

Weights and Measures Units in Petra Papyri

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Received 18 February 2018; accepted 22 April 2018
Published online 26 May 2018

Abstract

Petra papyri is one of the most important discovers in the history of ancient Jordan, and provide evidence that there were specified metrological units in Petra during the Byzantine period. The use of these weights and measurements was common in ancient Petra during the Byzantine period. So, this study will try to discuss various weight and measure units and measures of capacity dray and liquid that were practiced by the people in Petra and the modern equivalents of these weights and measures, although today it is difficult to define exactly how much certain these historic units measured, as compared to modern equivalents.

Most of these measures were widely used and known by the eastern people even though they had variations

in values. It seems that the people in Petra borrowed the measures technique from the Romans. This study will depend on the papyri of Petra and sources of the measures such as Epiphanius of Salamis.

Key words: Weight; Measure; Petra papyri; Petra; Metrological units; Roman measures

Al-Nasarat, M. (2018). Weights and Measures Units in Petra Papyri. *Canadian Social Science*, 14(5), 1-5. Available from: <http://www.cscanada.net/index.php/css/article/view/10345>
DOI: <http://dx.doi.org/10.3968/10345>

INTRODUCTION

As has been known, the documentary sources, particularly the papyri, are considered the main source for studying the history of Petra during the Byzantine period. The Petra papyri were discovered in 1993 at Petra church (Figure 1) opened an entirely new avenue of research on Byzantine Petra, and reveal very clearly picture for studying the

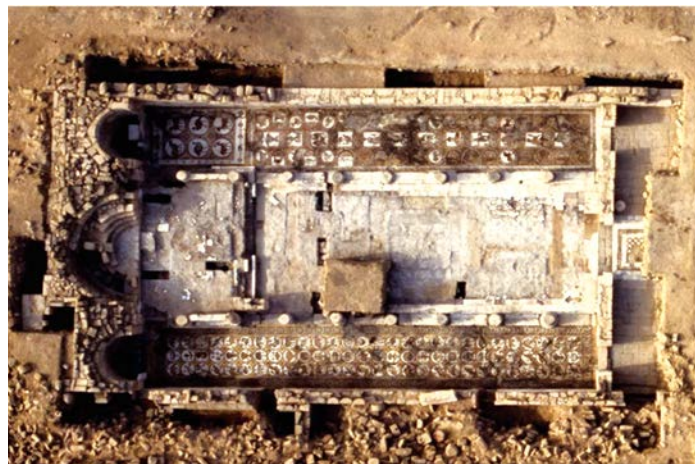


Figure 1
The Main Church in Petra
Source: <https://www.acorjordan.org/2015/08/01/petra-papyri/>

economic life and management of tax system by the end of the fifth century and beginning of the sixth century AD, at least at Petra (Figure 2).

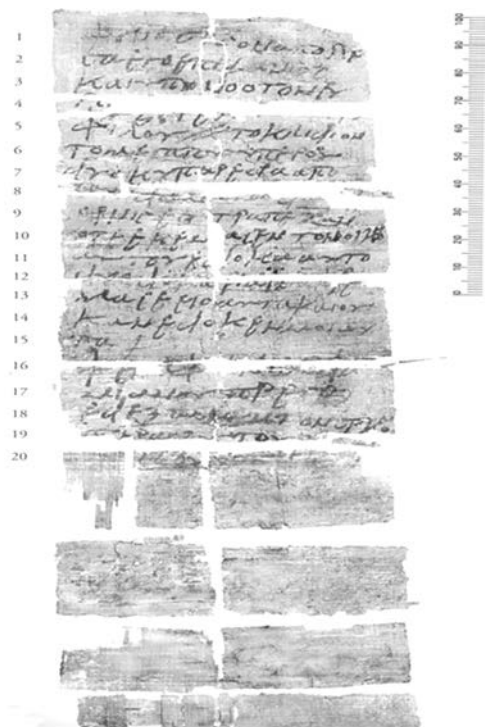


Figure 2
One of the Petra Papyri Which Lists Goods That a Landlord Priest Claims Were Stolen by One of His Colleagues

Source: <https://www.acorjordan.org/2015/08/01/petra-papyri/>

There is no counting without a thorough knowledge of contemporary metrology (Gelb, 1982, p.585). The study of any ancient system of weights and measures is always complicated by a lack of documentary evidence for the origin of the units used in ancient time (Richeson, 1954). With the gradual development of human societies, there was an urgent need for the use of the Weights and measures in daily life for buying and selling, in order to facilitate commercial transactions between the merchants and people.

