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## The demography of the first Mediterranean global network: The Roman Empire

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**Summary.** The study of the demographic characteristics of the first Mediterranean global network, the Roman Empire, is not an easy task. There are a lot of aspects to consider and an almost equal number of factors affecting them. In addition, the possible sources of information used to be incomplete and biased. Although methodology for conducting this kind of studies has evolved through time, allowing us to extract and to interpret the data in a better way, some aspects remain still obscure. [Contrib Sci 11:49-58 (2015)]

### Introduction

The present-day situation of the Mediterranean Sea and the conflicts that arise in its proximity are a topical subject, one that frequently gives rise to dramatic situations. Forced population movements and also large-scale migrations are taking place without any real possibility of balance or a decided search for solutions being seen for the moment in this situation, which may seem confusing from a general standpoint, but which actually reflects the sum of many far more localized and focused circumstances, which, considered in global terms, appear to have the same characteristics. Hence the lack of proposals and the ambiguity to be found in analyses, which often, as a result of seeking out common features,

distort or even trivialize the situations and conflicts being studied since they are unable to detect specific patterns of behaviour.

Priorities such as those under the heading of “societal challenges” have been established within the EU H2020 programs as a result of awareness of this insufficiency. Among them, we can mention the following: health, demographic change and well-being; food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy; and, to a lesser degree, secure societies (protecting freedom and security of Europe and its citizens).

The contribution that the study of the world of Antiquity can make to all these questions is substantial even though the chronological distance might lead one to think that such

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a remote period is unlikely to have had much bearing on the contemporary situation. Nevertheless, the settings are the same, military action is taking place in the same places and the geopolitical situation seems to be repeating itself. It is evident that this might simply lead us to the well-known commonplace that history repeats itself, but in fact nothing could be farther from the truth. It is apparent that history does not repeat itself although the conditioning factors sometimes continue in existence even if somewhat modified; the most obvious are territory, climate and production; in short, everything that shapes an environment, if we do not wish to speak of ethnic characteristics or territorial expansion phenomena. In both the ancient world and in the present-day one, external influences that open up otherwise unforeseen horizons are frequently responsible for triggering off such events.

All these factors lead us to adopt a holistic approach to the subject dealt with here, one that does not endeavor to look for patterns that can be extrapolated to the contemporary world and which, insofar as possible, avoids resorting to comparisons with distant historical contexts other than purely methodological ones. Only in this way can a certain degree of objectivity be obtained in our analysis of ancient society, in our case Roman society, which in itself already had serious difficulties as a consequence of its diversity, its timespan and its not always easily identifiable substrates and adstrates. Only from a viewpoint obtained with these analytical variables will we obtain a product that might be extrapolated to other moments and circumstances by other analysts, without the current circumstances under which our observations are being made having had undue influence, even though it is to a certain extent inevitable, on our own analyses and reconstruction.

## Factors affecting demography

At the moment, the demographic study of the Roman world is one of the principal contributions that can be made for a better understanding of this inland sea that is the Mediterranean, the *mare internum*, in order to obtain a broader historical perspective that can clearly be projected onto the world of today.

Despite the existence of earlier attempts, it is widely accepted that the start of this interest has its modern precursor in Karl Julius Beloch (1854–1929), whose *Die Bevölkerung der griechisch-römischen Welt* (Leipzig, 1886), a work that many scholars still consider to be valid; in spite of the advances in demographic studies, they have been only partially reflected

in works referring to the Roman world. Thematic emphasis on certain key points has barred the way to a more general overview; such analyses have obviously developed since Beloch's contribution, but have failed to advance insofar as a broader interpretation is concerned beyond the important works by Parkin [39] and Frier [19], to give but two examples of studies that aimed, at least in part, to cover the scope of Beloch's work, taking into account advances in our knowledge of the sources and methodological improvements.

