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# METROLOGICAL INVESTIGATIONS AT 8th AND 9th CENTURY SAMARIA AND MEGIDDO, ISRAEL

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## ABSTRACT

"Inductive" metrology is an invaluable tool in the debate regarding the chronology of the northern Kingdom of Israel in the 8th and 9th centuries BCE.

Findings show that the Building Period I 'Omride' palace at Samaria and the Stratum VA-IVB Palace 1723 at Megiddo were both built using the "short cubit" of 0.45 m., an Egyptian unit of measurement dating to the Third Intermediate Period. The second dynasty belonging to that period is the 22nd "Libyan" Dynasty (935-730), which coincides with the inception of the Omride dynasty in the 9th century, circa 880 BCE.

The Building Period II fortifications at Samaria and key Stratum IVA elements at Megiddo were both built using the "Assyrian cubit" of 0.495 m., signifying that these two cities must have been built during a period of Assyrian influence or even under its patronage, and should be dated no earlier than the 8th century BCE.

**KEYWORDS:** Samaria, Megiddo, Chronology, Architecture, Stratum VA-IVB, Building Period, Omride, Israel

## THE DISCOVERY OF THE USE OF BOTH THE 0.45 m "SHORT CUBIT" AND THE 0.495 m. "ASSYRIAN CUBIT"

This paper establishes which standard of measurement was employed in the construction of two of the 8th and 9th century key cities in the northern Kingdom of Israel - Samaria, the capital city, and Megiddo, its sentinel emporium located on the *Via Maris*.

Samaria is a rocky hill-top site, first

inhabited in the early Iron Age as a lucrative oil and wine production center (Stager 1990; Franklin 2004). The earliest monumental buildings (the focus of this article) were erected when this economic hub was chosen by Omri (I Kings) as the capital of the northern Kingdom of Israel in circa 880 BCE. The establishment of the Omride dynasty at Samaria is also documented in the Assyrian records (Eph'al 1991,37-38).

Conversely Megiddo is a multi-layered Tel, continuously inhabited from the Chalcolithic period to the Persian period. Of particular notice is the Mycenaean influence and/or trade connection at Megiddo, that were quite strong during Late Bronze Age II (abundance of pottery, tomb etc) and continued to a lesser extent into the Iron I period.

The debate regarding the chronology of the Iron Age strata, including the monumental architecture (the focus of this article), has been in the limelight for the last decade (Finkelstein 1996). Recently crucial evidence for lowering the date of the Iron Age strata of some of the major archaeological sites in the Northern Kingdom of Israel, including Megiddo, by ca. a 100 years has become available; namely new C14 readings (Finkelstein 2004; Gilboa and Sharon 2001). Yet despite this new data the debate regarding the identification of the 9th century strata at Megiddo continues (Mazar 1997; Ben-Tor 2000).

However, Samaria, the capital city of the northern Kingdom of Israel, can be used as a link in the chronological chain, and an important aspect of this link is dealt with below. Namely, two different units of measurement are revealed to be in use simultaneously at both Samaria and Megiddo, and it is this correspondence that can be used as an aid in establishing the relative, and absolute, chronology of these two cities.

Since Sir Flinders Petrie's pioneering work on metrology in Egypt (1877), it has been widely believed that metrology can throw light on ancient building practices and possibly trace spheres of influence. There are a number of possible "cubits" that may have been in use during any given period and archaeologists investigating this issue must resort to "inductive" metrology, i.e., they must search for the "regularities" in any building that will indicate the use of a particular unit of measurement. Once a prospective unit is recognized, a grid based on that unit must then be applied to all features of the building to test its reliability.

