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The Segermes-Project Population and Production in the Roman Province of Africa Proconsularis*

In the years 1987–90, the *Institut Nationale de Patrimoine*¹ in collaboration with a number of Danish research institutes carried out a survey in the area between Bou Ficha and Zaghouan, the so-called Segermes basin, in Tunisia (fig. 1). The results of this work were published in 1995². Its objectives were to reveal the economic mechanisms and social relations between a town and its environs in antiquity, and to find an empirical confirmation, or refutation, of the still ongoing and very theoretical discussion re-opened by M. I. Finley in 1973³.

At its outset the project was given the name *Africa Proconsularis*, in memory of C. T. Falbe, the Danish consul in Tunisia, who not only carried out pioneering work in mapping the centuriation around Carthage but was also the first Dane to visit the Segermes valley, and the first to leave a short description of Segermes itself⁴. It should be made clear, however, that the main title of this project does not cover an analysis of the province as a whole, especially as our studies have since made it clear that the greater part of the Segermes valley, in a purely adminis-

* Three volumes have appeared: Dietz, S., Sebäi, L. L., Ben Hassan, H. and Ørsted, P. et al., (eds.), *Africa Proconsularis. Regional studies in the Segermes Valley of Northern Tunisia* (Copenhagen 1995 and Aarhus 2000) Further refs. are made to Vol. I, or Vol. II.

¹ The formal framework for the project was an agreement made between the National Tunisian Institute for Archaeology (INAA, now IPA) through its then keeper of National Antiquities M. Fantar, and the University of Copenhagen, through Peter Ørsted and Erik Poulsen. The Tunisian side was managed by H. Slim, the director, L. Sebäi and H. Ben Hassen, to whom I am greatly indebted.

² Dietz (1995a). In recent research the area is mentioned in: Lassère (1977) 200 and passim; Lepelletier (1979–81) 304–305 and 248–250 (Ziqua); Gascon (1972) 146 and id. (1982) 230–320. Longer descriptions of the project are found in: Sebäi (1990); Ørsted (1990) 26–37; Carlsen (1989) 803–813, and: Extrait du Bulletin des Travaux de l'INAA no. 4 (Tunis 1991); Ørsted (1992) 69–97. Further in two articles in *Ant.Afr.* (1990) 43–86 and (1994) 7–55; Ørsted (1993) 128; Dietz (1995b) 171–95; Ørsted, in: *Ant.Afr.* (1998) 157–173.

³ The Ancient Economy (London 1973). More on this point is found in Ørsted (1992) 69 ff. and Vol. I, 11 ff. The discussion Ampolo (1987–89). Of importance for the ideas behind this approach are: Leveau (1984); Peyras (1983) 209–253 and Troussset (1977) 175–207.

⁴ See Lund I,3.

Fig. 1: Segermes Valley within *Africa Proconsularis*

trative context, lay in the later province of Byzacena. The analysis of the roughly 600 km² large valley should thus be regarded as a regional, geographically limited investigation which, when compared with other regional analyses, may be viewed as constituting an important piece of that jigsaw puzzle which is the study of the Roman world in Northern Africa. It is to be hoped therefore that our investigations may be able to contribute to a better understanding of the Roman Empire as a whole.

An archaeological survey, as I see it, has the ideal objective of recording all the material remains in a given area, making it possible to map the infrastructure of a region and to date it. However, neither descriptions of the archaeological evidence nor statistical dating can carry a survey across the boundary between pre-history and history. For this written sources are needed and are, indeed, a *desideratum* in regional studies of the Roman Empire, not least in marginal areas such as the Segermes valley. Apart from the inscriptions⁵, ancient Segermes⁶ is mentioned only a few times in connection with ecclesiastical gatherings in Carthage⁷, while the region itself is briefly and enigmatically mentioned by Victor Vitensis⁸.

Interpretation of the archaeological evidence must therefore rest primarily on comparison and analogy with related areas; related, that is in time as well as space. This presents difficulties, of course, when the starting-point is a relatively small regional framework. Administrative history, both local municipal and central Roman, constitutes a minor problem in this connection because it is marked by uniformity. Social and economic conditions are, on the other hand, determined to a far greater extent by specific environmental factors: for example, the balance between nature and human beings and the solutions dictated by the landscape and local climatic conditions⁹. The problem of methodology is obviously associated with the circumstance that no two regions are identical – as a result there is a risk of both *circuli vitiosi* and harmonisation. These difficulties are not mitigated by an apparent mental schism between archaeologists and historians, nor by the multitudinous, extremely heterogeneous, and not particularly consensus-focused studies carried out in and on Africa¹⁰.

Our starting-point, and the backbone of a detailed historical analysis, naturally lies in the site-related investigation as presented in volumes I and II of *Africa Proconsularis*. This survey revealed a structure where the dominating element was a

⁵ All the inscriptions from the area are republished with photos and commentary in Vol. II, 713 ff.

