NO. XVIII / 2015 ISSN 1301-2746

ADALYA

(AYRIBASIM/OFFPRINT)

SUNA-İNAN KIRAÇ AKDENİZ MEDENİYETLERİ ARAŞTIRMA ENSTİTÜSÜ
SUNA & İNAN KIRAÇ RESEARCH INSTITUTE ON MEDITERRANEAN CIVILIZATIONS

ADALYA

SUNA-İNAN KIRAÇ AKDENİZ MEDENİYETLERİ ARAŞTIRMA ENSTİTÜSÜ YILLIĞI
THE ANNUAL OF THE SUNA & İNAN KIRAÇ RESEARCH INSTITUTE ON MEDITERRANEAN CIVILIZATIONS

ADALYA
Vehbi Koç Vakfı
Suna-İnan KIRAÇ Akdeniz Medeniyetleri
Araştırma Enstitüsü Yıllık Dergisi
Yönetim Yeri: Barbaros Mh. Kocatepe Sk. No. 25
Kaleiçi 07100 Antalya Tel: +90 242 243 42 74
Faks: +90 242 243 80 13 E-posta: akmed@akmed.org.tr
Yayın Türü: Yerel Süreli Yayın ***Sayı:*** XVIII - 2015
Yayıncı Sertifika No: 25840

Sahibi: Vehbi Koç Vakfı Adına Erdal YILDIRIM
Sorumlu Müdür: Kayhan DÖRTLÜK
Yapım: Zero Prodüksiyon Ltd.
Abdullah Sokak No. 17 Taksim 34433 İstanbul
Tel: +90 212 244 75 21 www.zerobooksonline.com
Baskı: Oksijen Basım ve Matbaacılık San. Tic. Ltd. Şti.
100. Yıl Mah. Matbaacılar Sit. 2. Cad. No: 202/A Bağcılar-İstanbul
Tel: +90 (212) 325 71 25 Fax: +90 (212) 325 61 99
Sertifika No: 29487

ISSN 1301-2746

Adalya, **A&HCI** (*Arts & Humanities Citation Index*) ve
CC/A&H (*Current Contents / Arts & Humanities*) tarafından taranmaktadır.

Adalya *is indexed in the* ***A&HCI*** (*Arts & Humanities Citation Index*) *and*
CC/A&H (*Current Contents / Arts & Humanities*).

Hakemli bir dergidir / *A peer reviewed Publication*

Yazışma Adresi / *Mailing Address*
Barbaros Mah. Kocatepe Sk. No. 25
Kaleiçi 07100 ANTALYA-TURKEY
Tel: +90 242 243 42 74 • Fax: +90 242 243 80 13
akmed@akmed.org.tr
www.akmed.org.tr

Vehbi Koç Vakfı

İçindekiler

ADALYA XVIII, 2015

The Scale of Sagalassos Red Slip Ware Production - Reconstructions of Local Need and Production Output of Roman Imperial Tableware

Rinse WILLET – Jeroen POBLOME*

Introduction

At the site of Sagalassos, located in southwestern Asia Minor in the ancient region of Pisidia, evidence for the production of tableware during Roman Imperial times has been accumulated during the past decades through archaeological research[1]. The tableware produced here (Sagalassos Red Slip Ware or SRSW), was found on sites both in and around the territory of the ancient town, at a range of inner Anatolian sites, but also as far away as Aquileia (Italy), Carthage (Tunisia), Lepcis Magna (Libya), Hermopolis Magna (Egypt), Hama (Syria) and Tel Anafa (Israel)[2]. The scale and importance of this export of SRSW to these faraway (but also closer) markets are hitherto difficult to define due to a lack of quantified data on ceramic assemblages. Yet, judging from the representation of production infrastructure in the townscape, the scale of the ceramic production at Sagalassos seems substantial for a town of relatively modest size. Therefore, we need to wonder: why did Sagalassos initiate production in Roman Imperial times beyond the Hellenistic local scale; why was it apparently necessary to devote a large area within eastern suburbium to the production of mainly SRSW; and did this production play a significant role for the local economy and thereby contributed to the development of Sagalassos as a monumentalised city?[3]. Previously, the introduction of SRSW production was tentatively linked to wider effects of the founding of a string of official, Augustan *coloniae* in the wider region, possibly invoking a growth in demand for tableware in the region of Pisidia and/or linked to a pattern of associated regional demographic growth[4]. In the same early Imperial period, new parts could have been added to the territory of Sagalassos, thereby

* Dr. Rinse Willet, Institute of History - Leiden University, Postbus 9515, 2300 RA Leiden. The Netherlands. E-mail: r.willet@hum.leidenuniv.nl

Prof. Dr. Jeroen Poblome, Department of Archaeology - University of Leuven Blijde Inkomstraat 21/3314, 3000 Leuven, Belgium. E-mail: jeroen.poblome@arts.kuleuven.be

The research for this paper was supported by the CORES network of the Belgian Programme on Interuniversity Poles of Attraction (http://iap-cores.be/), the Research Fund of the University of Leuven (GOA 13/04), and Projects G.0562.11 and G. 0637.15 of the Research Foundation Flanders (FWO).

1 Poblome in press.

2 Poblome 1999, 25, 339; Poblome 2008, 207, fig. 4; M. Bonifay, personal communication January 2013.

3 Poblome 2013 *et al*., 88-93.

4 Poblome 1999, 314.

reaching its maximum extent[5]. Unpublished evidence produced by intensive surveys in the Ağlasun Valley indicates that this was also the period of lowest archaeological representation, possibly hinting at processes of urban nucleation. Clearly, the investment made into the potter's craft at Sagalassos in this period should not be linked to one or other incentive, but aspects of growing territorial impact and demographical change could have provided positive feedback mechanisms.

At the moment, the data on SRSW found at other sites is too sporadic to deduce the scale of export and its significance for the economic development of Roman Imperial Sagalassos, although future research will hopefully shed more light on this. This paper proposes to approach matters the other way round, by extrapolating direct demand for these products at Sagalassos and within its territory, relying on archaeological proxies, and comparing these with a reconstruction of the artisanal output of the pottery workshops producing SRSW at Sagalassos. Before proceeding, it is necessary to set the scene for Sagalassos, SRSW production and its economic potential. This is done by sketching the natural setting of the site and the historical framework for the city, its territory and the wider region, in which special emphasis is placed on factors which may have influenced the demand for SRSW. This is followed by a reconstruction of urban and territorial population levels, since these will have constituted potential consumers of SRSW. Next, the production and output of SRSW is outlined, which is to be compared with the potential local demand.

Sagalassos in its natural and historical context during Roman Imperial times

The ancient city of Sagalassos is situated on the slopes of the western Taurus Mountains at *c.* 90 km to the north of modern Antalya on altitudes between 1,490 m and 1,600 m above sea level (Fig. 1). Overlooking the valley of the modern town of Ağlasun to the south and (further southward) the plain of the village of Çanaklı, the terrain in the direct vicinity of Sagalassos is fertile and rich in water sources with a cold and sub humid Mediterranean climate, featuring wet winters and dry summers[6]. The territory of the town stretched beyond these valleys, however and, based on epigraphical documents including border stones and topographical observations in the field, the territory at its largest extent during Roman Imperial times measured *c.* 1,200 km^2 [7]. In terms of connectivity, Sagalassos lacked access to navigable waterways and only had indirect access to the *Via Sebaste*, which was constructed from *c.* 6 BC onwards. Although this road passed through the territory of Sagalassos, it did not pass the city proper. In that sense, Sagalassos does not seem an ideal candidate for production aimed at export, if traditional paradigms on costs of land transport are the determinants for economic activity[8].

Sagalassos became incorporated in the Roman Empire after 25 BC as part of the *provincia Galatia*, during which time the city expanded and potentially its population grew possibly following processes of nucleation. A scenario of colonization in Pisidia followed, in which a series of *coloniae* (Antiocheia pros Pisidian, Kremna, Parlais, Olbasa, Komana) were founded for veterans of Augustus' and Marc Anthony's legions, of which Antiocheia pros Pisidian was the largest at 46.5 ha[9]. Veterans were settled in existing cities as well (Kremna, Apollonia,

5 Waelkens *et al.* 1997, 54-56.

6 Steegen *et al.* 2000, 636; Paulissen *et al.* 1993, 231-233; Waelkens - Degryse 2003, 18-19.

7 Waelkens *et al.* 1997, 11-102; Waelkens *et al.* 2000, 17-216; Waelkens *et al.* 2003, 60-62; Waelkens - Poblome 2011, 11; Kaptijn *et al.* 2012.

8 Levick 1967, 38-39; Finley 1999; Waelkens - Poblome 2011, 60-61.

9 Levick 1967, 63; Mitchell 1993, 70-79.

Neapolis, Isaura, Attaleia). The settlement of veterans and their families will have added to the existing population in number, which will have caused an increase in the demand for (amongst other products) tableware, since these red slipped vessels slowly had become part of the many people's lives during the second and first centuries BC and first century AD[10]. Barbara Levick suggested that *c.* 9,500 male colonists were settled in the new *coloniae*, on the basis of ancient sources, the size of the *coloniae* and epigraphic and numismatic evidence[11]. Levick uses the factor of 3 1/3 to calculate the total population from these figures (*c.* 32,000 colonists), although if a factor 5 is used, as for example Anthony Snodgrass and John Bintliff did for the demographic modelling of ancient Boeotia[12], the resulting influx would be *c.* 47,500 newcomers. These grand total figures assume, of course, that veterans brought with them family and entourage, which may not necessarily have been the case. Ramsay MacMullen suggests a total of between 40,000-60,000 veterans for the colonies of the Roman East in total, which would have had a serious demographic impact, albeit with the qualifier that Asia Minor was already heavily urbanized[13]. Although the exact figure remains elusive, scholars seem in general agreement that a significant influx of people took place in early Imperial Pisidia (Fig. 5).

Sagalassos enjoyed a period of prosperity under the *Pax Romana* and the city would grow beyond the Hellenistic city walls during the first to third centuries AD, reaching its largest size of *c.* 37.5 - 40 ha (= the area enclosed within the necropoleis of the city during Roman Imperial times; excluding the eastern suburbium, where no residential area has been attested, the urban area measures *c.* 31 ha. On the basis of the urban survey and the measurements of known public spaces, an estimated 25.22 ha was residential area)[14]. By the end of the Severan period, the construction of public monuments stopped at Sagalassos, while, about a century later, Diocletian instated Antioch pros Pisidian as capital of the newly organised *provincia Pisidia*, possibly resulting in the loss of some centralised functions for Sagalassos. Around AD 400, new defences were erected at Sagalassos, enclosing 12.8 ha of the city, although it continued to occupy an area of 31.5 ha (=occupied area based on the urban survey) until the middle of the sixth century, as indicated by pottery-distributions found by intensive urban surveys[15]. The urban archaeological survey material seems to indicate much lower occupational activity during the last phase of occupation of the later sixth and seventh centuries AD[16].

