ANCIENT EGYPTIAN MEASURES OF CAPACITY

BY

A. LUCAS AND ALAN ROWE.

PART I.

There are in the Egyptian Museum three ancient inscribed measures of capacity, a small one of copper or bronze; a larger one of silver and a very large one of dark grey granite. There is also an uninscribed one of wood. In addition, there are three large inscribed alabaster vessels marked with their capacity and also some fragments of another one, which are not measures, but merely containers. All these will now be described.

I.—BRONZE MEASURE[1].

This was bought by the Museum in 1888 at Alexandria and is stated to have been found in Lower Egypt, its history, place of origin and date[2] being unknown. It has been described by both Daressy[3] and von Bissing[4].

The shape of the measure is that of an inverted truncated cone[5]. The bottom has been broken off and is missing, though tiny parts of the turned-over edge remain. There are six horizontal lines, forming circles,

[1] No. *J.* 28187 (*C. G.* 3576).

[2] Von Bissing gives the date as possibly Græco-Roman; the Museum register gives it as Eighteenth Dynasty. Dr. A. H. Gardiner and Prof. H. Junker, from an examination of a photograph both believe the hieroglyphs to be of Græco-Roman date.

[3] G. Daressy, *Deux vases gradués du musée de Ghizeh*, in *Bull. de l'Inst. Égyptien*, 1897, pp. 149-152.

[4] F. von Bissing, *Metallgefässe, Cat. gén. du musée du Caire*, 1901.

[5] See Pl. X.

deeply engraved, or punched, outside the vessel[1], the lines being so deep that in one instance (the top line) the metal has been cut through in places, the reason for deep lines manifestly being in order that the circles should be visible inside, where alone they would be of use. These circles divide the measure into seven segments. Several, possibly four, other segments have been broken off the top and are missing, the break being at one of the circles. There is also a large irregular piece missing from the top[1]. The dividing lines (circles) have been crudely made and are not truly horizontal; also they are so wide and unequal in width, varying from about half a millimetre to about one millimetre, that accurate measurements are impossible. Each segment is engraved with its capacity[1].

Daressy states[2] that this measure has been slightly flattened, but no evidence of this can be found. He does not mention, however, the very marked flattening of the silver measure and possibly, therefore, a mistake has been made between the two.

When first examined by me, the metal was covered with a layer of corrosion, thin outside and thick inside and the inside had been waxed or oiled in modern times. At some period, the greater part of the corrosion covering the hieroglyphic signs that indicate the contents of the various segments had been roughly removed by chipping in order that the sign-groups might be rendered visible, but several of these had not been fully cleaned and were not entirely legible.

Two peculiarities of the measure may be mentioned, namely, first that the metal is not the same thickness throughout, that at the top being approximately double that at the bottom, and, second, that there are a number of vertical cracks[1], which seem to indicate that the metal has been under considerable strain at some time.

The measure was carefully cleaned by means of dilute sulphuric acid (10 per cent.) and alkaline Rochelle salt, used alternately, with periodical brushing with a bristle brush and was finally well washed by soaking in water for several days[3].

---

[1] See Pl. X. — [2] G. Daressy, *op. cit.*, p. 150. — [3] A. Lucas, *Antiques : their Restoration and Preservation*, Second edition, pp. 90-93.

There is no evidence of any joints and I suggest that the measure has been made by casting (which is also the opinion of von Bissing), in which case the metal must be bronze and not copper, since the casting of copper in a closed mould, even at the Græco-Roman period, is most improbable.

This measure can only have been used for liquids, or for solids in the condition of fine powder, such, for example, as powdered drugs.

DIMENSIONS.

AUTHORITY.	HEIGHT.	DIAMETER.		THICKNESS.	
		TOP.	BOTTOM.	TOP.	BOTTOM.
	cm.	cm.	cm.	mm.	mm.
Daressy	9.8 (1)	Inside 7.15	2.60	2.25 (6)	0.75 (6)
von Bissing	9.8 (2)	... 7.70 (3)	2.80 (3)	1.50	1.00
Cairo Museum	10.2 (2)	... 7.50 (3)	2.80 (3)	...	...
Lucas	9.9 (1)	Inside 7.28 (4)	2.62 (5)	2.00	1.00

(1) Vertical. — (2) Not stated. — (3) Probably outside. — (4) Mean of four measurements. — (5) Mean of six measurements. — (6) Calculated by me from Daressy's measurements of the inside and outside diameters.

DISTANCE OF CIRCLES ABOVE BOTTOM [7].

CIRCLES FROM BOTTOM.	DARESSY.	LUCAS (8).
	cm.	cm.
VII (now the top)	10.10	10.01
VI	...	7.52
V	5.30	5.26
IV	3.50	3.48
III	2.10	2.08
II	1.35	1.41
I	0.95	0.90

(8) Mean of eight measurements taken in each case from as nearly as possible the middle of the dividing line.

(7) Measuring along the slanting side.

CAPACITY.

On account of the broken condition of the measure, it was impossible to obtain the capacity by direct determination, and the various measurements given above, made by me, were, therefore, submitted to Mr. F. S. Richards, Deputy Surveyor General, Survey of Egypt, who kindly computed from them the capacity, with the following results, alongside which Daressy's results (also obtained by calculation) are given for comparison.

FROM BOTTOM TO.	MARKED [1].	CONTENTS.	
		RICHARDS.	DARESSY.
		cc.	cc.
VII circle (top)...............	$\frac{1}{2}$ *dja*	201.2	195.99
VI —	$\frac{1}{4}$	115.6	110.35
V —	$\frac{1}{8}$	61.4	57.46
IV —	$\frac{1}{16}$	31.9	30.00
III —	$\frac{1}{32}$	15.4	14.09
II —	$\frac{1}{64}$	9.4	8.31
I —	$\frac{1}{128}$	5.5	4.84

[1] See Pl. X.

Since, as already stated, the dividing lines are not truly horizontal and vary in width, the capacities of the different segments must be regarded as only approximate and should not be used to calculate the true values of the *henew* and *dja*. In my opinion, the fractions $\frac{1}{4}$ to $\frac{1}{128}$ inclusive are parts of a *dja*. Mr. Richards says "Looking at the problem as a trained computer, the observation $\frac{1}{2}$ *dja*... must be rejected. Consequently I conclude the $\frac{1}{4}$, $\frac{1}{8}$ ...divisions are not *djas*".

If it be assumed, which is most reasonable, that this measure, like the silver measure, had originally eleven segments, the top four of which are now missing, and that it was marked in the same manner as the silver measure, then the missing segments may be calculated, the *dja* being twice the half *dja* and two-thirds of the *henew*. The results which, however, should be regarded only as approximations, are as follows :

FROM BOTTOM TO.	MARKED.	CONTENTS.
		cc.
Original top..................	...	...
X circle....................	One *henew*.	603.6
IX —	One *dja*.	402.4
VIII —	½ *henew*.	301.8

II.—SILVER MEASURE[1].