The earliest attested use of a unit of measure is the 0.525 m. "royal cubit," seen at both Yarmuth and Megiddo during the Early Bronze Age (de Miroschedji 2001). However, unlike the standards we know today, more than one unit of measure, i.e., cubit, was used in antiquity. The Egyptian-Near Eastern community of cubit-based metrology was far reaching, although Hitchcock's (1997,246-247 footnote 20) work on Late Bronze Age Crete found no evidence for a specific Minoan cubit, however this issue is still controversial. In ancient Israel during the Iron Age the use of more than one specific unit of measurement is implied in the phrase, "cubits of the old standard," in II Chronicles 3:3. This fact has been proven by both archaeological excavation and subsequent measurement. The identification of differing cubits can be facilitated when two distinct units of measure have been used on adjacent monuments. In such instances, the "regularities" on the different buildings are accentuated and thus assist in the determination of the unit of measure. For example, in 8th century BCE Jerusalem, adjacent rock-hewn tombs used both the "royal cubit" of 0.525 m. and the "short cubit" of 0.45 m. (Barkay and Kloner 1986). In 7th century BCE Megiddo, both the "Assyrian cubit" of 0.495 m. and the "Assyrian common cubit" of 0.396 m. were employed during the occupation phase represented by

Stratum III. The former was used for town planning and the latter for the palaces (Peersmann 2000,526-527).

Numerous attempts have been made to determine the "length of measure" (i.e., cubit) used in the construction of ancient rock-cut tombs and monumental buildings. Nevertheless caution must be expended when dealing with the measurements of monuments. In some instances, only the foundation or the foundation trench of the building remained as a testament to its original layout. In most cases, the monuments cannot be re-measured on site since they have either been removed or reburied. In such instances, the measurements can only be collated from the published plans. However when measurements are given in the text, it is often not clear which wall is actually referred to, or if they are interior or exterior measurements. Recently, it has been conclusively shown by de Miroschedji (2001, 471-480) that considering the exterior measurements is crucial. Furthermore, the actual guidelines for the building were often drawn on the approximately-laid foundations (Petrie 1938, 47-48). For example, the northern foundation wall of Megiddo's Palace 1723 has "setting out" marks incised into its outermost ashlars (*Megiddo I*, 20, Fig. 29).

This paper will focus on the monumental buildings at Samaria and at Megiddo and, contrary to standard archaeological practice, the later phases at both sites will be dealt with first in order to better elucidate the subject.

## SAMARIA

The original excavators of Samaria-Sebaste, the Harvard Expedition (Reisner *et al.* 1924), excavated the bulk of the Iron Age II monumental architecture. They referred to this architecture as the "Omri" Palace and the "Ahab" Palace respectively. The Joint Expedition (Crowfoot *et al.* 1942) re-evaluated the "Omri" Palace, re-naming it Building Period I, and further excavated the "Ahab" Palace, renaming it Building Period II.

Certain measurements given in the text do not match the published plans meticulously drawn by Clarence Fisher on behalf of the Harvard Expedition, and for the purpose of this paper the plans have been used and not the text.

The Building Periods were evaluated solely on stratigraphic grounds, and the pottery, despite a re-evaluation conducted by Tappy (1992), has not been a decisive chronological aid. The earliest monumental building at Samaria was attributed, on the basis of the passage in I Kings 16:23-24, to the 9th century BCE and specifically to Omri, King of Israel (Reisner *et al.* 1924). The period, later renamed Building Period I (Crowfoot *et al.* 1942), is represented by this inaugural building, while the later city is represented by Building Period II, which has conventionally been attributed to Omri's son, Ahab. Until now, it has been accepted that Building Periods I and II closely follow one another, particularly as there were no secure pottery loci to aid in their stratigraphic affiliation. Recently I have conducted a thorough reanalysis of the complex stratigraphy of the early Building Periods at Samaria and I have conclusively shown that Building Period I was of a much longer duration than previously thought, while Building Period II represents a new era, signifying a new regime (Franklin 2004).

## BUILDING PERIOD II

The major architectural elements attributed to Building Period II were constructed using the popular "Assyrian cubit" of 0.495 m. This cubit is first recorded on a statue of Gudea, King of Lagash, from 2170 BCE (Dilke 1997, 25) and it continued in use into the Assyrian period. The "Assyrian cubit," closest to the present-day metric system, tends to conform to modern plans,

making it the most easily recognized of all the ancient measures. Other cubits were sometimes used in Assyria, e.g., evidence from Khorsabad suggests the use of a short cubit of 0.396 m. (Scott 1958: 207-208).

