

Ancient Greek weights and measures

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March 4, 2017

Rostovtzeff [14, I, p. 259]:

Moreover, the comparative study of prices in Egypt and even in parts of Egypt (a nome, a toparchy, a village) is rendered very difficult by many peculiar circumstances. This is true, for example, of the prices of such a basic commodity as grain. In the statistical lists compiled by modern scholars the price of grain is shown per *artaba*, as if the *artaba* were a constant measure. In fact, as has been proved by Wilcken and Tarn, many *artabae* of various sizes were in use at the same time and in the same region of Egypt.

Rostovtzeff [14, I, p. 279]:

In addition to the rent, the peasant paid a countless number of different taxes for the privilege of cultivating his land. The list of these taxes, incomplete as it is, is imposing. The number of *artabae* paid as rent for each *aroura* and the quantity of grain paid in respect of the various taxes is often mentioned in the documents at our disposal. But we are reduced to uncertain guesses when we try to figure out what part of the crop the royal peasants paid to the king. It was certainly not less, and perhaps more, than half.

Rostovtzeff [14, I, p. 451]:

The Babylonian tablets of Hellenistic date suggest that there was no change as regards the weights and measures used in Babylonia in the Hellenistic period: the traditional weights and measures were still in exclusive use. But two bronze weights of the Parthian period (56/5 B.C. and A.D. 72/3), one found near Babylon bearing the name of the city *agoranomos*, the other in Seleucia with the monogram of the chief of the city police (the *paraphylax*), seem to testify to the use of the Attic standard in Parthian Babylonia, along with the Babylonian one.

Syll.³ 374, 283/2 BC, Athens Honours Philippides [1, p. 28]:

Whereas Philippides has continued in every circumstance to show his goodwill towards the *demos* and, having journeyed abroad to King Lysimachus and having first spoken with the king he obtained as a gift for the *demos* 10,000 Attic medimnoi of grain (πυρῶν μεδίμνους Ἀττικῶν) which were distributed to all the Athenians in the archonship of Euktemon, . . .

Milet I 3 138, 283/2 BC, Knidian Loans to Miletos [1, p. 31]:

The following Knidians made loans to the Milesians in Rhodian silver:

Stiphos (son) of Akroteles and Timodamas (son) of Lachartos: 6,000 drachmas.

Philophron (son) of Philistas and Archippos (son) of Timaitios: 3,000 drachmas.

Diotimos and Mellinos, (sons) of Agathoboulos and Timas (son) of Timas: 6,000 drachmas.

Kleisilochos (son) of Anaxippidas: 2,000 drachmas.

Antigonos (son) of Epigonos: 6,000 drachmas.

Thessalakon (son) of Kallippos: 3,000 drachmas.

Stipholaidas (son) of Akrotatos: 2,000 drachmas.

Antikrates and Philokrates, (sons) of Epikrates: 3,000 drachmas.

Menippos (son) of Apollodoros: 3,000 drachmas.

Euphragoras, Kleumenes and Kleumbrotos, (sons) of Philistas: 3,000 drachmas.

Kallikles (son) of Athenokritos, Halikarnassian: 6,000 drachmas.

Athenodoros (son) of Theodoros, Cyrenean: 12,000 drachmas.

These made loans for three years; the loan begins in the month Artemision in (the stephanephorate) of Alexippos; interest is three obols per mina per month.

The following made loans without interest for a year:

Athenagoras (son) of Kleon: 6,000 drachmas.

Boularchidas (son) of Archipolis: 6,000 drachmas.

Epikydes (son) of Theanos: 4,000 drachmas.

Nikandros (son) of Symmachos, Halikarnassian: 2,000 drachmas.

The total (of the loans): twelve talents and ten minas of Rhodian (silver).

Ilion 33, *RC* 11, ca. 274 BC, A Gift of Land by Antiochus I [1, p. 37]:

King Antiochus to Meleager, greeting. Aristodikides has come to us, saying that, because it had been assigned to Athenaios the commander of the naval base, he has not even yet received the place Petra and the land belonging to it, which we previously wrote giving it to him, and he has asked that there be conveyed to him instead of the

land of Petra the same number of *plethra* elsewhere, and that there be granted to him two thousand *plethra* besides, which he may join to any of the cities in our alliance he wishes, just as we wrote before.

