

THE POPULATION OF ROMAN ALEXANDRIA

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The eminent Arab historian, 'Abd ar-Rahmân Abu Zayd ibn Khaldûn, once observed that a highly positive correlation exists between the size of a city's population and the degree of civilization and prosperity which it enjoys.¹ Accordingly, one would expect the ancient testimonia on *Alexandria ad Aegyptum*, a city often eulogized as a crossroads of the civilized world, in greatness second only to Rome, to reveal that its population was considerable in size. Regrettably, the sources are both few and controversial. Nevertheless, on the basis of these some scholars have postulated population estimates for Alexandria.² To be sure, such endeavors are a credit to the dedicated perseverance of ancient historians; yet population estimates are only as valid as the sources on which they are based and the methodology by which they are derived. This study proposes to reassess the ancient evidence for Alexandria as well as modern

¹ Al-Muqaddimah (Kitab al 'Ibar) II 236; cf. II 244.

² On the praise of Alexandria, see: Diodorus Siculus 17.52.5; Josephus, *AJ* 4.656; Plutarch, *Mor.* 207a–b; Aelius Aristides, *Or.* 26; Dio Chrysostom, *Or.* 32.35–40 and 47; *HA: Firmus* 8.5; Ammianus Marcellinus 22.16.7; Achilles Tatius 5.1; cf. Diodorus Siculus 1.50.7, *IG* 12.1561, and *ZPE* 41 (1981) 71–83.

Modern attempts to assess the population of Alexandria: J. Beloch, *Die Bevölkerung der griechisch-römischen Welt* (Leipzig 1886) 259, followed by W. L. Westermann, "Concerning Urbanism and Anti-urbanism in Antiquity," *Farouk University. Bulletin of the Faculty of Arts* 5 (1949) 87: 500,000; T. Walek-Czernecki, "La population de l'Égypte ancienne," *Congrès international de la population, II: Demographie historique* (Paris 1937) = *Actualités scientifiques et industrielles*, no. 711 (Paris 1938) 12–13: 1,200,000 to 1,500,000; A. von Premerstein, *Alexandrinischen geronten vor Kaiser Gaius: Ein neues Bruchstück der sogenannten Alexandrinischen Martyrerakten*, Mitt. Papyrussaml. Giess. Univ. 5 (Giessen 1939) 55: 600,000; J. C. Russell, "Late Ancient and Medieval Populations," *TAPS* 48 (1958) 66–67: population density of 235 per hectare; Mostafa el-Abbadi, *The Alexandrians from the Foundation of the City to the Arab Conquest* (Diss. Cambridge University 1960) 115–22: 500,000; P. A. Fraser, *Ptolemaic Alexandria* (Oxford 1972) II 172: 1,000,000; P. Salmon, *Population et dépopulation dans l'empire romain*, Coll. Latomus 137 (Bruxelles 1974) 35; R. Duncan-Jones, *The Economy of the Roman Empire: Quantitative Studies*² (Cambridge 1982) 276: population density of 326 to 420 per hectare; L. Koenen, on a special panel on ancient Alexandria at the 1985 annual meeting of the American Philological Association in Washington, D.C., in response to an earlier version of this paper, 3: 500,000 to 1,000,000. See also A. Segré, "Note sull' economia dell'egitto ellenistico nell'età tolemaica," *BSAA* 29 (1934) 256–66.

methodologies of estimating populations of ancient cities and to suggest a reasonable, maximum range for the total population of Alexandria during the early Principate.

The rising water table, shoreline subsidence, and general humidity at Alexandria have doomed all papyri buried *in situ*. Hence no census records of tax-payers and property owners nor even comprehensive citizen registers akin to those preserved at Oxyrhynchus or in the Fayyum have survived. It happens that an archive containing more than a hundred documents of Augustan date which relate to the private and business interests of Alexandrians has been preserved in the form of mummy cartonnage at Abusir-el-Melek, in the Herakleopolite nome (*BGU* IV 1050-1061 and 1098-1129). However, the evaluation of these documents as representative of the Alexandrian population as a whole occasions difficulties, insofar as it is not clear that the archive represents a random sampling of documents rather than a selection of documents pertaining only to certain groups of Alexandrians—for example, those who addressed their petitions to the Alexandrian bureau supervised by an ἐπὶ τοῦ κριτηρίου, whose precise jurisdiction and duties are unknown.³ For the same reasons, statistics based on the documents in this archive would not accurately reflect ethnic ratios in Alexandria and should not be utilized as a basis on which to project population estimates.

Relatively few inscriptions of Roman date have survived at Alexandria. Some remain buried under the modern city; undoubtedly others were incorporated into Byzantine buildings or consigned to the lime kiln because of their remote significance or reminiscence of the pagan past. A glance at the major corpus of Alexandrian inscriptions edited by Evaristo Breccia in 1911 indicates a typical array: votive, sepulchral, honorific, and public. To date, this corpus has been supplemented by fewer than one hundred stones, but none of these inscriptions sheds any light whatsoever on the size of the population in the Roman period; for so significant a city, the epigraphic remains are indeed meagre.⁴ Had more inscriptions survived, they would no doubt reflect only that small portion of the population whose municipal service inspired or whose affluence made possible the erection of inscribed monuments.⁵

As in the case of other cities which have been continuously inhabited since antiquity, most of ancient Alexandria remains unexcavated and unexplored. The first and only comprehensive attempt to map the area of the ancient city and to chart the plan of its streets was conducted in 1866 by the royal astronomer,

³ D. Delia, *Roman Alexandria: Studies in its Social History* (Diss. Columbia University 1983) 27, note 3; cf. W. Schubart, "Alexandrinische Urkunden aus der Zeit des Augustus," *ArchP* 5 (1913) 57-60, and el-Abbadi, *Alexandrians* (above, note 2) 117-18. Von Premmerstein, 55, and Fraser, *PA* I 91-92, had excessive confidence in the figures deriving from this archive.

⁴ *Catalogue général des antiquités égyptiennes du Musée d'Alexandrie, nos. 1-568: Iscrizioni greche e latine* (Cairo 1911); subsequently unearthed inscriptions have been sporadically published in *BSAA*.

⁵ On the inherent class bias in inscriptions, see K. Hopkins, "On the Probable Age Structure of the Roman Population," *Population Studies* 20 (1966) 247.

