

**CHAPTER 13**  
**TWO STUDIES ON AMARNA PIGMENTS**

by

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**1. DISTRIBUTION AND USE OF PIGMENTS AT THE WORKMEN'S VILLAGE**

In *Amarna Reports V*: Chapter 10, a list of pigments from the Workmen's Village was presented, some of which were analysed for their chemical constituents. In this report their pattern of distribution across the site will be discussed together with their possible uses (six more pigments, listed in Table 13.2 on p. 393, have been added to the original catalogue). Evidence of painting with pigments at the Workmen's Village comes from two main spheres of artistic activity, not mutually exclusive: the decoration of wall-plaster in chapels and houses in the Village, and the decoration of tombs in the nearby cliffs.

**13.1 The decoration of wall-plaster in chapels and houses in the Village**

A brief survey of the excavated wall-plaster gives an idea of the scope of painting at the Village. However, it must be remembered that almost half of the walled Village remains to be excavated, and a few more chapels probably exist on the surrounding hill slopes.

Peet and Woolley describe polychrome decoration in some five out of the twenty-two chapels which they excavated in 1921 and 1922. These were Chapels 527, 529, 551, 552, and possibly 553 (*COA I*: 105–8, Pl. XXXVI; EES archive, Amarna Document 1.4). In the more detailed excavations of the site in 1979–1986, evidence was also found of painted plaster in Chapel 571 (*AR I*: 38), and in re-excavating Chapel 529 a few wall-plaster fragments missed by Peet and Woolley were also recovered (*AR II*: 47). Before revealing the spectacular quantities of fragmented wall-plaster in the Main Chapel (*AR I*: Chapters 2 and 7) in 1983 and 1984, several pieces had been found in the earlier excavators' spoil heaps overlying the Main Chapel and its Annexe 450; these are presumed to have come from nearby Chapels 521, 522, 524, and Building 523.

Of the houses in the Walled Village, Peet and Woolley found that seven of the thirty-seven which they excavated had painted wall-plaster, showing both polychrome and monochrome designs. These were Main Street Nos. 1, 3, 9, 10; and Long Wall Street 7, 10, and 11 (*COA I*: 74–85, 59–60, Pl. XVIII, Fig. 3; Kemp 1979: 47–53). Unfortunately, since the 1920s there has been much illicit digging in the houses (for Long Wall Street 6: Kemp 1980: 10–12; for Gate Street 8: *AR III*: 1–7; for Gate Street 9: *AR IV*: 30–35; for West Street 1–2: *AR III*: 28–33; for West Street 2–3: *AR IV*: 4–11), thus complicating the interpretation of finds found in the recent excavations. For instance, a small number of similarly painted plaster fragments was recently uncovered in the disturbed fills of both Gate Street 8 and 9, but it is likely that these all came from one house. In 1986 another monochrome sketch was discovered in undisturbed fill in West Street 3, possibly the head of Tutankhamun. Technical and stylistic analyses gave important information which added weight to the claim of Peet and Woolley that the western part of the village was a later extension to the original plan (*AR IV*: Weatherhead, 24–5).

Finally, fragments of wall-plaster were found in Square T12, presumably fallen from the area of a collapsed doorway in Building 541. Their presence runs counter to the idea that this building had once been an abattoir (*AR III*: 72–5).

### 13.2 The decoration of tombs in nearby cliffs

With regard to the decoration of the tombs, this activity appears to have been abruptly halted after Akhenaten's death, the latest datable scene being in the tomb of Meryre II (Tomb no. 2), which shows Meritaten and Smenkhkare (*RT* II: 43–4, Pl. XLI). The period of occupation at the Village lasted longer, and early and late phases of painting, denoted by two different artistic styles (Amarna and "post-Amarna") are seen in the Village houses. Wall-paintings in Main Street 10 and Long Wall Street 10 are examples of the first phase, while the king's head in West Street 3 is an example of the second (*AR* IV: 25). Stylistic differences also occur on the remains of wall-paintings from some of the chapels, at present being studied by the author.

A theory advanced by Kemp for a two-phase occupation of the Village could coincide with the two phases of painting style, that is, an earlier occupation by tomb-workers followed by reoccupation by guards responsible for maintaining security along the network of roads which encompass the Village, the tombs, and the Main City (*AR* I: 1, 3), but this is still a matter of some speculation.

Some of our pigments could derive from a tomb-decorating phase. But we cannot, with only a few exceptions, expect to find these, or other pigments, from an early stage of the Village's life clearly stratified (see sections A and B below), as the overall time-span of the site was so short, and, in any case, the proposed two-stages of occupation may have overlapped.<sup>1</sup>

### 13.3 The distribution of pigments

The pigments can be grouped into several broad categories depending on where they were found.

#### A. Squares around Building 350 and 400.

Excavations have shown that shortly after occupation began at the Village the villagers started to dump their rubbish a short distance from the main entrance on the flat desert surface around two disused marl pits, bounded by pen 400 on one side, and the path to the *Zir*-area on the other. At a later phase this rubbish area and the older animal pen 350 were levelled to become part of the territory belonging to the Main Chapel with its line of T-shaped basins (*AR* I: Chapter 1). However, some rubbish still accumulated over this area until the site was abandoned. The edge of Building 400 extended westwards over part of the rubbish area, and Annexe 450 was subsequently built on top (*AR* II: 8, 11).