*1) The Casemate Wall (fig.1)*

The western and southern sections of the casemate wall are 10 "Assyrian cubits" wide (ca. 5 m., 4.95 = 10 cubits). The casemates in the northern section are 18 "Assyrian cubits" wide (ca. 9 m., 8.91 = 18 cubits). The outer walls are 4 "Assyrian cubits" thick. The inner walls are 2 "Assyrian cubits" thick. The known short wall lengths are 80 (ca. 39.5 m., 39.6 = 80 cubits), 40 (ca. 20 m., 19.8 = 40 cubits), and 30 (ca. 15 m., 14.85 = 30 cubits) "Assyrian cubits" long. (Some of the other "published" lengths were based on reconstructions and should be treated with caution. The unusual length of only 28 "Assyrian cubits" recorded on the wall's southern projection may have resulted from necessity due to the acropolis's southern scarp).

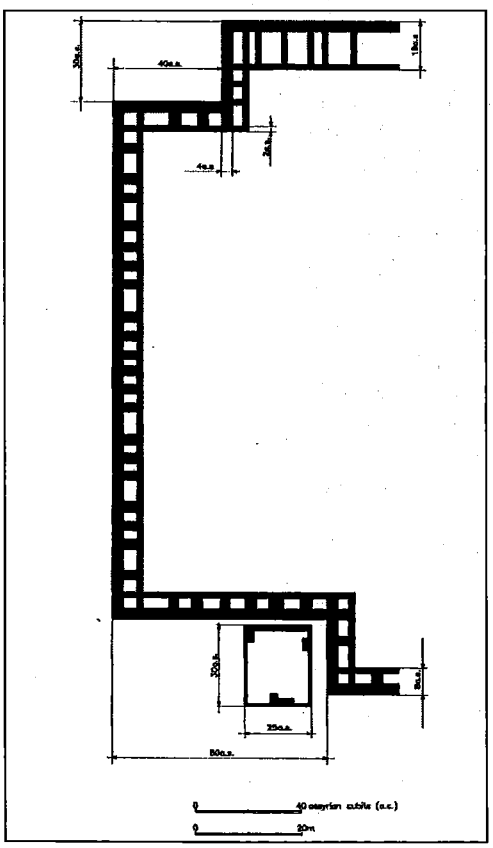

Fig. 1: Samaria Building Period II – The Casemate Walls and the Southern Tower.

*2) The Southern Tower (fig. 1)*

The Southern Tower is 25 by 30 "Assyrian cubits" (ca. 12.5 m., 12.375 = 25 cubits by ca. 15 m., 14.85 = 30 cubits). In addition, the tower is located 2 "Assyrian cubits" south of the casemate wall's southern stretch, and 6 "Assyrian cubits" west of the western face of the casemate wall's southern projection (ca. 3 m., 2.97 = 6 cubits).

## BUILDING PERIOD I

The earliest monumental building is the Building Period I "Omride" palace. It was built using the "short cubit" of 0.45 m. This unit of measurement was used during the Third Intermediate Period in Egypt (Shaw and Nicholson 1995,174). Also known as the "Egyptian short cubit," it consisted of six "palms," to differentiate it from the more common "Royal cubit" of seven "palms" (Ben-David 1973,27). It actually corresponds to 44.9 cm., but is usually computed as 0.45 m. Although the palace was only partially preserved and excavated, the remnant exposed provided ample evidence for the use of the "short cubit."

*1) The Building Period I Palace (fig. 2)*

The palace is built on the top of a rock-cut scarp that helps delineate its outline. The west wing is 60 "short cubits" long (ca. 27 m., 27 = 60 cubits, half a rope).It projects out from the main building line by 12 "short cubits" (ca. 5.5 m., 5.4 = 12 cubits, one rod) in the north, and by 16 "short cubits" (ca. 7.5 m.,

