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Counting the Greeks in Egypt

Immigration in the first century of Ptolemaic rule

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Abstract: This paper presents the data and the methods available to estimate the number of Greeks immigrating and settling in Ptolemaic Egypt. I shall argue that the evaluations generally proposed (10% of Greeks) are too high and the flow of immigration implicitly expected too regular. The new calculations demonstrate that we should rather consider 5% of Greeks in Egypt. I use four independent methods to evaluate the number of Greeks based on an estimation of the number of: (1) Greek soldiers fighting at Raphia (217 BC); (2) Macedonian soldiers settled in Egypt; (3) cavalry men granted with land; (4) adult Greek males living in the Fayyum. The first three methods focus on soldiers while the fourth one provides us with a mathematical model for evaluating both Greek military and civilian settlers. These demographic revisions refine our analysis of the socio-economic and cultural interactions between the different groups of population.

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Counting the Greeks in Egypt: immigration in the first century of Ptolemaic rule

In this paper, I present the demographic data available to evaluate the number of Greeks who immigrated to Egypt in the late fourth and third century BC. Greek immigration in the century after Alexander's conquest of Egypt is often characterized as massive, for indeed the scale of the phenomenon reached unusual proportions. However, I argue that the evaluations generally proposed for the number and the proportion of Greeks in Egypt, around 10% of the total population of Egypt, are too high and the flow of immigration implicitly expected is too regular. These estimations are often based on inaccurate extrapolations of the data. On the basis of a more plausible use of the sources, I propose a smaller number and proportion of Greeks, around 5% of the population, than usually admitted. Since immigrants were in large part soldiers, the military manpower of the Ptolemaic state was inherently connected to the availability of immigrants coming from the Aegean world and to a smaller extent from other regions of the Mediterranean world. These demographic revisions lead me to suggest that other people, in particular the Egyptians, played a larger role within the army – and probably from an earlier date – than is commonly accepted. In other words, this paper aims at encouraging a reassessment, in future studies, of the number of Greeks available for the Ptolemaic army, their cost to the state, and the amount of land to settle them.

In order to check the validity of my new estimates, I will use four independent methods to evaluate the number of Greeks (from the Aegean world and from Macedonia) who settled in Egypt in the third century BC: first, an evaluation based on the number of Greek soldiers present at the battle of Raphia (217 BC);¹ second, an estimate based on the number of Macedonian

¹ The battle of Raphia opposed Ptolemy IV to the Seleucid king Antiochos III.

cleruchs settled in Egypt in the third century; third, an extrapolation from the number of *katoikoi hippeis* (i.e. cavalry men who received land) in the second century BC (cf. *P.Lips.* II 124); fourth a calculation based on the number of adult Greek males living in the Fayyum, number which is initially evaluated on the basis of census from the third century BC and on the size of the metropolitan class living in the Fayyum during the Roman period. The first three methods focus on military settlers, while the fourth one provides us with an evaluation for both Greek military and civilian settlers and allows us to check the plausibility of the first ones.

As a preliminary remark, it is useful to recall the numbers generally accepted for the total population of Ptolemaic Egypt (cf. Table 1). Rathbone² describes the population increasing from below 3 million to almost 4 million in the 3rd century BC, and then decreasing below 3 million in the 2nd century BC; Manning³ suggests 3.5 to 4.5 million inhabitants, while Scheidel⁴ would accept numbers slightly below the 5 to 7 millions that he calculated for the second century AD. For computational purposes I will use 4 million for the total population of Ptolemaic Egypt. Similarly, different numbers have been evoked for the total population of the Fayyum: for an area of cultivation of 1,200 to 1,600 km² (ca. 6-8% of the 20,000 km² of cultivable land in Egypt) there were ca. 100,000 inhabitants in 145 villages in the mid-third century.⁵ Clarysse and Thompson evaluate the percentage of the military population of the Fayyum at this date at 15.5%.⁶ But they are skeptical about using a figure of ca. 100,000 inhabitants in order to apply it

² Rathbone (1990) 123.

³ Manning (2003) 47-49 and note 129.

⁴ Scheidel (2001) 220-223, where he considers that 20,000 km² – a maximum for the Roman period on the bases of nineteenth century data – is more reliable than the nine million arouras (24,800 km²) inscribed on the Edfu temple during the reign of Ptolemy V (*Edfu VI* = Porter and Moss (1960) vol. 6, 164); for the total population, cf. 246-247.

⁵ Manning (2003) 107 and note 49; Rathbone (1990) 130-132, suggests 1,200 km² (435,420 arouras) and a range of 70-100,000 (density population of 58 to 83 persons/ km²).

⁶ Clarysse and Thompson (2006) vol. 2, 90, note 2, and 95 count 1,500 km² (or 544,267 arouras) with “canals, ravines, marshes and other uncultivated areas lying within the cultivated area” for 85-95,000 inhabitants in the mid-third century BC, with 100,000 as a maximum.

to the whole country because the Fayyum is atypical and has still a low population density at this early time: 1.2 million inhabitants⁷ (calculated on the basis of 20,000 km² of cultivable land) would be indeed much too low for the entire population of Egypt.

Table 1: Population and area under cultivation in Egypt

My calculations are in italic.

Author	Area	Total number of inhabitants	Area under cultivation (km ²)	Density in person per km ²
Rathbone (1990)	Fayyum	70-100,000	1,200	58-83
	Egypt	4,000,000	25,000 (max)	<i>160⁸</i> <i>120 (maximum for rural population)</i>
Scheidel (2001)	Egypt	5-7,000,000	20,000	<i>250-350</i>
Manning (2003)	Egypt	3,500,000-4,000,000	25,000	<i>140-160</i>
Clarysse/Thompson (2006)	Fayyum	100,000 (max)	1,500	<i>67</i>
	Egypt	*1,200,000	20,000	<i>60</i>

First Method (Raphia): on the basis of Polybius' numbers of soldiers at the battle of Raphia in 217 BC (Pol. 5.65, 79.2), I count ca. 33,000 Greek military settlers (cf. Table 2, 32,700) who descended from the original settlers.⁹

