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The *Catalogus geometrarum* from the *Corpus Agrimensorum*

Part II: The Biography of Euclid the Mathematician

Richard M.A. Marshall | ORCID: 0000-0002-5645-3135

University College London, Dept. of History, London, United Kingdom

r.m.a.marshall@ucl.ac.uk

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Abstract

The *Catalogus geometrarum* from the *Corpus Agrimensorum*, an early witness to the Aratean commentary tradition, names an author with mathematical interests as Euclid the Sicilian. If this individual is identical with Euclid the geometer, then we are able to move beyond the traditional biographies of Euclid, which rest on the problematic evidence of Proclus and Pappus, and consider an ancient case of mistaken identity which suggests that Euclid may even have been a Geloian by birth. This new identification raises questions about the status of Doric as a scientific language, and Alexandria's role as a haven for those dislocated by war or civil strife, not merely as a magnet for scientific talent.

Keywords

Euclid – geometry – Alexandria – Sicily

1 Introduction

In Part I of this study, I have cautiously argued for the identification of Euclid the Sicilian with the famous geometer. Although the possibility remains that some otherwise unknown Euclid stands behind the reference in *CG* 3, we have seen that this identification relies upon the conjunction of a recognised problem in the Aratean presentation of the spherical cosmos, Euclid's established

auctoritas in this field, and the close association of a diagram related to this particular topic (CG 4).¹ Had CG 3 read simply *Euclidis Arismetica scripsit, Euclidis geometra...*, or even *Euclidis Alexandrinus...*, this identification would be absolutely straightforward. True, we would still have to explain away the issue raised by CG 3's reference to Euclid's *Arithmetica*, but this issue is only compounded if we posit a lost work by an unknown author: Euclid the geometer is at least known to have written on spherical geometry. The issue lies not with the author's name or the epithet *Siculus* (though the latter is otherwise unattested), but with the title, *Arithmetica*, which requires the commentary tradition to have taken notice of a branch of mathematics entirely alien to the contents of the poem of Aratus. Anyone familiar with Greek mathematics will recognise just how barren a field any treatise on this topic will have presented to even the most resolute of commentators. A more reasonable approach might be to obelize *Arithmetica* and keep our unknown Euclid: in the present state of our knowledge, this is quite possibly the correct option. However, if we choose the alternative, again throwing out *Arithmetica* but reading a reference to a famed authority on a topic known to have generated controversy among the commentators of Aratus—a perfectly reasonable choice—, then we may be able to add new detail to Euclid the geometer's extremely threadbare biography.

Traditional biographies of Euclid follow an outline established by Johan Ludvig Heiberg in 1882 and popularised by Sir Thomas Heath.² Active around 300 BC, Euclid (probably) obtained his mathematical training at Athens and afterwards moved to Alexandria, where he founded a mathematical school that survived into Late Antiquity. This reconstruction depends upon two late-antique sources: Proclus and Pappus. Unfortunately, no faith can be placed in either source: though we have external means of establishing a rough chronological horizon for our author, it is plain that Proclus and Pappus—with the exception of a single contested anecdote—had absolutely no solid biographical information to work from, and drew their inferences from materials which are still accessible to us.

1 The interrelation of CG 1-2 and 4 make it extremely unlikely that CG 3 is unrelated to the Aratean commentary tradition. The pattern of errors found in CG 1-2 suggests that the hapless 'Translator' depended directly on a Greek text equipped with interlinear glosses that ignored proper names, a circumstance which requires us to treat the evidence of CG 3 as a witness to said Aratean tradition seriously: CG is not a text that could easily have originated in any other fashion (e.g. via some garbled oral exposition in a classroom setting): see Part I, §§ 4-5. Although little faith can be placed in the erudition of the Translator, the source at his disposal is the key to the following argument.

2 Heiberg 1882, 1-7; Heath 1926, 1, 1-6.

Though the question of Euclid's homeland is unconnected with the question of whether he was active in any other centre—in early Alexandria, of course, everyone came from somewhere else—, Euclid's origins may shed light on his intellectual formation (and by reflection, on the culture of his place of origin), raise questions about the adoption of Koine (the language in which he wrote) as a medium for scholarly communication, and even hint that considerations besides intellectual ambition lay behind any decision to settle in Alexandria. Positing a Sicilian origin for Euclid cannot remove Euclid from the orbit of Alexandria (though it does encourage us to look more critically at those sources that do suggest such a connection); it invites us instead to take Euclid, hitherto an abstract token in the History of Ideas, and flesh him out in his Mediterranean context.