The pigments, roughly grouped, reflect these two phases:

**Group i:** Those from the lower rubbish levels are probably associated with paintings from the early decoration of houses and chapels, or tombs:

<p>rubbish, south of WV</p>	<p>L11 [25] L14 [11]</p>	<p>turquoise turquoise</p>
<p>animal pens 350, area vi, undisturbed rubble</p>	<p>L17 (3) / 1128</p>	<p>green</p>
<p>ancient floor surface in front of Chapel Annexe 450</p>	<p>O17 (3) sherd N17 (3) / 2089</p>	<p>turquoise turquoise</p>
<p>fill of robbers' pit, rubbish south of WV</p>	<p>P15 (5) feature 3</p>	<p>turquoise</p>
<p>organic fill of marl pit</p>	<p>L17 (7)</p>	<p>red</p>

<sup>1</sup> In *COA* I: 95–8 Peet and Woolley discuss the concurrence of Amun and Aten worship, based on religious inscriptions in Chapels 525 and 529.

## Pigments

**Group ii:** The surface finds are probably associated with decoration of later buildings, such as the Main Chapel, thrown out or dropped in the main thoroughfare in front of the Village. They are more likely to be caused by human deposition than the effects of wind and rain, as elsewhere cleared squares have not produced surface pigments:

rubbish covering animal pens 350:		
areas xiv–xvi	M15 (1)	turquoise
areas xiv–xvi	M15 (4)	turquoise
area xxvi	O15 (4)	green
immediately S. of WV	M18 surface	turquoise
surface S. of WV	N15 (1) / 4075	blue
	N15 (1)	yellow
surface S. of M. Chapel	P17 (1)	turquoise
	O17 (1) / 73	turquoise
surface sand S. of M. Chapel	R17 [273]	turquoise
surface rubbish S. of WV	L15 [135]	turquoise

### Uncertain:

rubble from collapsed enclosure wall around Village	L18 (4)	turquoise
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The fact that the pigments found in the rubbish area were thrown out or dropped is explained by their small size. Blue and turquoise frits often start off as quite large cakes (*AR V*: 210–13), supplies of which could have been obtained from the frit factory(s) in the Main City (Petrie 1894: 25ff; *AR V*: 210, 214).

**B. Edge of Main Quarry area.** Here the Villagers once quarried for marl, but very soon it became another area for dumping rubbish. The excavations at the edge of the quarry revealed floor sweepings and kitchen refuse (*AR I*: 8, Fig. 6.3; Kemp 1983: 7–13), also several pieces of pigment in the upper levels. This fill (group i) could represent pigments from early house and chapel decoration.

**Group i:** All rubbish fill. As previously, these pigments are mostly small disregarded fragments of frit, but difficult to explain is one large piece of yellow, M9 (4), almost 100g in weight. Perhaps this piece, which was analysed as impure goethite (see *AR V*: 209, Table 10.6), had been rejected on grounds of poor quality. Also puzzling is a discarded yet sizeable red piece visually identified as haematite (M12 [95] / 12549) which, by its worn sides, had evidently been used (Figure 13.1). This, like the piece found in West Street 3 (see Section F.b), is a maroon shade and unlike the usual red used abundantly on the later Main Chapel wall-plaster.

M12 [95] / 12549 red	M10 (2)	2 turquoises + blue
M12 [126] turquoise	M9 (4)	turquoise + blue + yellow
M12 [127] turquoise + blue	M11 [264]	turquoise + blue
M9 (8) feature 8 turquoise		
M10 (1)/(2) turquoise	M10 (3)	turquoise

**Group ii:** The surface pigments, as with those in Group Aii, were probably accidentally dropped or put out with rubbish at a slightly later date.

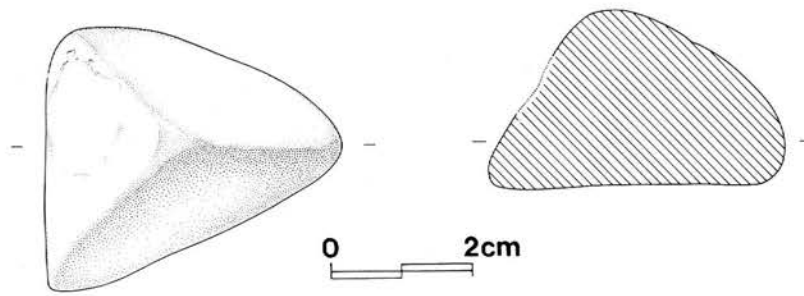


Figure 13.1. Triangular-shaped pigment, no. M12 [95] / 12549, with worn sides. Actual size.

surface above M. Quarry M. Quarry, drift sand	M10 (1) M10	2 greens + 2 blues turquoise
Building 300, surface sand	R10[1385]	blue
S.E. sector, surface sand	R11[1413] / 6951	turquoise
surface, disturbed soil	N15(1)	green

### C. Main Chapel 561

**Group i:** Dump over Main Chapel. These pigments, like the fragments of wall-plaster discarded by the early excavators also found in the dump, probably came from nearby Chapels 521, 522, 524, and Building 523, and may have been used to decorate them.

