POTTERY MANUFACTURE IN ROMAN EGYPT
A NEW PAPYRUS

By HELEN COCKLE

Our knowledge of the pottery industry in ancient Egypt has so far been derived from sculptured reliefs showing potters at work, from a few excavations of kilns and from chemical analyses of pottery wares. Documentary evidence has now come to light in the form of three pottery leases from Oxyrhynchus, all dated to the middle of the third century A.D.

They are so closely related in subject-matter, terminology, date and the names of the contracting parties that I publish in full only the earliest and most complete (which I shall refer to as A); but I include references to the more significant details of the other two (B and C).[1] Their importance lies in the fact that they reveal a remarkably large scale industry, and also much concerning the techniques and terminology of the pottery industry, especially the names of the clays used and the sizes of the jars.

Text

Provenance: Oxyrhynchus 13·8 × 29·5 cm. 5 September, A.D. 243

Top

Αὐρ[ηλίαις Λε]ο̣νταροῦτι καὶ Πλουσίᾳ κ̣αὶ ὡς χρηματίζεται διὰ Αὐ-
ρ[ηλίου . . . .]ο̣δώρου ἐπιτρόπου παρὰ Αὐρηλίου Παήσιος Ἡφαιστᾶ-
τ̣[ος μητρὸ]ς̣ Θαϊσοῦτος καταγεινομένου ἐν κώμῃ Σενέπτα
κ̣ε̣[ραμέως ο]ἰ̣νικοῦ κεράμου. ἑκουσίως ἐπι̣δέχομαι μισθώσασθαι
ἐπὶ χρόνον ἔτη δύο ἀπὸ τοῦ ὄντος μηνὸς Θὼθ τοῦ ἐνεστῶτος
ζ (ἔτους) τὸ ὑπάρχον ὑμεῖν ἐν ἐποικίῳ μεγάλῳ κτήματος περὶ Σενέ-
πτα κεραμ̣ε̣ῖον οἰνικοῦ κεράμου σὺν τ̣αῖς τούτου καμάραις
καὶ καμείνῳ καὶ λίθῳ κεραμευτικῷ καὶ τοῖς ἄλλοις χρη-
σ̣τ̣ηρίοις, ἐπὶ τῷ με κατ' ἔτος πλ̣άσαι ὑμεῖν κ̣αὶ ὀπτῆσαι
κ̣αὶ ὑποκαῦσαι καὶ πισσῶσαι κοῦφα Ὀξυρυγχειτικὰ τετάρ-
χ̣[ο]α λεγόμενα ἀριθμῷ μυράδα μ̣ί̣ν καὶ πεντακισχεί-
λια, διπλοκέραμα ἑκατὸ̣ν πεντήκοντα, δίχοα ἑκατὸν πεν̣-
τήκοντα, ὑμῶν παρεχουσῶν χοῦν χαυνόγιον
καὶ ἀμμόγειον καὶ μελ̣[ά]γ̣γειον κ̣αὶ πρὸς τῇ καμείνῳ
τὰ αὐτάρκη καύματα κ̣αὶ ὕδατα εἰς τὴν δεξαμε̣νὴν
κ̣α̣[ὶ] πρὸς πι̣σσοκοπίαν πίσσης ὁλκῆς μέτρῳ Ἀλίνης
c υ
ὡς τῆ⟦ν⟧ μ⟦η⟧ρ̣άδας μιᾶς τ̣άλαντ̣α εἴκοσι ἕξ, ἐμοῦ δὲ παρέ-
χοντος ἐμαυτῷ τοὺς αὐτάρκεις πλάστας καὶ ὑπουργοὺς
καὶ ὑποκαύσ̣τ̣ας καὶ λαμβάνοντος ὑπὲρ μισθοῦ μόνῳ
τῶν ἁπλοκεράμων ὡς τῶν ἑκατὸν δραχμὰς τριάκον-
τα δύο καὶ ὑ̣π̣ὲρ ἑκτάκτου τῆς μυριάδ̣ος ο̣ἴνου κεράμια δύο
ὄξους κεράμια δύο. τὰς δὲ συναγομένας τῶν μισθῶν
δραχμὰς τετρακισχει⟨λί⟩ας ὀκτακοσίας ἀπολήμψομαι κατ' ἔ-
τος ταῖσδε ταῖς δόσεσι, ἀπὸ Θὼθ ἕως̣ Παχὼν κατὰ μῆ-

[1] I am grateful to the Egypt Exploration Society for permission to publish A (inv. no. 36 4B. 99/J(6)) and to refer to B and C (inv. nos. 37 4B. 87/G(3)a and 38 3B. 85/A(3–5)c, dated respectively to 22 September, A.D. 260 and sometime before A.D. 269). A short discussion of them was presented at the XVI International Congress of Papyrology held in New York in July, 1980. All three texts will appear in a forthcoming volume of *The Oxyrhynchus Papyri*. I should also like to thank Professor F. G. B. Millar for the opportunity to present an earlier version of this paper at a seminar held at the Institute of Classical Studies, London and D. Hagedorn, J. Hengstl, C. Hope, K. Hopkins, H. G. T. Maehler, P. J. Parsons, J. R. Rea and many others who have expressed interest and offered helpful criticisms and comments on the texts. Dr. Hengstl will publish an article on their legal aspects in *Studies for A. Biscardi*. A list of the standard papyrological abbreviations used here is to be found in E. G. Turner, *Greek Papyri* (2nd ed., 1980).

The term 'lease' is used in this article in the meaning that it has in English common law.