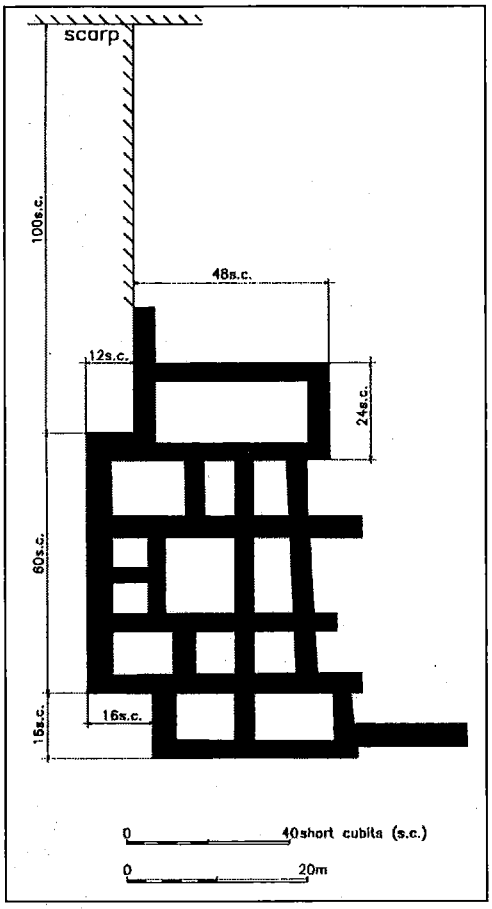


Fig. 2: Samaria Building Period I - The Omride Palace

7.2 = 16 cubits) in the south. There was also a southern extension that projected as far as the southern scarp, 16 "short cubits" (ca. 7.5 m., 7.2 = 16 cubits). North of the main building there is an enclosed rectangular courtyard, 24 "short cubits" (ca. 11 m., 10.8 = 24 cubits, two rods) by 48 "short cubits" (ca. 21.25 meters, 21.6 = 48 cubits = four rods). Furthermore, a probable northern extension from the western projection, still partially preserved below the stairs leading to the Herodian period Temple of Augustus, may have reached the northern scarp 100 "short cubits" to the north.

## SAMARIA: A SUMMARY

The use of two different units of measurement, the "short cubit" and the "Assyrian cubit," points to two different architects and/or building teams being responsible for Building Periods I and II. In fact, the city represented by Building Period II is very different from that of Building Period I. This is in keeping with the revised stratigraphy of Samaria and the newly attributed long duration attributed to Building Period I by the author (Franklin 2004).

## MEGIDDO

The Chicago Expedition originally allocated Stratum IV to the 10th century BCE, the period of the United Kingdom under Solomon. Later, Yadin (1960) renamed the stratum Stratum IVA, and attributed it to the 9th century BCE, the period of the Divided Monarchy under the Omride Dynasty. The latter attribution was the prevailing one until it was questioned by Finkelstein (1996).

### Stratum IVA

The major architectural elements attributed to Stratum IVA at Megiddo were constructed using the "Assyrian cubit" of 0.495 m.

*1) City Wall 325 (fig. 3)*

City Wall 325 is 8 "Assyrian cubits" wide (ca. 4 m. = 8 cubits). The offsets and insets are at regular intervals of 12 "Assyrian cubits" (one rod) along its length.

*2) City Gate 2156 (fig. 3)*

City Gate 2156 is 36 "Assyrian cubits" wide. It has been conclusively shown by Ussishkin (1980) to belong to Stratum IVA as originally allocated by the excavators. The gate is between 17.5 and 18 m. wide (17.82 meters = 36 cubits = three rods) and 40 "Assyrian cubits" long. According to Ussishkin (*ibid.*), it is ca. 20.3 m. long, but on the plan the