R18 [247] / 10260	blue
S18 [966] / 544	turquoise
S18-19	blue

**Group ii:** Pigments found in the fill of the Main Chapel Annexe 450 may have come from the decoration of the Main Chapel.

sand fill of Annexe 450	Q18 [418]	turquoise
Annexe 450, area vi, undisturbed rubble	S 18 [2156]	turquoise

### D. Site X1

This building has been interpreted as the checkpoint for the delivery of goods from the Main City to the *Zir*-area (Kemp 1980: 8; *AR* IV: Chapter 7). The pigments, broken into small fragments, may therefore have broken away from larger pieces received here.

Central rooms	X1.F6 (2c) [6]	yellow
West building	X1.D5 (3a) [3]	turquoise+blue
West building	X1.D6 (3b) [1]	yellow

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### E. Zir-area

The pigments found here are probably wind-blown, or remnants from pigments delivered to this commodity-distribution area.

surface sand	H6 [146]	blue
surface sand	I8 [254]	green

### F. Houses inside the Walled Village

**a. Dumps from 1922 excavation inside Walled Village:** Peet and Woolley mention pigments found in houses (see section b.), but the following small pieces appear to have been overlooked. They probably come from the excavation of houses in the southern part of the Village.

K18 (1)	yellow	N18 (1)	turquoise
sherd L18 (1) / 3956	turquoise	L16 (14)	turquoise
J17 / 938	red		

Although small, the yellow specimen K18 (1) which is visually identifiable as orpiment is important. This substance was used (so it is claimed) to decorate objects associated with royalty, the implication being that orpiment imitated gold more closely than the more readily available goethite, and was thus more suitable for royalty. For example, orpiment is said to have been used as the infill of inscribed glyphs and deities on royal sarcophagi (El-Goresy, *et al.* 1986: 26–30), and also to embellish other royal tomb furnishings, such as noted by Lucas in Tutankhamun's tomb (Lucas 1933: 174, 177–180). It was also used on wall-paintings, in the Theban tombs (El-Goresy, *et al.* 1986: 30–1; Mackay 1920: 27; Noll 1981: 426–8, Table 2a). At Amarna, in the City, Petrie describes orpiment applied to the “Princesses” panel from the King's House (Petrie 1894: 15, 23), now in the Ashmolean Museum (see section 2). Orpiment has recently been identified as a pigment used on fragments of papyrus, from the Central City, which depicts a battle (Schofield and Parkinson 1994: 163).

Thus several possibilities arise. Was our specimen a remnant from a piece used in the painting of a nearby tomb, or from the embellishment of an object, perhaps funerary, made in the Village for use by royalty? Or does it mean the use of orpiment was less restricted than has previously been supposed, and that commoners used it to decorate their own possessions? So far at the Village there is no good evidence to bear out the use of orpiment in the last two circumstances, and nearby it has only been identified in one of the tombs, that of Ahmose, tomb no. 3 (Jaksch 1985: Table 1).

The large piece of red pigment J17 / 938 was presumably also unrecognised as pigment by the early excavators. It seems likely that other pieces of pigment also went unrecognised, and are now lying in spoil heaps.

**b. Houses inside Walled Village:** Pigments were located in the following houses by Peet and Woolley (*COA I*: 69, 71, 77, 84, 86), none of which had wall-paintings. These were Main Street 5 (turquoise), West Street 3, Long Wall Street 8, opposite Long Wall Street 7, East Street 1 (all green).<sup>2</sup>

Several more pieces of pigment were found in the 1979–86 excavations:

West St. 3, Front Room, undisturbed fill	WS3 [2123] / 12374	blue + green
	WS3 [2128] / 12455	blue
	WS3 [2128] / 12516	red
West St. 3, modern spoil heap	WS3 [2094] / 66354 (sherd)	blue
	WS3 [2094] / 66393 (sherd)	blue

<sup>2</sup> Their final locations in Museums are uncertain (*AR V*: Table 10.2).

West St. 3, Middle Room, disturbed fill	WS3 [2122] / 7191	turquoise
West St. 2, area vi, disturbed fill over house	WS2 [1703] / 6089	turquoise
Gate St. 9, Middle Room, dist. fill	GS9 [2330] / 7013 GS9 [2508] / 7250	turquoise turquoise
Gate St. 9, Rear Room S., dist. fill	GS9 [2392]	yellow
Long Wall St. 6, Rear Room S., dist. fill	LW6 3a(2) 129	turquoise
Long Wall St. 6	LW6	yellow

The pigments found at the north end of the front room in West Street 3 were mixed with bricks and roofing fragments, in an intact fill unit [2128] (*AR IV*: 7). With the tiny blue pieces was found a large maroonish-red piece (analysed in *AR IV*: 208–9, Table 10.6). At the other end of the front room, in equivalent unit [2123], were found more tiny crumbs of blue and green, and sections of gridded bricks, painted with what may have been a sketch of Tutankhamun's head in white (*AR IV*: 21, 25). However, the presence of all the pigments close to the drawing does not seem to be connected, for two reasons. One is that it seems certain that the maroon pigment was not used to execute the grid, as it is a different shade of red from that on the bricks. The other is that it has already been suggested by the author, on close study of the sketch, that it was a finished drawing, not intended for colouring in. In fact, many questions arise as to the function of the front room itself, in view of the finds (especially the sketch), which have yet to be answered.

Elsewhere in the Village, pigments found in Long Wall Street 6, West Street 2, and Gate Street 9 were all from disturbed fills. Tiny scraps of painted wall-plaster were found in disturbed units in Gate Street 9, some of which were painted turquoise on yellow (units [2071, 2344], also in Gate Street 8 unit [1400]), the same colours as the pigments, which may thus have been used to paint the wall(s) whence they came.