⁶ Henchir Haratt, AAT f. XXXVI, n. 105, in the commentary erroneously given as no. 165. CIL, VIII, 11170. 11172. Lepelley (1979) 304ff; Gascon (1972) 142–144, 146. The word Segermes probably means “hill”. For the etymology of the word (Berber) see BAC (1888) 475 ff.

⁷ AD 256, 411, 484 and as late as 641 and 649. For references see Vol. I, 761 (Bejaoui, F.).

⁸ Victor de Vita, Hist. pers., (I,10), II,6: *stabat quidem praecelsus super montem qui Ziquensis dicitur et clamabat dextra leuaque*. V,15: *Cresconius presbyter Mizentinae civitatis in spelunca Ziquensis montis repertus est. For a decurio from Ziqua, see Lepelley, I,323. Acta purificationis Felicis, C.S.E.L., 26, p. 203, 1.21–22 (Ingentius respondit decurio sum Ziquensium)*. I think it is possible that the Ziqua mentioned here is not identical with Zaghuan but with a *civitas* south of Sidi Zit. For sources for the Christian period in this area, see Vol. I, 761.

⁹ As appears indirectly from Loth (1910) I. no. 1, and from below, I have found it profitable to consider the problems and production conditions experienced by the European colonists in the 19th century. See especially Poncet (1961) and Despois (1955).

¹⁰ It should be noted though that no attempt at completeness has been made with respect to references, except concerning the Segermes valley itself. See Carlsen below p. ff. Excellent bibliographic surveys are given in the bibliographies of Leveau (1984), Lassère (1977), Peyras (1991) and specifically Mattingly and Hitchner (1955) 165–214. Moreover in the issues of “Bibliographie analytique de l’Afrique antique”.

large number of agriculturally-based settlements of varying size, as well as signs of the immense efforts made to ensure the water supply manifested by cisterns, aqueducts and wells.

From the third century AD, Roman Segermes could be called an *agrotown*, to use Finley's term. The founding of the town as a *municipium*¹¹ was no doubt followed by a delimitation of its territory and the recognition of individual private ownership of land – an established *forma* or *aes*. Its closest hinterland, the *territorium*, was clearly associated with an agriculture that must have reached a stage of development that could at least ensure the symbiosis of town and countryside. The main production was a composite of grain – mainly barley – olives, and sheep/goats. In all probability, the town itself functioned as a centre for service and administration. However, Segermes and its growth cannot be fully understood if the *civitas* (that is *oppidum* and *territorium*) is not set in its wider, regional context. As Finley put it, the study of individual city-states is a kind of *cul de sac*. Even given the fact that the ideal was autarchy and autonomy, neither of these can be grasped without investigating and shedding light on the internal and external economic, social and administrative relations of the city-state. In order to do this we must start somewhere and, inspired by Max Weber, an obvious point of departure would be to consider a *civitas* as a form of *ideal typus* and to open the analysis here. To some extent it could be argued that all history is a composite of local histories. Our first result – obtained in only a couple of weeks – was that although Segermes was a Roman town, both in physical and legislative terms, the acculturation process or Romanization was never more than tentative in its hinterland. This observation turned out to be fundamental and thus to underlay the whole project.

¹¹ The neighbouring Puppit was raised to the status of *colonia* in the reign of Commodus (CIL VIII, 24093), which would indicate some growth in the region at this time. On these grounds alone it is easy to suggest that Marcus Aurelius was the founder, as usually was the case. CIL 23064 (=11168) Vol. II, 727 no. 6 is dedicated to divus Severus and was set up between 10th December 213 and 10th December 214 (under Caracalla) without doubt by the *municipium*, even though not directly stated. This date must be the *terminus ante quem*. If foundation occurred at so late a date, the achievement of *municipium* status might have had something to do with possible adjustments (confiscations) which undoubtedly took place in the whole area after Severus had conquered the Hadrumentumian Clodius Albinus in 197. See Foucher (1964) 201 ff. Contradicting this (admittedly hypothetical) view is CIL 11173 (ILT 258) which was erected in honour of Fabius Philippianus, who had been made ... *equo publico adlectus* ... by the emperors Antoninus and Verus. The stone was erected ... *decreto decurionum* ... and ... *publica pecunia* ... The question is how long the interval could have been between the setting up of the inscription and Philippianus's admission to the equestrian order under Marcus Aurelius and Verus, i.e. 161–169. But under all circumstances the year 161 can be considered the *terminus post quem*. Any narrowing of the interval between 161 and 214 would be hypothetical, but as it is the Marcus Aurelius *gentilicium* that gives the town its name (and not Commodus or Antoninianum), and as the stone must have been erected a fairly short time after Philippianus entered the equestrian order, it seems reasonable to put the achievement of municipal status in the 170's. In support of this idea is the occurrence of tribus Papiria (ILT 261 = vol. II, 722 ff. with references). At all events Segermes functioned, at the latest, from this time with an *ordo*, i.e. it was at any rate a *civitas*.

Given this starting point, the delimitation of the *territorium* as shown in fig. 5 – albeit a reconstruction – is essential for an analysis of the relation town/country-side, including an estimation of the size of population and production.