Mahmoud Bey el-Falaki. His results were distorted by indifference to stratigraphy, failure to distinguish among Ptolemaic, Roman, and Byzantine masonry, and arbitrary assessment of relative metrical equivalents among Greek στάδια and Roman *milia* in an attempt to reconcile discrepancies among the literary sources. For lack of systematic excavation, el-Falaki's plan has been the traditional starting point of nearly every topographical study of the city published since his day.⁶ In view of its serious shortcomings, however, his plan should be abandoned. One can only hope that the Egyptian Department of Antiquities will undertake a uniform series of trial excavations on land and a thorough investigation of the submerged Eastern harbor and shoreline so that these may serve as a scientific basis on which to reconstruct plans of the ancient city.⁷

Insofar as the physical dimensions of Alexandria are concerned, the disparity among literary sources can probably be reconciled on the basis of inclusion or exclusion of various προάστεια, or suburbs, by ancient authors, and by our awareness that the circuit of the city was not constant, but variable, expanding and shrinking over the course of time. Burial patterns indicate that in the early Ptolemaic period, the eastern city limit extended roughly as far as Cape Lochias (modern Silsileh) and, in keeping with Greek burial custom, cemeteries commenced just beyond this wall, at Chatby and Hadra. By the end of the first century B.C., however, these old nekropoleis had been abandoned in favor of cemeteries located further east at Ibrahimiya and Sporting and a new eastern wall was erected; the area in between appears gradually to have been inhabited and would remain residential during the Roman period.⁸

⁶ *Memoire sur l'antique Alexandrie* (Copenhagen 1872); el-Falaki's plan is conveniently reproduced in A. Adriani, *Repertorio d'arte dell'Egitto greco-romano*, ser. C (Palermo 1963–66), II, tav. 3. As early as 1894, D. G. Hogarth rejected el-Falaki's plan: "Report on the Prospects of Research in Alexandria," *Egypt Exploration Fund Archaeological Report* (1894–5) 17–18, note 1. Notwithstanding Hogarth's criticism, G. Botti's *Plan de la ville d'Alexandrie à l'époque ptolémaïque* (Alexandria 1898) was substantially based on el-Falaki's work. E. Breccia, *Alexandria ad Aegyptum* (Bergamo 1922) 71–76, and Fraser, *PA* I 13–14, echoed Hogarth's criticisms. However, A. Adriani and his students have been inclined to return to el-Falaki's plan: "Saggio di una pianta archeologica di Alessandria," *Annuario del Museo greco-romano 1932–33*, 53–57 and *passim*, and *Repertorio* I 18 and 55–57. Most recently see G. Caruso, "Alcuni aspetti dell'urbanistica di Alessandria in età ellenistica: il piano di progettazione," in N. Bonacasa and A. di Vita, ed., *Alessandria e il mondo ellenistico-romano. Studi in onore di Achille Adriani* I (Roma 1984) 43–53.

⁷ H. Frost, "Report and Recommendations on the Submerged Architecture and Statues at the Site of the Ancient Pharos, Fort Khait Bay, Alexandria," submitted to the Marine Information Center, UNESCO (1968?); see also the same author's "The Pharos site, Alexandria, Egypt," *J. Naut. Arch.* 4 (1975) 126–30.

⁸ On the Ptolemaic nekropoleis, see Adriani, *Repertorio* I 21; Fraser, *PA* I 12–13; and my figure 1, p. 292 below. On inhabitation of the Chatby-Hadra area during the late Hellenistic and early Roman periods, see Neroutsos-Bey, *L'ancienne Alexandrie: Étude archéologique et topographique* (Paris 1888) 80–83;

Strabo actually resided in Egypt from circa 25 to 19 B.C. His east-west estimate (17.1.8 and 10) of 30 στάδια from the Canopic gate bordering Ibrahimiya on the east to slightly beyond the Mahmudiya canal on the west compares favorably with the modern measurement of roughly 5.5 km.⁹ Strabo's north-south measurement of 7 or 8 στάδια at the isthmoi, or narrowest distances between the Mediterranean Sea and Lake Maryut, is approximately equivalent to the modern 1.5 km. distance along the western branch of the Mahmudiya canal which empties out into the western harbor. Today the distance from the Mediterranean coast at Ibrahimiya to Lake Maryut measures about 4 km. Some of this area appears to have been natural landfill of the old lake bed which originally may have extended as far north as the present lateral course of the Mahmudiya canal; accordingly, the ancient canal was probably situated farther north as well.¹⁰ Except for his measurement of the eastern isthmus, Strabo's estimate of the dimensions of the Roman city are nevertheless corroborated both by the topography of the modern city and by archaeological evidence of the city limits in the late first century B.C. in light of traditional burial practices. Relying on his figures, we may estimate that the city walls of Alexandria during the reign of Augustus enclosed an area measuring 8.25 sq. km. or 825 hectares.¹¹

Four criteria traditionally employed to estimate urban population density are the area of the city within its walled circuit, the size of its suburbs, the extent to which these areas were occupied by residential dwellings, and, in connection therewith, the ratio of town-houses to apartment buildings.¹² We

E. Breccia, "La necropoli di Sciatbi," *BSAA* 8 (1905) 55–56, and *Catalogue général des antiquités d'Égypte, nos. 1–624: La necropoli di Sciatbi* (Cairo 1912); A. H. Tubby et al., "An account of excavations at Chatby, Ibrahimieh, and Hadra," *BSAA* 16 (1918) 79–90; A. Adriani, "Scoperte de tombe," *Annuario 1932–1933*, 35–36, and "Vestiges de l'époque romaine à Chatby," *Annuaire du Musée 1935–1939*, 149–50.

⁹ One στάδιον is equivalent to 606.75 modern feet, and there are 5.4 στάδια per km. Modern measurements are based on the Egyptian Ministry of Finance, Survey of Egypt, *Pocket Atlas of Alexandria* (Giza 1935), plates 5–7 and 11–13.

¹⁰ In general, see A. De Cosson, *Mareotis* (London 1935).

¹¹ Cf. Beloch, *Bevölkerung* 258–59, followed by Duncan Jones, *Economy* 276, who proposed an area of 920 hectares.

The east-west dimensions preserved by Diodorus Siculus (17.52) of 40 στάδια and by Steph. Byz., s.v. Ἀλεξάνδρεια πόλεις (Meineke), of 34 στάδια probably included suburbs. Josephus (*BJ* 2.385) corroborated Strabo's lateral measurement of 30 στάδια. Cf. Pliny, *NH* 5.92: 15 *milia* wide. North-south dimensions of 10 στάδια preserved by Philo (*in Flacc.* 92) and Josephus (*BJ* 2.385) probably included the causeway and island of Pharos, to which the northern wall extended: *Bell. Alex.* 17; cf. Steph. Byz. loc. cit., for 8 στάδια from north to south. On the extent of the circuit at the time of the city's foundation, see Q. Curtius Rufus 4.8.2 and Steph. Byz. loc. cit.