## 2. PIGMENTS FROM THE INDUSTRIAL AREA Q48.4

### 13.4 Source and nature of the specimens

In the course of the 1987 excavation of the industrial area in the Main City (*AR V*: Chapter 2) almost forty fragments of pigment were found. These are listed in Table 13.1 (on the following three pages). In direct comparison with those from the Workmen's Village found over the period 1979–1986 (*AR V*: Table 10.1; Section 1 of this chapter), a large number was found in a single year, and most were yellow or red with few blue or turquoise, the exact opposite to the situation at the Village. They were found scattered across most of the 5-metre squares excavated, the majority being clustered in the north-west corner of the area dug.

None of the pigments has been chemically analysed, but we can reasonably assume on visual inspection alone that they are yellow ochre (goethite), red ochre (hydrated ferric oxide), blue frit (coloured by "Egyptian blue") and turquoise frit (possible colouring agent a calcium-copper-sodium-silicate, see *AR V*: 206–8).

Many of the fragments are quite sizeable pieces, unlike many of the small pieces from the Workmen's Village which appear to have been casually dropped or thrown out with domestic rubbish. The large accumulation of pigments in the relatively small area which has been interpreted as the remains of a pottery-workshop, lying within a larger industrial site, has led to the conclusion that they are connected with pottery manufacture (*AR V*: 90). Most of the reds and yellows come from square E5, where there is a clay deposit [3615] (*AR V*: Figure 2.3) with traces of possible spilled red slip, and within the vicinity of a puddling pit in square D5.

Red and yellow slips (containing presumably red and yellow ochres respectively) were found occasionally on unfired sherds in the area. It would appear likely that on firing in the kiln both types would produce similarly coloured vessels, since in the early stages of heating the goethite contained in the yellow slip would change to the less hydrated form of iron oxide, red ochre.

Date excavat.	Find spot/ ident. no.	Description	Colour identifications		Weight
			Pantone	Munsell	
<b>Blue pigments</b>					
1987	G5 [3354]/ 13085	1 lump, granular	285U	5.9 PB 4.8/10.9	< 0.5 g
<b>Turquoise pigments</b>					
—	—	—	—	—	—
<b>Green pigments</b>					
—	—	—	—	—	—
<b>Red pigments</b>					
1987	E5 [3722]/ 13199	2 lumps	173U	8.4R 5.0/9.0 to 8.3R 4.0/7.3	13g
1987	E4 [2979]/ 13086	lump of red-stained gypsum	—	0.1R 5.1/7.2	5g
1987	E5 [3734]/ 13203	1 lump	179-180U	6.9R 5.2/10.7 to 7.4R 4.4/7.2	2g
1987	D5 [2902]/ 13081	1 lump	179-180U	6.9R 5.2/10.7 to 7.4R 4.4/7.2	40g
1987	E5 [3384]/ 13161	2 lumps	179-180U	6.9R 5.2/10.2 7.4R 4.4/7.2	15g
1987	E5 [3722]/ 13208	1 lump	166U	9.9R 5.6/10.1 to 8.3R 4.0/7.3	39g
1987	D4 [2903]/ 13078	1 lump	179-180U	6.9R 5.2/10.7 7.4R 4.4/7.2	13g
1987	E5 [3742]/ 13209	1 lump	159U	8.3R 4.0/7.3 to 0.7YR 5.5/8.1	15g
1987	D4 [3162]/ 13088	several crumbs	173U	8.4R 5.0/9.0	—
1987	D4 [2903]/ 13089	—	173-179U	8.4R 5.0/9.0 to 6.9R 5.2/10.7	—
1987	E5 [3014]/ 13205	2 lumps, + crumb	166U	9.9R 5.6/10.1	—

1987	E5 [3744]/ 13218	3 bits, ? has been 1 piece. Fine ? quartz particles throughout	180U	7.4R 4.4/7.2	1.5g
<b>Yellow pigments</b>					
1987	D4 [3043]/ 12696	block broken into 2 large pieces, + crumbs	142-129U	8.9YR 7.5/8.1 to 0.1R 7.6/9.5	15g
1987	E5 [3362]/ 13074	slightly granular, powdered, soft	142-129U	8.9YR 7.5/8.1 to 0.1R 7.6/9.5	40g
1987	F6 [3362]/ 13075	several large broken lumps, slightly granular	129-142U	0.1R 7.6/9.5 to 8.9YR 7.5/8.1	210g
1987	G4 [2983]/ 13077	3 lumps, + powder	129-142U	0.1R 7.6/9.5 8.9YR 7.5/8.1	12g
1987	E6 [2947]/ 13080	2 lumps, granular	142U exterior	8.9YR 7.5/8.1	3g
1987	F6 [3265]/ 13082	large lump, slightly granular	121-129U	1.2Y 8.1/9.3 to 0.1R 7.6/9.5	55g
1987	E6 [2943]/ 13083	large lump, slightly granular	141U	1.5Y 8.1/6.5	66g
1987	F6 [3397]/ 13084	1 lump	129-131U	0.1R 7.6/9.5 to 9.6 YR 6.2/8.5	2g
1987	E4 [2979]/ 13086	small lump	124U but paler	8.6YR 6.4/9.0	—
1987	E4 [3007]/	—	—	—	10g
1987	F3 [2965]/ 13093	1 lump	124U	8.6YR 6.4/9.0	6g
1987	E5 [3380]/ 13156	2 lumps, 1 pale yellow	128U, 124-129U	3.8Y 8.2/8.0, 8.6 YR 6.4/9.0 to 0.1R 7.6/9.5	2g each
1987	E5 [3380]/ 13158	several small lumps	142U	8.9 YR 7.5/8.1	—
1987	E5 [3384]/ 13160	2 lumps	120U, 129U	3.6Y 8.4/7.8, 0.1R 7.6/9.5	30g
1987	E5 [3014]/ 13204	2 lumps, stained red in places	—	—	1g