Polybius, <i>Histories</i> , 5.65	Hultsch and Shuckburgh (1889)
εἶχον δὲ καὶ τὰς ἡγεμονίας ἕκαστοι τῶν προειρημένων ἀνδρῶν οικείας ταῖς ἰδίαις ἐμπειρίαις. [2] Εὐρύλοχος μὲν γὰρ ὁ Μάγνης ἡγεῖτο σχεδὸν ἀνδρῶν τρισχιλίων τοῦ καλουμένου παρὰ τοῖς βασιλεῦσιν ἀγήματος, Σωκράτης δ' ὁ Βοιωτίος πελταστὰς ὑφ' αὐτὸν εἶχε δισχιλίους. [3] ὁ δ' Ἀχαιὸς Φοξίδας καὶ Πτολεμαῖος ὁ Θρασεύου, σὺν δὲ τούτοις Ἀνδρόμαχος [ὁ] Ἀσπένδιος, συνεγύμναζον μὲν ἐπὶ ταῦτὸ τὴν φάλαγγα καὶ τοὺς μισθοφόρους Ἕλληνας, [4] ἡγούντο δὲ τῆς μὲν φάλαγγος Ἀνδρόμαχος καὶ Πτολεμαῖος, τῶν δὲ μισθοφόρων Φοξίδας, οὔσης τῆς μὲν φάλαγγος εἰς δισμυρίουσ καὶ πεντακισχιλίους, τῶν δὲ μισθοφόρων εἰς ὀκτακισχιλίους. [5] τοὺς δ' ἵππεῖς τοὺς μὲν περὶ τὴν αὐλήν, ὄντας εἰς ἑπτακοσίους, Πολυκράτης παρεσκεύαζε καὶ τοὺς ἀπὸ Λιβύης, ἔτι δὲ καὶ τοὺς ἐγχωρίουσ; καὶ τούτων αὐτὸς ἡγεῖτο πάντων, περὶ	All these officers, too, had commands in the army suited to their particular accomplishments. Eurylochus of Magnesia commanded about three thousand men of what were called in the royal armies the Agema, or Guard; Socrates of Boeotia had two thousand light-armed troops under him; while the Achaean Phoxidas, and Ptolemy the son of Thraseas, and Andromachus of Aspendus were associated in the duty of drilling the phalanx and the mercenary Greek soldiers on the same ground,-- Andromachus and Ptolemy commanding the phalanx, Phoxidas the mercenaries; of which the numbers were respectively twenty-five thousand and eight thousand. The cavalry, again, attached to the court, amounting to seven hundred, as well as that which was obtained from Lybia or enlisted in the country, were being trained by Polycrates, and were under his personal command: amounting in all to about three thousand men. In the

⁷ Clarysse and Thompson (2006) vol. 2, 101 calculate the total population of Egypt on the basis of the population of the Fayyum, multiplying this latter by 12 (since the Fayyum is about one 12th of the cultivated area of Egypt according to their estimation). They conclude: "Such a straightforward multiplication is, however, probably unjustified, since the Arsinoite was on most accounts an atypical area."

⁸ Rathbone (1990) 109 never calculates this number but only mentions a maximum density of 120 person per km² for the rural population based on papyrological evidence from the Greco-Roman Fayyum.

⁹ See note 23.

<p>τρισχίλιους ὄντων τὸν ἀριθμὸν. [6] τοὺς γε μὴν ἀπὸ τῆς Ἑλλάδος καὶ πᾶν τὸ τῶν μισθοφόρων ἱππέων πλῆθος Ἐχεκράτης ὁ Θετταλὸς διαφερόντως ἀσκήσας, ὄντας εἰς δισχίλιους, μεγίστην ἐπ' αὐτοῦ τοῦ κινδύνου παρέσχετο χρεῖαν. [7] οὐδενὸς δ' ἦπτον ἔσπευδε περὶ τοὺς ὑφ' αὐτὸν ταπτομένους Κνωπίας Ἀλλαριώτης, ἔχων τοὺς μὲν πάντας Κρήτας εἰς τρισχίλιους, αὐτῶν δὲ τούτων χίλιους Νεόκρητας, ἐφ' ὧν ἐτετάχει Φίλωνα τὸν Κνώσιον. [8] καθώπλισαν δὲ καὶ Λίβυας τρισχίλιους εἰς τὸν Μακεδονικὸν τρόπον, ἐφ' ὧν ἦν Ἀμμώνιος ὁ Βαρκαῖος. [9] τὸ δὲ τῶν Αἰγυπτίων πλῆθος ἦν μὲν εἰς δισχυρίους φαλαγγίτας, ὑπετάττετο δὲ Σωσιβίῳ. [10] συνήχθη δὲ καὶ Θρακῶν καὶ Γαλατῶν πλῆθος, ἐκ μὲν τῶν κατοίκων καὶ τῶν ἐπιγόνων εἰς τετρακισχίλιους, οἱ δὲ προσφάτως ἐπισυναχθέντες ἦσαν εἰς δισχίλιους, ὧν ἠγεῖτο Διονύσιος ὁ Θραξ. [11] Ἡ μὲν οὖν Πτολεμαίῳ παρασκευαζομένη δύναμις τῷ τε πλήθει καὶ ταῖς διαφοραῖς τοσαύτη καὶ τοιαύτη τις ἦν.</p>	<p>actual campaign the most effective service was performed by Echeocrates of Thessaly, by whom the Greek cavalry, which, with the whole body of mercenary cavalry, amounted to two thousand men, was splendidly trained. No one took more pains with the men under his command than Cnopias of Allaria. He commanded all the Cretans, who numbered three thousand, and among them a thousand Neo-Cretans,¹ over whom he had set Philo of Cnossus. They also armed three thousand Libyans in the Macedonian fashion, who were commanded by Ammonius of Barce. The Egyptians themselves supplied twenty thousand soldiers to the phalanx, and were under the command of Sosibius. A body of Thracians and Gauls was also enrolled, four thousand being taken from settlers in the country and their descendants, while two thousand had been recently enlisted and brought over: and these were under the command of Dionysius of Thrace. Such in its numbers, and in the variety of the elements of which it was composed, was the force which was being got ready for Ptolemy.</p>
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My understanding of Polybius' passage is presented in the table below (cf. Table 2).

Concerning the phalangists (5.65.4), I follow Rathbone (1990), according to whom there were indeed 25,000 Greek phalangists (total of the infantry: 70,000, cf. Pol.5.79.2),¹⁰ *contra* Walbank (1957) according to whom there were only 5,000 Greek phalangists (total of the infantry: 50,000).¹¹ In Walbank's view, there would be only ca. 12,000 Greek military (male) settlers.¹² Such a number would be surprising low, since it would correspond to the number of Greek soldiers in the 310s BC (cf. second method). Papyrological sources from the mid-third century show that many more immigrants came to Egypt to settle and that such a low number is unwarranted. On this basis, I rejected Walbank's interpretation.¹³

¹⁰ Goudriaan (1988) 122 and Bar-Kochva (1976) defend the same number.