This, like the bronze measure, was bought by the Cairo Museum at Alexandria in 1888, its history, place of origin and date[2] being unknown. It has been described by both Daressy[3] and von Bissing[4].

This, too, is in the form of an inverted truncated cone[5]. It is, however, larger than the bronze measure and the metal, for the most part, is thinner. The bottom has been broken off and is now separate, and considerable portions of the lower six segments are missing[5]. In addition to the bottom, there are seven other loose pieces, all small, three of which have been temporarily replaced, but there is so much of the metal lacking that it is impossible to find places for the rest. The metal near the bottom is very thin, crystalline, brittle and fragile. There are ten narrow horizontal lines (circles) deeply engraved round the measure, which show through to the inside and divide it into eleven segments. Each segment, except the top one, is engraved with its capacity[5]. The measure is distorted, being slightly flattened in one direction, which is manifestly not original, but the result of pressure. The metal, like that

---

[1] No. *J.* 28493 (*C. G.* 3577). — [2] See footnote No. 2, p. 69. — [3] G. Daressy, *op. cit.* — [4] F. von Bissing, *op. cit.* — [5] See Pls. XI, XII.

of the bronze measure, is much thicker (about four times) at the top than at the bottom. There are also vertical cracks in the metal, but since this is now very crystalline and brittle, and since the distortion must be due to pressure, the cracks have probably been caused in the same manner.

When first examined by me, the metal was largely covered, both inside and outside, with a thick layer of silver chloride, which in places had been scraped off, with the result that the surface is badly scratched, especially inside. The hieroglyphic sign-groups, although largely uncovered by the scraping, were not all entirely visible.

The measure was cleaned by immersion in strong ammonia solution, the loosened silver chloride being removed by means of a thin, flat wooden match stick and a small soft bristle brush [1].

There is no evidence of any joints and I am unable to suggest in what manner the measure was produced, unless it was by casting, which is also suggested by Daressy. It has been most carefully made and manifestly is the work of a skilled craftsman. This, like the bronze measure, can only have been used for liquids or fine powders.

DIMENSIONS.

AUTHORITY.	HEIGHT.	DIAMETER.		THICKNESS.	
		TOP.	BOTTOM.	TOP.	BOTTOM.
	cm.	cm.	cm.	mm.	mm.
Daressy	16.25	1.2 [2]	3.0	2.0	0.5
Von Bissing	16.60	11.7	3.1	2.0	1.0
Cairo Museum	16.50	...	...	...	...
Lucas	...	10.9 [3]	3.0 [3]	2.0	0.5

[2] Manifestly wrong, 11.2 evidently meant. — [3] Mean of two measurements.

[1] A. Lucas, *op. cit.*, pp. 124-125.

DISTANCE OF CIRCLES ABOVE BOTTOM.

CIRCLES FROM BOTTOM.	DARESSY.	LUCAS[1].
	cm.	cm.
Top	16.80	16.93
X	14.60	14.73
IX	11.90	11.98
VIII	10.60	10.53
VII	8.25	8.23
VI	5.60	5.53
V	3.60	3.58
IV	2.15	2.18
III	1.30	1.38
II	0.90	0.83
I	0.45	0.38

[1] The tenth to the third circles inclusive were measured from the top and calculated to the bottom; the second and first circles were measured from the bottom. All measurements were made along the slanting side. On account of the broken condition of the vessel, measurements could only be made in a few places and what seemed the best place was chosen and only one set of measurements taken.

CAPACITY.

This, like the bronze measure, was in too broken a condition for the capacity to be determined directly and it was kindly computed by Mr. Richards from measurements made by me, the results, together with those of Daressy, being given below.

FROM BOTTOM TO.	MARKED [2].	CONTENTS.	
		RICHARDS.	DARESSY.
		cc.	cc.
Top	...	691.8	712.48
X circle	One *henew*	510.4	514.91
IX —	One *dja*	331.1	331.89
VIII —	$\frac{1}{2}$ *henew*	255.6	262.69
VII —	$\frac{1}{2}$ *dja*	159.9	163.33
VI —	...	80.1	79.28
V —	...	40.8	40.18
IV —	...	20.6	19.36
III —	...	11.7	9.86
II —	...	6.5	5.23
I —	...	2.8	2.64

[2] See Pls. XI, XII.

From these results it will be seen that the *henew* is 511 [1] cubic centimetres; that the *dja* is two-thirds of a *henew* and that the capacities of the segments from which the sign-groups are missing or largely missing were from $\frac{1}{4}$ to $\frac{1}{128}$ of a *dja* respectively.

III.—GRANITE MEASURE [2].

This, which is of Eighteenth Dynasty date, was found by Legrain at Karnak in 1904 and is inscribed with the name of Tuthmosis III. It has been described by Daressy [3]. It is circular in section with vertical sides; a very slight ring base and three imitation bands round the outside, one at the top, one in the middle and one at the bottom [4]. It is much broken and has been repaired in modern times, a large part of one side, however, being missing. On account of its weight, which would have made it cumbersome and difficult to use, it was possibly intended, not as a measure for general employment, but as a standard to be kept for reference, say in a temple. It was certainly for solids and not for liquids.

DIMENSIONS.

AUTHORITY.	HEIGHT.	DIAMETER.
	cm.	cm.
Daressy	Inside : 24.1	Inside : 32.65
Lucas	Inside : 24.1 [5]	Inside : 32.60 [5]

[5] Mean of four measurements.

CAPACITY.

On account of the broken condition of the measure, any direct determination of the capacity was impossible, and it was kindly computed by

[1] Mean of one *henew* and half *henew* × 2.

[2] No. *J.* 36925.

[3] G. Daressy, *Une mesure égyptienne de 20 hin* in *Annales du Service,* XVIII (1919), pp. 191-192. The capacity 20 *hin* is evidently a printer's mistake for 40 *hin.*

[4] See Pl. XIII, *a.*

Mr. Richards from measurements made by me and was found to be 20,116 cubic centimetres. Using the value of a *henew* as calculated from the silver measure, namely, 511 cubic centimetres, the capacity is practically 39 $\frac{1}{2}$ *henew*. If, on the other hand, the capacity is 40 *henew*, then the value of a *henew* in this case is 503 cubic centimetres.

IV.—WOODEN MEASURE[1].

The date[2] and place of origin of this measure are both unknown. It is uninscribed and shows evidence of considerable use. It is circular in section with sloping sides, being slightly wider at the bottom than at the top[3]. The different pieces of wood forming the measure are fastened together with wooden pegs and in one place on the bottom, where the wood has broken, it has been repaired, probably anciently, by means of a piece of thick copper wire.

DIMENSIONS.