1987	E5 [3722]/ 13206	2 lumps, + crumbs	—	—	6g
1987	F5 [2964]/ 13090	1 lump, pale yellow	135U	0.1Y 8.3/6.7	12g
1987	G3 [2886]/ 13091	1 lump	128-129U	3.8Y 8.2/8.0 to 0.1R 7.6/9.5	1g
1987	E4 [2913]/ 13092	2 lumps	121U	1.2Y 8.1/9.3	7g
1987	E4 [3007]/ 13087	1 lump	121U	1.2Y 8.1/9.3	4g
1987	G3 [3729]/ 13202	1 lump	123U	7.1YR 7.3/12.0	—
1987	F6 [3328]/ 13207	1 lump, + 2 small bits	142U	8.9 YR 7.5/8.1	5g
1987	E5 [3722]/ 13199	1 lump	129U	0.1R 7.6/9.5	—
1987	E5 [3791]/ 13228	broken-off part of a lump, stained red on outside	121-128U	1.2Y 8.1/9.3 to 3.8Y 8.2/8.0	9.6g
1987	E5 [3743]/ 16213	1 small piece, 2 broken-off sides	128-135U	3.8Y 8.2/8.0 to 0.1Y 8.3/6.7	3.4g
1987	E5 [3014]/ 13219	1 sliver (from a larger block), slightly stained red on outside	128-135U	3.8Y 8.2/8.0 to 0.1Y 8.3/6.7	1.1g

Table 13.1. List of pigments from the industrial area Q48.4, 1987 excavations.

Date excavtd.	Provenience	Find spot/ident. no.	Description
1980	Dump from 1922 excav.	J17/938	Lump of red ochre, flattened worn sides, 4.2 x 3.4 x 1.0 cm, now in City Museum, Birmingham
1980	Organic fill of marl pit	L17 (7)	red 1.5 x 1.5 x 0.4 cm; 1 g
1985	Main Quarry, surface sand	R11[1413]/6951	turquoise 0.7 x 0.6 x 0.2 cm
1986	Gate St. 9, Middle Room disturbed fill	GS9[2330]/7013	large lump of turquoise, 3.5 x 2.3 x 1.0 cm; 6.5 g
1986	ditto	GS9[2508]/7250	turquoise, 1.2 x 0.7 x 0.5 cm
1986	Gate St. 9, Rear Room South, disturbed fill	GS9[2392]	irreg. lump of yellow, 1.5 g

Table 13.2. Appendix. Additional pigments excavated from the Workmen's Village 1979-86 (see AR V: Table 10.1).

**Errata appearing in AR V: Table 10.2.**

**Add**  
Cairo Museum 1931-2 JdE 57328 Sample of blue pigment, max. width 5.5 cm  
ditto JdE 57327 Sample of turquoise pigment, max. width 6.5 cm

**Omit**

The entry for Boston Museum of Fine Arts, in section on yellow pigments.