We all know how difficult, if not impossible, it is to reach an estimation of numbers in these fields¹². However, it was a *must* in terms of the whole idea of our project to make an attempt at what some scholars label number-games. The figures I have employed (see fig. 8) were reached by confronting data of chiefly modern date with the scanty data left to us from antiquity. In my view these data show a certain intrinsic cohesion, and seen individually represent an inner probability. The evidence available stems mainly from 5 sources:

1) The archaeological remains revealed by our survey¹³ (fig. 3, 4, 6 and 7).

2) Ancient written sources, in particular the *Digesta* and the *agrimensores*, Pliny and Columella and inscriptions from the region such as the famous ones from the Medjerda-valley and the Albertine tablets.

3) Information I have gathered from the writings of 19th century French colonists living in the area. This consists partly of descriptions from diaries and the like, partly of information on production and population stemming from the French *sociétés capitalistes* from Marseilles and Lyon, who bought, colonised and/or sold the valley.

4) Production and population figures from 1974, and

5) The corresponding figures for today, i.e. 1990, all of which were obtained from the *Département de Zaghouan* archives. Finally, conclusions by analogy are drawn from other parts of North Africa and from the Roman Empire as a whole. What I have called key numbers – reached in this way – are shown in fig. 8. Let us begin by taking a look at the population¹⁴.

A. Size of population:

The *territorium* of Segermes (fig. 5) – covered some 10300 hectares. Within this area we have located some 45 habitations (which must represent the minimum number). As was to be expected, they are of different size. Based on a hypothetical delimitation of the land belonging to the farm called Henchir Sherif, we established a typology containing three types of farm having the following total sizes (see fig. 4):

¹² See e.g. Hopkins (1978) 32, n.41: "I am aiming here at rough orders of magnitude only." Also Mattingly (1988a) 159; Jongman (1988) 108, 131.

¹³ The cartographic basis is Babelon, E., Cagnat, R. and Reinach, S. (1893); Cagnat, R. and Merlin A. (1914). Also Caillemet, A., Chevallier, R. and Piganiol, A. (1959). This is sheet B4 C37 in the old and sheet XXXVI in the new atlas (Bou Fichta). Important descriptions also in Gauckler (1897), vol. I, fasc. 3, p. 175–181, II, 2 p. 60–64, II, 3, p. 143–146.

¹⁴ Jongman (1988) esp. 66 ff. Very important L. Foxhall and H.A. Forbes (1982) 41–90. Duncan-Jones (1974); Shaw (1982).

Fig. 5: Sites with sherds dating from AD 200 to 450.

- Group I
 - Group II
 - ▲ Group III
 - Group IV
- +++ Limits of the territory of Segermes

Some useful numbers:

(based partly on empirical yields of the region, partly on ancient evidence (such as Varro/Columella) and partly on modern research (esp. White, Duncan-Jones, Foxhall-Forbes, Shaw and Mattingly))

Size of:

Valley: 60.000 hectar
 Surveyed area: 40.000 hectar
 The territorium of Segermes: 10.300 hectar
 Cultivated area inside the territorium: .. 3.519 hectar
 Production of olive: pr hectar 80 l.
 Production of grain: pr hectar ... 600.000 kg
 Sheep/goats: 6.700

Numbers of

Farms in the whole valley: 69
 Inside the territorium: 45

(Group I: 8 farms à 600 hectares
 Group II: 23 farms à 178 hectares
 Group III: 14 farms à 100 hectares

45 = in total: 10.354 hectares)

Conterweights 29

Population

in one family 6
 In the whole valley: 2.000
 Inside the *territorium*: 1.600 (with Segermes)

Prices

Oil: per litre 1 HS
 Grain: per kg 1 assis

Wages 2 HS

Consumption per person:

Water 10 litres per day
 Grain 237 kg per year
 Oil 20 litres per year

Labour:

1 hectar of olive 21,2 man-day
 1 hectar of grain 32 man-day

Profit per hectar

Grain 35 HS
 Oil 19 HS

Fig. 8.

1. (group I) A very large farm covering 600 ha, which must have required outside labour or have been managed indirectly by *coloni*.
 2. (group II) A medium-size farm of about 178 ha, which also made use of outside labour.
 3. (group III) A small farm covering about 100 ha, probably managed by one family on its own.
 4. (group IV) Some village-like agglomerations, defined as *vici*.
- There appear to be:
- 8 farms of 600 ha = 4800 ha (group I)
 - 23 farms of 178 ha = 4100 ha (group II)
 - 14 farms of 100 ha = 1400 ha (group III)

This amounts to 45 farms covering a total of 10.300 ha.

Using the figures set forward by Professor Foxhall¹⁵, 6 persons per family may be assumed, giving a minimum of 270 persons. It is clear, however, that at least two of the three above-mentioned groups of farms required more labour than a single family-unit itself could furnish. One of my basic ideas is that conditions in and around 1900 were very similar to those in ancient times, and it is therefore of interest that the population of the *Enfida estate* (a total of 96 000 hectares comprising the Segermes valley) in 1900 was 10758 *natives*¹⁶.

