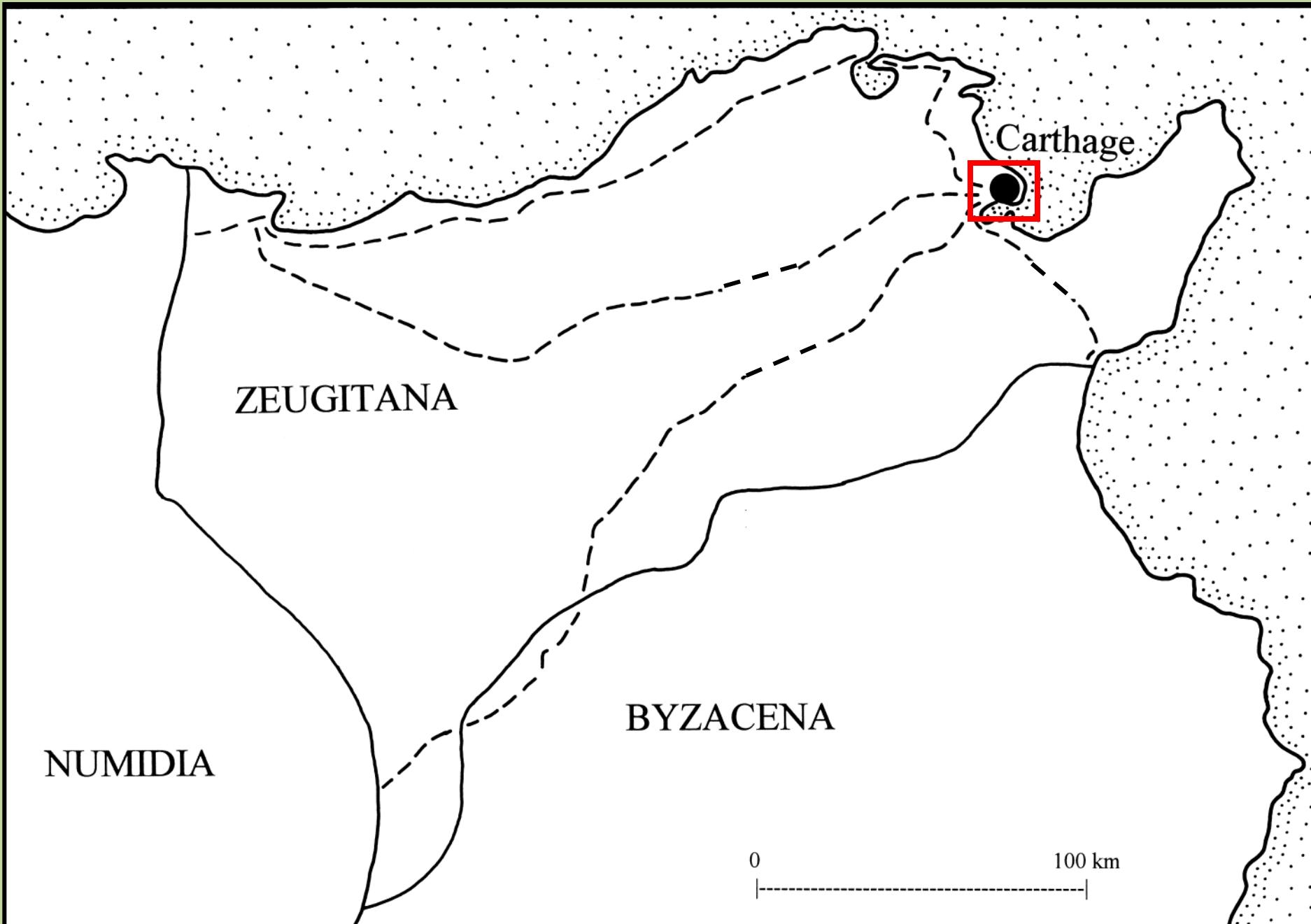


# **THE CARTHAGE OSTRAKA:**

## **EVIDENCE FOR THE STATE MOBILIZATION OF OLIVE OIL IN THE DIOCESE OF AFRICA DURING THE LATE 4TH CENTURY AD**

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# **BACKGROUND**





Google earth

Imagery Date: 6/28/2011

2004

36°50'35.13" N 10°19'35.52" E elev 3 m

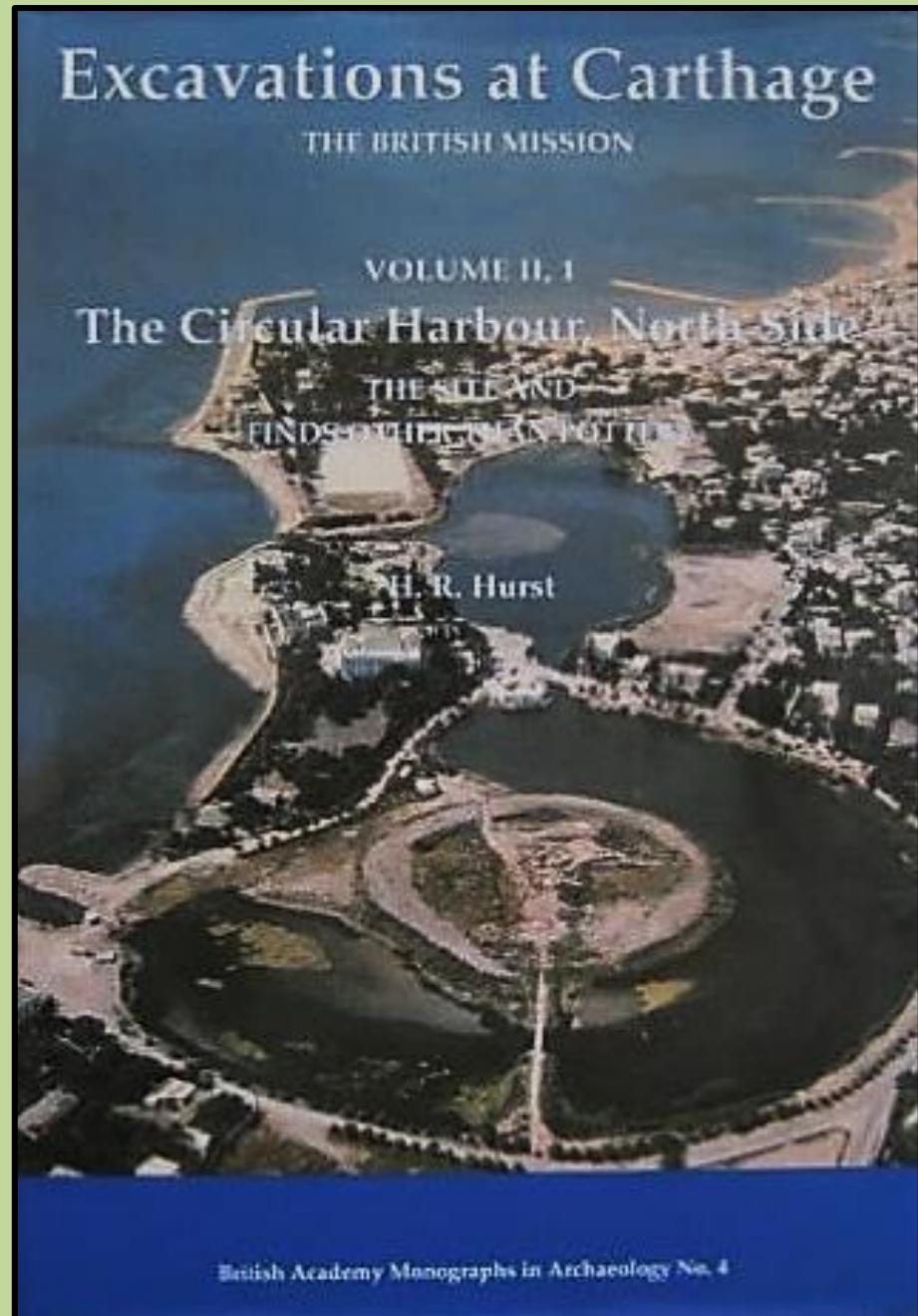
Eye alt 900 m



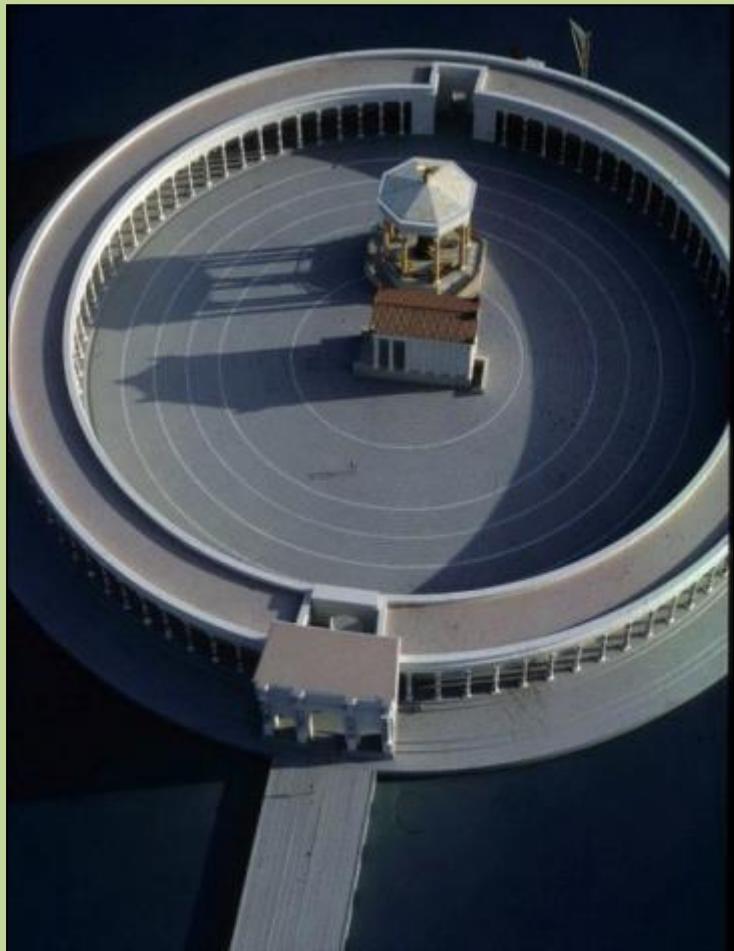
## HISTORY OF EXCAVATION:

1908-1913: DIRECTION DES ANTIQUITÉS  
DE TUNISIE  
(R. CAGNAT & A. MERLIN)

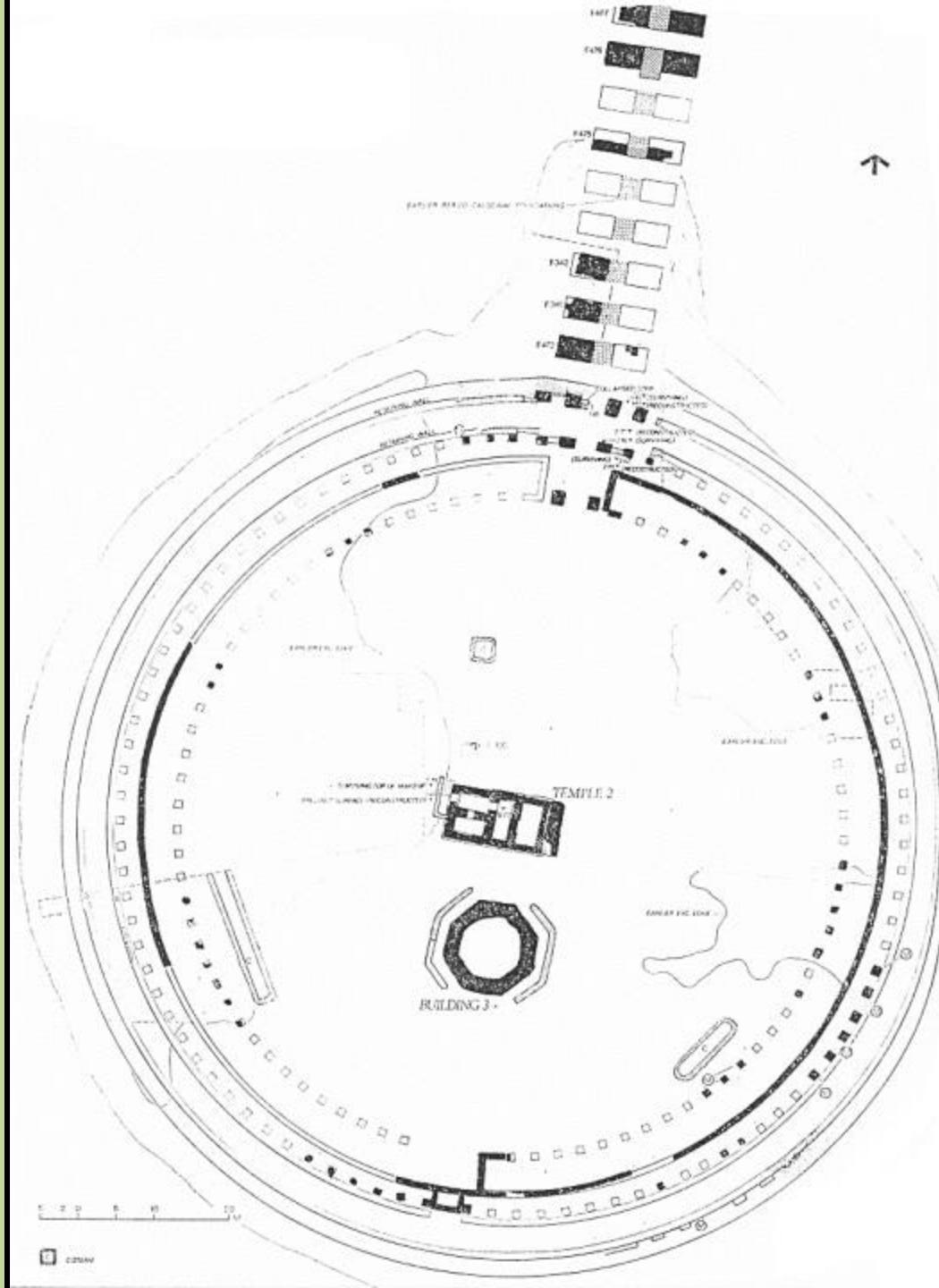
1974-1993: BRITISH ACADEMY  
(H. HURST)



# ÎLOT DE L'AMIRAUTÉ CA. AD 200



FACILITY CONSTRUCTED TO ACCOMMODATE CLASSIS COMMODIANA (FLEET OF COMMODUS), FLEET ORGANIZED TO CARRY STATE GRAIN TO ITALY (AD 186)?