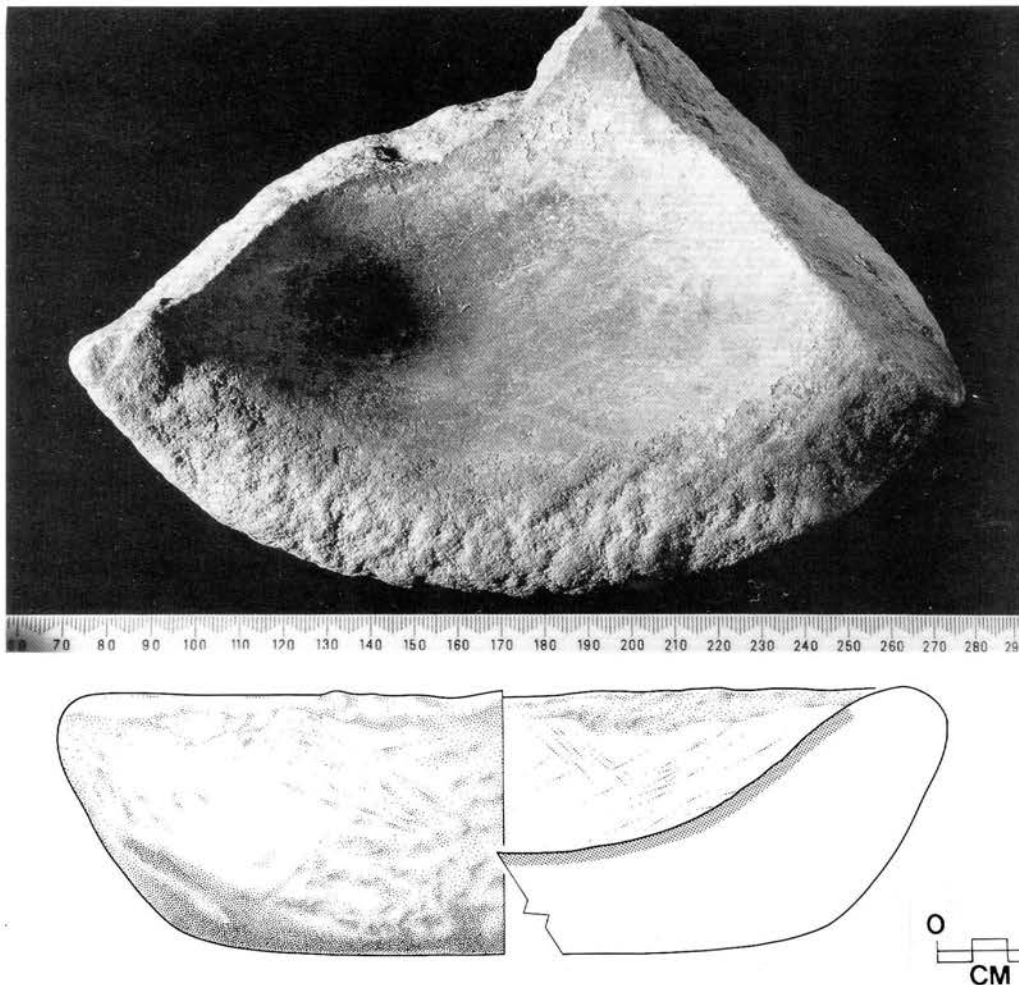
**Correct**

The excavation number of the piece of orpiment under the heading U.S.A. Unspecified Museum should be 24-5/ no no., and not 23/359.

## Pigments

### 13.5 The orpiment grinding-bowl

Close by the industrial area Q48.4 lay a large well, also excavated in 1987. From one of its upper layers (designated layer 8, see AR V: 8, Figure 1.3b) was found a section of a stone vessel containing traces of yellow pigment. It came from square G14 outside the main excavation area, in unit [2866], which is equivalent to unit [2868] in the well fill. This fill, mostly sand, is thought to be the product of erosion and wind-blown deposition, but it has not been possible to determine what time-scale lies behind the process and hence to what historic period this particular level belongs. (Although all the datable material in the well is from the Amarna period (AR V: 9), it has obviously been deposited there later, especially in the upper levels.) The presence of a heavy article is difficult to explain by either of these means and can only point to human agency. Presumably after the city was abandoned, and at the time of the filling up of the upper levels of the well, part or the whole of the vessel must have been thrown or dropped here. The robust construction of the bowl implies that the breakage may have been deliberate.



**Figure 13.2.** Grinding vessel, no G12 [2866] / 7568, drawn to half-scale. The shading shown in the section indicates the area in the vessel which retains a thin coating of orpiment.

The large size and roughness of the vessel, as well as the traces of pigment, suggest that it was once a grinding-bowl, or mortar, with the pestle, possibly a simple stone, now lost. It represents the first stage of the preparation of the paint, before it was mixed with the medium in a palette and applied for use. The fact that the bowl was found close to the industrial site Q48.4

may indicate that it came from an area, which has yet to be excavated, where paints were prepared. But other workshops further away are also possible (see below).

The limestone bowl, almost a quarter-section remaining, is roughly hewn on the exterior and rim. The interior is smoother, with some fine scratches from the shaping process. It contains traces of yellow pigment nearly up to the rim, except in a worn central patch (see Figure 13.2). The pigment has also travelled over the breaks, owing to burial in the ground. The bright crystalline appearance allows the pigment to be identified almost certainly as orpiment. At the time of study chemical analysis was not possible. Fine straw-like crystals can be seen in the interstices of the vessel. It has been stated that sometimes the ancient Egyptians ground up orpiment with realgar (Spurrell 1895: 232), but this was probably not deliberate, as orange-red particles of realgar often occur naturally with orpiment. The specimen considered here, however, looks fairly pure. The Munsell colour is 5.2Y 8.4/6.8 (=“Pantone” 127U).

Orpiment, like other ancient pigments, is very stable; it is unaffected by light or air, or by dilute acids or alkalis. However, it has a reputation for causing colour changes in paint media. In the fifteenth century Cennino Cennini, while discussing artificial orpiment, warns against its use with tempera, which it turns black. This rules out the use of egg white or yolk as a medium, but not glue-size, which he recommends. In ancient Egypt, therefore, size was probably the means of applying orpiment, although perhaps wax or gum should also be considered.

A.P. Laurie, quoting Cennini and later European art-commentators, also notes that orpiment is liable to attack other pigments, including those copper-based, applied next to it. However, ancient pigments — both the natural minerals and the manufactured copper-based frits — are reputedly more stable, so one would expect this to have been less of a problem in ancient Egypt. Perhaps a more significant property of orpiment, arsenic sulphide, is its poisonous nature — grinding up the pigment was probably a job for the apprentice!