¹¹ Walbank follows Mahaffy, Tarn, Griffith and Rostovtzeff's opinion: they think that the 20,000 Egyptians in the phalanx (5.65.9) must be included among the 25,000 the phalangists mentioned in 5.65.4 and thus deduce that there were only 5,000 Greeks in the phalanx.

¹² I.e. 5,000 phalangists + 3,000 men in the *agema* + 2,000 pelasts + 2,000 Cretans = 12,000, to whom we can add the Thracian and Galatian cleruchs (4,000).

¹³ There are indeed only two ways to explain Walbank's interpretation and both can easily be rejected: First, the Ptolemies would have used only a very small proportion of the cleruchs and would have preferred to spend money on new Greek mercenaries and to hire Egyptians in large number rather than Greek settlers: in this case one does not understand why the Ptolemies created the cleruchic system. Second, the Ptolemies had only a very small number of

Table 2: My understanding of Polybius 5.65

	INFANTRY		CAVALRY		Total
Recently hired Greek mercenaries	9,000	- 8,000: Greek mercenaries - 1,000: Neo-Cretans ¹⁴	2,000	- 2000: cavalry from Greece and mercenary cavalry	11,000
Recently hired Thracian and Galatian mercenaries	2,000	- 2,000: Thracians and Galatians 'lately raised elsewhere'			2,000
Egyptian and Libyan <i>machimoi</i>	23,000	- 20,000: Egyptian phalanx - 3,000: Lybians with Macedonian equipment	2,300	- [2,300 ¹⁵]: Libyan and native Egyptian cavalry	25,300
Cleruchs (coming from the Greek world)	32,000	- 3,000: <i>agema</i> - 2,000: peltastes - 25,000 Greek phalanx - 2,000: Cretans	700	- 700: cavalry of the guard	32,700
Cleruchs (coming from Thracia and Gaul)	4,000	- 4,000: Thracians and Gauls 'among settlers and their descendants'			4,000
Total	70,000	70,000	5,000	5,000	75,000

In the past, Rathbone calculated, on the basis of Raphia's numbers, that there was a maximum of 50,000 Greek military settlers at the end of the third century BC.¹⁶ My evaluation is slightly different on two points: first, contrary to Rathbone, I discount the new recruits mentioned

cleruchs available because their number would have drastically shrunk during the first half of the third century: however the sources do not indicate that the cleruchic system would have failed to that extent.

¹⁴ The meaning of 'Neocretans' is not clear, cf. Walbank (1957) commentary to 4.3.1. It probably refers to soldiers sent by Cnossus, and for this reason I consider them as recently hired. But the term may simply reflect a special type of armament, perhaps light-armed soldiers with small round *peltai*.

¹⁵ This number can be deduced from Pol. 5.65.5 where he mentions the 700 cavalry men of the guard, making 3,000 total with the Libyan and native cavalry.

¹⁶ Rathbone (1990) 112-113 does not explain in details how he interprets the text to reach these numbers. I reconstructed his interpretation in the table below, where the 50,000 must be based on 15-17,000 + 35-37,000.

Summary of Rathbone (1990)	INFANTRY	CAVALRY	Total
Recently hired Greek mercenaries	13-15,000	2,000	15-17,000
Egyptian and Libyan <i>machimoi</i>	23,000	---	23,000
Cleruchs (coming from the Greek world)	32-34,000	3,000	35-37,000
Total	70,000	5,000	73-77,000

at Raphia (15-17,000 according to Rathbone, but 11-13,000 according to my understanding of Polybius) since they needed to complement the insufficient number of reservists and were hired for the fourth Syrian war. My approach tries indeed to approximate the number of soldiers who settled before Raphia. Second, one must add some percentage of the 33,000 Greek military settlers that I counted in order to take into account the Greeks still serving in garrisons and those unfit for service at the time of the battle, i.e. a maximum of 40,000 Greek male settlers total.

Then the number of Greek adult male migrants has to be multiplied in order to obtain the total number of Greek migrants from military families. Usually scholars use comparative data from the 19th or early 20th century Egypt or from other Third World countries and multiply the number of adult males by 3.1 or 2.9.¹⁷ Assuming that more men than women immigrated to Egypt and thus that there was a high sex ratio among migrants (e.g. 115.8 according to the numbers in *P.Count. 1*), one should ideally check if these multipliers could be correct.¹⁸ Unfortunately, in view of the preserved material, we cannot refine these multipliers in a safe way. While using the Fayyum material for counting the military population (*P.Count 1* includes adult males and females living in military's households) and assuming that children are as half as numerous as adults (cf. 33.27% of children according to Cole and Demeny, *Female West 3*, stationary population) the multiplier would be 2.7. But a similar calculation with data for the whole population of the Fayyum (based on the same document) leads toward a multiplier of 3.1. In addition, the sex ratio may well have been quickly readjusted among the migrants and consequently it seems reasonable to use 2.9, which is more in agreement with the high sex ratio

¹⁷ Rathbone (1990) 130 uses of a multiplier worth 3.1 based on Boak (1955) 159 for calculating the total population from the Greek adult male population and does not take into account the high sex ratio; from discussions with Saskia Hin, Leiden University, about the problem of the multiplier, it appeared that Boak (1955) based his calculations on Cleland (1936) and his tables of census records for the early twentieth century Egypt but he seems to miscalculate one of his annual multipliers and should in fact obtain an average multiplier of 3.2.

¹⁸ Scheidel (2004) 24-25 already raised the issue of high sex ratio among the Greek migrants; Clarysse and Thompson (2006) vol. 2, 95, use 2.9 following Bagnall (1994) 103, note 35.

than the 3.1. Consequently, I evaluate the total number of Greeks belonging to military family to 116,000. This represents a minimum of the number of Greek settlers in Egypt in the third century BC since it only takes into consideration military settlers and their families and does not include the families of the civilian immigrants.