¹² L. Homo, "Topographie et demographie dans la Rome impériale," *CRAI* (1933) 298 and 304; R. Meiggs, *Roman Ostia*² (Oxford 1973) 532–34—cf. the studies by Packer cited in note 17 below; C. Clark, *Population Growth and Land Use* (New York 1967) 178–9; A. Lezine, "Sur la population des villes africaines,"

have already estimated the area of the city proper to have been 825 hectares in the Augustan period. The names and approximate locations of several προάστεια are known but it is uncertain how far *extra muros* these suburbs extended (a similar problem is encountered when one attempts to determine the relationship of the *ager Romanus* to Rome); nor is it known whether their inhabitants were included in the population estimates for Alexandria preserved by classical authors.¹³

Since, for the most part, Alexandria has remained unexcavated, the ratio of public buildings, palaces, and parks to shops and housing in both the urban and suburban areas also remains wholly unknown. Moreover, over the course of time, the proportions would have varied. Strabo claimed that in his day, the Βασιλεία, or royal quarter, comprised one-quarter to one-third of the total area of the city (17.18.). Three generations later, the elder Pliny allotted only one-fifth of the total area to the royal quarter (*NH* 3.9.62). Moreover, although literary sources attest to the existence of many public buildings at Alexandria, including baths, theatres, bouleteria, gymnasia, hippodromes, and amphitheatres, their precise locations and relative proportions are unknown. Indeed, the only public structures that have been unearthed at Alexandria are the *odeon* and baths at Kom el-Dikka; the former, originally built in the fourth century A.D., was twice reconstructed thereafter with seating capacity for approximately one thousand spectators, and the baths are Byzantine in date.¹⁴ However, the capacity of public buildings in a city which attracted visitors from the countryside is not a reliable reflection of the size of the urban population.¹⁵

Ant. Afr. 3 (1969) *passim*; and J.C. Russell, "The Population and Mortality at Pompeii," *Bulletin of the International Commission on Urgent Anthropological and Ethnological Research* 19 (1977) 109.

¹³ On the difficulties encountered in distinguishing the city proper from its own territory, or *Chora*, see A. di Vita, "L'urbanistica più antica della colonie di Magna Grecia e di Sicilia: Problemi e riflessioni," *ASAtene* 59 (1981) 66–71. On the Alexandrian *Chora* see A. Jähne, *Alexandreia in Ägypten: die Erhebung zur ptolemäische Metropole, die chora der Stadt*. Diss. Humboldt University, Berlin (1980); and "Die Ἀλεξανδρέων χώρα," *Klio* 63 (1981) 63–103.

¹⁴ A. Calderini, *Dizionario dei nomi geografici e topografici dell'Egitto greco-romano* I.1 (Cairo 1935), "Alexandreia," *passim*; see also Adriani, *Repertorio* II 201ff. (*Glossario di topografia*). For totals of baths, taverns, porticoes and temples, see below, note 17.

On the *odeon* at Kom el-Dikka, see Fawzi el-Fakharani, "The odeon of Kom el Dick," *Cahiers d'Alexandrie* 4 (1966) 32–36; cf. his "Les découvertes archéologiques d'Alexandrie," *ibid.* 18–27, and E. Makowiecka, "The Numbering of the Seating Places at the Roman Theatre of Kom el Dikka," *Acta Conventus XI Eirene* (1968) 479–83. Recently, J.-C. Balty suggested that this building functioned as a bouleterion: "Le bouleterion de l'Alexandrie severienne," *Études et Travaux* 13 (1983) 8–12.

The fundamental and most recent study of the baths is by M. Rodziewicz, "Thermes romains près de la gare centrale d'Alexandrie," *Études et Travaux* 11 (1979) 108–38.

¹⁵ Russell (1977) 108.

Curiously, the only housing remains of Roman date discovered at Alexandria belong to villas; two of these were built within the early Ptolemaic city limits and one was constructed at Chatby.¹⁶ Are we therefore to infer that Alexandria developed on the model of Pompeii rather than Ostia and Rome? Surely such a conclusion would be an absurdity, for in a city of Alexandria's commercial importance, it would certainly be reasonable to assume the existence of numerous multiple dwellings—those notorious *insulae* whose precise definition has generated endless dispute.¹⁷ Moreover, even if remains of pre-Byzantine multiple dwellings were discovered at Alexandria, how accurate would modern estimates be, based as they are on the direction in which stairs presumably ran on storeys no longer extant and the relative thickness of foundation walls? Also conjectural is the restoration of upper storeys based on ground storey or mezzanine plans. At best, these are educated guesses.¹⁸ Thus we would be unable to arrive at a realistic approximation of the number of households in a building even if we could estimate the number of apartment

¹⁶ On the "House of the Birds," a Roman villa built in the middle of the first century and destroyed by the end of the third century A.D. at Kom el-Dikka, see M. Rodziewicz, "Un quartier d'habitation greco-romain à Kom el-Dikka," *Études et Travaux* 9 (1976) 175–92. For the remains of a Roman villa at Chatby, see above, note 8. Concerning the remains of a private Roman bath which belonged to a villa dating to the first or second century A.D. at Kom el-Dikka, see K. Kolodziejczyk, "Private Roman Bath at Kom el-Dikka in Alexandria," *Études et Travaux* 2 (1968) 144–54; cf. J. Lipinska, "Polish Excavations at Kom el-Dikka in Alexandria," *Études et Travaux* 1 (1966) 184–85. On Byzantine houses excavated in the center of the city, see M. Rodziewicz, *Alexandrie III: Les habitations romaines tardives d'Alexandrie à la lumière des fouilles polonaises à Kom el-Dikka* (Warsaw 1984).

¹⁷ For the existence of *insulae* and *domus* in Roman Alexandria, see Michael Bar Elias, *Chronic.* 5.3, ed. and tr. J.-B. Chabot (Orfa 1899–1910), I 113–115, and P. A. Fraser, "A Syriac *notitia urbis Alexandrinae*," *JEA* 37 (1951) 107, note 7. Fraser astutely observed that the absence of Christian buildings and inclusion of the Serapeum, destroyed in A.D. 391, suggest that Michael's source for the *notitia* predated the "triumph of Christianity" in the fourth century A.D. Similar fourth-century lists survive for the city of Rome: see *Codice topografico della città di Roma*, edd. Valentini and Zuchetti (Rome 1940), and G. Hermansen, "The Population of Imperial Rome: The Regionaries," *Historia* 27 (1978) 129–68; cf. fragments of the Severan plan: G. Carettoni et al., *La pianta marmorea di Roma antica* I (Rome 1960).

At Ostia, two-thirds of which has been excavated, the ratio of multiple dwellings to private villas was an overwhelming 184:22. See J. E. Packer, "Housing and Population in Imperial Ostia and Rome," *JRS* 57 (1967) 83–86, and "Urban Life and Society in Imperial Ostia and Rome," *MAAR* 31 (1971) 66 and 80. Packer drew inferences from the Ostian evidence for Rome, as had von Gerkan earlier: "Die Einwohnerzahl Roms in der Kaiserzeit," *MDAI:R* 55 (1940) 149–95, and "Weiteres zur Einwohnerzahl Roms in der Kaiserzeit," *MDAI:R* 58 (1943) 213–43.