A proportional and even distribution of this number (10758 people : 96 000 ha × 10300 ha) would result in a population of about 1154 inhabitants *intra fines* in the Segermes valley in 1900. Half of them were certainly shepherd families, while the remainder cultivated grain and olives organised in the so-called *Henchir* system. Transferred to Roman times I would consider this number to be close to a minimum. This means that the size of the additional labour force is to be found somewhere between 270 persons – though these may not all have been workers – and a number somewhat in excess of 1154 persons.

We have been able to delimitate one farm with some certainty. It is the Henchir Sherif farm (L12, approx. 2 km north of Segermes itself), which forms another cornerstone in my analysis. This farm comprised some 600 hectares and is, as such, the model for the farms of group I. Of these 600 hectares, 125 hectares seem to have grown grain while 80 hectares were used for the growing of olives. The remaining 395 hectares served as grazing ground or lay fallow. If we use the figures presented by Varro and Columella¹⁷, one hectare of olives can be managed in 21,1 man-days, and one hectare of grain in 32 man-days¹⁸. Using the same distribution key for the other farm groups, the total for the olive-growing area *intra fines* will come to 1374 hectares for olives, and for grain 1000 hectares. The work force necessary will then amount to some 448 workers. I would like to suggest here that they would normally be attached to the individual farm, and that the annual number of working days amounted to around 200. If we further suppose that all

¹⁵ (1982) 49, no. 26.

¹⁶ Loth (1910) 96.

¹⁷ A survey Mattingly (1994) 93.

¹⁸ For the numbers used, see my fig. 8 with references and further below.

these workers were part of a family numbering 6 persons of which 4 were able to provide work on the farm, we can then divide this number by 4 and multiply it by 6. The resultant sum of 732 persons, when added to the owners families, gives a total close to 1000 persons. Finally, we added the shepherds for the estimated 6700 sheep/goats. Varro tells us – and Columella agrees – that the correct proportion of shepherds to animals is one shepherd to 100 animals. That is to say, a further 67 persons also living in some sort of family-structure, which forces us to add a further (67×6) 400 persons. As I consider Segermes itself to have had only a couple of hundred inhabitants and the *vici* to have been quite small, I reach a total of some 1600 persons. This represents 15 people per km². A surprisingly high number, I think. In comparison, the whole valley, including the mountains, would appear to have had about 4 inhabitants per km². Transferred to the approx. 6 000 000 km² of the empire as a whole in the third century, these figures form a picture of some 24 000 000 and 90 000 000 inhabitants respectively.

For the sake of clarity this information can be summarised for the area *intra fines* (10 300 ha, extrapolated from the 600 ha):

Year	Pop.	Grain ha	Yield kg/ha	Olives ha	Yield l./ha	Grazing ha	Sheep/goats
1990:	2500	2472	1000	1957	250	2884	6700
1974:	2000	2225	1000	2781	100	3090	6700
1900:	1000	600(?)	< 1000	200	115	12000	11300
AD 250:	1600	2145	600	1374	80	6781	6700

These figures can be used more specifically to set up a number of scenarios where area, exploitation, production, labour and number of farms may be viewed in relation to one another¹⁹. On this background an assessment of the individual farms income/profit²⁰ in antiquity may be of interest. To return to the farms of group I covering 600 hectares and consisting of 80 hectares of olives and 125 hectares of grain:

Olive production per year:

Area	Trees/ha	Olive/tree	Oil/tree	Price/l	Total prod./l	Total value
80 ha	40	10 kg	2 l	4 asses	6400	25 600 asses

Grain production per year:

Area	Production	Prod., total	Price per kg	Total value
125 ha	600 kg/ha	7500 kg	1 assis	7500 asses

¹⁹ In order to elucidate conditions in the Northern African region, I have used *Loth's* (1910) information indicating a planting density of between 39 and 72 trees/ha. Keeping inside Tunisia, *Despois'* (1955) figures for the area lying rather more to the south are similar, namely about 15 × 15 m land per tree, which gives 44 trees/ha. Perhaps (according to Despois) this reflects circumstances in Antiquity.

²⁰ For an estimation of prices, see *Mattingly* (1988c) 38. *Duncan-Jones* (1974) 33, 36.

Daily wage = 2 HS²¹.

Duration of work: 200 days per year²².