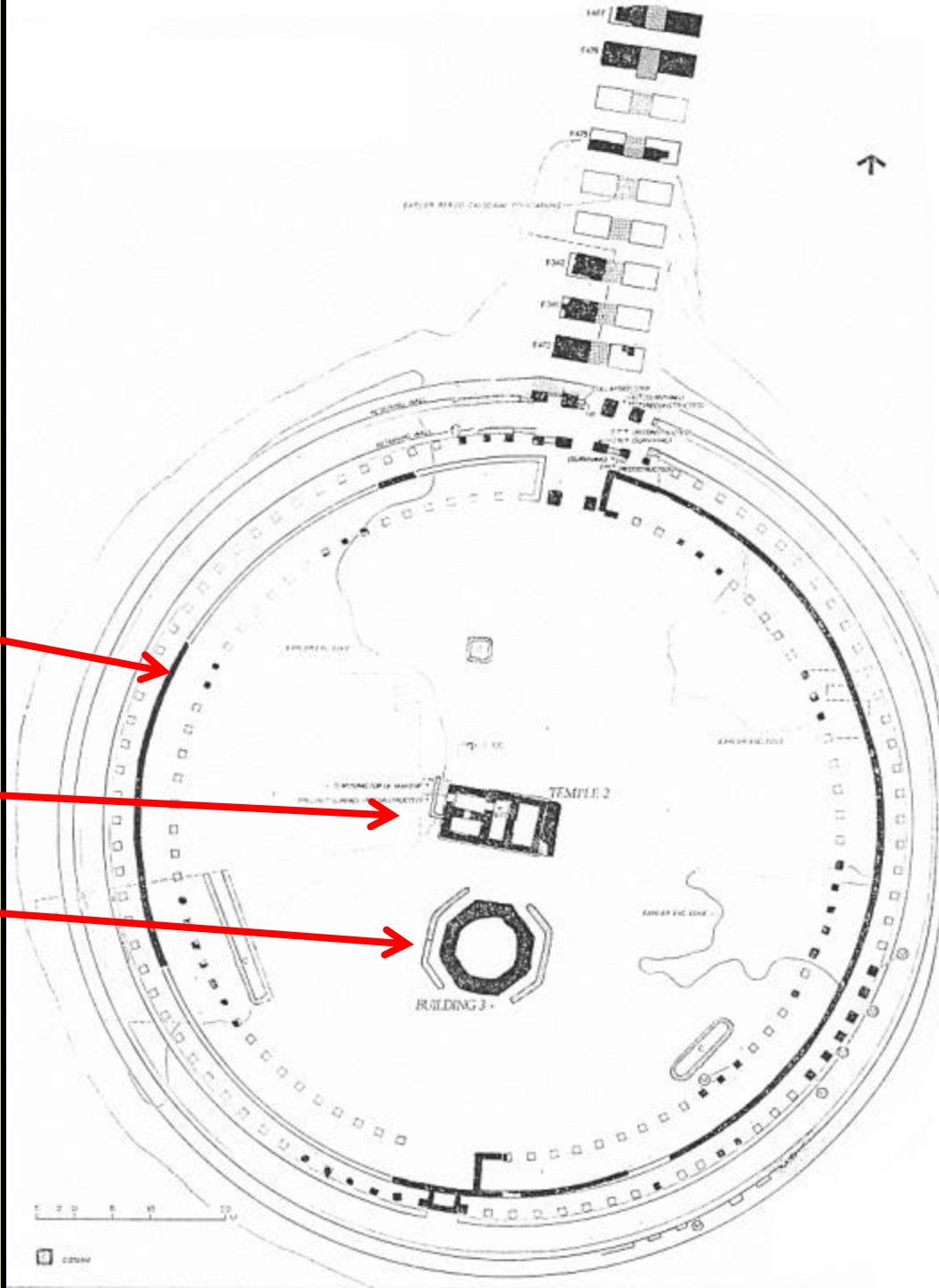
# ÎLOT DE L'AMIRAUTÉ

## CA. AD 200

ANNULAR WALL WITH  
INTERIOR AND EXTERIOR  
COLONNADE AND  
MONUMENTAL ENTRANCE

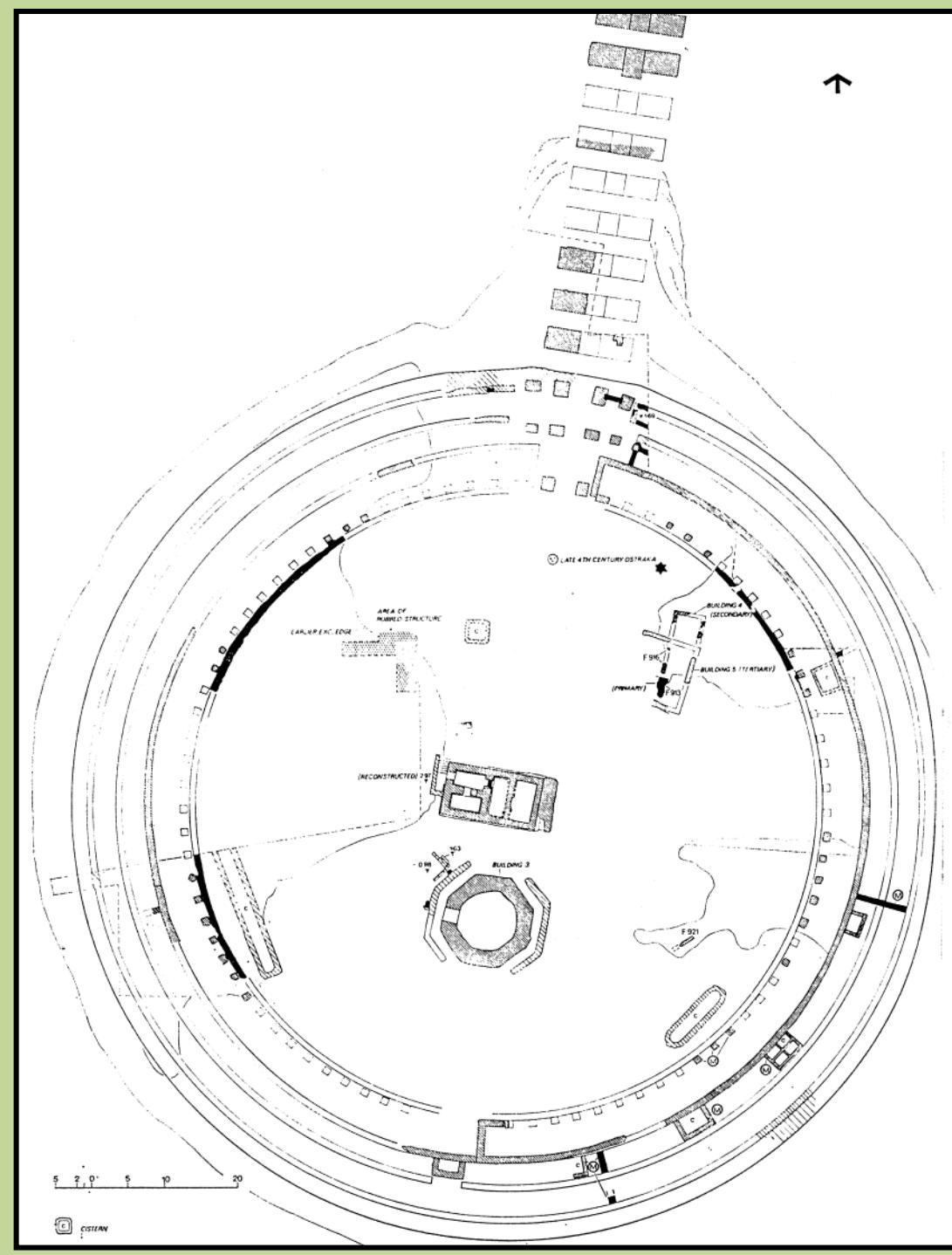
TEMPLE

OCTAGONAL STRUCTURE



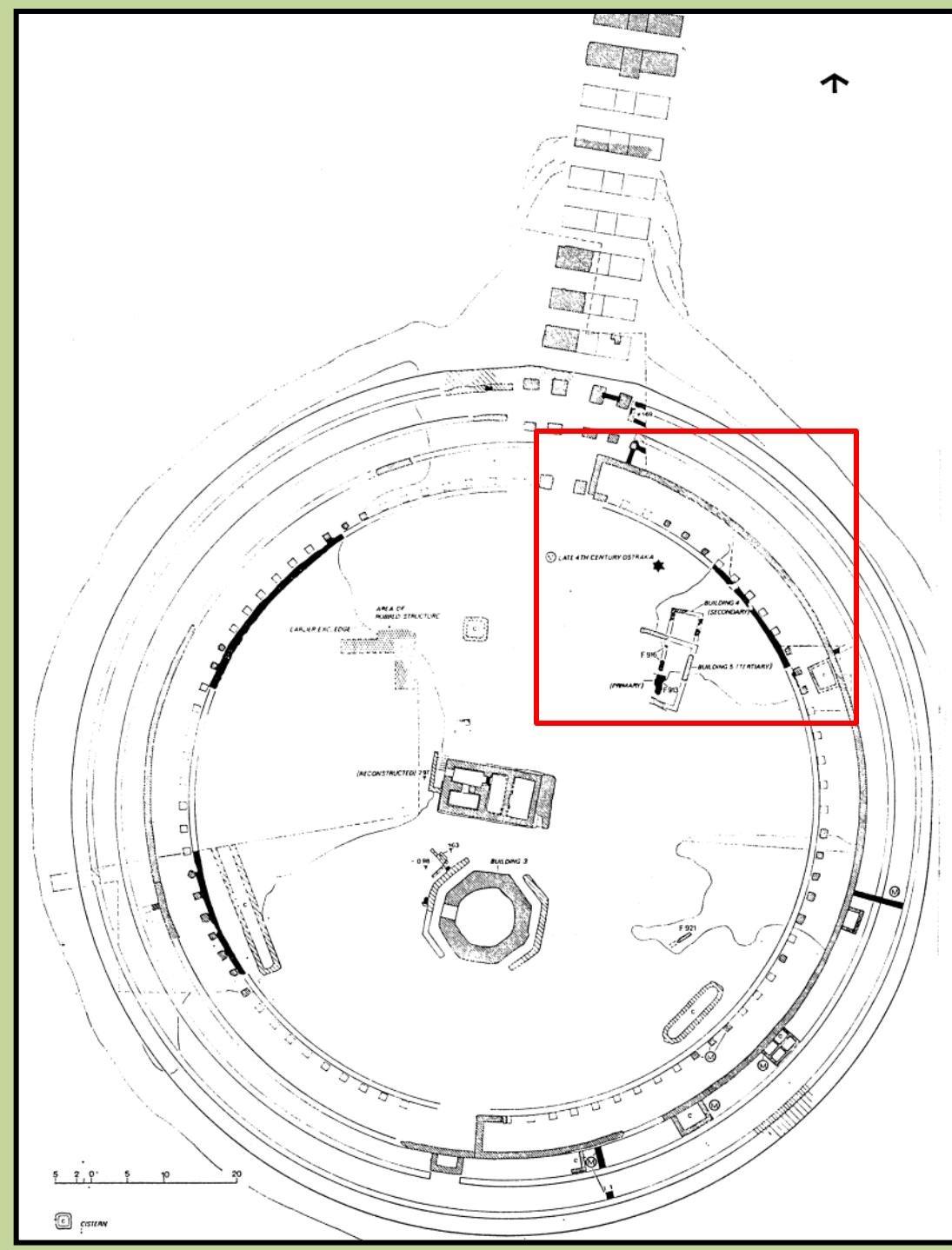
# ILÔT DE L'AMIRAUTÉ

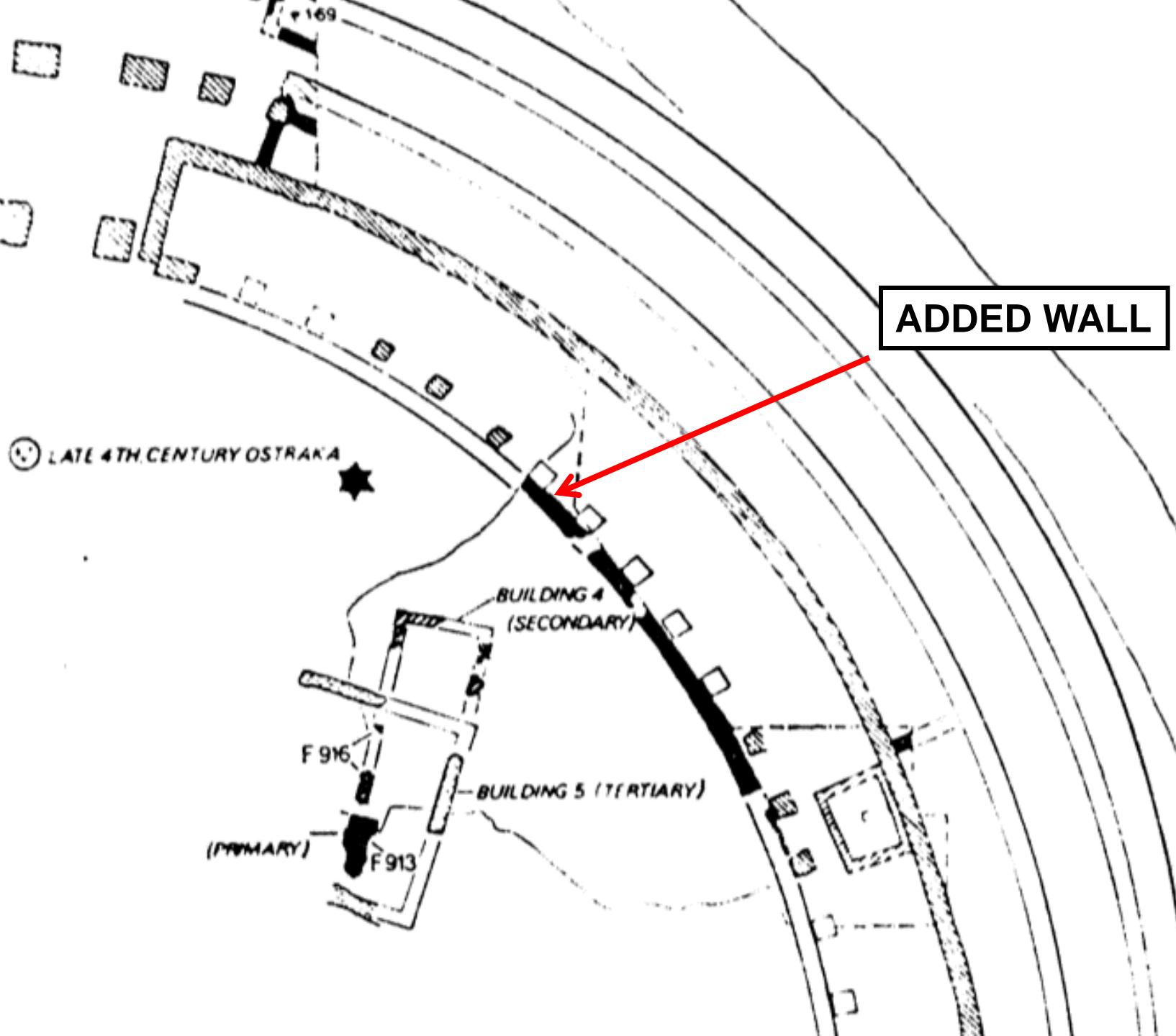
## 4<sup>TH</sup> – 5<sup>TH</sup> C. AD

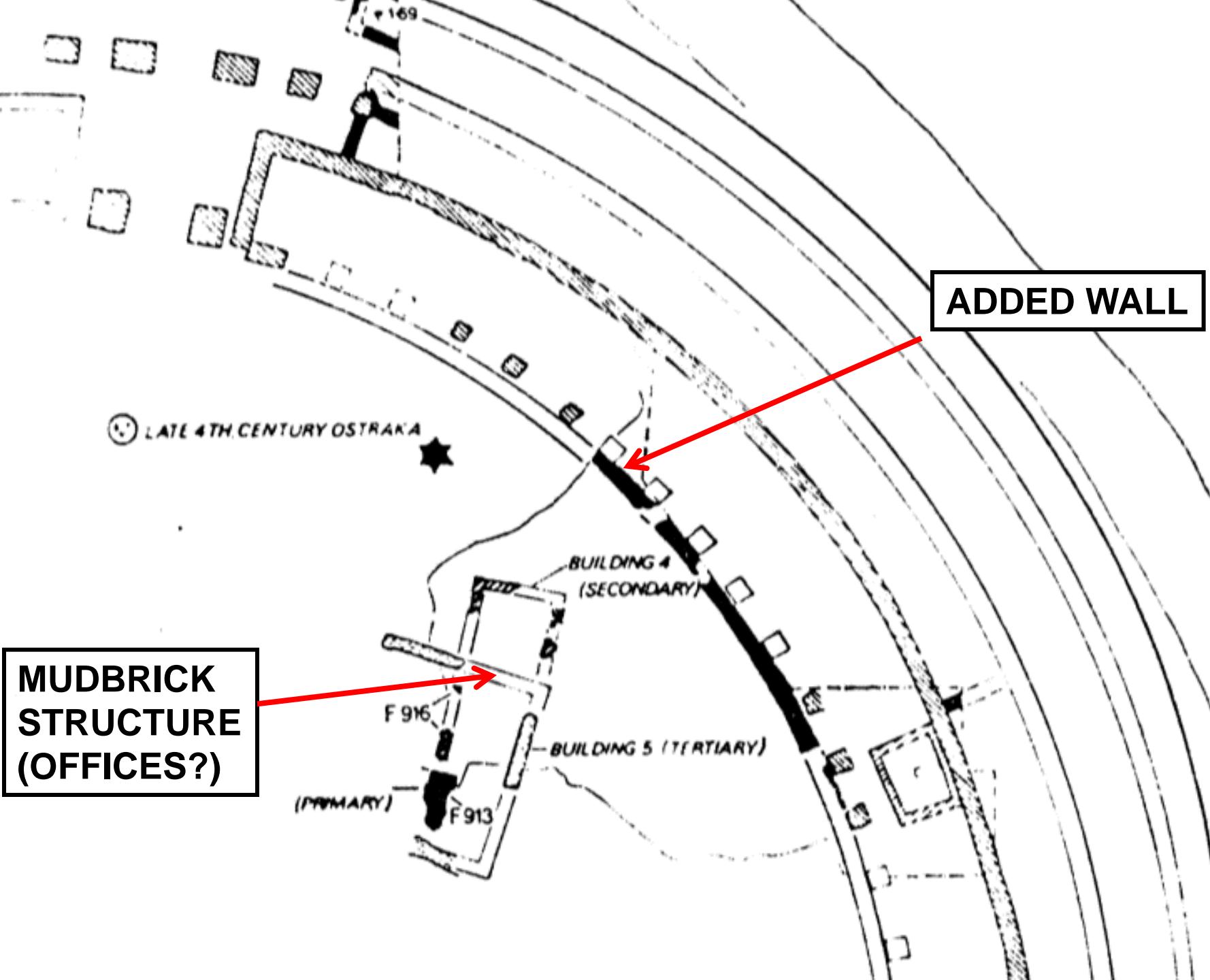


# ÎLOT DE L'AMIRAUTÉ

## 4<sup>TH</sup> – 5<sup>TH</sup> C. AD

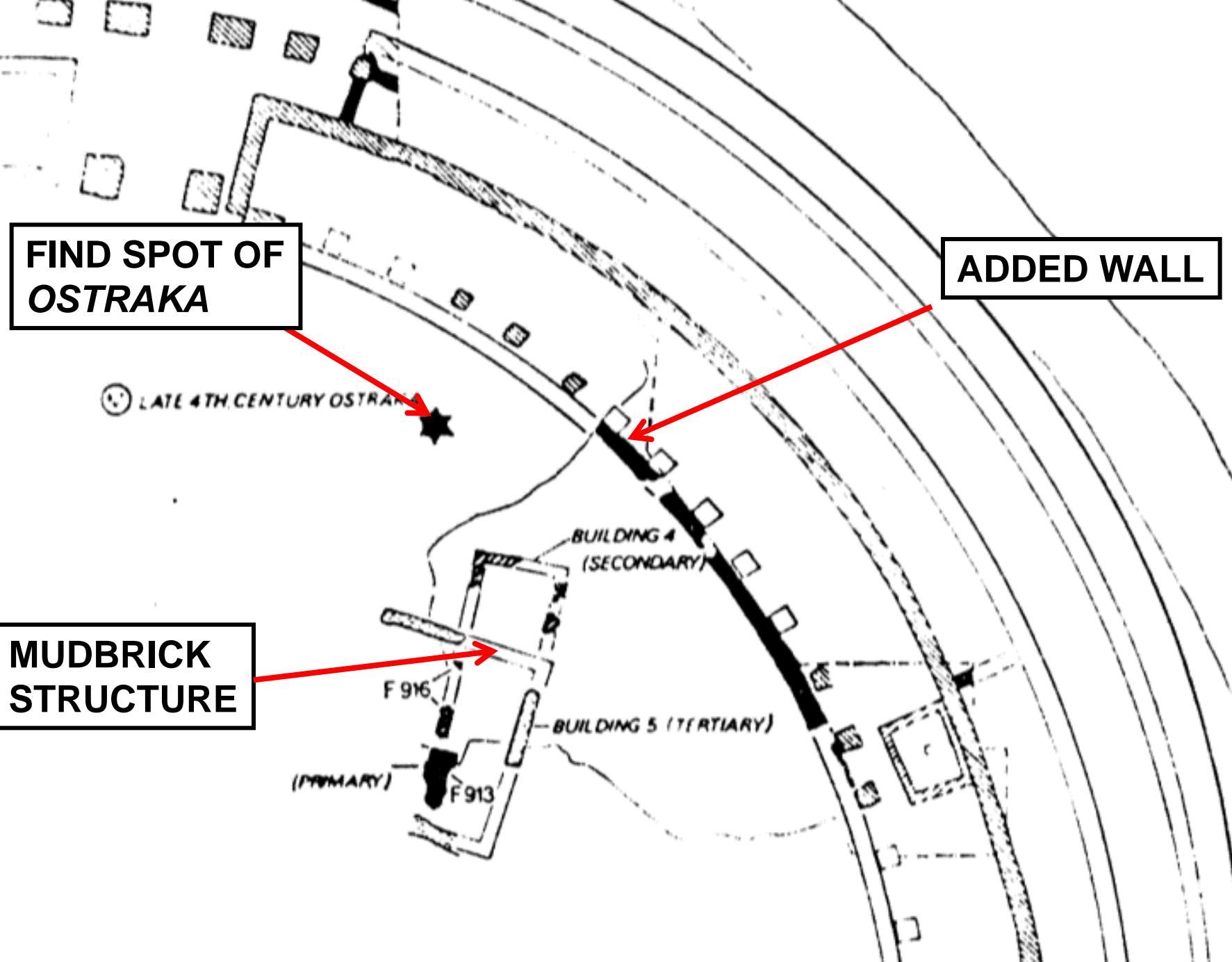






**FIND SPOT OF  
OSTRAKA**

**ADDED WALL**



**MUDBRICK  
STRUCTURE**

R. CAGNAT & A. MERLIN 1911  
*JOURNAL DES SAVANTS* 9:514-523

PRELIMINARY STUDY OF  
OSTRAKA PUBLISHED THE  
YEAR OF THEIR DISCOVERY  
(1911)

NOUVELLES ET CORRESPONDANCE.

OSTRAKA LATINS DE CARTHAGE.

On sait que, si les ostraka grecs se rencontrent fréquemment, surtout en Égypte<sup>(1)</sup>, les ostraka latins constituent encore une rareté épigraphique. L'Afrique, cependant, en a déjà fourni quelques-uns; ils proviennent pour la plupart du Sud de la province de Constantine. M. le commandant Guénin en a trouvé récemment encore une demi-douzaine lors des fouilles qu'il a fait pratiquer dans les ruines d'Henchir-Touta et d'Henchir-el-Abiod<sup>(2)</sup>.

La découverte que nous annonçons aujourd'hui mérite donc de fixer l'attention.

Au cours des recherches poursuivies à Carthage, dans l'îlot amiral des ports, par la Direction des Antiquités de Tunisie, avec le concours de la main-d'œuvre militaire, M. le lieutenant Esmiol, du 4<sup>e</sup> tirailleurs algériens, a découvert cette année une série de tessons de poterie plus ou moins épais, de forme incurvée, de couleur généralement rougeâtre, qui portent des caractères cursifs latins, tracés à l'encre noire.

Le déchiffrement de ces ostraka est assez malaisé à cause de la mauvaise conservation de l'écriture; leur interprétation offre de grosses difficultés et bien des incertitudes. Il nous a semblé que, malgré l'imperfection de nos copies, encore provisoires sur bien des points, il pourrait être utile aux érudits de connaître dès maintenant ceux de ces documents qui sont les mieux conservés et que, d'autre part, grâce à l'expérience des spécialistes, on arriverait peut-être à résoudre les nombreux problèmes que soulève leur interprétation.

Les inscriptions que nous avons pu lire se divisent en plusieurs catégories.

I

Le premier groupe comprend cinq textes, datés tous du postconsulat de Modestus et d'Arintheus (année 373 de notre ère) et analogues

<sup>(1)</sup> Cf. Wilcken, *Griechische Ostraka aus Aegypten*, I., p. 1 et suiv.

<sup>(2)</sup> *Bull. arch. du Comité*, 1908, p. ccXLVII et suiv.

The mobilization of state olive oil in Roman Africa:  
the evidence of late 4th-c. *ostraca* from Carthage

J. T. Peña

1. INTRODUCTION<sup>1</sup>

Excavations carried out in 1911 by the Direction des Antiquités de Tunisie on the îlot de l'Amirauté recovered a group of at least 32 Latin ostraca concerned with the reception and weighing of state olive oil at Carthage over a portion of the year A.D. 373.<sup>2</sup> Immediately upon their discovery Cagnat and Merlin published a brief article that reported transcriptions of 10 of these documents, their goal being to bring these extremely interesting, if somewhat problematic, texts to the attention of other specialists.<sup>3</sup> The remaining documents in the group they judged insufficiently legible to warrant publication, and they have never been reported in the literature. In the years since Cagnat and Merlin's publication, the îlot de l'Amirauté *ostraca* have received scant notice and they have yet to be the subject of any detailed analysis.<sup>4</sup> This is regrettable, as they represent a unique source of information regarding the state's involvement in the mobilization (i.e., the collection and transport to points of consumption) of foodstuffs in the period subsequent to the fiscal and administrative reforms carried out under Diocletian. This essay aims to redress the situation by first describing the documents and then discussing their implications for our understanding of the state's involvement in the mobilization of oil in the province of Zeugitana during the later 4th c.<sup>5</sup>

As this study will reveal, these documents constitute an important supplement to the evidence provided by legal sources, oil amphoras, and archaeological remains in the oil-producing regions of Roman North Africa, and their analysis provides important new insights into several aspects of state involvement in the mobilization of African oil, including the methods employed for its collection, transport, weighing, and packaging, the organization of the administrative bureaucracy responsible for conducting and overseeing oil mobilization operations, and

<sup>1</sup> It may be useful to single out certain of the conventions employed below. All dates are A.D. All linear measurements are expressed in centimeters. The words amphora/amphoras are used to denote containers, while amphora/amphorae are used to denote the unit of volumetric measure. The conversions of sextarius/amphorae of olive oil to (Roman) pounds (lbs), kilograms (kg), and liters (l) presented below are based on the following set of assumptions:

1. The Roman pound was equal to 327 g.

2. The sextarius was equal to 0.546 l, hence one amphora was equal to 26.2 l (i.e. 48 x 0.546 l).

3. The density of Roman olive oil was equal to 0.91;

4. The Romans considered 1 sextarius of olive oil to be equal to 1.5 lbs.

For the density of oil, see Vrielebaan 1912, 432, where it is stated that this varies from 0.91 to 0.93 as a function of several factors (e.g., quality of oil, temperature). At a density of 0.91–0.93, 1 kg of oil would have had a volume of 1.08–1.09 l. In a trial carried out to confirm these values, I determined that at room temperature 1.5 l of commercially distributed Bertoli olive oil from Italy weighs 1.37 kg, for a density of 0.913. I therefore assume a density of 0.91 and employ a factor of 1.1 to convert kilograms to liters of oil. For the assumption that 1 sextarius of oil was considered to weigh 1.5 lbs, see Hultsch 1864–66 [1971], 208, II.15–16; 223, I.26; 239, I.11; 241, I.13; 247, I.11; 251, I.2.

2 For the figure of 32 ostraca, see below. Cagnat 1911, ccxxxviii, reporting on their discovery, refers simply to a "série considérable de tessons de poterie."

3 Cagnat and Merlin 1911. The 10 documents treated in this publication are *AE* 1912 nos. 61–70.

4 I am aware of only a small number of passing references to the îlot de l'Amirauté *ostraca*, including Cagnat 1916, 257; Parvis d'Escuras 1976, 196; Hurst 1979, 39, 46–47; PLRE 103, 607; Bagnall et al. 1987, 278–81; Salama 1987, 137; Hurst 1994, 111, 114; Mattingly and Hitchner 1995, 183.

5 This essay thus makes no effort to address various palaeographic, linguistic, and onomastic issues raised by the *ostraca*.

JOURNAL OF ROMAN ARCHAEOLOGY  
SUPPLEMENTARY SERIES NUMBER TWENTY-EIGHT

# CARTHAGE PAPERS

## THE EARLY COLONY'S ECONOMY, WATER SUPPLY, A PUBLIC BATH, AND THE MOBILIZATION OF STATE OLIVE OIL

by

J. T. Peña,  
J. J. Rossiter,  
A. I. Wilson,  
C. Wells, M. Carroll, J. Freed & D. Godden

# CARTHAGE - ILÔT DE L'AMIRAUTÉ OSTRAKA

- 32 DOCUMENTS ON SHERDS OF AFRICAN AMPHORA OF TWO TYPES  
(6 TYPE 1; 17 TYPE 2; 9 INDETERMINATE)
- TYPE 1 DOCUMENT: RECEIPT OF SHIPMENTS OF OIL AT HARBOR; DATED AD 373  
(DATES: FEB. 3&4; 14&16; 15&16; MARCH 2-5&6; APRIL 11&15; JULY 22&27)
- TYPE 2 DOCUMENT: AMOUNT OF OIL WEIGHED AND ESTIMATE OF AMOUNT OF OIL HELD IN WEIGHING AND STORAGE FACILITIES ON A PARTICULAR DAY;  
VERY PROBABLY ALSO DATE TO AD 373  
(DATES: FEB. 17; MARCH 9; 15; 16-31; APRIL 7; 8; 25; 26; MAY 6; 30&31&JUNE 6]
- PRODUCED BY PROVINCE OF ZEUGITANA OR *PRAEFECTURA ANNONAE AFRICAE*  
(OFFICE OF *PRAEFECTURA ANNONAE* IN DIOCESE OF AFRICA) ?
- DOCUMENT PORTION OF OPERATIONS FOR FIRST PART OF AD 372-373 TAX YEAR  
(NOV. 1 – OCT. 31) IN PROVINCE OF ZEUGITANA

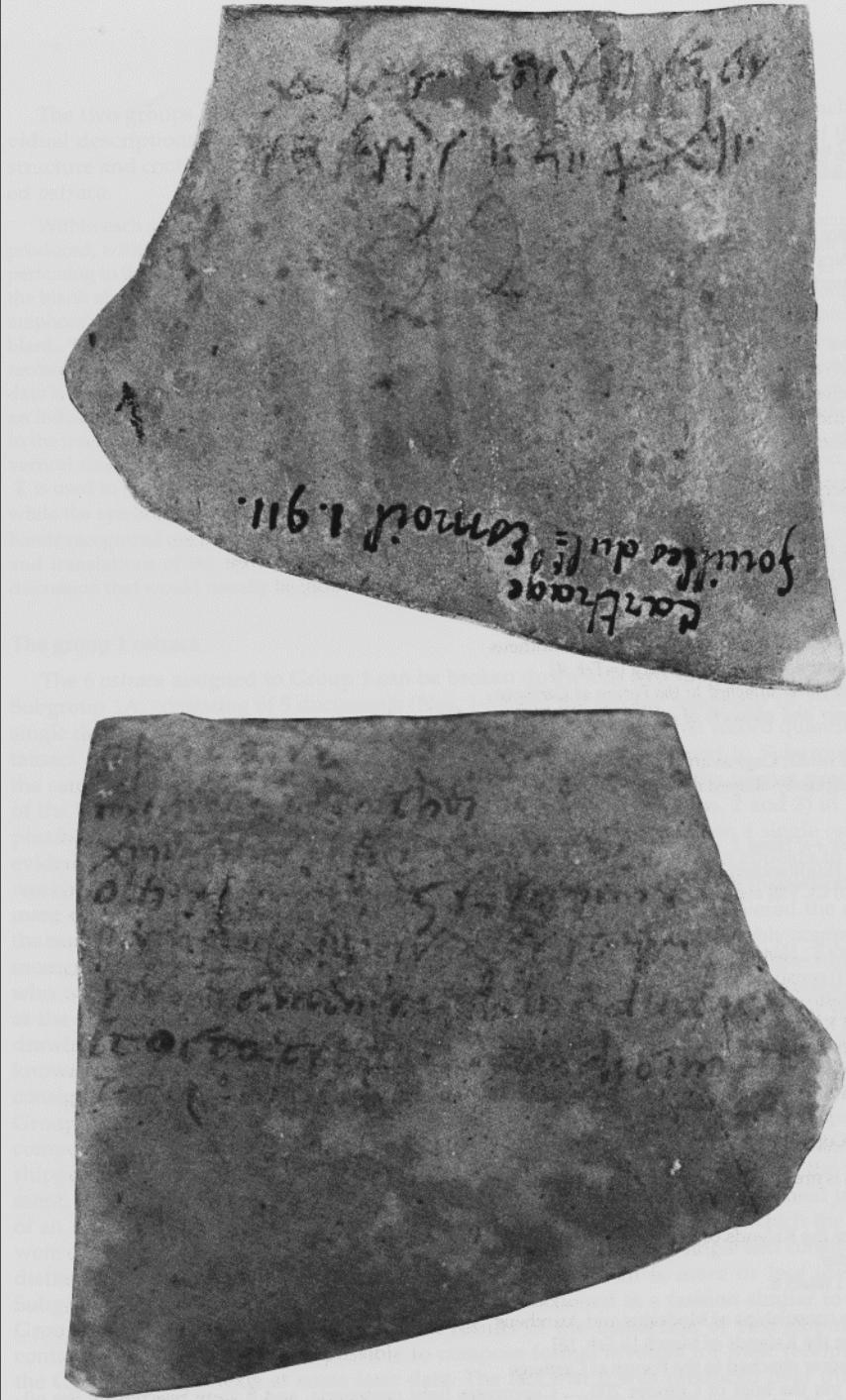
# **THE TYPE 1 *OSTRAKA***

**REPRESENTATIVE  
TYPE 1 OSTRAKON  
(NUMBER 2)**

**RECTO**

**VERSO**

**HEIGHT: 13.5 CM; WIDTH: 12.5 CM**



## NUMBER 2 – EXPANDED LATIN TEXT

### *RECTO*

XVI [k(a)l(endas) mart(ias)] n(avicula) [cilindri  
f(ero) CCVIII r(eprobo) V[III]

