritos) and, for two samples, by Dr V. Perdikatsis (at IGME). The limitations of XRF, however, should be made clear: the analysis would only indicate the principal elements present in the pigment, and care had to be taken with specimens that had multiple paint layers and/or had remnants of soil concretion on the surface. The reason for the emphasis on the blue pigments at the Menelaion is their relative frequency and diversity on Aegean LBA wall paintings (Jones 2005).

SF	***Colour***	***XRF***	***XRD***	***Comment***
SM 74 J24/25 11	Red		H, C, Q (plaster C, Q)	
SM74 DV 2 502	Red	Fe rich		Red painted onto mud plaster
SM74 K25L25 8 217	Orange	Fe rich		
SM 74 DV 2 510	Orange	Fe rich		
SM 73 P 3 804	OrangeBlue	Fe richCu and Fe rich		
SM 74 K25 3 123	Greenbrown	Fe rich		
SM 74 J24/25 19	Blue		I, C, Q (plaster C, Q)	
SM 76 N-P3 4 36	Blue	Cu rich		
SM75 DVII N 4 210	Blue	Cu rich		
SM73 P 11 828	Blue	Cu rich		
SM 74 H24 20 73	Blue	No Cu		
SM74 J25 9 18	Blue	?Cu		
SM75 DVII N 4 212	Blue	Fe rich		Blue and red applied first, followed by white
SM74 B J24/25 4 30	Blue-grey	Fe rich		
SM73 R 1402	Blue-grey	Fe rich		
SM75 D 1 2 253	Blue	Fe and Mn rich	C, Q, I	Amorphous pigment
SM73 S 3 1020	Blue	Fe rich	C, Q, I	Amorphous pigment
SM73 S 1000 offering table	Blue over red	Fe rich		
SM74 H25 4 81	Blue	Cu rich		
SM74 J24/25 19 45	Blue	Cu and Fe rich	EB; Q, I, ?muscovite mica (VP)	Larger dark blue crystals underlie the smaller E. Blue crystals
SM75 DVII 2 224	Blue	Cu and Fe rich	EB; Q, I, ?muscovite mica (VP)	
SM73 R 1 1444	Blue	Fe rich		
SM73 R 3 1430	Blue	Fe rich		
SM73 R 1 1413	Blue	Fe rich		
SM73 X 4	Blue	Fe rich		Blue underlying red underlying blue
SM74 J24 17 25	Blue	Cu rich		
SM73 S 3 1004	Blue grey	Fe and Mn rich		
SM ? N 4 211	Blue	Fe rich		
SM73 R 2 1403	Blue	Fe rich		
SM73 R 1 1405	Blue	Fe and Mn rich		
SM74 N23 DD	Plaster concretion		H, Q, C	

VP = Dr V Perdikatsis; EB = Egyptian Blue; Q = quartz; C = calcite; I = illite; H = haematite

The principal result of interest is the occurrence of at least two types of blue: first the synthetic copper-rich Egyptian Blue, second the presumably naturally occurring iron-rich mineral, and third their mixture. There is no surprise in finding the first of these pigments in a LBA Aegean context for it was widely employed in the Minoan and Mycenaean worlds (Jones 2005, table 2). The only detail that may be added is that the colour is attributable to copper and not apparently to bronze, as has been noted, for instance, at Mycenae. But the nature of the other type of blue is more elusive: it is neither riebeckite nor glaucophane which were minerals commonly used in central Crete and Akrotiri on Thera. At present, there seem to be two possibilities: either the material is amorphous but contains iron, or the colour is attributable to clay minerals such as mica, contaminated with an iron-bearing compound. Such findings have been closely paralleled at Chania where a programme of examination and analysis has recently been completed (Photos-Jones, *et al.*, forthcoming). The presence of three examples of blue containing both iron and manganese is puzzling and needs to be further investigated.

The presence of an iron-rich green is also of interest but regrettably it was not characterised mineralogically. The reds and oranges are surely iron oxides.

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