

2,511 feet above the sea, but on finding the surface of water in both of a different height, this cannot be, and I came to the conclusion that it was to collect the water accumulating in the lower tombs of the kings, to keep them dry, and that the water would from time to time be drawn up by buckets from the shaft. However, it wants more exact examination. I do not know how far Dr. Bliss and Mr. Macalister have examined the matter and reported on it.

3. The removal of the earth from the Greek part of the Muristan is going on again, and several interesting carved stones have been found, of which (if God permit) I will more fully report in my next and illustrate with drawings. The shaft leading to the stair by which Sir Charles Warren found the underground large tanks in the year 1865,¹ and myself at the time have measured, is not laid bare; when it is, someone will be able to go down and make fresh measurements.

DERIVATIVES OF THE ANCIENT CUBIT OF 20·6109 INCHES.

By Lieut.-General Sir CHARLES WARREN, K.C.B., F.R.S.

If we take consecutively 18, 12, 11, 9, 8, 7, 6, 5, tenths of 70,000 cubic inches (the content of the ancient double Royal cubit (20·6109 inches) cubed) and extract the cube roots we obtain the following cubits: 25·065, 21·89, 21·26, 19·89, 18·29, 17·30, and 16·34 inches. If we take four and five-sixths of 70,000 and extract the cube roots we obtain cubits of 18 and 19·39 inches.

With six-sevenths, 19·57 inches, and with $\frac{64}{70}$ we obtain 20 inches.

When these are compared with those found by Petrie from existing remains all over the world, in "Inductive Metrology," it will be found that the whole of the cubits he mentions are accounted for except those mentioned under columns "Digit," "Copass," and "Various" in his table at the end of the book. A table is attached showing the results obtained.

The following interesting points will be noticed:—

The most ancient cubit ranking after 20·6109, so far as we know at present, is that of Gudea, 19·57 inches.

¹ "The Recovery of Jerusalem," p. 272.

Next come a batch of four cubits, 25·065, 21·89, 21·26, and 19·89, called by Petrie respectively the Royal Persian, Hebrew and Chaldean, the Phœnician (foot), Assyrian cubit, and half Assyrian great U. Of these 25·065 and 19·89 are closely allied, the content of the former cubed being exactly double the content of the latter.

We then have three cubits of 18·29, 17·38, and 16·34, from which the Olympic, ancient Roman, and Plinian feet are derived.

Distinct from the above are two cubits of 19·39 and 18·00 inches, which correspond to Petrie's "double of Pythic foot" and "Hasta (?)."

Distinct again are two cubits 20 and 13·33 inches, based apparently on the Drusian foot. The 16-inch cubit of the "Handbook of the Bible" is evidently the same as the 20-inch cubit here given as they measure the same temples and synagogues. I think it doubtful whether this cubit is not the same as that of 19·89, but Petrie considers the unit of 13·33 inches distinct from that of 13·2 inches.

Comparison of Cubits derived from the ancient 20·6109-inch Cubit, with all the Cubits of the World, given by F. Petrie in "Inductive Metrology."

Proportion.	Content Cubic Inches.	Derived Cubit.	Petrie's Cubits.		Names of Cubit, according to Petrie.
			Maximum.	Minimum.	
7	70,000	20·6109	...	...	Ancient Royal cubit.
6	60,000	19·57	...	...	Scale of Gudea from Hemmel.
10	70,000	20·6109	20·76	20·6	Ancient Royal cubit, Egyptian and Babylonian.
		12·36	12·47	12·4	Babylonian foot, $\frac{2}{3}$ 20·61.
		25·065	25·38	25·1	Royal Persian, Sacred Hebrew and Chaldean.
18	126,000	16·710	16·89	16·66	Aretni [Royal foot ($\frac{2}{3}$ 25·065)].
12	84,000	21·89	22·5	21·48	Rude stone monuments of Great Britain and France (Phœnician foot, one half).
11	77,000	21·26	21·40	21·30	Assyrian cubit.
9	63,000	19·89	20·24	19·90	Half Assyrian great U (foot = 13·22).
7	49,000	18·29	12·28	12·11	Olympic foot.
		12·19			
6	42,000	17·38	11·74	11·51	Ancient Roman and Greek foot ($\frac{2}{3}$ 17·38).
		11·58			
5	35,000	16·34	10·92	10·80	Plinian foot.
		10·89			
6	70,000	20·6109	...	...	Ancient Royal cubit.
5	58,333	19·39	19·30	18·92	Double of Pythic foot.
4	44,656	18·00	17·90	17·82	Hasta?
35	70,000	20·6109	...	...	Ancient Royal cubit.
32	64,000	20·00	20·2	...	Synagogues and late temples, Syria.
		18·00	...	...	Do., according to "Handbook of Bible."
		13·33	13·45	13·16	Drusian foot.

THE CUBIT OF BABYLONIA, B.C. 2500 TO 2800.

ON the sitting statue of Gudea (or of his architect), *circa* B.C. 2500 to 2800, is a plan of a town, and alongside of it a scale known as the scale of Gudea (De Sarzec's "Deconvertes"). There is no certainty what the scale means, but the strong presumption is that it indicates the linear measures of that period for building purposes, and as it is the only vestige of an early linear measure yet found out of Egypt, it is naturally a scale of considerable importance to investigators of the length of early cubits. It may have been used only locally or throughout the country; it may have been used for temples or for all building purposes; but whatever purpose it was designed for it was evidently a linear measure of some kind connected with buildings.