¹⁸ Packer, *JRS* (1969) 84–87, and *MAAR* (1971) 66–68. See also B. W. Frier, *Landlords and Tenants in Imperial Rome* (Princeton 1980) 3–20.

buildings in Roman Alexandria. In sum, the evidence at present makes it impossible to estimate the population density of this city.

Moreover, lack of documentation from Alexandria precludes the possibility of estimating the average urban household size and no evidence of foundations survives on which an estimate of the number of families can be made.¹⁹ To be sure, the landmark studies of census declarations from the Oxyrhynchite and Arsinoite nomes by Calderini, Hombert and Préaux illuminate our understanding of the mean family size in Egyptian villages. However, statistics derived from rural villages are not valid models on which to base a profile of the population of an urban metropolis and provincial capital.²⁰ Valuable data contributing to our understanding of the average family size such as male:female ratios and mortality could have been gleaned from the study of skeletal remains, especially those from the three-storied catacomb utilized from the late first through the early fourth centuries A.D at Kom el-Schoqafa in Alexandria, but these skeletons were not examined and no data was preserved.²¹ Moreover, what is a reasonable estimate for the proportion of slaves to free persons in antiquity's big cities?²² Finally, the attempts to attribute to Roman Alexandria population estimates based on analogies with modern populations are both arbitrary and unconvincing; how does one go about choosing areas and dates which present reasonable parallels? ²³ In short, to base an estimate of the

¹⁹ For example, see R. P. Duncan-Jones, "Human Numbers in Towns and Town Organizations of the Roman empire: The Evidence of Gifts," *Historia* 13 (1961) 205–8.

²⁰ A. Calderini, *La composizione della famiglia secondo le schede di censimento dell'Egitto romano* (Milano 1923) 54; M. Hombert and C. Préaux, *Recherches sur le recensement dans l'Égypte romaine*, Pap. Lugd. Batav. 5 (Leiden 1952) 154–55 and 163.

²¹ See W. W. Howells, "Estimating Population Numbers through Archaeological and Skeletal Remains," and H. V. Vallois, "Vital Statistics in Prehistoric Population as Determined from Archaeological Data," in R. F. Heizer and S. F. Cook, ed., *The Application of Quantitative Methods in Archaeology* (New York 1960) 158–85 and 186–222, respectively.

²² W. L. Westermann's estimate of 25 to 30 percent for the proportion of slaves to the total population of a large ancient metropolis may be high: "Slavery," *Encyclopedia of the Social Sciences* 14 (1934) 76; see also his "Urbanism and Anti-urbanism" (above, note 2) 87 note 6. Beloch's estimate for the slave population of Roman Alexandria was based on that of Pergamum: *Bevölkerung*, 259. Conversely, F. G. Meier concluded that it is impossible to determine the number of slaves even in an ancient city as well documented as Rome: "Römische Bevölkerungsgeschichte und Inschriftenstatistik," *Historia* 2 (1953–54) 336–44.

²³ Boak's sources for the male:female ratio in Roman Egypt were early twentieth century census reports from China, India, and Egypt: "The Population of Roman and Byzantine Karanis," *Historia* 4 (1955) 159; see also Duncan-Jones, *Economy* (above, note 1) 276–77, and A. R. Burn, "Hic brevis vivitur: A Study of the Expectation of Life in the Roman Empire," *P&P* 4 (1953). For objections against relying on population density figures from the Moslem period, see

population of Roman Alexandria on any of the foregoing would be to place one's trust in a house built of cards.

When one turns to the literary sources, one is confronted by the sobering pronouncement of A. H. M. Jones: "it is unlikely that I shall be able to conceal the ignominious truth, that there are no ancient statistics."²⁴ Jones astutely observed that ancient literary sources were indifferent to figures of economic significance; as a result, data are scant and so diverse in terms of date that they are scarcely comparable. Moreover, noted Jones, manuscript copyists were most likely to err in the task of copying figures. An excellent example of this is the *notitia urbis Alexandrinae* preserved in the Syriac chronicle of Michael Bar Elias which contains two sets of figures: the first group are entries of the number of particular types of buildings in each of the five regions of urban Alexandria and the second group consists of totals for the entire city by building types which, however, do not equate with the sums of the individual entries appearing in the first set.²⁵

One consideration essential to the evaluation of ancient literary sources is the reliability of the evidence on which their figures rest. For example, Josephus relates that the total population of Egypt was seven and one-half million excluding the population of Alexandria, ὡς ἔνεστιν ἐκ τῆς καθ' ἐκάστην κεφαλὴν εἰσφορᾶς τεκμήρασθαι (*BJ* 2.16.4). Even were we to assume from this statement that Josephus had access to the complicated records of the λαογραφία, or poll tax, to which only adult males were subject,

Lezine, 78–79. I would not be so rash as to rule out modern demographic parallels if an adequate sampling of vital statistics from Roman Alexandria had survived. In that case, reasonable approximations of life expectancy might be gleaned from tables in A. J. Coale and P. Demeny, *Regional Model Life Tables and Stable Populations* (Princeton 1966). See, for example, B. Frier, "Roman Life Expectancy: the Pannonian Evidence," *Phoenix* 37 (1983) 328–44, and "Roman Life Expectancy: Ulpian's Evidence" *HSCP* 86 (1982) 213–51. See also K. Hopkins, *Death and Renewal* (Cambridge 1983) 69–107; R. Étienne, "Demographie et epigraphie," *Proceedings of the III International Congress of Greek and Latin Epigraphy* (Rome 1957) 415–24, and I. Kajanto, *On the Problem of the Average Duration of Life in the Roman Empire*. *Annales Acad. Scientiarum Fennicae*, ser. B, 153.2 (Helsinki 1968). An essential precondition for demographic investigation cited by G. Acsádi and J. Nemeskéri is completeness of evidence or, in the event that this is lacking, a random sampling: "Methods of Paleodemographic studies," in *History of Human Life Span and Mortality* (Budapest 1970) 57–58. See also N. Keyfitz and W. Flieger, *Population: Facts and Methods of Demography* (San Francisco 1971) 567–92, and P. Cox, *Demography*⁵ (Cambridge 1976) 20–45.

²⁴ *Ancient Economic History*. Inaugural lecture delivered at University College, London (1948) 3. See also M. I. Finley, "Le document et l'histoire économique de l'antiquité," *Annales. E.S.C.* 37 (1982) 697–713 = *Ancient History: Evidence and Models* (New York 1987) 27–46.