The population levels of Sagalassos and its territory

Reconstructions of ancient population levels are notoriously difficult due to a lack of proper demographic statistics for Roman times and the authors are well aware of the limitations imposed by the data[17]. However, an estimate on the urban and rural population can give a sense on the deficit, surplus or adequacy of artisanal production output in relation to local potential need. Naturally, these figures cannot hope to be more accurate than ranges.

---

10 Poblome - Zelle 2002.

11 Levick 1967, 93-95.

12 Snodgrass - Bintliff 1985, 49-70.

13 Macmullen 2000, 9-10.

14 Vanhaverbeke - Waelkens 2003, 247; Poblome 2006a, 201-207; Martens *et al.* 2008, 137; Martens 2004, 330; Waelkens - Poblome 2011, 59, 102-103; Mitchell 1999, 432-433.

15 Martens *et al.* 2008, 138; Poblome 1995, 194; Waelkens - Poblome 2011, 147-157.

16 Martens *et al.* 2008, 139.

17 Willet 2012.

A standard method is applying an assumed population density on the urban surface area in order to obtain a population estimate. Using the residential area of the city (25.22 ha), a population level of 2,500 - 3,750 people for the city is derived, based on a population density of 100 - 150 people per hectare[18]. Both John Bintliff and Mogens Hansen apply population densities for population level reconstructions on Classical *poleis*, although their models use total urban space of which the residential area is estimated[19]. For instance, Bintliff assumes in his model that 56 percent of the urban surface area (commonly demarcated by a city wall for the *poleis*) was used for residential purposes with a population density of 225 people per hectare, whereas Hansen assumes 50 percent was used for 'medium sized poleis' with a density of 150 people per hectare. For Sagalassos (37.5 ha), these percentages result in residential areas below the estimated 25.22 ha, although the resulting population estimates are broadly overlapping: *c.* 2,800 inhabitants to *c.* 4,700 inhabitants[20].

A recent assessment of a multitude of archaeological projects by Simon Price, suggests a lower density of 40-60 people / hectare for unplanned towns and for planned cities 110 people / ha. An orthogonal street-grid is lacking at Sagalassos, which is a typical feature for planned cities founded *ex novo*. The topography of the urban area, located on a mountainside may have prohibited the implementation of a regular grid, but equally possible is that the long history of the city may have caused a more organically developed city. On the other hand, the Augustan expansion of the city towards the east on the other hand seems more regular. If it is assumed that Sagalassos for the most part developed organically (and a lower population density is assumed), then the population levels are much lower, between 1,500-2,250 inhabitants[21].

The archaeological evidence of the houses corroborates a lower figure: the Sagalassos Project recently inventoried the number of houses in a quarter of the city, which was explored using geophysical and archaeological prospection and partly by excavation. For an area of 8.7 hectares, 92 houses were counted, which, when extrapolated to urban area, excluding the eastern suburbium (some 31 ha) results in 328 houses. From tax records in Roman Egypt, Roger Bagnall and Bruce Frier deduced that the average size for a household of the lowest class in cities was between 4.04 and 5.31 persons[22]. These figures constitute the only 'hard' evidence on ancient household sizes. At the same time, elite housing is clearly manifest in the urban mansion, so this must be taken into account as well. At the 3rd century BC city of Cosa (a planned Roman colony) in Italy, some 24 larger houses and 224 smaller houses were discovered, whereby the larger houses are assumed to have belonged to the local elite, which had a larger household of between 10-12 people[23]. If this ratio is employed for Sagalassos, i.e. 30 larger houses for the elite (10-12 people/household) and 298 houses for the lower classes (4-5 people per household), the number of inhabitants ranges 1,492-1,850.

---

18 Martens 2004, 330.

19 Bintliff 1997, 235; Hansen 2006, 61.

20 The former figure on the basis of Hansen 2006; the latter on the basis of Bintliff 1997. It must be noted that if for Sagalassos the area is used including the space of the necropoleis (resulting in an estimated total of 90 ha), a higher figure for residential area results. However, the methods by Bintliff and Hansen use the urban area, often demarcated by the city wall, which should not include necropoleis *etc.* located outside the urban area proper.

21 Price 2011, 23.

22 Bagnall - Frier 1994, 68.

23 Fentress - Badel 2003, 24; de Ligt 2012, 220.

Although these two calculations match, it is necessary to remain cautious, as the excavations in the residential area of Sagalassos are still ongoing. A slightly higher figure is possible, since other Roman cities, such as Pompeii, seem to have been dominated by elite housing[24]. Still, a figure below 5,000 inhabitants is probable and furthermore a population of significantly less than 10,000 people for Sagalassos seems a reasonable proposition in the light of other cities and their sizes in Antiquity as well[25]. For current purposes, a conservative size estimate of 1,500 - 5,000 people is used, based on observations on the size of the residential area (Fig. 5). The size of public buildings at Sagalassos, such as the Theatre, the Roman Baths or the nymphaea, are dubious demographic indicators, as they were part of the urban façade intended to impress both local dwellers and visitors alike[26].

Furthermore the agricultural carrying capacity of the primary catchment area of Sagalassos, which consisted of the *c.* 29 km^2 area of the Ağlasun and Yeşilbaşköy valleys. Although various methods for calculating agricultural carrying capacity exist, some assuming the amount of land needed per family of 5[27]. while others calculate the agricultural yield and calorific need per person per year[28], all indicate a sustained population of *c.* 2,000-4,500 people. This figure does not include the potential influx of agricultural products from the wider territory of Sagalassos (*c.* 1,200 km^2).

The 1,500-5,000 inhabitants constitute the urban people, who did consume SRSW products in large numbers, as attested in the urban excavation and survey programs. Yet, as indicated by the extensive territorial survey program, the people living in the territory of Sagalassos also bought these plates, dishes, bowls, cups and containers either directly in the city, from travelling peddlers, from periodic markets and fairs or potentially even local traders[29]. Since the territory of Sagalassos is sizable, it is necessary to attempt an estimate of its population, before anything meaningful can be said on the role of export of SRSW.

As stated above, the territory of Roman Imperial Sagalassos measured 1,200 km^2. Methods to establish the rural population or territorial population are often based on models for settlement hierarchy of a region, from which a ratio between urban and rural population is derived. Methods developed by both John Bintliff and Mogens Hansen to reconstruct the populations of *poleis* employ a ratio of 4:1 and 2:1 respectively for urban population:rural population[30]. Recent work on Roman Italy by Luuk de Ligt, Peter de Graaf and John Bintliff has revealed that its countryside was more populated and that the role for large urban centres was smaller[31]. Urbanization rates of 10-25 % (1:9 or 1:3) are proposed as an alternative model for the Roman world. If these ratios are applied to Sagalassos the following calculations can be made:

(Bintliff 1997) 1,500 - 5,000 urban population -> 4:1 -> 375 – 1,250 rural population - > 1,875 - 6,250 total population -> 1.6 – 5.2 people / km^2 population density

---

24 Zanker 1998.

25 Compare Grainger 2009, 234, where only the larger coastal cities of Side and Attaleia in neighbouring Pamphylia have an estimated population over 10,000; Levick 1967, 94 mentions 2,500-7,500 for Antiocheia pros Pisidia, which measured 46.5 ha intramural (Mitchell - Waelkens 1998, 99-100) Compare furthermore Kolb 1984, 191; de Ligt 2012

26 Duncan-Jones 1982, 262; Engels 1990, 179-181; Alcock 1993, 96-97; Willet 2012, 151-153.

27 Angelis 2000; Bintliff 2002.

28 Engels 1990; Garnsey 2004.

29 de Ligt 1993; Bang 2008.

30 Bintliff 1997, 235; Hansen 2006, 22, 43, 65; In a personal communication with J. Bintliff, a ratio of 7:3 was suggested.

31 de Graaf 2012, 91-92.

(Hansen 2006) 1,500 - 5,000 urban population -> 2:1 -> 750 – 2,500 rural population - > 2,250 - 7,500 total population -> 1.9 - 6.25 people / km^2 population density

(de Ligt, de Graaf, Bintliff) 1,500 - 5,000 urban population -> 1:3 - 1:9 -> 4,500 - 45,000 rural population - > 6,000 - 50,000 total population -> 5 – 41.7 people / km^2 population density

If the population densities resultant from Bintliff's and Hansen's methods for Classical cities are compared with estimates for Roman Anatolia by Bruce Frier and Walter Scheidel at 14-15 people / km^2, either this region had a relatively low population density, or these models are erroneous for Roman Imperial Sagalassos, with the possible exception of the third method, which in its higher outcomes results in a density nearly three times as high. (Fig. 5)[32].

The extensive archaeological survey conducted from 1993 to 1996 in the territory of Sagalassos, revealed an increase in the number of sites during Roman times in comparison to the preceding Hellenistic period and already indicated that the Roman Imperial territory was far from empty (41 larger sites (10,000+ m^2), which have been interpreted as local centres or villages, and 27 smaller sites, interpreted as farms for the Imperial period (late first century BC until mid-fifth century AD)[33]. Furthermore, several other factors also indicate human agricultural activity within the territory, as indicated by the presence of ancient press weights and by the palynological evidence which suggests intense agricultural activities during the first three centuries AD[34]. Furthermore, geomorphological evidence suggests increased sedimentation and erosion throughout the territory, suggesting deforestation, possibly as a result of human land-clearance by fire[35]. All these physical attributes of the landscape are not necessarily compatible with an image of a sparsely populated region. Furthermore, historical sources seem to attest a (comparatively) densely populated region as well. Livy (*Ab urbe condita libri* 38.15) mentions the region of Sagalassos during the early second century BC as being rich in all kinds of fruit, hinting at the fertility of the region (possibly referring to a situation after the second century, since Livy wrote almost two hundred years later). Justinian's *Novella* (XXIV, 1) (around AD 535-536) refers to the very populous villages of Pisidia[36]. In terms of modern comparanda, the estimated population densities are similar to the least densely populated countries in the world, such as Algeria, Sudan, Belize, Argentina, Paraguay, Uruguay, Finland, Norway and New Zealand for 15-20 people / km^2 or Botswana, Mauritania, Namibia, Canada, French Guiana, Guyana, Suriname, Kazakhstan, Mongolia, Iceland, Australia for a population density between 2.6 - 6 people / km^2 [37]. Today, Sagalassos is situated in a region of 67 people / km^2, higher than the highest outcome of the calculations above[38].

