King David's City at Khirbet Qeiyafa: Results of the Second Radiocarbon Dating Project

Document Version:
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KING DAVID'S CITY AT KHIRBET QEIYAFA: RESULTS OF THE SECOND RADIOCARBON DATING PROJECT

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ABSTRACT. Seventeen samples of burnt olive pits discovered inside a jar in the destruction layer of the Iron Age city of Khirbet Qeiyafa were analyzed by accelerator mass spectrometry (AMS) radiocarbon dating. Of these, four were halved and sent to two different laboratories to minimize laboratory bias. The dating of these samples is ~1000 BC. Khirbet Qeiyafa is currently the earliest known example of a fortified city in the Kingdom of Judah and contributes direct evidence to the heated debate on the biblical narrative relating to King David. Was he the real historical ruler of an urbanized state-level society in the early 10th century BC or was this level of social development reached only at the end of the 8th century BC? We can conclude that there were indeed fortified centers in the Davidic kingdom from the studies presented. In addition, the dating of Khirbet Qeiyafa has far-reaching implications for the entire Levant. The discovery of Cypriot pottery at the site connects the ^{14}C datings to Cyprus and the renewal of maritime trade between the island and the mainland in the Iron Age. A stone temple model from Khirbet Qeiyafa, decorated with triglyphs and a recessed doorframe, points to an early date for the development of this typical royal architecture of the Iron Age Levant.

INTRODUCTION

For millennia, the biblical narrative about the kingdoms of Judah and Israel was considered a reliable historical account. According to this narrative, the United Monarchy, a golden age ruled by Kings David and Solomon, was established about 1000 BC. After two generations, this kingdom was divided to form the kingdoms of Israel in the north and Judah in the south (see e.g. Malamat 1979; Mazar 1990). However, over the last 30 yr, some scholars have argued that the biblical tradition does not confirm real historical data. These interpretations entirely eliminate the United Monarchy and place the rise of the Kingdom of Israel in the early 9th century BC and that of Judah in the late 8th century BC, some 300 yr later than the biblical narrative (Lemche 1988; Finkelstein 1996; Thompson 1999). A third view is that although the United Monarchy of the biblical tradition did not exist, a kingdom was established in Judah by King David (Garfinkel 2011).

To resolve the historical and chronological debate, several hundred samples of organic materials from Iron Age sites in the southern Levant have been radiocarbon dated over the past decade. These samples were collected predominantly from excavations in progress, whose geographical distribution is limited mainly to the Kingdom of Israel, Philistia, and southern Jordan (e.g. Bruins et al. 2005; Sharon et al. 2007; Levy et al. 2008; Mazar and Bronk Ramsey 2008). No ^{14}C samples from the core area of contention, Judah in the 10th and 9th centuries BC, were tested. This situation has now been corrected by the testing of finds from the excavation at Khirbet Qeiyafa.

The accelerator mass spectrometry (AMS) ^{14}C datings of Khirbet Qeiyafa have direct implications extending far beyond the archaeology of Judah and the biblical debate. The discovery of two Cypro-Geometric barrel juglets of the types known as White Painted and Bichrome connects the ^{14}C datings to Cyprus and the entire Levant (Gilboa 2012). The distribution of these juglets includes various sites in Cyprus, Lebanon, and Israel. The barrel juglets from Khirbet Qeiyafa are among the earliest such vessels shipped out of Cyprus.

A carved stone temple model from Khirbet Qeiyafa is decorated with triglyphs and a recessed doorframe. This is the earliest known example of this elaborate royal architectural style, typical of the Iron Age and previously known from temples, tombs, and carved ivories (Garfinkel and Mumcuoglu 2013). The latter examples date from the 9th to 7th centuries BC, but it has now become clear that

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this style, including the triglyph motif of classical Greek architecture, developed some 150 yr earlier than previously thought.