The Cambridge School has been one of the main driving forces in the development of these studies, and its contribution defines the current state of knowledge. In brief, and without analyzing the methodology [15,31], this can be a succinct list of the subjects that need to be covered in a study of this type for which we currently have abundant data and even sufficient information for in-depth analysis:

- *Birth*: child mortality, contraception, infanticide.
- *Life expectancy*: population growth and decline, fertility. Population structure.
- *Morbidity*: common pathologies, pestilence, endemic plagues in many periods.
- *Food supply*: foodstuffs are always a scarce commodity in Antiquity. Roman evidence for this fact; agricultural produce and herding; advances in production techniques, and the arrival of new products. In the Roman world, food supply was a decisive factor for population movements.
- *Natural disasters*: earthquakes and tsunamis (well-studied and documented), floods, volcanic eruptions, droughts (in the field of agricultural production).
- *The impact of warfare*: war as a growth factor both as regards territory and the subject population, and especially the number of slaves; calculation of the number of soldiers in the Roman army in different periods; calculation of human losses in wars and battles; territorial growth and frontiers. Life expectancy within the army [34,46], the recruitment age and the length of service are other frequently studied aspects, although they have limited consequences for a relatively small sector of the population.
- *Social aspects*: slavery; rigidity of the class system; differences between rural and urban life; property ownership; the position of women; family structures. Geographical location is an inevitable conditioning factor.
- *Economic aspects*: land ownership; quantitative studies of production; consumer goods; agricultural production; artisan and semi-industrial production; prices and transport and distribution costs (both as regards raw materials and finished products).



Fig. 1. Low relief in the Roman Empire representing a birth. (From Ostia, now in the Welcome Collection of Medical Objects.)

- *Administrative aspects*: the structure of the administration and its development; juridical statutes and population settlements; administrative determination of land distribution. Specific elements such as the *familia Caesaris* and interaction with the army are also conditioning factors to be taken into account.
- *Urban aspects*: spectacles; assessment of the sizes of cities and their population densities; population movements between countryside and city; town-planning features and structures. In this context, it should be emphasised that public baths and buildings for spectacles have long been considered as fundamental sources of information.

The order in which these different aspects have been presented is not that of importance; instead, it reflects criteria that may seem arbitrary, depending on the different questions and interests that have led to this general analysis.

## Birth and life expectancy

It is self-evident that the subject of birth rate is linked to female fertility (Fig. 1). It is a subject of great significance, in which, however, it will only be possible to make advances if new evidence is found. In contrast, we are almost totally ignorant of a substantial sector of the population: slaves.

Researchers depend on documents and inscriptions that simply mention free men and women and hardly ever refer to slaves. It cannot be proved that Malthus' theories on the increase or decrease in population are valid for the ancient world, but the simplicity of his approach can lead to their application.

In addition, it is difficult for us to consider these aspects separately in any consideration of life expectancy. We can be certain that child mortality reached considerable proportions, particularly in the first year of life, as has been the case almost down to the present day. Furthermore, there are specific phenomena that deserve to be considered: contraception and abortion, well studied taking the case of the Imperial household as an example [16,33,41,42], the exposure or abandonment of new-born infants and infanticide [14,28], particularly frequent for girls. It should be mentioned that the seasonal birthing cycle has led to interesting research, once again based on the example of the Imperial household itself, the *domus divina*, which provides a large amount of information [50]. The age at which young people got married and reproduction started has also been another important question when evaluating fertility [32]. The studies of Parkin [39] can be of great use in this field. His approach, consisting of analyzing the four types of evidence (epigraphic, Egyptian, Ulpianic and skeletal) available for this category of observation, could not be more appropriate.