νᾳ δραχμὰς τετρακοσίας, Παῦνι Ἐπεὶφ εἰς ὑπόκαυσιν κατὰ μῆ-
να δραχμὰς πεντακοσίας, Μεσορὴ τὰς λοιπὰς δραχμὰς
διακοσίας. ἐὰν δὲ μετὰ τὸν προκείμενον ἀριθμὸν ἕτε-
ρα κοῦφα πλάσω καὶ τούτων χρείαν ἔχηται, ἔξεσται ὑ-
μεῖν βαστάξαι αὐτὰ λαμβάν[ο]ντός μου παρ' ὑμῶν
τὸν ἴσον μισθὸν καὶ τὴν πίσσαν καὶ τὰ ἄλλα κaθ' ὁμοιό-
τητα τοῦ προκειμένου ἀριθμοῦ. βεβαιουμένης δέ μοι
τῆς ἐπιδοχῆς παραδώσω τὰ προκείμενα κοῦφα ἐ-
πὶ τῶν τοῦ αὐτοῦ κεραμείου ψυγμῶν ἀπὸ χιμε-
ρινῆς πλάσεως καλῶς ὠπτημένα καὶ πεπισσοκο-
πημένα ἀπὸ πυθμένος μέχρι χειλῶν μὴ πειδῶ(ν)-
τα χωρὶς θεραπευσίνων καὶ ⟨ἐ⟩πισινῶν ἑκάστου τετρα-
χόου χωροῦντος μέχρι χείλου κοτύλας Μαξιμια-
νὰς εἴκοσι καὶ ἐπὶ τέλει τοῦ χρόνου παραδώσω τὸ αὐ-
τὸ κεραμεῖον καθαρὸν ἀπὸ σποδοῦ καὶ ὀστράκων
γεινομένης τῆς πράξεως ὡς καθήκει μένοντος
τοῦ λόγου περὶ ὧν ἐὰν φανῶ ὀφείλων. ἡ ἐπιδ[ο-
χὴ κυρία καὶ ἐπερω[τ]ηθεὶς ὡμολόγησα. (ἔτους) ζ″
Αὐτοκράτορος Καίσαρος Μάρκου Ἀντωνίου Γορδιανοῦ
Εὐσεβοῦς Εὐτυχοῦς Σεβαστοῦ Θὼθ ζ̄.
(m. 2) Αὐρήλιος Παῆσις Ἡφα[ιστᾶ]τος μεμίσθωμαι τὸ κερα-
μεῖον καὶ ποιήσομαι τὴ[ν πλά]σιν τῶν προκειμένων
κούφων μοιρίων καὶ π[εντακ]ισχειλίων, διπλοκερά-
μων ἑκατὸν πεντήκ[οντα], διχόων ἑκατὸν πεντή-
κοντα ἐπὶ τοῦ ἐπάνω μισθοῦ [καὶ] ἐκτάκτων καὶ παραδώ-
σω ὡς πρόκειται, κα[ὶ ἐπερωτη]θεὶς ὡμολόγησα. Αὐρή-
λιος Θέων ὁ καὶ Ἀς[κληπιάδης ἔγρα]ψα ὑπὲρ αὐτοῦ μὴ εἰ-
δότος γράμμ[ατα, μένοντος τοῦ] λόγου ὡς ἐπάνω δεδή-
λωτ[αι. . . [

Foot

Apparatus Criticus

3 θαϊcουτος 6 ὕπαρχον l. ὑμῖν 7 κεραμ'ε'ῖον, possibly two attempts at adding ε, one over the other 8 l. καμίνῳ as also line 14 9 l. ὑμῖν 10 πισσῶcαι: 2nd. c corr. from ω l. Ὀξυρυγχιτικά 11 l. μυριάδα, πεντακισχίλια and so in lines 23 & 47 13 l. χαννόγειον 14 l. μελάγγειον 17 l. μυριάδος 28 l. ἔχητε, ὑ/μῖν 35 πειδῶ l. πιδῶν/τα 36 l. θεραπευσίμων cf. B 33 37 l. χείλους 40 l. γενομένης 47 l. μυρίων 49 ἐκτάκτων: ων corr. from οις

Commentary

The hand of A is an upright, rounded and legible cursive similar to *P. Ryl.* II 176 =R. Seider, *Paläographie der griechischen Papyri* I (1967), no. 38 (A.D. 201/2).

1 Λε]ονταροῦτι. Before ν a mid-trace; almost anything is possible. F. Dornseiff and B. Hansen, *Rückläufiges Wörterbuch der griechischen Eigennamen* (1957), indicate only two possibilities, Ἀμυνταροῦς and Λεονταροῦς. The latter has a slight edge, there being three instances in D. Foraboschi, *Onomasticon Alterum Papyrologicum* (1967–71), together with *SB* VIII 9997. 47, but only one of the former, cited in F. Preisigke, *Namenbuch* (1922).

2 ἐπιτρόπου. The two Aureliae must be minors, presumably two young sisters. For ἐπίτροποι in general see L. Mitteis, *Grundzüge und Chrestomathie der Papyruskunde* (1912), 253–54, R. Taubenschlag, *The Law of Greco-Roman Egypt in the Light of the Papyri*[2] (1955), and N. Lewis, *BASP* 7 (1970), 116–18.

3 Σενέπτα: in the Middle Toparchy of the Oxyrhynchite nome.

4 κε[ραμέως ο]ἰνικοῦ κεράμου: as opposed e.g. to a λεπτοκεραμεύς, ' maker of fine pottery ', cf. T. Reil, *Beiträge zur Kenntnis des Gewerbes im hellenistischen Aegypten* (1913), 38.

11 μυράδα, and also l. 17. For the loss of unaccented iota before a back vowel see F. T. Gignac, *A Grammar of the Greek Papyri of the Roman and Byzantine Periods* I (1976), 304.

13–14 All three words for the clays are rare in the papyri: χαυνόγειος only in *P. Teb.* 342. 27; ἀμμόγειος to describe a place in *P. Lugd.-Bat.* II 3. 8; μελάγγειος in *P. Ryl.* IV 573. 6 describing a vineyard and in *BGU* VII 1529. 7 and 1534. 3 in the context of growing reeds as vine stakes.

μελ[ά]γγειον: γ, not γ because the foot of the right vertical is just visible.