²⁵ See above, note 17. In connection with similar fourth-century tallies for the city of Rome, Hermansen (1978) 159 suggested that the awe and admiration inspired by that city inflated the figures. The same suggestion may be entertained in connection with the *notitia urbis Alexandrinae*.

numerous documents indicate that many males throughout Egypt enjoyed privileged status which wholly or partially exempted them from liability to pay this tax. Hence the reliability of Josephus' estimate necessitates his having had access to figures for all of these categories as well as the summaries of family sizes and household staffs declared on individual census returns every fourteen years.²⁶ The likelihood that all of these sources were consulted by Josephus is remote. Another case at hand is Diodorus Siculus' (1.31.8) estimate of seven million for the population of Egypt in Pharaonic times and three million in his own day, circa 60 B.C. Dindorf expunged the second figure in his edition of the text; subsequent editors cast doubt by bracketing it, so that the passage reads: τοῦ δὲ σύμπαντος λαοῦ τὸ μὲν παλαιὸν φασὶ γεγενῆσθαι περὶ ἑπτακοσίας μυριάδας, καὶ καθ' ἡμᾶς δὲ οὐκ ἐλάττους εἶναι [τριακοσίων], thus making the passage compatible with the estimate of Josephus. Unfortunately, Diodorus does not disclose the source of his information, although his account may have served as one of Josephus' sources.²⁷

Heeding Jones' caution that classical authors were indifferent to the statistical ramifications of their figures, we should not read into their choice of terms a deliberate attempt at technical accuracy. Hence Walek-Czernecki probably goes too far in contrasting λαός—the total population inclusive of females and children, with δῆμος—which he would limit to adult male citizens. To be sure, the former is a general term, unlimited by gender and age, but the latter may be no more exclusive than the term οἱ πολῖται, which certainly included women, despite their lack of public visibility and exercise of franchise in Hellenic cities.²⁸

Our only key figure for the population of Roman Alexandria is preserved by Diodorus Siculus, who claimed that in his own day, circa 60 B.C., more than three hundred thousand ἐλεύθεροι resided there (17.52.6). Diodorus cites as his source οἱ τὰς ἀναγραφὰς ἔχοντες τῶν κατοικούντων, but both the

²⁶ S. L. Wallace, *Taxation in Egypt from Augustus to Diocletian* (Princeton 1938) 116–34. See also A. C. Johnson, *Roman Egypt* (Baltimore 1936) 531–36, who assumed that if Josephus had access to revenue figures he may also have had access to census records. Frankly, I am astonished that Jones (1948) 10 considered Josephus' estimate to be the sole reliable figure surviving in literary sources for the total population of an ancient society.

²⁷ Beloch, *Bevölkerung* 257, interpreted καθ' ἡμᾶς as referring not to Diodorus' own day but rather to the date of his principal source for the pharaonic period, Hekataios of Abdera; however, Walek-Czernecki, (above, note 2) 10–11, has demonstrated that this interpretation is untenable. Diodorus Siculus' sources for this passage are discussed by A. Burton, *Diodorus Siculus, Book I: A Commentary* (Leiden 1972) 6–9.

Wilcken argued in support of the textual emendation: see *O. Wilck.* I 487. For a hypothetical assessment of the demographic development of Egypt from pharaonic through Islamic times based on the amount of cultivable land, see K. W. Butzer, *Early Hydraulic Civilizations in Egypt: A Study in Cultural Ecology* (Chicago 1976).

²⁸ See note 2 above, 10–11; cf. Delia, *Roman Alexandria* 21–23.

nature of these registers and the scope of the term ἐλεύθεροι are uncertain.²⁹ 'Ελεύθεροι cannot possibly signify only free male citizens, since were we to treble this figure to allow for one wife and a minimum of one child per citizen family, the total free citizen population would amount to nearly one million, without even taking into account the extensive foreign resident population or slaves. On the other hand, if the term signifies all free males residing at Alexandria regardless of civic status, then a minimum total population of more than one million residents would still result after allowing for one wife and child each as well as slaves. Both sums are excessive for a city whose area was only six-tenths the size of third-century Rome.³⁰ Accordingly, 300,000 ἐλεύθεροι most probably represents an approximate total for Alexandrian citizens of both genders and all ages, although it is uncertain whether all of these actually resided within the city limits or were merely registered at Alexandria and resided throughout Egypt or abroad.³¹ In addition, the sources reveal that foreign residents were numerous at Alexandria throughout the Ptolemaic and Roman eras but it is impossible to estimate their numbers; nor can proportions of Egyptians and slaves in the city be advanced with any degree of accuracy. Nevertheless, I would be very surprised if the total population of Roman Alexandria ever exceeded the range of 500,000 to 600,000 persons.³²

In a paper delivered at the XVIII International Congress of Papyrologists, Mostafa el-Abbadi valiantly attempted to estimate the population of Alexandria during the late first century B.C. and the sixth century A.D. He interpreted Diodorus' figure as signifying the free resident population of Alexandria inclusive of citizen and foreign men, women and children.³³ On the model of Westermann,³⁴ el-Abbadi added an extra 25 to 30 percent of this figure for slaves, arriving at a total population of Alexandria circa 60 B.C. that ranged between 350,000 and 375,000 persons. However, this total does not compare at all favorably with el-Abbadi's estimate of 525,000 to 600,000 persons for the population of Alexandria in the sixth century A.D., while the latter also derives from tenuous assumptions that result from combining sources from remote chronological contexts.

²⁹ Nor has a search for ἐλεύθερος in the history and fragments of Diodorus Siculus in the *TLG* elucidated Diodorus' use of this term.

³⁰ Meier (above, note 22) 329.

³¹ Diodorus' estimate of the Alexandrian citizen population would have been facilitated by the fact that citizens of the Greek cities in Egypt were required to report births of their children. See Delia, *Roman Alexandria* 47 and 83, and H. I. Bell, "Diplomatica Antinoitica," *Aegyptus* 13 (1933) 518–22.

³² Strabo (16.2.5) characterized Seleucia on the Tigris and Alexandria as comparable in terms of δύναμις (strength, i.e. of manpower) and μέγεθος (magnitude, physical size). The elder Pliny subsequently related that in his day, circa A.D. 60, the population of Seleucia reportedly numbered 600,000 (*NH* 6.30.122). See also Beloch, *Bevölkerung*, 479.

³³ "The Grain Supply of Alexandria and its Population in Byzantine Times," (Athens 1986).

³⁴ See above, note 22.