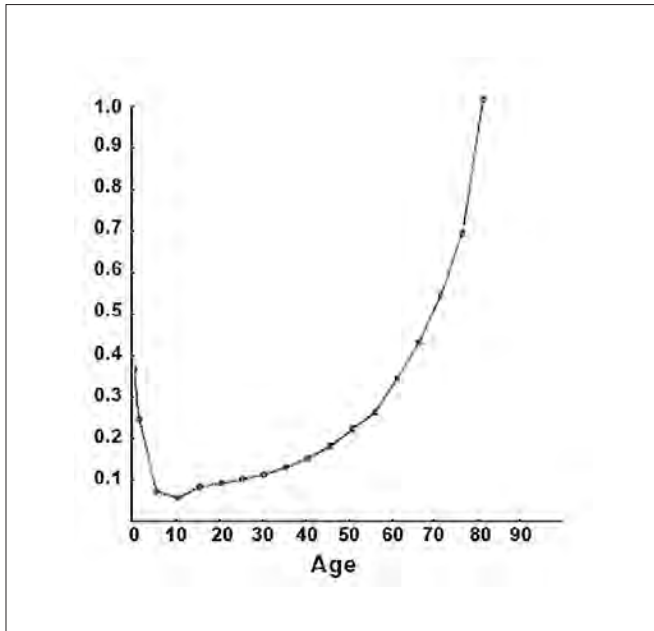


Fig. 2. Probability of dying between age  $x$  and age  $x + n$  [ $q_x$ ] in the Roman Empire. (Modified from Frier.)

**The epigraphic evidence.** Considering the meaning and relative significance of each of these forms of evidence, the epigraphic evidence is perhaps the most widely used, but the information so derived is of limited value for several reasons: (i) the chance nature of finds, the varying state of knowledge to be found in different geographical areas; (ii) the extent of what is known as the epigraphic habit [38]; (iii) the variations in the amount of information in different periods; and (iv) in particular, the fact that, at the most, it is indicative of only one sector of society at any given moment. Factors that favor the extensive use of such evidence include the simplicity of the calculations feasible. In addition, the distinction between men and women is perfectly clear and quantifiable in the epigraphic record and even the length of life can be easily calculated by adding the number of years lived by the individuals in the sample and dividing the total by the number of individuals concerned.

**The Egyptian evidence.** The Egyptian evidence is valid for Egypt alone but not for the whole Roman Empire, since the evidence is derived from the existence of censuses drawn up for tax-collection purposes. Consequently, they reflect only one sector of society and a very specific geographical area reliably. Furthermore, the number of censuses is insufficient to allow extrapolations outside Egypt itself. The demography of Egypt has been well studied [3,4], and excellent statistical data have been obtained as regards to female fertility and

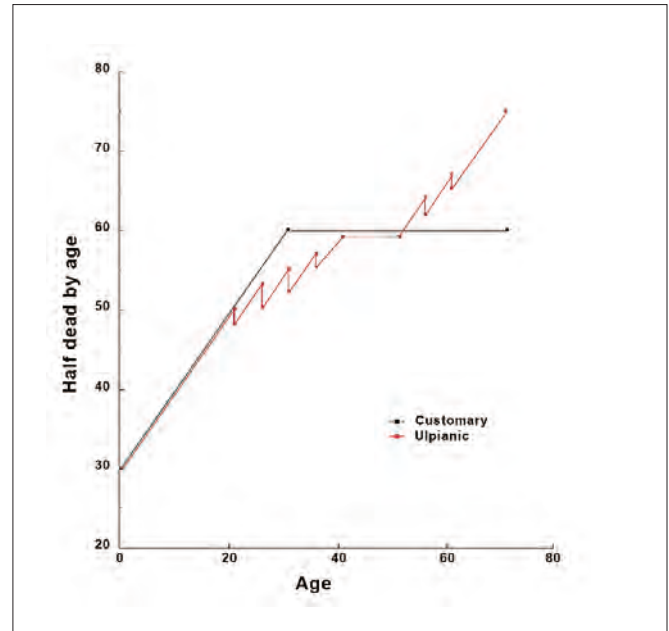


Fig. 3. Age by which a cohort of age  $x$  may be expected to be dead, according to the Ulpianic and customary tables.

birth rate. One distinctive feature of Egyptian society, brother-sister marriage, has also been a frequent subject of study [48]. Despite these limitations, our demographic knowledge is greater and better founded than the information that we have for other regions. W. Scheidel has insisted on the validity of applying modern parallels from the same area in order to evaluate death caused by plagues, seasonal mortality and the influence of food production on the population [47,48].

**The Ulpianic evidence.** The Ulpianic evidence (for the Roman jurist Domicio Ulpiano, 170–228 AD) is the information arising from a legal text contained in the *Digest*, in which, when the *XX hereditatium* and its consequences are considered, a gradual application of the *lex Falcidia* is proposed, depending on life expectancy. It is an element of general value as it can be applied to the Roman Empire as a whole, and it seems to reflect a degree of experience as regards the average lifespan. However, like all legal texts, it reflects one moment in time and a specific period, and, in all likelihood, the Italic context. Nevertheless, it is a relatively trustworthy source that can be extrapolated for analyzing the lifespan, and even more so when compared with other tables for the death rate in Antiquity [18]. (Figs. 2 and 3.)