Second Method (Macedonians): If we could approximate the number of Macedonian settlers in Egypt in the late fourth century and the third century BC and establish their proportion compared to other ethnic groups, we would have another way to check the total number of Greeks. However we face two problems: first, the term Macedonian was ambiguous,¹⁹ for it was used to designate cavalry men or heavy infantry armed with Macedonian equipment but it did not automatically imply that they were of Macedonian origin. It was in fact gradually less the case over time.²⁰ However, we can give it weight as a marker of origin in the third century; second, the evidence comes widely from the Fayyum, an area developed mainly under Ptolemy II, which means that the cleruchs settled in the third century –in opposition to the first cleruchs of Ptolemy I– “might well be overrepresented compared to the total population of cleruchs. Newcomers may well, therefore, form a larger share of the Arsinoite cleruchs than they do elsewhere.”²¹ In other words, the Macedonians may have been underrepresented in our sources against other groups who settled later on in Egypt.

Proportion of Macedonians: While keeping these biases in mind, one can evaluate the percentage of Macedonian cleruchs among the Greek cleruchs from Bagnall’s tables based on Uebel’s list of cleruchs.²² Bagnall demonstrates that two-thirds of the cleruchs attested in Uebel’s list came from regions that the Ptolemies did not control and thus “are the descendants of those

¹⁹ Launey (1987: 1st ed. 1949) 292-293.

²⁰ I discuss this question in the chapter 2 of my dissertation entitled *Army and society in Ptolemaic Egypt*.

²¹ Bagnall (1984) 10.

²² Bagnall (1984) 10-12; Uebel (1968).

soldiers in the army formed by Ptolemy I Soter during his first couple of decades of satrapal rule.”²³ If this list indeed gives a sense of the origins of the earlier military settlers, one can calculate the percentage of Macedonian cleruchs among Greek cleruchs (I consider of Greek origin people coming from areas displayed in lines 1 to 6, cf. Table 3). I obtain 29.8% of Macedonian cleruchs out of the Greek cleruchs until 242 BC and 38.7% between 241 and 205 BC, i.e. about one third of Macedonians among the third century Greek military settlers.

Table 3: The Origins of Cleruchs, cf. Bagnal (1984)

		until 242	242-204	205-145	III BC	Total
1	Macedonian	17	60	30	77	107
2	Balkan people	21	39	17	60	77
3	Greeks of the N. Aegean	1	9	0	10	10
4	Greek Islands	1	13	5	14	19
5	Peloponnesos	9	15	1	24	25
6	Asia Minor/Propontis	15	23	10	38	48
7	Cyrenaica	29	49	7	78	85
8	Occident	2	5	2	7	9
9	Levant	0	3	11	3	14

Absolute number of Macedonians: A starting point to quantify the number of Macedonian males who may have settled in Egypt in the late fourth century is Billows’ study²⁴ of the numbers of Macedonian emigrants in the decades following Alexander’s conquest. Billows concentrates on the number of Macedonian soldiers leaving Macedonia –not on the whole population of the Aegean– because his goal is to demonstrate that Macedonian imperialism under Philip and Alexander did not cause population decline and economic difficulties in Macedonia. He estimates that ca. 25,000 Macedonians settled in Asia and Egypt between 334 and 319 BC (p. 196) although we cannot know their exact distribution. He suggests that emigration from Macedonia stopped after 315 BC because none of the Macedonian rulers had the power to order them to

²³ Bagnall (1984) 16.

²⁴ Billows (1995) ch. 7, 183-217, esp. 196 and note 32 for the Macedonians in Egypt.

settle outside Macedonia *stricto sensu*.²⁵ On the contrary, Kassandros and his successors (Demetrios, Lysimachos, Ptolemy Keraunos, Antigonos Gonatas) probably tried to discourage Macedonian soldiers-to-be to join the armies of the other kings. However, the 270s were certainly a period of large emigration from Macedonia because of the chaotic situation due to the Gallic invasion, its consequent plundering for three years, and finally Pyrrhus' invasion.²⁶ This same situation explains, in Billows' view, the relative decline of Macedonia in the following decades.

Using Scheidel's rough ratio of the distribution of Macedonian settlers between Asia and Egypt (2:1) I suggest that ca. 16,000 Macedonian settled in Asia and ca. 8,000 in Egypt by 319 BC. But then, as Billow acknowledges, it becomes almost impossible to count the troops passing from one general or satrap to another in the last decades of the fourth century BC. Moreover, the evidence does not allow us to account for the emigrants who willingly left Macedonia after 315 BC for Asia and Egypt with hopes of wealth and of a better life.

In 331 BC, Alexander certainly left some Macedonians within the garrison set up in Egypt (Arrian, *Anab.* 3.5.5; Curtius 4.8.4-5). They constituted the nucleus of the Ptolemaic Macedonian force.²⁷ These soldiers must have constituted the Ptolemaic army at the battle of Gaza (312 BC), completed by mercenaries and armed Egyptians, in total 22,000 infantry men and 4,000 cavalry men (Diod. 18.4.3-4). From this number, if ca. 10,000-15,000 were Macedonians (including the 8,000 mentioned above by 319 BC) and thus the ancestors of the Macedonian cleruchs of the third century BC, and if Macedonians represent ca. 33% of the Greek military settlers as stated above, we reach a total of 30,000 to 45,000, which matches the number of Greek military male settlers suggested with the first method (Raphia, ca. 40,000).

²⁵ Billows (1995) 157-159.

²⁶ Billows (1995) 208-210.

²⁷ Bagnall (1984) esp. 15-18.

Third Method ('katoikoi hippeis' in the second century BC): Another method allows us to investigate the number of Greek military settlers in the cavalry in Egypt in the second half of the second century BC. Although this third method does not give us the total number of Greek adult males in the army, it demonstrates clearly the small number of *katoikoi hippeis* and its stability over centuries. A papyrus recently published by Duttonhöfer, *P.Lips. II 124* (137 BC or later),²⁸ contains a complicated text concerning the taxes paid by cavalry men holding cleruchic land, more commonly called *katoikoi hippeis*. In column III of the text, we learn that the *dioiketes* of Egypt, Dioskourides, established a fixed amount that all the *katoikoi hippeis*, except those of the Thebaid, would have to pay each year, i.e. 234,777 artabas. Because the name and the amount of the tax per capita is not given, it is not possible to precisely calculate the size of the population of the *katoikoi hippeis*. In fact, on the basis of col. V, we can only conjecture that the διαρταβία, the ἐπιγραφή, the φυλακτικόν (l. 83) and other amount which were not called taxes (l.89) could have flown into the account and the case of the εισφορά (l.3) is not clear. Duttonhöfer suggests that the establishment of a fix amount could speak in favor of a land tax (vs. harvest tax).²⁹ In this case, according to a first hypothesis, the tax concerned would be the *di-artabeia* (l. 77) perfectly attested at this period.³⁰ The second hypothesis is that the 234,777 artabas is a total for both the *diartabeia*-tax, a land-tax, and for the *epigraphe* (l. 36 and 70), a harvest tax, as in P.Tebt. I 99.³¹

Following our first hypothesis, the *katoikoi hippeis* were at most cultivating 117,388 1/2 arouras total (= 323.5 km²). Then, in order to know the number of *katoikoi hippeis* that this amount of land implies, we have to divide it by the size of their average allotments: 80 arouras at best, 20 arouras at worse. Indeed, although in the third century the *katoikoi hippeis* usually

²⁸ Duttonhöfer and Scholl (2002).