Using the man-day figures, (fig. 8: 21,2 man-days for 1 hectare of olives and 32 man-days for 1 hectare of grain) the labour force required on this farm is some 40 plus three shepherds²³. Allowing for consumption (i.e. 0.65 kg grain and 0.05 litre oil per person per day (fig. 8)), the following table can be set up in order to calculate potential profits:

	Grain	Olive oil
Production: 125 ha at 600 kg (80 ha at 80 l)	75 000 kg	6400 l
Deductions for:		
Labour force	3 900	300
Stores for above	3 900	300
For the family	1 422	120
Stores for above	1 422	120
Seed grain	7 500	
Vectigal (decuma)	7 500	640
Net for sale	49 356 kg	4920 l
Potential income:		
49 356 kg grain at 1 assis	49 356 asses	
4920 l olive oil at 4 asses	19 680 asses	
Total	69 036 asses	

Considering this surplus per hectare and making reductions for labour costs, we then find:

Olives: 19,680 asses : 80 ha	246 asses per ha
Wages: 1694 man-days at 8 asses : 80 ha	170 asses
Profit on sales	76 asses
Grain: 49,356 assis : 125 ha	395 asses per ha
Wages: 4000 man-days at 8 asses : 125 ha	256 asses
Profit on sales	139 asses

Wages in total would amount to (5694 man-days × 8 asses) 45 552 asses, to be paid out of the above 69 036 asses. This money would rapidly be put into circulation in a secondary circuit in the area, thus giving work and income to other groups in (and possibly outside) the valley. When all the expenses incurred in production were paid, the owner of this farm would have had a profit of 23 484 asses, or 5871 HS.

²¹ See *Duncan-Jones* (1974) 54, no. 2 with references. For example, a Dacian miner received 2 HS per day as well as his food, see with refs. *Ørsted* (1985) 207.

²² *Duncan-Jones* (1974) 45, 327; *White* (1965) 102

²³ *Cato* 10,1.11.10; *Duncan-Jones* (1974) 327; *White* (1970) 390 ff.

On this type of farm both the surplus for export and the income this produced, and thus the farm's (owner's) total potential income would have been relatively modest. By comparison the salary of the *procurator regionis*, probably seated in Segermes which was a *ducenarius*, was some thirty times this amount.

If we transfer these numbers from the Henchir Sherif-farm to the whole *territorium* the following figures can be derived, under the assumption, of course, that there is the same ratio between grain and olives throughout the entire 10300 ha as is the case for Henchir Sherif. Again for one year:

Grain-growing area:	2142 ha (annual management of a total of 4285 ha)
Olives:	1370 ha
Grazing/unused:	6788
Labour for:	3512 ha
Sheep:	6700 sheep/goats

The surplus would then be:

Grain:	2142 ha at 139 asses (wages and taxes deducted)	= 74435 HS
Olives:	1370 ha at 76 asses ()	= 26030 HS

Total <i>intra fines</i>	A. Income: (wages and taxes deducted)	= 100465 HS
	B: Income (before wages and taxes)	= 296292 HS

Income per group per farm in HS:

Group:	I	II	III
No. of farms:	8	23	14
Before wages:			
(296.292)	137833	118015	39330
After wages:			
(100465)	46713	40085	13563
Per farm/owner	5841	1743	969

Through a detailed consideration of the economy of the individual farm types we can draw a further important conclusion. Assuming a general economic rationality, in which the basic element is a reasonable relationship between labour and profit, the surplus of the Group III farms is remarkably low. One family helped by a shepherd has a surplus of 969 HS, which should be compared with the approx. 1600 HS (4 persons at 2 HS for 200 days) that the same family could earn as casual labourers, although perhaps under favourable circumstances. A reasonable question is whether these farms were able to survive as independent units. A scenario can be set up in which the Group III farms are managed indirectly through *locatio* and their produce is transferred to the less resource-demanding olives:

Group III farms in *locatio* management:

34 ha olive trees = (34 × 80 l) =	2720 l
from which must be subtracted:	
Rent = 1/3 =	907 l
Own consumption, 6 × 20 l =	120 l
<hr/>	
For sale	1693 l
Income (1693 × 4 asses)	1693 HS.

The labour needed to achieve this production would be about 21,2 man-days per ha. Therefore 34 ha requires $(21,2 \times 34)$ 720 man-days. In a working season of 90 days, a single family produces labour to the extent of about (90×4) 360 man-days, bearing in mind that pressing probably took place at the main farm. In addition, this family needed seasonal help to the tune of about 360 man-days – an expenditure of ca. $(360 \times 2 \text{ HS})$ 720 HS, which must be subtracted from the 1693 HS noted above. The surplus in this case amounts to 973 HS.

In this light, it may be concluded that a *colonus* family such as this would work less, but earn much the same, if they gave up ownership of their land. It is certainly not unimportant that the *coloni* system furthermore provided greater social and economic security in times of crisis. This means that the roughly fourteen farms in Group I were probably owned by the larger farms, and also that grain production *intra fines* should be reduced by $(14 \times 21 \text{ ha})$ 294 ha, or about 176 400 kg, which reduces even further the possibility of exporting grain from the valley. If so, it would have been of equal importance that there should exist a structure comprising *coloni* inside the *fines*; as this would increase the area of the large farms and their incomes.