**The skeletal evidence.** The skeletal evidence is the most reliable way of evaluating this information for a group. However, it does require a multidisciplinary approach that is not



always applied, and specific knowledge which archaeologists do not always possess. Once again, as in the case of the epigraphic evidence, the chance factor plays an important role, together with the diversity of our knowledge depending on the zone. Funerary rituals are also decisive as it is far easier to interpret a set of inhumations than a group of cremations. As Parkin recognized [39], it is clear that this is the most reliable indicator and the results thus obtained for the length of life are comparable with the standard charts or average pattern for the west that are habitually used as a comparative guideline. And Salmon similarly preferred this source of evidence over that of epigraphy [46].

The skeletal evidence allows us to carry out paleopathological studies and analyze child morbidity or mortality and gender differences. Literary sources and also epigraphic references to events tell us of the existence of pestilence and plagues. To take but one example, we might recall the long plague in the Antonine period (138–180 AD), which brought about the death of the Emperor Marcus Aurelius (121–180 AD) [46].

## Food supply

Food is a factor of vital significance in modern demographic studies in order to be able demonstrate whether life is sustainable or not in a particular area for a specific number of inhabitants; if this number is exceeded, the result may well be shortages, population decline and population movements caused by famine. Frier has stated *cum mica salis* that more is worse [17].

Surely famine was an endemic factor in the Roman world, and there is no doubt that food resources were always scarce or limited. It can be added that these circumstances were increased and verged on the extreme insofar as the slave population was concerned. It might be recalled that, as a model Roman matron, Cicero's mother exercised rigid control over food in her household, particularly in order to prevent slaves from gaining access to food supplies and, moreover, both Roman and Greek comedies represent slaves as being permanently obsessed with the possibility of eating (Fig. 4).

The Roman public authorities are also known to have established a supply system for the city of Rome and, by extension, for the area of modern-day Italy as a whole. Individual cities would seek out secure and constant sources of food supply, and it is widely assumed that needs might have been less serious in rural contexts because of the proximity of resources. Some historians would like to replace the term of *famine* by that of *Versordgunskrise* (supply crisis) [35], and there are no



Fig. 4. Distribution of bread in Pompeii (found at the "House of the Baker").

doubts that such difficulties did occur. To provide just one example, an inscription from *Hispania* makes this very clear in straightforward terms (IRC II, 32), but, at the same time, there can be no doubt that we are far from sure that food resources were adequate in all the area covered by the Roman Empire and that prolonged periods of famine did not take place [20–22,29]. It is apparent that health depended to a great extent on these food possibilities, and hence population also increases or decreases did occur. The care taken in supplying drinking water or water for the public baths in largely urban areas and military bases formed part of this concern. The *annona militaris*, the supplies provided to the army, which received oil from *Baetica* or wine from Italy in distant lands, is an example of this concern for supply, which was carried out with such a high degree of efficiency at certain times that it came to modify the eating habits of the areas in which the Roman army was based, as was the case of *Britannia*.

## Warfare and natural disasters

Rises or falls in population can also be due to factors external to the natural increase in population, such as wars. Brunt [10] emphasized how the population of Roman Italy fell by almost 450,000 citizens between 225 BC and 90 BC because of wars.



Fig. 5. Plaster casts of human bodies at the “Garden of the Fugitives” from Pompeii, after the Vesuvius eruption in 79 AD.

Natural disasters, earthquakes and especially tsunamis produced a particular impact on late Roman society, as Ammianus Marcellinus (ca. 330–ca. 400 AD) reminds us [24–26]. We should not forget the disaster that supposed for cities such as Pompeii and Herculaneum the eruption of the Vesuvius in 79 AD (to mention the best known example of a natural phenomenon of this type) (Fig. 5). Finally, reference has already been made to the shortages that arose from the dependency of crops on climatic conditions and the inadequate measures available to alleviate the effects of such circumstances.