AUTHORITY.	HEIGHT.	DIAMETER.
	cm.	cm.
Lucas.	Vertical : 13.3 [4]	Inside : Top. 18.0 [4]. Bottom 21.5 [4]

[4] Mean of four measurements.

CAPACITY.

The capacity was kindly computed by Mr. Richards from measurements made by me. It is 4,524 cubic centimetres. Using the value of a *henew* as calculated from the silver measure, namely, 511 cubic centimetres, this measure has a capacity of practically nine *henew*. It was certainly not for liquids, but for solids and probably for corn.

---

[1] No. *J.* 29864. — [2] The Museum register suggests that the date may be Coptic. — [3] See Pl. XIII, *b*.

V.—ALABASTER VESSEL[1].

This was found at Saqqara by Jéquier[2]. It is marked with the name of Pepi II (Sixth Dynasty) and the capacity. When found it was broken and about two-thirds were missing. It has been restored, but it is impossible to determine the capacity.

VI.—ALABASTER VESSEL[3].

This was found by Pendlebury at El-Amarna during the season 1931-1932[4]. It is of alabaster with a limestone lid, which is firmly fixed on, and since it was thought better to leave it in the condition in which it was found, the capacity was not determined. It is marked with the name of Hatshepsut and the capacity 24 $\frac{1}{2}$ *henew*. It is not a measure, but merely a receptacle holding approximately the quantity marked upon it.

VII.—ALABASTER VESSEL[5].

This, which was found at Saqqara in 1872[6], has been described by both Daressy[7] and von Bissing[8]. The shape is that of a globe with a wide and almost cylindrical neck, a projecting rim at the top; a loop handle at one side and a flat ring base. It is marked with the name of Tuthmosis III and the capacity 21 *henew*.

Daressy, evidently regarding it as a measure (which it is not, but merely a receptacle holding approximately the quantity marked upon it)

---

(1) No. *J.* 65340 (*C. G.* No. 5019 MS.).

(2) G. Jéquier, in *Annales du Service*, XXXIV (1934), p. 99, fig. 4; p. 100, figs. 6, 7.

(3) No. *J.* 57203.

(4) J. D. S. Pendlebury, *Prelim. Report of the Excavations at Tell El-Amarnah, 1931-1932*, in *Journ. of Egypt. Archæol.*, XVIII (1932), p. 148; Pl. XIX (3).

(5) No. *J.* 21863 (*C. G.* 18734).

(6) Von Bissing gives the date wrongly as 1873.

(7) G. Daressy, in *Bull. de l'Inst. Égyptien*, 1897, p. 151.

(8) F. von Bissing, *Steingefässe, Cat. gén. du musée du Caire*, 1904. Pl. IV.

determined the capacity by direct measurement, (*a*) to the bottom of the neck and (*b*) to the top of the neck, the results being as follows, namely, (*a*) contents 8.210 litres, which gives 391 cubic centimetres as the value of a *henew;* (*b*) contents 9.640 litres, with the value of a *henew* as 459 cubic centimetres. Daressy took the mean of these two determinations, namely, 425 cubic centimetres, as the true value of a *henew.* This, however, is fallacious, since there cannot be any doubt that the vessel was meant to be filled either to the bottom of the neck, or to the top of the neck, the former being the more probable, since it is manifestly intended for liquids, and in my opinion the value 425 cubic centimetres should be disregarded entirely. Also, the other capacities are probably only approximate and neither of them should be used as the true value of a *henew.*

VIII.—FRAGMENTS OF ALABASTER VESSEL[1].

These fragments are inscribed with the name of Hatshepsut and the capacity, 35 *henew*[2].

VALUE OF *HENEW* AND *DJA*.

Two kinds of vessels of capacity have been described, one being measures and the other merely containers inscribed with their capacities, which are probably only approximate.

In addition to the measures mentioned, Daressy has described a further graduated one of bronze, which is in the Louvre Museum, Paris, the capacity of which he determined[3]. These five measures (two of bronze; one of silver; one of granite and one of wood) are the only ones known to me from ancient Egypt. For the reasons already given, the bronze measure in the Cairo Museum may be excluded from any calculations of the values of the *henew* and *dja* respectively, as also the wooden

---

(1) No. $\frac{17}{17}\Big|\frac{12}{1}$.

(2) E. Naville and H. Carter, *The Tomb of Hatshopsitu*, 1906, p. 110; No. 8, Fig. 8.

(3) G. Daressy, *Bull. de l'Inst. Égyptien*, 1897, pp. 223-226.

measure, since its capacity is not marked. The containers mentioned, all of which are of alabaster, as also additional ones described by other writers [1], must also be excluded, since the capacities marked on them are almost certainly only approximate. The measures left for consideration are as follows :

AUTHORITY.	VESSEL.		VALUE OF	
	MATERIAL.	CAPACITY.	HENEW.	DJA.
		henew.	cc.	cc.
Daressy	Bronze.	1	475 [2]	308 [3]
—	Silver.	1	520 [2]	329 [3]
—	Granite.	40	504	...
Lucas.....................	Silver.	1	511 [2]	325 [3]
—	Granite.	40	503	...
		MEAN...	503	321

[2] Mean of one *henew* and half *henew* × 2. — [3] Mean of one *dja* and half *dja* × 2.

The value of a *henew*, therefore, as computed from the above-mentioned measures in the manner described, is about 503 cubic centimetres and the value of a *dja*, which is approximately two-thirds of a henew, is about 321 cubic centimetres.

A. LUCAS.

---

[1] F. CHABAS, *Détermination métrique de deux mesures égyptiennes de capacité*, Paris 1867; G. DARESSY, (*a*) in *Bull. de l'Inst. Égyptien*, 1897, p. 151; (*b*) in *Annales du Service*, XVIII (1919), p. 192; G. P. G. SOBHY, in *Journal of Egyptian Archæology*, X (1924), pp. 283-284.

PART II.

THE INSCRIPTIONS.

No. 1.—BRONZE MEASURE.

The inscriptions on this vessel[1] are as follows :

ZONE.	
VII	[2] 1/2 *dja.*
VI	1/4 [*dja*]
V	1/8 [*dja*]
IV	1/16 [*dja*]
III	1/32 [*dja*]
II.	1/64 [*dja*]
I	1/128 [*dja*]

Before cleaning, part only of the sign in Zone VII and only the first parts of the numerals in Zones II and I were visible. The signs in Zones III to VI were never much corroded.

In this case as on the silver measure, No. 2, where the calculations of Mr. Richards prove the fractions 1/4 to 1/128 inclusive to be parts of the *dja*, these fractions appear also to be parts of the *dja* (= , see below).

With regard to the bronze measure, it is not known what proportion the *dja* was of a *henew* since the *henew* zone is missing, but in the silver measure the *dja* is clearly 2/3 of a *henew*. In Erman-Grapow[3] the capacity of the *henew* is given as c. 0.45 litre, while the capacity of the *dja*

---

[1] From the analogy of the silver vessel we may safely assume that there were three more inscribed zones on the bronze measure, namely, X, IX and VIII.