THE KHIRBET QEIYAFA EXCAVATION PROJECT

Khirbet Qeiyafa is located ~30 km southwest of Jerusalem in the core area of the early biblical kingdom of Judah. An Iron Age city, 2.3 ha in area, was constructed on bedrock and surrounded by massive fortifications of megalithic stones. Seven seasons of excavation were carried out in 2007–2013; six areas of the site (Areas A–F) were examined, and over 25% of the city was uncovered. The expedition excavated the city wall, two gates, two gate piazzas, a pillar building (a small stable?), and 10 houses (Garfinkel and Ganor 2009; Garfinkel et al. 2010). The city came to an end in a sudden destruction, as indicated by hundreds of restorable pottery vessels, stone utensils, and metal objects left on the floors of the houses. Khirbet Qeiyafa was rebuilt 700 yr later and occupied during the mid-4th to early 3rd centuries BC, in the late Persian–early Hellenistic period. A few short episodes of occupation (Late Chalcolithic, Middle Bronze Age, and Byzantine) are also known at the site.

The urban planning of Khirbet Qeiyafa includes the casemate city wall and a belt of houses abutting the casemates, incorporated in the fortifications (Figure 1). Such urban planning has not been found at any Canaanite or Philistine city or in the northern Kingdom of Israel, but is a typical feature of city planning in Judean cities such as Beersheba, Tell Beit Mirsim, Tell en-Nasbeh, and Beth Shemesh (Shiloh 1978; Herzog 1997:237–49).

Figure 1 Aerial view of Khirbet Qeiyafa

We regard Khirbet Qeiyafa as a Judean city for the following reasons: (a) its location in Judah, only one-day's walk from Jerusalem; (b) city planning typical only of Judah (Garfinkel and Ganor 2009); (c) the absence of pig bones among the finds, although these do occur in the nearby Philistine cities of Gath and Eqron (Kehati 2009); (d) the ceramic baking trays, unknown at Philistine sites, that were found in nearly every house; (e) the discovery at the site of an inscription written in a Semitic language, probably Hebrew (Misgav et al. 2009); (f) the three cultic rooms uncovered in the 2010–2011 seasons did not yield objects bearing any of the anthropomorphic or zoomorphic imagery characteristic of Canaanite or Philistine cultic activity, while nude female figurines made of clay, common in this period in Israelite sites in the north, were not found at all at Khirbet Qeiyafa.

Based on pottery typology (Kang and Garfinkel 2009a,b) and the very archaic script of the inscription uncovered at the site (Misgav et al. 2009), the city clearly belongs to the very first stage of state formation in Judah. Thus, the ¹⁴C dating of Khirbet Qeiyafa plays a major role in resolving the debate on the chronology of the state-formation process in biblical Judah.

THE RADIOCARBON DATING PROJECTS

In the first ¹⁴C dating project, which took place during the early seasons of excavation (2008–2010), olive pits from various contexts in the Iron Age city were processed at Oxford University. The results suggested at the 68.3% confidence level that the destruction of the city took place between 1012 and 967 BC (Garfinkel and Ganor 2009; Garfinkel et al. 2012). However, our interpretation of these results has been criticized on the grounds that the olive pits were collected from various contexts and thus should not be averaged. In this view, the earlier dates represent the construction of the city and the later dates represent its destruction (Finkelstein and Piasetzky 2010; Gilboa 2012). Hence, the single-phase city existed from about 1050 to 925 BC. What was needed, according to this critique, was a secure context containing a large number of short-lived samples.

In the excavation season of 2012, such a secure context was found: a pottery storage jar containing some 20 burnt olive pits found in the destruction layer of the city (Figure 2). The jar (C11747) was uncovered in Building C10 near the southern city gate. Firstly, all the olive pits came from a well-controlled context, a closed container that minimized the chance of contamination (isolated olive pits can travel up and down the sediment of a site and the location in which an object is found is not always that of its original deposition). Secondly, the short-lived nature of olives suggests that they were harvested in the very last years before the destruction of the city. After this discovery, a second dating project was initiated.

Figure 2 Photograph of pottery storage jar C11747 with the olive pits

In the second ¹⁴C dating project, 11 olive pits were examined by 17 different measurements. Six olive pits were processed at the ¹⁴CHRONO Centre for Climate, the Environment, and Chronology at Queen's University Belfast and one was dated at the Oxford Radiocarbon Accelerator Unit. In addition, four olive pits were halved and a sample was sent to each laboratory. Altogether, 17 samples were analyzed, 12 at Belfast (including two reruns labeled a and b) and 5 at Oxford (Table 1).

Table 1 AMS ^{14}C dates from the Iron Age IIA city of Khirbet Qeiyafa: the second ^{14}C project. An error multiplier of 1.2 was applied to the UBA ^{14}C ages based on secondary standard replicates.