### Social, economic and administrative aspects

The slave population is very difficult to quantify and also complicated to place it within the structure of society. Against the position adopted by the scholar G. Alföldy (1935–2011), who believed in the social mobility of the slave population by means of frequent manumission processes [1] (see the frequent reprints and translations of his *Römische Sozialgeschichte* [2]), at least in the urban context, there are divergent opinions based on the limitations for manumission and the need for a slave workforce for agriculture, animal herding and industrial production. It is very difficult to identify

the free peasantry, and for this reason we cannot calculate their significance in agricultural production [22]. According to Alföldy, in contrast, the capture of slaves in conquered lands and their swift manumission would have been an efficient way to increase the free population and thus also income through taxation.

As has already been mentioned, it is impossible to calculate the number of slaves for many reasons; whereas some scholars tend to maximize their numbers, others would reduce them to a minimum. Spartacus’ revolt (70 BC) involved at least 200,000 slaves in Roman Italy. The evidence of Livy (ca. 60 BC–17 AD) enables us, for example, to make a calculation as regards the number of slaves obtained as a consequence of the conquest of *Hispania*. The conclusions that can be drawn from all these sources are partial and in no way is it possible to make generalizations on their basis. A scholar of the stature of Brunt [10] has calculated a population of some 3,000,000 slaves out of a total population for Roman Italy that cannot have been greater than 7,500,000. In contrast, as Brunt himself also points out, for the free population of Roman Italy we can point to considerable growth between 508 BC and 14 BC, a period during which the census went from 130,000 to 4,937,000 [30,34]. However, this increase did not take place without fluctuations as a result of innumerable factors outside the natural biological increase. We do

not know exactly what the sources are referring to when they speak of population or census figures, and even in the case of the free population, they are likely to have excluded those who had the least weight, to a certain women and children.

Population density calculations are a frequent point of comparison when it comes to evaluating population figures in Antiquity. The density of 22–28 inhabitants/km<sup>2</sup> for Sardinia in 1881 was used by Beloch (1854–1929) as a variable for his calculations, increasing or reducing it in accordance with other factors such as terrain, soil fertility or the data derived from the sources for a particular moment. Similar calculations have been applied to Roman society taking advantage of the more sophisticated present-day knowledge of demography although with uneven results.

The size of military contingents and the establishment of new cities together with the resulting migrations are further factors to which particular attention has been rightly paid. However, it should be taken into account that these phenomena are unlikely to have taken place in hitherto empty regions and that they also had a noticeable impact on the pre-existing populations, who had to be displaced unless reduced to the condition of slaves. The Roman procedure of territorial planning and structure by means of *centuriatio* undoubtedly led to such effects, and in areas where there were no newly-established foundations, the establishing of divisions necessary for Roman government must have had traumatic consequences.

Social structure is a factor of particular importance. It is not only a question of the problems presented by a slave-owning society such as the Roman one, but also of the vectors that arise within such a society as a consequence of living alongside slaves [23]. Compared with the characteristics of most ancient societies, the rigid social structure that conditioned even marriages allowed relatively swift social promotion, particularly between the 1st and 3th centuries AD, with the result that within barely three generations a family might rise from the lowest ranks of society to the highest. As Alföldy pointed out, this mobility was not to be found again until the Early Modern period (ca. 1500–1789). In this context, we should remember the willingly-accepted strict social immobility of Byzantium as a paradigmatic case. Neither are we aware of the relative weight of the social classes, that is to say, for example, the *ordo senatorius*, the *ordo equester* and the Roman citizens with full rights, as well as the freedmen, so as to be able to establish their relative proportions.

In addition, social mobility in itself did not have a decisive or direct impact on population growth even though the impression may be given that there was an increase in the

numbers recorded in censuses as a consequence of some inhabitants obtaining their freedom and autonomy. The same situation arose as a result of the *constitutio Antoniniana*, by which the Emperor Caracalla (188–217 AD) gave all the free inhabitants of the empire Roman citizenship under certain conditions. Once again, the accumulation of property in a small number of hands, the limited possibilities for female autonomy and, in particular, broad family structures in rural contexts make it very difficult to assess population figures unless we are prepared to resort to models based on density (inhabitants/km<sup>2</sup>). We are aware of elements leading to agricultural development, but we are unable to evaluate their precise impact on population growth [8].