### *VERSO*

pos(t) cons(ulatu)s  
modesto et arinthei  
XIIII K(a)l(endas) mart(ias) felix mensor olei fori  
karthag(iniensis) suscepimus per nav(i)c(u)la(m)  
cilindri caproreses centenaria  
levia ducenta X ml }c et m(ensore) ol(e)i  
petro reprob(ata sunt) octo  
Con(ditorium) z(eugitanum)

## NUMBER 2 – EXPANDED LATIN TEXT

### *RECTO*

XVI [k(a)l(endas) mart(ias)] n(avicula) [cilindri  
f(ero) CCVIII r(eprobo) V[III]

### *VERSO*

pos(t) cons(ulatu)s  
modesto et arinthei  
XIIII K(a)l(endas) mart(ias) felix mensor olei fori  
karthag(iniensis) suscepimus per nav(I)c(u)la(m)  
cilindri caproreses centenaria  
levia ducenta Xml }c et m(ensore) ol(e)i  
petro reprob(ata sunt) octo  
Con(ditorium) z(eugitanum)

## NUMBER 2 – EXPANDED LATIN TEXT

### RECTO

XVI [k(a)l(endas) mart(ias)] n(avicula) [cilindri  
f(ero) CCVIII r(eprobo) V[III]

### VERSO

pos(t) cons(ulatu)s  
modesto et arinthei  
XIIII K(a)l(endas) mart(ias) felix mensor olei fori  
karthag(iniensis) suscepimus per nav(I)c(u)la(m)  
cilindri caproreses centenaria  
levia ducenta xmi }c et m(ensore) ol(e)i  
petro reprob(ata sunt) octo  
Con(ditorium) z(eugitanum)

## NUMBER 2 – EXPANDED LATIN TEXT

### RECTO

XVI [k(a)l(endas) mart(ias)] n(avicula) [cilindri  
f(ero) CCVIII r(eprobo) V[III]

### VERSO

pos(t) cons(ulatu)s  
modesto et arinthei  
XIIII K(a)l(endas) mart(ias) felix mensor olei fori  
karthag(iniensis) suscepimus per nav(I)c(u)la(m)  
cilindri caproreses centenaria  
levia ducenta xmi }c et m(ensore) ol(e)i  
petro reprob(ata sunt) octo  
Con(ditorium) z(eugitanum)

## NUMBER 2 – ENGLISH TRANSLATION

16 days before the Kalends of March [= Feb. 14]

Boat of Cilinder

I receive 208. I reject 8.

Following the consulship of Modestus and Arintheus [= AD 373]

14 days before the Kalends of March [= Feb. 16]

Felix, oil measurer attached to the Forum at Carthage

We received via the boat of Cilinder 200.....

Caproreses light *centenaria*, and 8 were rejected  
by the oil measurer Petrus.

Zeugitana storehouse

# RELIEF (PORTUS; 2<sup>ND</sup> - 3<sup>RD</sup> C. AD; TORLONIA COLLECTION)



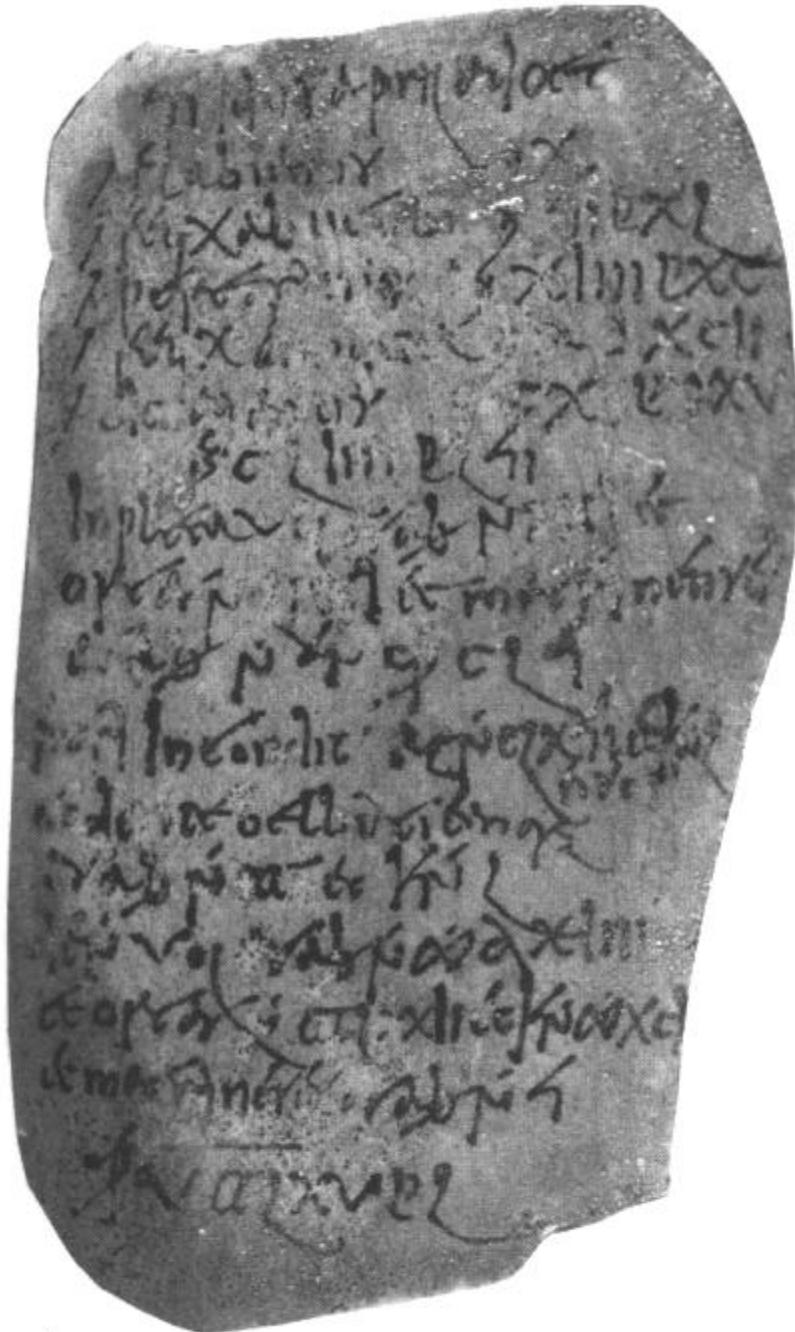
# FRESCO (OSTIA, CASEGGIATO DELL'ERCOLE; 2<sup>ND</sup> C. AD)



# **THE TYPE 2 OSTRAKA**

**REPRESENTATIVE  
TYPE 2 OSTRAKON  
(NUMBER 13)**

**HEIGHT: 17.0 CM; WIDTH: 11.0 CM**



## NUMBER 13 – LATIN TEXT

VII Idus april ad oct

7 Flabianus	I/ X	
7 Felix ab Ucubi	I/ VII	<u>P</u> XL
7 Peregrinus	I/ XIII	<u>P</u> XC
7 Felix ab [....]c	I/ X	<u>P</u> XCII
7 doi..anus	I/ CXI	<u>P</u> XXXV
	I} CLIII	<u>P</u> LVII

Inpletu vol asab N XXI et  
oRc as N CLXI et  
macrinenses asab N VI 7 CLVI

fieri In conditZ ag N CLXVII et KNT L fisci et  
de N tebelbucitan qz asab N CCC et KNT L et  
de N vol asab N 7dXIII et  
oRc as N CCLXXII et KNT 7XCI et  
macrineses asab N VI

I} VCCLXV P L

## ABBREVIATIONS AND SPECIAL CHARACTERS

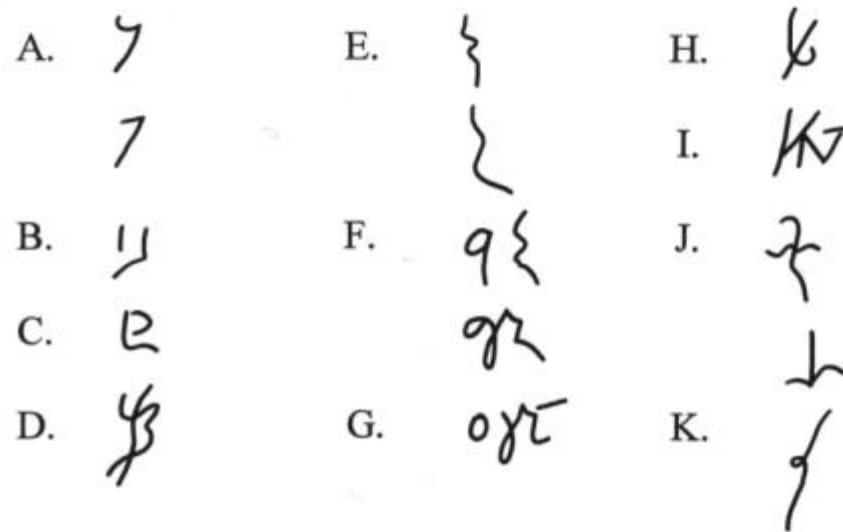


Fig. 10. Examples of special/problematic characters appearing in the *ostraca*.

- A: Sign in Subgroup 2A and 2B documents translated as *centenarius* (two variants).
- B: Sign in Subgroup 2A and 2B documents standing for *cwt*.
- C: Ligature of P and L in Subgroup 2A and 2B documents standing for *pondus librae*.
- D: Sign in Subgroup 2A and 2B documents standing for sum of *cwt*.
- E: Final element in heading in Subgroup 2B documents transcribed *fieri inconditZ* (two variants).
- F: Second element in provenience/ownership designation in Subgroup 2B documents transcribed *Tebelbucitan qz* (two variants).
- G: Provenience/ownership designation in Subgroup 2B documents transcribed *oRc*.
- H: Probable ligature of b and y in container type designation in Subgroup 2B documents transcribed as *a b*.
- I: Container type designation consisting of ligature of K, N, and T in Subgroup 2A and 2B documents transcribed *KN<sup>T</sup>*.
- J: Sign of uncertain nature standing for container type with 400-lb. capacity in Subgroup 1B, 2B, and 2C documents transcribed *ψ* (two variants).
- K: Figure in Number 7 *recto*, line 8, transcribed *ſ*.

## NUMBER 13 – LATIN TEXT (ELEMENT 1)

VII Idus april ad oct

7 Flabianus	I/ X	
7 Felix ab Ucubi	I/ VII	P XL
7 Peregrinus	I/ XIII	P XC
7 Felix ab [....]c	I/ X	P XCII
7 doi..anus	I/ CXI	P XXXV
	I} CLIII	P LVII

Inpletu vol asab N XXI et  
oRc as N CLXI et  
macrinenses asab N VI 7 CLVI

fieri In conditZ ag N CLXVII et KNT L fisci et  
de N tebelbucitan qz asab N CCC et KNT L et  
de N vol asab N 7dXIII et  
oRc as N CCLXXII et KNT 7XCI et  
macrineses asab N VI

I} VCCLXV P L

## NUMBER 13 – LATIN TEXT (ELEMENT 2)

VII Idus april ad oct

7 Flabianus	I/ X	
7 Felix ab Ucubi	I/ VII	<u>P</u> XL
7 Peregrinus	I/ XIII	<u>P</u> XC
7 Felix ab [....]c	I/ X	<u>P</u> XCII
7 doi..anus	I/ CXI	<u>P</u> XXXV
	I} CLIII	<u>P</u> LVII

Inpletu vol asab N XXI et  
oRc as N CLXI et  
macrinenses asab N VI 7 CLVI

fieri In conditZ ag N CLXVII et KNT L fisci et  
de N tebelbucitan qz asab N CCC et KNT L et  
de N vol asab N 7dXIII et  
oRc as N CCLXXII et KNT 7XCI et  
macrineses asab N VI

I} VCCLXV P L

## NUMBER 13 – LATIN TEXT (ELEMENT 2 – WORK GROUPS)

VII Idus april ad oct

7 Flabianus	I/ X	
7 Felix ab Ucubi	I/ VII	<u>P</u> XL
7 Peregrinus	I/ XIII	P XC
7 Felix ab [....]c	I/ X	<u>P</u> XCII
7 doi..anus	I/ CXI	<u>P</u> XXXV
	I} CLIII	<u>P</u> LVII

33 CONTAINERS @ 97.9

11 CONTAINERS @ 99.1

112 CONTAINERS @ 99.4

156 CONTAINERS @ 99.1

Inpletu vol asab N XXI et  
oRc as N CLXI et  
macrinenses asab N VI 7 CLVI

fieri In conditZ ag N CLXVII et KNT L fisci et  
de N tebelbucitan qz asab N CCC et KNT L et  
de N vol asab N 7dXIII et  
oRc as N CCLXXII et KNT 7XCI et  
macrineses asab N VI

I} VCCLXV P L

## NUMBER 13 – LATIN TEXT (ELEMENT 2 – CHECK)

VII Idus april ad oct

7 Flabianus	I/ X	
7 Felix ab Ucubi	I/ VII	<u>P</u> XL
7 Peregrinus	I/ XIII	P XC
7 Felix ab [....]c	I/ X	<u>P</u> XCII
7 doi..anus	I/ CXI	<u>P</u> XXXV
	I} CLIII	<u>P</u> LVII

33 CONTAINERS @ 97.9

11 CONTAINERS @ 99.1

112 CONTAINERS @ 99.4

156 CONTAINERS @ 99.1

Inpletu vol asab N XXI et  
oRc as N CLXI et  
macrinenses asab N V ? CLVI

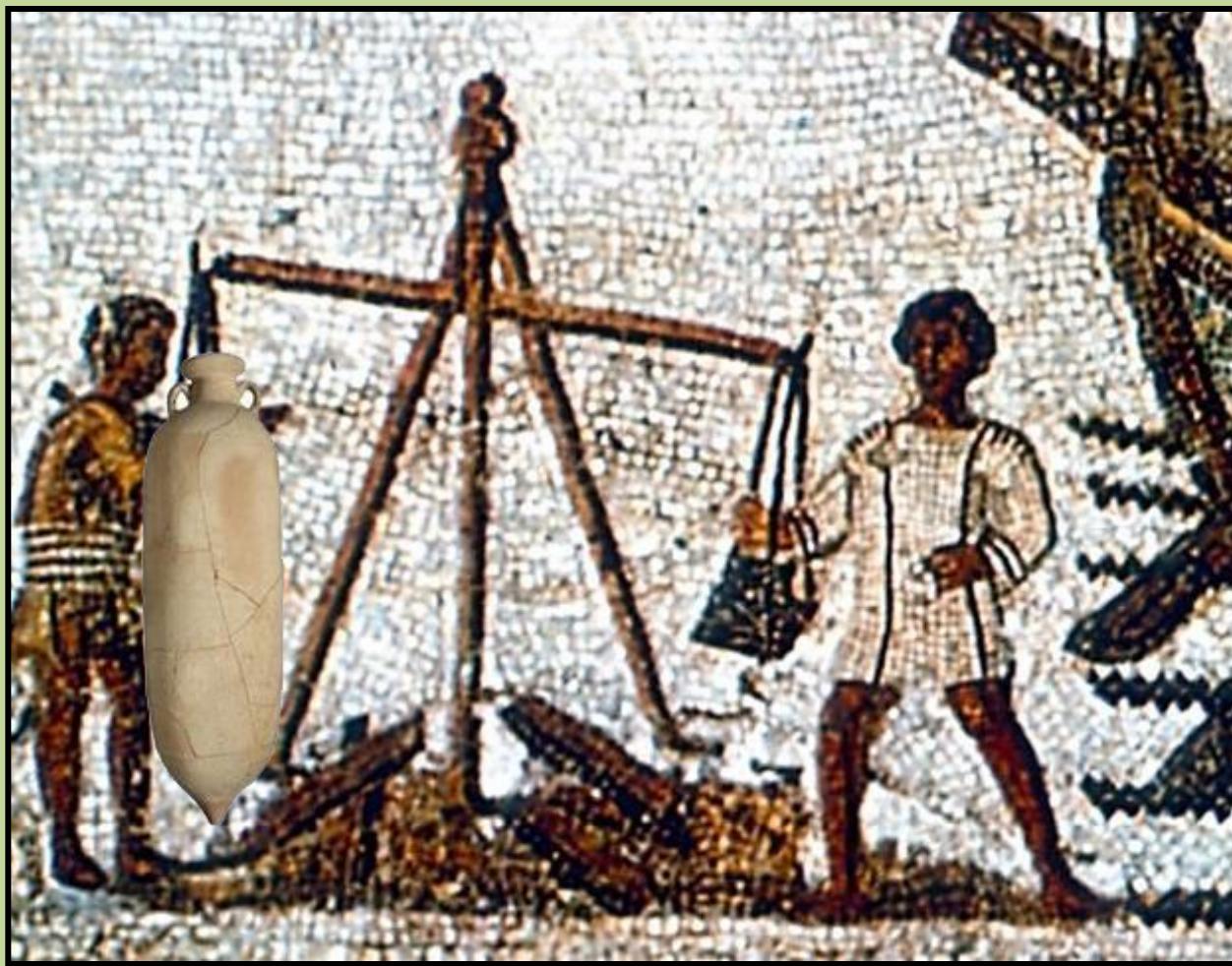
fieri In conditZ ag N CLXVII et KNT L fisci et  
de N tebelbucitan qz asab N CCC et KNT L et  
de N vol asab N  $\infty$ dXIII et  
oRc as N CCLXXII et KNT  $\infty$ XCI et  
macrineses asab N VI

I} VCCLXV P L

# MOSAIC (HADRUMETUM/SOUSSE; 3<sup>RD</sup> C. AD; BARDO MUSEUM)







## NUMBER 13 – LATIN TEXT (ELEMENT 3)

VII Idus april ad oct

7 Flabianus	I/ X	
7 Felix ab Ucubi	I/ VII	P XL
7 Peregrinus	I/ XIII	P XC
7 Felix ab [....]c	I/ X	P XCII
7 doi..anus	I/ CXI	P XXXV
	I} CLIII	P LVII

Inpletu vol asab N XXI et  
oRc as N CLXI et  
macrinenses asab N VI 7 CLVI

fieri In conditZ ag N CLXVII et KNT L fisci et  
de N tebelbucitan qz asab N CCC et KNT L et  
de N vol asab N 7dXIII et  
oRc as N CCLXXII et KNT 7XCI et  
macrineses asab N VI

I} VCCLXV P L

## NUMBER 13 – LATIN TEXT (ELEMENT 3A)

VII Idus april ad oct

7 Flabianus	I/ X	
7 Felix ab Ucubi	I/ VII	<u>P</u> XL
7 Peregrinus	I/ XIII	<u>P</u> XC
7 Felix ab [....]c	I/ X	<u>P</u> XCII
7 doi..anus	I/ CXI	<u>P</u> XXXV
	I} CLIII	<u>P</u> LVII

Inpletu vol asab N XXI et  
oRc as N CLXI et  
macrinenses asab N VI 7 CLVI

fieri In conditZ ag N CLXVII et KNT L fisci et  
de N tebelbucitan qz asab N CCC et KNT L et  
de N vol asab N 7dXIII et  
oRc as N CCLXXII et KNT 7XCI et  
macrineses asab N VI

I} VCCLXV P L

## NUMBER 13 – LATIN TEXT (ELEMENT 3B)

VII Idus april ad oct

7 Flabianus	I/ X	
7 Felix ab Ucubi	I/ VII	<u>P</u> XL
7 Peregrinus	I/ XIII	<u>P</u> XC
7 Felix ab [....]c	I/ X	<u>P</u> XCII
7 doi..anus	I/ CXI	<u>P</u> XXXV
	I} CLIII	<u>P</u> LVII

Inpletu vol asab N XXI et  
oRc as N CLXI et  
macrinenses asab N VI 7 CLVI

fieri In conditZ ag N CLXVII et KNT L fisci et  
de N tebelbucitan qz asab N CCC et KNT L et  
de N vol asab N 7dXIII et  
oRc as N CCLXXII et KNT 7XCI et  
macrineses asab N VI

I} VCCLXV P L

## NUMBER 13 – LATIN TEXT (ELEMENT 3 - ENTRIES)

VII Idus april ad oct

7 Flabianus	I/ X	
7 Felix ab Ucubi	I/ VII	P XL
7 Peregrinus	I/ XIII	P XC
7 Felix ab [....]c	I/ X	P XCII
7 doi..anus	I/ CXI	P XXXV
	I} CLIII	P LVII

Inpletu vol asab N XXI et

oRc as N CLXI et

macrinenses asab N V P CLVI

fieri In conditZ ag N CLXVII et KNT L fisci et

de N tebelbucitan qz asab N CCC et KNT L et

de N vol asab N dXIII et

oRc as N CCLXXII et KNT XCI et

macrineses asab N VI

I} VCCLXV P L

## ELEMENT 3B ENTRIES

ag Ḵ CLXVII et KNT L fisci  
tebelbucitan qz asab Ḵ CCC et KNT L  
vol asab Ḵ oođXIIII  
oRc as N CCLXXII et KNT ooXCI  
macrineses asab Ḵ VI

## **PROVENIENCE/OWNERSHIP DESIGNATION**

**ag N CLXVII et KNT L fisci**

**tebelbucitan qz asab N CCC et KNT L  
vol asab N oodXIIII**

**oRc as N CCLXXII et KNT oXCI**

**macrineses asab N VI**

# CONTAINER TYPE

ag ḇ CLXVII et KNT L fisci  
tebelbucitan qz asab ḇ CCC et KNT L  
vol asab ḇ ፩፭፭፭  
oRc as N CCLXXII et KNT ፩፭፭  
macrineses asab ḇ VI

# NUMBER OF CONTAINERS

ag ḇ CLXVII et KNT L fisci  
tebelbucitan qz asab ḇ CCC et KNT L  
vol asab ḇ oođXIII  
oRc as N CCLXXII et KNT ooXCI  
macrineses asab ḇ VI

## NUMBER 13 – LATIN TEXT (ELEMENT 3C)

VII Idus april ad oct

7 Flabianus	I/ X	
7 Felix ab Ucubi	I/ VII	P XL
7 Peregrinus	I/ XIII	P XC
7 Felix ab [....]c	I/ X	P XCII
7 doi..anus	I/ CXI	P XXXV
	I} CLIII	P LVII

Inpletu vol asab N XXI et  
oRc as N CLXI et  
macrinenses asab N VI 7 CLVI

fieri In conditZ ag N CLXVII et KNT L fisci et  
de N tebelbucitan qz asab N CCC et KNT L et  
de N vol asab N 7dXIII et  
oRc as N CCLXXII et KNT 7XCI et  
macrineses asab N VI