No other source records Euclid's homeland, though ignorance of this has naturally encouraged speculation, including the wild hypothesis that 'Euclid' was the pseudonym of an ancient mathematical collective *à la* 'Nicolas Bourbaki', rather than an historical individual.³ The epithet 'Alexandrinus' is modern and stems from confusion with Euclid's supposed place of teaching.⁴ In the Arabic biographical tradition, Euclid is reported to be a Tyrian, but the origin of this misunderstanding belongs to the epistolary preface of the work that now circulates as Book XIV of Euclid's *Elements*.⁵ Although authored by a certain Hypsicles (according to manuscript paratexts), this book was erroneously thought to have been written by Euclid himself in the Arabic tradition.⁶

Mauritz Haupt drew attention to the *Catalogus geometrarum* in 1867, but left the investigation of Euclid's homeland to others.⁷ Friedrich Marx provided an enthusiastic reminder of the passage's existence in 1902.⁸ Unfortunately, Haupt and Marx went unheeded. In a ground-breaking investigation into Euclid's biographical tradition, Heiberg wrote in 1882—apparently unaware of Haupt: "vom Geburtsort Euklids haben wir keine Nachrichten; er war seinen

3 Itard 1961, 9-12.

4 See Heiberg 1882, 22.

5 The surveys of Heiberg 1882, 1-7 and Heath 1926, i, 4-6 both focus on Ibn al-Qifī (AD 1172-1248), but his account is ultimately reliant on al-Kindī (ca. AD 801-873), mediated via Ibn an-Nadīm (died AD 995/998) and Šā'id al-Andalusī Al-Qāḍī (AD 1029-1070). The latter seems to have introduced Tyre to the tradition (*Ṭabaqāt al-'Umam*, 28.12 Cheikho).

6 [Euc.] 14.pr.: 'Basilides of Tyre, O Protarchus, when he came to Alexandria and met my father, spent the greater part of his sojourn with him on account of the bond between them due to their common interest in mathematics.' (Trans. Heath 1926, 1, 5-6). See Heiberg 1882, 4; Cantor 1894, 247; Heath 1926, 1, 5-6.

7 Haupt 1867, 3 (= 1876, 361).

8 Marx 1902, 198-199: "eine Notiz, durch die die Heimat des Euclid als gesichert überliefert betrachtet werden muß."

Zeitgenossen und den nächsten Jahrhunderten nach ihnen, wo die Kunde von seiner Herkunft sich erhalten haben mag, in dem Grade der einzige Euklid, daß sie unterließen, wie es sonst wohl Sitte war, seinem Namen das ἔθνικόν beizufügen; die späteren wußten es nicht mehr.⁹ A potential explanation for this blind-spot has been noted in Part I, §2: formal diagnosis of the eccentric habit of the scribe of manuscript *A*, which inadvertently makes the *-ulus* of *Siculus* appear to be a supplement (see Part I, fig. 1), came years after Heiberg's study.¹⁰ Be that as it may, Heiberg's uncontested assumption underpins all modern biographies of Euclid,¹¹ none of which note the *Catalogus geometrarum*.

Although the Translator's grasp of Greek was weak, Σικελός was early naturalised as Latin *Siculus*, a perfectly standard item of vocabulary that even our hapless Translator should have handled confidently. Absent any suspicion of error, there is another reason in favour of retaining *Siculus*, rather than posit e.g. a garbled translation of Στοιχειωτής ('The Elementist'), an epithet associated with Euclid in later antiquity:¹² the testimonium also agrees with an alternative ethnicity assigned in antiquity to Euclid of Megara, in what is very likely to be a case of mistaken identity.

Diogenes Laertius quotes Alexander Polyhistor (active in Rome ca. 80-60 BC)¹³ for the suggestion that Euclid of Megara (ca. 450-380 BC) came from the city of Gela in Sicily:

Euclid was a native of Megara on the Isthmus, or according to some of Gela (ἢ Γελῶος κατ' ἐνίους), as Alexander states in his *Successions*.¹⁴

Either Euclid of Megara has been confused with someone else,¹⁵ or Euclid of Megara's birthplace was genuinely disputed. The latter seems unlikely: Cicero (*Ac.* 2.129) and Strabo (9.1.8) agree that Euclid of Megara's home, for which there is extensive and early evidence (Pl. *Th.* 142c, *Phd.* 59c; D.L. 2.106, 3.6) was also his birthplace. Polyhistor's mistaken identification might thus serve

9 Heiberg 1882, 22.

10 Thulin 1911a, 25-26.

11 See e.g. Hultsch 1907, 1004-1005; Heath 1926, 1, 1-6; Bulmer-Thomas 1971, 414-415; Fraser 1972, 1, 387; Mau 1979, 417; Schreiber 1987, 25-29; 1989, 26; Caveing 1990, 15; Folkerts 1998, 238; Waschkie 1998, 372; Vitrac 2000, 253; Schönbeck 2003, 5-13; Acerbi 2007a, 177-212; Asper 2014, 462.

12 Cf. e.g. Theon. *In Ptol.* 468.9; Porph. *In Ptol.* 94.25; [Hero] *Deff.* 128.1.

13 Schwartz 1894, 1449.

14 D.L. 2.106 = *BNJ* 273 F87 (trans. Hicks 1925, 235).

15 So Blakely 2015, *ad loc.* Deycks 1827, 4 invents Euclid 'the Jester' (γελοῖος) to explain the confusion, but his evidence (Ath. 6.242b, 250e) is worthless. No other literary / philosophical Euclids are known.

to corroborate the *Catalogus geometrarum*: a tradition was current in which some other Euclid was connected with Sicily.