El-Abbadi assumed that the two million *medimni* of grain extorted by the prefect of Egypt from the Alexandrian grain dole in A.D. 546 represented the entire dole, although the text of Procopius (*HA* 26.41-3) does not imply that this was the whole but merely relates that two million *medimni* was the amount of grain which the prefect, Hephaestus, pocketed. El-Abbadi next advanced the argument that a total grain dole of two million *medimni* was distributed in the sixth century at the one *artaba* per person rate documented in A.D. II/III, so that there were 300,000 recipients of the grain dole. Finally, el-Abbadi assumed that the dole was distributed among all adult residents, regardless of gender or civic status, by extending the generic phrase *πλήθος οἰκητόρων* of Eusebius *HE* 7.21.9 to *οἱ τεσσαρακοντούται καὶ μέχρι τῶν ἑβδομήκοντα* of the sentence which follows, although the latter probably signified exclusively male recipients of the Roman grain dole in A.D. 261. In conclusion, el-Abbadi projected a total population range of 525,000 to 600,000 persons at Alexandria during the sixth century A.D. based on the assumption that males and females were evenly represented on the dole, which yielded 150,000 adult males, and by adopting Duncan-Jones' ratio of adult males = 28.6% of the free population.³⁵ Nonetheless, it would be most unusual for the population of Alexandria, reduced by endemic racial hostilities and wars during the Roman principate, to have doubled by the sixth century. Recently, the assumption that after a war or natural disaster has reduced a population, it will replenish itself to its former size, *provided that no new catastrophe occurs* has been challenged. Only a conservative growth rate can be demonstrated.³⁶

Figures for the population of Alexandria at the time of the Arab conquest (A.D. 642) are preserved in the accounts of several Arab sources. The *Futuh Misr* of 'Abd al-Hakam relates that according to one source, 'Amr reported to Omar that he had found 40,000 Jews at Alexandria paying taxes.³⁷ The schematic sequence of 4,000 baths, 40,000 Jews and 400 royal pavillions, however, cautions one against placing excessive trust in these figures. 'Abd al-Hakam goes on to relate that other sources said that 70,000 Jews at Alexandria were apprehensive, and that there were 200,000 Byzantine (literally, "Roman") men, 30,000 of whom along with their families and possessions abandoned Alexandria. Finally, 'Abd al-Hakam relates that 600,000 males at Alexandria were subject to the capitation tax. With respect to the tax, The *Khitab al Khitat* of al-Makrizi notes that 'Amr levied a tax on all Jews at the rate of 2 dinars per head, exempting only elderly men, children who had not reached maturity, and women;³⁸ but what of Christians, who were required to pay this tax as well? Al-Baladhuri related that at the time of 'Amr's conquest, the capitation tax from

³⁵ *Economy*, 264 note 4.

³⁶ M. Hansen, "Demographic Reflections on the Number of Athenian Citizens, 451-309 B.C.," *AJAH* 7 (1982) 173-76.

³⁷ *The History of the Conquest of Egypt, North Africa and Spain known as the Futuh Misr of Ibn 'Abd al-Hakam*, ed. C. C. Torrey. Yale Oriental Series, Researches III (New Haven 1922) 82 (Torrey).

³⁸ *MIFAO* 3 (1906) 126-28, tr. P. Casanova.

Alexandria amounted to 180,000 dinars, which suggests that 90,000 had refused to embrace Islam.³⁹ To be sure, the figures preserved in these sources are contradictory, and those of greater magnitude may well excite suspicion on the grounds that the glorious tradition of the Arab conquest of Alexandria would have been enhanced by exaggerating the size of its captive population.⁴⁰

One fragment of the notorious *Acta Alexandrinorum* warrants consideration in connection with our discussion of the population of Roman Alexandria. In *P. Giss. Univ.* V 46, the figure 180,000 appears in the line which follows the mention of 173 elders. Von Premenstein restored the text of column I to read:

‘Ο δὲ τῶν γονάτων αὐ]τοῦ ἀψάμενος εἶπε(ν).
 ’Ακουσόν μου, Καί]σαρ. ’Αλεξανδρέων ὁ
 δῆμος ἐπιθυμεί, κύ]ριε αὐτοκράτωρ, πο-
 λειτικῆς γερουσί]ας ἀπὸ ῥῶγ γερό]ντων,
 ἢ ἥδη ἐν συνόδῳ δ]έκα καὶ ὀκτὼ μυριάδα[ς
 περιεχούση ἐχειροτον]ήθη.⁴¹

Recently, L. Koenen transcribed the text as follows:

‘Ο δὲ γονάτων αὐ]τοῦ ἀψάμενος εἶπε(ν).
 κατηγορῶ, κύριε Καί]σάρ. ’Αλεξανδρέων [ο?
 δὲ ἔφη. κύ]ριε αὐτοκράτωρ [πο-
 ρεύόμεθα(?) ἡμ]εῖς ἀπὸ ῥῶγ γερό]ντων,
 πόλεως ἥς περὶ δ]έκα καὶ ὀκτὼ μυριάδα[ς
 εἰκάζεται εἶναι τὰ] πλ]ήθη, τόδε εἶπεν]⁴²

Notwithstanding the difficulties encountered in attempting to restore so badly damaged a text, at best hypothetical due to the absence of parallels, both von Premenstein and Koenen have argued that δ]έκα καὶ ὀκτὼ μυριάδα[ς can only relate to the population of Alexandria, presumably at the close of Tiberius’ reign and the accession of Gaius in A.D. 37.⁴³ To be sure, δ]έκα καὶ ὀκτὼ

³⁹ *Kitab Futuh al Buldan*, tr. P. Hitti (Bierut 1966).

⁴⁰ In general, see A.J. Butler, *The Arab Conquest of Egypt and the Last Thirty Years of the Roman Dominion*² (Oxford 1978) 310–27 and 368–400. The extant remains of Arab walls in the Shalalat Gardens and south of the Kom el-Dikka fortress indicate that these enclosed an area considerably smaller than in Roman times.

⁴¹ *P. Giss. Univ.* V 46, ed. A. von Premenstein, see note 2 above; this document has been re-edited as *P. Yale* II 107. Von Premenstein’s reconstruction of the text has earned both praise and censure: H. I. Bell, *CR* 54 (1940) 48–49; H. A. Musurillo, *The Acts of the Pagan Martyrs* (Oxford 1954) 106; H. C. Youtie, *CW* 54 (1943) 163–65 = *Scriptunculae* (Amsterdam 1973) II 863–67. On the *gerousia* at Alexandria, see M. el-Abbadi, “The Gerousia in Roman Egypt,” *JEA* 50 (1964) 164–69.

⁴² See above, note 2.

⁴³ Von Premenstein believed that the Tiberius, referred to in columns I and II of this document, was Gemellus and accordingly dated the first audience prior to

μυριάδα[ς is intimately connected with the subject under appeal. If 180,000 *drachmai* (the equivalent of 30 talents) were in question, we are at a loss to appreciate the significance of this sum; likewise, the figure probably did not refer to *artabai* of grain distributed in connection with a local alimentary scheme, since the earliest evidence of imperial intervention in such matters (in Italy, not the provinces) dates to the reigns of Nerva and Trajan. If this figure indeed refers to persons, who can they be?