I} VCCLXV P L

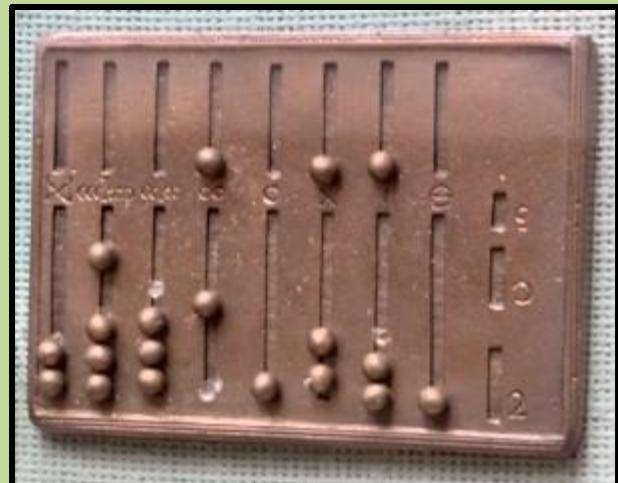
## METHOD FOR CALCULATING FIGURE IN ELEMENT 3C

17	42
XVII	XXXXII
VIII	LXXXI
IV	CLXVIII
II	CCCXXXVI
I	DCLXXII
	= DCCXIIII
	= DCCXIV
	714

61	14
LXI	XIIII
XXX	XXVIII
XV	LVI
VII	CXII
III	CCXXIIII
I	CCCCXXXVIII
	= DCCCLIIII
	= DCCCLIV
	854



RELIEF OF MAN USING  
HAND ABACUS

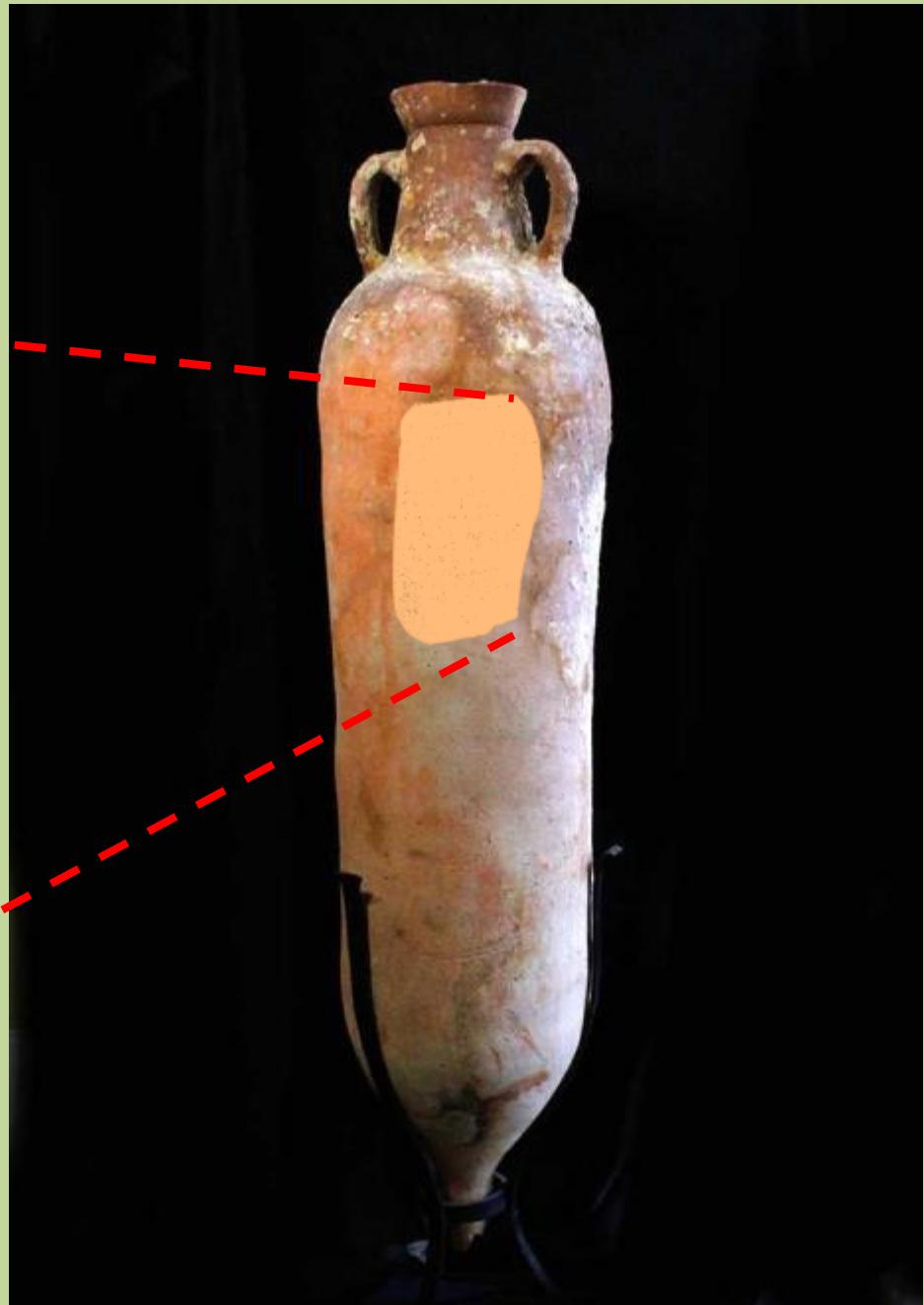
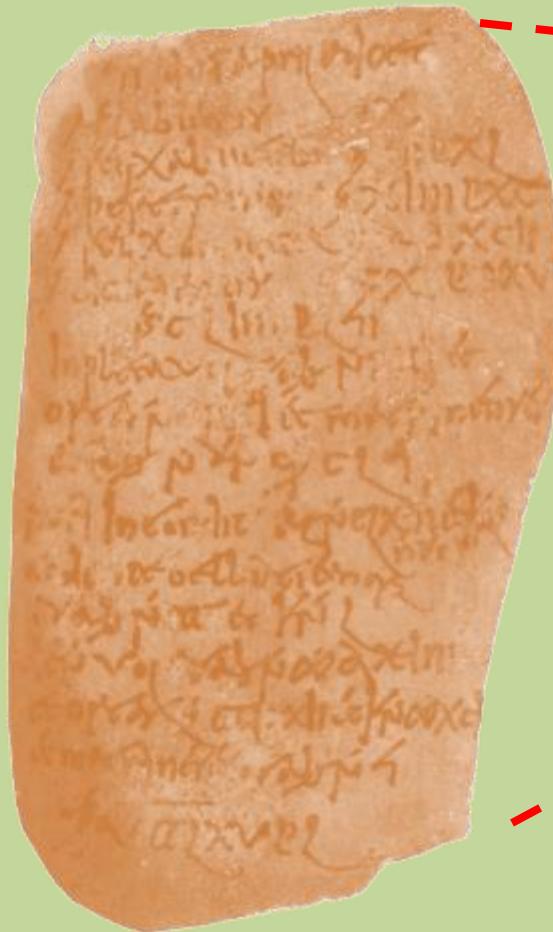


MULTIPLYING ROMAN NUMERALS:  
PUT MULTIPLIER IN COL 1, MULTIPLICAND IN COL 2;  
HALVE MULTIPLIER & DOUBLE MULTIPLICAND;  
CONTINUE UNTIL MULTIPLIER REACHES I;  
ELIMINATE ROWS IN WHICH MULTIPLIER IS EVEN;  
ADD REMAINING ROWS TO OBTAIN PRODUCT

REPLICA OF ROMAN  
HAND ABACUS

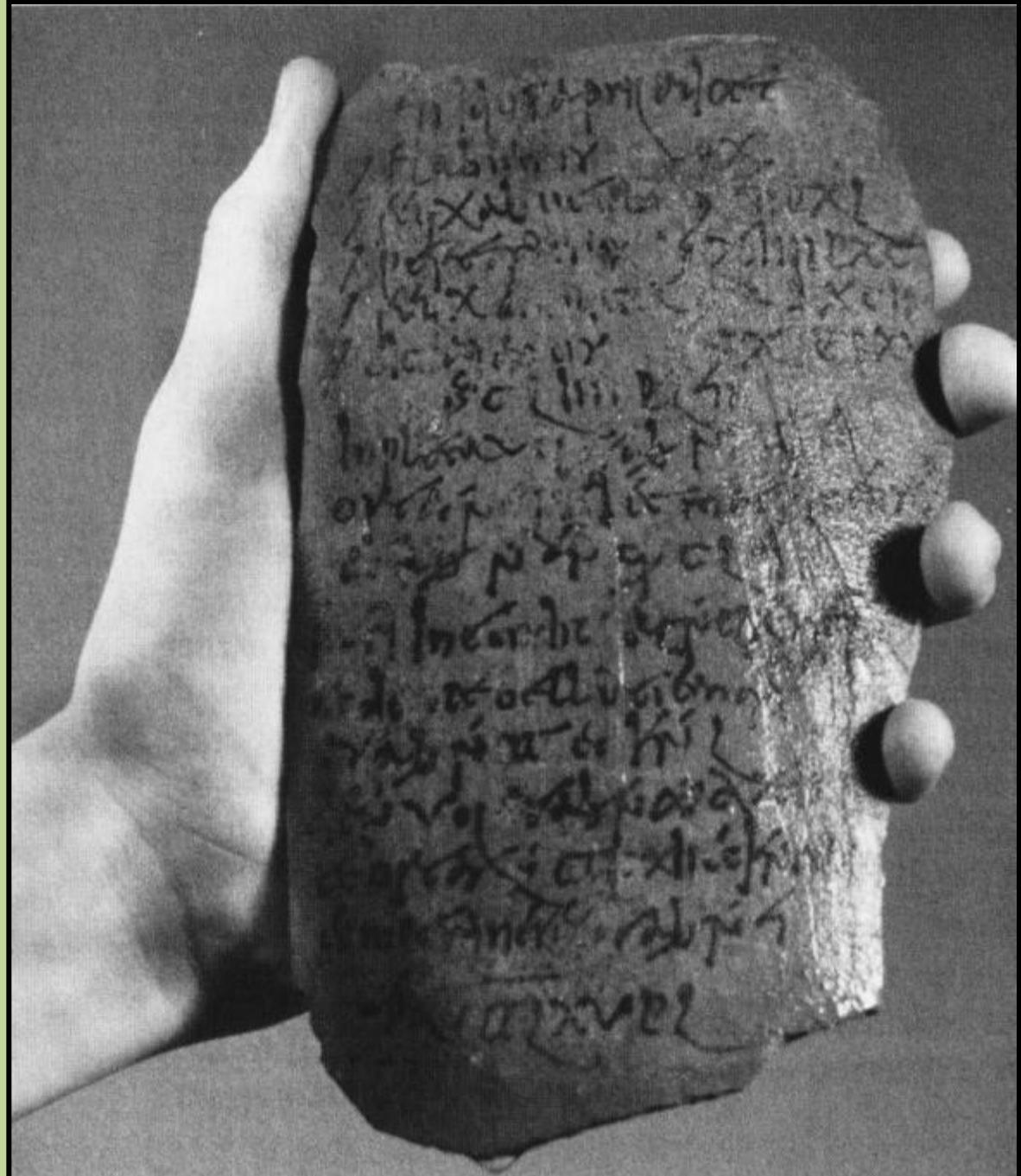
# **THE *OSTRAKA* AS OBJECTS**

**MANUFACTURE:  
MADE FROM AFRICAN AMPHORAS;  
MOST TEXTS MADE ON SHIELD-  
SHAPED BLANKS CUT FROM WALL**



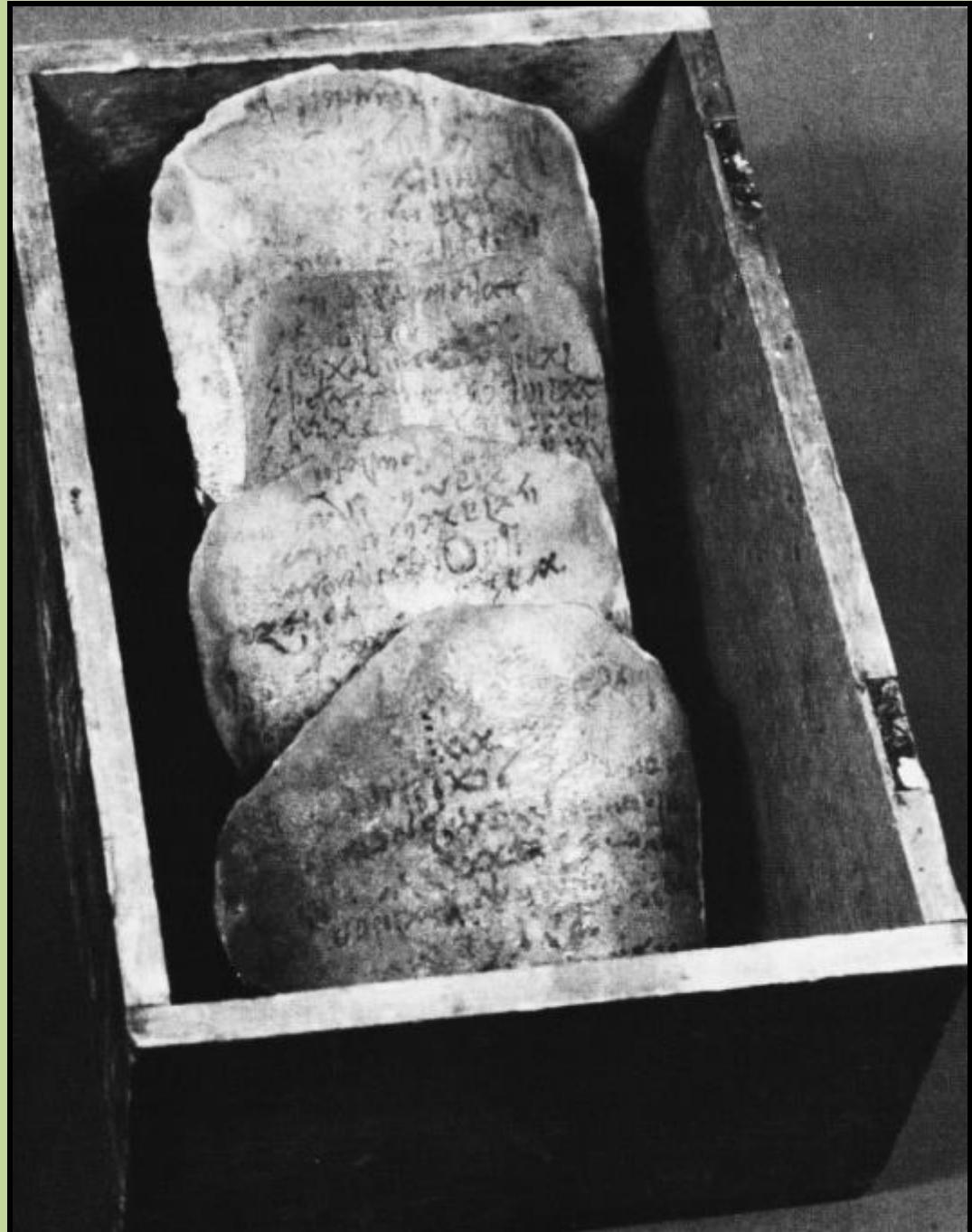
**BLANKS FOR  
TYPE 2 *OSTRAKON*  
GRASPED IN HAND**

**BLANKS PRECUT  
TO FIT IN HAND?**



**FOUR TYPE 2  
*OSTRAKA*  
ARRANGED  
AS FILE**

**DOCUMENTS LAID  
OUT WITH DATE AT  
TOP TO ALLOW  
CONVENIENT SEARCH  
BY DATE WHEN  
STORED IN  
CONTAINER?**



# **THE NATURE AND IDENTITY OF THE CONTAINER TYPES**

## ELEMENT 3 OF FOUR DOCUMENTS RENDERED AS POLYNOMIAL EQUATIONS

**No. 09:**  $3400 + 167A + 27B = 41,320$

**No. 13:**  $15600 + 167A + 1847B + 433C + 1191D = 526,550$

**No. 17:**  $3875 + 167A + 2679B + 757C + 1644D = 785,275$

**No. 19:**  $11110 + 167A + 2844B + 757C + 1644D + 184E = 880,275$

Where A =  $ag$ , B =  $asab$  , C =  $as$ , D =  $KNT$ , and E =  $\psi$

## METROLOGICAL BACKGROUND

- **1 AMPHORA (26.2 LITERS) (AKA QUADRANTAL) = 48 SEXTARI<sup>II</sup> (0.55 LITERS)**
- **1 LIBRA (ROMAN POUND) = 327 GRAMS (NOT 454 GRAMS)**
- **1 SEXTARIUS OLIVE OIL WEIGHS 1.5 LIBRAE**

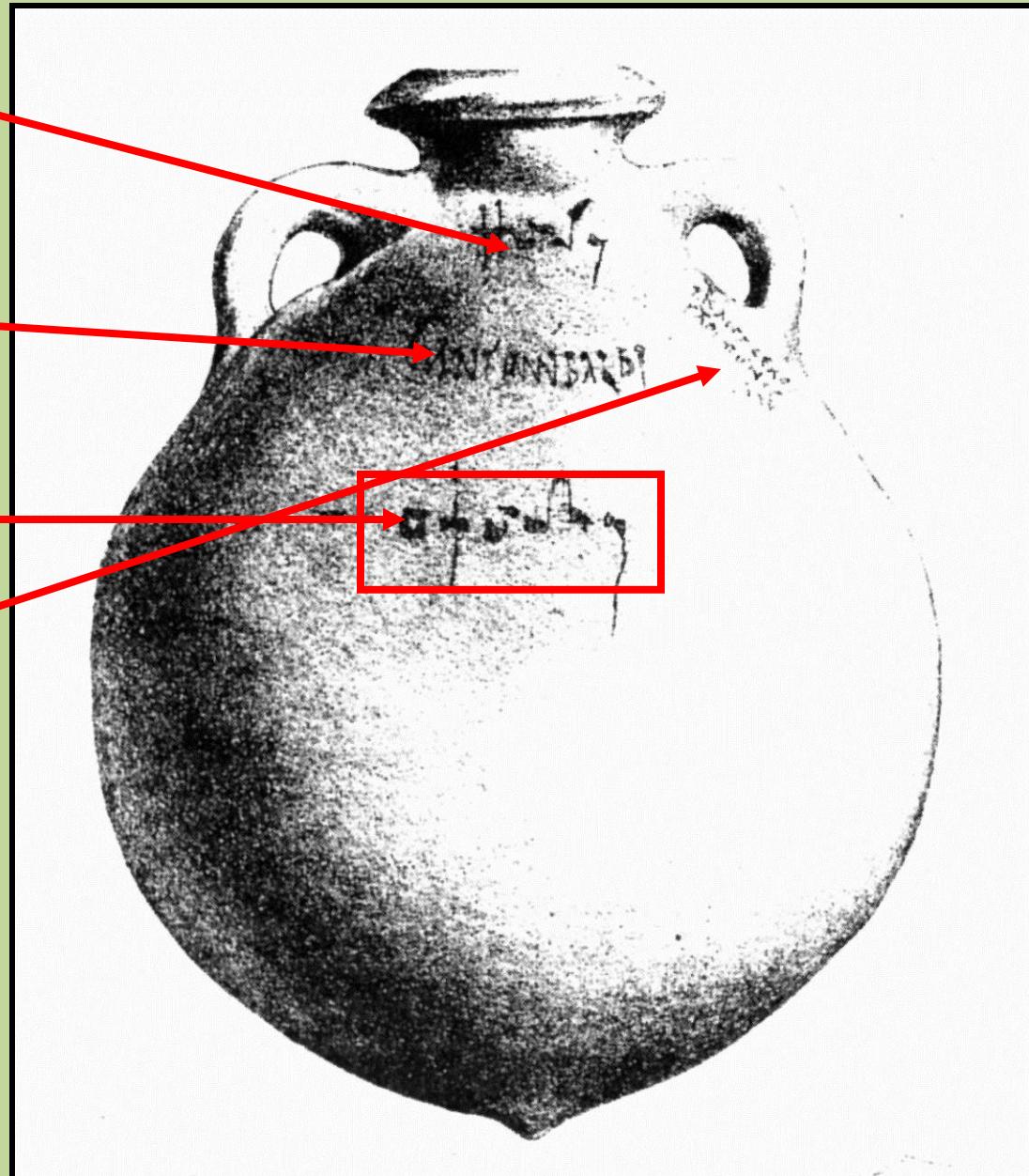
# DRESSEL 20 *TITULUS PICTUS* COMPONENTS

ALPHA  
(TARE WEIGHT)

BETA  
(SHIPPER)

GAMMA  
(WEIGHT OF OIL)

DELTA  
(ADMINISTRATIVE  
INFORMATION)



# DRESSEL 20 GAMMA *TITULUS PICTUS* COMPONENT

FIGURES RANGE FROM  
162 TO 230S

CA. 1/3 TO 1/2 OF ALL EXAMPLES  
HAVE VALUE OF 216  
(214, 215 ALSO VERY COMMON)

216 LIBRAE OIL/1.5 = 144 SEXTARI

144 SEXTARI/48 = 3 AMPHORAE



# VALUES OBTAINED FOR VARIOUS CONTAINER TYPES

## EQUATIONS

No. 09:  $3400 + 167A + 27B = 41,320$

No. 13:  $15600 + 167A + 1847B + 433C + 1191D = 526,550$

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Where A = *ag*, B = *asab*, C = *as*, D = *KNT*, and E =  $\psi$

D (*KNT*) = 100.0 *librae* (assumed)

## VALUES OBTAINED:

A (*ag*) = 215.0 *librae*

B (*asab*) = 074.9 *librae*

C (*as*) = 505.6 *librae*

E ( $\psi$ ) = 397.3 *librae*

Process involved:  
Rounding to 5s and 10s  
Truncation of some figures

Minor differences of method from document to document/hand to hand

Result was thus an approximate figure (an estimate of total amount of oil)

# VALUES OBTAINED FOR VARIOUS CONTAINER TYPES

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No. 09:  $3400 + 167A + 27B = 41,320$

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## WEIGHT (IN *LIBRAE*) AND CAPACITY VALUES FOR FIVE CONTAINER TYPES

CONTAINER DESIGNATION	VALUE USED FOR CALCULATION (DERIVED)	VALUE USED FOR CALCULATION (CONJECTURED)	TRUE WEIGHT OF CONTAINER CONTENT (CONJECTURED)	TRUE CAPACITY OF CONTAINER (CONJECTURED)
<i>asab</i>	74.9	75	72 (75?)	1 AMPHORA
<i>KNT</i>	100 (ASSUMED)	100	100	1 CENTENARIUM
<i>ag</i>	215.0	215	216	3 AMPHORAE
$\psi$	397.3	400	400	4 CENTENARIA
<i>as</i>	505.6	505	504	7 AMPHORAE

72 ROUNDED UP TO 75 (INSTEAD OF DOWN TO 70) TO SIMPLIFY MULTIPLICATION OPERATIONS (I.E.,  $4 \times 75 = 300$ )?

## WEIGHT (IN *LIBRAE*) AND CAPACITY VALUES FOR FIVE CONTAINER TYPES

CONTAINER DESIGNATION	VALUE USED FOR CALCULATION (DERIVED)	VALUE USED FOR CALCULATION (CONJECTURED)	TRUE WEIGHT OF CONTAINER CONTENT (CONJECTURED)	TRUE CAPACITY OF CONTAINER (CONJECTURED)
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## IDENTIFICATIONS OF FIVE CONTAINER TYPES

ABBREVIATION	CAPACITY	TRANSP. BY SHIP	TRANSP. OVERLAND	STORAGE (FISCUS)	NATURE	NAME	IDENTIFICATION
<i>asab</i> ( <i>asałce</i> )	20.2 L		X				
<i>KNT</i>	36.7 L	X	X	X			
<i>ag</i>	78.6 L		X	X			
$\Psi$	146.7 L	X	X	X			
<i>as</i>	183.4 L		X				

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ABBREVIATION	CAPACITY	TRANSP. BY SHIP	TRANSP. OVERLAND	STORAGE (FISCUS)	NATURE	NAME	IDENTIFICATION
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<i>ag</i>	78.6 L		X	X			
$\Psi$	146.7 L	X	X	X			
<i>as</i>							



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ABBREVIATION	CAPACITY	TRANSP. BY SHIP	TRANSP. OVERLAND	STORAGE ( <i>FISCUS</i> )	NATURE	NAME	IDENTIFICATION
<i>asab</i> ( <i>asabce</i> )	26.2 L		X				
<i>KNT</i>	36.7 L	X	X	X			
<i>ag</i>	78.6 L		X	X			
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<i>as</i>	183.4 L		X				



