



# Palatial architecture under the microscope: Production, maintenance, and spatiotemporal changes gleaned from plastered surfaces at a Canaanite palace complex, Tel Kabri, Israel

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## ABSTRACT

Modern archaeology in the Near East has paid little attention to construction materials and techniques of monumental architecture within the forming cities of the Bronze Age. We present here a study of plastered surfaces in a Middle Bronze Age palace located at Tel Kabri, a Canaanite polity in the southern Levant that was connected to the Aegean world. Recent excavations uncovered many plastered surfaces within the palace and several satellite monumental structures. In order to identify the types of plaster used in construction and maintenance of the site, as well as understand spatiotemporal patterns associated with the use of plaster, we systematically sampled plaster floors and possible wall/ceiling plaster in more than ten room contexts within five monumental structures. Fourier Transform Infrared (FTIR) spectroscopy and polarized light microscopy (micromorphology) were used in tandem, demonstrating that two types of plasters exist at the site – geogenic, prepared from crushed/pulverized chalk and pressed into flat surfaces, and pyrogenic lime plaster. Lime plaster appears to have been prepared using the cold manufacture technique, i.e., from aged lime putty, and was often applied as coats, indicating maintenance. A most surprising observation is the identification of lime plaster tempered by chaff. To our knowledge, such a technology has not been identified previously and is not reported ethnographically or historically. Spatial patterns reveal that lime plaster was applied in contexts of high distinction (e.g., ceremonial, ritual) while geogenic plaster underlined contexts of more domestic nature (e.g., residential, storage). Temporal changes in plaster technology have not been identified throughout the life span of the palace. The rather limited use of lime plaster may be related to craft specialization and/or environmental impact. Future research should focus on systematic studies in other monumental structures in order to allow understanding of technology transfer and interconnectedness in the ancient Near East.

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## 1. Introduction

Monumental architecture from the ancient Near East has been studied since the earliest days of archaeology. Early excavations focused much attention on such structures, studying their architectonic plan and associated artifacts, which in turn served as guides for spatiotemporal comparisons and understanding regional and international connections. Modern archaeology (roughly since the 1970s) brought about changes in research foci in the study of Near Eastern sites. New attention began to be paid to domestic structures and household archaeology (Parker and Foster, 2012; Yasur-Landau et al., 2011) and microarchaeological

techniques began to be included in the study of Near Eastern sites from historical periods (e.g., Finkelstein et al., 2015). Following this trend, the current research presents a microarchaeological study of floors in a Bronze Age Near Eastern palace that shows connections to the Aegean world.

The rise of palaces in the southern Levant during the Middle Bronze Age (henceforth MBA, ca. 1950–1500 BCE; Bietak, 2002)<sup>1</sup> was accompanied by architectonic solutions. One of the building techniques occurring in this new class of buildings is the use of plastered floors such as identified in three palaces excavated at Aphek (Gal and Kochavi, 2000; Kochavi, 2009; Yadin, 2009), two at Megiddo (Kempinski, 1989; Loud, 1948; Nigro, 1994), one at Lachish (Ussishkin, 2004) and one at Tel el Ajjul (Kempinski, 1974; Petrie, 1933). The overarching assumption in

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<sup>1</sup> In this article we follow the chronology proposed by Bietak (2002), in which Middle Bronze Age I is dated to ca. 1950/1920–1700 BCE; Middle Bronze Age II is dated to ca. 1700–1600 BCE; and Middle Bronze Age III is dated to ca. 1600–1540/1470 BCE.

these previous studies is that the plastered floors were prepared from lime, i.e., a material produced by pyrogenic technology (see more in Section 2 below). Yet, while lime plaster was used in the southern Levant for thousands of years (since the Natufian, ca. 14,000 years ago; Kingery et al., 1988), the nature of MBA plastered surfaces was not studied systematically, except for Lachish where Shimron (2004) conducted chemical, mineralogical and petrographic analyses on samples from various periods, structures and loci.

At Tel Kabri, we are presented with the rare opportunity to study a Middle Bronze Age palace that is currently under excavation (since 2005) and which was minimally disturbed by later building efforts after its abandonment at the end of the MBA. This is a 34 ha. low mound site, situated in the western Galilee (Israel), gently rising over an alluvial plain, echoing limestone and chalk hills to the east (Fig. 1). The site has been excavated by two expeditions, the first led by Aaron Kempinski and Wolf-Dietrich Niemeier from 1986 to 1992 (Kempinski et al., 2002) and the second by Eric H. Cline and Assaf Yasur-Landau (Yasur-Landau et al., 2008, 2012, 2013, 2015). The two teams uncovered sections of a Canaanite fortified urban center that dominated the plain to its west during the Middle Bronze Age (Yasur-Landau et al., 2008). In area D, a monumental building was identified as a Canaanite palace. It may have covered at least 6000 m<sup>2</sup>, of which 1200 m<sup>2</sup> has been excavated, providing a glimpse into the building process and maintenance of a building of monumental scale, and of Canaanite political ideology (Yasur-Landau et al., 2013, 2015). Five major phases were associated with the MBA activity at the palace, spanning from MB I (ca. 1950/1920–1700 BCE) to the end of the MBII (ca. 1600 BCE) when the site was abandoned (Table 1) (Kempinski et al., 2002; Samet, 2014; Yasur-Landau et al., 2014).

While the palace at Tel Kabri is well known for its Aegean style decorated plaster floor and fragments of wall painting (Cline et al., 2011;

Niemeier and Niemeier, 2002), excavations also revealed plastered surfaces and plaster debris across the entire site, in every room and level of the construction. The abundant plaster material throughout the building is the focus of the current study, in which we aim to evaluate the nature of plaster production and use at the Kabri palace. We shall especially focus on the question of whether different types of plaster were used in different parts of the palace and at different periods during its history, or whether that plaster use was uniform throughout. A second question relates to diachronic uses of the palace, i.e., whether plaster composition is changing throughout the long use period of the palace that spanned ca. 300 years.

## 2. The study of ancient plaster

Plaster is a general term that refers to prepared smoothed surfaces, either horizontal (floors) or vertical (walls). Plastering materials have a certain degree of plasticity that enables smearing and smoothing; these include mud (from soils and/or sediments), dung, gypsum, lime, and mixtures of these materials. While mud and dung attain plasticity when wet without special pre-treatment, gypsum and lime attain plasticity following specific pyrotechnological processes that include heating, slaking, aging, and application (see details in Artioli, 2010).

The production of these pyrogenic construction materials demands investment in quarrying of raw material, fuel supply, and craft expertise. In the case of lime plaster, quicklime (CaO) is produced from the thermal disintegration of limestone or other members of the carbonate rock family (e.g., chalk, dolomite) at temperatures higher than ca. 800 °C. Quicklime is highly reactive, so when it is mixed with water to produce slaked lime, or lime putty [Ca(OH)<sub>2</sub>], much heat is released quite violently. Because lime plaster is a product of pyrotechnology applied to carbonate rocks, it is often composed of partially burnt rock



Fig. 1. Map of the Eastern Mediterranean region, showing the location of Tel Kabri as well as location of several key sites mentioned in the text.

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