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THE MONOCHORON AND DICHORON: STANDARD MEASURES FOR WINE BASED ON THE OXYRHYNCHITION

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The terms Oxyrhynchition, monochoron and dichoron, dealing with quantities of wine, appear in the Heroninus archive and in related Fayum documents of the third century A.D. The quantitative relationship of one term to the other has been well established, primarily in a note to line 79 (p. 195) of *P. Lond.* III 1170 which states that the monochoron was the equivalent to 1.5 Oxyrhynchitia, that the dichoron equaled 2 monochora or 3 Oxyrhynchitia, and that a donkey load was 8 monochora or its equivalent. This much appears secure, but what is not is the precise quantity that these terms represent or the value for the smallest component, the Oxyrhynchition, to which the other two terms are related. The monochoron also requires clarification of its role as an accounting principal in the region's wine industry.

D. Rathbone, in his detailed study of Heroninus archive and related documents, takes the terms Oxyrhynchition, monochoron and dichoron as "containers cum measures", as both jars and measures, and holds that the monochoron "seems to have denoted what was commonly called the keramion." To arrive at a working number of liters per monochoron, he assumes that 8 monochora keramia of wine was the maximum number possible for a donkeyload, less 35% to account for the weight of the empty jars. This would yield the net weight of the contents of a keramion of wine as no more than 7.3. liters or roughly 7 per monochoron of wine.[1] Although this approach to assess an approximate metric value for the monochoron in terms of liters is a workable one, it leaves open the role of the the Oxyrhynchition, the basic unit of the three measures, and the reason for its use when the other two measures only reflect an arithmetical relationship to it.

Oxyrhynchition: The term Oxyrhynchition may be best described as a standard measure as defined by the authorities of the Oxyrhynchus nome. It was not only a standard applied to a liquid measure such as wine, but it also applied to weights of metals and other goods. For example, *P. Col.Youtie* II 67.16-18, dated to 260/61, calls for the return of a dowry of "all the goods, in full by weight and valuation, which are: of gold, in goods, all together, by the Oxyrhynchite standard, seventeen minas weight…" (εἴ-δη πάντα σταθμῷ καὶ συντιμ[ήσ]ει πλήρη ἅπερ ἐστὶν χρυσίου μὲν ἐν εἴδεσι ἐπὶ τὸ αὐτὸ στ[αθμ]ῷ [Ὀ]-

[1] Economic Rationalism and Rural Society in the Third Century A.D. Egypt (Cambridge 1991) 468-470. The figure of 35% to account for the weight of the empty jars (p. 478) is derived from an early analysis of the ceramic material from the shipwreck at Yassi Ada. A more detailed assessment of these jars in *JRA* 1996, 192, provides a figure of 44% for "Avg. full capacity 7.322 l." The weight of clay jars differs from potter to potter and whether they are used for local transport by donkey/camel or for distant transport by ship. Applying one figure for all jars is risky, as is assuming that the maximum load for a donkey is 90 kg. In either instance, a reasonable allowance must be made to account for differences above or below the average or the maximum.

ξ[υρυγχιτικῷ] μνα[ια]ῖ[α δέ]κ̣α̣ ἐ̣[π]τ̣ - - -). Similarly, in *P. Oxy.* III 496.3, a marriage contract dated to 127, χρυσίο]υ̣ σταθμῷ Ὀξυρυγχειτ[ικῷ μναιαῖα δέκα πέντε καὶ τετάρτας.[2]

The creation of a standard measure for wine is reflected in *P. Oxy.* L 3595, one of three pottery leases dating between 243 and 260 (*JRS* 71 [1981] 87-97). The potter of 3595 contracts to produce a large number of "empty tetrachoun jars called 'Oxyrhynchite'" (κοῦφα Ὀξυρυγχειτικὰ τετάρχοα λεγόμενα), "each tetrachoun holding up to the rim (sc. up to the neck of the jar) 20 Maximian cotylae" (ἑκάστου τετραχόου χωροῦντος μέχρι χείλου κοτύλ̣α̣ς Μαξιμιανὰς εἴκοσι).[3] The potter also contracted to produce a small number of dichoun jars and double ceramia, each bearing a metric relationship to the tetrachoun of 20 Maximian cotylae.[4]