Spurrell, who contributed much to the early study of pigments, maintains that, because of its rarity, orpiment was ground up for use in small quantities (Spurrell 1895: 231). The large size of the bowl found in the well might, however, indicate that the quantity ground in it was not necessarily small. The nearest places of origin are reputedly outside Egypt, in Turkey and Iran (Jaksch 1985: 133–43). Its occurrence in shipwrecks in the Mediterranean also appears to show that this commodity might have been obtained by trade (Bass 1986: 278). It has, however, recently been suggested that orpiment could in theory occur in the mineral deposits formed by hydrothermal processes in the Eastern Desert, such as among gold and barite veins.<sup>3</sup> Either way, its gold-like appearance and the relative infrequency in which it was used (see below) imply that it was regarded as a precious substance by the ancient Egyptians.

### 13.6 Orpiment at Amarna and elsewhere.

Specimens of orpiment have come from elsewhere at Amarna. According to EES archive records (registrar's cards), Room 4 in House O49.17 contained two large pieces with several small lumps, no. 1921/14 (in *COA* I: 28–9 this is wrongly listed as coming from house O48.17). In the 1935–1936 excavations of the Great Palace a large piece of yellow pigment was found in the East Hall, no. 1935–36/144, but this could have been yellow ochre. Lastly, in the recent excavations of the Workmen's Village, a piece weighing 1g was found overlooked in Peet and Woolley's dump, from the excavations of houses inside the Walled Village (this is discussed in Section 1 of this chapter).

Fragments of orpiment from Amarna have also been located in museums, but unfortunately the information linking them with find-spots is missing (see Table 10.2 in *AR* V). In Bolton Museum (museum no. 30.24.70) there is a rather dirty fragment of orpiment, roughly rhomboidal, with traces of red within it. These traces are presumably realgar, AsS, which is unstable and tends to transform to the more stable state, As<sub>2</sub>S<sub>3</sub>, orpiment. In Liverpool Museum (museum no. 56.20.195–6) there is a sizeable lump, about 2.5 x 1.5 x 1.0 cm, which clearly shows the laminated structure. One more piece of orpiment from Amarna went to an unspecified museum in the USA.

<sup>3</sup> Personal communication from S. Nicolescu, Department of Mineralogy, University of Cluj, Romania.

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Pieces of orpiment have also been found at other town sites in Egypt, such as at Eighteenth- or Nineteenth-Dynasty Gurob (Petrie 1890: 38), and a piece streaked with realgar at Late-Period Tanis (Petrie 1885: 39). They have also been found in Theban tombs. In the tomb of Kheruef a large and valuable quantity (2–3 kg) occurred with realgar and other pigments (Saleh, *et al.* 1974: 141–5); in Tutankhamun's tomb orpiment occurred mixed with realgar (Lucas 1933: 177).

At the city of Amarna evidence for the use of orpiment has so far been found on only one piece of wall-painting. It has recently been identified by the author on some of the fragments now in University College, London, which were found by Petrie with the famous "Princesses" panel in the King's House. Using x20 magnification, the compacted substance was noted on three fragments which form part of a standing group of princesses (Davies 1921: Pl. II) (museum no. UC 2262). It occurs as occasional specks over the skin, and mixed or layered<sup>4</sup> with other pigments to form the buff background areas. The colour identification is the same as in the grinding-bowl. On a fragment showing part of a cushion (UC 2289), the crystals could be very easily recognised in the yellow diamond pattern. On the "Princesses" panel itself, which is in the Ashmolean Museum, Petrie visually identified orpiment in the highlights on the figures (Petrie 1894: 15). Spurrell also notes that it occurred on the earrings, and that only the royal figures and not the attendants were treated with the substance (Spurrell 1895: 231–2). Orpiment is no longer visible on the figures; possibly it was inadvertently removed during consolidation treatment of the surface some years after its excavation (Petrie 1931: 139). Another find from the Central City on which orpiment has been recognised is a group of papyrus fragments which depicts a battle, where it has been used to colour the helmets of foreign (possibly Mycenaean) warriors (Schofield and Parkinson 1994: 163).

Outside the city proper, the tombs of the nobles at Amarna are decorated mainly with painted relief. In his recording of the tombs, Davies notes the presence of yellow on the walls, without commenting on its appearance. Later analysis, however, shows that at least one tomb, that of Ahmose, no 3, used a mixture of orpiment and yellow ochre (Jaksch 1985: Table 1). Orpiment has not been found in the Royal Tomb, while the identification of the green pigment in Tombs 28 and 29 in the Royal Wadi as arsenic sulphide (AsS) is questionable since the published X–RD data would indicate a copper compound (Iskander 1985: 35).

The use of orpiment applied as decoration to wooden or stone objects should also be considered (orpiment on Amarna pottery is less certain, although it has been found on pottery of the New Kingdom [Noll 1981: 428–9]). Two such objects spring to mind. Orpiment is reported by Borchardt on the stone head of Nefertiti, now in the Berlin Museum (Borchardt 1911: 12),<sup>5</sup> and by Schäfer on a wooden figure of Akhenaten (Schäfer 1934: 3). More recently, orpiment has been identified by the author on a model wooden sarcophagus containing the name of the royal scribe Iny. This came from a pit in the Royal Estate in the Central City, building P42.2, and is now in the British Museum (COA III: 90, 188, Pls. LXXIV, CIV).<sup>6</sup> Orpiment occurs on the bands around the mummy-case and on the wig, the implication being that gold was imitated. On this miniature coffin the coarse application of orpiment, without yellow ochre, is reminiscent of the observations of El-Goresy, *et al.* (1986: 27–9) regarding the full-scale royal sarcophagi of the New Kingdom.<sup>7</sup> It is a possibility that the grinding-bowl came from a painter's workshop connected with the decoration of such figures. The house of Thutmose, for instance, wherein was

<sup>4</sup> The blending of orpiment is also reported on wall-paintings in Theban tombs. This was in the yellow paint, where it would appear that the purpose was not to adjust the colour, but to eke out the rare pigment with a similar colour. In their study of the tomb paintings, El-Goresy, *et al.* (1986: 30–1) maintain that yellow ochre and orpiment were applied in separate layers. This may not always be the case, as orpiment was not reported as layered with yellow ochre in the detailed paint survey of the tomb of Queen Nefertari (Corzo 1987: 95).