²⁹ Duttonhöfer and Scholl (2002) 23, commentary to lines 21-29.

³⁰ Lesquier (1911) 221; Préaux (1979; 1st ed. 1939) 131; see e.g. P.Tebt. I 99, a close example to P.Lips II 124.

³¹ About the *epigraphe* and the difference between a harvest tax and a land tax, Vandorpe (2000) esp. 197-198.

received 80 to 100 arouras plots, the extension of the *katoikia* to a larger number of people made the plots become smaller in the second century BC.³² If we assume that the *katoikoi hippeis* held between 80 and 20-aroura plots, they must have been minimum 1,460 and maximum 5,900 in Egypt without the Thebaid. If we admit an average of 40-aroura plots, they could have been ca. **3,900** to whom we can add a few hundreds of *katoikoi hippeis* settled in the Thebaid: indeed the sources indicate that cavalry men in Upper Egypt were rather *misthophoroi* (mercenaries) and did not have clerouchic land.

According to the second hypothesis, the *di-artabeia* represents only some part of the taxes paid. I base my hypothesis on the fact that as in P.Tebt. I 99, the amounts for both taxes are more or less equivalent and I consider that 177,388 artabas were paid as *di-artabeia*. Consequently, the number of *katoikoi hippeis* is simply half of that evaluated above, i.e. between 730 and 3,000, on average perhaps 1,800, plus a few hundreds of them settled in the Thebaid. Of course these are only hypothesis and over-simplifications. We could also suppose, among other possibilities, that the *katoikoi hippeis* either paid the *di-artabeia* or the epigraphy, depending of the nome where they were settled (cf. l. 36), but the order of magnitude would not change.

We can compare this approximation with the number of Greek cavalrymen in Raphia (cf. Table 2, row 1 and 4): 700 cavalrymen of the guards and 2,000 cavalrymen from Greece and cavalry mercenaries (whom I counted as newcomers in the first method but who probably settled in Egypt after the battle of Raphia). Admitting that probably a few hundreds of them were not present at Raphia, we can suppose that there were ca. 3,000 Greek *katoikoi hippeis* at the time of the battle. There were certainly *katoikoi hippeis* from other origins, so that the total of *katoikoi hippeis* could have been slightly above 3,000, which fits our evaluations based on P.Lips II 124.

³² Van 't Dack (1977) 85.

This specific group of the population seems to have remained pretty stable until the 130s BC, when a slight increase perhaps occurred due to the enlargement of the accessibility to the *katoikia* offered to infantry men from diverse ethnic background.

We can deduce some important elements from this method: first, the number of Greek cavalry men at Raphia being similar to that in the 130s BC, this papyrus allows us to check the order of magnitude suggested by the first method. Second, we obtain a chronological precision on the population of Greek settlers in the sense that this sample of population illustrates that Greek immigration stopped after Raphia and that the Greek population (in the sense ‘coming from Greece’) did not increase.³³ Third, if the calculation of the area of land cultivated by *katoikoi hippeis* is correct (= 323.5 km²), it represents a little bit more than land estimated to be held by Greek *katoikoi hippeis* in the Fayyum in the second half of the third century (299 km², cf. note 35): this suggests that most of the *katoikoi hippeis* in Egypt (except the small number of them living in the Thebaid) were living in the Fayyum and in the Herakleopolite nome.³⁴

Fourth Method (extrapolation from the Fayyum): The fourth method consists of calculating the total Greek population in Egypt (i.e. both military and civilian) in order to check whether the order of magnitude for the number of Greek and Macedonian military settlers is correct. The estimation is made on the basis of the size of the metropolitan class in the Arsinoite nome during the Roman period, called ‘the *katoikoi* from the total of 6,475 (or 6,470) Hellenic men in the Arsinoite’. Knowing from the mid-third-century BC *P.Count.* 1 that there were 4,898 military men (cavalrymen) in the Fayyum, the 6,500 people from a Greco-Macedonian origin –

³³ If it increased, it must have been through intermarriage and cultural hellenization; Chauveau (1997) admits that immigration almost completely stopped under Ptolemy V: but I this section show that it certainly stopped earlier.

³⁴ The same conclusion in terms of their localization can be deduced from Christensen (2002) 189, note 353 where he calculated the amount of land held by cleruchs in each nome till 145 BC (based on Uebel (1968)); such a calculation is of course approximate because of the loss of evidence and obvious chronological problems.

although this number is taken from a later period – is a good guess for the Ptolemaic period.³⁵ It would also include some civilians and some of the infantrymen – these latter being mysteriously absent from *P.Count.* 1. In any case, calculations based on 8,000 Greek adult males in the Fayyum – to allow more space to the mysterious missing infantrymen – do not drastically alter the absolute number of Greeks and have hardly an impact on the final percentage of Greeks in Egypt, (cf. the intermediary step in Table 5, col. 3). Since the Fayyum corresponds to a certain fraction of the total cultivable land in Egypt (1/x, e.g. 1/20 or 5%), this number of ca. 6,500 is multiplied by x/1 (e.g. 20) in order to obtain an estimate for the number of Greek males settled in Egypt.

Rathbone³⁶ calculated the total size of the Greek population from the Fayyum this way (cf. Equation 1, Equation 2 and Table 4) and obtained 130,000 Greek adult males. Then he multiplied the number of adult males by a 3.1 factor, reaching a maximum of 400,000 for the total Greek population (ca. 10% of the total population in Egypt –as Segrè (1934) 67 suggested in the past).

Equation 1: Rathbone's method

$$\text{Ad. male Greek in Fayyum} \cdot \frac{\text{cult. area Egypt km}^2}{\text{cult. area Fayyum km}^2} = \text{Ad. male Greek in Egypt}$$

Equation 2: Rathbone's calculation

$$6,500 \cdot \frac{20}{1} = 130,000$$

³⁵ Thompson (2007) suggests that in fact only ca. 1,500 to 2,800 of them were actual cavalrymen, for there were several males per household; it is not possible to guess whether the other males living in the household were military (infantry) or civilians; for the 6,500, see SB XII 11,012 (55AD) and for instance Capponi (2005) 20 and 102.