16 μέτρῳ Ἀλίνης. Private measures occur frequently (see J. Herrmann, *Studien zur Bodenpacht im Recht der graeco-aegyptischen Papyri* (1958), 103–105 and D. Hennig, *Untersuchungen zur Bodenpacht* (1967), 13–21) but these are the first examples of this particular one. It is interesting that they appear in two documents from different villages. Ἀλίνη is not a common name; a woman of this name is the central figure in the archive of Komon, *P. Oxy.* XXXVIII 2834–46 (mostly dated to the second half of the first century), whose family owned land in several toparchies. Is it far-fetched to wonder if a measure named after her was still being used nearly 200 years later on land once in her family?

17 μ[[ή]]ράδας: for ο)α see Gignac I 287–88. It seems strange if only 10,000 of the 15,000 4-choes jars are to be coated with pitch but the emphasis of μυράδας μιᾶς and a special payment τῆς μυριάδος in l. 21 does suggest this. So does the arithmetic: in C, assuming that only τετράχοα are pitched, the rate is 3 talents per 1,000 jars; here in A it is 2·6 talents but disproportionately small at 1·7 talents per 1,000 if the pitch is required for 15,000.

Since a talent = 60 lb, the total quantity of pitch required here is approximately 1,560 lb = 707 kg.

18 αὐτάρκεις here strengthens the case for the same word to be read in *P. Oxy.* XLVI 3267. 12.

19 μόνῳ, not μόνου. In B and C too pay is reckoned on the basis of the 4-choes jars only.

29 βαστάξαι, the usual aor. form of this verb in the papyri; not βαστάσαι. See B. G. Mandilaras, *The Verb in the Greek non-literary papyri* (1973), §301. 2.

33 The same provision about handing over the jars on the drying-floors is made in *P. Teb.* 342. 22.

35 πιδάω: not elsewhere in the papyri. It is a rare word, the more common form being πιδύω, cf. *TLG* and *LSJ*, *s.v.*, translated by the latter as ' gush forth '. Here it must mean ' leaking '.

36 θεραπευσίνων. B and C show that this is an error for θεραπευσίμων. For the assimilation of the mu to the final nu see Mayser I 1², 165. Probably *addendum lexicis*; it is not given in *LSJ*, F. Preisigke, *Wörterbuch d. gr. Papyrusurkunden* (1925–), *Onomasticon*, H. van Herwerden, *Lexicon Graecum* (1910), Du Cange, *Glossarium mediae et infimae graecitatis* (1688) or E. A. Sophocles, *Greek Lexicon* (1887). *TLG* curiously lists the word with the meanings ' *medicabilis*, *sanabilis* ' but gives no citations. Although adjectives in -ιμος commonly had an active meaning (see C. D. Buck and W. Petersen, *A Reverse Index of Greek Nouns and Adjectives* (1944), 185), in medieval and modern Greek they have largely taken the place of verbals in -τος. The context here demands a passive sense. -σιμος is a productive form of suffix, see L. R. Palmer, *A Grammar of the Post-Ptolemaic Papyri* (1946), 16 and 27.

⟨ἐ⟩πισινῶν. Without the initial ε a *vox nihili*. The correct form is given in B and C. In the papyri and elsewhere it is used in its passive sense of people who are infirm or disabled. Its use for an inanimate object, here of jars that are ' seconds ', is new. *P. Oxy.* XIV 1631. 16 and n. refers to the ' ringing ' of jars to test them.

37 χείλου. For confusion in the gen. between ο- and s-stem nouns see Mayser I 276.

42 κυρία. See M. Hässler, *Die Bedeuting der Kyria-Klausel* (1960), 28 ff. For the English translation ' irrefutable ' see H. J. Wolff, *ZRG* 90 (1973), 373.

47 κούφων. Here and in B and C κοῦφα is synonymous with ἁπλοκέραμα.

51 Ἀσ[κληπιάδης. The alias is supplemented from *P. Oxy.* XIV 1636. 44–45, a photograph of which shows that the scribe is the same in both cases. A scribe of this name appears in *P. Mich.* III 165. 5–7 (A.D. 236) but so little of his writing survives that I am uncertain from the photograph (pl. II, 2) that he is the same person.

53 After -λωτ̣αι the tops of two or three letters?

Translation

'To Aurelia Leontarous (?) and Aurelia Plousia and however she is styled through Aurelius . . . odorus their guardian from Aurelius Paesis son of Hephaestas and Thaïsous who lives in the village of Senepta, a potter who makes wine jars. Of my own free will I undertake to take on lease for a period of two years from the current month Thoth of the present seventh year the pottery for the making of wine jars which belongs to you in the large farmstead of your estate around Senepta together with its store rooms, kiln, potter's wheel and the other equipment on condition that each year I make for you, fire, re-fire and coat with pitch what are termed Oxyrhynchite four-choes jars to the number of 15,000, 150 double ceramia and 150 two-choes jars, while you provide the friable earth, the sandy and the black earths, sufficient firing material for the kiln, water for the cistern and for coating with pitch 26 talents of pitch in weight by the measure of Alinē for the 10,000 jars and I provide for myself sufficient potters, assistants and stokers and receive for the price of the single ceramia only, 32 drachmas per 100 and as special payment for the 10,000 jars two ceramia of wine and two ceramia of sour wine. The total payment of 4,800 drachmas I shall receive annually in the following instalments, from Thoth to Pachon 400 drachmas a month, in Payni and Epeiph for re-firing 500 drachmas a month and in Mesore the remaining 200 drachmas. If over and above the aforesaid number I make other jars and you have need of them, you will be able to take them provided I receive from you the equivalent price and the pitch and the other things in the same way as for the aforesaid number. If my undertaking is confirmed, I shall hand over the aforesaid jars on the drying floors of the said pottery from the winter manufacture, well fired and coated with pitch from the foot to the rims, not leaking and excluding any that have been repaired or are blemished, each four-choes jar holding up to the rim 20 Maximian cotylae and at the end of the period I shall hand over the said pottery free from ash and sherds. The right of execution is as is proper and the account of whatever I may appear to owe shall remain outstanding. The undertaking is irrefutable and in answer to the formal question I gave my assent. The seventh year of the Imperator Caesar Marcus Antonius Gordianus Pius Felix Augustus, 7th Thoth.' (2nd hand) 'I, Aurelius Paesis, son of Hephaestas, have taken the pottery on lease and shall carry out the making of the aforesaid 15,000 jars, 150 double ceramia and 150 two-choes jars for the above price and special payments and I shall hand them over as aforesaid and in answer to the formal question I gave my assent. I, Aurelius Theon, also called Asclepiades, wrote for him because he is illiterate. The account is outstanding as specified above.'