OGIS 266, 263–241 BC, Eumenes I and his Mercenaries [1, p. 46]:

Requests which Eumenes (son) of Philetairos granted to [the] soldiers [in] Philetaireia and to those in Attaleia. To pay as the cash value of the grain (allowance) four drachmas the *medimnos*, and of the wine (allowance) four drachmas the *metretes*.

P. Tebt. I 5, 118 BC, Decree of Amnesty and Regulation [1, p. 98]:

And since it sometimes happens that the sitologoi and antigraphais use larger measures than the correct bronze measures appointed in each nome . . . in estimating dues to the Crown, and in consequence the cultivators are not charged the (correct number of) choinikes, they have decreed that the strategoi and the overseers of the revenues and the royal scribes shall test the measures in the most thorough manner possible in the presence of those concerned with the revenues, of the farmers, and the priests and the cleruchs and other holders of conceded land . . . , and the measures must not exceed (the government measure) by more than the two... allowed for errors. Those who disobey this decree are punishable with death.

SB XX 14708, 151 BC, A Komarchs Extortion Racket [1, p. 159]:

Moreover, in the 29th year he compelled us to take charge of the same *paralogeia*, for a half-artaba and 50 dr. of bronze for each aroura, which was exacted illegally through us and Thothes son of Papentpos by the six-choinix measure of the village, and the wheat was stored in the houses of Limnaios and Leontomenes the 80-aroura settler, and the bronze money was turned over to Mesthasytmis himself.

paralogeia: “A term used for collections beyond (para) the legal amount, with the usual sense of being collected for the benefit of the collector, not to enrich the treasury.” [1, p. 160].

P.Cair.Zen. V 59823, 253 BC, Letter to Zenon about Wax [1, p. 161]:

Promethion to Zenon, greeting. You wrote to me about the wax to say that the cost per talent, including the toll at Memphis, comes to 44 drachmas, whereas you are told that with us it costs 40 drachmas. Now do not listen to the babblers; for it is selling here at 48 drachmas. Please therefore send me as much as you can. Following your instructions I have given your agent Aigyptos 500 drachmas of silver towards the price of the wax, and the remainder, whatever it may

be, I will pay immediately to whomever you tell me to. And of honey also let 5 metretai be procured for me. I appreciate the kindness and willingness which you always show to me, and if you yourself have need of anything here, do not hesitate to write. Farewell. Year 33, Pharmouthi 19. (Address) To Zenon.

P. Lille 1, 259 BC, Plans for Reclamation Work [1, pp. 170–171]:

The perimeter of the ten thousand arouras is 400 schoinia, there are 4 dikes, and in the middle (running from south to north) will be 3 dikes at a distance of 25 schoinia from each other, and 9 others running cross-ways from East to West, ten schoinia distant from each other; in the 10,000 arouras (there are) 40 dike-enclosed basins of 250 arouras each, whose measurements are 25 by 10 (schoinia); the total number of dikes is 16, each 100 schoinia in length, for a total of 1,600, which need to be excavated.

The width of the ditch (is to be) 4 cubits, the depth 2, for we suppose that a ditch of this size will give dikes of the stated size; the total per schoinion is thus 86 naubia, and for the 1,600 (schoinia) 137,600 naubia. And it is necessary for another four water-channels to be made in addition to the four existing ones, at 100 schoinia each, a total of 400 schoinia, at 86 (naubia) a total of 34,000, or a grand total of 172,000 (naubia).

P. Hib. I 85, 261 BC, Receipt for Seed-grain [1, p. 173]:

In the reign of Ptolemy son of Ptolemy and his son Ptolemy, year 24, the priest of Alexander and the Brother and Sister Gods being Aristonikos son of Perilaos, the canephore of Arsinoe Philadelphos being Charea daughter of Apios, in the month of Mesore. Pasis, son of ..., priest, has received from Paris son of Sisymbaios, agent of Harimouthes the nomarch from the lower toparchy, as seed for the 25th year, being included in the lists of receipts and expenditures, for the royal holding of Philoxenos of the (troop) of Telestes 40 artabas of wheat, $38\frac{1}{3}$ of barley which are equivalent to 23 of wheat, and $67\frac{1}{2}$ of olyra which are equivalent to 27 of wheat, making a total of 90 artabas of wheat, in grain pure and unadulterated in any way, according to just measurement by the 29-choenix measure on the bronze standard.