Lab nr	No.	Comments	Basket	Material	^{14}C yr BP	$\delta^{13}C_{VPDB}$ (‰)	Calibrated date BC 68.3%	95.4%
OxA-19127	KQ3		B302	Olive pit	2910 ± 26	–19.70	1189–1046	1211–1011
OxA-19589	KQ1b		B297	Olive pit	2883 ± 29	–22.23	1114–1015	1193–943
OxA-22044	KQ9		B648	Olive pit	2858 ± 33	–22.55	1111–943	1127–923
OxA-23505	KQ16		C8803	Olive pit	2852 ± 26	–20.91	1052–943	1116–928
OxA-19425	KQ5		B493	Olive pit	2851 ± 31	–20.64	1055–936	1117–925
OxA-23506	KQ15		C8811	Olive pit	2843 ± 26	–20.05	1041–941	1112–921
OxA-19426	KQ6		B375	Olive pit	2837 ± 29	–21.99	1027–933	1112–914
OxA-22045	KQ10		B651	Olive pit	2830 ± 30	–22.59	1017–927	1111–906
OxA-23504	KQ14		C8811	Grape seed	2827 ± 27	–23.05	1011–931	1054–905
OxA-19588	KQ7		B466	Olive pit	2799 ± 31	–19.55	996–914	1026–846
OxA-25615	KQ17		C11130	Olive pit	2796 ± 29	–20.29	995–910	1016–846
UBA-22138	KQ19	Identical to OxA-27783	C11747	Olive pit	2840 ± 31	–23.1	1045–935	1114–916
OxA-27783	KQ29	Identical to UBA-22138	C11747	Olive pit	2825 ± 26	–21.81	1009–931	1050–909
UBA-22139	KQ20	Identical to OxA-27612	C11747	Olive pit	2790 ± 29	–19.4	980–904	1011–845
OxA-27612	KQ30	Identical to UBA-22139	C11747	Olive pit	2838 ± 27	–20.53	1027–935	1111–916
UBA-22140	KQ21	Identical to OxA-27747	C11747	Olive pit	2895 ± 28	–20.1	1122–1026	1208–999
OxA-27747	KQ31	Identical to UBA-22140	C11747	Olive pit	2823 ± 27	–20.08	1008–931	1050–906
UBA-22141a	KQ22	Identical to OxA-27613	C11747	Olive pit	2988 ± 46	–20.2	1303–1130	1384–1056
UBA-22141b	KQ22	Identical to OxA-27613	C11747	Olive pit	2806 ± 32	–20.2	999–920	1048–851
OxA-27613	KQ32	Identical to UBA-22141	C11747	Olive pit	2884 ± 28	–21.82	1114–1016	1192–946
UBA-22142	KQ23		C11747	Olive pit	2868 ± 37	–23.7	1118–997	1192–922
UBA-22143	KQ24		C11747	Olive pit	2847 ± 40	–20.1	1056–928	1130–904
UBA-22144	KQ25		C11747	Olive pit	2896 ± 33	–27.0	1126–1016	1212–979
UBA-22145	KQ26		C11747	Olive pit	2903 ± 29	–19.7	1128–1024	1211–1004
UBA-22146a	KQ27		C11747	Olive pit	2757 ± 31	–21.3	925–843	993–828
UBA-22146b	KQ27		C11747	Olive pit	2871 ± 29	–16.5	1113–1004	1188–933
UBA-22147	KQ28		C11747	Olive pit	2776 ± 38	–22.9	976–850	1011–831
OxA-27748	KQ33		C11747	Olive pit	2790 ± 27	–21.24	977–905	1011–846

Calibrations were made using the OxCal v 4.2 software (Bronk Ramsey 1995, 2009a) against the IntCal13 radiocarbon calibration curve interpolated to yearly intervals (resolution = 1) (Reimer et al. 2013).

Pretreatment

The samples analyzed at Oxford were pretreated according to the Oxford protocol for charred plant remains (Brock et al. 2010). The samples underwent an acid-base-acid (ABA) pretreatment consisting of an initial hydrochloric acid wash at 80°C for ~20 min, a sodium hydroxide base wash at 80°C for ~20 min, and a final acid wash at 80°C for ~1 hr. The samples were then freeze-dried at –18°C

for a minimum of 12 hr and then weighed into clean tin capsules. They were then combusted and graphitized for measurement.