I propose to compare the measures given on this scale with the ancient cubit of 20·6109 inches recorded in the Great Pyramid of Gizah, and the date of which is supposed to be about B.C. 4000, and to do so I will make use of measurements of the former given by Professor Hommel in his article on Babylonia, Hastings's "Dictionary of the Bible" (1898). From the measurements of this scale he deduces the length of the double cubit of that period as lying between 990-996 mm. coincident with the length of the second's pendulum, viz., 992·35 mm. in the latitude of Babylon (30' N. lat.), and arrives at the standards of linear, square, and cubic measure and weight of that period, and I will show how far these results agree with those which can be derived from the ancient cubit of Babylon and Egypt.

The Babylonian cubit of this period appears to have been derived from the content of the ancient double cubit (20·6109 inches) cubed, 70,000 cubic inches, by taking *six* out of seven parts, and abstracting the cube roots of this quantity (60,000 cubic inches) = 39·1487 linear inches. This I take to be the double cubit of Gudea, it equals about 994 mm., which lies between the 990-996 mm. given by Hommel. He states that the double cubit was divided into 10 parts, and this serves as the side of a cube containing exactly a *ka* when filled with water (weighing 990 grammes), 360 *ka* = a *gur*. A cube on 3·9148 inches being the tenth part of 39·1487 inches, will contain exactly 60 cubic inches, and 360 of these (the *gur*) amount to 2,160 cubic inches.

He also points out that the Babylonian *gur* and *ka* correspond to the Hebrew *kor* and *kab*.

The two measures will thus be—

Babylonian	<i>Gur</i> = 21,600 C.I.	<i>Ka</i> = 60 C.I.
Hebrew ..	<i>Kor</i> = 23,333 C.I.	<i>Kab</i> = 129·6 C.I. (<i>Quarterly Statement</i> , July 1899, p. 267.)

If the *ka* be taken as the double mina it equals 15,158 Imperial grains, and therefore (at 60 shekels to the mina) the shekel equals 252·64 Imperial grains, or exactly the weight of a cubic inch of rain water.

Hommel also speaks of two other weights, one of them $\frac{5}{6}$, and the other $\frac{10}{9}$, of the light or half mina.

$$\frac{10}{9} \text{ of } 30 \text{ C.I.} = 33\cdot3 \text{ C.I.} \left(\frac{1}{3} \text{ of } 100 \text{ C.I.} \right)$$

$$\frac{5}{6} \text{ of } 30 \text{ C.I.} = 25\cdot0 \text{ C.I.} \left(\frac{1}{4} \text{ of } 100 \text{ C.I.} \right)$$

He also points out that the sixtieth part of $\frac{10}{9}$ of the light mina equals the Egyptian *kab*.

$$\frac{15,158 \times 10}{2 \times 60 \times 9} = 140\cdot3 \text{ Imperial grains (see Table IX, } \textit{Quarterly Statement}, October, 1899, p. 367).$$

It thus seems that the cubit and other measures derived by Hommel from the scale of Gudea can all be derived from the ancient Egyptian cubit of 20·6109, and it will be seen that they differ in very small degree from those given by Hommel from actual measures and weights.

Babylonian cubit of Gudea (from 20·6109 inches)

$$= \frac{1}{2} \sqrt[3]{\frac{6}{7}} \times 70,000 \text{ C.I.} = 19\cdot5743 \text{ inches linear.}$$

Babylonian cubit as given by Hommel

$$= 19\cdot48 \text{ to } 19\cdot606 \text{ inches linear}$$

$$= 495 \text{ to } 498 \text{ mm.}$$

As derived from 19·5743 inches cubit—

Gur = 21·60 C.I. *Ka* = 60 C.I. or 15,158 Imperial grains.

As deduced by Hommel—

Ka = 15,275·7 Imperial grains.
= 990 grammes.

EGYPTIAN WEIGHTS AND MEASURES SINCE THE EIGHTEENTH DYNASTY AND OF THE RHIND MATHEMATICAL PAPYRUS.

By Lieut.-General Sir CHARLES WARREN, K.C.B., F.R.S.

MR. F. L. GRIFFITH in "Notes on Egyptian Weights and Measures," vols. xiv and xv, "Proceedings Bib. Arch.," points out that the *uten* weighed from 1,400 to 1,500 grains Imperial, and that the *kiti* (*kat*) from the beginning of the New Kingdom weighed from 140 to 150 grains Imperial.

He gives the following from the Rhind papyrus and other records:—

Henu (or *hon*) = 5 *utens* of water.

Hekt (or gallon) = 10 *henu*.

Apt (*dell* or *tovit*) = 4 *hekt*.

By taking the lower value of the *kat* or *kiti*, this agrees exactly with the measures I have given in Table IX, "Ancient Weights and Measures in the East," Palestine Exploration Fund *Quarterly*, October, 1899.

There is, however, a difference in the number of *hons* or *henu* to the cubic cubit, which he takes at 20·6 to 20·65 inches. I give 320 *hons* at 27·3 cubic inches each = 8,755 cubic inches. Mr. Griffith gives 300 *henu* at 29·2 cubic inches each = 8,760 cubic inches. This he does by adopting the higher value of the *kiti* as 150 grains Imperial; and in a note, p. 406, vol. xiv, objects to 320 *henu* to the cubit cubed as leading to a *hon* of 27·3 to 27·8 cubic inches.

There is no doubt a great difficulty on the subject if the 300 *henu* to a cubit cubed is to be adhered to. Either Mr. Griffith's value must be accepted when the cubit stands at 20·6109 inches, or else the cubit must be reduced to 20·16 inches, for which I can see no cause.