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Technological study of Middle Bronze Age painted plaster fragments from the Canaanite Palace of Tel Kabri, Israel - materials and painting techniques

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ABSTRACT

This study investigated technological aspects of newly discovered painted plaster fragments from the 2008–2011 excavation seasons at Tel Kabri, Israel. Kabri is one of only four Eastern Mediterranean sites with such Aegean-style paintings.

The purpose of this technical study was to characterize the painting, discuss the technique, and identify the pigments present. Advanced imaging techniques were combined with optical microscopy and instrumental analysis for the examination of the painted fragments.

The findings of the study align very well with other studies of Aegean-style paintings from the same era, insofar as the painting techniques, the materials used, and the color palette. This includes a limited number of just five pigments that were used in order to obtain a total of eight different colors or tones: blue, yellow, orange, red, pink, black, brown and white.

The pigments identified in this study were of mineral origin except the synthetic blue pigment. This is similar to pigments found in other studies of Aegean-style paintings of that period. Blue was the most common color found. Based on the plaster characteristics, the plaster paint interface, and the quality of the surfaces, the fragments could be separated into three groups.

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1. Introduction

Tel Kabri is located in the Western Galilee in the northwestern Israel, approximately 5 km east of the Mediterranean coast (Fig. 1). It is one of only four Eastern Mediterranean sites that have examples of Aegean-style paintings (the others are Alalakh in Turkey, Qatna in Syria, and Tel el-Dab'a in Egypt) and is the only one located in Israel.

During the Middle Bronze Age (ca. 1950–1550 BCE.) the 34 ha site was the capital of a Canaanite kingdom. Excavations conducted by two expeditions have revealed the remains of one of the largest Middle Bronze Age palaces in Canaan, equipped with a rich wine cellar, large halls, and both wall and floor paintings (Kempinski, 2002; Kempinski and Niemeier, 1994; Yasur-Landau et al., 2014).

The first major excavation, undertaken from 1986 to 1993, revealed the remains of the MB II palace (Kempinski, 2002; Kempinski and Niemeier, 1994).

Paintings were found within the palace in ceremonial Hall 611. A unique, painted plaster floor there is divided into squares and decorated with both marbling and a floral design. Underneath Threshold 698, one of the entrances to this hall, approximately 2000 small painted plaster fragments (sized ~1 × 1 cm) originally from one or more wall paintings were found in secondary use as packing material. These depicted landscape and architectural scenes in a miniature style, reminiscent of the miniature fresco from the West House in Akrotiri. They have been studied by Niemeier, Cornale, and Brysbaert (Niemeier and Niemeier, 2000, 2002: 254–285; Cornale et al., 2002: 287–288; Brysbaert, 2008: 101).

The second major excavation began in 2005 and continues until present, co-directed by Yasur-Landau and Cline. This excavation significantly expanded the exposure of the palace, as well as contributing data about its development – from its construction in the 19th century BCE to its demise in the 17th century BCE (Cline et al., 2011; Cline and Yasur-Landau, 2013; Höflmayer et al., 2016; Yasur-Landau et al., 2014; Yasur-Landau et al., 2016). During these excavations, ca. 100 fragments of wall (and possibly floor) plaster were found in two areas of the

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Fig. 1. Map of the Eastern Mediterranean showing Tel Kabri and archaeological related Bronze Age sites.

palace, of which 60 were painted. As in the case of the wall paintings found by the previous expedition, these fragments, too, were not found in their original context, but in secondary use as patching for a floor and in fills. This reuse is likely to date to phase 4 of the palace, with the paintings originally in place on the wall(s) during the penultimate period of the palace (phase 3). The provisional date of the fragments is the 17th century BCE.

In area D-west, outside room 740 and ceremonial hall 611 (where the painted floor is located), several painted fragments were found in the excavated fill by wall 2129, built north of room 740 and probably functioning as a foundation for a curtain wall (Yasur-Landau et al., 2014: 362).

The majority of the painted plaster fragments were found in area D-south in the south-east wing of the palace, in a one-room monumental structure, perhaps of a cultic nature (Locus 3055). The fragments were found face down on a crushed lime floor, probably used as packing material to mend the floor (Cline et al., 2011: 250; Yasur-Landau et al., 2014: 361–2). An initial study divided the painted plaster fragments into groups based on their style and color palette (Cline et al., 2011: 245–250).