Discussion

All three leases are taken out by individual potters for one or two years for the use of a pottery and its equipment and the making of considerable quantities of wine amphorae. Although land and house leases are numerous, those of other types of property are rarer.[2] Only three, or possible four, pottery leases have so far been published: two are late, *P. Lond.* III 994, p. 259 from Hermopolis, dated A.D. 517, apparently a 10-year lease for 1/14 of a pottery, and *P. Cairo Masp.* I 67110 from Aphroditopolis (A.D. 565) for ⅓ of a pottery for life.[3] *P. Teb.* II 342, a report on confiscated property of the late second century A.D., contains the terms of a lease of a pottery and some of the same terminology as occurs in the present texts. The only Oxyrhynchus document is *P. Mert.* II 76 (A.D. 181), a lease of part of a workshop which may be a pottery, but the reading is doubtful and in any case there are no specific 'pottery' words.

Leases for short periods up to about five years are the norm for the Roman period.[4]

[2] See the bibliography and lists in O. Montevecchi, *Aegyptus* 21 (1941), 287–90 and *La Papirologia* (1973), 216 and 218.

[3] Dr. K. Worp has kindly pointed out to me that among the Vienna papyri there is another pottery lease (inv. no. G 16723) from Hermopolis, dated probably to A.D. 316, which he hopes to publish shortly. It has already been referred to in *P. Landlisten*, pp. 17–18; *BASP* 16 (1979), 166 and *ZPE* 30 (1978), 242.

[4] See Taubenschlag, *Law*², 268–9, S. Waszynski, *Die Bodenpacht* (1905), 90–1 and Herrmann, ibid., 89–91.

Property leases usually begin, as here and in B and C, with the new year, although the contract may be drawn up before or after 1 Thoth (29 August), (see e.g. *P. Oxy.* XLIV 3200. 6–7n.). All three leases are in the standard hypomnema form. This, as opposed to the private protocol, only began to predominate at Oxyrhynchus in the third century; by the end of the century it was the invariable form.[5] The sequence of clauses is quite regular for leases of real estate (see the clauses listed in *P. Yale* 69 and 70) with the additions, however, necessary to cover the supply of materials and labour and the payment of wages to the lessee. The usual rent and rent payment clauses are therefore replaced by stipulations about the provision of jars by the lessee. Though in the form of leases, the documents are in effect labour contracts; compare those for 'labour in vineyards' in *P. Oxy.* XIV 1631; 1692 and XLVII 3354.

Potters appear in a number of papyri from the city and nome of Oxyrhynchus.[6] A guild of potters of earthenware pottery is mentioned in *P. Oxy.* XXXI 2570. 10–12 (A.D. 329) but as far as we know there was no 'Potters' Quarter'.

The detailed elaboration of the terms of these three leases, which are often the same in each though differently ordered, is paralleled in the leases for 'labour in vineyards' mentioned above. The lessor supplies the pottery, store-rooms, wheel, kiln and other equipment, clays, firing-material, water and pitch, the lessee the workmen (only specified in A 18–19 and B but presumably the same applied in C); and the lessee is to manufacture specific numbers of 8-choes, 4-choes and 2-choes jars.

Their quantity is strikingly large; in return the lessee received a certain amount per 100 4-choes jars and a special payment of wine and/or lentils, possibly covering the 2-choes and 8-choes jars for which he does not seem to have earned a money payment:

	2-choes jars	4-choes jars	8-choes jars
A	150	15,000	150
B	35	8,000	100
C	15	4,000	100

	per 100 4-choes jars	Total money payment	Special payments
A	32dr.	4,800dr.	2 ceramia of wine, 2 ceramia of sour wine
B	32	2,560	[2 ceramia of sour wine, 1 artab of lentils (n. 7)]
C	36	1,440	1 ceramion of sour wine, 1 artab of lentils

The quantities of jars, and hence the amount of payment, in B and C should be multiplied by three and four respectively to get a true picture of the capacity of these two potteries (i.e. 24,000 4-choes jars and 7,680 dr. in B and 16,000 jars and 5,760 dr. in C). In the former the lessee takes on lease a third of the pottery, in the latter a quarter and it is reasonable to assume that in each case similar leases were drawn up with the owners of the other parts.

[5] See H. J. Wolff, *Proc. XIV Int. Cong. Pap., Oxford* (1974), 350–51, id., *Das Recht der griechischen Papyri Ägyptens* (1978), 117–19, H. Comfort, *Aegyptus* 14 (1934), 286–7 and Herrmann, ibid., 25–39.

[6] See the list given by E. Constantinides in her publication of a letter from a creditor to a recalcitrant potter in *CÉ* 44 (1969), 101–5 (now = *P. Oxy.* XLI 2996). Her confidence that *P. Teb.* 342. 22–23 is evidence for temple potteries at Oxyrhynchus is misplaced because the vital word θεοῦ is doubtfully read. For a general discussion of the pottery industry in Egypt in the Graeco-Roman period see Reil, ibid., 37–46.