In terms of liters, I have estimated the value of a Maximian cotyla to be between 0.6 and 0.576 l. vis à vis a nominal cotyla of 0.24 and 0.27 l.[5] In other words, the Maximian cotyla was the virtual equivalent of the sextarius/xestes, the Roman standard for a liquid measure. If my analysis of *P. Oxy.* 3595 is on track, then the Oxyrhynchite dichoun was the equivalent of 10 Maximian cotylae or 10 sextarii; the tetrachoun would have a capacity of 20 sextarii, and the double ceramion 40 sextarii (*ibidem*). The dynamic involved in this move was to put the Maximian cotyla on a one-to-one basis with the sextarius rather the the conventional equivalent of two nominal cotylae to one sextarius. It appears as an attempt, short lived most likely, to fall in line with the standard Roman liquid measure.

Monochoron: Returning to the monchoron and its relationship to an Oxyrhynchition on the basis of 1.5 to 1, a monochoron would be the equivalent of 1.5 Oxyrhynchite dichoa, the smallest of the measures in *P. Oxy.* 3595. The monchoron would then be the equivalent of 15 Maximian cotylae/xestai or c. 8 liters.[6] As such, a donkeyload of 8 monochora would represent 64 liters, leaving a variable of over 40% to account for the weight of clay jars, if clay jars, rather than wineskins, were used in every instance.

If this analysis holds, then the Oxyrhynchite dichoun of 10 sextarii/xestai was the basic measure that influenced the creation of the monochoron (15 xestai)—very close to Rathbone's 7.3 liters—and the dichoron (30 xestai). To take this one step further, the three-unit system of Theadelphia also seems to have been influenced by the three standard measures of Oxyrhynchus (dichoun, tetrachoun, diplokeram(i)on) but with different capacities.

We are presented with another difficulty and that is whether the Oxyrhynchition, monchoron and the dichoron are, as Rathbone puts it, "measures cum jars"; that (p. xvi) the Oxyrhynchition was a wine jar one and a half times the size of a monochoron; that the monochoron was the main wet measure and size of a wine jar, and that dichoron was a wine jar twice the size of a monochoron. In support of his

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[2] See also *P. Oxy.* VI 905.5, a marriage contract dated to 170, [χ]ρυσοῦ μέν κοινοῦ σταθμῷ [Ὀξυρυγχειτικῷ] μναγαῖον ἐν εἴδεσι συντιμηθέν. *P. Harr.* I 86.3-4, dated to A.D. 444, is a loan of four imperial gold solidi "of Oxyrhynchite (?) weight." The restoration is given as [Ὀξυρυγχ]ιτικ(οῦ) σταθμοῦ, but the editor states that Ἀρσινο]ιτικοῦ σταθμοῦ would also be possible. *BGU* III 781.10 may be another possibility (…ἀργυρώματα Ὀξυρυγνχιτικὰ 2).

[3] The word "Maximian" associated with cotylae turns up only in one other document, *PSI* XII 1252, a contract for the delivery of 200 jars of wine in which the vinter guarantees to provide (lines 8-11) "(each jar containing) up to 15 cotylae of wine (measured) by the Maximian cotyla, in jars which are the so-called tetrachoa." See above, my article on "The Value of the Maximinian Cotyla in *P. Oxy.* L 3595 and *PSI* XII 1252. On "up to the rim", see n. 1).

[4] The popularity of the Oxyrhynchite pattern extended to the Hermopolite nome. *P. Teb.* II 342, a report of confiscated property dated to the late second century, involved a pottery that manufactured jars (line 23) τύπῳ Ὀξυρυγχ(ειτικῷ) κεραμείων.

[5] See above (n. 3). I have ruled out *PSI* 1252 as a basis for this calculation. This document, the only one other than *P. Oxy.* 3595 that makes reference to Maximian cotylae, is a receipt for the sale of wine in which the vintner attests that he will provide the buyer "200 jars of wine each with 15 cotylae of wine (measured) by the Maximian cotyla ἀνὰ κοτύλας δεκαπέντε Μαξιμιανῇ κοτύλῃ) in jars which are called Oxyrhynchite tetrachoa." Unlike the potter of *P. Oxy.* 3595, who was turning out empty tetrachoas with a specific capacity of 20 Maximian cotylae, the vintner of *PSI* 1252 was decanting 15 Maximian cotylae of wine into jars capable of holding 20.