A similar calculation for the Group II farms gives the following:

61 ha olives ($\times 80 \text{ l}$)	4880 l
from which must be subtracted:	
Rent ($1/3$)	1627 l
Own consumption ($\times 6$)	120 l

Total	3133 l
Income ($\times 4$ asses : 4)	3133 HS
Labour costs:	
$(61 \text{ ha} \times 21,2 \text{ man-days}) =$	1293 man-days
The family itself produces	360 man-days

The owner must purchase	933 man-days
Costs $(933 \times 2 \text{ HS}) =$	1866 HS
The surplus is thus roughly:	1267 HS

In this case the result lies some way from the 1743 HS that the farm could expect to achieve as owner-occupied. Such farms could well exist as independent units, *but did not achieve so much more by way of surplus than that the distribution of the cultivated area I have used in the ideal type should be somewhat altered. The area of cultivated land belonging to the Group II farms originally assumed in the ideal type was rather larger than suggested. Correspondingly that of the Group I farms was rather smaller, perhaps so small that there would be no need of outside labour.*

A classification according to forms of management, in my opinion, thus indicates three types and at the same time points towards a revision of the previous *ideal typus* and a new direction of research: a number of *locator* farms/estates (*fundi*) – perhaps five in all comprising somewhat more than 600 hectares and having around them some thirty *coloni* farms. In which case the remaining

farms, those classed in Group II above, would have totalled around ten. The latter were owner-occupied and were torn between developing into *locator*-type farms or becoming *coloni* farms, that is being purchased by or included into large farms. Considering general developments in Africa, the latter seems most probable.

Because these conclusions imply that grain exports were the exception and that the production of grain just balanced the consumption in the valley as a whole, we are left – looking at exports from the region – with a monocultural economy entirely dependent on marketing prospects for olives should there arise a need to import coins. On the other hand, this was an area of land which could easily feed itself and where the extent of the soil cultivated could be increased if marketing prospects improved, if the population increased, or other incentives materialised.

Given a price of 1 HS per l olive oil and 1 assis pr. kg. grain, the valley could reckon on an annual income of about 300 000 HS from sales (coin imports), and if this were achieved – here exclusively based on olives – then a daily wage of 2 HS could well have been paid. The question is, though, whether this in fact holds up very well. Hitherto a *possible potential* production has been discussed. Consider, for example, the total consumption of oil in Rome, which can be estimated at around $(1\,000\,000 \times 20\text{ l})$ 20 000 000 l per year. Segermes could supply 200 000 l of this oil, that is to say 1%. It is suggestive that some 100 city states of the size of Segermes would have been able to supply this amount of oil. In terms of ha, this requires 250 000 ha, and in terms of labour, around 58 823 men for 90 days. Approximately 2500 km² of land would thus have been sufficient to supply Rome with its oil, even assuming marginal soil of the type in the Segermes valley. Extrapolating these figures to the Empire as a whole (say 50 000 000 inhabitants), the requirements can be covered by an area of 125 000 km² (modern Andalusia is some 90 000 km²) using a labour force of around 3 000 000 men for 90 days per annum. Even taking into consideration the large unproductive sections of the population such as the millions in the large cities, the Roman army, and the administration, it would seem that millions of tons of olives must have rotted away or been unsellable and thus valueless – if we are to accept the figures given in recent studies. Mattingly proposed that Libya alone produced perhaps 10 000 000 litres of oil, which corresponds to half of Rome's requirements. Adding the large olive-growing areas in the rest of Africa, in Spain and in Italy, and assuming the same production figures would result in a surplus production making any sensible pricing impossible. These figures lead us astray, and in consequence the minimalist approach and moderate ideas about a widespread trade in agricultural products must be retained. The same can, in my view, be applied to the production of grain. *Vectigalia* and the surplus from the very largest estates (perhaps only the imperial ones) were transported to Rome, hardly anything else. Roman economy can only be understood on a regional basis, and only the regions that can be directly related to large unproductive groups would have been in a position to earn large sums from agriculture. The fact that famine was widespread at times cannot alone have been the result of a lack of potential. There must have been other causes; primarily

a lack of safe marketing outlets and, in association with this, controlled production. This leads me to doubt that the prices for olive oil and grain proposed above would hold good at times of poor harvests. In contrast, it is evident that a surplus production for several years running would keep prices down. It should be recalled in this connection that Segermes lies in an area of Africa where much olive oil and grain are produced. Large production in favourable times would give marketing difficulties on the local, interregional level. Olive oil cannot be sold to those who grow olives and one's own consumption cannot be greatly increased either. Several good years in succession would have led perhaps to a curtailment of the cultivated area, or to allowing part of the production to rot away, as mentioned above. The monetary surplus calculated for the Segermes valley must therefore have been occasional and variable. There is no doubt, though, that olives could normally be marketed locally and, on rare occasions, interregionally. This is proved by the imports that clearly took place. They must therefore have followed the same curve, i.e. a very uneven one. In spite of the modest amounts involved – which could, however, for the biggest farms sometimes have been quite large – an explanation can at any rate be found for the dedicatory inscription at Djeradou, where donations lie around a meagre 2000 HS, and also for the unpretentious buildings of Segermes which, of course, were erected over the course of many years. In the lower stratas of society this must have meant that wages were under constant pressure, probably varying with the prices that could be obtained for the oil. In poor years the whole valley would initially have had to reduce private consumption, then to sell or consume their stores, and perhaps even their seed grain, in the hope that the money earned would be sufficient to purchase foodstuffs and seed grain in the following year.