Units of weights and measures did not have the same value throughout the ancient Near East (al-Salameen, 2007, p.22). However, there were no exact standers in the ancient world, the high amount of variations takes place from period to period and from area to area and even from one city to another (Gelb, 1982, p.585). The weights and measures are established for the purpose of facilitating commerce and transactions in the state (Rainey, 1965, p.34). There is no counting without a thorough knowledge of contemporary metrology (Ibid.). From the earliest period of their history the Nabataeans used the system of weights and measures for buying, selling and measuring areas (al-Salameen, 2007, p.23). This inductor that the people of Petra were civilized society during the sixth century AD.

Units and Measures: Papyri texts provide us with a considerable kinds of weights and measures, these are as follows:

1. MEASURES OF AREA

The units of measures land mentioned in the Petra papyri are Roman *iugera*.¹ The Petra papyri are the first source to attest land specified as “*iugera of the patrimonium*” (πατριμωνίου ιουγερα) (Frösén et al., 2002). The tax expected by the taxpayer is calculated based on units such as *iugum* (Jones, 1964). Literally, in the Petra papyri, the farmers use Semitic land measures such as: the *koriaia* (*kor*), *satiatia* (*se’ah*) and *kabiaia* (*kab*) (Invs. 13 and 14; Fiema, 2005; Koenen, 1996, p.86; Frösén et al., 2002, p.77). St. Epiphanius (AD 315-403)² mentions that these are measures of the ground area which can be sown by these tools (Dean, 1935).

The first measure in Petra papyri is *iugera* or *iugerum*, the land measure (Frösén et al., 2002, p.103). It is a Roman area unit, meaning “yoke of oxen” (Pliny: 18:9; Dean, 1935). This unit used in determining imperial taxes (Dean, 1935). Later, the term came to mean the area that a yoke of oxen could plow (Caldwell, 2001). Pliny gives a *iugum* as 40 *iugera* or 30 if the soil is difficult (Jones, 1990). The Syro - Law book defines the *iugum* as 20 *iugera* of arable first- class land, in terms of vines; the *iugum* equals 5 *iugera* (Jones, 1990). Epiphanius, at the end of the fourth century AD defined the *iugum* as 13 *iugera* (Caldwell, 2001). This measure was used before Diocletian, but was defined in his reign, and was made statutory (Caldwell, 2001)³. Jones describes the *iugum* as a tax unit, and as a unit used in the measurement of land (Jones, 1990). It is worth noting that the *iugum* is not mentioned in the Egyptian papyri, although, it is known from the Theodosian Code that the *iugum* or *iugatio* was used for property holdings in Egypt (Caldwell, 2002). As well as in Nessana papyri (Stroumsa, 2008, p.42). In the Petra papyri, the land taxes were paid based on *iuga* that were calculated by considering the size and type of land (Caldwell, 2003).

Most of the fields mentioned in the Petra papyri are under Petra’s communal tax authority rather than the imperial fiscus (Fiema, 2002, p.226). The amount of assessed tax was determined by the total area of land registered for Petra (Ibid.).

In general, land around Petra was measured in Roman *iugera* (Nasarat et al., 2012, p.112), and it is clear from

¹ The standard Roman *iugerum* of about 2523 square meters was used. All the land in Petra is measured in Roman *iugera*. (Koenen, 1996, p.186).

² An Eastern Church Father, born in *Eleutheropolis* in Judae, Epiphanius was a monk from his earliest youth. For more information about his life, see (Shaw, 1936).