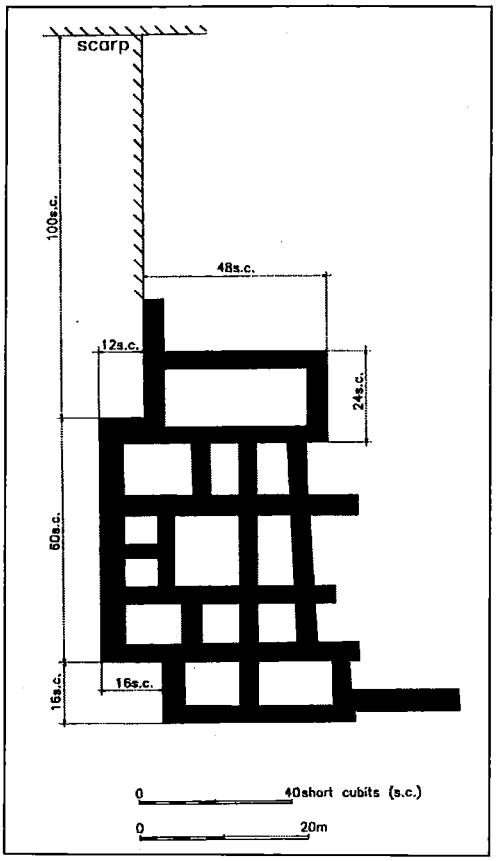


Fig. 3: Megiddo Stratum IVA – City Wall 325 and gate 2156

measurement appears to be slightly less (19. 8 m. = 40 cubits = one third of a rope).

The passageway through the gatehouse is 10 "Assyrian cubits" wide, (ca. 5 m., 4.95 = 10 cubits), and the narrowest section of the entranceway is 8 "Assyrian cubits" wideΨjust wide enough to allow two Assyrian chariots to pass each other, for the axle length of an Assyrian chariot was 1.80 m. (Nimrud I, 83).

*3) The Southern "Stables" (fig. 4)*

Courtyard 977 is 120 "Assyrian cubits" square (ca. 60 m. = 120 cubits, a rope). This is a known square unit – an Akkadian iku. The Courtyard Entrance 1846 is 8 "Assyrian cubits" wide (ca. 4 m. = 8 cubits). (See also fig. 6.) The two side rooms, 1847 and 1848, are 10 "Assyrian cubits" wide (ca. 5 m., 4.95 = 10 cubits). Each stall plus one side wall is 8 "Assyrian cubits" wide (ca. 4 m. = 8 cubits). Each stall is 56 "Assyrian cubits" long (ca. 28 m., 27.72 = 56 cubits). The line of city wall, Wall 325, runs 30 m. or 60 cubits, south of the stable courtyard. That is, a length of 60 cubits was set aside for each stall. However, a length of ca. four cubits was apparently required for technical reasons and so the length of each stall was reduced to 56 cubits.

*4) Building 338*

The measurements for Building 338 (based on the published plan) are not decisive but they do favor the use of the 0.495 m. "Assyrian cubit," i.e., ca. 42, 34, 28, 22, 20, 16, and 10 "Assyrian cubits."

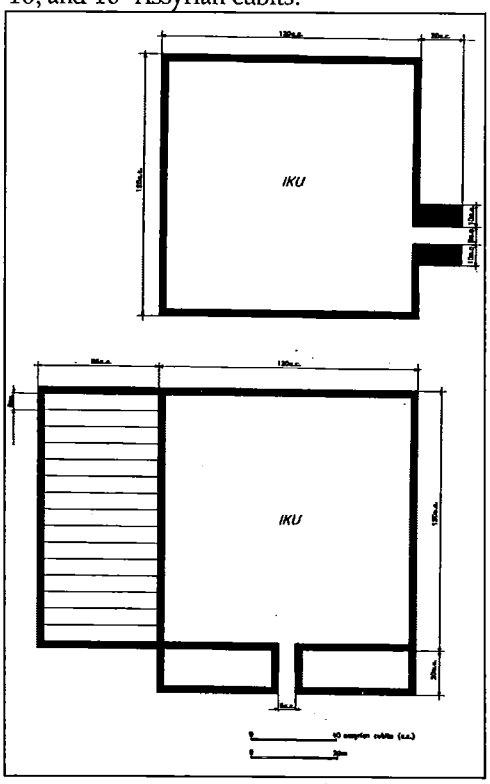


Fig. 4: Megiddo Stratum IVA – Stable Courtyard 977 and Gate 1846; Courtyard 1693 and Gate 1567

**Stratum VA-IVB or V?**

Now that it has been established that Stratum IVA at Megiddo was built using the "Assyrian cubit" I will return to the preceding stratum, Stratum VA-IVB.