Von Premerstein and Koenen argued that by this date a *numerus clausus* of 180,000 male citizens had been established at Alexandria and that this figure should be associated with the tribal schema of *P. Hib.* I 28 (265 B.C.);⁴⁴ accordingly, they projected estimates for the total population of Alexandria during the reign of Gaius. Nevertheless, the very concept of a *numerus clausus* of citizens is unacceptable, because it is grounded on the assumption that the number of citizens remained fixed regardless of whether the citizen population actually experienced demographic growth or decline. I do not know of a single parallel among Greek cities in the Roman empire.⁴⁵ Moreover, as I have argued elsewhere, *P. Hib.* I 28 may well refer to the tribal organization at Ptolemais or Naukratis during the third century B.C., and not to Alexandria.⁴⁶

One possibility hitherto not considered is that δ[έκα καὶ ὀκτὼ μυριάδα[ς represents the number of Jews resident at Alexandria and its immediate environs. For Josephus related that 50,000 (but by no means all) of the Jews had been massacred in the Delta district of Alexandria in A.D. 61, pursuant to the orders of the prefect Tiberius Iulius Alexander (*BJ* 494-98). One generation earlier, the Alexandrian Philo had claimed that one million Jews resided in Egypt (*in Flacc.* 43).⁴⁷ To be sure, the accuracy of Philo's estimate as an absolute figure, like that of Josephus for the total population of Egypt discussed earlier, is subject to doubt; these may, however, suggest that Jews stood in approximately a 1:7 ratio to the total population of Egypt. Moreover, one would expect that the largest concentration of Jews occurred in the city of Alexandria.

It is undoubtedly true that Jewish and Alexandrian polemic may have exaggerated the accounts of the endemic civil strife which took place during the reigns of Gaius and Claudius between Alexandrians and Jews resident in this city. Philo's *in Flaccum* and *Legatio ad Gaium*, the historical accounts of Josephus, and the emperor Claudius' response preserved as *P. Lond.* VI 1912.

Gemellus' suicide towards the end of A.D. 37. However, it is indeed likely that the emperor Tiberius was meant, the first audience having taken place before him at Capri and the second audience occurring before Gaius at Rome after Tiberius' death in March A.D. 37. See the discussion in *P. Yale* II 107, p. 86.

⁴⁴ Von Premerstein, 46-47; Koenen, 2. See also Fraser, *PA* I 39-40.

⁴⁵ To be sure, *SEG* IX 1 (Cyrene, reign of Ptolemy I) preserves the text of a constitution imposed on Cyrene which established a *politeuma* limited to ten thousand citizens; this constitution may have been imposed as early as 321 B.C., but it is uncertain how long it remained in effect. The Cyrenaean edicts of Augustus (*SEG* IX 8-9, Cyrene, 7/6^a) do not mention a closed body of citizens, but focus instead on the distinctions between Roman citizens and Hellenes.

⁴⁶ Delia, *Roman Alexandria* 80-82.

⁴⁷ Cf. *Leg.* 124, 256 and 350.

(Philadelphia, A.D. 41) relate that Alexandrian citizens and resident Jews had repeatedly come to blows over their respective rights and privileges in the city and that, on several occasions, these issues were the subject of appeals directed to the emperor. Accordingly, it is just possible that similar circumstances led to the embassy described in *P. Giss. Univ.* V 46, preserved for posterity as one episode in the ardently nationalistic and anti-Roman *Acta Alexandrinorum*; it was intended to inflame Alexandrian passions and solidarity by means of denouncing what critics perceived as Rome's philojudaic proclivities.

With the total population of Alexandria probably ranging between 500,000 and 600,000 persons during the Roman principate, 180,000 Jews would have represented 30 to 36 percent of the whole. If one accepts this figure, an extraordinarily large proportion of Jews resided at Alexandria, which would explain why this city experienced repeated violent outbreaks between its Hellenic and Jewish factions.⁴⁸ Alternatively, one might also dismiss the figure of 180,000 Jews as suspect, if indeed it emanated from propaganda designed to exaggerate an alleged Jewish threat to citizens of Alexandria.

In terms of manpower, casualty and captive figures in the *Bellum Alexandrinum* are not helpful, insofar as a general levy had been conducted throughout Egypt to meet the demands of the war (*Bell. Alex.* 2). Nor does this source disclose the amount of food required to feed the Alexandrian population under siege, however inflated its numbers may have been as a result of recruitment in the Delta and Upper Egypt.⁴⁹

There appears to have been an *annona* at Alexandria during the third century A.D., the institution of which may have coincided with the first appearance of εὐθηνιάρχαι. Five in number (one per city district), these magistrates replaced the former ἐπὶ τῆς εὐθηνιάς and were responsible for the regulation of prices

⁴⁸ For a ratio of 70,000 Jews to 200,000 Byzantines (presumably all males) at Alexandria at the time of the Arab conquest note the discussion above.

⁴⁹ The classic study which tried to estimate a population based on the total food supply of a city is that of W. J. Oates: "The Population of Rome," *CP* 26 (1934) 101–16. Oates presupposed that the food consumption of a human individual has a constant average, regardless of geographic situation or the caloric demands of various professions. Moreover, he disregarded the significant difference in the amounts of monthly rations cited by ancient authorities, which vary from 4 to 5 modii per month, or 20 to 20%. He ignored the disparity of occupations of the intended recipients and also did not take into consideration the fact that the weights of various grains considerably differ. Cf. A. Jardé, *Les céréales dans l'antiquité grecque* (Paris 1925) 128–44; Packer, "Housing and Population" (above, note 17), 87–89; C. Clark and M. Haswell, "Food Consumption," in *The Economics of Subsistence Agriculture*⁴ (London 1970) 1–26; and G. D. R. Sanders, "Reassessing Ancient Populations," *ABSA* 79 (1984) 251–62. For an ordinary grain allowance of one *artaba* (= 4 *modii*) per slave or laborer in Roman Egypt, see Johnson, *Roman Egypt* (above, note 26) 301 and the documents cited therein. The total food consumption of Roman Alexandria is in any case unknown.

and the food supply.⁵⁰ Circa A.D. 261, after the acclamation of the Egyptian praefect M. Julius Aemilianus by the Alexandrian populace and the Emperor Gallienus' measures to capture the usurper and recover the province, Alexandria was laid waste. Eusebius purportedly preserves the account of Bishop Dionysios of Alexandria which describes the slaughter and resulting pestilence (*H.E.* 7.21.9). In these dire circumstances, all males between the ages of fourteen and eighty years were eligible for the Alexandrian grain dole; but no figures are preserved for the total number of recipients.⁵¹