The same situation arises as regards the production of goods, whether in artisan or pre-industrial contexts; we might suppose that both free and slave labor were being used at the same time, but we are unable to quantify it. Information is available on aspects such as production costs, transport and distribution costs, thus we can even calculate production times, but we are not able to evaluate effectively the human role in the process [9,13,49].

An example in order to better understand the problem is that of marble quarrying. For the Romans, *marmor* was any stone that could be used for decorative purposes by means of working and polishing it and, consequently, it was a widespread and necessary activity throughout the empire.

The main quarries are well known to have been Imperial property. Diocletian (ca. 244–311 AD) and Maximian's (ca. 250–311 AD) *Edictum de pretiis maximis* (301 AD) provides us a production rate per cubic foot and the price of transport. The production inscriptions on the surviving unworked marble blocks show how production was organized, its dates and the names of those responsible for organizing it, with a considerable proportion of military personnel being present. Archaeological examination of the quarrying points, such as, for example, those where the so-called *cipollino* marble was quarried near the modern-day city of Karystos (Greece), enables us to become familiar with the quarrying places themselves. We indeed know the structures to house the military personnel stationed in the area, but there is no evidence whatsoever for the number of people present in the area and necessary for the extraction process, or for preparing, sometimes roughing out and transporting the stones. The cost of and the time required to produce the final product can therefore be calculated [5,43], but for the moment, we are unable to verify the number of individuals involved and their condition although we are aware of the presence of imperial slaves and freedmen. There is somewhat more information



about Egypt once again, more precisely on the production of porphyry and granite at the quarries near the Red Sea [37].

Confusions such as those that have been noted are almost always to be found whenever an attempt is made to quantify production processes from the point of view of human involvement. And the same occurs when any attempt is made to relate population to monetary circulation and the changes in the value of money under the empire, where inflation and devaluation were constant features, balanced by the circulation of gold coinage in the late Roman period [6,11,12].

The working of the Roman administration and its development are fairly well known, but once again we are faced with the difficulty of quantifying the number of civil servants. It may seem paradoxical that the uppermost levels are better known than the lower ones. We are aware of who succeeded whom in posts among the ruling classes, but not how their subordinates were organized and, above all, we are almost totally ignorant of their numbers. The family of the Caesars, that is to say the slaves and freedmen within the Imperial household, provided service for it, but at the same time they were in charge of the administrative bureaucracy of Imperial estates in distant territories and civil servants at the service of not only the Imperial administration. Their marriage union customs do not appear to have been ruled by the same factors that made the union of a free woman with a slave impossible, and, in spite of the many studies of the family of the Caesars at different moments, we cannot even be certain of its real structure. If this administrative interaction might also involve the army, the situation in which we find ourselves can easily be imagined if we seek to quantify the number of members and relate it to overall population figures, a detail that could turn out to be extremely meaningful.

The *Notitia Dignitatum*, which is essential for an understanding of the later period leading up to the break-up of the Roman Empire, is once again a relatively detailed organizational list of administrative and military structure, but does not enable us to progress beyond overall numbers, higher-ranking civil servants and military units, which makes it possible to propose likely approximations but does not allow great security in our calculations. The passage from Late Antiquity to the medieval world presents the same problems of quantification as those of the Classical period [44,45].

## Urban life

Urban and rural life in the ancient world were very different. And differences appear also when comparing different cities,

especially regarding the number of inhabitants, not only because of their dimensions, but also because of the availability of land in the area in which they were located and their strategic or logistical importance. No effort will be made here to define what was understood as a city in the ancient world, but I will underline the importance of the existence of a series of public buildings that identified the cities in general terms.

In addition, attention should also be paid to the structure of private residences, which in the case of the Roman Empire were basically *domus* and *insulae*, together with some mixed forms. For this purpose, considerable archaeological knowledge of the city being studied is required, a situation that is rarely found. As a result, assumptions as regards *insulae* are largely guesswork. Even when we possess ample archaeological knowledge, there will always be the question of the calculation of the slave population, to which the same variables for the occupation of space as the rest of the population cannot be applied.