The Belfast samples were placed in beakers that had been cleaned and baked at 500°C for 8 hr. Hydrochloric acid (4%, 30–50 mL) was added to cover the samples and they were heated on a hotplate (80°C for 2–3 hr). The samples were then rinsed in deionized water until neutral and dried overnight at 60°C. The dried samples were weighed into precombusted quartz tubes with an excess of copper oxide (CuO), sealed under vacuum, and combusted to carbon dioxide (CO_2). The CO_2 was converted to graphite on an iron catalyst using the zinc reduction method (Slota et al. 1987). The $^{14}C/^{12}C$ ratio and $^{13}C/^{12}C$ ratio were measured by AMS at the ^{14}CHRONO Centre.

Dating Jar C11747: Average and Bayesian Modeling

Because all samples are of the same species and were contained in a storage jar found *in situ* on a bench, we can assume that they all date from the same year and therefore contain the signal of the same ^{14}C reservoir. Therefore, a weighted average of all 15 samples (and the two reruns) was taken. The results are presented in Table 2 and Figure 3. The weighted average dates the samples to 1018–948 BC at 68.3% or 1047–938 BC at 95.4%. The data set fails the χ^2 test at 5% (df = 16, T = 44.3 (5% 26.3)). The removal of samples UBA-22141a and UBA-22146a, which are unusually high and low, respectively, does not correct the problem. The further possible outlier UBA-22145, which might bias the average to an older date (and hence the High Chronology), has been eliminated. The weighted average then passes the χ^2 test at 5% (df = 13, T = 22.0 (5% 22.4)) and dates to 1013–947 BC at 68.3% and 1044–934 BC at 95.4%. No major shift in calendar years between the weighted average before and after outlier removal was observed. The average calculated with the outlier analysis after Bronk Ramsey (2009b:1028–9) yields nearly identical results of 1018–948 BC at 68.3% and 1047–936 BC at 95.4%, identifying the same three samples as outliers. A comparison between laboratories and different pretreatments of the halved samples passed the χ^2 test (5%) with the exception of the reruns UBA-22141a and UBA-22141b, which failed as a pair but independently agreed with OxA-27747.

Table 2 Weighted averages of samples recovered from jar C11747.

R_Combine	68.3%	95.4%	χ^2
All 17 samples	1018–948	1047–938	Fails at 5%: df = 16, T = 44.3 (5% 26.3)
15 samples (UBA-22141a and UBA-22146a removed)	1021–947	1046–939	Fails at 5%: df = 14, T = 26.6 (5% 23.7)
14 samples (UBA-22141a, UBA-22146a, and UBA-22145 removed)	1013–947	1044–934	*df* = 13, T = 22.0 (5% 22.4)
All 17 samples with outlier analysis	1018–948	1047–936	

If one accepts the possibility of residual olive pits remaining in the jar and thus the mixing of several harvests, a phase model should be applied. It is likely that most samples originate from immediately before the destruction, with a decreasing likelihood of older residual samples. Therefore, a phase model restricted at its start with a Tau boundary and at its end with a simple boundary was chosen to incorporate this taphonomic information (Figure 4). Reruns of the same olive pit were averaged with R_Combine and the weighted average was included as a single data point. Note that the average of two samples (UBA-22141a, UBA-22141b and OxA-27613; UBA-22146a and UBA-22146b) does not pass the χ^2 test. Therefore, the ill-fitting determinations (samples UBA-22141a and UBA-
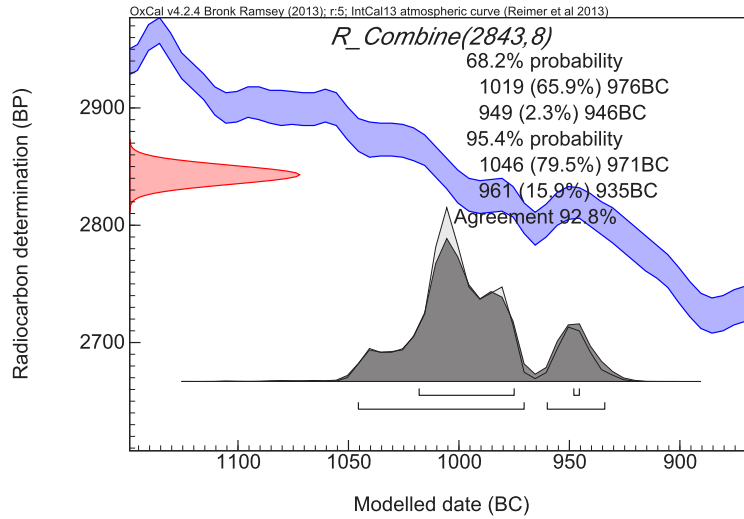
Figure 3 Calibrated probability distribution of the average of all 17 determinations from jar C11747 shown with the IntCal13 calibration curve.