In the view of the authors, this puts much doubt on the low outcomes of Bintliff's and Hansen's models. The adjusted model by de Ligt, Bintliff and de Graaf seems to compare better, albeit still on the low side. A higher urban population for Sagalassos (*e.g.* 5,000 people) results in a higher range (15,000 - 45,000 rural pop.; 20,000 - 50,000 total pop.; 16.7 – 41.7

32 Frier 2000, 812; Scheidel 2007, 48.

33 Vanhaverbeke - Waelkens 2003, 241-246.

34 Bakker *et al.* 2012, 259.

35 Six 2004; Kaniewski *et al.* 2008.

36 Mitchell 2000, 145.

37 Compare map 1.1 of Eurostat Regional Yearbook 2010 or table 3 of the United Nations Demographic Yearbook 2010 & 2013.

38 Eurostat regional yearbook 2010, map 1.1; Note that the sizeable city of Antalya is incorporated in this region.

people / km^2 population density)[39]. Frier's and Scheidel's estimates for Roman Anatolia, with an overall population density of 15 people / km^2 would imply a total population of 18,000 for the territory of Sagalassos. John Grainger uses the more or less arbitrary figure of 200 people / km^2 for the *chorai* of the Pamphylian cities, although this must be too high for antiquity[40].

This all demonstrates that the application of a model developed for a different region and a different epoch can be problematic, as the modern *comparanda* demonstrate. The evidence for intensity of agriculture and scale of deforestation in the territory of Sagalassos seem to stand in sharp contrast with the rainforests of Suriname or the steppes of Mongolia. Only the model which assumes a higher ruralisation provides reasonable figures in terms of population density.

Recent work on the mitochondrial DNA of the human skeleton material excavated at Sagalassos, seems to suggest a population in the tens of thousands in the territory of Sagalassos, based on modelling the variation and changes in the gene pool[41]. Furthermore, preliminary calculations of the agricultural carrying capacity of the entire territory of Sagalassos suggest a population of 40,000 can be sustained, under optimal circumstances[42]. Being aware of the problematic nature of all these models, a cautious estimate for a total population (urban + rural) range between 6,000 and 25,000 is used.

The local market for Sagalassos Red Slip Ware

On the basis of these data concerning the total population in the city and territory of Sagalassos an estimate can be made of the local need for SRSW[43]. The first parameter in this estimate is the life-cycle in primary use of tableware, for which J. Theodore Peña's range of 3 years (based on archaeological inference and references provided from ethnography or ancient testimonies) is used as a lower limit and the generational shift of a household as proposed by Hansen (based on ancient sources) as the upper limit (30 years)[44]. The latter's estimate on the average dynamic urban household is adopted for the size of the household (3-7 members), which forms the second parameter. The need for red slipped tableware per household cannot be easily ascertained, due to lack of relevant published deposits. Therefore, in this exercise a range of vessels per household (1-10 vessels) is used for the sake of argument[45].

---

39 Waelkens - Poblome 2011, 59.

40 Grainger 2009, 234, which results in the much larger city (49 ha) and smaller territory (600 km^2) of Perge having 70,000 inhabitants. Following his population densities (200 people per ha urban and 200 people per km^2 rural) a total population of 245,044 people for Sagalassos, larger than optimistic estimates for Pergamon (see below). For Antiocheia pros Pisidian, 50,000 inhabitants were estimated based on a 1950 census; Mitchell – Waelkens 1998, 3. However, this city is larger and its territory is much less mountainous, more arable and *c.* 200 km^2 larger than Sagalassos.

41 Ottoni *et al.* forthcoming.

42 Personal Communication M. Van Loo and G. Verstraeten.

43 A similar methodology was employed in 2011 and 2013 by the authors to circumscribe the total amount of tableware which was produced for the Roman east. Willet - Poblome 2011 provides more background on these calculations; Poblome 2013 contrast theoretical pottery consumption rates with actual archaeological assemblages; an adapted version of this methodology is used here, relying on several assumptions with a large margin of error.

44 Hansen 2006, 43; Peña 2007, 58, 331.

45 Allison 2010, 24; In a personal communication of early 2010, P. Allison noted that information on the number of vessels per household is very sparse, with 8 vessels of terra sigillata in the Casa di Julius Polibius in Pompeii being considered representative (Pompeian Households: An On-Line Companion - http://www.stoa.org/projects/ph/home), while the 52 domestic contexts in the ICRATES-database (Inventory of Crafts and Trade in the Roman East - http://icrates.arts.kuleuven.be/icrates/) contain on average *c.* 9 vessels of tableware. Pompeii is not an ideal comparison, as the city had to import its tableware and demand may have risen as more products were available, such as at a producer site as Sagalassos, yet it still constitutes one of the few closed archaeological contexts of primary deposition.

This is a simplification, since it does not take any variation within this broad category of 'tableware' into account. Yet what is presented here is an attempt to estimate the possible range of a yearly need for tableware for which generalizations are necessary. The results from these calculations should not be regarded as absolute figures, but rather as a first attempt to demarcate the yearly need for ceramic tableware for the total population living in the territory of Sagalassos.

Need Roman ceramic tableware = (population / size of the household) * no. vessels needed per household * (need per year)

Minimum Need Roman ceramic tableware = (6,000/7) * 1 * (1 / 30) = 28 vessels per year

Maximum Need Roman ceramic tableware = (25,000/3) * 10 * (1 / 3) = 27,778 vessels per year

This is obviously a large range and with the current state of research of the demographics in the region, there is no hope to be more accurate. At this point, calculations have to rely on assumptions of life-span of the vessels, the amount of people living in a typical household in the region *etc*. Already we can reason that the lowest estimate (28 vessels per year) must be too low, since such a demand would probably not suffice for even a single specialised workshop to make a livelihood, unless the vast majority of the production is intended for export. The high count (27,778 vessels per year) is not only reliant on a higher population estimate, but also on a rather high yearly consumption rate of vessels. As mentioned in the previous discussion, the total population levels are not very well known. A further study on the wear and tear of SRSW in combination with micro-stratigraphical research may narrow down the life-cycles of primary use. The size of the household can be further approached by focusing on a variety of houses, including non-elite residences at Sagalassos and in its territory. As to the number of vessels needed per household, closed contexts of primary deposition need to be located and quantified. These are rare in the world of archaeology at large and, so far, non-existent at Sagalassos for the first centuries AD. Comparanda, such as Pompeii, even though this city had to import its tableware, are helpful to a certain extent, although ideally changes in shape, size and usage of the red slipped tableware will need to be incorporated in this figure as well[46]. A range of options rather than a single figure is therefore a more potent solution. This range, which incorporates a consciously chosen yet well-defined margin of error, represents an estimate for the need for SRSW in the territory of Sagalassos, based on scholarly accepted yet critically reviewed parameters. The next step is to proceed reconstructing the output of SRSW production at Sagalassos, starting with a very brief overview of the evidence, output of SRSW over time and the area devoted to its production.

The production of SRSW

Although the Hellenistic potters' quarter was recently located underneath and east of the later, Roman Imperial Odeon, the remains of clustered workshops and their activity in the Potters' Quarter (PQ), located to the east of the Theatre, constitute the most significant evidence for SRSW production during Roman Imperial times[47]. The PQ is located on a plateau to the north east of the city and is nowadays considered as part of eastern suburbium of Sagalassos with

[46] Hudson 2010; Willet - Poblome 2011, 104.

[47] Poblome *et al.* 2013.

recent excavations indicating other, non-industrial activities in the area as well. Although other crafts have been attested at Sagalassos (glass production in the early Byzantine phase; bone-working; textile production as indicated by epigraphic evidence; lime burning as a final use for some of the pottery kilns excavated in the PQ; iron working has been attested on the Upper Agora), none have been specifically linked with the Roman Imperial phase of the PQ[48]. At the moment, it is assumed that pottery production was the mainstay of artisanal activity at the PQ. The evidence for this was first encountered (in the form of dumps of wasters) during the initial surface survey in 1987 and excavations, starting in 1989 and continuing to this day, augmented by geophysical survey of the area, have revealed several workshops, kilns, tools and concentrations of dumped ceramics in the PQ, associated with the production of SRSW with no other produced wares being attested[49]. Archaeometric studies indicated that the clay for the fabric of SRSW was mostly obtained from a source northwest of the village of Çanaklı, whereas the clay for the slip was obtained from ophiolitic clays in the PQ, although Lake Burdur and an unknown source were attested as well. The evidence for fuels is sparse[50].

The production of SRSW started in the Augustan period and possibly *in tandem* with the expansion of the city, the production of ceramics shifted away from its Hellenistic location towards the newly installed PQ, as indicated by workshops and kilns found on its eastern and northern slopes. If all SRSW rim sherds are plotted, using a Gaussian data distribution method[51], an exponential growth of SRSW distribution at Sagalassos (and thereby presumably output of production as well) seems to take place during Flavian times, peaking during Antonine times (Fig. 2). There is a decline in the third and fourth centuries and resurgence in the fifth century. The area of the PQ was used for pottery production into the sixth century AD, albeit not on the same large scale[52]. During the seventh century AD, no production is attested in this area, while the tableware continued in production at unknown locations.

Continued excavations as well as the completed geophysical programme indicated the area of the PQ to have measured 3.5-4 ha, forming part of the 6 ha eastern suburbium. Still, considering the total estimated city surface area of 37.5-40 ha, it is remarkable that *c.* 10 percent of the area of the city was devoted to the production of SRSW, even if it is not possible to determine the diachronic development of the size of the PQ with accuracy.

Output of SRSW production

The next step is to reconstruct the potential total output of the pottery workshops at Sagalassos. Some reservations must be made before continuing. At the moment eight (five in the Coroplast area, two on the east Slope, one in Site F) workshops have been excavated in the PQ[53]. Our knowledge on the presence of other workshops in the area is founded on the presence of 'kiln' anomalies and associated walls of workshop complexes indicated by geophysics (magnetometry, although Ground Penetrating Radar and electrical resistivity measurements also saw limited application) and by the large quantities of surface-finds (sherds, wasters, moulds).

48 De Cupere *et al.* 1993; Poblome 2002, 51; 2004, 493; Lauwers *et al.* 2005, 28.

49 Poblome 1999; 2006b, 357; Poblome *et al.* 1998; 2000; 2001, 146; Murphy - Poblome 2011; Murphy - Poblome 2012

50 Degryse - Poblome 2008, 241; Degryse *et al.* 2008, 257-258; Vanhaverbeke - Waelkens 2003, fig. 121; This is not exceptionally distant, see *e.g.* Rice 2005, 178.

51 *i.e.* a bell-curve is plotted using the date ranges for each type as demarcations, the curve is multiplied by the quantity of the type, and all the resultant Gaussian curves are accumulated into a single curve. See also Willet 2014.