Now, this other Euclid could, of course, be our hypothetical unknown individual, but there is additional evidence for the contemporary confusion at Rome of the biographies of Euclid of Megara and Euclid the geometer, as witnessed by Valerius Maximus:

This reflection also touched the most learned bosom of Plato. He told persons who had contracted to build a sacred altar and wished to discuss its measurements and shape with him that they should go to Euclid the geometer (*Eucliden geometren*). He yielded to Euclid's knowledge, or rather to his profession.¹⁶

This is a garbled version of a story found in Plu. *De genio Socratis* (*Mor.* 579b-c), in which Plato advised the Delians to confer with Eudoxus or Helicon for a solution to the problem of doubling a volume. Valerius Maximus (active in Rome ca. AD 20-30) thus confuses Euclid with Eudoxus, not Euclid of Megara, but Heiberg rightly notes that this confusion could only arise if Euclid the geometer was incorrectly assumed to be a contemporary of Plato (died 348/47 BC), as was Euclid of Megara.¹⁷

Polyhistor was a rather careless scholar,¹⁸ Valerius Maximus a collector of moral *exempla* who did not consult Greek sources directly and chiefly relied upon Cicero and Livy.¹⁹ Although Proclus, for one, could correctly infer that Euclid lived later than Plato, the testimonia of Polyhistor and Valerius Maximus demonstrate that the biographies of the two Euclids were poorly understood at Rome in this period. Confusion between Euclids was likewise rife in the Middle Ages: deeply ingrained, the tradition was only corrected in the late sixteenth century.²⁰

2 Proclus and Pappus

I return to the potential Gela connection below. It is now time to survey the biographical tradition represented by Proclus and Pappus.

16 Val. Max. 8.12.ext.1 (trans. Shackleton Bailey 2000, vol. 2, 261).

17 Heiberg 1882, 23.

18 Blakely 2015 [Biographical Essay].

19 See Briscoe 2019, 6-9 and Fleck 1974, 8 (the reference to Polyhistor at Val. Max. 8.13.ext.7 is thus not original). Whether Polyhistor was responsible for the confusion of 8.12.ext.1 is unknowable (cf. Briscoe 2019, 191, blaming Valerius Maximus).

20 See Heiberg 1882, 23-25; Heath 1926, 1, 3-4; Goulding 2010, 117-142.

In the opening of his commentary on Euclid, Proclus (AD 410 or 412-485) provides a chronological catalogue of geometers stretching back to Thales (sixth century BC).²¹ Following the contemporaries of Plato, Proclus names several individuals connected with Eudoxus and ends with the shadowy Philippus of Mende:

These men (sc. Amyclas of Heracleia, a follower of Plato, Menaechmus, a student of Eudoxus, Dinostratus, Theudius, and Athenaeus of Cyzicus) lived together in the Academy, making their inquiries in common (διήγον οὖν οὗτοι μετ' ἀλλήλων ἐν Ἀκαδημία κοινὰς ποιοῦμενοι τὰς ζητήσεις). Hermotimus of Colophon pursued further the investigations already begun by Eudoxus and Theaetetus ... Philippus of Mende, a pupil whom Plato had encouraged to study mathematics, also carried on his investigations according to Plato's instructions and set himself to study all the problems that he thought would contribute to Plato's philosophy.

All those who have written histories bring to this point their account of the development of this science (οἱ μὲν οὖν τὰς ἱστορίας ἀναγράψαντες μέχρι τούτου προάγουσι τὴν τῆς ἐπιστήμης ταύτης τελείωσιν). Not much younger than these men (sc. Philippus of Mende *et al.*) is Euclid, who brought together the *Elements*, systematizing many of the theorems of Eudoxus, perfecting many of those of Theaetetus, and also putting in irrefutable demonstrable form propositions that had been rather loosely established by his predecessors. This man lived in the time of the first Ptolemy; for Archimedes, who followed closely upon the first (Ptolemy), mentions Euclid (γέγονε δὲ οὗτος ὁ ἀνὴρ ἐπὶ τοῦ πρώτου Πτολεμαίου· καὶ γὰρ ὁ Ἀρχιμήδης ἐπιβαλὼν καὶ τῷ πρώτῳ μνημονεύει τοῦ Εὐκλείδου). It is also reported that Ptolemy once asked him if there was not a shorter road to geometry than through the *Elements*, to which he replied that there was no royal road to geometry. He is therefore younger than Plato's circle, but older than Eratosthenes and Archimedes; for these were contemporaries, as Eratosthenes somewhere says. He belonged to the persuasion of Plato and was at home in this philosophy; and this is why he made the goal of the *Elements* as a whole to be the construction of the so-called Platonic figures.²²

21 Procl. *In Euc.* 64.16-68.6 Friedlein. Cf. [Hero.] *Deff.* 108.10-25 Heiberg.

22 Procl. *In Euc.* 67.8-68.23 Friedlein (trans. Morrow 1970, 55-57, adapted). Fraser (1972, vol. 2, 562-523, nn. 82-83) interprets ἐπιβαλὼν as 'overlapping', and makes this refer to Euclid, not Ptolemy (with αὐτῷ understood); καὶ τῷ πρώτῳ is then emended to ἐν τῷ πρώτῳ, 'in the first (book)' (i.e. Archim. *Sph. Cyl.* 1.prop.2). However, an independent source is needed for the information that Euclid and Archimedes overlapped, which Proclus plainly lacked. On