[2] Wrongly shown by von Bissing as (*sic*).

[3] *Wörterbuch*, II, p. 493.

is stated to be c. 0.33 litre [1]; that is to say, the above-mentioned authorities regard the *dja* as 3/4 of a *henew*, although they do not specifically say so.

On the basis of Mr. Richard's calculated value of 201.2 cc. for the 1/2 *dja* on the bronze measure, the *dja* must here be 402.4 cc., which means, if the 2/3 ratio be accepted as correct, that the value of the *henew* is 603.6 cc., while if the 3/4 ratio of Erman-Grapow be accepted its value is 536.6 cc.

Taking the value of the *dja* as 2/3 of a *henew* this means that the former quantity equal two "cups", because as in seen from the following inscription, "one cup makes 1/3 of a *henew*" : …….. [2]. If on other objects, however, the *dja* is 3/4 of a *henew* the *dja* will then equal three "*heben*" measures, a single *heben* ( ) being equivalent to 1/4 of a *henew* [3].

The shape of the *dja* sign on the bronze vessel (somewhat like or) is similar to that found in the name Wedja-ren-ef (=) on a Ptolemaic stela published by Ahmed Bey Kamal [4].

Again, there is a sign like in the following quantities inscription of Tuthmosis III at Semna : [5] which Sethe reads as "Corn of the south, 425 *heḳat*, and 20 spelt" [6]. Chabas thought that was a measure of some kind [7], but Griffith (who does not mention the *dja* measure in his article) later wrote that in the Semna inscription = and was to be read *beti* [8] ("spelt"), the reading which Sethe has adopted [9]. Erman-Grapow, however, do not give as an equivalent

---

[1] *Op. cit.*, V, p. 516. An answer to an inquiry to the Editors of the *Wörterbuch* regarding the source of their *dja* reference (sent many months before the present war) was never received.

[2] F. Chabas, *Détermination Métrique de deux Mesures Égyptiennes de Capacité*, 1867, p. 16, also F. G. Hilton Price, in *Trans. Soc. Bib. Arch.*, IX, p. 353.

[3] Hilton Price, *loc. cit.*

[4] *Stèles Ptolémaïques et Romaines* (in *Cat. gén.*), I, p. 94, No. 22109.

[5] K. Sethe, *Urkunden der 18. Dynastie*, IV, p. 195.

[6] *Op. cit.*, Translation vol., 1914, p. 91.

[7] F. Chabas, *Recherches sur les Poids, Mesures, etc.*, 1876, p. 12.

[8] In *Proc. Soc. Bib. Arch.*, XIV, p. 430.

[9] Also J. H. Breasted, *Ancient Records of Egypt*, II, p. 70.

of [1]. Regarding the Semna sign Dr. Alan H. Gardiner writes as follows to one of us (A. L.) : "As you will see from *Proc. S. B A.*, XIV, p. 430, Griffith denies that in the Semneh inscription...... is a measure. He renders as if it were *Bwte* 'spelt' (—an early kind of wheat) and Sethe, in his translation, agrees. The trouble is that *Bwte* would not very probably be so spelled, and would, I should have thought, have required a measure after it". I am personally strongly of the opinion that the Semna sign is a measure-perhaps Nubian in origin.

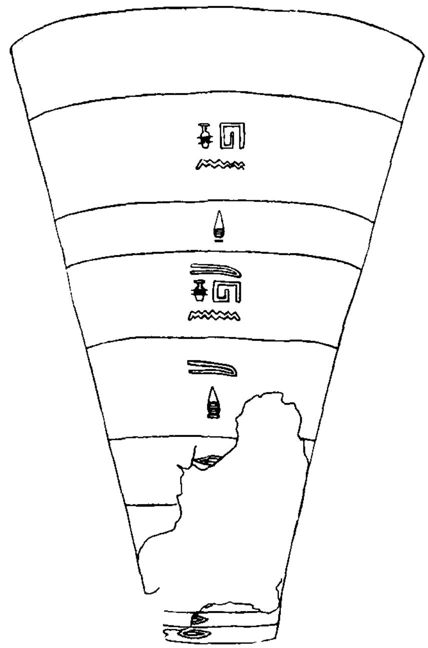


Fig. 10.—Facsimile of text on silver measure (No. 2).

The forms of the signs clearly indicate that the bronze measure, like the silver one (No. 2), dates from the Græco-Roman period. Both Dr. Gardiner and Dr. H. Junker agree with me on this point.

No. 2.—SILVER MEASURE.

The inscriptions on this vessel are as follows, my restorations of the missing signs, enclosed in [ ], obviously being correct as will be seen both from the parallel inscriptions on the bronze measure and from the calculations of Mr. Richards.

ZONE.		
Top............	Blank.	—
X		1 *henew.*
IX.............		1 *dja.*

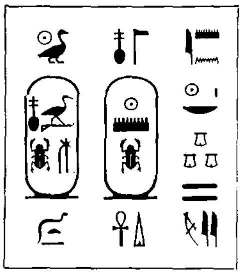
[1] *Wörterbuch*, I, pp. 486, 487.

ZONE.		
VIII.		1/2 *henew*.
VII		1/2 *dja*.
VI.	[1]	1/4 [*dja*].
V		1/8 [*dja*].
IV.		1/16 [*dja*].
III	[2]	1/32 [*dja*].
II.	[3]	1/64 [*dja*].
I.	[3]	1/128 [*dja*].

As already mentioned the value of the *dja* in the silver measure is 2/3 of a *henew;* the object dates from the Græco-Roman period.

No. 3.—GREY GRANITE MEASURE OF TUTHMOSIS III.

The inscriptions on this measure, which are as follows, are incised in the upper zone of the exterior part of the vessel :



"The good god, *Men-kheper-rêᶜ*, the son of Rêᶜ, *Djeḥewty-mes nefer kheper,* given life for ever. Beloved of Amen-rêᶜ, the lord of Karnak".

No details are given of the capacity of the measure, but as has already been shown above the calculations indicate it was made to hold 40 *henew* or a quadruple *ḥeḳat*[4], which latter measure makes its first appearance in the Rhind Mathmetical Papyrus of the Hyksos era under the form : *ḥḳ3t fdw*, "4 *ḥeḳat*"[5]. In the (later) temple of Medinet Habu, the quadruple *ḥeḳat* was known

---

[1] Right part of ⊂⊃ is missing; shown by von Bissing as .

[2] Only the lower right part of ⊂⊃ is visible.

[3] Not clearly visible before cleaning.

[4] There were of course 10 *henew* to the *ḥeḳat*.