52 Poblome *et al.* 2005, 225-226.

53 Poblome 2006b; Murphy - Poblome 2011, 32-33.

There is no guarantee that anomalies detected by geophysics are necessarily related to archaeology, although control excavations in the area of the Coroplast workshop resulted in the identification of kilns on the locations suggested by geophysical anomalies. However, in 2011 a severely damaged kiln was excavated, which was not detected by geophysics, as a later wall was constructed over the kiln remains. In the same year, another badly preserved kiln was not discovered by geophysics as it had been covered by the collapse of terraces in the area. But all of the well preserved kilns excavated in the PQ so far, are also well attested in the preceding geophysical prospection. This means that in all likelihood the figure for the amount of kilns derived from the geophysical survey is a conservative estimate. Although excavation work continues in the PQ, at this point there is no solution but to work with the available evidence, despite its limitations and despite the fact that future research will undoubtedly reveal more workshops.

The geophysics revealed some 89 anomalies (Fig. 3) of kilns or furnaces of which a total of 18 (seven kilns for the east Slope Workshop, one for Site F and ten for the Coroplast Workshop) have been excavated and confirmed. Estimates on the production output of the workshops in the PQ are hindered by many unknown factors, such as the average size of the kiln load per firing; the number of firings per kiln per year; contemporaneousness of the kilns; and the type of vessels fired in the kiln, if this can be associated with a specific kiln at all (workshop association seems more likely).

The evidence of the kilns reflects the process of firing as part of the entire production cycle of ceramics. Other aspects of the production cycle such as the processes of obtaining raw materials, fuel, forming, drying, slipping, finishing, cooling, possibly storing and distributing cannot (yet) be used for an estimation of the total output, since these processes are less well attested in the archaeological record. But using the kilns alone, it seems certain that the PQ was able to produce more vessels per year than the proposed minimum need of ceramic tableware of 28 vessels (see above)[54].

As an experiment, Elizabeth Murphy estimated the load capacity of two fairly well preserved late Roman kilns (Kiln 2 and 4) forming part of the so-called east Slope Workshop. Apart from extrapolating the dimensions of both kilns, the size and markings on vessels and kiln-spacers attested in the pottery dumps associated with the same workshop were used to reconstruct stacks of vessels, which could be fitted into the kilns. With this information, a kiln load was estimated at 358-879 vessels for Kiln 2 (with a more likely "better fit" estimate of 574 vessels; although the chamber of this kiln may have been smaller than estimated, resulting in a lower capacity of 165-395 vessels) and 512-1,270 vessels for Kiln 4 (with a "better fit" estimate of 779 vessels)[55]. Recently, further reconstructions on the average capacity using CAD software, resulted in an average kiln-load of 1,708 vessels (ranging typically 1,500-2,000 vessels) for second-century SRSW and 398 vessels (typically ranging 350-450 vessels) for the sixth-century SRSW[56]. This obviously reflects a change in production methodology, organization and quite possibly scale, although as evident from the distribution plot (Fig. 2), late SRSW production is still substantial. For our current purposes, the lowest average kiln-load of 398 and the highest figure of 1,708 are used.

54 Rye 1981; Sinopoli 1991, 33-41; Rice 2005, 173.

55 Murphy 2007, 14-26; These are considered conservative estimates. For more details on the production sequence of SRSW, see Murphy - Poblome 2012.

56 Murphy, forthcoming.

Yet the amount of firings per year must at this moment be tentatively conjectured. Ethnographic evidence has observed a process of firing every four to five days at Gujrat, Pakistan, although this rapid firing is directly related to infrastructure and organizations of that particular workshop and the cultural/socio-economic context, which was probably different at Sagalassos[57]. The climate of Sagalassos, with many cold and rather wet months prevented a continuous production of pottery in the PQ, since drying is an important element in the process of pottery production and the availability of fuel is also an important seasonal factor[58].

The other unknowns, such as contemporaneousness of the kilns and the types of vessels produced, average size of the kilns *etc.* needs to be confirmed by future study of the workshops present in the PQ. Only for the kilns excavated at the east Slope Workshop and the Coroplast Workshop a sequence of use could be determined. But for a reconstruction of the total output we have to rely on assumptions, which, if the assumptions are cautiously chosen and defined, provide a tentative yet useful result, if the general scale of production is considered.

If as an example an arbitrary firing rate per kiln is set at once every two weeks (which is well below ethnographically observed firing rates of a process of firing every four to five days, although this rapid firing is directly related to infrastructure and organisations of that particular workshop and cultural/socio-economic context)[59], only during the five warmer months of the year (due to the process of drying) and assuming that only 10 kilns (out of 89, the excavated kilns of which show prolonged and contemporary use) are contemporaneous throughout the history of SRSW production, using the minimum and maximum amount of vessels reconstructed by Murphy as kiln-load and a rather high failure rate of 25-50 % is applied per kiln load, the following yearly production would result:

Number of firings per year = (30 days * 5 months)/14 days = 10 firings per year

Number of vessels per firing (minimum) = 398 * 0.50 = 199 vessels per firing (minimum)

Number of vessels per firing (maximum) = 1,708 * 0.75 = 1,281 vessels per firing (maximum)

Yearly output for 10 kilns (minimum) = 10 * 10 * 199 = 19,900 vessels per year

Yearly output for 10 kilns (maximum) = 10 * 10 * 1,281 = 128,100 vessels per year

This is a large range of results, which resembles a static situation, not taking into account dynamics and variation of production over the years. And yet these results, which can be improved by future research, and are derived by using arbitrary (but conservative) figures for the firing rate, failure rate and firings per year, can be considered as remarkable. The output figures are probably too low, since in all likelihood more kilns were contemporaneous, the failure rates were probably not so high and there may have been more firings per year, as anthropological *comparanda* indicate. Yet, even these figures demonstrate that the calculations for the total population, their need for SRSW and the output of production are discrepant: i.e. the lowest (conservative) output estimate would not fulfil the highest local need for tableware, but the highest output estimate outweighs local high demand by more than 4 times. The lowest need estimate for Sagalassos and its territory must be too low, since the 53,695

57 Rye - Evans 1976, 87; Murphy - Poblome 2011, 36.

58 Rye 1981, 65; Sinopoli 1991, 29-30; Rice 2005, 66-70; Poblome forthcoming.

59 Murphy - Poblome 2011, 36.

SRSW sherds used for Fig. 2 already constitute a yearly amount of *c.* 75 vessels for 700 years of Roman Sagalassos. But even if the highest population estimate is used at 50,000, the local need would still be less than half as much as the higher output figure. The fulfilment of local need seems to be corroborated archaeologically by the fact that imported tableware is relatively rare at Sagalassos or in its territory, at least during the first three centuries AD and most excavated contexts are simply dominated by SRSW[60]. With the conservative high output estimate and the high local need figure, only 1 out of every 4 vessels made would be consumed locally with the other 3 transported beyond the territory (or 100,322 vessels per year).

Although further study on the size of the rural population and the production of SRSW will certainly improve the estimates presented here, for now it is not only plausible that the production of SRSW at its peak was most certainly aimed for markets beyond the territory of Sagalassos, but that the scale of production was substantial (Fig. 4).

The meaning of the scale of SRSW production at Sagalassos

The question remains whether production of pottery on this scale was exceptional. In other words, was it common that the size of the production area made up *c.* 10 % of the urban area? Comparable sites of large scale artisanal production (of ceramics) are few in number in the Roman East and many of them have a different chronology. Furthermore their geographic, social and economic contexts are highly variable even in the Eastern Mediterranean. However, there were major producers of sigillata in the East, alongside smaller ones and a reconnaissance of these producers sheds light on the production and socio-economic logic of SRSW.

At Jerusalem at the site on Binyanei Ha'uma (2 km west of the Old City), a (potentially large-scale) pottery producing complex, consisting of several kilns and workshops operated from the mid first century BC and continued after AD 70-135 as a legionary complex until the third century, producing construction ceramics, cooking ware and tableware[61]. The size of the output of these workshops and the size of the ceramic production zone cannot be extrapolated yet at Jerusalem, since the details on the kilns have not yet been published and archaeological demarcation of the complexes is not yet possible.

At Pergamon another example of a Roman Imperial 'Potters' Quarter' was uncovered between 1977-1988 in the Ketios River valley, where four workshops tentatively linked to Eastern Sigillata C and/or Pergamene Sigillata production were excavated over an area of 2,000 m^2 [62]. Yet there are no measurements for the total scale of the tableware production at Pergamon (and not likely to follow, since the area of the Ketios valley is flooded by a reservoir nowadays). It must be noted that other places in the general vicinity of Pergamon have been associated with ESC production as well, such as Çandarlı[63]. Although the export of ESC throughout the Mediterranean is well established, the totality of this production cannot be attributed solely to Ketios Valley[64]. In terms of city-size, Pergamon was in a different league than Sagalassos, with some (overly optimistic) population estimates as large as 120,000-200,000 inhabitants

60 Willet - Poblome 2011, 108.

61 Arubas - Goldfus 2005, 14-16; Magness 2005, 69; Goren 2005, 192-194.

62 Meyer-Schlichtmann 1988; Poblome *et al.* 2001, 145-146.

63 Loeschke 1912; Hayes 1985, 71-78; Japp 2009, 208-209.

64 Poblome - Zelle 2002, 276-277; Bes 2007, 22-24.

based on an account by Galen[65]. But, for the moment, despite being producer of tableware, a ratio between size of production and local need cannot be established for Pergamon.

At Delphi, production of ceramics during the fourth to seventh century AD has been identified, which partially consisted out of tableware, alongside storage-vessels, cooking wares, lamps and others[66]. This production was concentrated at two places (near the Gymnasium and southeast of the Peribole), forming artisanal quarters with many kilns and workspace uncovered. However, the kilns are not contemporary and the production seems to have been aimed at the local market(s), since some shapes are exclusively found at Delphi and the material has not (yet) been recognised at other sites[67]. At the moment it is difficult to determine the relation between production and local demand at Delphi from the available research.

Another example of substantial tableware (alongside plain ware, cooking ware, lamps, ritual vessels *etc.*) production has been attested at Gerasa (Jerash) in the northwest of Jordan[68]. In this city of *c.* 100 ha (enclosed by city wall), an array of workshops and kiln dumps have been unearthed during the last 30 years, most notably at the Hippodrome and the north Temenos or Upper Zeus Temple[69]. These workshops started producing in Hellenistic times, and continued to produce during phases of major building programs and urban expansion of the second and third century AD[70]. Production was located at the sites of the Upper Temple and Hippodrome, although latter production saw a hiatus between the mid second to later third century due to the construction and use of the Hippodrome. Afterwards, pottery production ensued (attested by dumps in chambers and workshops) until the early seventh century. The scale of production has been compared to western Terra Sigillata factories and it has been hypothesised that production of Gerasa was geared towards the Roman forts of the nearby eastern *limes*[71]. Although the production at Gerasa was at least enough for local needs (as evidenced by the rather small role of imported vessels), at this moment further analyses are needed for pottery found elsewhere to determine the extent of its export production. Being situated in the Decapolis of the Levant, a role of regional pottery producer for Gerasa seems likely, which would make its role, although of a bigger size, somewhat similar to Sagalassos.

