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JÉRÉMIE CHAMEROY

Early Silver Coinage of Elaea and Pergamum – A Comparative Study

The 5th to 4th century silver coinage of western Asia Minor¹ has long been considered from the viewpoint of Athenian or Persian policy, rather than in connection with economic or political matters of the issuing cities. Thus, in the Athenian Empire, the Tribute Lists and the Standards Decree have often served as the keystones of the chronology in dealing with the Allies' silver issues. Forbidding the use of local coinage, weights and measures by the tributary cities, the Decree is said to have led to a general ban on coinage² within the Empire in the course of the second half of the 5th century. Hence, many civic issues were tentatively placed to before or after its enactment, although its dating (450–440 or 425/424 BC) is still being debated.³ Concerning the

My thanks go to CLIVE BRIDGER for improving my English.

¹ The following abbreviations are used: BABELON, Perses = E. BABELON, *Catalogue des monnaies grecques de la Bibliothèque nationale. Les Perses achéménides*, 1893; BABELON, *Traité* = E. BABELON, *Traité des monnaies grecques et romaines II* 3, 1914; DE CALLATAÏ, *Quantifications* = F. DE CALLATAÏ, *Quantifications et numismatique antique. Choix d'articles* (1984–2004), 2006; LE RIDER, *Naissance* = G. LE RIDER, *La naissance de la monnaie*, 2003; MILDENBERG, *Münzwesen* = L. MILDENBERG, *Über das Münzwesen im Reich der Achämeniden*, *Archäologische Mitteilungen aus Iran* 26, 1993, 55–79; MILDENBERG, *Kleingeld* = L. MILDENBERG, *Über das Kleingeld des 4. Jahrhunderts im Perserreich*, in: S. HURTER – C. ARNOLD-BIUCCHI (eds.), *Pour Denyse. Divertissements numismatiques*, 2000, 137–151.

² E. S. G. ROBINSON, in: *Commemorative Studies in Honor of T. L. Shear*, 1949, 338 concluded that there was a general but not absolute ban on coinage within the Empire between 450 and the last decade of the century – with limited concessions in Thrace and occasional issues of small change in Asia Minor (e.g. E. CAVAIGNAC, *RN* 1953, 3 on civic silver issues attributed to the 430s [Ainos] and 420s [Akanthos]); C. M. KRAAY, *Archaic and Classical Greek Coins*, 1976, 247 («[the Decree] was responsible for the interruption of the surviving coinages [in Western Asia Minor] soon after 450»); T. FIGUEIRA's interpretation of the Decree as a measure imposing solely the recognition of Attic coinage as legal tender (T. FIGUEIRA, *The Power of Money*, 1998, 392–410) received a great deal of criticism (e.g. H. B. MATTINGLY's review in *AJA* 103, 1999, 712f.).

³ The epigraphic, literary, historical and numismatic evidence might support the later dating of 425/424 (H. B. MATTINGLY, *Klio* 75, 1993, 99–102), making the Decree a «short-lived, over-ambitious measure» (H. B. MATTINGLY, *AJA* 103, 1999, 713); see recent discussions in T. FIGUEIRA, *AIIN* 52, 2006, 14, 35 admitting two versions or redactions of the Decree; M. B. HATZOPOULOS, *Tekmeria* 12, 2013–2014, 250–257.

silver coinage of the cities under Persian rule, more attention has been paid to the occurrence of Persian elements in the iconography, generally interpreted as a sign of the involvement of the satraps or dynasts in the coin production.

Relevant examples illustrating these points are to be found in the early silver coinages of Pergamum and Elaea. Both cities were not only closely related through the Caeus Valley but they issued a relatively abundant silver coinage starting probably in the Athenian and Persian Empires of the 5th to early 4th century. Through the comparison of both civic silver coinages, attempts should be made to assess how much both Empires influenced their development (as stated above) and how much both cities were able to adjust their production in a common system of weights and denominations, even though Elaea and Pergamum belonged to two distinct empires. In this sense, the study will focus on the weight standards and the volumes of production, based on the completion of a corpus of the early silver coinage issued at Elaea and Pergamum. At the present state of knowledge, the silver issues of nearby cities are much too rare or have been too poorly explored to be used here more than marginally.⁴ This must not prevent us from considering the silver issues of Elaea and Pergamum from each city's viewpoint – an aspect that has been largely ignored in earlier works on both coinages.