The cash payments were made over in instalments as the work progressed through the year: [7]

	Operation	*Month(s)*	*Payment in Drachmas*
A		Thoth–Pachon (9 months) (August–May)	9 × 400 = 3,600
	Firing	Payni, Epeiph (May–July)	2 × 500 = 1,000
		Mesore (July–August)	200
			4,800
B		Advance payment(?)	700
		Thoth–Tybi (5 months) (August–January)	5 × 200 = 1,000
		Mecheir (January–February)	300
	Firing	Epeiph, Mesore (June–August)	560(?)
			2,560

The varying size of the instalments through the year presumably relates to the different tasks in the potters' workshops which required more or fewer workmen. Potters no doubt arranged the heavier part of their schedule to coincide roughly with periods of less activity on the land.

An idea of the social status and wealth of the lessors can be gained from B and C. The lessee in both is the same potter, Claudianus, a dependant of the gymnasiarch, Septimius Eudaemon; he is probably to be identified with the Claudianus of *P. Oxy* XXXI 2616 (post A.D. 244–9) who issues a note to a subordinate instructing him to hand over 500 jars for which he has already received the order. Moreover, external evidence shows that Aurelia Apia, the lessor of C, is the sister of Septimius Eudaemon, the lessor of B. Aurelia Apia is the daughter of Septimius Serenus, an ex-exegetes and ex-prytanis, also known from *P. Oxy.* XXXVIII 2854, A.D. 248,[8] where he is mentioned as father of Septimius Eudaemon, gymnasiarch and councillor. Since in that document Eudaemon resigns all his property to avoid serving as eutheniarch, his mother and/or father must have died between A.D. 248 and 260, the date of B, as a result of which he inherits property; part of this he is now letting out on lease. He also appears in *P. Oxy.* XX 2271. 1,[9] dated to the mid-third century, where he is in addition a public banker, and *P. Oxy. Hels.* 25. 10, A.D. 264. His father is attested also in *P. Oxy.* XLVII 3365. 4 (=*Coll. Pap.* I no. 65), dated to some time after 22 May, 241, in which he is recorded as having bought a large amount of property, 93 19/24 arouras, in A.D. 238. None of those lots is apparently the estate around Sennis mentioned in B and C. It seems highly likely that the pottery in both documents is the same. In C Apia has a fourth share of an estate described as ' Mother's ', while in B Eudaemon has a third share of the pottery held jointly πρὸς τοὺς ἀδελφούς on their estate; ἀδελφούς surely includes sisters. Eudaemon is thus attested twice as holder of the office of gymnasiarch: in A.D. 248/9 and 260/1. It is not certain that he was in office in A.D. 264 since *P. Oxy. Hels.* 25. 10 could read γυμνασιαρχ[ήσαντος or γυμνασιάρχ[ου.

It is worthwhile to attempt to elucidate the words for the pottery clays. The same terms are used in each lease but in slightly differing arrangement from which I take it that χοῦς is

[7] C is too damaged for the individual instalments to be deciphered. In each lease there is a stipulation that the potter shall make and coat with pitch additional jars in return for the necessary materials and payment in money or in kind (A 27–31); in B the special payments are for this purpose rather than for the original quantity.

[8] A. K. Bowman, *The Town Councils of Roman Egypt* (1971), 135.

[9] P. J. Sijpesteijn, *Liste des Gymnasiarques* (1967), no. 430 and *P. Theon*, Appendix A and Bowman, ibid., 143.

qualified by three adjectives: A 13–14 χοῦν χαυνόγιον/καὶ ἀμμόγειον καὶ μελ̣[ά]γγειον; B χοῦν/μελ̣άνγιο̣ν, ἀμμόγι̣ο̣ν, χαυνόγιον and C χοῦ̣[ν μελάγγε]ι̣ο̣ν, χαυνόγειον, ἀμμόγειο(ν). All three terms are rare, and only one is employed elsewhere in a pottery context. *P. Teb.* 342. 27, has the phrase, εἰc ἐκcκαφὴν χοὸc καὶ χαυνογείου καὶ ἄμμου, but the editor of the text makes no comment about its interpretation.

A. Lucas [10] defines two types of Egyptian pottery clays, firstly an alluvial clay from the Delta and Nile which is brown or black when wet but brownish-grey when dry and brown or red after firing, secondly a brownish-grey marl which fires grey. D. Arnold [11] adds a third type, a mixture of the other two. Nile clay has a fairly high proportion of silica, iron oxide, organic matter, sand and various stone particles, usually occurring as a natural compound. The clays of the second group contain less silica but a significantly higher proportion of calcium carbonate. In this group, however, there is an important distinction (Arnold, ibid., 396), not made by Lucas and the earlier literature, between the marl from Qena and Ballas in Upper Egypt which has an admixture of sand but no organic matter and fires a greenish-buff, and the marls from elsewhere characterized by a high proportion of quartz, feldspar and calcareous matter and by a pinkish colour in the centre of the pottery when fired. Although the former type of marl is the only one extracted in modern Egypt, there are a large number of suitable beds rich in lime on the edges of the Nile Valley which were exploited in antiquity.[12] The mixed clays of the third type occur in various forms, two of which are discussed in detail by C. Hope in a forthcoming article.[13] He says, 'The identification of the fabrics that belong to this group is still a little uncertain, but two distinct fabrics have been isolated which are probably the result of mixing siliceous iron-bearing Nile clays with calcareous desert marls. . . . As yet, it is not entirely certain whether this type of clay could occur naturally, being the result of secondary deposition of calcareous material in a siliceous Nile clay, or whether it is an artificial product of the potter's hand.'

Since the available native clays will have remained the same, these analyses can be linked with the Greek text. χοῦc μελάγγειοc is clearly the Nile alluvial clay, readily obtainable at Oxyrhynchus, and χοῦc χαυνόγειοc, translated by *LSJ* as 'friable earth', a desert marl. χοῦc ἀμμόγειοc is presumably a temper or binder of some sandy material such as quartz grains used to reduce the porosity of the clay and lower the sintering point, i.e. the point to which the clay has to be fired.[14] The phrasing of the Greek implies that the mixture of the alluvial clay and desert marl is artificial and not natural. Dr. Hope notes that one of the two mixed clays used in the Malkata pottery, which usually fires red with a greyish-red core, is the one most commonly used for the amphorae from that site.