In closer proximity, other instances of pottery production centres have been identified over the past years in Southwestern Anatolia (Balboura [Middle Hellenistic and Late Roman], Kibyra [Late[?] Hellenistic to Early Byzantine], Patara [Late Roman to Early Byzantine], Xanthos [Late Roman to Early Byzantine], Araxa [Roman Imperial], Pednelissos [Late Roman to Early Byzantine], but these do not necessarily produce tableware and are difficult to compare due to lack of knowledge on the size of their respective populations and production output[72]. Other ceramic production centres known in Roman Asia Minor, such as near Sinop or Knidos, produce amphorae, relating to the agricultural economy and therefore follow their own logic[73].

---

65 Galen, De Propriorum Animi Dignotione et Curatione 9 (Kühn 5.49 = Corpus Medicorum Graecorum 5.4.1.1.33); Radt 1999, 57-59; Wulf 1994, 166 gives a lower, more reasonable estimate of 34,000-40,000 inhabitants for the city proper at 200 ha.

66 Pétridis 2010, 43-121.

67 Pétridis 2010, 35-37.

68 Kehrberg 2007, 31-48.

69 Seigne 2002, 6; Kehrberg 2011, 5-8; 2007, 31-44.

70 Kehrberg 2011, 7; Seigne 2002, 20-22.

71 Kehrberg 2007, 45-46.

72 Uygun - Dökü 2008; Armstrong 2012, 35-38; although not everywhere workshops have been found.

73 Doonan 2004, 101-108; Tuna 2012, 41-48.

Despite the difficulties of *comparanda*, the product specialization at Sagalassos and the instances of SRSW found at sites outside the territory of Sagalassos are strong indications that a large surplus of output, such as illustrated in the presented reconstructions, is highly likely during periods of economic prosperity. Although it would go too far to establish actual generated income for the city by this industry, it must have impacted (seasonal) local employment and will have, combined with trade in agricultural and other products, constituted significant trade flows through a hilly to mountainous terrain[74].

Conclusion

This paper has not only demonstrated that the tableware production of Roman Imperial Sagalassos did not see occasional export to markets outside its territory, but was more than capable to fulfil local needs and was in all likelihood primarily aimed at outside markets, at least during the first three centuries AD. The influx of colonists to Pisidia in early Imperial times and local developments may have provided the opportunities for either potters or those involved in pottery production at Sagalassos to invest in and expand the already existing production of ceramics[75]. Although demographic reconstructions for Roman Imperial Pisidia have not been made, the estimated number of colonists (some 32,000) and other inhabitants of Pisidia would already constitute a much larger potential market than the highest estimate for the total population of Sagalassos and territory[76]. The growth during the first century AD could either be the result of an increased need, either locally, regionally or beyond. Simple reasons for this could be 1) demographic growth (more people form a potentially larger market)[77]; 2) stable population levels but more people were convinced to consume red slipped tableware[78]; 3) if SRSW vessels were relatively costly (compared to average income) an increase in living standards could mean more people could 'upgrade' to SRSW vessels[79]; 4) SRSW became an (increasingly accepted) alternative for tableware products made elsewhere in Pisidia or imported to Pisidia, effectively replacing other products on the market (the evidence for such a scenario would need significant expansion, for quantified and published information on tableware and SRSW specifically at other sites in Pisidia and south-western Anatolia is insufficient).

Realistically, a plethora of factors, consisting of natural, socio-cultural and -economic constraints will have caused or provided the opportunities for the SRSW production at Sagalassos to expand beyond local needs. The simplistic reasons outlined above may all have been at play (although probably in more complex and nuanced ways), but more factors may have been operating which are simply unknown to us. Even so, the movement of goods via land routes on a scale as potentially took place at Sagalassos contradicts classical ideas on the ancient economy, namely that land-transport constrained the development of manufacture[80]. Furthermore, reports of SRSW found at sites located in inner Anatolia, already hints at the importance and

74 this aspect is further elaborated in Poblome *et.al.* 2013.

75 Poblome in press.

76 Poblome 1999, 314.

77 Scheidel 2007.

78 Wallace-Hadrill 2008.

79 Roth 2007.

80 Finley 1999; Landels 2000, 170; a rather deterministic interpretation of this rationale has been beautifully outlined in the website/database "Orbis - The Stanford Geospatial Network Model of the Roman World", created by W. Scheidel and E. Meeks. http://orbis.stanford.edu/.

possibilities of the road-network for economic activities in the ancient world[81]. Recent work on Graeco-Roman roads also emphasise the importance of land transport for local and regional trade[82]. The *Via Sebaste* was the most important connection both to the Mediterranean and central Anatolia and it probably formed the default route for longer distance land based movement of SRSW, in Pisidia and beyond, supplemented with local byways. The fact that SRSW ended up in Perge, close to the coast, a place that was connected, via a navigable river, to the Mediterranean, indicates that the Sagalassos products could find plenty buyers, 85 km away, without any indication of involvement of Roman authorities to steer this trade flow[83]. At this point, no quantified data are available on the size of SRSW distribution beyond the region and it is therefore difficult to reconstruct how these complex trade flows took form. We can assume that the region of Pisidia was a primary market for SRSW and that Sagalassos constituted a large if not the largest producer of tableware in the region during Roman Imperial times. Although friction of transport and connectivity may have been a constraint on the development of production, it seems that in the case of SRSW production, the relatively bad connection of the region with the Mediterranean basin may in fact have opened up possibilities for investment in regional production centre for tableware.

81 Poblome 2008, 207, although good quantitative data for export are lacking.

82 Quilici 2008, 575; Raepsaet 2008, 581, 600-602.

83 Poblome 2008.

Abbreviations and Bibliography

Alcock 1993 S. E. Alcock, Graecia Capta. The Landscapes of Roman Greece (1993).

Allison 2010 P. M. Allison, "Understanding Pompeian households practices through their material culture", FACTA 3, 2010, 24.

Angelis 2000 F. D. Angelis, "Estimating the Agricultural Base of Greek Sicily", Papers of the British School at Rome 68 (2000) 111-148.

Armstrong 2012 P. Armstrong, "The survey pottery: Hellenistic and later", in: J. J. Coulton (ed.), The Balboura survey and settlement in highland Southwest Anatolia 2. The Balboura survey: detailed studies and catalogues. British Institute at Ankara Monograph 43 (2012) 35-38.

Arubas – Goldfus 2005 B. Y. Arubas – H. Goldfus, "Introduction to the excavations", in: B.Y. Arubas – H. Goldfus (eds.), Excavations on the site of the Jerusalem International Convention Center (Binyanei Ha'Uma). A settlement of the Late First to Second Temple period, the Tenth Legion's kilnsworks, and a Byzantine monastic complex. The pottery and other small finds. JRA. Supplement 60 (2005) 14-16.

Bagnall – Frier 1994 R. S. Bagnall – B. W. Frier, The demography of Roman Egypt, Cambridge studies in population, economy and society in past time (1994) 68.

Bakker et al. 2012 J. Bakker – E. Paulissen – D. Kaniewski – V. De Laet – G. Verstraeten – M. Waelkens, "Man, vegetation and climate during the Holocene in the territory of Sagalassos, Western Taurus Mountains, SW Turkey", Vegetation History & Archaeobotany 2.4, 2012, 49-266.

Bang 2008 P. F. Bang, The Roman Bazaar. A Comparative Study of Trade and Markets in a Tributary Empire (2008).

Bes 2007 P. Bes, A geographical and chronological study of the distribution and consumption of table wares in the Roman East (University of Leuven Unpublished PhD Thesis, 2007) 22-24.

Bintliff 1997 J. L. Bintliff, "Further Considerations on the Population of Ancient Boeotia", BAR International Series 666 (1997) 235.

Bintliff – Snodgrass 1985 J. L. Bintliff – A. M. Snodgrass, "The development of settlement in South-West Boeotia", in: G. Argoud – P. Roesch (eds.), La Béotie Antique (1985) 49-70.

Bintliff 2002 J. L. Bintliff, "Rethinking early Mediterranean urbanism", in: R. Aslan (ed.), Festschrift für Manfred Korfmann, Mauerschau (2002) 153-177.

de Cupere et al. 1993 B. De Cupere – W. Van Neer – A. Lentacker, "Some Aspects of the Bone-Working Industry in Roman Sagalassos", in: M. Waelkens – J. Poblome (eds.), Sagalassos II. Report on the Third Excavation Campaign of 1992. Acta Archaeologica Lovaniensia Monographiae 6 (1993) 269-278.

Degryse – Poblome 2008 P. Degryse – J. Poblome, "Clays for mass production of table and common wares, amphorae and architectural ceramics at Sagalassos", in: P. Degryse – M. Waelkens (eds.), Sagalassos VI. Geo- and Bio-Archaeology at Sagalassos and in its Territory (2008) 241.

Degryse et al. 2008 P. Degryse – J. Poblome – W. Viaene – H. Kucha – R. Ottenburgs – M. Waelkens – J. Naud, "Clays for mass production of table and common wares, amphorae and architectural ceramics at Sagalassos", in: P. Degryse – M. Waelkens (eds.), Sagalassos VI. Geo- and Bio-Archaeology at Sagalassos and in its Territory (2008) 257-258.