Bronze Age wall and floor paintings have been found at many sites within the Aegean region, on Crete, mainland Greece, and the Cyclades (previously Immerwahr, 1990; see now Chapin, 2010,with further references, and contributions in Brecoulaki et al., 2015). However, they are less widespread in the Eastern Mediterranean during the Middle and Late Bronze Ages, found only at the sites of Alalakh, Qatna, and Tel el-Dab'a, in addition to Kabri, as mentioned (Brysbaert, 2002, 2008, 2011; Niemeier and Niemeier, 2000; Bietak et al., 2007; Von Rüden, 2011). The Kabri Aegean-style wall paintings, dating to well within the Middle Bronze Age II period, may be as early as the Alalakh stratum VII paintings or perhaps even earlier (Cline et al., 2011).

Thus, painted fragments from Tel Kabri play a significant role in understanding the cultural contacts between the polities of the Canaanite coast and the cultures of the Aegean. Although the paintings are fragmentary and found detached from their original positions, they reveal important information regarding architectural decoration, artistic styles, cultural relations, and level of technology. Moreover, the painting techniques are often well represented in the fragments where it is much easier to investigate sections and layers (Chapin, 2010; Westlake, 2007:3–4). Therefore, they help to understand the trade and the transfer of artistic styles out of the Aegean region (Immerwahr, 1990; Jones and Photos-Jones, 2005: 204; Chapin, 2010; Von Rüden, 2011: 7).

This study investigated approximately 60 painted plaster fragments that were uncovered at Tel Kabri between 2008 and 2011. Representative fragments from the excavation are shown in Fig. 2a–d:

The main goals of this study were to identify the pigments that were in use, characterize the color palette, the color mixtures, the paint layers, and the painting techniques, as well as to examine the stratigraphy of the plaster layers.

2. Material and methods

The methodology was guided by the principle of gaining maximum data with minimum use of invasive techniques (sampling). The investigation was conducted using optical microscopy in order to limit the amount of damage to the fragments. This was followed by instrumental analytical techniques when necessary, with a preference for non-destructive analysis.

In this study, two methods were used for the first time on the Aegean-style painted fragments: Visible Induced Luminescence (VIL) technique to identify the Egyptian Blue pigment and RTI (Reflectance Transformation Imaging) to investigate the surface characteristics of the fragments.

2.1. Selection of fragments

Initial examination of the 60 painted fragments provided general information on the color palette, the painting schemes, the painting techniques, the plaster layers, and the fragments' conservation condition.

Subsequently, 20 painted fragments were selected for further analysis based on whether they provided a good representation of the entire collection and valuable information on the pigments, the painting technique, and the plaster layers (Table 1). Most of the selected 20 fragments were very small in size (5 × 5 mm) and could not be joined to other fragments. These fragments were examined using microscopy, advanced non-destructive imaging techniques, and complementary analytical spectroscopic methods.

2.2. Microscopy

A portable microscope Brunel model Dino-lite Pro AM4113T with ×50 and ×200 magnifications was used to examine the surfaces, painting techniques, plaster layers, and traces of inclusions. A Kyowa Binocular Microscope with ×6–×50 magnifications was used for examination and imaging of the fragments and to obtain the characterization of the plaster layers. A Leica DMRX Polarized Light Microscope was used for the optical analysis of samples. Cross-sections were prepared from samples (~1 mm) taken from the fragments and mounted in polyester resin in styrene with Butanox M50 hardener. The cross sections were examined in incident light for the analysis of the stratigraphy of the paint layers. Pigment samples were mounted on a glass in order to analyze and identify the pigments in transmitted light both in plane polars [PPL] and with crossed polars [XPL]) based on their optical characteristics (Eastaugh et al., 2004).

2.3. Imaging techniques

Visible Induced Luminescence (VIL) was employed with a Nikon D5100 digital camera, equipped with an IR filter (Verri, 2009) to identify and map the distribution of Egyptian Blue pigment on specific fragments. Reflectance Transformation Imaging (RTI) was used to investigate the surface of the fragments (Earl et al., 2011) together with raking light photography.

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