Once his source(s) (see below) ran out, Proclus clearly had no biographical information to work from: Euclid is placed after Eudoxus and Theaetetus (the pupils of Plato, who died 348/347 BC) because he relied upon their works, and before Archimedes (died 212 BC) because the latter was supposed to have quoted him.²³ The horizon for Euclid's activity given here is thus *ca.* 347 BC to some time before 212 BC. The synchronism drawn with the life of Ptolemy I Soter (satrap from 323 BC; reigned 305/304-283/282 BC) was obviously prompted by the anecdote in which Euclid informs Ptolemy that there is no 'royal road' to geometry. Unfortunately, the same anecdote is also told about Alexander the Great and Menaechmus.²⁴ Although the encounter between Euclid and Ptolemy may have been intended to be chronologically and geographically plausible,²⁵ little weight can be placed on such evidence, not least because the Ptolemy in question may never have been specified in the tradition. Proclus himself suggests that the choice of Ptolemy I was prompted by the chronology he attributed to Archimedes, who is placed 'shortly after the first Ptolemy' on the grounds that he was a contemporary of Eratosthenes.²⁶ This rough coincidence is enough to explain the rather odd choice of Ptolemy I Soter; in the absence of the ordinal, we might otherwise have conjectured Ptolemy II Philadelphus (283/282-246 BC), in whose reign Alexandrian scholarship reached its maturity.²⁷

the text of this passage see also Heiberg 1882, 18-22; Heath 1926, 1, 1 n. 3; Bulmer-Thomas 1971, 432 n. 8. Cf. [Hero] *Deff.* 108.21-25 Heiberg, 'Not much younger than these is Euclid ... he lived under the first Ptolemy, and was younger than Plato, older than Eratosthenes and Archimedes ...' (οὐ πολὺ δὲ τούτων νεώτερός ἐστιν ὁ Εὐκλείδης ... γέγονε δὲ οὗτος ἐπὶ τοῦ πρώτου Πτολεμαίου νεώτερος μὲν τοῦ Πλάτωνος, ἀρχαιότερος δὲ τοῦ Ἐρατοσθένους καὶ Ἀρχιμήδους ...).

- 23 This claim used to be dismissed by pointing to Archim. *Sph. Cyl.* 1.prop.2, an obvious interpolation to modern eyes (see Hjelmlev 1950, 7; Dijksterhuis 1956, 150 n. 1; Netz 2004, 44). However, the Archimedes Palimpsest now supplies a second reference to Euclid in *Sphere and Cylinder* that may well be genuine (Netz, Noel, Wilson, and Tchernetska 2011, vol. 2, 276-277). A third, more questionable reference is also to be found in the Arabic translation of Archimedes, *On tangent circles* (Dold-Samplonius, Hermelink, and Scheamm 1972, 17.15-17). Whether Proclus was thinking of any of the above references must remain unknowable: many works by Archimedes are lost.
- 24 Stob. 2, 228.30 Wachsmuth.
- 25 So Vitrac 2000, 254.
- 26 John Tzetzes, 2.hist.35 claims that Archimedes died at the age of 75 (and so was born in 287 BC), but is this poetic shorthand for 'in old age'? The birth of Eratosthenes is dated elsewhere to the 126th Olympiad (i.e. 276-273 BC): *Suda* ε 2898 Adler. The dating of Archimedes is thus controversial (see Schneider 2016, 2-3), which problematizes the Euclidean chronology proposed by Proclus even further.
- 27 Though cf. Netz 2020, 290-306.

As Fabio Acerbi has noted, Proclus thus proceeds by inference.²⁸ Even the assertion that Euclid was younger than the pupils of Eudoxus is an argument *ex silentio*: the sources on which Proclus relied excluded Euclid but included the pupils of Eudoxus, therefore Euclid was presumed to be more recent than them.

The one ‘hard fact’ generally adduced about Euclid is that at some point he came to Alexandria (founded 331 BC).²⁹ This relies on the anecdote of Proclus and a claim made by the *Alexandrian* mathematician Pappus (fl. ca. AD 320) that the geometer Apollonius of Perga was taught there by Euclid’s own pupils:

(Apollonius) added the missing things to the locus (sc. of three and four lines) ... having studied for a long time in Alexandria under the pupils of Euclid, where he also acquired this great habit of mind, which was not without defect (σχολάσας [συσχολάσας *em. Hultsch*] τοῖς {ὑπὸ} Εὐκλείδου μαθηταῖς ἐν Ἀλεξανδρείᾳ πλείστον χρόνον, ὅθεν ἔσχε καὶ τὴν τοιαύτην ἔξιν οὐκ ἀπαθῆ [οὐκ ἀμαθῆ *Hultsch*]).³⁰

Apollonius himself was likely active in Alexandria during the reigns of Ptolemy III Euergetes (acceded 246 BC) and Ptolemy IV Philopator (reigned 221-204 BC).³¹ On the assumption that Apollonius was born ca. 260 BC, this would place Euclid’s period of activity ca. 300 BC, broadly in agreement with the external evidence for Euclid’s date alluded to above.³²

However, there are three serious problems if one wishes to rely on Pappus. Firstly, the implication that Apollonius learned mathematics in a settled institutional setting is an obvious anachronism: this description is better suited to the Alexandria of Late Antiquity than anything we know about the early

28 Acerbi 2007a, 182-183.

29 See the studies listed at n. 11.

30 Papp. 7.35 (= 678.6-10 Hultsch); trans. Jones 1986, 120. On the textual difficulties of this passage, see Fraser 1972, vol. 2, 572 n. 148. As elsewhere, Hultsch is too quick to condemn pp. 676.25-678.15 as the work of an interpolator. See Jones 1986, 1, 18-20.