22146a) have been removed from the data set. The General outlier model analysis (Bronk Ramsey 2009b) was employed as an objective statistical tool to identify outliers, which were subsequently downweighted in the model. As the OxCal program does not allow outlier analysis in phase models that include weighted averages, the calculated weighted average has been included as R_Date.
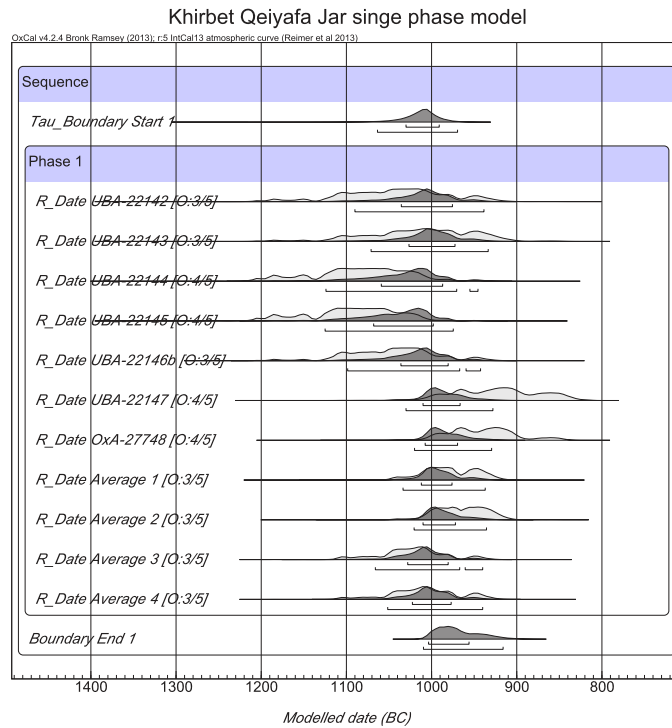

Figure 4 Single-phase model on jar C11747

The start boundary is dated to 1031–992 at 68.3% and 1064–970 BC at 95.4%. The end boundary, which represents the destruction of the city, is dated to 1004–957 BC at 68.3% and 1010–917 BC at 95.4%. The latest olive pits sampled from the jar should thus be dated to the first third of the 10th century BC.

Dating the Destruction of Khirbet Qeiyafa

The results of the first and second ¹⁴C projects are now combined into a single-phase model in order to date the destruction of the city of Khirbet Qeiyafa. All samples are short-lived olive pits except for OxA-23504 (a grape seed) and thus most likely date from just before the destruction event. Therefore, a Tau-start boundary and a normal end boundary were chosen. The 17 determinations from the jar were averaged using R_Combine and then included in the model as R_Date calculated with outlier analysis (Table 2). The end boundary, which indicates the destruction of the city, is calculated as 1006–961 BC at 68.3% and 1011–921 BC at 95.4% (Figure 5). Khirbet Qeiyafa was most likely destroyed somewhere in the first third of the 10th century BC. Allowing a few decades for the existence of the city prior to its destruction, the latest feasible option for its foundation is the late 11th or early 10th century BC (Table 3).
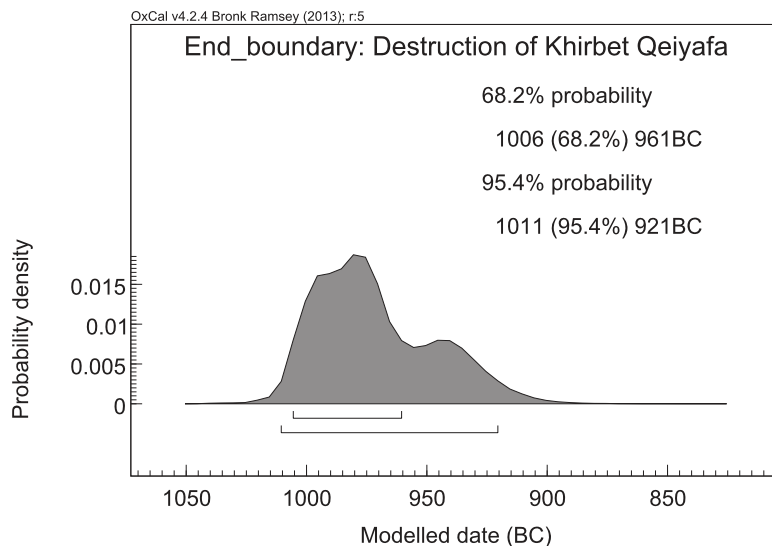