This stratum was originally designated by the Chicago Expedition as Stratum IVB and attributed to the early part of the 10th century BCE, under Davidic rule. According to Chicago, Stratum IVB was comprised of a monumental palace (Palace 1723) set in a courtyard (Courtyard 1693). Later, Albright (1943) amalgamated Stratum IVB with certain elements of Stratum V to form Stratum VA-IVB, which he attributed to the 10th century BCE, the period of the United Monarchy under Solomon. Recently I have conducted a thorough reanalysis of the complex stratigraphy of Stratum V, Stratum VA-IVB, and Stratum IVA (Franklin forthcoming). There I have conclusively shown that there is no separate entity that can be named Stratum VA-IVB and that the architectural elements must be reallocated to either Stratum V or Stratum IVA.

**Stratum V**

The central monumental building belonging to Stratum V can now be seen to be Palace 1723.

*1) Palace 1723 (fig. 5)*

The northern wall of the palace is 50 "short cubits" (ca. 22.975 m., 22.50 = 50 cubits) (Megiddo I:18, note 10). The northern wall of the palace's platform (Platform 1728) is 16 "short cubits" (ca. 7.7 m., 7.2 = 16 cubits) (Megiddo I:18). The southern wall of the palace is 48 "short cubits" long (ca. 21.25 m., 21.6 = 48 cubits = 4 rods). The western wall of the palace is also 48 "short cubits" long, which can be further broken down into six lengths of 8 "short cubits" or three lengths of 16 "short cubits." The eastern wall of

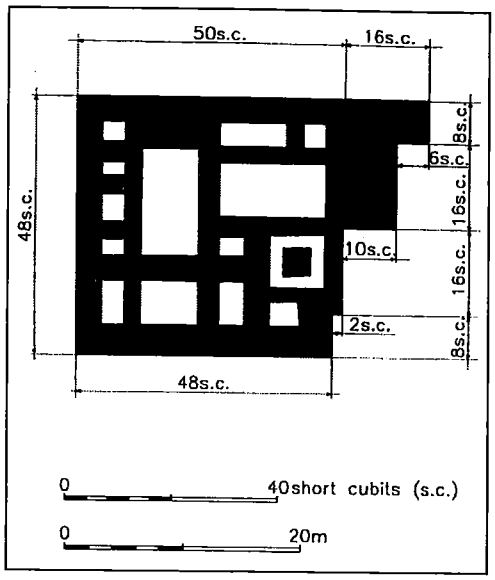


Fig. 5: Megiddo - Palace 1723

Platform 1728 repeats this pattern of 8 and 16 "short cubits." Platform 1728 is at its greatest extension for a length of 8 "short cubits." The remaining 16 "short cubit" length of the platform is reduced by 6 "short cubits." South of the platform, the eastern wall of the main building is exposed for 16 "short cubits" and then recessed by 2 "short cubits" for a length of 8 "short cubits."

**Stratum VA-IVB or IVA?**

The Chicago Expedition proposed that Courtyard 1693 was constructed in Stratum IVB (later VA-IVB) to enclose Palace 1723, and that after the palace was dismantled, the courtyard (Courtyard 1693) continued in use during Stratum IVA. Herzog (1997) and Kenyon (1971) suggested that Palace 1723 was constructed in Stratum V, and that it co-existed with Courtyard 1693 only later, before being dismantled. However, following my stratigraphic reanalysis of Stratum VA-IVB, Courtyard 1693, including Gate 1567, and Platform 1617, it can now be seen that they all originate in Stratum IVA, that is, the Courtyard

never co-existed with the Palace. Furthermore, these elements were built using the "Assyrian cubit" and therefore conform to the other buildings that originate in Stratum IVA.

*1) Courtyard 1693 (fig. 4)*

Courtyard 1693 is 120 "Assyrian cubits" square (ca. 60 m. = 120 cubits), the unit of land measurement known as the iku. The courtyard was bordered on three sides by Wall 1610 and on its south side by city wall, Wall 325 (Franklin Forthcoming). Note Courtyard 1693 has the same measurements as Stable Courtyard 977, which has always been allocated to Stratum IVA.