31 See now Netz 2015, 311-315 (cf. Evans and Carman 2014, 151 n. 27); Netz 2017, 63-72, defending the traditional dates assigned in antiquity to Apollonius against Toomer 1970, 179-180; Fraser 1972, vol. 1, 415-416; Gallo 1980, vol. 2, 33, 36 (all use similar arguments to place Apollonius ca. 20 years later).

32 The evidence for Euclid’s *t.a.q.* is provided by the results that Archimedes is able to take for granted, and by a group of ostraca (Pack² 2323), dated palaeographically to ca. 250-200 BC, whose contents are closely related to results found in Euc. 13.10 and 16. See e.g. Fowler 1999, 209-210; Vitrac 2000, 253-255; Acerbi 2007a, 177-200.

Hellenistic period.³³ Secondly, as Alexander Jones has noted, the testimony of Pappus is no more impressive than that of Proclus: Apollonius writes in the preface of the *Conics* (2.11-13 Heiberg) that he composed the work at the request ‘of Naucrates the geometer at the time when he came to Alexandria and stayed with me’ (ὕπὸ Ναυκράτους τοῦ γεωμέτρου, καθ’ ὃν καιρὸν ἐσχόλαζε παρ’ ἡμῖν παραγενηθεὶς εἰς Ἀλεξάνδρειαν). If Pappus misunderstood ἐσχόλαζε as meaning ‘went to school’,³⁴ his comment σχολάσας τοῖς Εὐκλείδου μαθηταῖς ἐν Ἀλεξανδρείᾳ ... is explained; with it any evidence for the school days of Apollonius evaporates. Why Pappus claimed that Apollonius had been taught by Euclid’s pupils need only depend on Apollonius’s clear debt to Euclidean geometry, the knowledge that Apollonius lived after Archimedes and that Archimedes, in turn, had cited Euclid, and the obsession of later philosophers with the concept of ‘succession’ (διαδοχή). Most damningly, Pappus had particular reasons for making such a claim: it rounds off a polemical passage in which Apollonius is reproached for his ungenerous attitude towards Euclid in claiming to have completed the three- and four-line locus (the ‘mental defect’ neatly restored by Jones above).³⁵ A teacher himself,³⁶ Pappus was evidently keen to sharpen the impression of ingratitude by making Apollonius a link in a living Euclidean chain (and burnish his own glory as an Alexandrian successor to Euclid). Thirdly, even if we suspend our disbelief, the presence in Alexandria of ‘students’ (μαθηταῖ) of Euclid is no absolute guarantee that their master was once to be found there (or, if he did visit, that he remained for any significant length of time). Though the anecdote of Proclus may be thought to provide some corroboration, there is a final complicating factor: Proclus knew the works of Pappus.³⁷ These are not independent sources.

Why is the mathematical tradition silent as regards Euclid’s homeland? The question was surely of interest, and Proclus, for one, was plainly eager for biographical (especially chronological) information related to Euclid, no matter how tenuous.³⁸ The answer is clearly that no tradition was known that recorded this: the historical account on which Proclus ultimately relied—usually

33 See Acerbi 2007a, 183-194; 2007b. On (mathematical) education in late-antique Alexandria, see e.g. Cuomo 2000; Watt 2004.

34 Jones 1986, vol. 2, 403.

35 Papp. 7.33-35 (= 676.19-678.15 Hultsch). Cf. Decors-Foulquier and Federspiel 2008, ix n. 3.

36 Cf. Procl. *In Euc.* 429.13 Friedlein.

37 Procl. *In Euc.* 189.12, 197.6, 249.20-250.12 Friedlein.

38 Note that as an argument *ex silentio*, the failure of Proclus and others to report any birthplace for Euclid cannot undermine the credibility of *CG* 3 in and of itself: significantly, Proclus lays no particular stress on the Alexandrian connection, except in so far as it contributes to the elucidation of Euclid’s dates.

identified with the lost *History of Geometry* (or *Geometrical Researches?*) of Eudemus of Rhodes, perhaps as mediated by some later Platonist, most likely Porphyry³⁹—tantalisingly closed a generation or so too early. No other biographical source on Euclid is known from antiquity. Unlike later authors such as Archimedes and Apollonius, Euclid also failed to supply his works with discursive prefaces that included autobiographical or dedicatory data. The gap was filled in Islamic times by pure invention (see above).

The *CG* material, on the other hand, whatever the shortcomings of its sixth-century translator, ultimately belongs to a very early (pre- Φ) branch of the Aratean commentary tradition, rooted in the Hellenistic age. By the time of Proclus and Pappus, Euclid, like Pyrrhus of Magnesia (named in *CG* 1-2: see Part I), had long been pruned from a main trunk of that tradition: scholia from Φ —a tradition shorn of Euclid—, had already made their way into the commentary tradition of Germanicus by *ca.* AD 300, whence they were cited by Lactantius.⁴⁰ In any case, Euclid could only conceivably have been cited to illuminate the problematic exposition of the spherical cosmos at Aratus, *Phaenomena* 19-26:⁴¹ his role in the tradition, dictated by the source material, was always fated to be tenuous.