³ Some scholars argue that the *iugum* represents an accountancy unit not a land unit of measurement. (See Goffart, 1974).

the papyri that taxation was based on a fixed fiscal unit calculated according to the type, amount and quality of the land. Therefore, different types of land would be taxed at different rates, so all land cannot be lumped together under one measurement. The Petra papyri show that tax collectors from Petra and Augustopolis used the system of taxation based on the registration and classification of land prescribed by the Byzantine state. The accounts of tax liability were kept in records for the cities of Petra and Augustopolis (Caldwell, 2001, p.76). Koenen says that

Measuring a field by the needed amount of seed makes sense when local conditions did not allow farmers to sow the entire area regularly. This easily occurs in desert agriculture when the amount of rain or other water changes from one year to the next or when rocks and migrating stones and sand render part of the area infertile. (Koenen, 1996, pp.177-188)

The oldest and one of the most important documents of the Petra archive is inv.10, dated to AD 527/537 mentioned a division of property among three brothers named Bassos, Epiphanius, and Sabinos. Three brothers divided about 130 *iugera* between them, containing vineyards and sown land (Caldwell & Gāgos, 2014). This means that the people of Petra during the sixth century AD used not only Roman land measures but also Semitic land measures. These measures are also used in the Nessana papyri, from the archive of Babatha⁴ (Yadine et al., 2002). Koenen says that “three brothers may have had the choice of using their traditional local measures” (Koenen, 1996, p.187). In general, in the ancient Near East the system of measuring area was based upon the quantity of seeds sown in it (Koenen, 1996, p.187; al-Salameen, 2007, p.22). In Babylonia and Assyria the Land was measured by the area a team of oxen could plow in a day, “land was also measured according to the quantity of grain necessary to sow it” (Bible Encyclopedia, “Weights & Measures”).

Using *iugera* by the people of Petra shows the Roman influence on the community of Petra, especially after AD 106, when the Nabataean kingdom was transformed into *Provincia Arabia*.

2. MEASURES OF CAPACITY

Some measures were primarily used for units of dry-goods, others for liquids, but it has not been definitively proven that this distinction was valid throughout the whole system. It is difficult for us to give the exact information when we can merge the liquid and dry measures into one system of measure.

2.1 Dry

(a) The first dry and capacity measure mentioned in Petra papyri is *se'ah*, or *saton* “*σάτον*” in Greek (Dean,

⁴ The Babatha archive contains documents of a Jewish woman who lived in the village of Maaza situated in the southern shore of the Dead Sea (Cotton, 1993).

1935; Yadine et al., 2002, p.69), and the plural form *sata* (Schmidt, 2014). This measure is attested in the Nabataean in the plural form *sayn* as follows “the portion of our lord, the leasing (tax) for a year, as well, in its amount of ten *Se'ah*” (al-Salameen, 2007, p.23). The *se'ah* a measure of flour or grain (Bible Encyclopedia, “Weights & Measures”). It was sometimes used to determine both liquid and dry measures. *Se'ah* is the most common word for measure of volume in Bible lands (Hastings, 2004a, p.820). The area of sowing a *se'ah* is 625m² (Frösén et al., 2002). The word *se'ah* is attested in Aramaic and Hebrew texts “*סאה*” (Gen. 18:6; I Sam. 25:18; I Kings 18:32; al-Salameen, 2007, p.24). This measure is mentioned in the Elephantine papyri⁵ from the fifth century BC (*Encyclopedia Judaica*: “Weights & Measures”). This is a traditional local measure used in Petra instead of the standard Roman area measures (Koenen, 1996, p.186). The same measure *se'ah* was used in Mesopotamian measures (*Encyclopedia Judaica*: “Weights & Measures”). Its capacity has been a matter of some discussion (Yadine et al., 2002, p.69). Although one *se'ah* equals 1 and quarter *modii* (μῶδιος)⁶ (Dean, 1935). The *se'ah* was 1/30 of a *kor* (Frösén et al., 2002), or 12.148 litres (Bible Encyclopedia, “Weights & Measures”). *Se'ah* also equaled 50 *xestes* (Stone and Ervine, 2000). Josephus says that a *Se'ah* is equal to one and one-half Italian *modii* (Josephus, Antiq: ix.iv.5). This measure was used during the Islamic period (Strange, 2010).