[6] *Ibidem*, the 15 Maximian cotylae that the vintner of *PSI* 1252 contracted to put into each of the 200 tetrachoas of the Oxyrhynchite pattern would represent 200 monochora in Theadelphia.

view that these terms represented wine jars (keramia) of different sizes, Rathbone cites as examples (p. 468) *P. Flor.* 322.11; *P. Prag.* 104.7; cf. *P. Mich.* 620.229-30; and "more specifically, in *P. Flor.* 266.15 Heroninos was ordered to send '102 keramia monochora' which shows that 'monochoron' and 'dichoron' were adjectives…used substantively to denote two sizes of keramion…"

P. Flor. 322 mentions the price of 102 keramia of wine at a price of nine drachmas and one obol per jar. *P. Prag.* 140, calls for 40 monochora at the rate of ten drachmas per keramion. The keramia in these two accounts do not specify monochora keramia. Most compelling in Rathbone's judgement is *P. Flor.* 226.15, mistakenly cited as 266.15: "Send 102 keramia of equal size with a capacity of a monochoron," πέμψον τὰ ἴϲα κεράμ(ι)α μονόχω(ρα) 102.

P. Mich. XI 630.3.228-230, presents a different picture. It shows a total number of monochora for a month (1081 1/2) and the vessels, introduced by the word ἐν, containing that number: 91 dichora, 585 Oxyrhynchitia, and 22 monochora (see below.).

The relationship of the monochoron to Oxyrhynchition and the dichora is more complex than Rathbone would have it. The monochoron, unlike the Oxyrhynchition and the dichoron, may be a jar, but in many cases it was a record-keeping term for aggregate quantities of wine expressed as monochora. For example, we can speak of gallon jugs of wine, but the production of a winery may be calculated as hundreds or thousands of gallons without reference to whether the wine was held in jugs, bottles, or barrels. This dual function of the term monochora as jars and as a ledger entry for an aggregate quantity can be observed in a number of documents.

P. Mich. XI 620.3.228-230, mentioned above, summarizes a previous month's activity thus: οἴνου ὁμοίωϲ ἐλοιπογραφήθην ἐκ λόγου τοῦ (προτέρου) μηνὸϲ [(μονό)]χω(ρα) 1081 1/2, ἐν διχώ[(ροιϲ) 91], ἐν Ὀξ[υρ]υγχιτίοιϲ 585 καὶ μονοχώ(ροιϲ) 22. ("Wine likewise. Balance carried over from the account of the previous month: 1,081 1/2 monochora, in (ἐν) 91 dichora, 585 Oxyrhynchitia, and 22 monochora).

Similarly in *SB* XVI 12380.1-3 (P.J. Sijpesteijn, *Chron. d'Eg.* 55 [1980] 179-188; Rathbone's P.Vindob.G 32018) (γίνεται) ἐπ(ὶ τὸ αὐτὸ) κυριακὰ μονόχω(ρα) 244 ἅ ἐϲτιν ἐν διχώροιϲ 73 μονοχώ(ροιϲ) 98. However, entries in 12380.4-11 record the yield of a vineyard in the amount of 612 monochora from which was debited 22 monochora for expenditures to a number of people, making a net total of 590 monochora. Were the 22 monochora of expenditures dispensed in monchora keramia or was 22 monchora metra decanted into a variety of jars, or even wineskins (ϲπάθια), that the individuals brought to the vineyard? We can't be sure unless the word ἐν precedes the terms, as in lines 19-21: (γίνεται) ἐπ(ὶ τὸ αὐτὸ) κυριακὰ μονόχω(ρα) 413 ἅ ἐϲτιν ἐν διχώροιϲ 206, μονοχώ(ρῳ) 1. (Total: for the owner 413 monochora which are in 206 dichora (keramia) and one monochoron (keramion).[7]