By reason of its pre- Φ date, the epithet might just depend on some authentic Alexandrian knowledge (e.g. a pinacographical source connected with the library, or even a living tradition): the earliest commentary on the text of Aratus, that by Attalus of Rhodes, dates to the earlier second century BC;⁴² the latest authority identifiable in the Greek author catalogues from which *CG* 1 is drawn—Geminus—belongs to the first century BC.⁴³ Alternatively, one might posit reliance on some early manuscript paratext.

In the mathematical tradition, by contrast, there is a clear break: Eudemus inspired no followers, and the age of Hellenistic mathematics is marked by an almost complete lack of interest in the history of the discipline.⁴⁴ A commentary culture that might have taken an interest in such questions is scarcely attested before the age of Pappus: the earliest commentaries on Euclid himself belong, with a single exception, to late antiquity.⁴⁵ Proclus went only as

39 = Eudemus fr. 133 Wehrli. See e.g. Tannery 1882 and 1887, 66-80; van Pesch 1900, 80-86; Heath 1921, vol. 1, 118-121 and 1926, vol. 1, 45-48; Zhmud 2006, 179-191.

40 See Part I, n. 76.

41 See Part I, § 7.

42 See Dickey 2007, 56-57.

43 See Part I, n. 84.

44 Zhmud 2006, 280-283.

45 Netz 2020, 760-762. The exception is a commentary by Heron. Following Neugebauer 1938, Heron is usually placed in the middle of the first century AD, though his evidence is

far back as his intermediary—likely Porphyry (AD 234—*ca.* 305)—for the information contained in Eudemus; if Porphyry also wrote a commentary on Euclid—a reasonable but far from certain conjecture—,⁴⁶ the whole substance of Proclus's historical introduction may ultimately belong to Porphyry.⁴⁷ Such speculation, however, only pushes the issue back to the generation before Pappus (who surely also knew Porphyry): by the time mathematicians took notice of such details, it was far too late to bemoan the absence of any historiographical or biographical tradition in the exact sciences.⁴⁸ This absence is perhaps the most telling argument against the 'evidence' of Proclus/Porphyry and Pappus. An odd piece of genuine biographical data might just survive and be inadvertently overlooked, however, in some other early context: who would ever think to search out the birthplace of Euclid in one of the many commentaries on Aratus?⁴⁹

3 Gela

Situated on the south-western coast of Sicily, the Greek polis of Gela was founded by Rhodian colonists *ca.* 690 BC.⁵⁰ Once a powerful city, Gela was sacked by the Carthaginians in 405 BC: its defences were levelled and the

highly questionable (see Sidoli 2011). A date in the following century may be more appropriate: Netz 2020, 673 n. 78.

46 See e.g. Heath 1921, vol. 2, 529. *Contra*: Mansfeld 1998, 24.

47 Zhmud 2006, 188.

48 Cf. Zhmud 2006, 277-297. The outstanding exception to this general rule is, of course, the biography of Archimedes, said to have been written by one Heracles/Heracleides, though it is highly significant that even this work is only known from a single citation (Eutoc. 266.1 Heiberg).

49 Ancient scholarship is full of such curious gaps. To take but one example, Augustine (writing *ca.* AD 415) blithely assumed that the greatest Roman scholar of antiquity, Marcus Terentius Varro (died 28 BC), was a Roman of Rome, and attempted to score polemical points from this 'fact': Aug. *Civ.* 4.1, 'Varro did not make this assertion on his own authority, but because he was born and brought up in Rome ...' (*non auctoritate sua fecit, sed quoniam ... Romae natus et educatus*). Ordinarily, one would take it on trust that Augustine, himself antiquity's greatest Varronian scholar, knew what he was talking about. Yet we know from Symmachus, of all people, that Varro was actually *Reatinus* (*Epist.* 1.2): he is the *only* ancient witness to this epithet. Augustine's ignorance is as perplexing as the channels by which Symmachus came by this knowledge, clearly correct: Varro lived only four hundred years before Augustine, was the author of an autobiography, and became himself the subject of a biography by Suetonius. See generally Marshall 2014, 55-58.

50 For histories of Gela, see: Schubring 1873; Ziegler 1910; Griffo and von Matt 1968; Gabba and Vallet 1980, vol. 1, 561-571; Canzanella and Buongiovanni 1990 (with full bibliography); Panvini 1996; Anello 1999; Congiu 2012.

remaining inhabitants were forced to pay tribute (D.S. 13.108-14). Archaeology confirms the rapid decline in the fortunes of the city, and that any recovery was extremely limited:⁵¹ most of the settlement was abandoned and the city ceased to mint its own coinage.⁵² The inhabitants fled to Syracuse or the eastern Mediterranean.⁵³

Under the stewardship of Timoleon, however, Gela experienced a re-birth. In 338/337 BC,⁵⁴ finding the city ruined and depopulated, Timoleon sponsored a civic revival and gathered new settlers; so successful was his project that he was hailed as Gela's founder (Plu. *Tim.* 35.3).⁵⁵ The honour is amply justified by the archaeological record, which shows a dramatic rise in the city's fortunes.⁵⁶ Gela reborn was not without intellectual distinction:⁵⁷ famous sons include the comic playwright Apollodorus, the contemporary of Menander (ca. 341-290 BC),⁵⁸ and the philosopher Timagoras, coaxed from the school of Theophrastus (ca. 371-ca. 287 BC) by Stilpo (ca. 360-ca. 280 BC).⁵⁹

The origin of Timoleon's colonists is potentially significant, as from what we know of Euclid's floruit, Gela's history, and the socio-economic status of those who engaged seriously with mathematics in antiquity—an amateur enterprise pursued by a leisured and wealthy elite—,⁶⁰ it would be reasonable to date Euclid's association with the city to the period after Timoleon's refoundation in 338 BC.