(b) The second liquid or dry measure used in the Papyri is *Kor*. This word is attested in Mesopotamian measures (*Encyclopedia Judaica*: “Weights & Measures”; Schmidt, 2014), and used simultaneously in Hebrew texts the word is *cor*, *corus* “*כר*” (Ezek. 45:14), and in Greek “*κόρος*” (*kóros*) (Schmidt, 2014). In the dictionary of the bible the *cor* contained 41 Graeco-Roman *modii* (Hastings,

⁵ The Elephantine Papyri consist of 175 documents from Egypt. For more information. (See Porten, 1996).

⁶ Both a dry and a liquid measure, equal to 1/6 of the chief unit, Arabic, *mudy* (Figure 3). (Welborn, 1935). Also equal to 8.49 liters, a *modius* was used in Palestine during the Hellenistic and Roman period (*Encyclopedia of the Bible*, “Weights and Measures”). Retrieved from <https://www.biblegateway.com/resources/encyclopedia-of-the-bible/Weights-Measures>



Figure 3
Bronze Modius Measure (4th Century AD) With Inscription Acknowledging Imperial Regulation of Weights and Measures
Source: http://en.wikipedia.org/wiki/Ancient_Roman_units_of_measurement

2004b, p.904). Epiphanius point out that this measure has thirty *modii* and that the word *kor* means a heap which a camel loads. One *koriaia* equaled one *iugum* (Dean, 1935; Frösén et al., 2002, p.77). The *Kor* is 30 *modii* (Welborn, 1935). One cor would sow 23,200 m² (Rathbone, 1991, p.242). The origin of the word is *kūra*, taken from the Hebrew language (Dean, 1935). The *kor* was mostly used for weighting grain, barley, oil, and flour (Dean, 1935; al-Salameen, 2007, p.24). One *kor* of barley is equal to one shekel of silver (Welch, 1999), and equaled five *iugera* (Frösén et al., 2002), and 880 *xestes* (Stone and Ervine, 2000). A *koriaia* in Petra papyri was the area which could be sown with a *kor* (Frösén et al., 2002, p.77).

(c) *kāb* or *Kabb* is a dry measure (Hastings, 2004b, p.910) mentioned in the Petra papyri (inv.14; Frösén et al., 2002), and Nessana papyri (Kraemer, 2015, p.79) used in weight grain (Schmidt, 2014) and corn (Strange, 2010). The capacity measure *kāb* appears in the second century Greek documents from the Judaen desert (Frösén et al., 2002, p.77). A *Kāb* was 1/6 of a *se'ah*, or 1/80 of a *kor* (Frösén et al., 2002). This measure derived from the Hebrew word “קב” *qava* (Dean, 1935). A *kāb* equals one-fourth of a *modius* (Kings II 6:25; Dean, 1935). *Kāb* is also attested in Greek as *Kabos* (*káβóc*) (Frösén et al., 2002). Kraemer state that the *kab* a grain measure containing 4 sextarii (Kraemer, 2015, p.79).

2.2 Liquid

One of the important and widespread measures appearing in the Petra papyri is *xestes*, used as a liquid measure, for oil and wine, in inv.4 (Frösén et al., 2002, p.75). *Xestes* (ξέστης), a Greek measure (Smith and Anthon, 1843), was used for both liquid and dry measure (Tarbell, 1891), and called the measure of a wine-vat (Stone and Ervine, 2000). It corresponds to the Roman *sextarius* (Jones, 1976, p.52). As 1/16 of the basic Roman *modius*, the *sextarius* held about 0.539 liters (Jones, 1976). Epiphanius says that a *xestes* has great variation and was used widely (Dean, 1935; Frösén et al., 2002). Epiphanius was aware of the changeable values of *xestes*, stating that “its standard is variously fixed among many peoples” (Mayerson, 1999). A *Xestes* was used for weight corn and wine (Kelly, 1821), as well as for weight oil in Alexandrian and Southern Palestine (Mayerson, 1999).

CONCLUSION

It's clear that the Petra papyri provided good details about the economic life of the Nabataean during the late byzantine period. The information extracted from the papyri reveals that the community in Petra was open to other communities. Due to the scarcity of the information, papyri are our chief source of information for the commercial daily life in Byzantine Petra.

The system of weights and measures in the Petra was based on those of Roman and Mesopotamia. Most of these

measures were widely used by the ancient Near Eastern neighboring societies. In the Petra, dry things, such as Wheat, Barley, and Flower were measured according to their capacity.

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