Latent in such a structure are a number of contrasts both *intra fines* and in relation to the world outside. Perhaps only the five very large farms with dependent smaller farms were actually of sufficient size to give their owners a substantial surplus – at times even a very good surplus. These owners and their families comprise only about 3% of the population. The presumed ten farms in Group II – the dubious, indistinct position lying between independence and dependence – comprised perhaps 6%, while the thirty *coloni* farms totalled 18% of the population. The uppermost 3% of the population is reflected in the inscriptions evidence, and together with the next group whose farms were quite often provided with bath complexes, they made up a superficially Romanized sector of the population, a kind of upper class, with an indefinite transition to the *coloni* farms. The political élite can be found among these roughly forty-five *patres familias* out of a total of 200. The number of adult males would be rather larger, but the potential political influence was in the hands of about 22% of the adult male population.

Bibliography

- Ampolo, Carmine and Pucci, Guiseppe* (eds.) (1987), *La cité antique? À partir de l'oeuvre de M. I. Finley*, Opus VI-VIII (1987-1989)
- Amouretti, M.-C. and Brun, J.-P.* (eds.) (1993), *La production du vin et de l'huile en Méditerranée*, in: *Bulletin de correspondance Hellénique*, Suppl. XXVI (Paris 1993)
- Amouretti, M. C.* (1986), *Le pain et l'huile dans la Grèce antique* (Paris)
- Babelon, E., Cagnat, R. and Reinach, S.* (1893), *Atlas archéologique de la Tunisie*, 1^{er} sér., (Paris 1893-1913)
- Baradez, Jean* (1949), *Vue-aérienne del'organisation Romaine dans le Sud-algerien. Fossatum Africae* (Paris)
- Barker, Graeme and Lloyd, John* (1991), *Roman Landscapes. Archaeological Survey in the Mediterranean Region* (Archaeological Monographs of the British School at Rome, no. 2, London)
- Cagnat, R.* (1884), *Explorations épigraphiques et archéologiques en Tunisie*, II. fasc. (Paris)
- Caillemer, A.* (1954 a), *Les centuriations romaines de Tunisie* (Paris)
- Caillemer, A. and Chevallier, R.* (1954 b), *Les Centuriations de l'Africa vetus*, in: *Annales E.S.C.* 9 (1954) 433-60
- Caillemer, A. and Gauckler, P.* (1898), *Les monuments historiques de la Tunisie*, 1^e partie: *Les temples païens* (Paris)
- Caillemer, A.* (1902), *Les limites de l'Afrique Proconsulaire et de la Byzacène*, in: *Klio* 2 (1902)
- Caillemer, A. and Merlin, A.* (1914), *Atlas archéologique de la Tunisie*, 2^e sér. (Paris 1914-1926 AAT)
- Camps-Fabrer, H.* (1953), *L'olivier et l'huile dans l'Afrique romaine* (Algiers)
- Carlsen, Jesper and Tvarnø, Henrik* (1989), *The Segermes Valley Archaeological Survey, l'Africa romana. Atti des VII convegno di studio* (Sassari)
- Despois, Jean* (1955), *La Tunisie orientale. Sahel et basse steppe* (Paris)
- Dietz, Søren* (1995 a), *Bebyggelsesstudier i et romersk landskab – Segermes i Nordafrika*, in: *Klassiske arkæologiske studier* 2 (1995)
- Dietz, Søren, Sebaï, Ladjimi and Ben Hassen, Habib* (1995 b), *Africa Proconsularis. Regional studies in the Segermes valley of Northern Tunisia*, Vol. I-II (Copenhagen)
- Dietz, Søren* (1977), *The ancient city from Fustel de Coulanges to Max Weber and beyond*, in: *Comparative studies in society and history* 19 (1977)
- Duncan-Jones, Richard* (1974), *The Economy of the Roman Empire. Quantitative studies* (Cambridge)
- Finley, Moses I.* (1973), *The ancient Economy* (London)
- Foucher, Louis* (1964), *Hadrumetum* (Paris)
- Foxhall, L. and Forbes, H. A.* (1982), *Sitometreia: The role of Grain as Staple Food in Classical Antiquity*, in: *Chiron* 12 (1982)
- Gabrielsen, Vincent* (1991), *The Athenian Trierarchy* (Odense)
- Garnsey, Peter* (1988), *Famine and food supply in the Graeco-Roman World -response to risk and crisis* (Cambridge)
- Gascoü, Jean* (1972), *La politique municipale de l'empire romain en Afrique Proconsulaire de Trajan à Septime-Sevère* (Rome)
- Gascoü, Jean* (1982), *La politique municipale de Rome en Afrique du Nord*, in: *ANRW* II, 10, 2 (1982)
- Gauckler, M. P.* (1897), *Enquête sur les installations hydrauliques romaines en Tunisie* (Tunis 1897-1912)
- Ghalia, T.* (1994), *Au pays de l'Enfida* (Tunis)
- Hopkins, Keith* (1978), *Conquerors and Slaves* (Cambridge)
- Hopkins, Keith* (1980), *Taxes and trade in the Roman Empire*, in: *JRS* 70 (1980) 101-125
- Jongman, Willem* (1988), *The Economy and Society of Pompey* (Amsterdam)