[5] Cf. A. H. Gardiner, *Egyptian Grammar*, 1927. p. 198.

as the *ipet* [1]. The *ḥeḳat* itself was the official corn measure unit of the country [2].

The quadruple *ḥeḳat*, like the single *ḥeḳat*, was divided into halves and was usually employed for measuring grain [3]. In the Medinet Habu example the *ipet* (like the *ḥeḳat* elsewhere) was divided into 320 *ro* [4].

Vessels very similar in shape to the grey granite measure are among the gifts dedicated by Tuthmosis III to the god Amen. They are described as : "[Measuring-vessels (*dbḥ*)] of gold for measuring (*dbḥw*) the property of the god" [5]. There is no doubt whatever that the grey granite measure also was employed for a similar purpose in the great temple of Amen at Karnak. Two Vth Dynasty examples, in use, and of wood, are seen in L. Borchardt, *Denkmäler des alten Reiches* (in *Cat. gén.*), I, 1937, Pl. 48, No. 1534 A (second register from top).

As the present quadruple-*ḥeḳat* measure is of granite it would have been rather difficult actually to have used it, so it may well be presumed that it was nothing else than an official standard measure upon which the more practical wooden measures were based.

No. 4.—UNINSCRIBED WOODEN MEASURE.

This measure has no inscriptions, and its date is uncertain. In the *Journal d'entrée* it is described as "Coptic?", but it appears to be earlier.

Whatever may be its date, however, the measure is akin to the type of ancient Egyptian wooden measure called *debeḥ* ( ) [6], which determined with the grain-sign is named in Chapter or Spell CXXV of the so-called *Book of the Dead*, in which the deceased declares he has not increased or reduced the measuring-vessel [7]. A gold *debeḥ* is referred to in the description of No. 3 above.

---

(1) F. Ll. Griffith, in *Proc. Soc. Bib. Arch.*, XIII, p. 534, XIV, p. 432.

(2) *Op. cit.*, XVI, p. 243.

(3) T. E. Peet, *The Rhind Mathmetical Papyrus*, 1923, p. 26.

(4) F. Ll. Griffith, in *Proc. Soc. Bib. Arch.*, XIII, p. 534.

(5) T. E. Peet, *op. cit.*, p. 122 = K. Sethe, *Urkunden der 18. Dynastie*, p. 635, Nos. 30-33.

(6) T. E. Peet, *op. cit.*, Pl. W, No. 80.

(7) *Op. cit.*, p. 122; F. Ll. Griffith, in *Proc. Soc. Bib. Arch.*, XVI, pp. 242, 243; E. A. W. Budge, *The Chapters of Coming Forth by Day*, Text Vol. II, 1910, p. 124, No. 6.

The following inscription published by Griffith indicates that measures called *khay* ("cups" — see also above No. 1) were contained in the *debeḥ* measure : , "As to the *debeḥ*-measure, the *khay*-measures that are in it", etc. [1].

No. 5.—ALABASTER JAR OF PEPY II.

Although this VIth Dynasty object is not actually a "measure" it is included here because it bears an important incised inscription giving the name and quantity of its contents. The inscription, now deciphered for the first time, is as follows :

"*Sefeṯ*-oil [2] : *Ḏewt*-jars [3] VIII [and] portions [4] IV. Ȇʿnkh-tawy". In other words the jar held *Sefeṯ*-oil to the quantity of eight *ḏewt*-jars and four portions of a *ḏewt*-jar, and also bears the name of that part of the Ṣaqqâra cemetery called Ȇʿnkh-tawy [5].

The chief interest of this inscription lies in the fact that the Old Kingdom *ḏewt*-jar (usually considered to be merely an ointment vessel) is here clearly seen to be an early dynastic unit of measure, a fact which has hitherto not been noted. Compare the  "*Ḏewt*-jars fifty", in P. Montet, *Les scènes de la vie privée*, etc., 1925, pp. 162, 163. In our original text has no neck.

No. 6.—ALABASTER JAR OF ḤATSHEPSUT.

Like No. 5, this XVIIIth Dynasty jar is certainly not an actual "measure" on account both of its shape and the fact that it has a cover (of limestone) cemented in position.

---

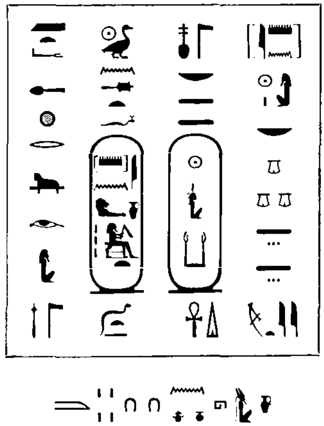
(1) F. Ll. Griffith, in *Proc. Soc. Bib. Arch.*, XVI, p. 242.

(2) Cf. Erman-Grapow, *Wörterbuch*, IV, p. 118. One of the seven oils of the ritual.

(3) See *op. cit.*, V, p. 549.

(4) = or , "portion", etc., in the Old Kingdom. *Op. cit.*, I, p. 158.

(5) Cf. H. Gauthier, *Dict. des noms géographiques*, 1925, I. p. 149; Erman-Grapow, *op. cit.*, I, p. 203.



The inscriptions, incised on the jar, are as follows :

"The good god, the lord of the Two Lands, *Maĕᶜt-ka-rêᶜ*, the son of Rêᶜ, of his body, *Chnem-àmen Ḥatshepsewt,* given life for ever, beloved of Amen-rêᶜ lord of Karnak, triumphant before Osiris the great god".

"Nechnem (*nḫnm*)-oil [1] of Amen [2]. *Henew* XXIV-1/2". Above the inscriptions is the protecting symbol of heaven.

Attempts have been made to remove the name of Amen in two places.

No. 7.—ALABASTER JAR OF TUTHMOSIS III.

The inscriptions on the jar, also not a "measure", are incised on its shoulder and are arranged as follows :

Above is the sign for "heaven", below which are the two cartouches and so on of Tuthmosis III : "The good god, *Men-kheper-rêᶜ*, the son of Rêᶜ, *Djeḥewty-mes neḟer-kheper,* given life for ever."

Under are details of the capacity of the jar, namely, "*Henew* XXI".

Why jars such as this one should have been made to hold an odd number and not an even number of *henew* is not clear. Many examples of jars holding odd numbers could be cited, as for instance the two-handled jar or amphora of eighty-one *henew* published by G. A. Reisner and others [3]. This particular jar came from Samaria and dates from the reign of Osorkon II,

---

[1] This was another of the seven oils mentioned above. Cf. A. H. Gardiner, *Egyptian Grammar*, p. 512, No. W. 9. and Erman-Grapow, *op. cit.*, II, p. 319, where the usual New Kingdom spelling is given as . See also G. Jéquier, *Les frises d'objets des sarcophages du Moyen Empire*, 1921, pp. 144 ff.