P. Rev., 259 BC, “Revenue Laws” of Ptolemy Philadelphos [1, p. 188]:

They shall seal the oil in the country at the rate of 48 drachmas in copper for a metretes of sesame oil or cnecus oil containing 12 choes, and at the rate of 30 drachmas for a metretes of castor oil, colocynth oil, or lamp oil. (Altered to . . . both sesame and cnecus oil and castor oil, colocynth oil and lamp oil at the rate of 48 drachmas in copper for a metretes of 12 choes and 2 obols for a cotyla.)

P. Tebt. I 35, 267 BC, Regulating the Price of Myrrh [1, p. 197]:

Apollonios to the epistatai in the division of Polemon and the other officials, greeting. For the myrrh distributed in the villages no one shall exact more than 40 drachmas of silver for a mina-weight, or in copper 3 talents 2,000 drachmas, and 200 drachmas on the talent for carriage; which sum shall be paid not later than Pharmouthi 3 to the collector sent for this purpose.

SEG 46, 2120:

Rectangular local pink sandstone stele with rounded top; found in Bir 'Iayyan (Eastern Desert), an unfortified Ptolemaic station supplying water to passersby on the road between the gold-mining center at Barramiya and the Nile River centers of Edfou and el-Kab; it is located ca. 97 km. east of Apollinopolis Magna (Edfou).

[2, p. 322]

From the river to this point, four hundred sixty-one stadii (στάδιοι τετρακόσιοι ἐξήκοντα εἷς). In the reign of Ptolemy son of Ptolemy Soter, year 28, month of Epeiph, Rhodon son of Lysimachos, from Ptolemais, toparch of the three ?, set up (this stone).

[2, p. 322]

The Greek stade was of notoriously variable length. If, as one would expect, it means here the most common Ptolemaic stade of about 212 meters, the distance of 461 stades here would be about 97.7 km, very nearly exactly the actual measured distance (cf. section 1). Minor deviations in the course of the modern road from the ancient would suffice to explain this difference.

SEG 38, 619 [17, p. 367]:

When Timesios was priest of Lysimachos. King Lysimachos has given these estates to Limnaios son of Harpalos as a patrimonial possession: the estate in the (former) territory of Sermylia, 1200 πλέθρα of land planted with trees, contiguous with the properties of Agathokles of Lysimachos and Bithys son of Kleon; the estate in the (former) territory of Olynthos at Trapezous, 360 πλέθρα of land planted with trees, contiguous with the properties of Menon son of Sosikles and Pylon son of Epiteles; and the estate in the (former) territory of Strepsa, 900 πλέθρα of land planted with trees and 20 πλέθρα of vineyards, contiguous with the properties of Gouras son of Annythes, Chionides, and Eualkes son of Demetrios. (He has granted these estates) to him and his descendants with the full right to possess and sell and exchange and give them to whomsoever they wish.

SIG 3, 302 [17, p. 371]:

God. Good fortune. When Alexander was king, in the eleventh year when Menandros was satrap and Isagoras was prytanis.

Krateuas gave to Aristomenes a plot (ἀγρός) of arable land (γῆ ψιλή) on which to settle (ἐποικίσαι), in addition to the nursery (φυτόν) planted under Krateuas.

The perimeter of the land (γῆ) is 170 κύπροι of seed, and building-plots (οἰκόπεδα) and a garden (κῆπος). The tribute (φόρος) payable on the garden is one gold stater (χρυσοῦς) per year.

Athenian Agora [6, p. 296]:

Latin and late Greek literatures are full of evidence in the form of comments, anecdotes, and quotations from earlier writers, as to the esteem in which the wine of Chios was held; it is the famous wine of antiquity. There was a not unnatural excitement, therefore, over some broken jars found last year in an ancient well when it was realized that they were stamped with the arms of Chios. One of these jars is illustrated on p. 202 (Fig. 1, 1). Of the five reconstructed, the shape and dimensions are so constant that evidently a uniform capacity was intended. This is approximately 22 litres, or six gallons. An anecdote of Plutarch informs us that in the time of Socrates an amphora of Chian wine sold in Athens for one mina, which is a hundred drachmas, or a hundred day's wages to the skilled workman of that period. Our jars are dated by the deposit in which they were found in the third quarter of the fifth century B.C., probably about 430.

Athenian Agora [6, pp. 303–304]:

Chian amphora: third quarter of 5th cent. B.C.