Doonan 2004	O. P. Doonan, Sinop Landscapes. Exploring Connection in a Black Sea Hinterland (2004) 101-108.
Duncan-Jones 1982	R. Duncan-Jones, The economy of the Roman Empire : quantitative studies, second edition (1982) 262.
Engels 1990	D. Engels, Roman Corinth: an alternative for the Classical City (1990) 179-181.
Fentress - Badel 2003	E. Fentress – J. P. Badel, "Cosa in the Republic and early Empire", in: E. Fentress (ed.), Cosa V. An Intermittent Town, Excavations 1991-1997 (2003) 24.
Finley 1999	M. I. Finley, The Ancient Economy. Updated Edition with a Foreword by Ian Morris (1999).
Frier 2000	B. W. Frier, "27. Demography", in: A. Bowman – P. Garnsey – D. Rathbone (eds.), The Cambridge Ancient History Volume XI (2000) 812.
Garnsey 2004	P. Garnsey, Cities, Peasants and Food in Classical Antiquity. Essays in Social and Economic History (2004).
Goren 2005	Y. Goren, "Appendix: the pottery technology", in: B. Y. Arubas – H. Goldfus (eds.), Excavations on the site of the Jerusalem International Convention Center (Binyanei Ha'Uma). A settlement of the Late First to Second Temple period, the Tenth Legion's kilnworks, and a Byzantine monastic complex. The pottery and other small finds. JRA Supplement 60 (2005) 192-194.
de Graaf 2012	P. de Graaf, Late Republican-Early Imperial Regional Italian Landscapes and Demography. BAR International Series S2330 (2012) 91-92.
Grainger 2009	J. Grainger, The Cities of Pamphylia (2009) 234.
Hansen 2006	M. H. Hansen, The Shotgun Method. The Demography of the Ancient Greek City-State Culture (2006).
Hayes 1985	J. W. Hayes, "Sigillate orientale", in: Enciclopedia dell'Arte Antica. Classica e Orientale. Atlante della forme ceramiche II: ceramica fine romana nel bacino mediterraneo (tardo ellenismo e primo imperio) (1985) 71-78.
Hudson 2010	N. Hudson, "Changing Places: The Archaeology of the Roman Convivium", AJA 114, 2010, 663-695.
Japp 2009	S. Japp, "Archäometrisch-archäologische Untersuchungen an Keramik aus Pergamon und Umgebung", IstMitt 59, 2009, 208-209.
Kaniewski et al. 2008	D. Kaniewski – E. Paulissen – V. De Laet – M. Waelkens, "Late Holocene fire impact and post-fire regeneration from the Bereket Basin, Taurus Mountains, southwest Turkey", Quaternary Research 70, 2008, 228-239.
Kaptijn et al. 2012	E. Kaptijn – R. Vandam – J. Poblome – M. Waelkens, "Inhabiting the Plain of Burdur. Results from the 2010 and 2011 Sagalassos Project Survey", Anmed 10, 2012, 142-147.
Kehrberg 2011	I. Kehrberg, "Roman Gerasa Seen from below. An Alternative Study of Urban Landscape", Australasian Society for Classical Studies 32, 2011, 5-8.
Kehrberg 2007	I. Kehrberg, "Gerasa as provider for Roman frontier stations: A view seen from Late Roman potters' waste at the Hippodrome and the Upper Zeus Temple", Studies in History and Archaeology of Jordan 9, 2007, 31-48.
Kolb 1984	F. Kolb, Die Stadt im Altertum (1984) 191.
Landels 2000	J. G. Landels, Engineering in the Ancient World (2000) 170.
Lauwers et al. 2005	V. Lauwers – P. Degryse – J. Poblome – M. Waelkens, "Le verre de Sagalassos, de nouvelles preuves d'une production locale de verre", in: H. Cabart (ed.), Eclats de verre. XIXième recontres de l'Association Française pour l'Archéologie du Verre (14-16 Octobre, Gaillac and Montanse) (2005) 28.

Levick 1967 B. Levick, Roman Colonies in Southern Asia Minor (1967) 38-39, 93-95.

de Ligt 1993 L. de Ligt, Fairs and Markets in the Roman Empire. Economic and Social Aspects of Periodic Trade in Pre-Industrial Society (1993).

de Ligt 2012 L. de Ligt, Peasants, Citizens and Soldiers. Studies in the Demographic History of Roman Italy 225 BC-AD 100 (2012) 220.

Loeschke 1912 S. Loeschke, "Sigillata-topfereien in Tschandarli", AthMitt 37, 1912, 342-407.

MacMullen R. MacMullen, Romanization in the time of Augustus (2000) 9-10.

Magness 2005 J. Magness, "The Roman legionary pottery", in: B.Y. Arubas – H. Goldfus (eds.), Excavations on the site of the Jerusalem International Convention Center (Binyanei Ha'Uma). A settlement of the Late First to Second Temple period, the Tenth Legion's kilnsworks, and a Byzantine monastic complex. The pottery and other small finds. JRA. Supplement 60 (2005) 69.

Martens et al. 2008 F. Martens – H. Vanhaverbeke – M. Waelkens, "Town and suburbium at Sagalassos: an interaction investigated through survey", in: H. Vanhaverbeke – J. Poblome – F. Vermeulen – M. Waelkens – R. Brulet (eds.), Thinking about space: the potential of surface survey and contextual analysis in the definition of space in Roman times (2008) 138, 139.

Martens 2004 F. Martens, Interdisciplinary research concerning the urban development of Sagalassos: settlement development, urban layout and infrastructure (University of Leuven Unpublished PhD Thesis 2004) 330.

Meyer-Schlichtmann 1988 C. Meyer-Schlichtmann, Die pergamenischen Sigillata aus der Stadtgrabung von Pergamon. Mitte 2. Jh. v. Chr. - Mitte 2. Jh. n. Chr. (1988)

Mitchell 2000 S. Mitchell, "The settlement of Pisidia in late antiquity and the Byzantine period: methodological problems", in: K. Belke – F. Hild – J. Koder – P. Soustal (eds.), Byzanz als Raum. Zu Methoden und Inhalten der historischen Geographie des östlichen Mittelmeerraums (2000) 145.

Mitchell 1999 S. Mitchell, "Greek epigraphy and social change. A study of the Romanization of south-west Asia Minor in the third century AD", in: XI Congresso Internazionale di Epigrafia Greca e Latina (1999) 432-433.

Mitchell 1993 S. Mitchell, Anatolia. Land, Men, and Gods in Asia Minor 1. The Celts and the Impact of Roman Rule (1993) 70-79.

Mitchell – Waelkens 1998 S. Mitchell – M. Waelkens. Pisidian Antioch: The Site and the Monuments (1998) 99-100.

Murphy, forthcoming E. Murphy, "From Formal to Technical Styles: Production Challenges and Economic Implications of Changing Tableware Styles in Roman Imperial to Late Antique Manufacturing Waste", AJA, forthcoming.

Murphy – Poblome 2012 E. Murphy – J. Poblome, "Technical and social considerations of tools from Roman-period ceramic workshops at Sagalassos (Southwest Turkey): not just tools of the trade?", JMedA 25.2, 2012, 69-89.

Murphy – Poblome 2011 E. Murphy – J. Poblome, "Producing pottery vs. producing models: interpreting workshop organization at the Potters' Quarter of Sagalassos", in: M. Lawall – J. Lund (eds.), Pottery in the Archaeological Record: a view from the Greek World. Gösta Enbom Monograph Series 1 (2011) 32-33, 36.

Murphy 2007 E. Murphy, Speaking Volumes about Production: Innovative Approaches towards the Study of Roman Table Wares (University of Leuven Unpublished MA Thesis 2007) 14-26.

Ottoni et al. forthcoming C. Ottoni – R. Rasteiro – R. Willet – J. Claeys – P. Talloen – K. Van de Vijver – R. Yaka – J. Poblome – L. Chikhi, R. Decorte, "Contrasting maternal genetic variation across two millennia reveals the demographic history of an ancient human population in Southwest Turkey", forthcoming.

Paulissen et al. 1993 E. Paulissen – J. Poesen – G. Govers – J. De Ploey, "The Physical Environment at Sagalassos (Western Taurus, Turkey). A Reconnaissance Survey", in: M. Waelkens – J. Poblome (eds.), Sagalassos II. Report on the Third Excavation Campaign of 1992. Acta Archaeologica Lovaniensia Monographiae 6 (1993) 231-233.

Peña 2007 J. T. Peña, Roman Pottery in the Archaeological Record (2007) 58, 331.

Pétridis 2010 P. Pétridis, La céramique protobyzantine de Delphes: une production et son contexte. Fouilles de Delphes V. École française d'Athènes (2010).

Poblome (in press) J. Poblome, "The potters of Sagalassos revisited" in: M. Flohr – A. Wilson (eds.), Beyond Marginality. Craftsmen, Traders and the Socioeconomic History of urban communities in the Roman World (in press).

Poblome et. al 2013 J. Poblome – D. Braekmans – B. Music – M. Van Der Enden – B. Neyt – B. De Graeve – P. Degryse, "A pottery kiln underneath the Odeon of ancient Sagalassos, SW Turkey. The excavation results, the table wares and their archaeometrical analysis", in: N. Fenn – C. Römer-Strehl (eds.), Networks in the Hellenistic World according to the pottery in the Eastern Mediterranean and Beyond, BAR Int. Series 2539 (2013)

Poblome 2008 J. Poblome, "Sherds and coins from a place under the sun. Further thoughts from Sagalassos", FACTA 2, 2008, 207, fig. 4.

Poblome 2006a J. Poblome, "Mixed feelings on Greece and Asia Minor in the third century AD", in: D. Malfitana – J. Poblome – J. Lund (eds.), Old pottery in a new century: innovating perspectives on Roman pottery studies. Convegno internazionale di studi. Catania, 22-24 Aprile 2004 (2006) 201-207.

Poblome 2006b J. Poblome, "Made in Sagalassos: modelling regional potential and constraints", in: S. Menchelli – M. Pasquinucci (eds.), Territorio e produzioni ceramiche: paesaggi, economia e società in età romana. Convegno internazionale. Pisa, 20-22 ottobre 2005 (2006) 357.

Poblome et al. 2005 J. Poblome – P. Bes – P. Degryse, "The Decline and Fall of Sagalassos. A Ceramic Perspective", Rei Cretariae Romanae Fautores Acta 39 (2005) 225-226.

Poblome 2004 J. Poblome, "Comparing ordinary crafts: textile and pottery in production in Roman Asia Minor", Journal of Economic and Social History of the Orient 47, 2004, 493.

Poblome 2002 J. Poblome, "Textiel- en aardewerkproductie in Romeins Klein-Azië: een vergelijkend onderzoek", Tijdschrift voor mediterrane archeologie 26, 2002, 51.

Poblome – Zelle 2002 J. Poblome – M. Zelle, "The table ware boom: a socio-economic perspective from western Asia Minor", in: C. Berns – H. von Hesberg – L. Vandeput – M. Waelkens (eds.), Patris und Imperium: kulturelle und politische Identität in den Städten der römischen Provinzen Kleinasiens in der frühen Kaiserzeit. BABesch Supplement 8 (2002) 276-277.

Poblome et al. 2001 J. Poblome – O. Bounegru – P. Degryse – W. Viaene – M. Waelkens – S. Erdemgil, "The sigillata manufactories of Pergamon and Sagalassos", JRA 14, 2001, 145-146.

Poblome et al. 2000 J. Poblome – R. Brulet – O. Bounegru, "The concept of sigillata: regionalism or integration?", Rei Cretariae Romanae Fautores Acta 36, 2000, 279-283.

Poblome 1999 J. Poblome, Sagalassos Red Slip Ware. Typology and Chronology (1999) 25, 314, 339.