The manufacture of the pots took place during the winter and the whole process was finished by Epeiph (June–July) in time for use in the wine harvest. The season for this was by no means as fixed as C. Ricci makes out when she assigns it to Mesore,[15] but could be between mid-July and mid-September. The manufacturing process (Lucas, ibid., 368–72) began with the removal of small stones from the clay. The 'cistern' of A 15 must be the vessel to which water and temper were added and in which workmen trampled the clay to bring it to the right consistency. After the jars had been made on a wheel (cf. πλάcαι and πλάcιc in A 9, 28, 34, 46), they needed to be dried before firing to prevent the rapid vaporization of water in the kiln from rupturing them. This is evidently the purpose of the ψυγμοί (A 33).[16]

[10] *Ancient Egyptian Materials and Industries*, 4th. edition, ed. J. R. Harris (1962), 368.

[11] *Lexikon der Ägyptologie*, ed. W. Helck and E. Otto (1972–), *s.v.* Keramik, 394 ff.

→ K. W. Butzer, *JNES* 33 (1974), 377–82 and C. Hope, *Jar Sealings and Amphorae of the 18th Dynasty: A Technological Study* (1978), 72–74. I am greatly indebted to Dr. Hope for discussing these leases with me and guiding me through the bibliography on clay types.

[13] 'The XVIIIth Dynasty Pottery from Malkata' will appear in *An Introduction to Ancient Egyptian Pottery* to be published by the German Archaeological Institute in Cairo.

[14] See A. B. Searle and R. W. Grimshaw, *The Chemistry and Physics of Clays and other Ceramic Materials* (1959), 399.

[15] *La Coltura della vite* (1924), 55–6.

[16] For a detailed discussion with figs. of the types of kilns and potter's wheels see R. Holthoer, *New Kingdom Pharaonic Sites: the Pottery. The Scandinavian Joint Expedition to Sudanese Nubia 5:1* (1977), 28–37 and for the excavation of kilns of the Roman period e.g. K. Michalowski, *Annales du service des antiquités de l'Égypte* 57 (1962), 49–57.

The fourth stage was the firing. Two words are used in the papyri which might bear this meaning: ὀπτῆcαι and ὑποκαῦcαι and the corresponding substantives, ὄπτηcιc and ὑπόκαυcιc (cf. A 9–10, 25 and 34). In technical descriptions of this kind it is to be assumed, I think, that the words are not synonymous and that each has a specific meaning. Either the two terms occur together or ὀπτάω (or ὄπτηcιc) is used alone, especially in the description of the jars at the end of manufacture, καλῶc ὠπτημένα καὶ πεπιccοκοπτημένα. Since this seems to be more significant than ὑποκαίω, it must surely refer to the firing and is indeed the normal meaning of the word in this context, cf. e.g. Hdt. 1 179. Although ὀπτάω is sometimes used of baking in the sun's heat, cf. Plut. 298B, Xen. *Oec.* 16. 13 and Bion 6. 12, καλῶc ὠπτημένα has to mean ' well fired ' and not ' well dried ', and cannot refer to the earlier process conducted on the ψυγμοί. Given this and that the simple form καῦcιc is elsewhere used for firing, what is implied by the compounded word ὑπόκαυcιc? In B and C occurs an *addendum lexicis*, καπνιcμόc ' smoking ', together with references to the firing material required for it. This supports the conclusion of Lucas, ibid., 372–76, that ware described as black, but in fact dark grey, was produced by creating dense smoke in the kilns after firing and not by the reduction of red oxide of iron to black oxide. This technique had no doubt developed from an attempt to cover up accidental smoke stains. ὑποκαῦcαι is probably then to be referred to the introduction of firing material under the pots for the καπνιcμόc. The firing material (A 15) was most likely chaff.[17] A. E. Hanson has published a document of A.D. 156/57 from Oxyrhynchus which is a request from an overseer of an estate for payment on the transport of chaff intended for the firing of jars.[18] In the light of this and the interpretation of the clay types I doubt Constantinides' view that the chaff in *P. Oxy.* 2996. 10 was primarily used as a temper rather than as fuel.

The final stage in manufacture was the coating of the jars on the inside with pitch, (cf. A 10, 16, 34–5). For the Graeco-Roman and Coptic periods, but not earlier, there is plenty of evidence for this practice.[19] In an interesting letter from the Zenon papyri, *P. Cairo Zen.* III 59481 (=*PSI* II 441), a potter employed by Zenon warns his employer that some potters may be wasting pitch by coating the interiors of the jars twice over. The papyri here and elsewhere refer clearly to pitch, but C. C. Edgar, in a note on this Zenon papyrus, quotes Lucas who had analysed the black coating on some Graeco-Roman jars and found, ' [that it is] a true resin, i.e. not gum-resin, and is neither pitch nor bitumen. Wine stored in a jar so treated would acquire a slight flavour of resin, such as that imparted to much modern Greek wine by the deliberate addition of resin, and it is suggested that the present practice originated from the acquired taste due to the old necessity to use resin in order to make the wine-jars impermeable.' Pliny, *N.H.* 14. 25 mentions pitch *ad vasa vino condendo.*

Pitch occurs frequently in accounts, cf. *P. Oxy.* XXXI 2580, especially in connection with pottery and the wine industry,[20] but also as a medicine and for water-proofing. The price of pitch rose steeply in the latter half of the third century, from 71dr. a talent in the earlier half to 240dr. in A.D. 255 and 3,400dr. in 279 (see *P. Oxy.* 2580. 2–3n.). *P. Cairo Masp.* I 67110. 38 mentions a ' pitch oven ' as part of a pottery.