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<i>KNT</i>	36.7 L	X	X	X			
<i>ag</i>	78.6 L		X	X			
$\Psi$	146.7 L	X	X	X			
<i>as</i>	183.4 L		X		SKIN CONTAINER		7-AMPHORA OIL SKIN

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ABBREVIATION	CAPACITY	TRANSP. BY SHIP	TRANSP. OVERLAND	STORAGE (FISCUS)	NATURE	NAME	IDENTIFICATION
<i>asab</i> ( <i>asałce</i> )	26.2 L		X		SKIN CONTAINER		1-AMPHORA OIL SKIN
KNT	36.7 L	X	X	X			
<i>ag</i>	78.6 L		X	X			
Ψ	146.7 L	X	X	X			
<i>as</i>	183.4 L		X		SKIN CONTAINER		7-AMPHORA OIL SKIN

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<i>asab</i> ( <i>asałce</i> )	26.2 L		X		SKIN CONTAINER		1. AMPHORA OIL SKIN
<i>KNT</i>	36.7 L	X	X	X			
<i>Ag</i>	78.6 L		X	X			
<i>Ψ</i>	146.7 L	X	X	X			
<i>as</i>	183.4 L		X		SKIN CONTAINER	ASCOPA/ASCOPERA	7. AMPHORA OIL SKIN

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KNT	36.7 L	X	X	X			
<i>ag</i>	78.6 L		X	X			
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<i>KNT</i>	36.7 L	X	X	X	TRANSPORT AMPHORA		1-HUNDREWEIGHT OIL AMPHORA
<i>ag</i>	78.6 L		X	X			
<i>Ψ</i>	146.7 L	X	X	X			
<i>as</i>	183.4 L		X		SKIN CONTAINER	ASCOPA/ASCOPERA	7-AMPHORA OIL SKIN

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<i>KNT</i>	36.7 L	X	X	X	TRANSPORT AMPHORA		1-HUNDREWEIGHT OIL AMPHORA
<i>ag</i>	78.6 L		X	X	TRANSPORT AMPHORA		3-AMPHORA OIL AMPHORA
<i>Ψ</i>	146.7 L	X	X	X			
<i>as</i>	183.4 L		X		SKIN CONTAINER	<i>ASCOPA/ASCOPERA</i>	7-AMPHORA OIL SKIN

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<i>KNT</i>	36.7 L	X	X	X	TRANSPORT AMPHORA		1-HUNDREWEIGHT OIL AMPHORA
<i>ag</i>	78.6 L		X	X	TRANSPORT AMPHORA		3-AMPHORA OIL AMPHORA
Ψ	146.7 L	X	X	X	TRANSPORT AMPHORA		4-HUNDREWEIGHT OIL AMPHORA
<i>as</i>	183.4 L		X		SKIN CONTAINER	<i>ASCOPA/ASCOPERA</i>	7-AMPHORA OIL SKIN

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KNT	36.7 L	X	X	X	TRANSPORT AMPHORA	CENTENARIUM (CENTENARIUM LEVE)	1. HUNDREWEIGHT OIL AMPHORA
Ag	78.6 L		X	X	TRANSPORT AMPHORA		3. AMPHORA OIL AMPHORA
Ψ	146.7 L	X	X	X	TRANSPORT AMPHORA		4. HUNDREWEIGHT OIL AMPHORA
As	183.4 L		X		SKIN CONTAINER	ASCOPA/ASCOPERA	7. AMPHORA OIL SKIN

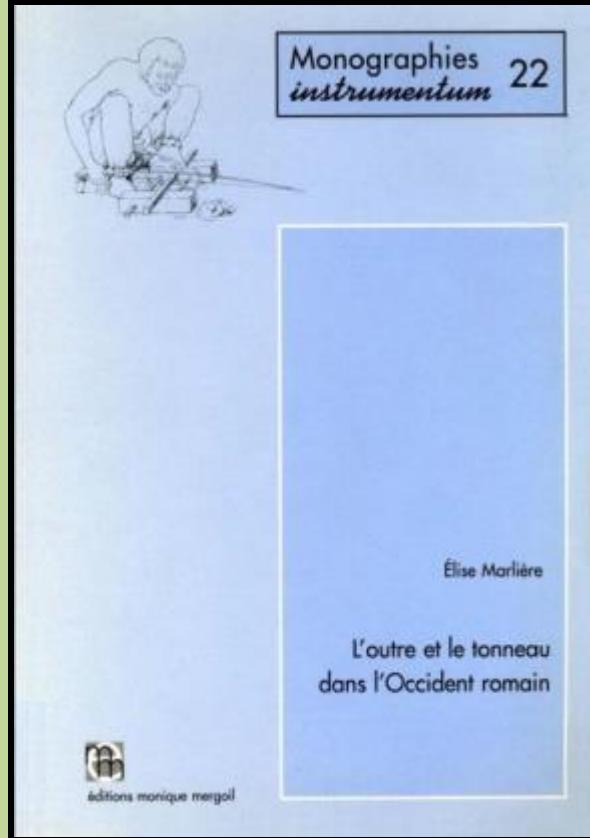
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<i>ag</i>	78.6 L		X	X	TRANSPORT AMPHORA	AMPHORA GEMELLARIA?	3. AMPHORA OIL AMPHORA
Ψ	146.7 L	X	X	X	TRANSPORT AMPHORA		4. HUNDREWEIGHT OIL AMPHORA
<i>as</i>	183.4 L		X		SKIN CONTAINER	ASCOPA/ASCOPERA	7. AMPHORA OIL SKIN

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KNT	36.7 L	X	X	X	TRANSPORT AMPHORA	CENTENARIUM (CENTENARIUM LEVE)	1. HUNDREWEIGHT OIL AMPHORA
<i>ag</i>	78.6 L		X	X	TRANSPORT AMPHORA	AMPHORA GEMELLARIA?	3. AMPHORA OIL AMPHORA
Ψ	146.7 L	X	X	X	TRANSPORT AMPHORA	???	4. HUNDREWEIGHT OIL AMPHORA
<i>as</i>	183.4 L		X		SKIN CONTAINER	ASCOPA/ASCOPERA	7. AMPHORA OIL SKIN

# SKIN CONTANERS: ÉLISE MARLIÈRE



PROYECTO ÁMFIORAE  
Bajo los auspicios de la  
REAL ACADEMIA DE LA HISTORIA

## IN AFRICA ET IN HISPANIA: ÉTUDES SUR L'HUILE AFRICAINA

A. Mrahat  
J. Remesal Rodríguez (Eds.)

ers (par ordre alphabétique):

Marlière, M.; Ben Abbes, M.; Ben Messaoud, L.; Lagostena Barrion, E.; Marlière, J.; Molina Vidal, Nádhari; J. Remesal Rodríguez, J.A.; Remolí Vall, V.; Revilla Calvo, J.; Torres Costa,

TRANSPORT ET STOCKAGE DES DENRÉES DANS L'AFRIQUE ROMAINE: LE RÔLE DE L'OUTRE ET DU TONNEAU.

ELISE MARLIÈRE<sup>\*</sup>  
Université de Paris X

JOSEP TORRES COSTA<sup>\*\*</sup>  
CEIPAC - Universitat de Barcelona

En Afrique du Nord comme dans le reste du monde romain, les contenants biodégradables ont bien souvent été utilisés dans les recherches relatives à l'histoire économique contrairement à l'indestructible amphore, constamment présente sur les sites de consommation<sup>1</sup>. Pourtant, l'outre et le tonneau (sans parler des paniers, caisses et sacs de toile) ont tenu une place essentielle dans les échanges de l'Occident romain, comme l'est démontré les études qui leur ont été consacrées ces dernières décennies, en Europe principalement<sup>2</sup>. Pour ce qui est des provinces d'Afrique du Nord et d'Orient, s'il existe des

<sup>\*</sup>UMR 7041, Archéologie et Sciences de l'Antiquité, Equipe Archéologie de la Grèce, Mission de l'Archéologie et de l'Ethnographie, Paris X-Nanterre (marlier@ccr.jussieu.fr.edu).

<sup>\*\*</sup>CEDAC, Área de Historia Antigua, Universidad de Barcelona (jtorres@ccr.jussieu.fr.edu).

<sup>1</sup> Nous devons exprimer ici notre gratitude aux personnes qui nous ont prêté leur aide pour la rédaction de ce travail: M. Ben Messaoud, M. Bouafit, M. Makhrouss, A. Mrahat et F. Schmäsch. Ces recherches à par ailleurs été présentées lors du XVIIIe congrès de « L'Afrique romaine » de Séville en décembre 2008.

<sup>2</sup> Pour les études antérieures à 2001, qu'il s'agit difficile de toutes citer ici, cf. E. Marlière, *L'outre et le tonneau dans l'Occident romain*, Paris, 2001.

<sup>3</sup> Cf. J.-P. Bouchot, *Le cuirasseur en Grèce*, dossier dans *Grecia* 18, 2001, 181-201 ; E. Marlière, Tonnerres et amphores à Phidias: contribution à la connaissance de l'apprentissage des techniques stoniarées sur la frontière sud de l'Empire, *de A. Baucis* (Dir.), *Archaeological Papers* 2002, *Hesiodus* 2003, 125-150 ; E. Marlière, Appareils comparatifs des inscriptions sur tonneaux et sur amphores, *de J. Remesal Rodríguez* (Dir.), *EpiGraphy, archéos*, *Sicilyca* 2004, 307-313; E. Marlière, Outres et tonneaux, *de J.-P. Bouchot, M. Bouchot, A. Thomas* (Dir.), *Le vin, Naissance des Discours*, Gévaudan Mémoires,

Publicacions i Edicions:



## **AS (ASCOPA) AND ASAAB (ASCOPA A BYZACENA?)**

**AS (7 AMPHORAE/183 LITERS): MADE FROM HIDE OF MEDIUM-SIZED QUADRUPED?**

**SIMILAR TO CULLEUS (20 AMPHORAE; MADE FROM WHOLE HIDE OF AN OX).**

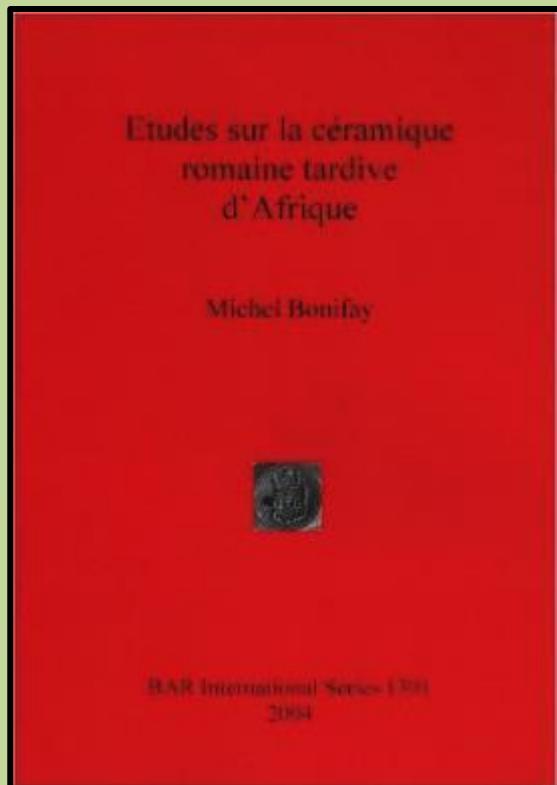
**SEE *DIGEST 13.7.43.1 (SCAEVOLA; 2<sup>ND</sup> C. AD)* FOR REQUISITION OF CULLEI BY  
“CENTURIO MISSUS EX OFFICIO ANNONAE”**

**ASAAB (1 AMPHORA/26.2 LITERS): MADE FROM WHOLE HIDE OF GOAT?**



**SKIN CONTAINER MADE FROM WHOLE HIDE OF SHEEP; CA. 100 CM LONG  
X 12 CM DIAMETER, CAPACITY CA. 40 L. (CAVE OF LETTERS, ISRAEL; AD 120S-130S)**

# AFRICAN AMPHORAS: MICHEL BONIFAY



BAR – IS 1301 , 2004

## Que transportaient donc les amphores africaines?

Michel Bonifay

### 1. Introduction

L'explication de la large diffusion des céramiques africaines (amphores et sigillées) du IIe au VIe s. a longtemps reposé sur deux postulats:

1. Les sigillées africaines étaient diffusées en accompagnement des amphores, selon le fameux "diptyque" unissant, durant l'Antiquité, les vases-conteneurs et la vaisselle.<sup>1</sup>
2. Les amphores africaines transportaient une denrée de première nécessité, l'huile, massivement produite en Afrique et donc appelée à une large commercialisation.<sup>2</sup>

Manifestement, le premier postulat ne se vérifie pas en Méditerranée orientale. Dans cette partie du bassin méditerranéen, les sigillées africaines sont abondantes puisque c'est à Athènes et à Antioche qu'en ont été réalisées les toutes premières classifications,<sup>3</sup> en revanche, les amphores africaines sont plus rares, hormis les *sphætra* tardifs des Ve-VIe s.<sup>4</sup> Dans ce cas, il faut imaginer que les sigillées africaines étaient commercialisées pour leur valeur propre, ou bien qu'elles voyaient en accompagnement d'autres denrées, ce nécessitant pas un conditionnement en amphores.

Qu'en est-il du second postulat? Peut-on se contenter, pour la diffusion des amphores africaines, d'une explication exclusivement fondée sur un "olive boom" en Afrique romaine?<sup>5</sup> De fait, c'est cette explication qui a été retenue tout au long de la construction typologique des amphores africaines (fig. 1). La mise en évidence en 1969 d'amphores en provenance de Byzance<sup>6</sup> avait permis de mettre en concordance des témoins archéologiques "objectifs" avec les données historiques concernant le développement de l'arboriculture africaine sous les Antonini.<sup>7</sup> Il paraissait clair que les amphores africaines étaient majoritairement destinées au transport de l'huile. Cette opinion fut reprise durant les années 70 par C. Panella et D. Manacorda dans leur typologie des amphores des IIe-IVe s., basée sur le matériel des Terme del Nudatore à Ostie,<sup>8</sup> puis en 1984 par S. J. Keay dans son classement (fondé sur les collections des sites catalans) des conteneurs des Ve-VIe s.<sup>9</sup> Les statistiques réalisées à Ostie semblaient confirmer pleinement cette hypothèse: dans la stratigraphie des thermes à Ostie, l'augmentation du nombre des amphores africaines coïncidait avec une diminution de la proportion des amphores hispaniques Dressel 20 et paraissait démontrer le remplacement au IIIe s. des importations d'huile de Béthique par les importations d'huile africaine.

Pourtant, dès 1969, F. Zevi et A. Tchernia avaient mis en garde leurs lecteurs: l'existence de deux types distincts "africano piccolo" et "africano grande", produits dans les mêmes ateliers comme le prouvaient les imbrures parfois identiques, semblait indiquer deux contenus différents. Le premier type (Africane I), trouvé en abondance aux abords de l'une des deux seules usines de salaisons fossilières en Tunisie (celle de Salakta), pouvait être destiné de préférence au transport

<sup>1</sup> Le titre de cette communication est emprunté à un article de R. Boëns posant la même question à propos des amphores lusitanianas: R. Etienne, "Qui transportaient donc les amphores lusitanianas?" in A. Alarcão et P. Mayer (edid.), *Les amphores lusitanianas. Typologie, production, commerce*. Actas Coimbra 1989 (Coimbra 1990) 15-19.

<sup>2</sup> Morel 1983, 71.

<sup>3</sup> Carandini 1970.

<sup>4</sup> En 3933 en 1948 par F.-O. Wangé.

<sup>5</sup> Sedini 2000.

<sup>6</sup> Selon l'expression de Mattingly (1988).

<sup>7</sup> Zevi et Tchernia 1969.

<sup>8</sup> Carandini 1970.

<sup>9</sup> Panella 1973; Manacorda 1977.

<sup>10</sup> Keay 1984.

JRA SUPPL. 69, 2007

**KNT/CENTENARIUM LEVE, AG (AMPHORA GEMELLARIA?), ψ (?)**

**KNT/CENTENARIUM LEVE (</= 100 LIBRAE/36.7 LITERS)**

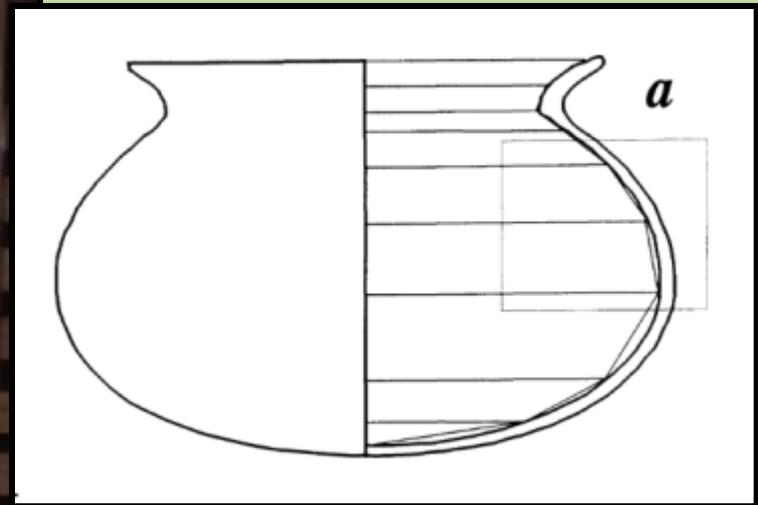
**AG (3 AMPHORAE/78.6 LITERS)**

**ψ: (400 LIBRAE/146.7 LITERS)**

**PERHAPS ALSO:**

**B: A DISTINCT AMPHORA ([AMPHORA] BYZACENA, 1 AMPHORA/26.2 LITERS?) OR JUST THE ASAAB SKIN CONTAINER?**

# 1996-1998: MEASUREMENT OF AFRICAN AMPHORA CAPACITIES

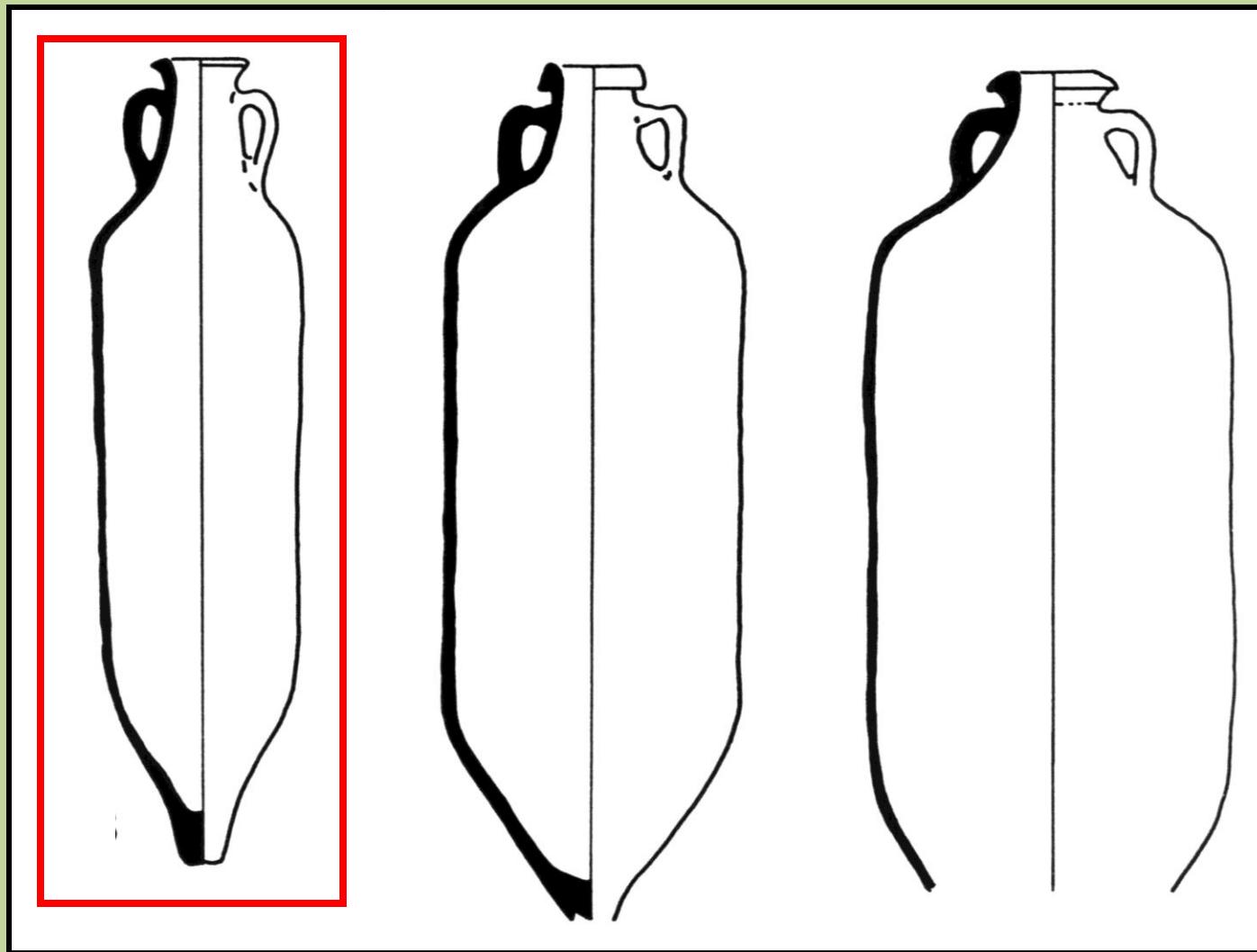


ESTIMATE FROM  
PROFILE DRAWING  
USING PROGRAM FOR  
STACKED CYLINDERS  
METHOD AND DIGITIZING  
TABLET

DIRECT MEASUREMENT WITH WATER  
(CANTINONE, U. DI ROMA LA SAPIENZA)

# SUGGESTED IDENTITIES OF AMPHORA CLASSES (1998)

KNT



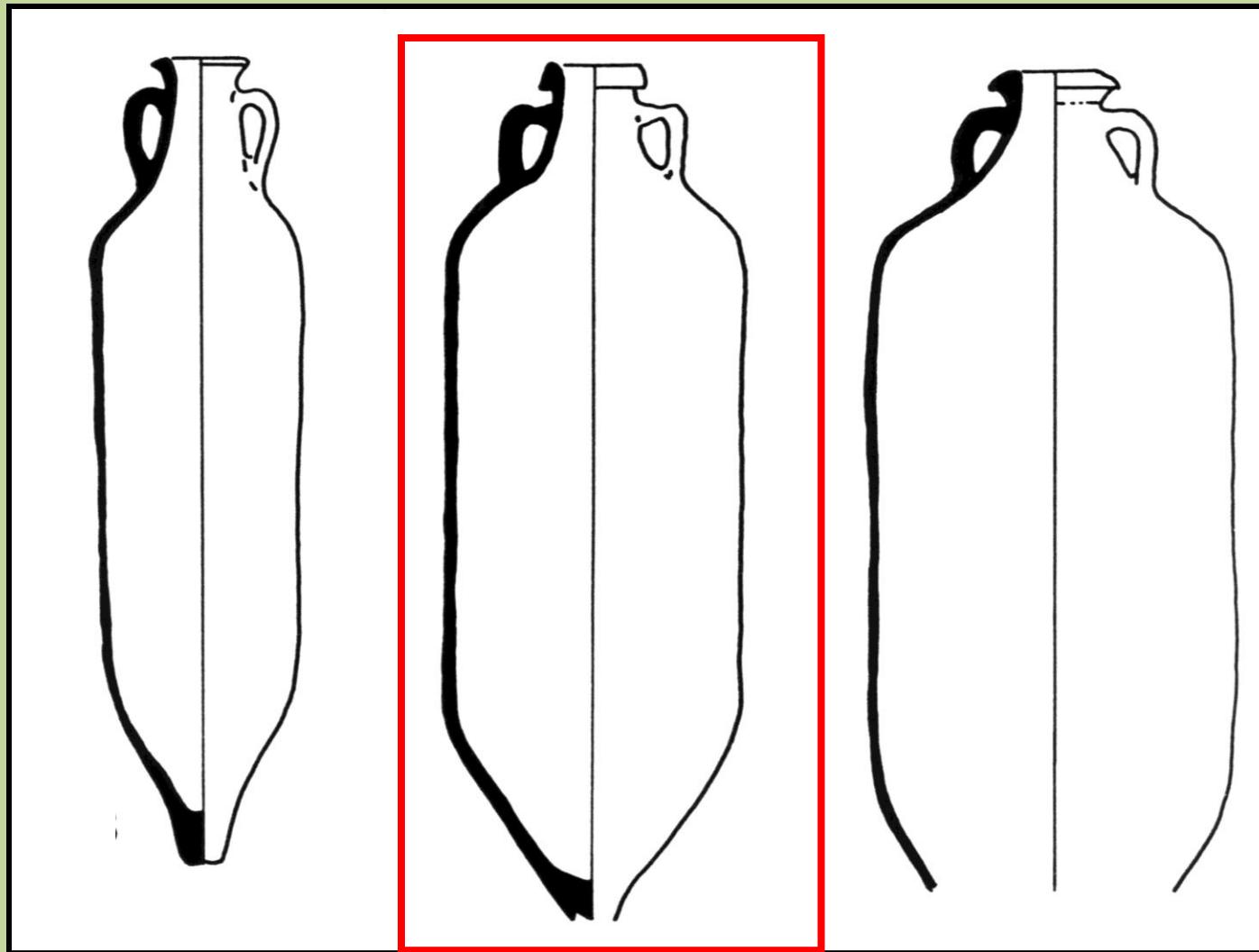
KEAY 25 (LARGE)