Poblome et al. 1998 J. Poblome – P. Degryse – I. Librecht – W. Viaene – M. Waelkens, "Sagalassos red slip ware: the organization of a manufactory", Münstersche Beiträge zur antiken Handelsgeschichte 17, 1998, 52-64.

Poblome 1995 J. Poblome, "Sherds and Coins. A Question of Chronology", in: M. Waelkens – J. Poblome (eds.), Sagalassos III. Report on the Fourth Excavation Campaign of 1993. Acta Archaeologica Lovaniensia Monographiae 7 (1995) 194.

Price 2011 S. Price, "Estimating Ancient Greek Populations. The Evidence of Field Survey", in: A. Bowman – A. Wilson (eds.), Settlement, Urbanization, and Population (2011) 23.

Quilici 2008 L. Quilici, "Land Transport, Part 1: Roads and Bridges", in: J. P. Oleson (ed.), The Oxford Handbook of Engineering and Technology in the Classical World (2008) 575.

Radt 1999 W. Radt, Pergamon: Geschichte und Bauten einer antiken Metropole (1999).

Raepsaet 2008 G. Raepsaet, "Land Transport, Part 2: Riding, Harnesses, and Vehicles", in: J. P. Oleson (ed.), The Oxford Handbook of Engineering and Technology in the Classical World (2008) 600-602.

Rice 2005 P. M. Rice, Pottery Analysis. A Sourcebook (2005) 66-70, 173, 178.

Roth 2007 R. E. Roth, Styling Romanisation. Pottery and Society in Central Italy (2007).

Rye 1981 O. S. Rye, Pottery Technology: Principles and Reconstruction (1981).

Rye – Evans 1976 O. S. Rye – C. Evans, Traditional Pottery Techniques of Pakistan: Field and Laboratory Studies (1976).

Scheidel 2007 W. Scheidel, "3. Demography", in: W. Scheidel – I. Morris – R. Saller (eds.), The Cambridge Economic History of the Greco-Roman World (2007) 48.

Seigne 2002 J. Seigne, "Gerasa-Jerasch - Stadt der 1000 Säulen", in: A. Hoffman - S. Kerner (eds.), Gadara-Gerasa und die Dekapolis (2002) 6, 20-22.

Sinopoli 1991 C. M. Sinopoli, Approaches to Archaeological Ceramics (1991).

Six 2004 S. Six, Holocene geomorphological evolution of the territory of Sagalassos. Contribution to the palaeo-environmental reconstruction of Southwest Turkey. (University of Leuven Unpublished PhD Thesis 2004).

Steegen et al. 2000 A. Steegen – K. Cauwenberghs – G. Govers – M. Waelkens – E. J. Owens – P. Desmet, "The water supply to Sagalassos", in: M. Waelkens – L. Loots (eds.), Sagalassos V: report on the survey and excavation campaigns of 1996 and 1997 (2000) 636.

Tuna 2012 N. Tuna, Knidos Teritoryumu'nda Arkeolojik Araştırmalar. Archaeological Investigations at the Knidian Territorium (2012) 41-48.

Uygun – Dökü 2008 Ç. Uygun – E. Dökü, "Kibyra Yerel Kırmızı Seramiklerinden Örnekler", Adalya 11, 2008, 133-163.

Vanhaverbeke – Waelkens 2003
H. Vanhaverbeke – M. Waelkens (eds.), The chora of Sagalassos: the evolution of the settlement pattern from prehistoric until recent times. Studies in Eastern Mediterranean Archaeology V (2003) 241-246, 247, fig. 121.

Waelkens et al. 2003 M. Waelkens – E. Paulissen – H. Vanhaverbeke, "The physical setting: topographical units within the territory of Sagalassos", in: H. Vanhaverbeke – M. Waelkens (eds.), The chora of Sagalassos: the evolution of the settlement pattern from prehistoric until recent times. Studies in Eastern Mediterranean Archaeology V (2003) 60-62.

Waelkens – Poblome 2011
M. Waelkens – J. Poblome, Sagalassos. City of Dreams (2011).

Waelkens et al. 2000 M. Waelkens et al., "The 1996 and 1997 excavation seasons at Sagalassos", in: M. Waelkens – L. Loots (eds.), Sagalassos V: report on the survey and excavation campaigns of 1996 and 1997 (2000) 17-216.

Waelkens – Degryse 2003
M. Waelkens – P. Degryse, "Tectonic setting and natural mineral resources", in: H. Vanhaverbeke – M. Waelkens (eds.), The chora of Sagalassos: the evolution of the settlement pattern from prehistoric until recent times. Studies in Eastern Mediterranean Archaeology V (2003) 18-19.

Waelkens et al. 1997 M. Waelkens – E. Paulissen – H. Vanhaverbeke – I. Öztürk – B. De Cupere – H. Ekinci – P. Vermeersch – J. Poblome – R. Degeest, "The 1994 and 1995 surveys on the territory of Sagalassos", in: M. Waelkens – J. Poblome (eds.), Sagalassos IV (1997) 11-102.

Wallace-Hadrill 2008 A. Wallace-Hadrill, Rome's Cultural Revolution (2008).

Willet 2014 R. Willet, "Experiments with diachronic data distribution methods applied to Eastern Sigillata A in the Eastern Mediterranean", Herom: Journal of Hellenistic and Roman Culture 3, 2014, 39-69.

Willet 2012 R. Willet, "Whirlwind of numbers. Demographic experiments for Roman Corinth", Ancient Society 42, 2012, 151-153.

Willet – Poblome 2011
R. Willet – J. Poblome, "The pale red slipped dot", FACTA 5, 2011, 104, 108.

Wulf 1994 U. Wulf, "Der Stadtplan von Pergamon. Zu Entwicklung und Stadtstruktur von der Neugründung unter Philetairos bis in spätantike Zeit", IstMitt 44, 1994, 166.

Zanker 1998 P. Zanker, Pompeii. Public and Private Life, Revealing Antiquity (1998)

Özet

Sagalassos Kırmızı Astarlı Mallarının Üretim Ölçeği Yerel Talep ve Roma İmparatorluk Dönemi Yemek Takımı Üretim Çıktısının Rekonstrüksiyonları

Bu makale Sagalassos'un yerel çanak çömlek üretim ölçeğini ve Roma İmparatorluk Dönemi'ndeki yerel talep ile arasındaki ilişkiyi irdelenmektedir. Batı Toroslardaki yerleşimde onlarca yıl sürdürülen yoğun araştırmalar sonucu Doğu banliyösünde çoğunlukla atölyeler ve keramik çöplüğü şeklinde önemli miktarda yemek takımı (Sagalassos Kırmızı Astarlı Mallar veya SRSW) kalıntıları ortaya çıkartılmıştır.

Çalışma söz konusu malların üretim ölçeğini ve bu üretimin sadece yerel talebi karşılamak için mi yoksa ihracat amaçlı olup olmadığını da incelenmektedir. SRSW, Augustus döneminden itibaren büyük miktarlarda üretilmeye başlanmıştır. Fiziksel mekan açısından Sagalassos kentsel alanının büyük bir bölümü SRSW üretimine ayrılmıştı; özellikle altı hektarlık Doğu banliyösünün yaklaşık dört hektarlık kısmı bu işe ayrılmıştı ve 37.5 hektarlık kentsel alanın genelinde en az 89 fırın yer alıyordu. Arkeolojik açıdan bu üretimin kentin ve egemenlik alanındaki (yak. 1200 km^2) halkın ihtiyacını karşıladığı saptanmıştır; ancak bu malların Anadolu'nun uzak diyarlarında ve ötesinde bulunması doğrudan şu soruyu gündeme getirmiştir: Kentin siyasi sınırlarının dışındaki pazarlar üretim planlamasının ve karar verme sürecinin bir parçası mıydı?

SRSW hakkında nicelik olarak ihracat verisi bulunmamasına karşın bu malların ortaya çıkışı eskiden Erken Roma İmparatorluk Dönemi'nde Pisidia Bölgesi'ne iskan edilen ve SRSW için potansiyel bir pazar oluşturan Roma kolonistleriyle ilintilendirilmekteydi. SRSW üretiminin sadece yerel talebi mi yoksa uzak pazarları da mı hedeflediğini belirlemek amacıyla mevcut arkeolojik ve tarihsel kanıtlardan türetilen temsili veriler kullanılarak üretim çıktısı ve yerel talep miktarı bu çalışmada rekonstrüksiyon edilmiştir. Bu rekonstrüksiyonlar tam kesin olmamakla birlikte tutucu çıktı miktarı rakamları yerel talebi birkaç kat aşıyor görünmektedir. Karşılaştırma için bir çerçeve sunabilmek amacıyla Doğu Akdeniz'deki diğer Roma çanak çömleği üretim merkezlerindeki (Bergama, Kudüs, Delfi, Gerasa ve Anadolu'daki diğer daha küçük merkezler) üretim altyapısının ölçeği irdelenmiştir. Öyle anlaşılıyor ki Roma İmparatorluğu'nun doğusunda, kentsel alan içinde konsantre ve ihtisaslaşmış üretim alanları görece nadir görülmektedir ve Sagalassos'taki üretim altyapısına kıyasla büyüktür ve ihtisaslaşmıştır. Hem bundan hem de temsili kanıtlardan yola çıkılarak Sagalassos'taki üretimin kentin egemenlik alanının ötesindeki pazarları hedeflediği ve SRSW üretiminin gelişmesi ile Pisidia'daki nüfus hareketleri arasında bir ilişkinin bulunduğu hipotezi, Eskiçağ demografik rekonstrüksiyonlarının çok güvenilir olmamasına karşın, büyük olasılıkla mümkün görünmektedir. Sagalassos'un nakliye güzergahlarına veya bir anayola (Via Sebaste Sagalassos egemenlik alanı içinden fakat kentten uzak bir noktadan geçiyordu) (doğrudan) erişimi bulunmamasına ve de nakliye ve bağlantıların Eskiçağ'daki ekonomik gelişmeyi kısıtlayıcı görülmesine karşın SRSW üretimi söz konusu olduğunda görece zayıf bağlantılar ve coğrafi tecrit aslında bölgesel yemek takımı üretim merkezi yatırımı yapmak için fırsat doğurmuş olabilir.