We cannot tell whether the pitch used by the potters here was wood or mineral pitch. R. J. Forbes [21] refers to places in Ethiopia and on the Red Sea coast where there were apparently oil seepages in antiquity and hence a possible source for pitch. Indeed the potter in C seems to have had some at least of his pitch from this area; the lessor is to supply him with cτερεὰ τάλαντα δώδεκα ὧν Τρωαδηcίαc τὸ ᾗ[μι]cυ Cιρητικῆc τὸ ἥμιcυ. The same descriptive terms for pitch appear in *P. Oxy.* XXXI 2570. 23–25 (A.D. 329):

πίccηc ξηρᾶc . . . . [
τικῆc κεν(τηναρίου) α . . . [
τ̣ρ̣[.].α̣δ̣[..].ac κε[ν(τηναρίου) . .

with the note, ' After ξηρᾶc: σ̣τ̣ρ̣ι[could be read.'

[17] See Preisigke, *Wörterbuch*, *s.v.* καύcιμοc and καῦcιc.

[18] *Le monde grec, Hommages à Claire Préaux* (1975), 609–10; now = *P. Theon* 12.

[19] See H. E. Winlock and W. E. Crum, *The Monastery of Epiphanius at Thebes* I (1926), 79 and *Fouilles franco-polonaises, Tell Edfou* I (1937), 124.

[20] e.g. *P. Oxy.* XIV 1754; XVI 1913. 29–32; XXXI 2570 ii; XLI 2996. 33; *BGU* III 884; *P. Cairo Zen.* III 59481.

[21] *Studies in Ancient Technology* I (1955), 26–7.

A photograph confirms that the lines can now be read:

πίccηc ξηρᾶc Σιρι-
τικῆc κεν(τηναρίου) α . . . [
Τρωαδ[η]σίας κε[ν(τηναρίου . .

Σι (or ει)ρητικόc is used of olive oil in *P. Oxy.* VII 1070. 29–30 and XXIV 2433 *verso* iii 21, etc. In neither text is the word explained but W. Pape-G. E. Benseler give as one of the locations of Σῖριc, ' Name des Nils zwischen Syene u. Meroe '.[22] That olive oil came from this area, part of Aethiopia (Strabo 17. 1. 53), is confirmed by Dioscorides (*De Materia Medica* I 105. 1 and 6) who mentions ἡ Αἰθιοπικὴ ἐλαία. Τρωαδήcιοc is new in the papyri. The only example of the word I can find is in Hesychius of Miletus [23] where it is used to describe the headlands outside Constantinople. This hardly seems relevant here. I am tempted by the idea that it somehow conceals or is a corruption of an adjective from Τρωγλοδύται (also spelled without the lambda) who live directly east of this stretch of the Nile, on the Red Sea coast and whose commerce with Egypt is attested by Strabo 17. 1. 13. The two papyri containing the word do not, however, support this.

In all three leases the jars to be made are described as 'Οξυρυγχιτικά. The only other instances of ' Oxyrhynchite ' jars I have found are *P. Teb.* 342. 22–23, (sc. κοῦφα) ἀρεστὰ πεπλασμένα πλάcεωc χειμερινῆc τύπῳ 'Οξυρυγχ(είτῃ) κεραμείων θεροῦ, and *PSI* XII 1249. 19–20 and 1252. 10–11, ἅ ἐcτιν τετράχοα 'Οξυρυγχειτικὰ [λεγ]ό-/μενα. In the last two and in the present texts the term seems to be applied only to 4-choes jars. Clearly it indicates a particular style or pattern of jar, but whether the smaller and larger sizes were also to be of the same style is doubtful.[24] 'Οξυρυγχ(είτῃ) in the Tebtynis papyrus (why -ῃ?) should probably now be expanded as 'Οξυρυγχ(ειτικῷ). The phrasing here and in A 37–38 does not point to the liquid measure, the 'Οξυρυγχίτιον (cf. e.g. *P. Mich.* XI p. 87). As it was used at Tebtynis, the pattern must have been well known.[25]

From A 10–12 and 20 where the τετράχοα are referred to as ἁπλοκέραμα, the ratio of the sizes of δίχοα, τετράχοα and διπλοκέραμα is seen to be $\frac{1}{2}$: 1 : 2, with a κεράμιον holding 4 choes. Wine was normally measured by the κεράμιον. For this and the single ceramion/double ceramia ratio see *W.O.* I 759 ff. At that time Wilcken considered the ceramion to be a fixed quantity of liquid, of 8 choes, but since then *P. Petrie* III 70(a) i has shown that it was variable in size, in that particular instance measuring 5, 6, 7 or 8 choes. Ceramia of 4 choes are not uncommon.

The capacity of the 4-choes jars required here is specified precisely in ll. 37–38 at 20 Maximian cotylae. This is, however, rendered somewhat confusing by comparison with *PSI* 1252. 9–10 (cf. l. 10 n.), the only other reference I know, where similar Oxyrhynchite 4-choes jars are said to contain 15 Maximian cotylae! In a note on this A. Segrè says that a 4-choes ceramion from Oxyrhynchus = 19·41 l., a chous of wine = 4·852 l., a Maximian cotyle = 1/15 of 19·41 l. = 1·294 l. Since a chous, he continues, =10 Ptolemaic minas =15 Roman pounds, a Maximian cotyle is a liquid measure equivalent to the weight of 4 Roman pounds of water. He suggests that it was a measure introduced by a Roman οὐcία. Apart from the fact that I am doubtful about his interpretation of the capacity of the chous, based as it is on an equivalence in *SB* V 7647 [26] of the Attic chous to a measure that is specifically described as Arsinoite, his figures for the Maximian cotyle must be wrong, since in the present text it is 1/20 ceramion. All this strongly suggests that the chous was of variable capacity, sometimes defined by reference to a measure of fixed capacity. A nice example of the general imprecision about measures is *P. Lugd.-Bat.* XVII 4. 9–11 where

[22] *Wörterbuch der griechischen Eigennamen* (1884), *s.v.*

[23] Müller, *FGH* IV 153–4; see Pape-Benseler, *s.v.*

[24] Cf. other adjectives from place names, e.g. Κνίδιον and Ῥόδιον for shapes and sizes of jars; see H. C. Youtie, *Scriptiunculae* I (1973), 155.