- Lassère, Jean-Marie* (1977), *Ubique populus* (Paris)
- Lepelley, Claude* (1979), *Les cités de l'Afrique romaine au bas-empire* (Paris 1979–1981)
- Leveau, Philippe* (1983), La ville antique et l'organisation de l'espace rural: Villa, ville, village, in: *Annales E.S.C.* 4 (1983)
- Leveau, Philippe* (1984 a), Caesarea de Maurétanie, une ville romaine et ses campagne (Rome)
- Leveau, Philippe* (1984 b), La question du territoire et les sciences de l'antiquité. La géographie historique, son evolution de la topographie à l'analyse de l'espace, in: *REA LXXXVI* (1984)
- Leveau, Philippe* (1986), Occupation du sol, géosystemes et systemes sociaux. Rome et ses ennemis des montagnes et du désert dans le Magrebh antique, in: *Annales ESC* 6 (1986) 1345–1358
- Lund, John and Wriedt Sørensen, Lone* (1988), Vejen til Segermes. Nationalmuseets Arbejdsmark 9–23
- Mattingly, David* (1988 a), *Olea mediterranea?*, in: *JRA* 1 (1988)
- Mattingly, David* (1988 b), Oil for Export, in: *JRA* 1 (1988)
- Mattingly, David* (1988 c), The olive boom. Oil surpluses. Wealth and power in Roman Tripolitania, in: *Libyan Studies* 19 (1988)
- Mattingly, David* (1991), The field survey: Strategy, methodology, and preliminary results, in: *JRA* 4 (1991)
- Mattingly, David* (1994), Regional variation in Roman Oleoculture. Some problems of Comparability, in: *Carlsen, Jasper, Skydsgaard, Jens Erik and Ørsted, Peter* (eds.), *Landuse in the Roman Empire* (Rome)
- Mattingly, David and Hitchner, B.* (1995), Roman Africa: An archaeological review, in: *JRS* 985 (1995) 165–214
- Ørsted, Peter* (1985), Roman imperial economy and romanization (Copenhagen)
- Ørsted, Peter* (1990), Municipales et économie régionale, le programme de recherche Tuniso-Danois dans le bassin de Segermes, in: *Andreau, J. and Ørsted, P.* (eds.), *Models of regional economies in antiquity and the middle ages* (Proceedings, 10th international economic history congress, Louvain)
- Ørsted, Peter et alii* (1992), Town and Countryside in Roman Tunisia, in: *Journal of Roman Archaeology* 5 (1992)
- Ørsted, Peter* (1993), Historie og arkæologi i det romerske imperium. Project Africa Proconsularis, in: *Historisk Tidsskrift* 93,1 (1993)
- Ørsted, Peter* (1994), From Henchir Mettich to the Albertine Tablets, in: *Carlsen, Jesper, Skydsgaard, Jens Erik and Ørsted, Peter* (eds.), *Landuse in the Roman empire* (Rome)
- Ørsted, Peter* (1998), Aménagement et dynamique territoriale dans le bassin de Segermes (Tunisie) à l'époque Romaine, in: *Antiquités Africaines* 34 (1998)
- Peyras, Jean* (1975), Fundus Aufidianus, in: *Ant. Afr.* 9 (1975)
- Peyras, Jean* (1983), Paysages agraires et centuriations dans le bassin de l'oued Tine, in: *Ant. Afr.* 19 (1983) 209–253
- Peyras, Jean* (1991), Le Tell Nord-est Tunisien dans l'antiquité (Éditions du CNRS, Paris)
- Poncet, Jean* (1961), La Colonisation en Tunisie depuis 1881 (Paris)
- Sebaï, Ladjimi* (ed.) (1990), Zaghuan et sa region. Présentation historique (Zaghuan)
- Shaw, B. D.* (1981), Climate, environment and history, in: *Wigley, Tom M. L., Ingram, M. J. and Farmer, G.* (eds.), *Climate and history* (Cambridge)
- Shaw, B. D.* (1982), Lamasba: an ancient irrigation community, in: *Ant. Afr.* 18 (1982)
- Shaw, B. D.* (1984), Water and society in the ancient Maghrib: technology, property and development, in: *Ant. Afr.* 20 (1984)
- Trousset, Pol* (1977), Nouvelles observations sur la centuriation a l'est d'El Jem, in: *Ant. Afr.* 11 (1977)
- White, K. D.* (1965), The productivity of labour in Roman Agriculture, in: *Antiquity* 39 (1965)
- White, K. D.* (1970), *Roman Farming* (Oxford)