The clarity of these book-keeping entries showing the net yield of estate vineyards in terms of net monochora, less amounts "bottled" in jars, and expenditures to individuals, can be best observed in *SB* XIV 12054 (S.M.E. van Lith, *Talanta* 8-9 [1977] 59-73; Rathbone's P.Vindob.G. 32017b).[8] The recto of *SB* 12054 is a day-book recording the production of a number of estate vineyards on the 11th, 12th, 14th, the 15th, 16th and 17th of Mesore, A.D. 253. The format provides name of the vintner, the number of baskets of grapes (κόφινοι), presumably treaded in the ληνόϲ, and the total yield (ρύϲιϲ) expressed in monochora. From this total were deducted expenditures (ἀναλώματα) in monochora to individuals, and, where appropriate, the share that went to the *karponai* (Rathbone, pp. 193-195): ἀφ᾽ ὧν αἱρεῖ καρπώνῃ ὑπὲρ ( ) μέρουϲ. After deducting these amounts, the balance for the estate owner from each vineyard or group of vineyards was expressed as λοιπὰ κυριακὰ μονόχωρα x ἐν διχώροιϲ x, μονοχώροιϲ x.

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[7] Note P.Rein. I 54, a letter to Heroninus concerning a delivery of an unspecified amount of wine to be loaded on beasts of burden (lines 8-9) τὸ ἥμιϲυ ἐν μονοχώ(ροιϲ) καὶ τὸ ἥμιϲυ ἐν διχώ(ροιϲ).

[8] For corrections see P.J. Sijpesteijn *loc. cit.* (see above) 175-178 .

The verso of 12054 contains a summary of the net quantity of monochora that the estate owner received from each of the vintners cited in the recto and the vessels which contained that amount. For example, the production and related expenditures of the three vineyards of Ausimachos, Kalena, and Paniskos, detailed in the recto (lines 20-41), are summarized thus in the verso (lines 128-130):

καθαρὰ μο(νό)χω(ρα) 221
τὰ ἐν δ(ι)χώροις 30 μ(ονοχώροις) 161[9]

The grand total is given in lines 138-140 as (γίνονται) ἐπ(ὶ τὸ αὐτὸ) ἁπλᾶ μο(νό)χ(ωρα) 1211 ταῦτα ἐν δ(ι)χ(ώροις) 188 μο(νο)χ(ώροις) 835.

The recto and verso of *SB* 12054 demonstrates the interest of the estate owner in having a detailed account of expenditures relating to his income from various vineyards so as to arrive at a figure representing the net aggregate number of monochora of wine. This net figure of monochora is at times prefixed by the words ἁπλᾶ which is translated by the editor (p.66) as "ohne Zugabe", the equivalent of "net" in English.[10] In 12054 the aggregate figure of 1211 on line 138 is in the form of (or "bottled" in) 188 dichora and 835 monochora.

Another bookkeeping procedure designed to arrive at a net figure of monochora can be observed in *SB* XIV 11555 (*P.Flor*. II 148v; *ZPE* 20 [1976] 39-242). The document, in part a monthly account of expenditures of Oxyrhynchite, monochora and dichora (keramia) of wine, are converted into aggregate monochora in this manner:

Line 4: Oxyrhynchitia	150	225	Line 7: monochora	65	65
5: Oxyrhynchitia	559	838 1/2	9: Oxyrhynchitia	11	16 1/2
6: dichora	358	716			

These illustrations demonstrate the use of the monochoron in accounting procedures as a means of calculating aggregate or quanitative measures of wine as distinct from measures "bottled" in jars. All in all, the Heroninus archive and related Fayum documents present us with a sophisticated accounting system employed on the wine-producing estates in the Arsinoite nome based on a standard measure from Oxyrhynchus. Paradoxically, published documents from Oxyrhynchus do not reflect anything to match the degree of standardization and record-keeping sophistication at Theadelphia. If it were not for the Maximian cotylae recorded in *P. Oxy*. 3595 and *PSI* 1252, we would not be able to recognize the process of standardization of liquid measures taking place in third-century Egypt.

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[9] The word καθαρά in this context is translated by the editor van Lith as "frei von Abzug." The editor expands the μ to μ(ονόχωρα). In my view, the word ἐν which governed διχώροις should also apply to μ(ονοχώροις). The same applies to line 137 (below). P.J. Sijpesteijn, the editor of *SB* XVI 32018.3,21,28, also takes this position.

[10] Note the use of ἁπλᾶ in several letters addressed to Heroninus concerning deliveries of wine to indicate that what is being delivered is the net amount of monochora. See *P. Lond*. III 1210, *P. Flor*. II 1901; 191; 209; 210; 244.