[25] For the bewildering variety of possible amphora shapes and styles see e.g. *Méthodes classiques et méthodes formelles dans l'étude des amphores, Collection de l'école française de Rome* 32 (1977), plates *passim* and for Graeco-Roman Egypt in particular *Fouilles franco-polonaises, Tell Edfou* I (1937), pl. 36; id., II (1938), pl. 27; id., III (1939), fig. 226 and pl. 37. The only published representation of an amphora from Oxyrhynchus is a small drawing in W. F. Petrie, *Tombs of the Courtiers and Oxyrhynkhos* (1925), pl. XLVIII no. 17.

[26] = *BRL* 18 (1934), no. 11, pp. 122–4.

wine is to be measured μέτρῳ ᾧ ἂν τὴν ἐξάντλησιν ποιῶμαι. V. Grace points out how various local standards existed simultaneously and even that in the same place a standard jar was of different capacity at different periods.[27]

After a detailed discussion of the texts it is worthwhile to consider more general questions, even if only the most tentative and speculative answers can be given. For what purpose were the jars made? What quantity of wine would be needed to fill them? What size of estate would produce the necessary quantity of wine? For whom was it intended? If not for consumption in Oxyrhynchus or the nome, how was the wine transported? What size of labour force would be needed to manufacture so many jars?

It is safe to assume since the potteries are on the lessors' estates (cf. A 6), since there is a clause dealing with the need for extra jars (A 27–28) and since the lessors of B and C are known to belong to a family owning considerable estates, that the wine jars were made for bottling the wine produced from the lessors' own vineyards.

I hesitate to estimate the capacity of the jars produced because of my doubts about Segrè's figures; but if his figure of 19. 41 l. for a 4-choes jar is used (and leaving aside the 2-choes and 8-choes jars which may not have been used for long-term storage), the 15,000 4-choes jars of A would have needed to fill them 291,150 l. of wine = 64,053 gallons. A. Sichel considers that though Egypt has a climate suitable for vine growing, it produces much less than might be expected.[28] Its 31 sq. miles of vineyards (=19,840 acres = 8,029 hectares) ought to produce 6 million gallons of wine (i.e. in the region of 300 gallons per acre). If the yield in the Graeco-Roman period were nearer this level, 64,053 gallons ought therefore to be the produce of 212 acres (=86 hectares = 312 arouras). This is a considerable area of land but need not of course have been one estate; one pottery could serve several smaller estates owned by the same person.

Such quantities of wine could not be consumed on the estate(s) alone but whether it was for the use of the inhabitants of the town and nome of Oxyrhynchus or partly or wholly for use further afield is quite unclear. We have no idea of the local population beyond Flinders Petrie's estimate that the theatre at Oxyrhynchus could hold 11,200 spectators and that from *P. Ryl.* IV 594 it seems that 5,000–6,000 people (i.e. more than 1,000 taxpayers) lived in a single village of the Arsinoite nome in the middle of the second century. The population of a metropolis and its surrounding villages would have been much higher.[29]

Some wine we know was transported outside the nome. A contract was drawn up in A.D. 257 (*P. Oxy.* XLIII 3111) between a ship master and inspectors of the military *annona* for the transport of 800 ceramia of wine at a cost of 80 dr. per 100 ceramia from the port of the Oxyrhynchite nome to the port of Cleopatra in the Heracleopolite nome; it was then to be delivered to the legion stationed there. Similarly a letter of A.D. 316 (*P. Oxy.* XVII 2114) concerns an order for wine transported from the Thebaid to the Heptanomia for the *annona militaris*. The wine here may have been for a similar purpose; if so it would have been transported down the Bahr Yusuf, the tributary of the Nile that flows past Oxyrhynchus.

A calculation of the number of workmen employed in the pottery can give only an idea of scale and is made more uncertain by the high inflation rate in the later part of the third century. In A the total amount paid to the lessee is 4,800 dr. On the basis of R. P. Duncan-Jones' figures for the price of wheat in Roman Egypt,[30] this would pay for 400 artabas of wheat at 12 dr. an artaba (the price at Theadelphia in A.D. 254(?)) = 8,800 kg., i.e. 400 artabas × 29·2 l. × $\frac{3}{4}$ kg. (the specific gravity of wheat).[31] In a recent article[32], K. Hopkins has used wheat to express the total consumption of food, clothing, housing, etc., needed for minimum subsistence and calculates that this amounts to 250 kg. wheat equivalent per person/year. If a family is taken as numbering on average 4 people, 8,800 kg. would support 9 families. This of course makes no allowance for the potter's profit or for

[27] → ' Standard Pottery Containers ', *Hesperia*, Suppl. 8 (1949), 175–89.

[28] *The Penguin Book of Wines* (2nd. revised ed. 1972), 245.

[29] → E. G. Turner, *JEA* 38 (1952), 81.

[30] *Chiron* 6 (1976), 253.

[31] For the size of an artaba see Duncan-Jones, ibid., 257.

[32] → *JRS* 70 (1980), 118.

the evidently seasonal nature of the work with an increase in the number of workmen hired at particular times of year. If wheat is reckoned at a price of 24 dr. an artaba, which it had reached in Oxyrhynchus by A.D. 269, the numbers above will be halved.

Thus the texts, though defying a complete interpretation as the speculations above demonstrate, give us a fascinating and detailed insight into the workings of one of the most important and productive of Egyptian industries and an understanding of a process which may well have had parallels in other parts of the Empire.

University College London