³⁶ Rathbone (1990) 112-113.

Table 4: Total number of Greeks in the mid-third century Egypt according to Rathbone (1990)

1	2	3	4	5	6	7
Number of Greek adult males in the Fayyum	Total number of adult males in the Fayyum	Percentage of Greek adult males in the Fayyum	Rough ratio of the developed area of the Fayyum compared to Egypt	Number of Greek adult males in Egypt	Maximum number of the Greek population in Egypt (factor 3.1)	Percentage of Greeks to the total population of 4 million
6,500	30,000	ca. 20%	20	130,000	400,000	10% ³⁷

However, there are two flaws in his argumentation that lead to overestimate the total Greek population to a considerable extent. Indeed, two adjustments are needed: the first one has to be made because of the Fayyum's low population density (cf. Equation 3, Equation 4 and my explanations below). Indeed, its low population density in the third century prevents us from considering this part of Egypt as a sample that can be multiplied to obtain an average number for the whole Egypt. We mentioned above that such a straightforward calculation was not possible (cf. note 7).

Equation 3: First adjustment (low population density of the Fayyum compared to Egypt)

$$\text{Greek ad. males in Fayyum} \cdot \frac{\text{inh/km}^2 \text{ in Egypt}}{\text{inh/km}^2 \text{ in Fayyum}} \cdot \frac{\text{km}^2 \text{ in Egypt}}{\text{km}^2 \text{ in Fayyum}} =$$

$$\text{Greek ad. males in Fayyum} \cdot \frac{\text{inh in Egypt}}{\text{inh in Fayyum}} = \text{Greek ad. males in Egypt}$$

Equation 4: Computation of the first adjustment

$$6,500 \cdot \underbrace{\frac{200}{58}}_{3.45} \cdot \underbrace{\frac{20,000}{1,500}}_{13.3} = 6,500 \cdot \frac{4,000,000}{87,000} = 298,850$$

³⁷ It is not possible to start with a sample of population (in this case the Fayyum) where the percentage of Greek adult males is of ca. 20% (col. 3) and to have only 10% of Greek adult males (col. 7) once the sample has been multiplied by the factor necessary to reach the surface of the whole Egypt. In addition, the 10% happened only by chance to fit Segrè's estimates (1934). It is indeed incoherent to compare the Greek adult male population in Egypt based on the multiplication by 20 of the Greek adult male's number in the Fayyum (20 = ratio of the Fayyum territory compared to Egypt) to a total adult male population of ca. 1.3 million (i.e. the total number of adult males out of a population of 4 million) – obtained by a random multiplication of the total male population of the Fayyum by 43. Thus follows the abnormal transformation of the 20% of Greeks in the Fayyum (col. 3) into 10% of Greeks within Egypt (col. 6).

The result obtained in Equation 4 is much too high because a second adjustment is necessary in reason of the high concentration of Greek military settlers in the Fayyum (cf. Equation 5).³⁸

Equation 5: Second adjustment (larger number of Greek adult males in the Fayyum compared to Egypt)

$$\frac{298,850}{[4\dots5]} = [74,713\dots59,770]$$

Thus, the new calculation that I propose for the Greek population in Egypt can be explained in details as follow: the first step consists in compensating for the low population density of the Fayyum (cf. Table 5, lines 8 to 10: 58 inh/ km² in the Fayyum vs. 200 inh/ km² as an average for the whole Egypt) by multiplying the number for the Fayyum, 6,500, by a factor 3.45 (i.e. 200 divided by 58) which has for effect to level the numbers for the Fayyum to an hypothetical Egyptian average (cf. Equation 3 and Equation 4). Then this number is multiplied by the factor in line 11, i.e. 13.3 (or 16.7) to obtain a number of Greeks for the whole superficies of Egypt (line 12).³⁹ Finally, to go from a male population to a total population (line 13), I use the multiplier 2.9, in line 4 (cf. above).

In fact, one can see that this equation can be simplified and that it only relies on the total population of Egypt (4 million) and that of the Fayyum (87,000) (cf. Equation 3, line 2 and Equation 4).⁴⁰ Consequently, if the following calculations were to be made on the basis of larger

³⁸ Scheidel (2004) 24-25 makes the same comment on the use of Fayyumic evidence. He guesses around 100,000 Greek settlers in Egypt and double of this for the Seleucid empire, perhaps a total of 400-500,000 emigrants from the Aegean world out of a population of about 4-5 million. He obtains a NROM (Net rate of Out-Migration) of 0.1 per cent to contrast to 0.7 per cent for Italy in the first century AD and 0.25 per cent for the period 48-14 BC.

³⁹ We need to multiply our sample (the Fayyum) so that its superficies equals that of Egypt: since the Fayyum corresponds to 1/13.3 (or 1/16.7) of the whole territory of Egypt, the Fayyum's numbers of inhabitants must be multiplied by 16.7.

⁴⁰ 87,000 is the total population obtained by the multiplication by 2.9 of the number of adult males attested in the Fayyum: I counted ca. 30,000 according to *P.Count.* 1 and Clarysse and Thompson (2006) vol. 2, 94-95 and table 4:2. The 4 million is the total population of Egypt obtained by the multiplication by 2.9 of the number of adult males

or smaller areas for Egypt and the Fayyum, this would not impact the result at all (cf. Table 5, col. 4 and 5). However, if the calculations were based on a lower number for the total population in Egypt, the absolute number of Greek would also be lower, but the proportions would remain the same (cf. Table 5, col 2). In other words, only new information on the number of Greek adult males in the Fayyum, on the total population of Egypt and on that of the Fayyum could alter these results.

Table 5: Data & Results after the first adjustment

This table contains the data and the results summarized in the Equation 3. The figures in *italic* do not represent any real values. They are an intermediary step. The figures in **bold** highlight the changes from column 1.