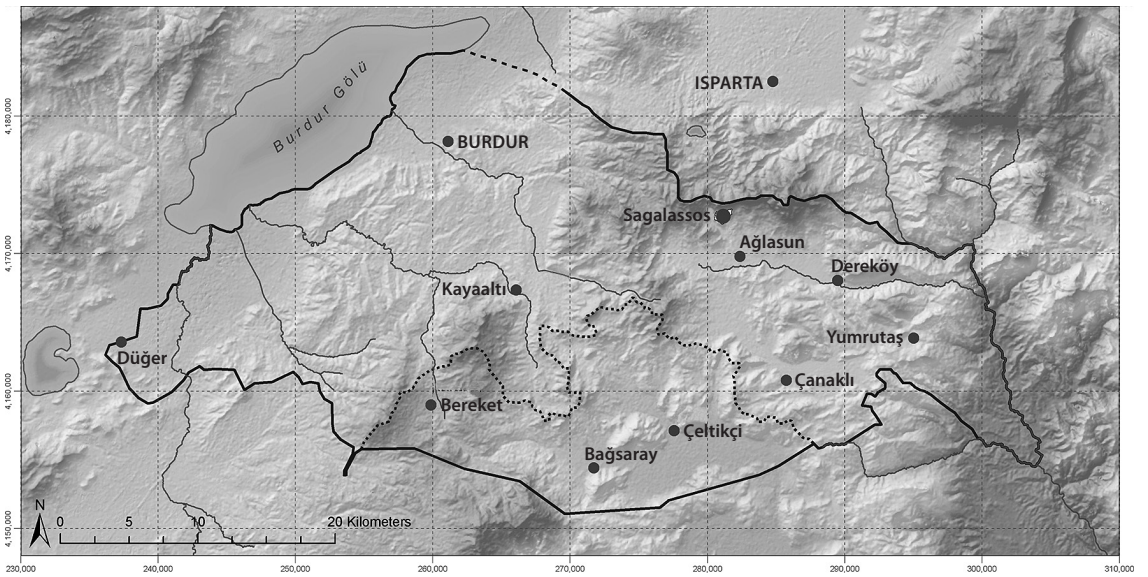

Fig. 1 Map of the study region of Sagalassos, with the presumed Roman Imperial territory outlined in black (Source: Sagalassos Archaeological Research Project).

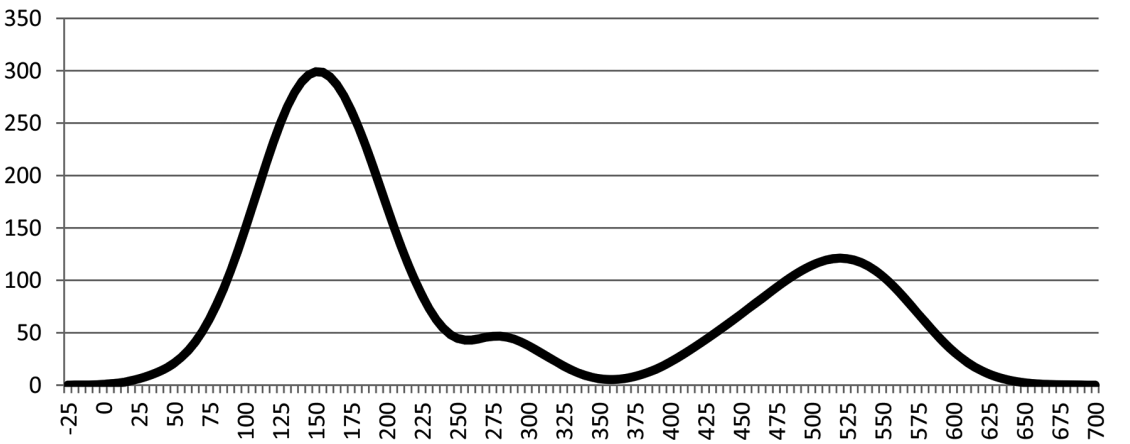

Fig. 2 Diachronic overview from 25 BC to AD 700 using a Gaussian distribution method for 53,695 rimsherds of SRSW from a selection of representative and well-studied excavated contexts in Sagalassos (Source: authors and Sagalassos Archaeological Research Project).

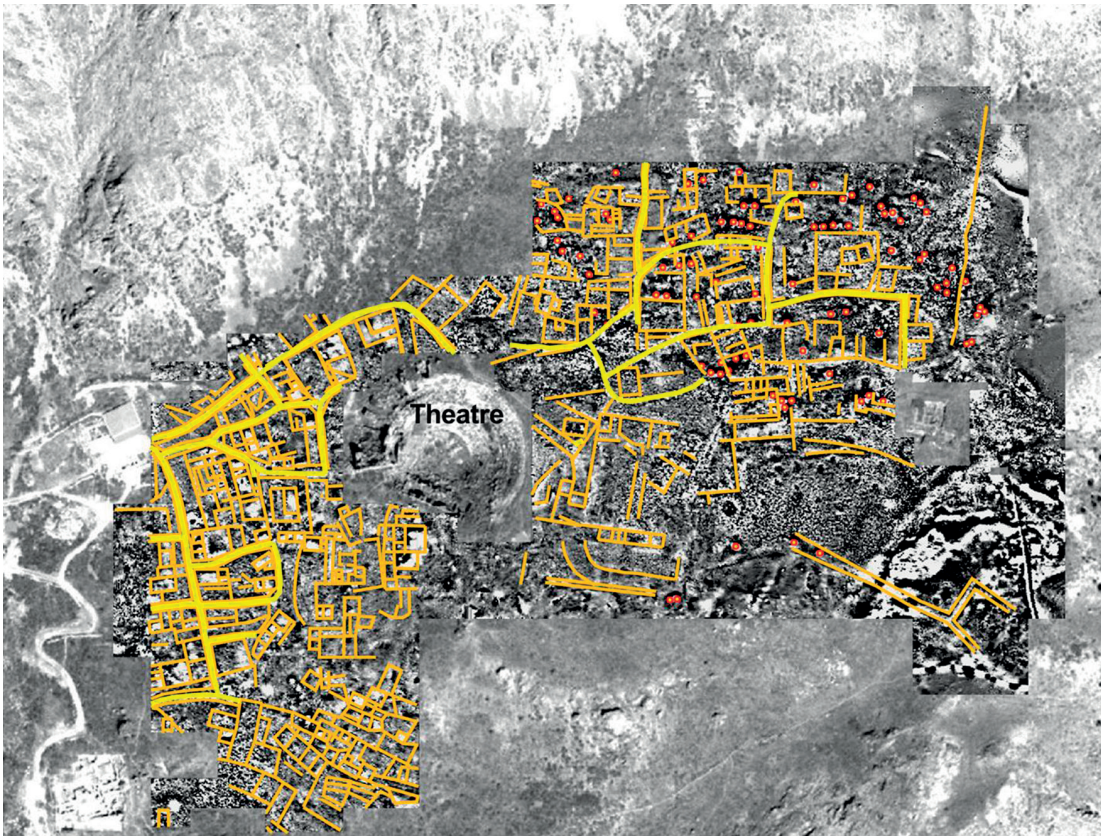

Fig. 3 Overview of the eastern suburbium with reconstructed streets plotted.
The red dots indicate thermoremnant magnetization, which have been interpreted as kilns.
(Source: Sagalassos Archaeological Research Project).

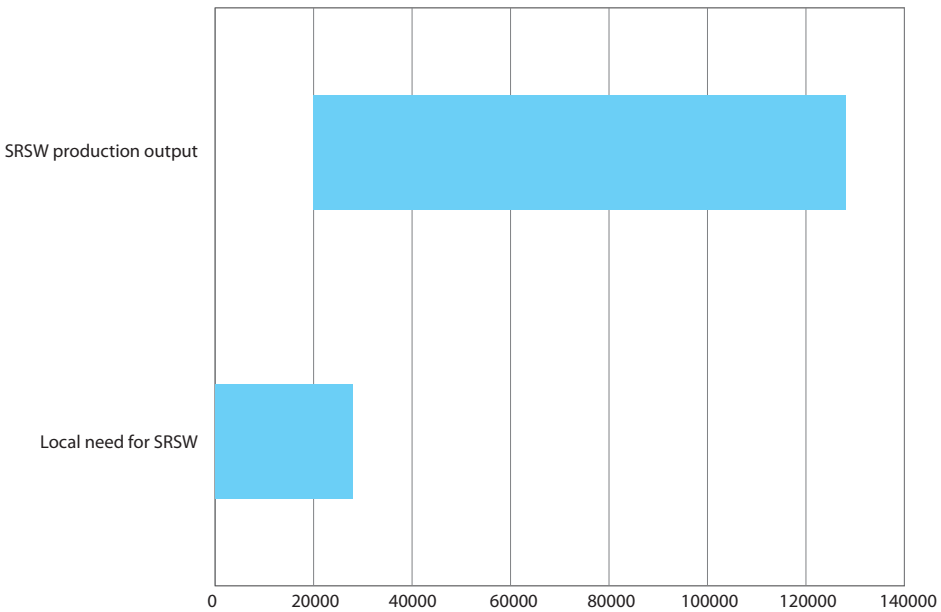

Fig. 4 The ranges of the reconstructed SRSW production output and local need.

Estimates for the number of colonists in Roman Pisidia			
author	**parameters**	**number of colonists**	
Levick 1967, 93–95	9,500 male colonists, multiplied 3 1/3 for family size	*c.* 32,000	
Bintliff – Snodgrass 1985, 49–70	9,500 male colonists, multiplied 5 for family size	*c.* 47,500	
Macmullen 2000, 9–10		*c.* 40,000 – 60,000	
Estimates for the number of inhabitants for Sagalassos			
author	**parameters**	**number of inhabitants**	
Martens 2004, 330	25.22 ha residential area, 100-150 people per hectare	*c.* 2,500 – 3,750	
Hansen 2006, 61	37.5 ha urban area, 50 percent residential area, 150 people per hectare	*c.* 2,800	
Bintliff 1997, 235	37.5 ha urban area, 56 percent residential area, 225 people per hectare	*c.* 4,700	
Price 2011, 23	37.5 ha urban area, 40-60 people per hectare	*c.* 1,500 – 2,250	
Bagnall – Frier 1994, 68; Fentress – Badel 2003, 24; de Ligt 2012, 220	298 houses lower classes at 4–5 inhabitants, 30 houses elite at 10–12 inhabitants	*c.* 1,492 – 1,850	
Estimates for the number of inhabitants for Sagalassos and the territory (1,200 km²)			
author	**parameters**	**total population**	**population density** (people / km²)
Bintliff 1997, 235	1,500-5,000 urban population; urban: rural population 4:1	1,875 – 6,250	1.6 – 5.2
Hansen 2006, 22, 43, 65	1,500-5,000 urban population; urban: rural population 2:1	2,250 – 7,500	1.9 – 6.25
de Graaf 2012, 91–92	1,500-5,000 urban population; urban: rural population 1:3 – 1:9	6,000 – 50,000	5 – 41.7
Frier 2000, 812; Scheidel 2007, 48	territory of 1,200 km², 14–15 people / km² population density	16,800 – 18,000	14 – 15

Fig. 5 Demographic data and methods as mentioned in the text.