As a member of the Athenian League, Elaea paid an annual tribute of one sixth of a talent (1,000 drachms) corresponding to the ἀπαρχή, i. e. the first-fruits consecrated to Athena. The city is exclusively recorded on the quota lists from 454/453 onwards (IG I³ 259, I l. 16) but is not attested on the fragments of the assessment decrees for the payment of the φόρος.⁵ One thousand drachms is the lowest amount (ca. 4.35 kg silver) recorded by the allies from the Ionian district, suggesting that Elaea was at that time a small city of little significance like the neighbouring Pitane and Gryniun paying the same ἀπαρχή.⁶ The silver series issued at Elaea have been attributed to the second half of the 5th century on considerations of style, while their assumed Attic standard and the bust of Athena on the obverse have been interpreted as a sign of the city's allegiance to Athens.⁷ Moreover, the minting of silver small change at Elaea and other cities of the Ionian district revealed the supposed accommodation of the

⁴ Note that the first silver coins of Mysian and Aeolian cities like Autokane (N. CORF  , GNS 260, 2015, 105f.; a second example in CNG 102 [18/05/2016] 403) and Gryniun (Numismatik Naumann 57 [01/09/2017] 208) have only recently been recorded.

⁵ B. D. MERITT et al., *The Athenian Tribute Lists I*, 1939, 268f., 484; B. PAARMANN, *Aparchai and Phoroi. A New Commented Edition of the Athenian Tribute Quota Lists and Assessment Decrees* (PhD Fribourg), 2007, 8f. and IIA, 14; complete references of the quota lists mentioning Elaea in L. MEIER, in: I. SAVALLI-LESTRADE (ed.), *L'  olide dans l'ombre de Pergame*, 2016, 108 n. 7.

⁶ The highest amount recorded in the Ionian district (7 talents and 3,000 drachms) is that of Ephesus; for comparison see the index to amounts of tribute in B. D. MERITT et al., *The Athenian Tribute Lists II*, 1949, 122–124; R. MEIGGS, *The Athenian Empire*, 1972, 540–543.

⁷ FIGUEIRA (n. 2) 60, 73.

poleis and their monetary system to Athens's leadership, exceptionally granting the right to issue silver fractions of the drachm and the obol.⁸ In fact, this interpretation masks significant uncertainties. First, there is no secure basis like hoard evidence to date Elaea's silver series, so that suggestions of style cannot be objectively confirmed. Moreover, one cannot exclude that Elaea became a member of the League at an earlier date, i. e. before the record of the ἀπαρχή started in Athens, maybe after the Battle of the Eurymedon in 466 and the liberation of the coastal cities of Asia Minor from the Persians by Cimon. Finally, the tribute payment may have taken different forms (local coinage, Attic coins, sigloi⁹); therefore, the mention of Elaea in the Tribute Lists does not necessarily imply that the city issued silver coins from 454 onwards.

Historical records about Pergamum around the same time largely depend on Xenophon's *Anabasis* relating the arrival of the Ten Thousand in the Caicus Valley. According to his narration, the Greek dynasty of the Gongylids, represented by Gorgion and his brother Gongylos (III?),¹⁰ had the authority over the cities of Gambrium and Palaigambrium, Myrina and Grynium respectively, while their mother Hellas, as a widow of Gongylos (II?), resided in Pergamum (An. VII, 8, 8; Hell. III, 1, 6) (fig. 1).¹¹ However, Pergamum seems to have been ruled by the dynasty of the Demaratids in the person of Eurysthenes (Hell. III, 1, 6),¹² while his brother (?) Procles¹³ was archon of Teuthrania (An. II, 1, 3; VII, 8, 17) and the hitherto unlocalised Halisarna (Hell. III, 1, 6).¹⁴ Now, the first silver issues of Pergamum depict a head with tiara on the reverse that earlier studies interpreted as the portrait of a dynast. Indeed, it was tempting to identify the older bearded man with a Persian tiara as

⁸ E. ERXLEBEN, APF 20, 1970, 77, 126; for whatever reason, E. S. G. ROBINSON (n. 2) did not include Elaea in his conspectus of the coinage of the Allies.

⁹ A tribute of 4.35kg silver in Elaeian silver coins of 0.21 to 1.24g (see below) was certainly not the most practical way to make the payment. On the basis of a metrological study, M. VICKERS, JHS 116, 1996, 173f. suggests that some payments recorded in the Tribute Lists were made in sigloi rather than a mixture of currencies; H. B. MATTINGLY, *Historia* 10, 1961, 184 already suggested the existence of exchange operations by payment of the tribute.

¹⁰ J. HOFSTETTER, *Die Griechen in Persien. Prosopographie der Griechen im persischen Reich vor Alexander*, 1978, 70–72, nos. 123–125.