*2) Gate 1567 (fig. 4)*

The piers are 10 "Assyrian cubits" wide (ca. 5 m., 4.95 = 10 cubits) and 20 "Assyrian cubits" long (ca. 9.6 m., 9.9 = 20 cubits). Gate 1567 enabled access to Courtyard 1693.

The entranceway is 8 "Assyrian cubits" wide (ca. 4 m. = 8 cubits). This is the same width as Gate 1846 that enabled access to Courtyard 977, and the narrowest part of Gate 2156 that served as the main city gate.

*3) Platform 1617*

Platform 1617 is 20 "Assyrian cubits" long (ca. 9.6 m., 9.9 = 20 cubits). The western section is 10 "Assyrian cubits"wide (ca. 5 m., 4.95 = 10 cubits). The eastern section is 6 "Assyrian cubits" wide (ca. 3 m., 2.97 = 6 cubits). Note that Platform 1617 abutted the upper elevation of Wall 1610, and was at the same elevation as the surface of Courtyard 1693 (Franklin forthcoming).

**Stratum IVA or III ?**

*1) Building 1616*

Building 1616 was constructed directly over the remains of Palace 1723. Its layout was similar to the earlier building but it was built on a slightly smaller scale. The Chicago Expedition could not securely attribute Building 1616 to either Stratum IVA or Stratum III, and the discussion regarding Building 1616 was placed in the section relating to Stratum III but the possibility was acknowledged that the building originated in Stratum IV (*Megiddo I*, 21, 68 ff.). Once again, following my detailed stratigraphic analysis of Stratum V to Stratum IVA, Building 1616 can finally be securely allocated to Stratum IVA (Franklin forthcoming). J. Peersmann (2000, 526-527) previously noted that Building 1616 was built using the "Assyrian cubit," while the other monumental buildings of Stratum III were built according to the "Assyrian short cubit" of 0.396 cm.

**Megiddo: A Summary**

The use of the "short cubit" of 0.45 m. in Palace 1723 is unique at Megiddo. Its use sets the structure apart from the other architectural elements that have been associated with it until now. This metrological study strengths the author's revised stratigraphy of Stratum V and Stratum IVB (Franklin forthcoming). It confirms that Palace 1723 existed exclusively in Stratum V and that it was replaced by Building 1616 in Stratum IVA. The two adjacent courtyards, each measuring an Assyrian iku, were built together and formed an integral part of the great Stratum IVA city.

## CONCLUSION

The Building Period I palace at Samaria and the Stratum V Palace 1723 at Megiddo were both built using the "short cubit" of 0.45 m., an Egyptian unit of measurement dating to the Third Intermediate Period. The second dynasty belonging to that period is the 22nd "Libyan" Dynasty, 935-730, which coincides with the reign of Omri, 882-871 (Kitchen 1986).

This chronological anchor accords with the biblical account that the palace at Samaria marks the inception of the Omride dynasty in

the 9th century BCE. Palace 1723 at Megiddo appears to have been constructed by a team of architect/builders who also used the same Egyptian-influenced building practices. Therefore, Palace 1723 and the Palace of Omri must be contemporaneous. This is not the only evidence discovered by the author that links the two buildings. Another unique feature is the common use, in the foundations of both palaces, of distinctive masons' mark (Franklin 2001).

Building Period II at Samaria and Stratum IVA at Megiddo (including certain elements until now incorrectly attributed to Stratum VA-IVB and Stratum III) were both built using the "Assyrian cubit" of 0.495 m. Therefore the major architectural elements at both cities must have been built during a period of Assyrian influence or even under its patronage. This fact points to a period some decades after the inception of the Omride dynasty. Furthermore, stratigraphically Building Period II at Samaria can now no longer be attributed to Ahab, 871-852, the second king of the Omride dynasty (Franklin 2004). In other words, Building Period II at Samaria and Stratum IVA at Megiddo should be dated no earlier than the 8th century BCE.

This metrological correspondence between Samaria, the capital of the northern Kingdom of Israel, and Megiddo, can now be seen to be a significant component in establishing the revised chronology for the 8th and 9th centuries BCE.

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