SS 1838. Ht. 0.702 m. One of a series of nearly complete jars found in Section I in an ancient well the filling of which can be dated closely by the red-figured and black-glazed stamped ware included. Of the large jars, seven bear stamps: five, of which this is one, have the Chian coin type illustrated Pl. I, 1; these are all similar in shape to a sixth, the stamp of which shows simply a kantharos; the seventh is no. 2 of this figure. For Chian clay, see the note on fabric (p. 201). For the profile of the handle, see Pl. II, 1. The capacity of each of the six similar jars is roughly twenty-two litres

Similar complete Chian amphorae of a somewhat later time hold seven Athenian choes. Despite the evidence which makes the twelve-chous metretes the large liquid unit, the ordinary amphora of Greek as well as Roman times is more likely to hold eight choes.ⁱ This fact

combines with the 7: 8 ratio of Chian and Athenian coins to persuade us that the Chian standard chous also stood in a 7: 8 ratio with the Athenian chous. These jars would then hold eight Chian, or seven Athenian, choes. On this pot the informal indication of capacity would then be the work of the Athenian purchaser, probably for a re-use of the jar.

SIG 334

This was 80 certified talents of Alexandrian silver and 18,000 gold pieces, making a total of 140 talents.

P. Lond. V, 1718 [3, pp. 154–165]

Plutarch, *Moralia* 416 B, “often the measures and the things measured are called by the same name, as, for example, the kotyle, choinix, amphoreus and medimnos.”

Greek liquid measures

kotyle

chous 12 kotylai

metretes 12 choes

Greek dry measures

kotyle

choinix 4 kotylai

medimnos 48 choinikes

stadion

cubit

parasang

Herodotus 2.6.3, Strabo 11.11.5

Olympics, Julius Africanus, *Chronographiae*, 199

33rd. Gylis of Laconia stadion race.

A pancration was added, and the victor was Lygdamis of Syracuse, an enormous man who measured out the stadion with his feet in only 600 paces.

A horse race was added, and the victor was Craxilas of Thessaly.

Rhodes and Osborne [13, p. 121]:

The buyer will weigh out the wheat at a weight of a talent for five *hekteis*, and the barley at a weight of a talent for a *medimnos*, dry and clean of darnel, arranging the standard weight on the balance, just as the other merchants.

Engels [5]

Walbank [18]

P. Oxy I.9 verso [7, pp. 77–79], Oxyrhynchus, third or early fourth century AD, List of Weights and Measures:

A copper drachma has 6 obols, and an obol 8 chalki, so that the copper drachma consist of 48 chalki. A drachma has seven, 7, obols, and an obol has 8 chalki, so that the drachma consists of 56 chalki. The talent has 60 minae, and the mina 25 staters or 100 drachmae, and the stater has 4 drachmae, so that the talent consists of 1500 staters or 6000 drachmae, or forty-two thousand obols. An artaba has 10 measures, and the measure has 4 choenices, so that the artaba consists of 40 choenices. A medimnus has 12 hemihekta and the hemihekton four choenices, so that the medimnus consists of forty-eight choenices. The ell has 6 palms, and the palm 4 digits, so that the ell consists of 24 digits. The metretes has 12 choës, and the chous 12 cotylae, so that the metretes consists of 144 cotylae. The mina-weight has sixteen, 16 quarters, and a quarter has

P. Oxy. IV.669 [8, pp. 116–121], Oxyrhynchus, end of the third century AD, Metrological Work, ll. 1–20:

The schoenium [σχοινίον] used in land-survey has 8 eighths [ὥγδοα η], and the eighth [ὀγδοοον] has 12 cubits [πῆχινς ιβ], so that the schoenium used in land-survey has 96 cubits [πῆχῶν ϑϛ], while the ... schoenium has 100 cubits [πῆχῶν ρ]. The linear cubit [εὐθυμετρι]χός πῆχινς] is that which is measured by length alone, the plane cubit [ἐμβαδινός] is that which is measured by length and breadth; the solid cubit [στερεός] is that which is measured by length and breadth and depth or height. The ... building cubit [(ο)ικοπεδικός πῆχινς] contains 100 plane cubits. Ναύβια are measured by the ξύλον; the royal ξύλον contains 3 cubits, 18 παλαισταί, 72 δάκτυλοι, while the ... ξύλον contains $2\frac{2}{3}$ cubits [ββ'], 16 παλαισταί and 64 δάκτυλοι; so that the schoenium used in land-survey contains 32 royal ξύλα and 36 ... ξύλα.

ll. 31–41:

2 παλαισταί make a λιχάς, 3 παλαισταί a σπιθαμή, 4 παλαισταί an (Egyptian?) foot [πούς], 5 a cloth-weaver's cubit [πῆχυς λινοῦφικτός] ..., 6 παλαισταί a public and a carpenter's cubit, 7 παλαισταί a Nilometric cubit, 8 παλαισταί a ... cubit, 10 παλαισταί a βῆμα, which is the distance of the outstretched feet. 3 cubits [γ πῆχινς] make a public ξύλον, 4 cubits an ὀργυιά, which is the distance of the outstretched hands. ... cubits make a κάλαμος, $6\frac{2}{3}$ [ϛβ'] an ἄκαινα.