¹¹ In the reconstruction of L. PARETI, Ellas was the widow of Gongylos II, son of Gongylos I (L. PARETI, in: *Studi minori di storia antica II. Storia greca*, 1961 [paper first published in 1911], 184, 191).

¹² This interpretation was first expressed by E. BABELON, *Mélanges numismatiques* II, 1893, 201f. and accepted by PARETI (n. 11) 180–182; Procles (I) and Eurysthenes were considered as grandsons of the dynasty founder Demaratos; contra P. DEBORD, *L'Asie Mineure au IV^e siècle* (412–323 a.C.), 1999, 189–191 arguing that Pergamum was «dominated» by Hellas. Owing to the strategic importance of Pergamum, the interpretation of T. REINACH, RH 32, 1886, 75 that the city «jouissait d'une existence indépendante, quoique étroitement associée aux destinées de ces deux principautés [Gongylides et Démaratides]» seems very unlikely.

¹³ HOFSTETTER (n. 10) 68, no. 116; 157, no. 274.

¹⁴ M. H. HANSEN, *An Inventory of Archaic and Classical Poleis*, 2004, 1042, no. 810.

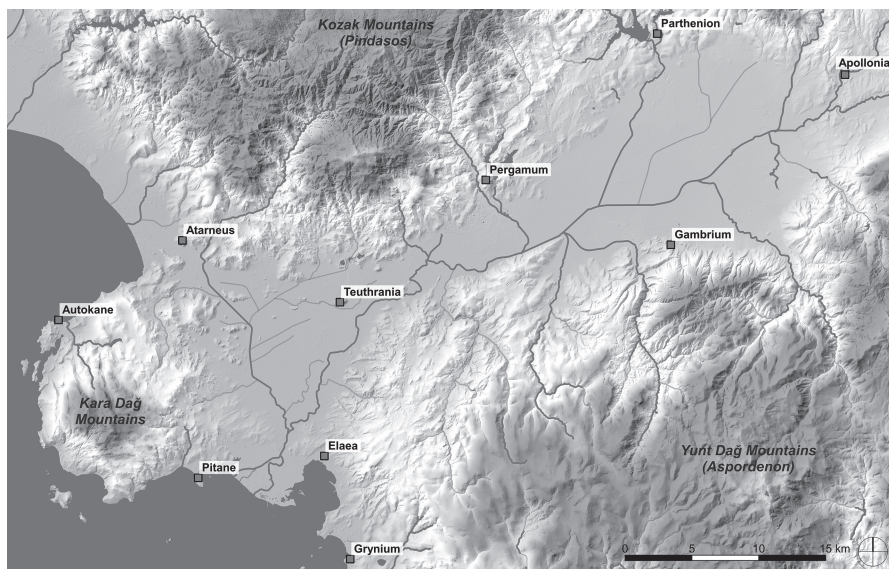


Fig. 1: Map of the Caicus Valley (DAI).

Eurysthenes,¹⁵ while a similar Persian type head (without beard) on silver coins of Teuthrania has been associated with the Greek dynast Procles (I), a contemporary of Xenophon.¹⁶ The suggested identifications assume that the dynasts depicted on the coins would have been involved in the minting of the issues. However, the head with tiara is always accompanied by the ethnic of the issuing city without any mention of a dynast, so that both series have to be considered as civic coins of Teuthrania and Pergamum. Paradoxically, silver coins with the legend ΓΟΡΓΙΟΝ attributed to Gorgion¹⁷ did not depict any portrait at all but only the types of the city where they were struck, in this case Gambrium.¹⁸ Though there are differences of opinion as to whether a mint-

¹⁵ BABELON, *Perses*, LXXIf., nos. 373f. Assuming that the Gongylids controlled Pergamum, J. P. SIX identified the reverse as a (posthumous?) portrait of Gongylos (NC, 1890, 194f.; followed by H. VON FRITZE, *Die M nzen von Pergamon*, 1910, 4).

¹⁶ BABELON, *Perses*, LXXf. followed by J. P. SIX, NC 1894, 318 rejecting his first interpretation of the depicted head as Procles II, son-in-law of the philosopher Aristoteles (above n. 15); A. GR NER, in: I. SAVALLI-LESTRADE (n. 5) 73–75 does not call into question the attribution of these coins to Procles (I).

¹⁷ Gorgion I lived at the time of Xenophon (BABELON, *Perses*, LXIX, no. 375; SIX [n. 16] 315f.).