	Data	1	2	3	4	5
1	Pop. Tot. in Egypt	4,000,000.00	3,500,000.00	4,000,000.00	4,000,000.00	4,000,000.00
2	Greek adult males in the Fayyum	6,500.00	6,500.00	8,000.00	6,500.00	6,500.00
3	Adult males in the Fayyum	30,000.00	30,000.00	30,000.00	30,000.00	30,000.00
4	Factor Male -> Pop. Tot.	2.90	2.90	2.90	2.90	2.90
5	Fayyum (km2)	1,500.00	1,500.00	1,500.00	1,200.00	1,500.00
6	Egypt (km2)	20,000.00	20,000.00	20,000.00	20,000.00	16,000.00
	Results					
7	Pop. Tot. in the Fayyum	87,000.00	87,000.00	87,000.00	87,000.00	87,000.00
8	Density F (inhab/km2)	58.00	58.00	58.00	72.50	58.00
9	Density E (inhab/km2)	200.00	175.00	200.00	200.00	250.00
10	Factor Low Pop. Density (F->E)	3.45	3.02	3.45	2.76	4.31
11	Ratio Egypt/Fayyum	13.33	13.33	13.33	16.67	10.67
12	Greek adult males in Egypt	<i>298,850.57</i>	<i>261,494.25</i>	<i>367,816.09</i>	<i>298,850.57</i>	<i>298,850.57</i>
13	Greek Tot. Pop.	<i>866,666.67</i>	<i>758,333.33</i>	<i>1,066,666.67</i>	<i>866,666.67</i>	<i>866,666.67</i>
14	Percentage of Greeks in the Fayyum and in Egypt	21.67	21.67	26.67	21.67	21.67

The calculations in Table 5 demonstrate that it is problematic to use the numbers given by the Fayyumic evidence for the whole Egypt, even for a rough approximation. Indeed, if we multiply a sample of land overpopulated with Greeks to obtain a number for the whole Egypt, as Rathbone does, one will obtain a number that is in fact overpopulated with Greeks. Indeed, using the first method (Raphia) to check this number, one would not understand why Ptolemy IV would

in the Fayyum once adjusted to an average density of population, i.e. 30,000 x 3.45 x 13.3 (replace 6,500 by 30,000 in the Equation 4).

have needed to hire Greek soldiers for the fourth Syrian war if he had had almost 300,000 Greek adult males available. In addition, it is demographically impossible that such a number of Greek adult males would have left the Aegean in the late fourth-early third century BC (cf. note 38).

Then, the second step of the compensation process must take into account the higher concentration of Greek settlers in the Fayyum: the number in Table 5, col. 12 must thus be divided (cf. Equation 5). Although Rathbone stressed that the settlers were not distributed equally throughout Egypt but that they formed pockets -notably in the Fayyum (ca. 20%), Alexandria, Memphis, Ptolemais and Thebes- he did not take this into consideration in his calculation. It is indeed very difficult to evaluate the degree of magnitude of this concentration in view of our scarce data. Ideally we would need to know the proportion of Greeks in different nomes to obtain an Egyptian average. But if we had such data we would not need to use the Fayyum which is so unrepresentative.

In order to approximate the percentage of Greek in Egypt and at the same time the degree of higher concentration of Greek settlers in the Fayyum – or at least a range of this higher concentration – I suggest using a mathematical model of diffusion.⁴¹ The calculation of the average of this function assumes, in concrete terms for the case of the Greek population in Egypt, that the Greeks propagated on a regular basis from the north of Egypt to the south. This is of course an enormous simplification. In addition, this oversimplification does not refer to real variable since the distance from the coast was not the main criterion for the settling of Greeks in Egypt. On the contrary, they settled in pockets such as Alexandria, the Fayyum, or Ptolemais in Upper Egypt. However, it appears that there was much more available land in the Delta and the Fayyum to settle new populations than in the Nile valley, and for this reason the distribution of

⁴¹ We could in fact directly use this method, without going through the normalization of the Fayyum, but this showed why the way Rathbone was using the Fayyum had flaws.

the Greeks in Egypt may match, by chance and at a high level of simplification, a mathematical model of diffusion.

For making this calculation, I use the data concerning two nomes. I assume that the Fayyum is more or less representative of the Delta and that Edfu is more or less representative of Upper Egypt. Using the available data, I can only compare the amount of cleruchic land in the Fayyum with that in the Edfu nome at different periods.⁴² The percentage of Greeks in the Fayyum, 22%, and the size of their land, are based on the population of military cavalryman in the 3rd century BC (P.Count. 1) and the size of the metropolitan elite in the Roman period.

Once again, to make the comparison possible, the first step is to compensate for the smaller size of the Edfu nome (cf. Table 6 for the absolute and adjusted values).⁴³ According to the percentage of cleruchic land in both nomes there would be ca. 17 times more cleruchs in the Fayyum than in the (standardized) Edfu nome. If one accepts the parallel between cleruchic land and (Greek) cleruchs for the sake of obtaining an order of magnitude, it follows there would be ca. 17 times more cleruchs in the Fayyum than in the (standardized) Edfu nome.

⁴² Of course, these are estimates based on land and not on the number of persons, and they do not take into account any distinctions between cavalry and infantry and their different land allotments. In fact, the cleruchic land for the Fayyum is for now on simply based on the number of cavalrymen, because the number of infantrymen is so far problematic, cf. note 35. I am also aware that the source for the Edfu nome is from the second century BC and that the cleruchs in the Edfu nome are probably mostly indigenous or from Greco-Egyptian families. However it does not question the whole approximation since the goal is to estimate how much low military settlement could have been in certain areas.

⁴³ In order to adjust the size of the Edfu nome to that of the Fayyum, it is necessary to use the factor 9.55: consequently, there would be 17.57 km² of cleruchic land in the Edfu nome (1.84 km² x 9.55), while there is 299 km² of cleruchic land in the Fayyum.

Table 6: Land and population in the Fayyum and in Edfu

The figures are based on the dissertation of Christensen (2002) for Edfu and on Clarysse and Thompson (2006) and Thompson (2007); my calculation is in italic. In parenthesis, I added the figures based on Butzer (1976) 74-75 used by Mueller (2006) 64.