<sup>5</sup> Orpiment and other pigments have recently been analysed from this figure (Weidmann and Bayer 1982).

<sup>6</sup> The orpiment has been generously applied, up to 0.5 mm thick. Under x20 magnification the pigment looks similar to the raw material in Liverpool and Bolton Museums, but erosion has reduced the laminations to piles of crystals, with some crystals more clearly defined than others, and some isolated. These are up to 0.5 mm long. In some areas the pigment is more pulverised. The Munsell reading is 3.6Y8.4/7.8–1.2Y8.1/9.3 (= "Pantone" 120–121U).

<sup>7</sup> Here orpiment was used to fill the incised designs. The exception in the period between Tuthmosis II and Horemheb is Akhenaten's stone sarcophagus where no pigment decorations were detected (Martin 1974: 13–19, Pls. 6–15, 19–20).

found the sculptor's model of Nefertiti's head, is in the square adjacent to the well, P47. Elsewhere orpiment is known to decorate royal tomb furnishings, such as noted by Lucas in Tutankhamun's tomb (1933: 174, 177–80), but it has not been identified on any objects in Akhenaten's tomb (Martin 1974).

While the occurrence of a find of orpiment is, in itself, interesting, the presence of the grinding bowl in area Q48.4 is also significant, being probably a unique find at Amarna. Shallow stone bowls have turned up at the site before, but these are unlikely to be connected with the grinding of pigment, as none shows deposits, or even traces, of colouring matter.

A different type of grinding vessel, two examples of which were found at Amarna (*AR* V: 217, Fig. 10.8; *COA* II: 27, Pl. XXXII.4), has a rectangular shape and a shallow depression on the otherwise flat top surface. They are thought to be grinders, as they are similar to, but larger than, the grinding-blocks<sup>8</sup> used for the preparation of pigments for cosmetics, or inks (e.g. Petrie 1927: 26, Pl. LVI.11–14). These latter are often found with cone-shaped mullers. Both the smaller and larger types of grinding-blocks are hewn from hard stone, such as diorite or granite.

In later times, it is interesting to note that surfaces which are not only hard (made from such stones as granite or red porphyry) but flat have been recommended by various authors for the grinding of pigments, from the Middle Ages to the modern era (e.g. Cennini 1933: 21–2; Thompson 1936: 88–9). The prescribed method is first to crush a small lump of pigment, and then to grind it with water into a creamy or pasty consistency on a flat stone, usually for as long a period as the artist-craftsman can tolerate. The pigment is gathered up and kept from going over the sides of the slab by various implements, such as a thin wooden slice. This is paralleled in ancient Egypt by a stone or wooden spatula (Černý 1952: 13).

The best practical information on the grinding of orpiment for painting comes from Cennini (1933: 29). He mentions that orpiment was the most refractory pigment to prepare. It was ground up in the same way as other pigments, but with the addition of a little crushed glass. It is suggested<sup>9</sup> that this is because the mineral orpiment has the property of perfect cleavage, which determines its breakdown into tiny platelets of differing sizes. When the crushed glass is added, the glass particles act as tiny grinders which reduce the orpiment into granulometrically homogeneous dust, such as would be suitable for painting. The difference in specific gravity of the two ground substances would allow them to be separated in a vessel containing water; a suspension or pure pigment could then be drawn off and dried, ready for use.

### 13.7 Conclusions

At Amarna, the mortar-like vessel from Q48.4, with its fairly uneven interior and visible crystals of orpiment, would suggest that the operation was not to grind up the pigment finely. As already discussed, it appears that orpiment was sometimes applied in a coarse state to stone or wooden artifacts. Although its use for the preparation of the pigment for painting should not be ruled out, it seems more likely that the bowl came from a workshop in the Central City, and had been used to break down the raw material for the application to objects made there. The hardness of the vessel would not have been such an important factor as for the harder pigments, such as malachite, haematite, and frits. It may even have been made for other uses first, and then adopted for orpiment preparation.

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<sup>8</sup> These are often called "palettes", but this is probably a misnomer. Vessels which are clearly artists' palettes are known, such as the sherds containing pigment, at Amarna (*AR* V: 217, Figure 10.9) and elsewhere; and the small pots held by artists depicted on the wall-paintings at Beni Hassan (Wilkinson 1837: Pl. 385). Shells containing pigment, such as those found in Tutankhamun's tomb, may be scribal or cosmetic palettes (Lucas 1933: 179; Černý 1952: 13). Other stone slabs found at Amarna may also be grinding-blocks rather than palettes.

<sup>9</sup> Personal communication, S. Nicolescu, Department of Mineralogy, University of Cluj, Romania.

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