36.1 L

# SUGGESTED IDENTITIES OF AMPHORA CLASSES (1998)

KNT

AG



KEAY 25 (LARGE)

36.1 L

KEAY 35

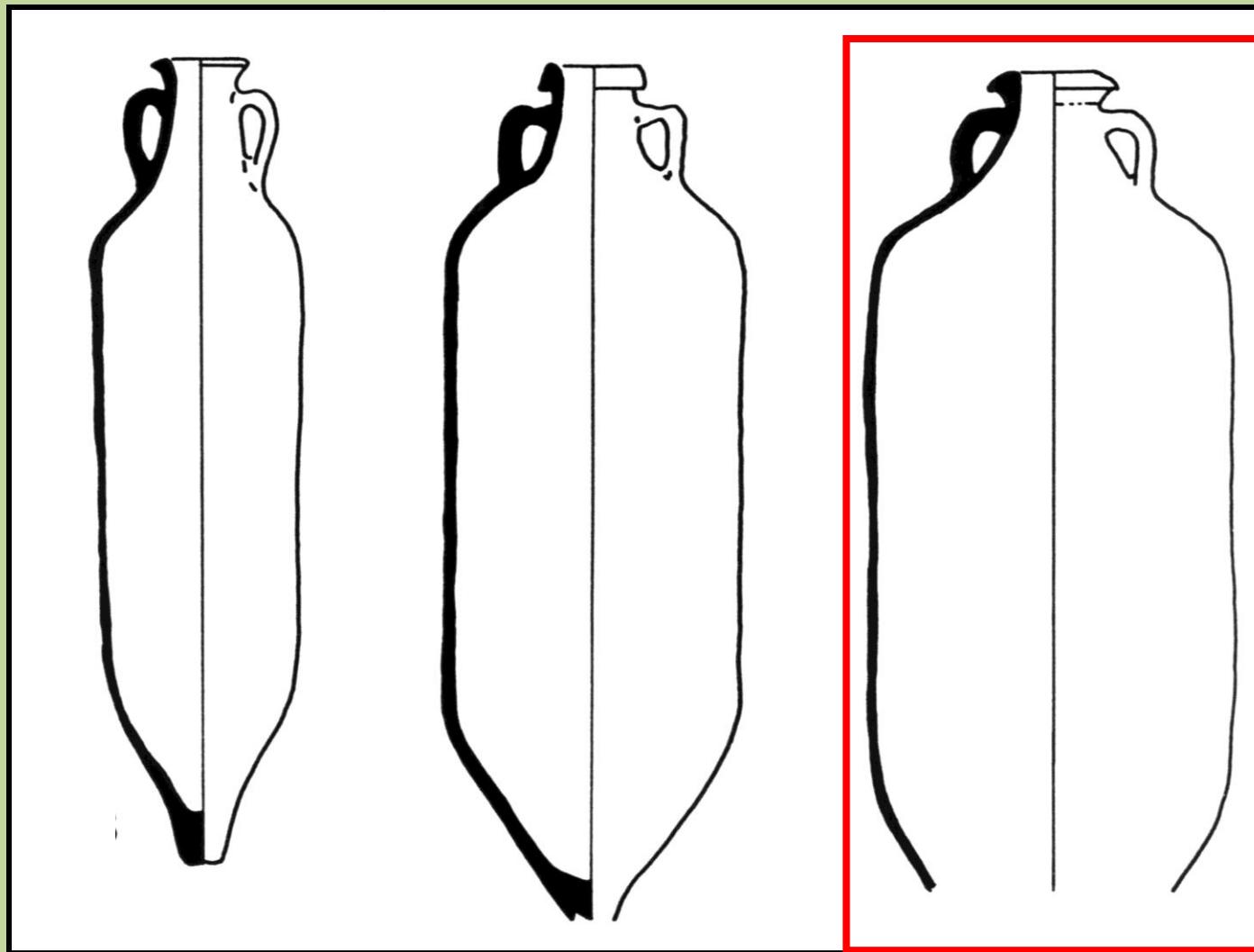
80.2 L

# SUGGESTED IDENTITIES OF AMPHORA CLASSES (1998)

KNT

AG

$\Psi$



KEAY 25 (LARGE)  
36.1 L

KEAY 35  
80.2 L

KEAY 35 (WIDE BODIED)  
>143 L

## IDENTIFICATIONS OF FIVE CONTAINER TYPES (1998)

ABBREVIATION	CAPACITY	TRANSP. BY SHIP	TRANSP. OVERLAND	STORAGE (FISCUS)	NATURE	NAME	IDENTIFICATION
<i>asab</i>	26.2 L		X		SKIN CONTAINER	ASCOPA/ASCOPERA A BYZACENA?	1-AMPHORA OILSKIN
<i>KNT</i>	36.7 L	X	X	X	TRANSPORT AMPHORA	CENTENARIUM CENTERNARIUM LEVE	1-HUNDREWEIGHT OIL AMPHORA [KEAY 25]
<i>ag</i>	78.6 L		X	X	TRANSPORT AMPHORA	AMPHORA GEMELLARIA?	3-AMPHORA OIL AMPHORA [KEAY 35]
$\Psi$	146.7 L	X	X	X	TRANSPORT AMPHORA	???	4-HUNDREWEIGHT OIL AMPHORA [KEAY 35 WIDE BODIED]
<i>as</i>	183.4 L		X		SKIN CONTAINER	ASCOPA/ASCOPERA	7-AMPHORA OILSKIN

## IDENTIFICATIONS OF FIVE CONTAINER TYPES (1998)

ABBREVIATION	CAPACITY	TRANSP. BY SHIP	TRANSP. OVERLAND	STORAGE (FISCUS)	NATURE	NAME	IDENTIFICATION
<i>asab</i>	26.2 L		X		SKIN CONTAINER	ASCOPA/ASCOPERA A BYZACENA?	1-AMPHORA SKIN
KNT	36.7 L	X	X	X	TRANSPORT AMPHORA	CENTENARIUM CENTERNARIUM LEV	2-HUNDREWEIGHT AMPHORA [KEY 35]
<i>ag</i>	78.6 L		X	X	TRANSPORT AMPHORA	AMPHORA GEMELLA	3-AMPHORA OIL AMPHORA [KEY 35]
$\Psi$	146.7 L	X	X	X	TRANSPORT AMPHORA	???	4-HUNDREWEIGHT AMPHORA [KEY 35 WIDE BO]
<i>as</i>	183.4 L		X		SKIN CONTAINER	ASCOPA/ASCOPERA	5-AMPHORA SKIN



### BONIFAY'S NEW IDENTIFICATIONS:

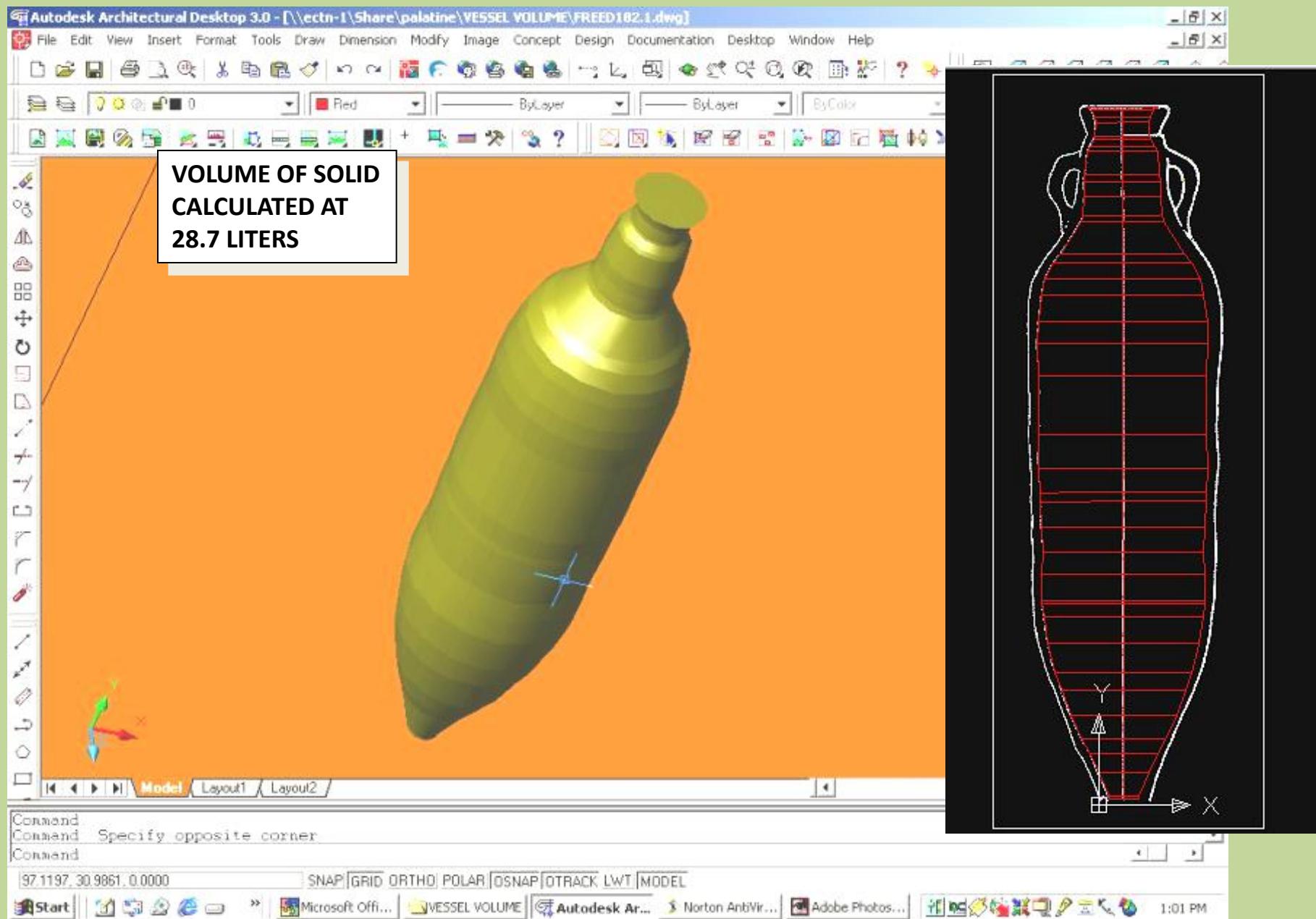
KEAY 25: WINE

KEAY 35B: FISH PRODUCTS

WIDE-BODIED KEAY 35 B: FISH PRODUCTS

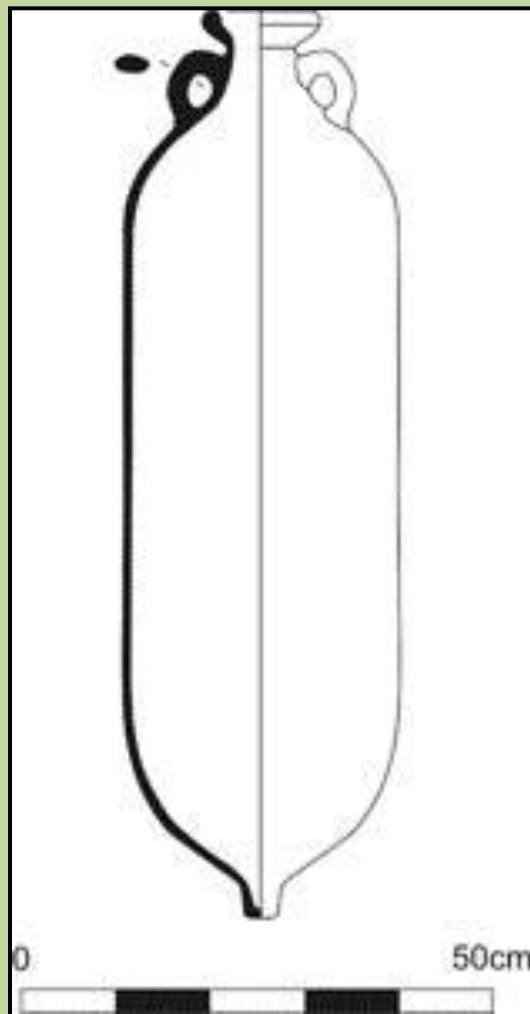
KEAY 35A : OIL, BUT NOT FROM ZEUGITANA

## 2000S: CAD ROUTINE TO MEASURE CAPACITY FROM PROFILE DRAWINGS



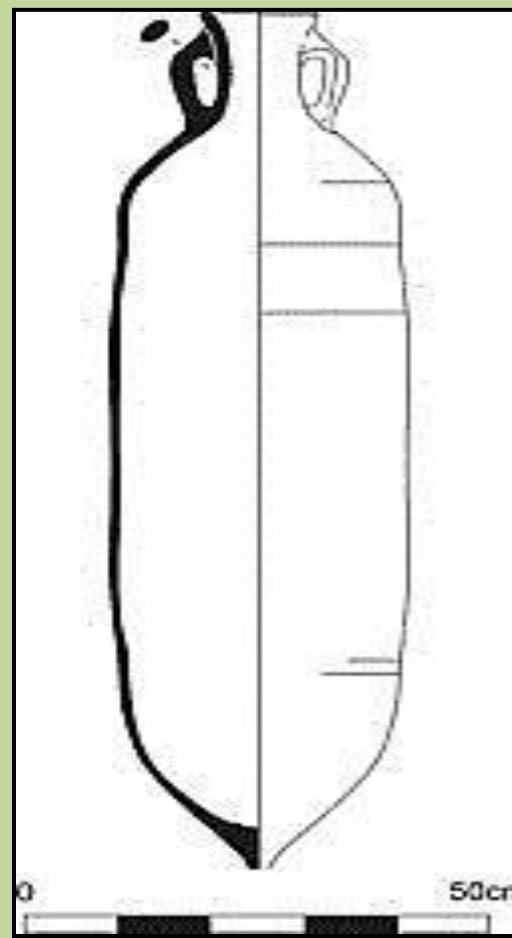
# SUGGESTED IDENTITIES OF AMPHORA CLASSES (2016)

KNT



AFRICAN 1 (LATE)  
36.5, 41.8, 43.3 L

*CENTENARIUM LEVE ?*



KEAY 27  
36.6L

AG: KEAY 3B SIMILIS?  
KEAY 39?

Ψ: AFRICAN STORAGE  
AMPHORA?

## IDENTIFICATIONS OF FIVE CONTAINER TYPES (2016)

ABBREVIATION	CAPACITY	TRANSP. BY SHIP	TRANSP. OVERLAND	STORAGE (FISCUS)	NATURE	NAME	IDENTIFICATION
<i>asab</i>	26.2 L		X		SKIN CONTAINER	ASCOPA/ASCOPERA A BYZACENA?	1-AMPHORA OILSKIN
KNT	36.7 L	X	X	X	TRANSPORT AMPHORA	CENTENARIUM CENTERNARIUM LEVE	1-HUNDREWEIGHT OIL AMPHORA [AFRICAN 1 LATE; KEAY 27]
<i>ag</i>	78.6 L		X	X	TRANSPORT AMPHORA	AMPHORA GEMELLARIA?	3-AMPHORA OIL AMPHORA [KEAY 3B SIM, 39]
$\Psi$	146.7 L	X	X	X	TRANSPORT AMPHORA	???	4-HUNDREWEIGHT OIL AMPHORA [AFRICAN STORAGE AMPH]
<i>as</i>	183.4 L		X		SKIN CONTAINER	ASCOPA/ASCOPERA	7-AMPHORA OILSKIN

# OIL MOBILIZATION

# TRANSPORT

## ESTIMATED WEIGHTS OF CONTAINER TYPES

CONTAINER TYPE	WEIGHT OF CONTAINER KG	WEIGHT OF CONTENT KG	NET WEIGHT KG
AS AB	03*	23	26
B	11	23	34
KNT/CENT. LEVE	12	33	45
AG	28	70	98
Ψ	35	131	166
AS	15*	165	180

\*CONJECTURED FIGURE.

# CONTAINER TYPES LIGHT ENOUGH TO BE CARRIED BY ONE MAN

CONTAINER TYPE	WEIGHT CONTAINER KG	WEIGHT CONTENT KG	NET WEIGHT KG
AS AB	03*	23	26
B	11	23	34
KNT/CENT. LEVE	12	33	45
AG	28	70	98
Ψ	131	166	
AS	165	180	



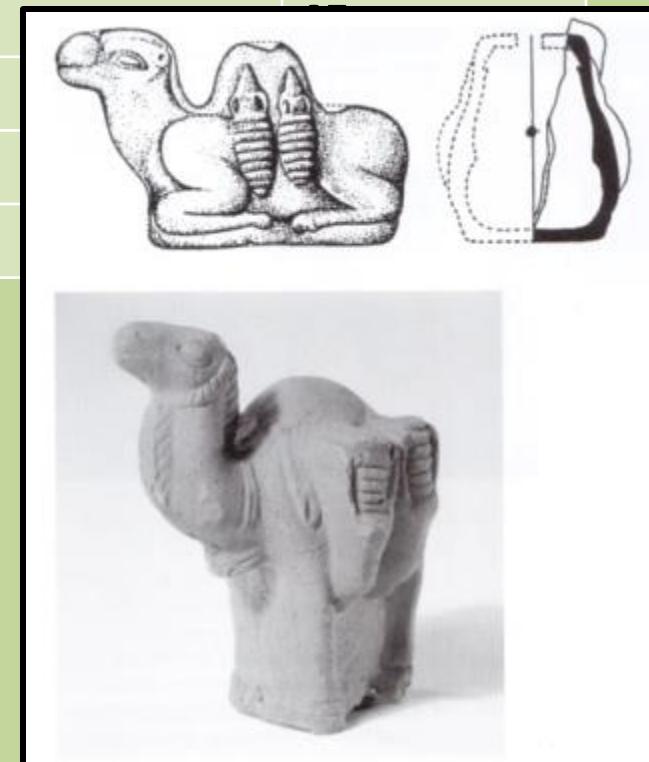
# CONTAINER TYPES TOO HEAVY TO BE CARRIED BY ONE MAN

CONTAINER TYPE	WEIGHT CONTAINER KG	WEIGHT CONTENT KG	NET WEIGHT KG
AS AB	03*	23	26
B	11	23	34
KNT/CENT. LEVE	12	33	45
AG	28	70	98
Ψ	35	131	166
AS	15*	165	180

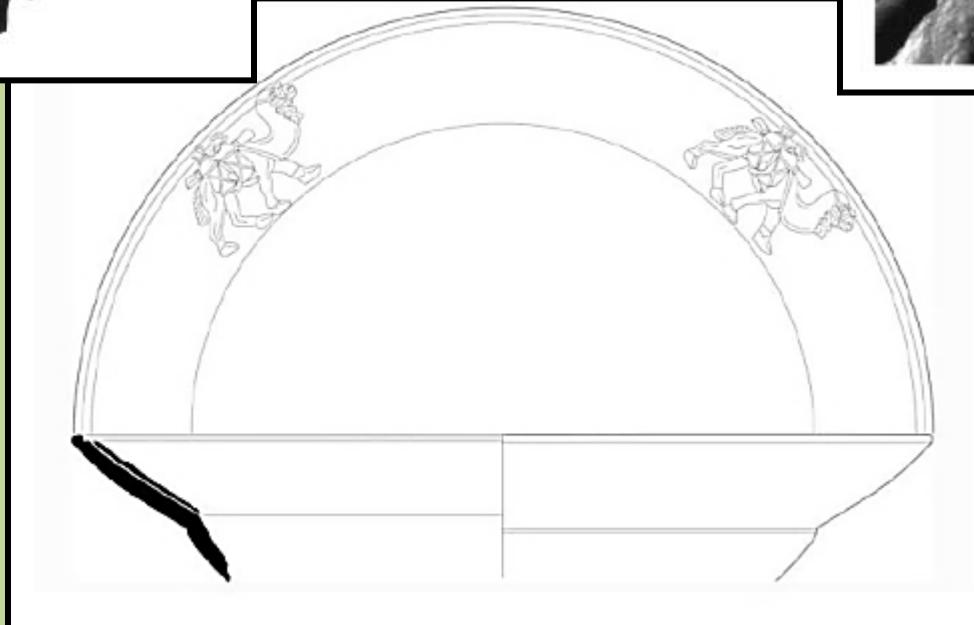


# CONTAINER TYPES LIGHT ENOUGH TO BE TRANSPORTED IN FOURS BY CAMEL OR DONKEY

CONTAINER TYPE	WEIGHT CONTAINER KG	WEIGHT CONTENT KG	NET WEIGHT KG
AS AB	03*	23	26
B	11	23	34
KNT/CENT. LEVE	12	33	
AG	28	70	
Ψ	35	131	
AS	15*	165	



# AFRICAN SIGILLATA C HAYES 55C (CENTRAL TUNISIA; AD 325-350)



ARCHÄOLOGISCHE  
STAATSSAMMLUNG  
MÜNICH, INV. 1988-3009

# CONTAINER TYPES LIGHT ENOUGH TO BE TRANSPORTED IN PAIRS BY CAMEL OR DONKEY

CONTAINER TYPE	WEIGHT CONTAINER KG	WEIGHT CONTENT KG	NET WEIGHT KG
AS AB	03*	23	26
B	11	23	34
KNT/CENT. LEVE	12	33	45
AG	28	70	98
Ψ			166
AS			180