Another approach which has hitherto been unexplored might be based on a correlation of the water storage capacity with the development in the Roman period of the vast network of canals and cisterns which undermine the ancient city of Alexandria. It nevertheless appears impossible to estimate the average amount of water consumed by an individual in light of the extensive use of water for public and private baths, household needs, and for beasts of burden and livestock. Moreover, although the early network of canals and cisterns was probably designed to anticipate future needs, we may never be sure about the extent to which subsequent additions satisfied or surpassed the requirements of the current population.⁵²

Finally, the modern historian often fails to appreciate the fact that population figures are, after all, only rough estimates. Numerous factors constantly modified these figures; among them were local conditions, elective population controls, and emigration of Alexandrians into the Egyptian *Chora* and abroad. Conversely, in view of the splendid libraries and Museum, a fine reputation for training in philosophical, medical, and, eventually, Christian studies, and its distinct commercial advantages, Alexandria attracted scores of foreign immigrants as well. Moreover, we must not forget the pattern of

⁵⁰ Delia, *Roman Alexandria* 158–59; cf. Breccia, *IGA* 71 (Alexandria, A.D. 158). Note Johnson's suggestion (above, note 26, p. 19) that εὐθηνιάρχαι may have been appointed to regulate the market and food supply in times of scarcity.

⁵¹ A minimum figure for the Byzantine *annona* is preserved by Procopius, who relates that during the reign of Justinian, the Alexandrians were deprived of as many as two million measures of grain from their *annona* allotment by a dishonest governor (*H. A.* 26). What proportion this represented of the whole *annona* and how many people the ration was intended to subsidize are unknown; see above, 283. On the use of *frumentationes* and *congiaria* to estimate the population of Rome, see Hopkins (1978) 97.

⁵² On the network of subterranean canals and cisterns fed by the Nile, see Bell. *Alex.* 5 and *IGRR* I 1055; cf. G. Botti, "Les citernes d'Alexandrie," *BSAA* 2 (1899) 15–26, and L. Dabrowski, "La citerne à eau sous le mosquée de Nabi Daniel," Alexandria University, *Bull. Faculty of Arts* 12 (1958) 40–48. The huge el-Nabeh cistern on Sultan Hussein Street where the Shalalat Gardens begin appears to be Roman in origin, with considerable Byzantine renovation. However, R. P. Duncan-Jones has argued that there is no way of estimating the amount of water used per person: "City Population in Roman Africa," *JRS* 53 (1963) 85.

ἀναχώρησις which swelled the Egyptian component of the city population.⁵³ Other factors which influenced population size were the occurrence of natural disasters such as famine, especially those occasioned by low Nile inundations, pestilence, the recurrent riots and reprisals by Hellenes and Jews alike throughout the first three centuries of the principate, the Jewish revolt of A.D. 115-16, the massacre of Alexandrian youths by the Emperor Caracalla in A.D. 215, and the devastation of the city both at the hands of Gallienus' army circa A.D. 261 and again in A.D. 268 pursuant to the Palmyrene invasion and occupation.⁵⁴ Hence the maximum estimate for the population of Roman Alexandria suggested herein—500,000–600,000—is a mere approximation of a

⁵³ On the average age at death in Roman Egypt, see M. Hombert and C. Préaux, *CdE* 20 (1945) 139–45. See also F. A. Hooper, "Data from Kom Abou Billou on the Length of Life in Greco-Roman Egypt," *CdE* 31 (1956) 332–340; A. el-Sawy, J. Bouzek and L. Vidman, "New Stelae from the Terenouthis Cemetery in Egypt," *Archiv Orientalni* 48 (1980) 330–55; and Abd el-Hafeez abd el-Al, J. C. Grenier and G. Wagner, *Stèles funéraires de Kom Abu Bellou* (Paris 1985). On the reasons for a high mortality level in cities of the Roman empire, see A. Scobie, "Slums, Sanitation and Mortality in the Roman World," *Klio* 68 (1986) 399–433.

On ancient modes of family limitation, see K. Hopkins, "Contraception in the Roman Empire," *PSSH* (1965) 124–51; cf. P. A. Brunt, *Italian Manpower: 225 B.C.–A.D. 14* (Oxford 1971) 146–54.

On Alexandrians in the *Chora*, see el-Abbadi, *Alexandrians* (above, note 2) 539–41 and 557–60. Undoubtedly numerous Alexandrians went abroad to serve in the Roman army or navy, as itinerant professionals (athletes, musicians, rhetors), or in connection with banking and commerce: see Seneca, *Ep.* 77.1, Strabo 2.5.12, 14.5.13, and 17.1.13. For Alexandria as an educational center, consult *idem* and Ammianus Marcellinus 22.16.16–19; cf. Dio Chrysostom, *Or.* 32.40 on the cosmopolitan character of the Alexandrian populace.

As at Athens, immigrants to Alexandria might acquire citizenship only by special decree; hence the flow of immigrants into the city did not offset the emigration of Alexandrian citizens: Hansen (1982) 177. On ἀναχώρησις see R. P. Duncan-Jones, "Demographic Change and Economic Progress," in *Tecnologia, economia e società nel mondo romano* (Como 1980) 74.

⁵⁴ Pliny, *Paneg.* 31–32, refers to a famine in Egypt during the reign of Trajan. On the unpredictable flooding of the Nile, see: *IGRR* I.1290 (the Elephantine nilometer), and *P. Oxy.* III 486.31–33 (A.D. 131). See also Pliny, *NH* 5.10.58, and D. Bonneau, *La crue du Nil: divinité égyptienne* (Paris 1964). For pestilence, see *HA: Verus* 8.1 and Euseb. *HE* 7.21.9. See also G. Casanova, "La peste nella documentazione greca d'Egitto," *Proceedings XVII International Papyrological Congress* (Naples 1983) 949–56, and "Epideme e fame nella documentazione greca d'Egitto," *Aegyptus* 64 (1984) 174–75. On the Jewish revolt, see A. Fuks, "The Jewish Revolt in Egypt (A.D. 115–117) in the Light of the Papyri," *Aegyptus* 33 (1953) 131–58, and "Aspects of the Jewish revolt in A.D. 115–117," *JRS* 51 (1961) 98–104; and M. Pucci, "La rivolta ebraica in Egitto (115–117 d.C.) nella storiografia antica," *Aegyptus* 62 (1982) 195–217.

variable which would wax and wane in the course of the next four centuries under Roman rule.⁵⁵

⁵⁵ I am indebted to Roger Bagnall, William V. Harris, Ludwig Koenen, Mostafa el-Abbadi, Ruth Scodel and the referees of *TAPA* for their careful reading of the manuscript and their stimulating comments. My sincere thanks also go to Jeanette Wakin, Edward Kamal and Mahmoud Helmi for their assistance in translating the text of 'Abd al-Hakam's *Futuh Misr*. A 1983–1984 fellowship from the American Research Center in Egypt enabled me to study first-hand the topography and monuments of ancient Alexandria.