P. Ryl. II.64 [11, pp. 4–5]

P.Oxy.XIII 1609, 1669 v, P.Oxy.XLIX 3455, P.Oxy.XLIX, P.Oxy.XLIX 3457, P.Oxy.XLIX 3458, P.Oxy.XLIX 3459, P.Oxy.XLIX 3460

Hultsch [10]

Tabula Heroniana [9, p. 182]

Segrè [16]

Pernice [12]
 Stilbach [15]
 Smith, A *Dictionary of Greek and Roman Antiquities*, 1891, s.v. *logistica*.
 Ptolemy, *Geography* [4]

References

- [1] Roger S. Bagnall and Peter Derow (eds.), *The Hellenistic Period: Historical Sources in Translation*, Blackwell Sourcebooks in Ancient History, vol. 1, Blackwell Publishing, 2004.
- [2] Roger S. Bagnall, Joseph G. Manning, Steven E. Sidebotham, and Ronald E. Zitterkopf, *A Ptolemaic Inscription from Bir 'Iayyan*, *Chronique d'Égypte* **71** (1996), no. 142, 317–330.
- [3] H. I. Bell (ed.), *Greek Papyri in the British Museum, Vol. V*, British Museum, London, 1917.
- [4] J. Lennart Berggren and Alexander Jones, *Ptolemy's Geography: An annotated translation of the theoretical chapters*, Princeton University Press, 2000.
- [5] Donald W. Engels, *Alexander the Great and the logistics of the Macedonian army*, University of California Press, 1978.
- [6] Virginia Grace, *Stamped amphora handles found in 1931–1932*, *Hesperia: The Journal of the American School of Classical Studies at Athens* **3** (1934), no. 3, 197–310.
- [7] Bernard P. Grenfell and Arthur S. Hunt (eds.), *The Oxyrhynchus Papyri, Part I*, Egypt Exploration Fund, London, 1898.
- [8] Bernard P. Grenfell and Arthur S. Hunt (eds.), *The Oxyrhynchus Papyri, Part IV*, Egypt Exploration Fund, London, 1904.
- [9] Friedrich Hultsch, *Metrologicorum scriptorum reliquiae. Volumen I quo scriptores Graeci continentur*, Bibliotheca scriptorum Graecorum et Romanorum Teubneriana, B. G. Teubner, Lipsiae, 1864.
- [10] ———, *Griechische und römische Metrologie*, second ed., Wiedmannsche Buchhandlung, Berlin, 1882.
- [11] J. de M. Johnson, Victor Martin, and Arthur S. Hunt (eds.), *Catalogue of the Greek papyri in the John Rylands Library, Manchester. Volume II. Documents of the Ptolemaic and Roman Periods (Nos. 62–456)*, Manchester University Press, 1915.
- [12] Erich Pernice, *Griechische Gewichte*, Weidmannsche Buchhandlung, Berlin, 1894.

- [13] P. J. Rhodes and Robin Osborne (eds.), *Greek historical inscriptions 404–323 BC. Edited with introduction, translations, and commentaries*, Oxford University Press, 2003.
- [14] M. Rostovtzeff, *The social and economic history of the Hellenistic world*, 3 vols., Clarendon Press, Oxford, 1953.
- [15] Erich Schilbach, *Byzantinische Metrologie*, Handbuch der Altertumswissenschaft XII.4, C. H. Beck, München, 1970.
- [16] Angelo Segrè, *Metrologia e circolazione monetaria degli antichi*, N. Zanichelli, Bologna, 1928.
- [17] Peter Thonemann, *Estates and the Land in Early Hellenistic Asia Minor: The Estate of Krateuas*, Chiron: Mitteilungen der Kommission für Alte Geschichte und Epigraphik **39** (2009), 363–393.
- [18] F. W. Walbank, *A Historical Commentary on Polybius, Volume II: Commentary on Books VII–XVIII*, Clarendon Press, Oxford, 1967.