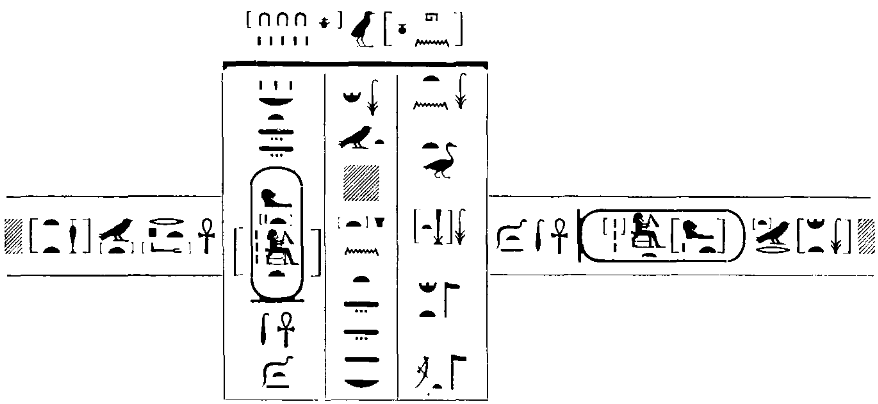
[2] In the original sign, the god holds ☥.

[3] *Harvard Excavations at Samaria*, I, 1924, p. 247, II, Pl. LVI, *g*.

of the XXIInd Dynasty, that is to say from about the time when Ahab's "house of ivory" (I *Kings*, XXII, 39) was built there, and the vessel may well have been a gift of the king of Egypt to Ahab [1].

No. 8.—ALABASTER JAR FRAGMENT OF ḤATSHEPSUT.

A hand copy of this fragment (part of an oil or unguent jar) was originally published by Howard Carter [2]. In my own copy of the text I have restored certain signs left unrestored by Carter and also added from Carter's copy other signs which no longer exist on the original. Only the signs not enclosed in | | are now to be seen on the fragment.



At the top is mentioned the capacity of the jar, namely, "*Henew* XXXV". Only the legs of the 𓅯 in *henew* are now visible.

Below is the sign for "heaven", protecting, as it were, three lines of vertical inscription : "The daughter of the king, sister of the king, wife of the god, beloved of the god, great royal wife, ... , mistress of all lands [3], lady of the Two Lands, Ḥatshepsut, may she live for ever."

To the right is the end of a horizontal band of text reading : " . . . . .great royal wife, Ḥatshepsut, may she live for ever."

---

[1] See further ALAN ROWE, *A Catalogue of Egyptian Scarabs, etc., in the Palestine Archæological Museum*, 1936, p. XXXVIII, No. 76.

[2] In the volume by T. M. DAVIS and E. NAVILLE, *The Tomb of Hâtshopsîtû*, 1906, p. 110, No. 8.

[3] Compare [hieroglyphs], in H. GAUTHIER, *Livre des Rois*, II, p. 329.

To the left is the beginning of another horizontal band of text, which reads : "May live the hereditary princess, great of favour. . . . ."

The form of the royal titles clearly indicates that the jar was made during the time Ḥatshepsut was the wife of Tuthmosis II [1].

GENERAL NOTES ON THE HENEW, ETC.

It would appear from Erman-Grapow [2] that originally the word *henew* was given to a type of vessel of fixed form and was later probably generally applied to certain vessels including those used specifically in preparing medicines. After the Middle Kingdom the word *henew* was mostly applied to a *measure* for wine, beer, milk and other liquids, and to measures of grain, fruits, fats, incense and so on. It was also applied to a measure for taking medicine [3]. For what purpose the bronze and silver vessels (Nos. 1 and 2) were employed there is no evidence to show; the smallness of the lowest measures, however, may possibly indicate that the vessels were used for liquids or for fine powders such as powdered aromatic substances or drugs.

The origin of the word *henew* is not clear, but there is just the possibility that *henew* is associated with *Ra-henew,* the ancient name of the Wâdi el-Ḥammâmât; in other words the *henew* vessels may originally have been made of "schist" (*bekhen*), the typical stone of the valley [4].

The *henew* itself was 1/10 of a *ḥeḳat* (roughly a "gallon")—the unit of capacity—the latter being divided into 320 *ro* (⊂⊃). In other words, there were 32 *ro* to the *henew*.

On the silver vessel, No. 2, taking the *henew* as 510.4 cc., 1 *ro* should equal nearly 16 cc. Dr. B. Ebbell, in his translation of the Ebers medical papyrus, gives the value of the *ro* as 15 cc. [5].

---

(1) See *op. cit.,* II, p. 234.

(2) *Wörterbuch*, II, p. 493.

(3) See also A. H. Gardiner, *Egyptian Grammar*, p. 199.

(4) This stone is fully described by A. Lucas and Alan Rowe, in *Annales du Service*, XXXVIII, pp. 127 ff.

(5) B. Ebbell, *The Papyrus Ebers*, 1937, p. 16. This writer regards the *ḥeḳat* as 4.785 litres (the *henew* thus being 0.478 litres).

It will presently be shown that 1/6 of a *ro* (equals *indicated* value of about 2-2/3 cc., in the case of the silver vessel) is the lowest quantity marked on the bronze and silver measures. Actually, however, owing to the maker's error in the silver measure, Zone I holds about 1/3 more than the quantity marked on it, which means that 1/6 of a *ro* in the lowest zone in the vessel *contains* not 2-2/3 cc., but 2-16/35 cc.

The bronze and silver measures will now be reduced to *ro*[*s*] and fractions of the *ro*, as this makes the comparison of the quantities easier :

No. 1. — BRONZE MEASURE.			No. 2 — SILVER MEASURE.		
ZONE.	TEXT.	RO.	ZONE.	TEXT.	RO.
—	—	—	Top....	Blank.	—
—	—	—	X.....	1 *henew*.	32
—	—	—	IX.....	1 *dja* (= 2/3 of a *henew*)	21-1/3
—	—	—	VIII ...	1/2 *henew*	16
VII....	1/2 *dja*	10-2/3	VII....	1/2 *dja*	10-2/3
VI.....	1/4 [*dja*]	5-1/3	VI.....	1/4 [*dja*]	5-1/3
V.....	1/8 [*dja*]	2-2/3	V.....	1/8 [*dja*]	2-2/3
IV.....	1/16 [*dja*]	1-1/3	IV.....	1/16 [*dja*]	1-1/3
III.....	1/32 [*dja*]	2/3	III.....	1/32 [*dja*]	2/3
II.....	1/64 [*dja*]	1/3	II.....	1/64 [*dja*]	1/3
I......	1/128 [*dja*]	1/6	I......	1/128 [*dja*]	1/6

The *ḥeḳat* unit of measure (as well as certain other units) was divided into the following fractions :

Fractions.	*Ro* to the *ḥeḳat* (1 *ḥeḳat* = 320 *ro*).	*Ro* to the *henew* (1 *henew* = 32 *ro*).	*Ro* to the *dja*.	
			3/4 ratio. (1 *dja* = 24 *ro*).	2/3 ratio. (1 *dja* = 21-1/3 *ro*).
1/2 =	160	16	12	10-2/3
1/4 =	80	8	6	5-1/3
1/8 =	40	4	3	2-2/3
1/16 =	20	2	1-1/2	1-1/3
1/32 =	10	1	3/4	2/3
1/64 =	5	1/2	3/8	1/3

the symbols for the fractions in the first column—totalling 63/64—being derived from the parts of the sacred-eye of Horus (the *wedjat*) which was torn in fragments by his enemy Seth. The eye was subsequently "completed" or "filled" (*meḥ*) by Thoth who joined together the six fragments, and presumably supplied magically the missing 1/64 [1].