	Fayyum	Edfu	Edfu (standardized at the size of the Fayyum: factor 9.56 or 10,69 in parenthesis)	Egypt
Total nb inhab.	87,000	70,000 ⁴⁴ (52,000)	<i>668,000</i> <i>(492,000)</i>	4,000,000
Nb. of Greeks	19,500	<i>120 (105)</i>	<i>1150</i>	<i>184,000</i>
Size (km ²)	1,500	157 (137)	<i>1,500 (1,500)</i>	20,000
Land belonging to Greeks (km ²)	300	1.84	<i>17,6</i>	?
Density (inhab/km ²)	58	445 (380)	<i>445 (380)</i>	200
% of Greeks	22	<i>0.17 (0.21)</i>	<i>0.17 (0.21)</i>	4.6
Density of Greeks (inhab/km ²)	13	<i>0.77</i>	<i>0.77</i>	9.2

In fact, the only values needed are the percentages of Greeks in the Fayyum and in the standardized nome of Edfu (cf. Table 6 and Figure 1). Then I introduce them in the diffusion function, which is $f(x) = f_0 \cdot e^{-\mu x}$ where f_0 is the percentage of Greeks in the Fayyum. μ is computed by using the data points that we know, that is 22 % of Greeks in the Fayyum and 0.2% of Greeks in Edfu: $f(x) = 22 \cdot e^{-\mu x}$ and $f(1) = 22 \cdot e^{-\mu} = 0.2$, which leads to $\mu = \ln\left(\frac{22}{0.2}\right) = 4.7\%$

The average percentage of Greeks for the whole Egypt is deduced by computing the area of the diffusion function using the normalized scale of Egypt (0 starts at Fayyum and 1 ends at

$$\text{Edfu): } \bar{f} = \int_0^1 f_0 \cdot e^{-\mu x} \cdot dx = \frac{f_0}{\mu} (1 - e^{-\mu}) = \frac{22}{4.7} (1 - e^{-4.7}) = 4.6\%$$

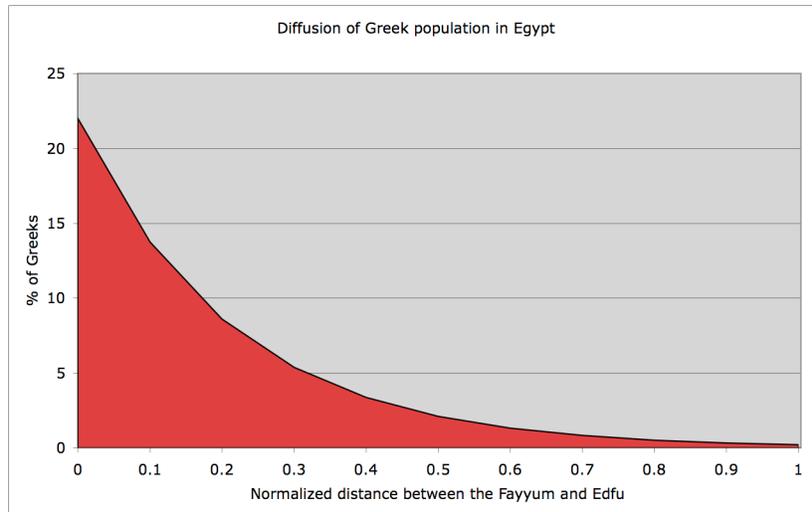
⁴⁴ Clarysse (2003) 21 suggests this number on the basis of annual income coming from mummification business and thus the yearly number of deaths. However we cannot, as in his note 21, simply multiply this number by 40 to obtain the total of inhabitants in Egypt since Edfu does not represent 1/40 of the cultivated areas and does not have a representative density of population.

Figure 1: Diffusion of the Greek population in Egypt

I indicated on the abscissa what I schematically considered as the two geographical extremes:

- 0 = Fayyum where I assume that the percentage of Greeks is the highest

- 1 = Edfu, where I assume that the percentage is the lowest



I obtain **4.6 % of Greeks in Egypt** on the basis of the mathematical calculation of the average of a diffusion function $f(x)$. It suggests that there were between four and five times more Greeks in the Fayyum (cf. Table 7). and ca. 23 times less in Edfu than on a hypothetical average in Egypt. On a total population of 4 million, **there were about 184,000 Greeks total** *contra* Rathbone, who stated that there was a maximum of 400,000 Greeks. There were about 63,500 adult males.

This last figure has the same order of magnitude as the number of Greek military males obtained in the first method (Raphia), i.e. max. 40,000, and in the second one (Macedonians), i.e. 30,000-45,000. Indeed, Raphia's number compared to this fourth method suggests that ca. 63% of the Greek adult males were in the army in the third century BC, a percentage that seems reasonable in the view of the papyrological documentation. Of course this average must be considered as an approximation. However, all these estimates are still much below the ones advanced by scholars in the past decades.

Table 7: New estimates of the number of Greeks in the mid-third century Egypt

The number of Greek adult males obtained in Table 5, col. 12 (298,851) is divided to compensate the higher number of Greeks in the Fayyum.

298,851 divided by	Greek adult males in Egypt	Total Greek pop. in Egypt	Percentage of Greek pop. in Egypt
4	74,713	216,667	5.42
5	59,770	173.334	4.33

Conclusion

In conclusion, these new calculations of the number of Greeks in the third century BC Egypt demonstrate that we should rather consider that there were ca. 5% of Greeks in Egypt rather than the 10% usually accepted. In addition, the investigation concerning the Macedonian settlers (second method) suggests that the flow of immigration was not a regular one. Since Ptolemy IV had to hire new mercenaries from the Aegean for fighting at Raphia (217 BC), it seems that Greek immigration stopped in the mid-third century – at least mass immigration of potential soldiers – except for special cases of emergency hiring such as Raphia. Further on, the third method (the *katoikoi hippeis*) illustrates that the Greek population did not grow during the second century BC.

These demographic revisions should thus be taken into account when analyzing the Ptolemaic state and the socio-economic as well as cultural interactions between the different groups of population in Egypt. As far the army is concerned, the calculation presented in this paper shows that a little bit more than half of the Greek migrants were military⁴⁵ and that the Greek military settlers represent a very small part of population (40,000 x 2.9 = 116,000), i.e. 2.9% of the total population of four million: there were pockets of concentration, notably in the

⁴⁵ This order of magnitude is corroborated by the census-lists from the mid-third century BC: Clarysse and Thompson (2006) count 9,125 adults who belong to the category of the army and 7,914 adults who are tax-*Hellênes*, that is, a total of 17,039 Greeks out of 58,709 adult inhabitants in the Fayyum (29%); from this number I evaluate the proportion of Greek adults belonging to the military category among the Greeks, that is, 54% (9,125 divided by 17,039).

Fayyum, which was a very unique reservoir for the settled cavalry (perhaps half of the *katoikoi hippeis*). This must help us to consider how much the army could have cost to the Ptolemies, how they organize their strategy of military settlement and to what extent the Ptolemaic government had to rely on the Egyptians to maintain or to mobilize an army sufficiently large for accomplishing its task.

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