Figure 5 End boundary of single-phase model for Khirbet Qeiyafa (destruction date)

Table 3 Phase models for the entire site.

| Model | Area | Start date BC | | End date BC | | $A_{overall}$ | A_{model} |
		68.3%	95.4%	68.3%	95.4%		
Single-phase Tau	Jar only	1031–992	1064–970	1004–957	1010–917	98	101.6
Single-phase Tau	Entire site	1021–994	1046–975	1006–961	1011–921	94.4	127.5

IMPLICATION FOR CYPRIOT CHRONOLOGY

Two Cypro-Geometric barrel juglets of the types known as White Painted and Bichrome were found at Khirbet Qeiyafa (Figure 6). Barrel juglets are among the earliest pottery types, exported from Cyprus in the Iron Age (Gilboa 2012). As their distribution includes various sites in Cyprus, Lebanon

(Tyre and Sarepta), and Israel (Achziv, Dor, Tel Zeror, Azor, and Tell el-Farʿah south) (for detailed discussion, see Gilboa 2012), this ceramic shape is an essential crosslink between the absolute chronologies of Cyprus and the southern Levant. The conventional dating of these juglets is the middle or late 10th century BC (Gilboa and Sharon 2003; Iacovou 2012:23). Indeed, it is possible that this pottery group reached its zenith in the late 10th century BC; however, the new radiometric datings from Khirbet Qeiyafa clearly indicate that the beginning of this pottery tradition started as early as ~970 BC. This early date contradicts the various attempts to lower the chronology of the Iron Age IIA era in the Levant and the eastern Mediterranean (see e.g. Gilboa 1999; Fantalkin 2001; Fantalkin et al. 2001; Gilboa et al. 2008).

Figure 6 Cypro-Geometric barrel juglet found at Khirbet Qeiyafa.

DISCUSSION

The second dating project provides a reliable and precise date for the end of the Judean city of Khirbet Qeiyafa. This chronological anchor has significant implications for the debated Iron Age chronology and its connection to the biblical tradition. "Minimalist" approaches have flourished over the past 30 yr, claiming that since there are no archaeological data for fortified urban centers in Judah from the 10th–9th centuries BC the Judahite monarchy could have developed only in the late 8th century BC. However, the ^{14}C data from Khirbet Qeiyafa clearly indicate that the process of state formation and urbanization started in the Kingdom of Judah as early as the late 11th century BC. Even if one hesitates to accept unequivocally the historicity of the golden age of the "United Monarchy" as portrayed in the biblical narrative, it does appear that a kingdom was established at that time in Judah.

These results fit well with the recent ^{14}C sequence and subsequent modeling of the Iron Age levels at Megiddo (Gilboa et al. 2013). A Bayesian model of the available data (after removal of outlying samples) calculates the transition of Iron IB to Iron IIA transition at Megiddo as 990–945 BC at 68.3% and 1000–925 BC at 95.4%. This, however, is based on only three Iron Age IIA samples.

The destruction of Khirbet Qeiyafa in the first third of the 10th century BC has direct implications

for the dating of the Cypro-Geometric barrel juglets. As the barrel juglets from Khirbet Qeiyafa are among the earliest such vessels shipped out of Cyprus, their dating shows when maritime trade connections began in the Iron Age Levant. In the same way, the dating of the stone model with triglyphs and recessed doorframe provides an indication of the beginning of the typical Iron Age royal architecture.

ACKNOWLEDGMENTS

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