According to Plutarch, the new settlers came from the island of Keos (ἐκ Κέω) under the leadership of Gorgus (Plu. *Tim.* 35.2). As the name Gorgus is epigraphically unattested on Keos but widespread on Kos, the emendation ἐκ Κῶ has been proposed, a suggestion strengthened by a Geloian decree of 242 BC (*SEG* 12.380) concerning an invitation to participate in the Koan

51 The picture of complete abandonment painted by Orlandi 1956 is no longer tenable, cf. Di Miro and Fiorentini 1976-1977; Panvini 1996, 99-100; Fiorentini 2002; Congiu 2012, 118-120.

52 Jenkins 1970.

53 See Asheri 1970. Arcestratus, 'the Hesiod or Theognis of gluttons' (Ath. 7.310a), active ca. 400-348 BC and said to hail from Gela or Syracuse (Ath. 1.4e), was probably a Geloian refugee who settled in the latter city: Olson and Sens 2000.

54 For the date see Westlake 1942, 85.

55 See Asheri 1970.

56 See Orlandini 1956; 1957; 1958; Adamesteanu 1958; Panvini 1996, 100-121; Congiu 2012, 120-131.

57 See Panvini 1996, 121 (though the physician Pausanias belongs to the fifth, not fourth century).

58 *Suda* α 3405 Adler (not to be confused with Apollonius of Carystus: Capps 1900, 45-50). See *PCG* 2.502-516.

59 D.L. 2.133.

60 See e.g. Netz 1999, 279-292; 2002; Zhmud and Kouprianov 2018, 470-472.

penteteric games.⁶¹ Euclid's family would likely have belonged to the new wave of immigrants, as only one ill-fated individual from Gela is known with the name Euclid before or after Timoleon's refoundation: a son of the tyrant Hippocrates of Gela, murdered in 491 BC.⁶² By contrast, two men by this name are known from the epigraphic record of Keos (both fourth or third century BC),⁶³ and an architheoros from Kos (ca. 250 BC).⁶⁴

After twenty years of peace following the Timoleonic refoundation, the city found itself drawn into the wars of Agathocles, tyrant of Syracuse (ruled 317-289/288 BC).⁶⁵ Briefly attacked in 317 BC (D.S. 19.4.4), Agathocles captured the city by ruse in 311 BC: he slaughtered at least 4,000 inhabitants, carried off the city's wealth, and turned it into an armed camp (D.S. 19.107.4-5). In 309 BC Xenodocus liberated the city (D.S. 20.31.4-5), but in 307 BC the city was handed over to Agathocles once again (D.S. 20.90.2). Worn down by constant strife, archaeology points to a dramatic reduction in the settlement's size thereafter.⁶⁶

At some point between 287-280 BC, the city of Gela ceased to exist:⁶⁷ Phintias of Acragas led the remaining inhabitants away to found a new city named in his honour (D.S. 22.2.2). The death blow was struck by marauding Mamertine mercenaries, who sacked the city shortly before Phintias deported the remaining population (D.S. 23.1.4).⁶⁸ Gela remained uninhabited into the age of Augustus (Str. 6.2.6).

The Roman inhabitants of Phintias continued to identify themselves as *Geloi*.⁶⁹ Alexander Polyhistor uses the phrase 'from Gela', and thus avoids the ambiguous epithet 'Geloian' (which after the destruction of the original city actually describes the Phintians),⁷⁰ but it is tempting to speculate that if Euclid was not born in (or carted off to) Phintias's new city, and instead left Gela some time before its final destruction, he will have done so to escape its turbulent final years.

61 See e.g. Pais 1894, 299 n. 1; Herzog 1928, 45; Herzog and Klaffenbach 1952, 22-24; Asheri 1970; Sherwin-White 1978, 80-81; Manganaro 1990, 396-400. For arguments against harmonizing these references, see Guzzo 2017 (with Seibert 1963, 137 n. 2).

62 Hdt. 7.155b = *LGPN* IIIa, Εὐκλείδης no. 58 (note the Doric spelling).

63 *LGPN* I, Εὐκλείδης nos. 35-36.

64 *LGPN* I, Εὐκλείδης no. 25.

65 See Meister 1984.

66 Orlandini 1956, 173; Griffo and von Matt 1968, 192; Canzanella and Buongiovanni 1990, 23.

67 For the chronological controversy, see Zambon 1999; 2004, 464 n. 8.

68 Schubring 1873, 70; Griffo and von Matt 1968, 195; Gabba and Vallet 1980, vol. 1, 561-571; Pavini 1996, 102; Zambon 1999; 2004, 464-465.