The sketch below indicates the eye and its fractions :

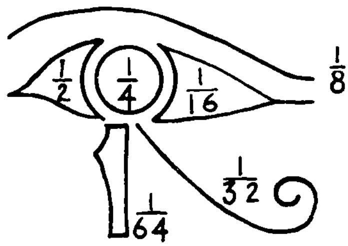


Fig. 11.—Fractions of the Sacred Eye.

In connection with the "filling" of the eye attention may be drawn to the following interesting text from Chapter or Spell XVII of the so-called *Book of the Dead*, in which the deceased declares : , "*I have completed the eye* after it had been injured on the day of the combat of the two rivals (Horus and Seth)" [2].

All the eye fractions (1/2 to 1/64) occur on both the bronze and silver vessels dealt with in this article, not as parts of the *heḳat* or *henew* but as parts of the *dja*; 1/2 however also occurs as a fraction of the *henew* on the silver vessel, and doubtless also on Zone VIII, now missing, of the bronze vessel. In addition there is in each case the fraction 1/128,

Fraction.	*Ro* to the *heḳat.*	*Ro* to the *henew.*	*Ro* to the *dja* (3/4 of *henew*).	*Ro* to the *dja* (2/3 of *henew*).
1/128 =	2-1/2	1/4	3/16	1/6

which, so far as is known to me, is inscribed nowhere else on vessels of the nature under discussion. As a matter of fact the fraction 1/128 is

---

(1) Cf. A. H. Gardiner, *Egyptian Grammar*, p. 197; also B. Gunn, in *ZAS.*, LVII, pp. 71 ff.; G. Möller, in *ZAS.*, XLVIII, pp. 99 ff.; and A. B. Chase, *The Rhind Mathematical Papyrus*, 1927, p. 175. Other symbols are known for the fractions; see especially F. Ll. Griffith, in *Proc. Soc. Bib. Arch.*, XIII, p. 394.

(2) After L. Speleers, in *Recueil d'Études Égyptologiques dédiées à ..... Champollion*, 1922, p. 640.

rarely written; compare, for instance, F. Ll. Griffith, in *Proc. Soc. Bib. Arch.*, XIII, p. 537. In the Ebers[1] and other medical papyri the lowest fraction is 1/64.

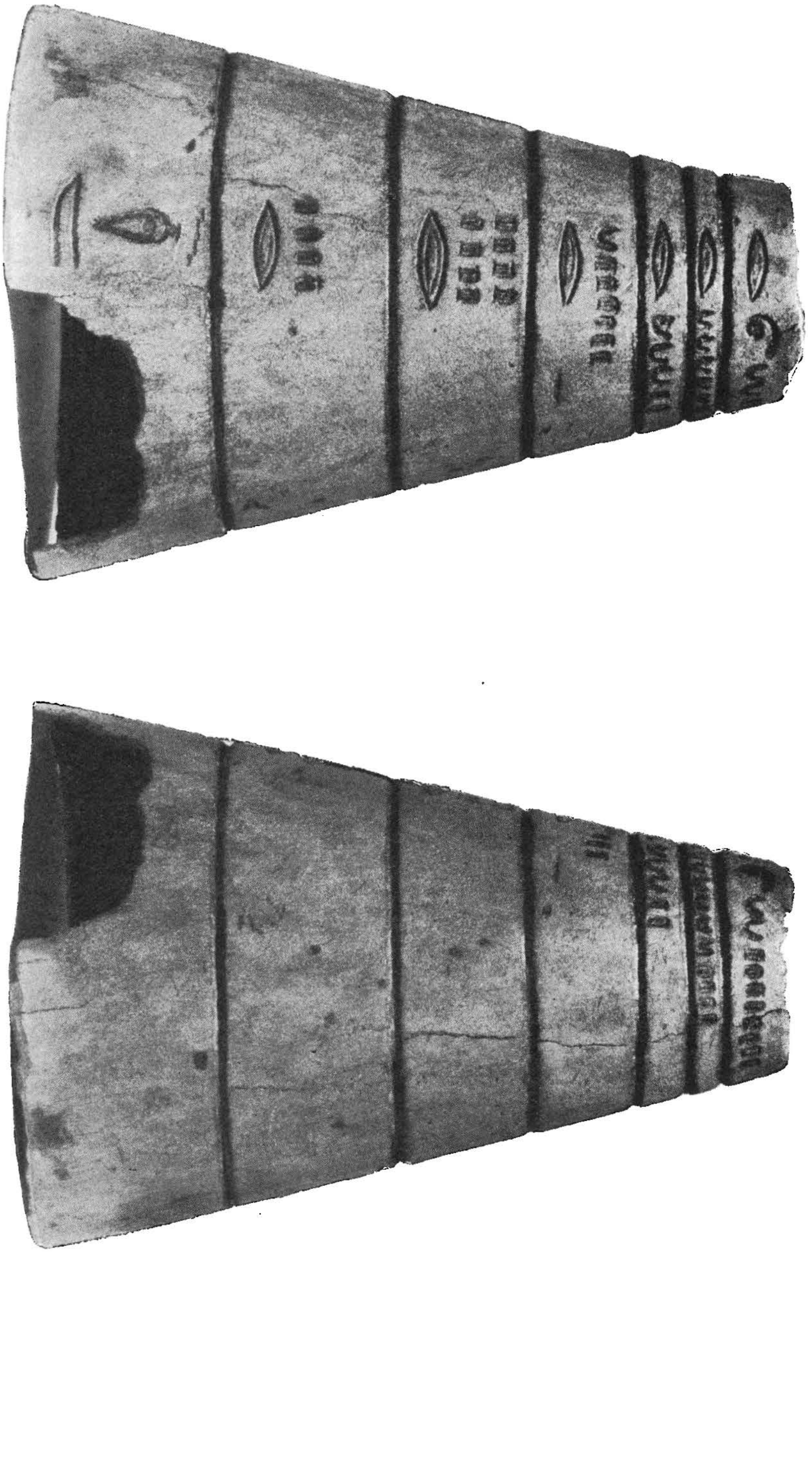
Dr. Ebbell rightly points out that in the Ebers papyrus ordinary fractions frequently occur—without any indication of what standard is used—but which are generally supposed to be fractional parts of the *henew*[2]. The possibility, apparently overlooked by the translators of these documents, that the *dja* measure is sometimes inferred should not however be neglected.