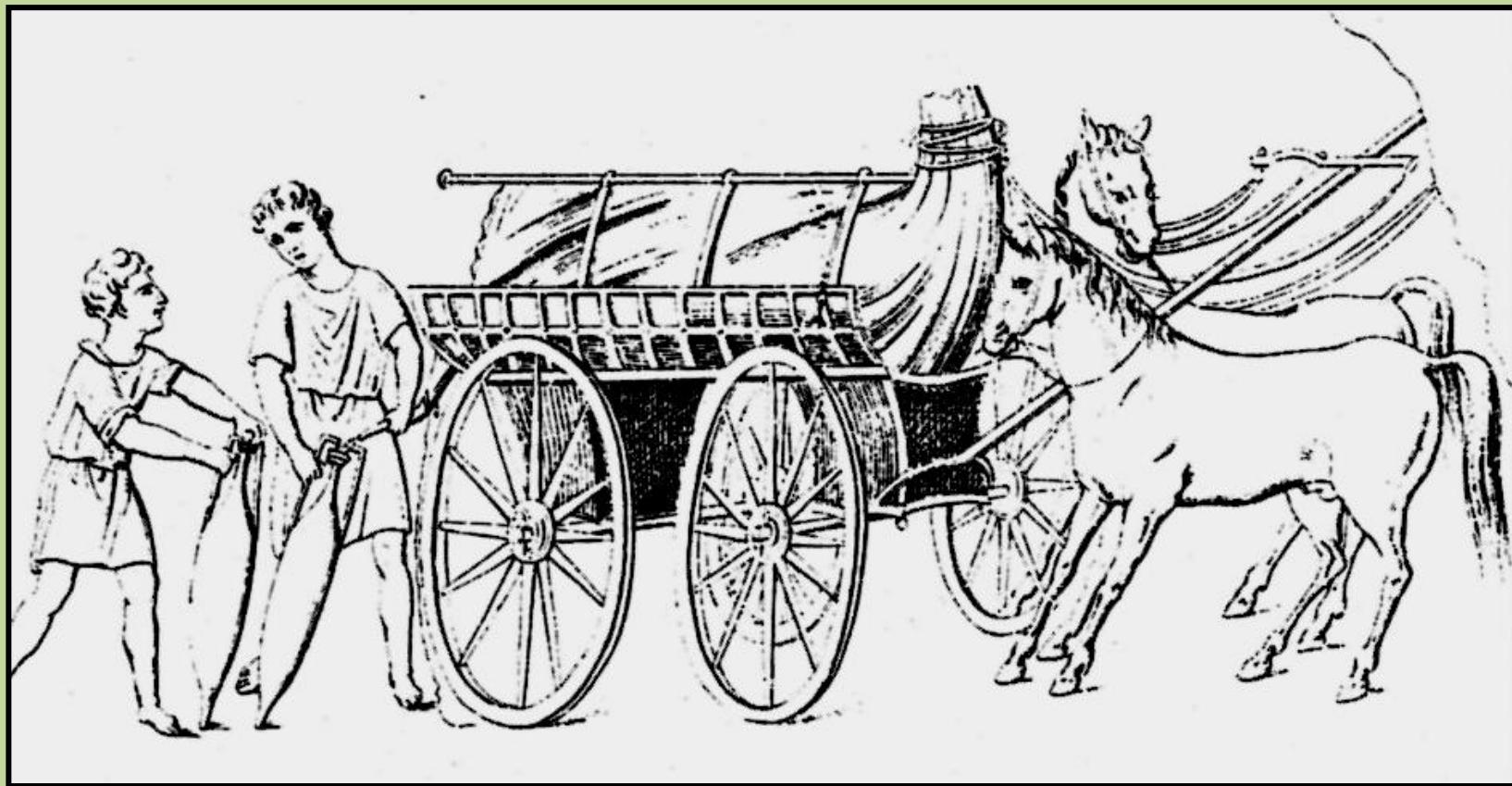


# CONTAINER TYPES SO HEAVY AS TO REQUIRE TRANSPORT OVERLAND BY CART OR WAGON

CONTAINER TYPE	WEIGHT CONTAINER KG	WEIGHT CONTENT KG	NET WEIGHT KG
AS AB	03*	23	26
B	11	23	34
KNT/CENT. LEVE	12	33	45
AG	28	70	98
Ψ	35	131	166
AS	15*	165	180



## DRAWING OF FRESCO (POMPEII; 1<sup>ST</sup> C. AD; NOW LOST)

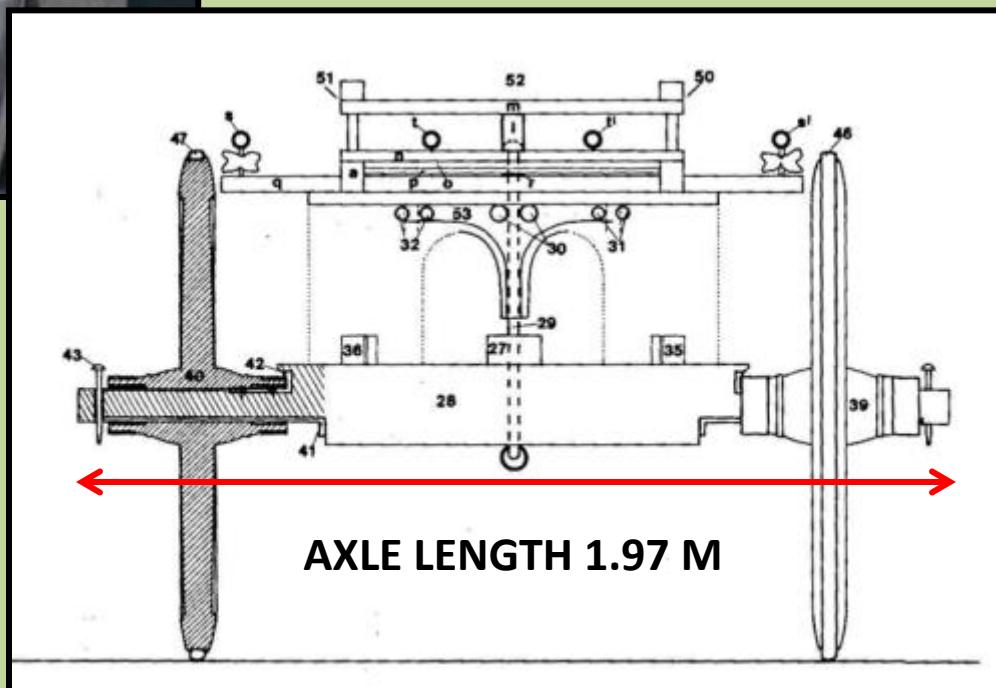


**CODEX THEODOSIANUS 8.5.8 (AD 357): SETS MAXIMUM LOAD FOR RAEDAE AND ANGARIAE (MEDIUM AND LARGE WAGONS OF CURSUS CLABULARIUS) AT 1000 AND 1500 LIBRAE (= +/- 2 AND 3 AS) (CULLEUS OF OIL WEIGHS 1440 LIBRAE)**

# RAEDA (MEDIUM WAGON) (VILLA ARRIANA, STABIAE; 1<sup>ST</sup> C. AD)



FOUND 1981  
RECONSTRUCTION PUBLISHED  
BY MINIERO 1987



# **OIL MOBILIZATION**

# **ORGANIZATION**

# SUMMARY OF DATA FOR OIL BY DESIGNATION

DESIGNATION	<i>Ψ</i>	<i>B</i>	ASAB	AS	KNT	LIBRAE	PERCENT	KG	HA	PERSONS
<i>TEBELBUCITAN</i>			446		65	39,950	3.0	13,064	119	719
<i>MARCRINENSES</i>			61		285	33,075	2.5	10,816	98	594
<i>VOL CALASSINI</i>			2,365		86	184,975	13.8	60,487	550	3,327
<i>CAPRORENSES</i>					1,019	101,900	7.6	33,321	303	1,831
<i>ORC</i>				799	1,232	526,695	39.4	172,229	1,566	9,463
<i>UNIDENT. 1&amp;2</i>	99	140	262		296	99,350	7.4	147,267	1,338	8,092
<i>UNIDENT. 2</i>	-	-	-	-	-	351,009	26.3	"	"	"
<b>TOTAL</b>	<b>99</b>	<b>240</b>	<b>3,134</b>	<b>799</b>	<b>2,983</b>	<b>1,336,954</b>	<b>100.0</b>	<b>437,184</b>	<b>3,974</b>	<b>24,024</b>

OIL ATTESTED IN *OSTRAKA* (HENCE MINIMUM ANNUAL FIGURES).

OIL WITH *FISCUS* DESIGNATION (AND ALL AG CONTAINERS) NOT INCLUDED.

FIGURES FOR PRODUCTIVITY OF OLIVE ORCHARDS AND ANNUAL CONSUMPTION TAKEN FROM MATTINGLY.

# INITIATIVE 1

DESIGNATION	<i>Ψ</i>	<i>B</i>	ASAB	AS	KNT	LIBRAE	PERCENT	KG	HA	PERSONS
<i>TEBELBUCITAN</i>			446		65	39,950	3.0	13,064	119	719
<i>MARCRINENSES</i>			61		285	33,075	2.5	10,816	98	594
<i>VOL CALASSINI</i>			2,365		86	184,975	13.8	60,487	550	3,327
<i>CAPRORENSES</i>				1,019		101,900	7.6	33,321	303	1,831
<i>ORC</i>				799	1,232	526,695	39.4	172,229	1,566	9,463
<i>UNIDENT. 1&amp;2</i>	99	140	262		296	99,350	7.4	147,267	1,338	8,092
<i>UNIDENT. 2</i>	-	-	-	-	-	351,009	26.3	"	"	"
<b>TOTAL</b>	<b>99</b>	<b>240</b>	<b>3,134</b>	<b>799</b>	<b>2,983</b>	<b>1,336,954</b>	<b>100.0</b>	<b>437,184</b>	<b>3,974</b>	<b>24,024</b>

OIL ATTESTED IN *OSTRAKA* (HENCE MINIMUM ANNUAL FIGURES).

OIL WITH *FISCUS* DESIGNATION (AND ALL AG CONTAINERS) NOT INCLUDED.

FIGURES FOR PRODUCTIVITY OF OLIVE ORCHARDS AND ANNUAL CONSUMPTION TAKEN FROM MATTINGLY.

# INITIATIVE 2

DESIGNATION	<i>Ψ</i>	<i>B</i>	ASAB	AS	KNT	LIBRAE	PERCENT	KG	HA	PERSONS
<i>TEBELBUCITAN</i>			446		65	39,950	3.0	13,064	119	719
<i>MARCRINENSES</i>			61		285	33,075	2.5	10,816	98	594
<i>VOL CALASSINI</i>			2,365		86	184,975	13.8	60,487	550	3,327
<i>CAPRORENSES</i>					1,019	101,900	7.6	33,321	303	1,831
<i>ORC</i>				799	1,232	526,695	39.4	172,229	1,566	9,463
UNIDENT. 1&2	99	140	262		296	99,350	7.4	147,267	1,338	8,092
UNIDENT. 2	-	-	-	-	-	351,009	26.3	"	"	"
TOTAL	99	240	3,134	799	2,983	1,336,954	100.0	437,184	3,974	24,024

OIL ATTESTED IN *OSTRAKA* (HENCE MINIMUM ANNUAL FIGURES).

OIL WITH *FISCUS* DESIGNATION (AND ALL AG CONTAINERS) NOT INCLUDED.

FIGURES FOR PRODUCTIVITY OF OLIVE ORCHARDS AND ANNUAL CONSUMPTION TAKEN FROM MATTINGLY.

# INITIATIVE 2

OIL ASSOCIATED WITH *ORC* DESIGNATION

JUST 2 MASSIVE CONSIGNMENTS PACKAGED IN AS AND KNT:

- 1: ARRIVES 3/15-4/4; 43 AS AND 1,091 KNT (327,765 LIBRAE)
- 2: ARRIVES 4/8-4/25; 366 AS AND 141 KNT (198,930 LIBRAE)

TAX IN KIND RAISED UNDER *CAPITATIO TERRENA* (LAND TAX)?

3 TRIMESTERS (NOVEMBER-FEBRUARY; MARCH-JUNE; JULY-OCTOBER)  
[N.B. TYPE 2 ELEMENT 1: *AD OCT(OBREM)*]

REPRESENT TRIMESTRAL TAX PAYMENT DUE MARCH 1?

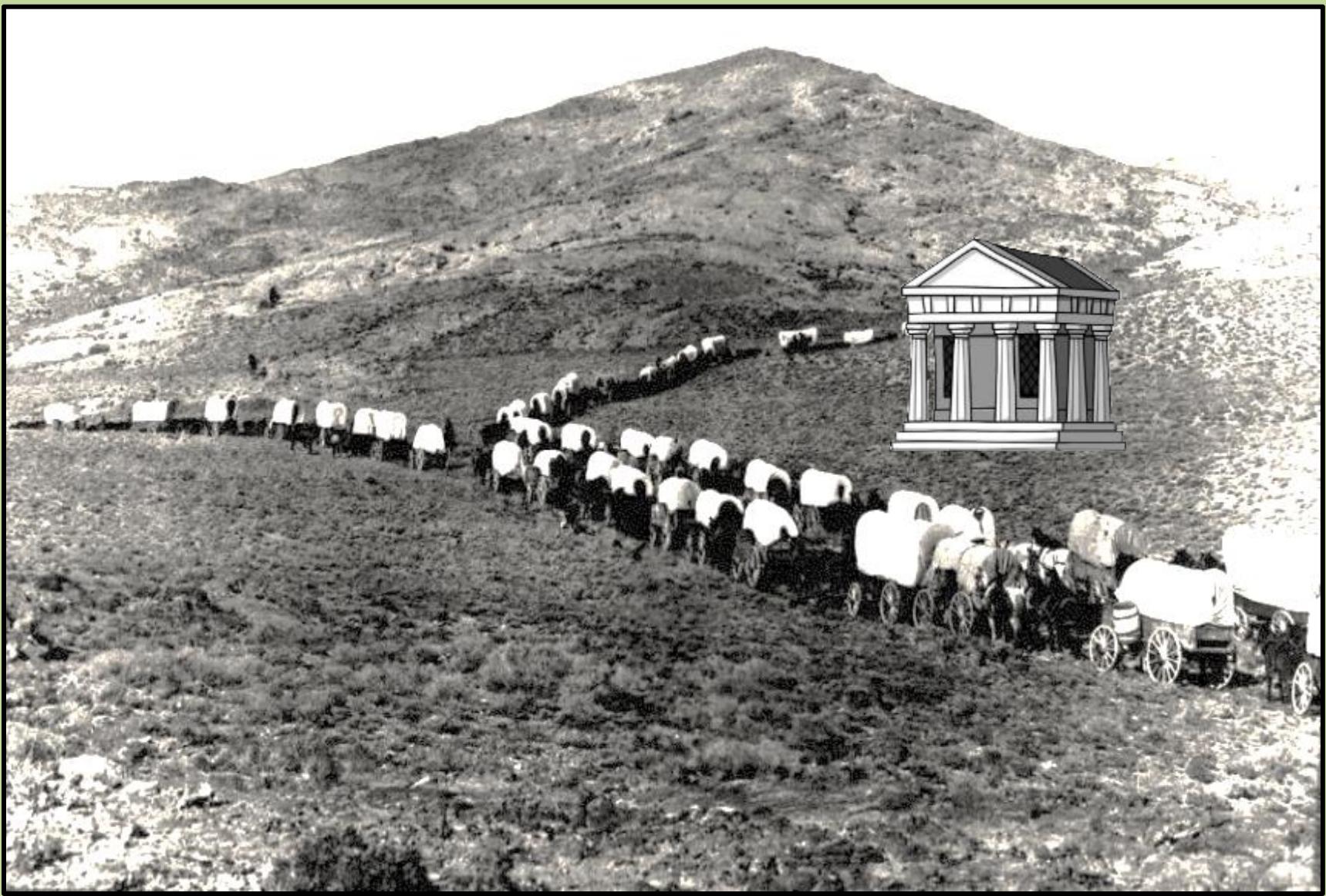
TOTAL ANNUAL AMOUNT CA. 3X THIS FIGURE?

FOR SUPPLY OF POPULACE OF ROME?

*ORC = OLEI (URBIS)ROMAE CANON ?*

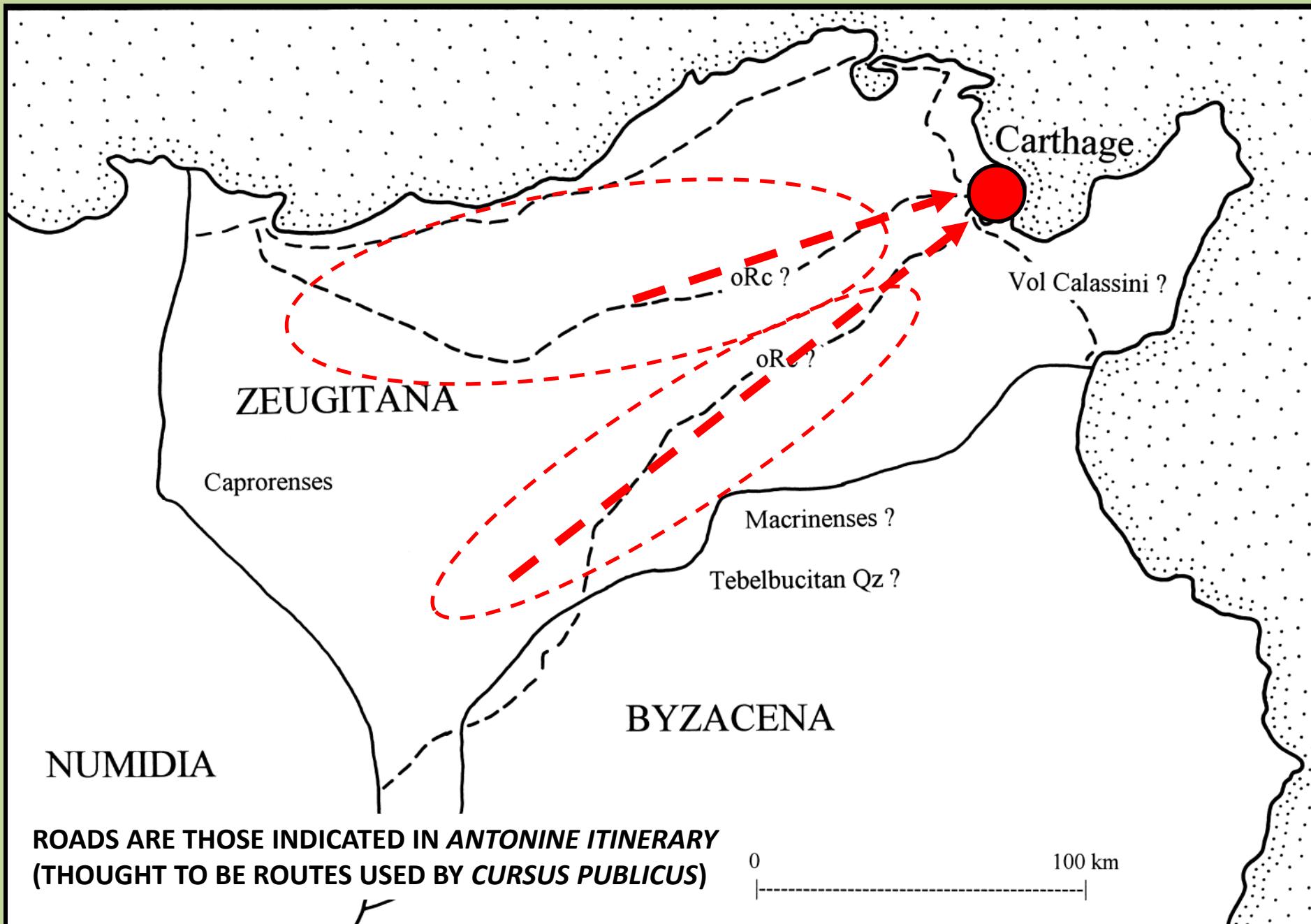


OIL COLLECTED BY SUSCEPTORES; TRANSPORTED BY CURSUS CLABULARIUS  
IN TRAINS OF RAEDAE AND ANGARIAE (ALSO SOME KNT BY MEANS OF STRINGS  
OF PACK MULES/CAMELS?)



OIL COLLECTED BY SUSCEPTORES; TRANSPORTED BY CURSUS CLABULARIUS  
IN TRAINS OF RAEDAE AND ANGARIAE (ALSO SOME KNT BY MEANS OF STRINGS  
OF PACK MULES/CAMELS?)

## INITIATIVE 2 – CONJECTURAL GEOGRAPHY



# **INITIATIVE 1**

**OIL ASSOCIATED WITH FOUR DISTRICTS:**

**VOL CALASSINI TO SE OF CARTHAGE**

**CAPRORENSES IN FAR WESTERN ZEUGITANA**

**TEBELBUCITAN AND MARCINENSES PROBABLY IN NORTH-CENTRAL BYZECENA**

**SEVERAL SMALL TO LARGE CONSIGNMENTS THAT ARRIVE THROUGHOUT PERIOD FOR WHICH WE HAVE DOCUMENTS (FEBRUARY THROUGH JULY)**

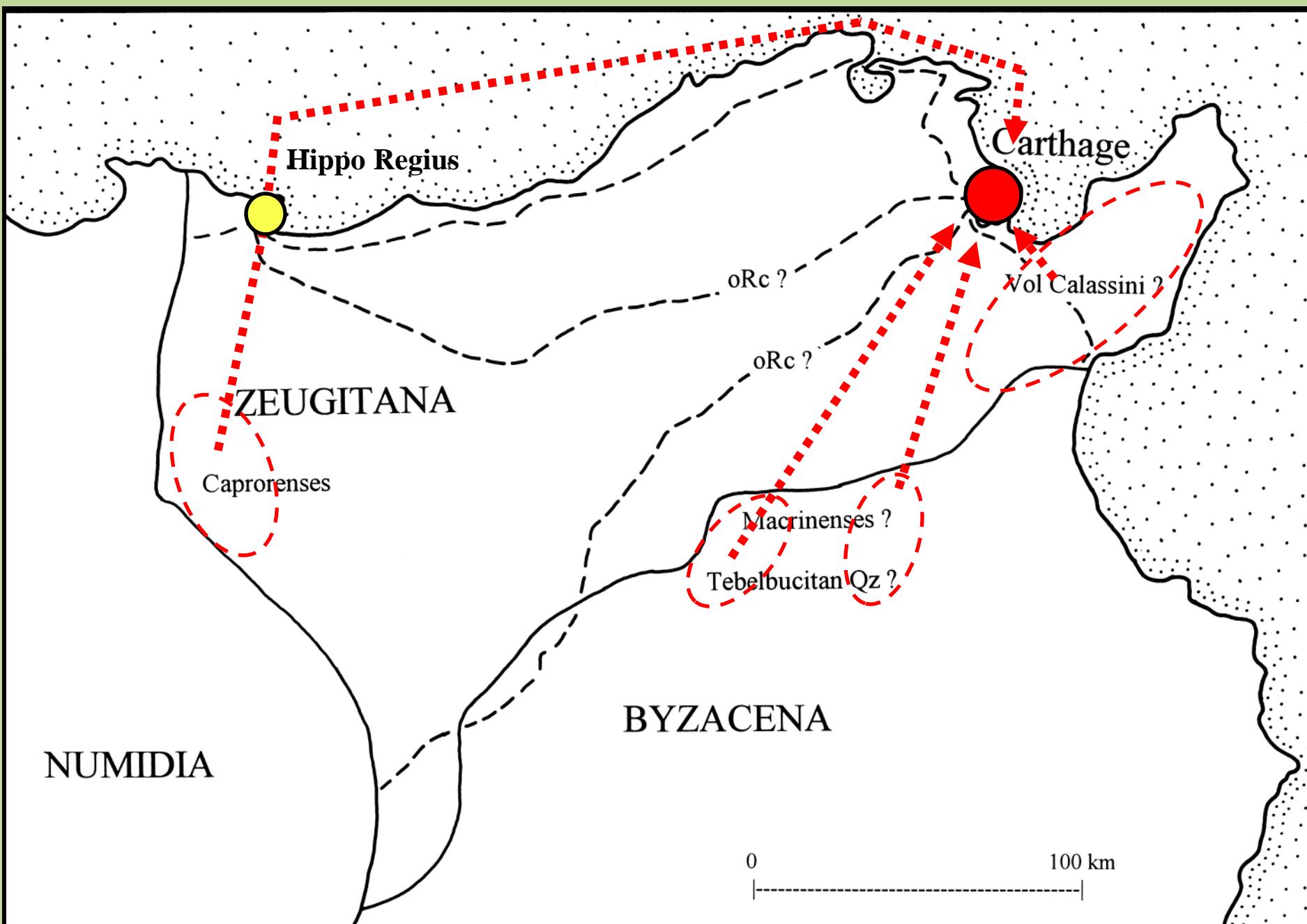
**1 OR 2 SUPPLEMENTS TO LAND TAX?**

**PACKAGED IN ASAB AND AS (ALSO PROBABLY B AND Ψ)**

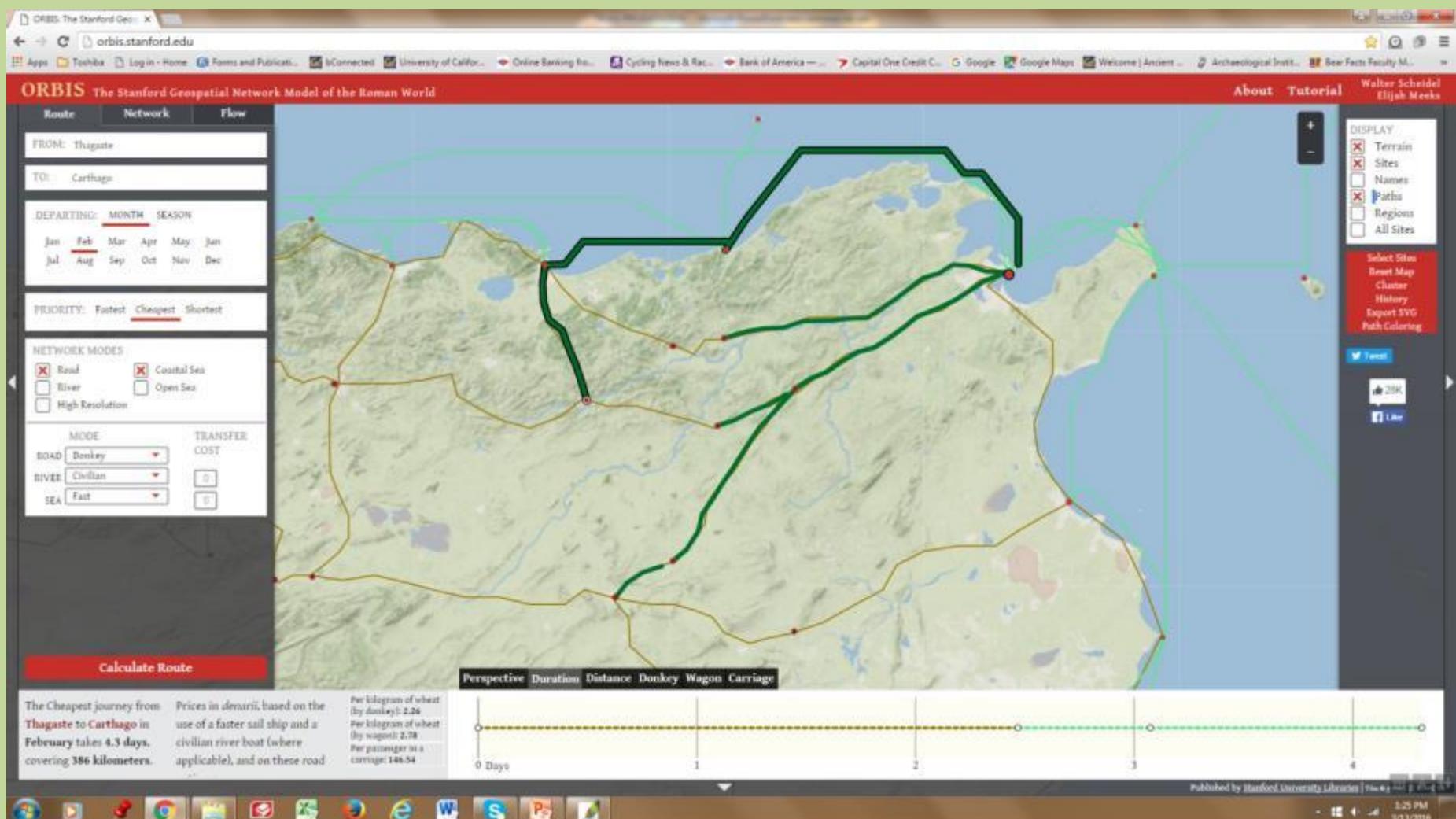
**TRANSPORTED BY BOAT, PACK ANIMAL (AND ALSO WAGON?)**