69 Schubring 1873, 76-79.

70 Cicero still calls the people *Gelenses* (*Verr.* 2.3.103, 2.4.73) but their city Phintia (*Verr.* 2.3.192).

Based on the concluding remarks of Pappus concerning Euclid's alleged Platonic sympathies, some scholars have postulated that Euclid made a long sojourn in Athens, though Michalis Sialaros has recently demolished the three pillars that supported this argument, namely that Euclid's *Elements* is the work of a committed Platonist, that Athens was the only pre-Alexandrian centre of geometrical instruction, and that Athens was the only place in which Euclid could have accessed the works of his principle sources (Theaetetus and Eudoxus).⁷¹ If Sicily was the land of Euclid's birth, he was in good company: Archimedes's father Phidias worked on astronomical problems and was presumably responsible for his son's elementary mathematical education.⁷² Conon of Samos may have been making his Sicilian astronometeorological observations (Ptol. *Phas.* 67.7-8 Heiberg) at roughly the same time.⁷³ The island was clearly no intellectual or mathematical backwater: Plato famously visited Syracuse on three occasions during the reigns of Dionysius I and Dionysius II.⁷⁴ Hermodorus of Syracuse went to Athens to study alongside Plato and returned to Sicily to publicise his mentor's works and biography (Cic. *Att.* 13.21a; *Suda* λ 661 Adler); he also wrote a book *On the (Mathematical) Sciences* (Περὶ μαθημάτων: D.L. 1.2).⁷⁵ A circle of late Pythagoreans was active at Syracuse in the first half of the fourth century: we know the names of Hicetas and Ecphantus (Diels and Kranz 50-51), both astronomers, and Damon and Phintias (Diels and Kranz 55).⁷⁶ The Sicilian Petron of Himera (Diels and Kranz 16), who hypothesized a triangular universe consisting of 183 discrete *kosmoi* (Plu. *Mor.* 422b), may also belong to this period.⁷⁷

On the other hand, both Pappus and Proclus attest to the existence of an ancient tradition that placed Euclid in Alexandria. Even if their claims rest on extremely problematic evidence, it is not in itself an unlikely proposition,⁷⁸ and with the destruction of Gela, we may find a motive more pressing than the intellectual attractions of the Ptolemaic capitol to explain Euclid's abandonment of his homeland (*ca.* 311-287/280 BC?) and resettlement in that city.

71 Sialaros 2020.

72 Archim. *Aren.* 220.21 Heiberg. See Knorr 1978, 271; Schneider 2016, 5.

73 A *t.p.q.* for Conon's death in Alexandria is supplied by his 'discovery' of the Coma Berenices catasterism in 246/245 BC. See now van Oppen de Ruiter 2015, 71-116.

74 See DeVoto 2006 and the papers in Reid and Ralkowski 2019.

75 See Dillon 2003, 198-204.

76 See Zhmud 2014, 106-108, 110.

77 See Huxley 1968.

78 On the magnetism exerted by Alexandria and its centrality in the mathematical networks of the Hellenistic age, see now Netz 2020, 257-306.

No trace of the Doric dialect of Sicily is to be found in the works of Euclid, but it is unclear whether (or what) significance should be attributed to this absence. The philosophico-mathematical treatises of Archytas served as the model for literary Doric prose,⁷⁹ and many of the works of Archimedes preserve traces of their author's Doric dialect: there was clearly no generic expectation that mathematical treatises should be written in a particular flavour of Greek. On the other hand, several Archimedean works are virtually free of Doric dialect (notably *Sph. Cyl.* 1 and 2):⁸⁰ the traditional assumption, formulated by Heiberg but as yet untested, is that this is a result of later redaction, not authorial decision.⁸¹ Euclid's treatises, early adopted as school texts, may have undergone a similar process of linguistic levelling (though surely some trace of this process would have remained?). Other explanations also present themselves: a new city and new audiences may have prompted a conscious decision to adopt the new Koine. Alternatively, as Euclid chiefly devoted himself to systematising the existing geometrical tradition, the Eastern Greek dialects employed by his principle sources may have decisively influenced his linguistic choices.⁸² And if Euclid's parents were indeed Kean settlers to Gelos, his mother-tongue will have been Ionic. Unfortunately, as it is not yet clear whether the choice to write mathematics in Koine or Doric carried specific cultural meaning—the query itself was only recently proposed by Reviel Netz⁸³—, a key question in the assessment of the potential historical significance of Euclid's place of birth must remain, at present, indeterminate.



The above is one of the stories that can be reconstructed from the evidence of the *Catalogus geometrarum*. It is clearly not the only story that can be told: *Euclides Siculus* may not refer to the geometer at all, but to an unknown author; *Siculus*, in a sixth-century text so riddled with errors, may itself be an error—not even, necessarily, of translation, but perhaps an outright brain cramp—; Euclid's association with Gela relies on the particular explanation one attributes to a potential error of mistaken identity. The links in the chain each deserve careful consideration, though when dealing with so many variables, it is only honest to admit that Euclid's Sicilian homeland remains a tantalising

79 Greg. Cor. 6 Schaefer.

80 A solitary Doric τῆνον is attested at Archim. *Sph. Cyl.* 6.4 Heiberg².

81 Heiberg 1879, 69–70. But see now Netz 2012, 188–191.

82 For overviews of Euclid's sources and his relationship to them, see e.g. Knorr 1991, 149–153; Acerbi 2007a.

83 Netz 2012, 190.

possibility, rather than a probability, until the discovery of new evidence that might corroborate or substantiate such a claim.⁸⁴

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