I have to thank Mr. J. Leibovitch for making the two figures in the text.

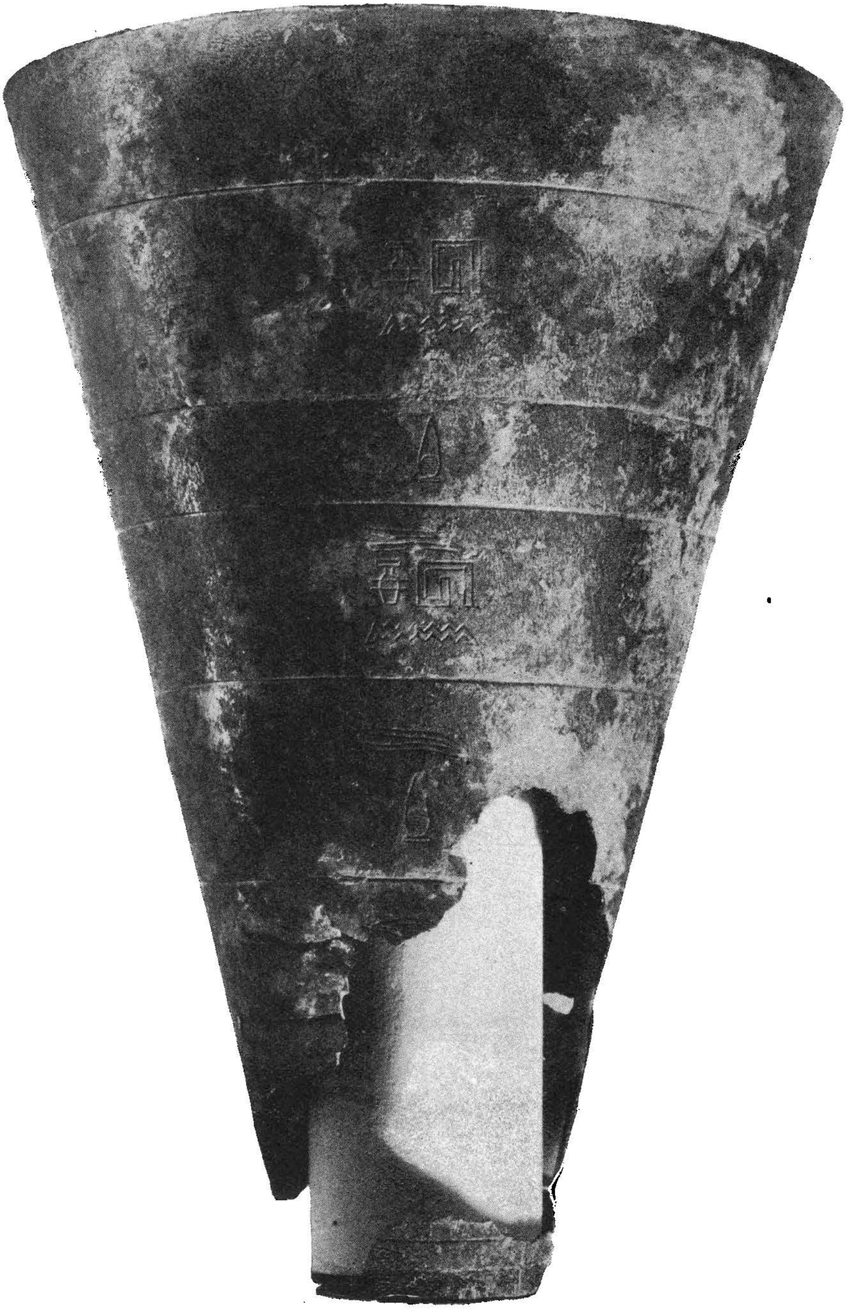
Alan Rowe.

---

[1] B. Ebbell, *The Papyrus Ebers*, p. 16. — [2] *Loc. cit.*



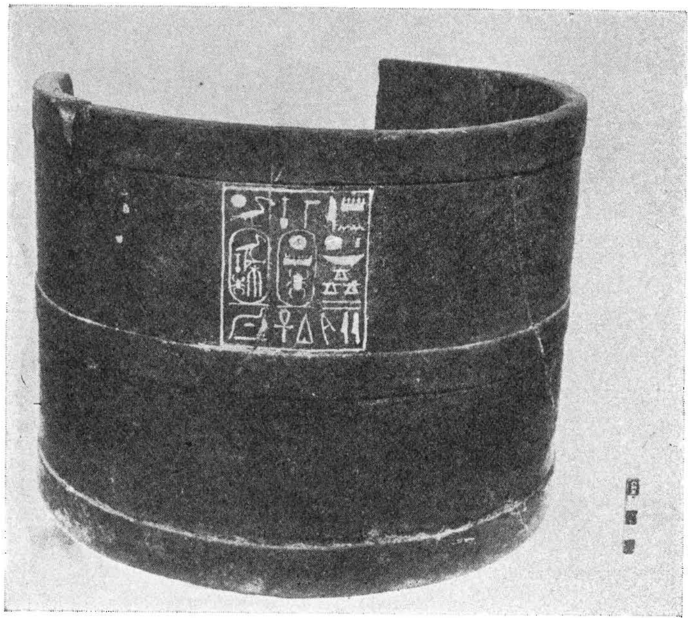
Bronze measure (No. 1).



Silver measure (No. 2).—Inscribed side.

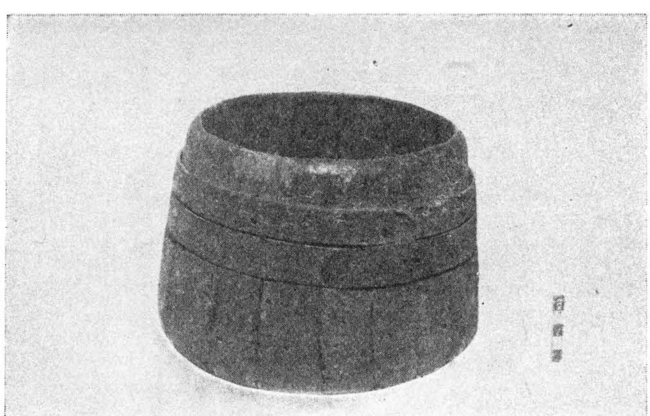
Silver measure (No. 2).—Plain side.

a



Granite measure (No. 3).

b



Wooden measure (No. 4).