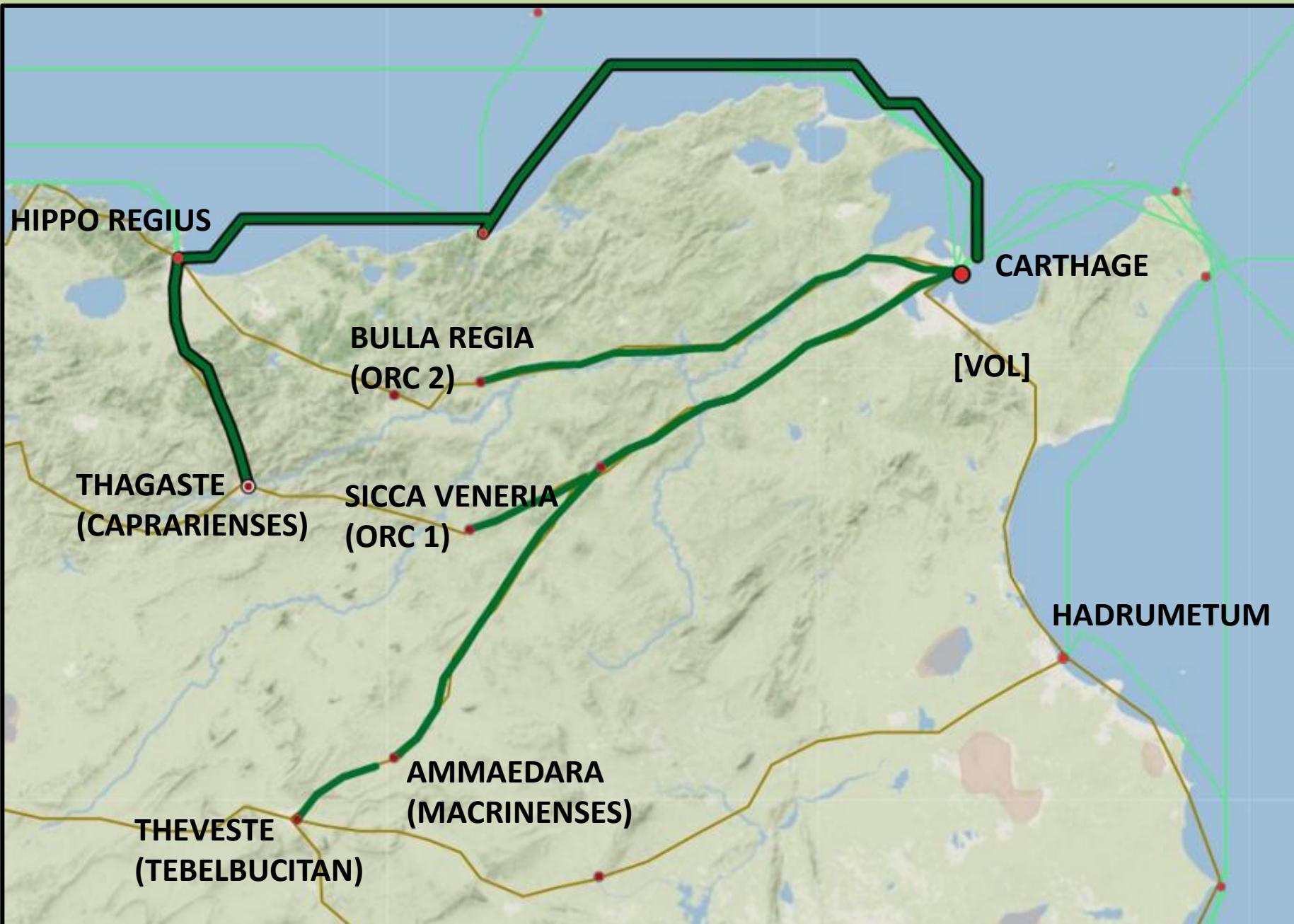
**CAPRORENSES OIL ARRIVES FEBRUARY AND THEN DISAPPEARS (DUE TO REVOLT OF FIRMUS?)**

# INITIATIVE 1 - CONJECTURAL GEOGRAPHY



# ORBIS TRIALS





# ORBIS DATA

ORIGIN	ORBIS ORIGIN	DESTINATION	MONTH	MODE	DIST. KM	DAYS	COST
ORC 1	SICCA VENERIA	CARTHAGE	APR	WAGON	166	5.5	4.66
ORC 1	SICCA VENERIA	CARTHAGE	APR	OXCART	166	13.9	4.66
ORC 2	BULLA REGIA	CARTHAGE	APR	WAGON	153	5.1	4.31
ORC 2	BULLA REGIA	CARTHAGE	APR	OXCART	153	12.8	4.31
CAPRARIENSES	THAGASTE	CARTHAGE	FEB	DONKEY, SHIP	386	4.3	2.26
CAPRARIENSES	THAGASTE	HIPPO REGIUS	FEB	DONKEY	074	2.5	2.07
HIPPO REGIUS	HIPPO REGIUS	CARTHAGE	FEB	SHIP	312	1.8	0.19
MACRINENSES	AMMAEDARA*	CARTHAGE	APR	DONKEY	231	7.7	6.49
MACRINENES	AMMAEDARA*	HADRUMETUM	APR	DONKEY	298	9.9	8.35
TEBELBUCITAN	THEVESTE*	CARTHAGE	APR	DONKEY	267	8.9	7.49
TEBELBUCITAN	THEVESTE*	HADRUMETUM	APR	DONKEY	262	8.7	7.35
CARTHAGE	CARTHAGE	OSTIA/PORTUS	APR	SHIP	601	3.6	0.36

ORBIS ORIGIN: \* = ORIGIN SUBSTANTIALLY FARTHER FROM CARTHAGE THAN MAY HAVE BEEN CASE

MODE: WAGON = RAEDA; OXCART = ANGARIA

COST: COST EQUIVALENT FOR 1 KG OF WHEAT TRANSPORTED BY DONKEY.

**OIL MOBILIZATION**

**CARTHAGE**

## FACILITIES, PERSONNEL, OPERATIONS

TWO SEPARATE BUT NEIGHBORING FACILITIES: STOREHOUSE CALLED  
*CONDITORIUM ZUEGITANUM* AND WEIGHING FACILITY (“*IN PLETU*”)

OIL RECEIVED AND WEIGHED AND TRANSVASED FROM SKIN CONTAINERS (AND AMPHORAS?) TO AMPHORAS FOR EXPORT BY SEA FOR SUPPLY OF ROME (SOME RETAINED FOR EMERGENCIES AND/OR SUPPLY OF LOCAL OFFICIALS?)

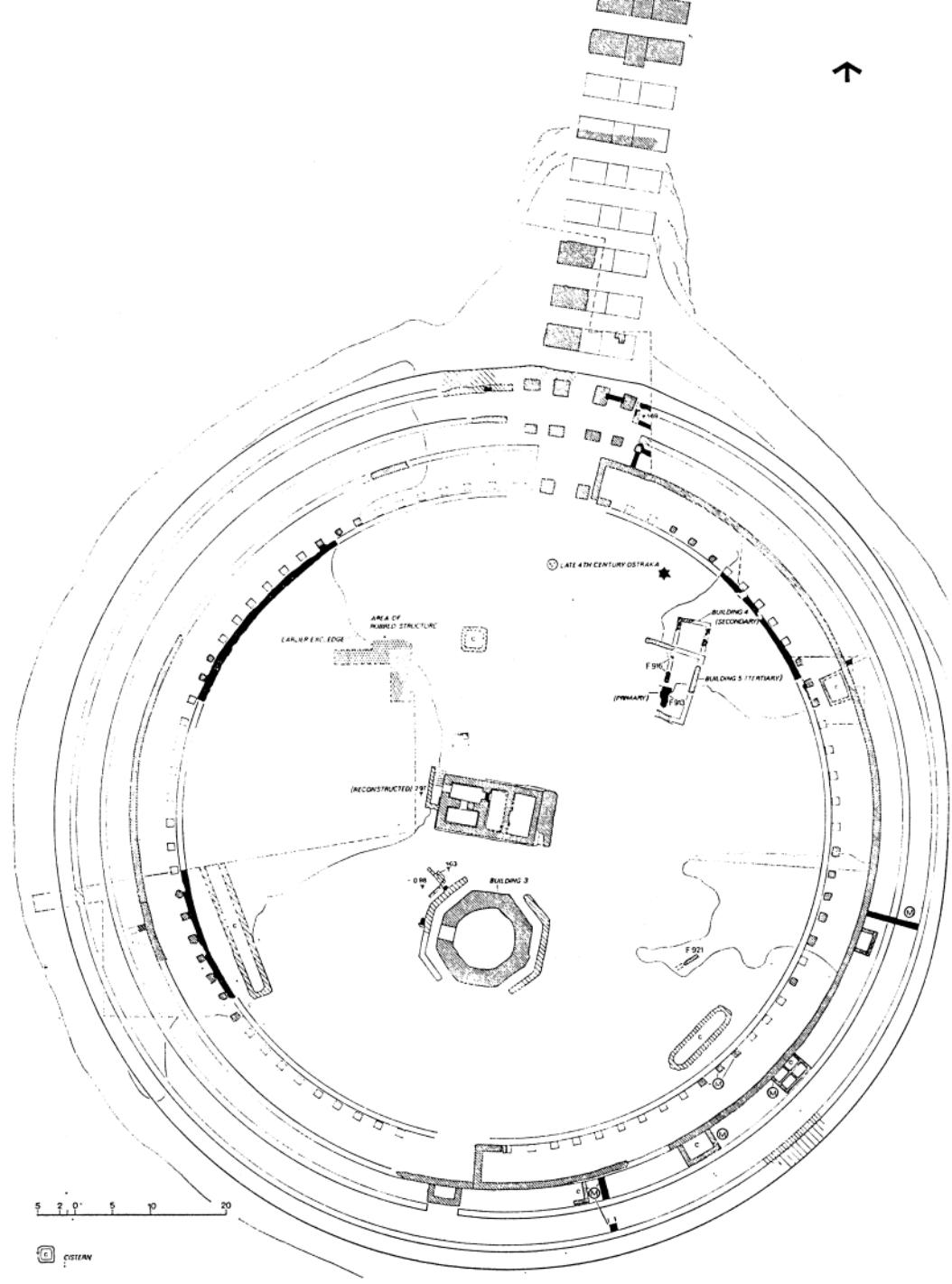
FACILITIES OPERATED BY PROVINCE OF ZEUGITANA

OIL WEIGHING CARRIED OUT BY *CORPUS OF MENSORES OLEI*, WITH *MENSOR OLEI FORI KARTHAGENIENSIS* CHIEF OFFICER, AND WEIGHERS KNOWN AS *CENTENARI*

RECORD KEEPING CARRIED OUT BY PROVINCE OF ZEUGITANA OR *PRAEFECTURA ANNONAE AFRICAE*?

# ILÔT DE L'AMIRAUTÉ CA. 4<sup>TH</sup> – 5<sup>TH</sup> C. AD

BOTH FACILITIES  
LOCATED ON ISLAND?



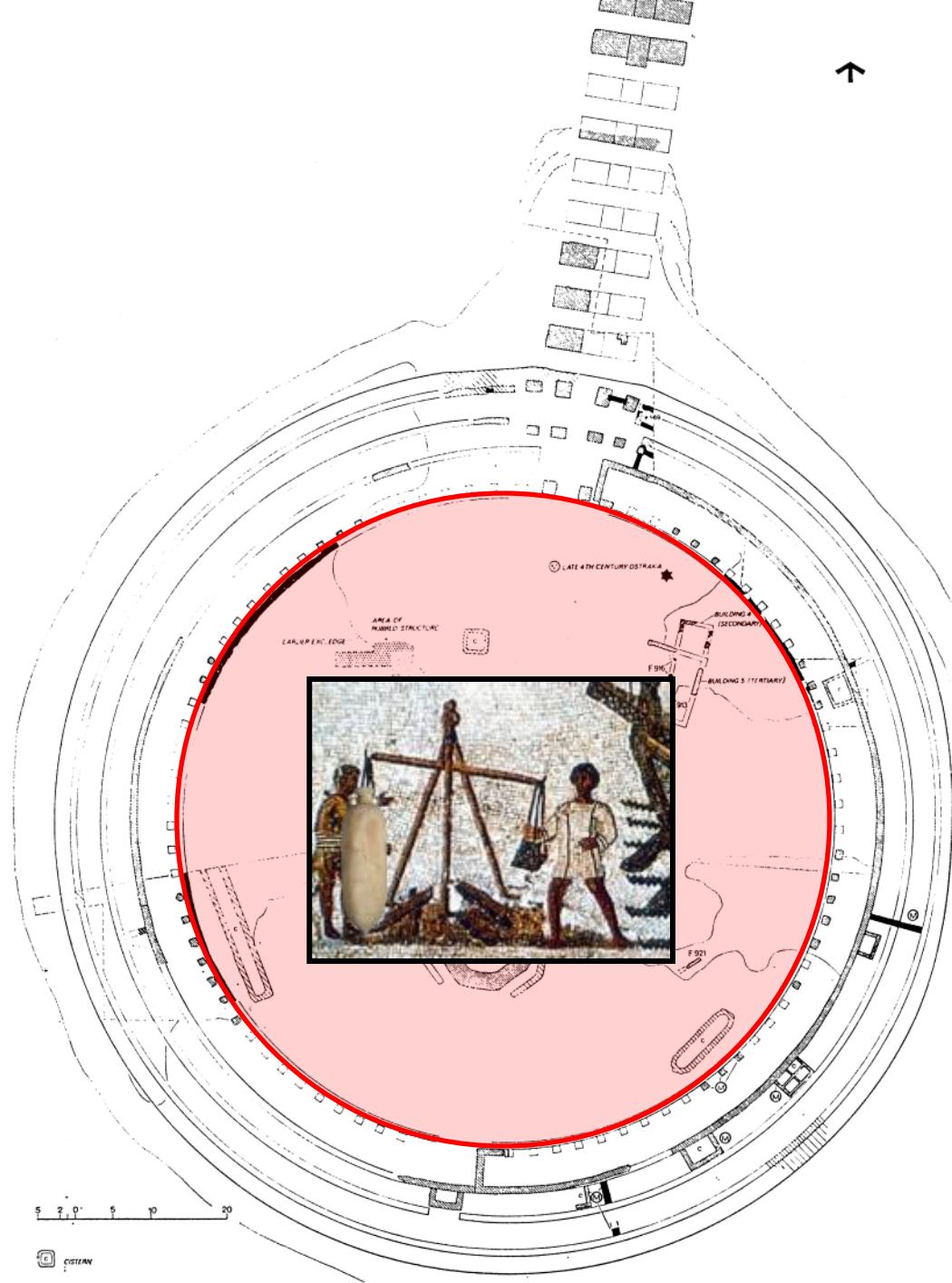
# ÎLOT DE L'AMIRAUTÉ

## CA. 4<sup>TH</sup> – 5<sup>TH</sup> C. AD

### OIL WEIGHING AREA?

NEEDS TO HAVE ENOUGH  
ROOM FOR SIMULTANEOUS  
OPERATION OF AS MANY AS 13  
BALANCES AND ROOM FOR  
TEMPORARY STORAGE OF  
LARGE NUMBER OF FILLED  
AND EMPTY CONTAINERS

NEEDS TO BE ABLE TO ADMIT  
WAGONS (OPENING OF  
CA. 2.5 M SHOULD BE  
ADEQUATE FOR LARGE  
WAGON)



# ÎLOT DE L'AMIRAUTÉ

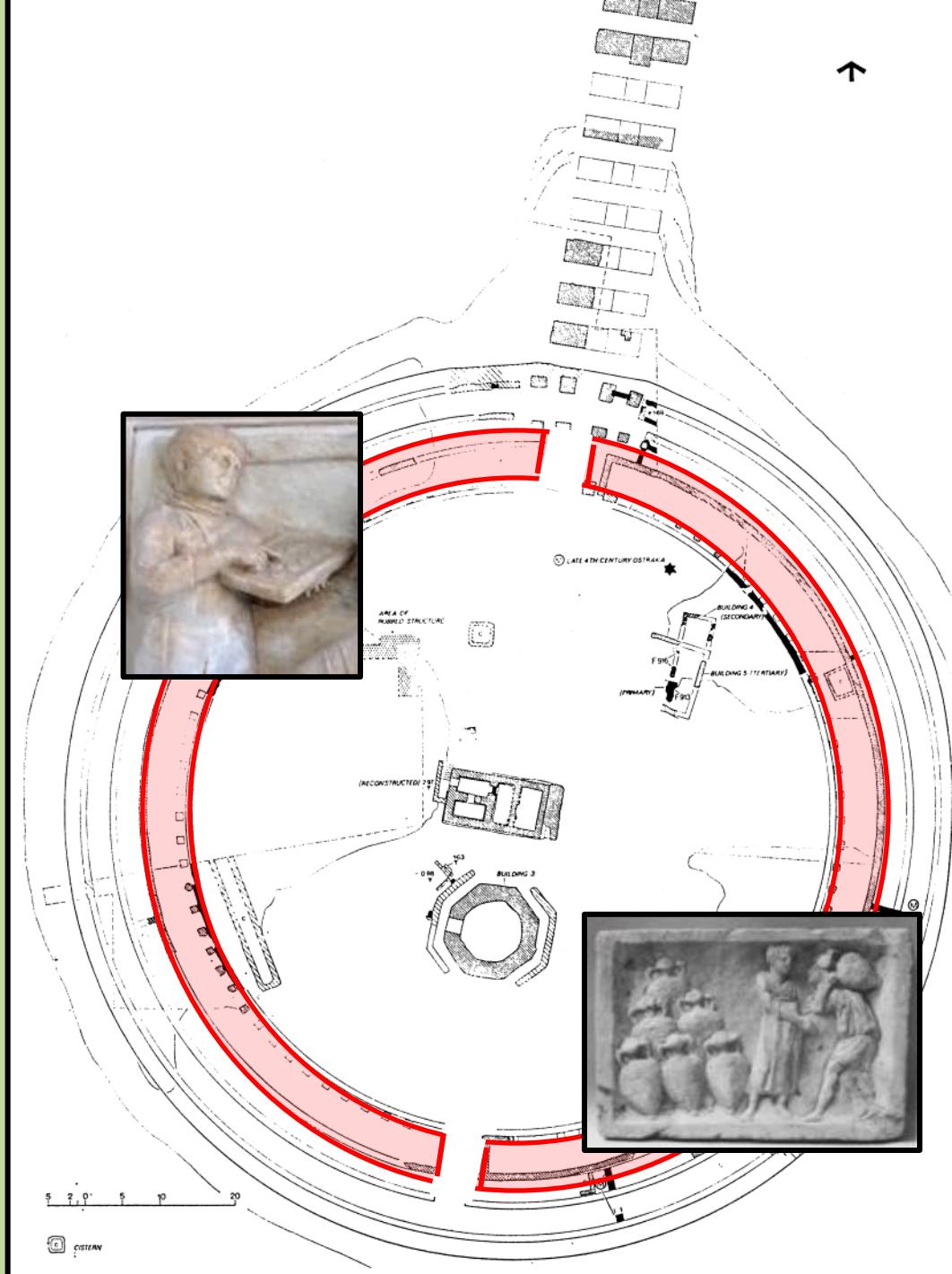
## CA. 4<sup>TH</sup> – 5<sup>TH</sup> C. AD

**CONDITORIUM ZEUGITANUM?**

NEEDS TO BE SECURE AND TO  
HAVE ENOUGH ROOM TO HOUSE  
(AND TO ALLOW INVENTORYING  
OF) VERY LARGE NUMBER OF  
CONTAINERS

GREATEST NUMBER ATTESTED:  
**2,844 ASAB, 1,644 KNT, 167 AG,  
184 Ψ, AND 757 AS  
[= 5,596 CONTAINERS]).**

INTERIOR FLOOR SPACE CA.  
5,000 SQ M.



## **DOCUMENTATION OF OPERATIONS**

- STATE RECORDS EXACT TYPE AND NUMBER OF CONTAINERS OF OIL DELIVERED BY SHIP, AND ACCEPTED AND REJECTED BY DATE, BY ORIGIN, BY SHIPMASTER (SIMILARLY FOR OIL DELIVERED OVERLAND?).
- STATE MEASURES OIL TO THE POUND (USING THIS INFO TO COMPENSATE WEIGHERS?).
- STATE PERFORMS PERIODIC CALCULATION OF AMOUNT OF OIL ON HAND BY HUNDREDWEIGHTS/POUNDS WITH NO REQUIREMENT FOR HIGH ACCURACY (USING THIS INFO FOR GENERAL PLANNING PURPOSES?).
- OSTRAKA WERE TEMPORARY DOCUMENTS (THAT COULD BE DISCARDED AT END OF TAX YEAR OR TAX TRIMESTER?).

# ÎLOT DE L'AMIRAUTÉ CA. 4<sup>TH</sup> – 5<sup>TH</sup> C. AD

OFFICE/ARCHIVE WHERE  
*OSTRAKA* WERE HOUSED?

BASE FOR CORPUS  
*MENSORUM OLEI*?  
*PRAEFECTURA ANNONAE*  
*AFRICAE*?