Public buildings for spectacles—the theatre, amphitheater and circus, as well as the stadium and odeon in the eastern part of the empire—are one of the most widely used variables or tools for population measurement through calculations based on the number of spectators they could hold. These results are indeed valid for these buildings, but they cannot be used in a directly proportional way to estimate the population of the cities where they stood [40]. Every city of a certain status or size had one or more buildings of these characteristics, although archaeology may not have brought it to light. Such is the case, for example, of *Barcino* (Barcelona). Public spectacle buildings would have served not only the city, but also an entire zone, and the inhabitants of its hinterland used to attend performances, as well as inhabitants of other cities. In *Calagorri*, modern-day Calahorra in La Rioja, Spain, the home-town of Quintilian (ca. 35–ca. 100), around the year 100 AD pottery vessels associated with spectacles taking place in the theatre, amphitheater and circus were manufactured. The products, all from the same workshop, that of Gaius Valerius Verdullus, allude to the spectacle and even provide a date. The distribution of this pottery is thus significant, as it was carried by spectators when they returned home. If this distribution is examined, we will see that the distances travelled were occasionally over three hundred kilometers, which gives us an idea of its power of attraction for spectators from distant areas. However, not all the population could attend the spectacles and women, children and slaves were often excluded for various reasons. The consequence is clear: although these structures offer many possibilities for quantification, the results are not directly ap-





Fig. 6. Roman theatre in Bosra (southern Syria), capital of the Roman province of *Arabia Petraea*.

plicable to the cities where they are located, and they must have had a floating population of no small size (Fig. 6).

The calculations carried out on the basis of the cemeteries adjoining the city suffer from the same limitations, depending on the extent of our archaeological knowledge. There are also unusual superimpositions of sites, such as the case of the circus of *Segobriga*, in the central plateau of Spain (currently, province of Cuenca, Spain), which was built over a cemetery that had been in use until a few years earlier. This situation is a perfect illustration of the difficulties involved in this type of calculation.

There are specific problems when calculating the urban numbers in the great cities of the empire—with Rome, Alexandria, Athens and Antioch heading the list—because of the large number of buildings and urban spaces depending on their extent and the number of inhabitants. In all cases, the system of calculation is based on an estimate of the population density (inhabitants/ha), which in principle should reflect archaeological criteria, also taking into account uninhabited or unoccupied urban spaces.

In addition, the existence of these great cities led to their becoming a pole of attraction for the migratory population looking for a better or easier life, a need that the great city may not have been able to answer with its services. Consequently, there could be a large mass of jobless inhabitants, for whom some way out had to be sought in one way or another. An explanation of this type has been given, for instance, in


the case of Rome, when the so-called Gracchan colonies, named after the Gracchi brothers (Tiberius and Gaius) who promoted them in the 2nd century BC, were established. Similar reasoning is used by historians to explain expansions, migration and colonial foundations. The results of urban population figure assessments are thus very varied and confirm one point that is widely seen in this type of calculations: in essence they are opinions with a greater or lesser degree of scientific value and methodological basis.

Finally, a rarely mentioned subject in the field of demographic studies which is still a pending and unquantified subject is literacy. This variable should be related to population volumes even though the data in this case are almost exclusively epigraphic. It is a subject for which a specific methodology will have to be established, one that cannot be found in the previous contributions to the field, such as that of Harris [27], the results of which have gradually been modified or even refuted as knowledge has advanced.

## Conclusion

The different levels to which knowledge of writing penetrated may provide an explanation for the bias of our data when they do not depend on calculations of density nor on skeletal evidence. Generally speaking, written sources refer to a population that is capable of being the subject of legal business,

and not to the population as a whole. For this reason, it is both difficult and risky to extrapolate from this sort of data.

Looking at the subject as a whole, we are thus faced with calculations of limited reliability, whatever the quantification methodology might be, and with almost informed opinions to all extents and purposes. As Scheidel stated [47], only by means of cross-disciplinary embeddedness is there a future for the study of the demography of the Ancient World. 

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