¹⁸ In the past, these apparent contradictions between iconography and legends suggested a compromise between the cities and the representatives of the King (H. VON FRITZE, *Die antiken M nzen Mysiens*, 1913, 139). At Teuthrania and Pergamum, the dynasts (or the satraps) would have allowed the cities to strike coins in their own name by imposing the «Persian head» type as a sign of submission to their tyranny. In the case of Gambrium, the dynast would have imposed his

ing right was accorded by the King to the cities,¹⁹ recent studies have pointed out the lack of evidence for any kind of control or interference by the Persian administration in the civic coin production.²⁰ Moreover, it has been stressed that the head with tiara was a common iconographical type in 5th/4th century Asia Minor.²¹ For these reasons, its occurrence on coins of the Caicus Valley does not necessarily entail that the Gongylids and Demaratids were involved in the silver issues of the cities they controlled.

For Pergamum as for Elaea, however, substantial difficulties remain in identifying the denominations and the weight standards because of the rarity of value marks on the coins and the great inconsistency in the production of the small change blanks.²² Furthermore, the lack of objective arguments (e.g. evidence from hoards) to confront stylistic considerations or the assumptions derived from historical sources noted above is certainly the major dilemma. One may accept that the presence of an incuse square on the reverse should characterize the earliest silver issues, while the use of common reverse types at different cities might indicate their contemporaneity. In any event, the relative chronology of the Elaeian and Pergamene series still remains

name on the coins by accepting civic types, just like the satrap Orontas took over civic types of Adramytteion (F. IMHOOF-BLUMER, *Monnaies grecques*, 1883, 246f., nos. 89, 95) and Cisthene (H. A. TROXELL, *SNR* 60, 1981, 3, no. 6) for some of his silver and bronze coins.

¹⁹ LE RIDER, *Naissance*, 177 probably relying on Pseudo-Aristotle, *Oec.* II, 1, 2. However, this passage doesn't necessarily imply a royal monopoly on the right of coinage but rather the king's responsibility for establishing the value of gold and silver coins in relation to commodities (T. R. MARTIN, *Sovereignty and Coinage in Classical Greece*, 1985, 270). In the same sense, MILDENBERG, *Münzwesen*, 66 stressed the great variety of coinages in the Achaemenid Kingdom and suggested a considerable freedom in the coin production; further MILDENBERG, *Kleingeld*, 138: «man anerkannte die vielen lokalen Autoritäten als berechnigte Münzherren».

²⁰ In Cilicia, Caria or on Cyprus, the influence of the Persian administration is only rarely discernible in the iconography, types, legends and weight standard of the coins struck there (O. CASABONNE [ed.], *Mécanismes et innovations monétaires dans l'Anatolie achéménide*, 2000, 58, 60 [Cilicia], 171, 179 [Caria], 235 [Cyprus]). See further A. MEADOWS, in: J. CURTIS – N. TALLIS (eds.), *Forgotten Empire. The World of Ancient Persia*, 2005, 207; M. ALRAM, in: W. E. METCALF (ed.), *The Oxford Handbook of Greek and Roman Coinage*, 2012, 71. In the same way, there is no reason to look for a «satrapal coinage», because the satraps depended on the King in financial matters (e.g. soldiers' and mercenaries' payments) (see MILDENBERG, *Münzwesen*, 58–60 underlining the absence of any satrapal title on the coins depicting a head with tiara). The satrap Pharnabazos might have received the King's authorisation to strike coins through his function as strategos (H. KLINKOTT, *Der Satrap*, 2005, 246f., 253).

²¹ For an overview see H.-H. NIESWANDT, in: A. LICHTENBERGER et al. (eds.), *Das Diadem der hellenistischen Herrscher*, 2012, 65–123; MILDENBERG, *Kleingeld*, 142, n. 18.

²² The inconsistency in the weights of silver fractional coinage has long been pointed out as a consequence of its minting «al marco» (F. IMHOOF-BLUMER, *NC* 1895, 282; H. A. CAHN, in: *Congresso internazionale di numismatica Roma 1961*, 1965, 19). Concerning silver fractions of the drachm, it seems likely that the users paid more attention to the types or value marks on the coins than to their weight (D. BÉREND, in: A. HOUGHTON et al. [eds.], *Studies in Honor of Leo Miltenberg*, 1984, 17); for this reason, silver coins with marks of value should be considered as a sort of «Kreditmünzen» (H. A. CAHN, *Knidos. Die Münzen des 6. und des 5. Jahrhunderts v. Chr.*, 1970, 181).

uncertain. In this vast field of speculation, the study starts with a new attribution of a silver coin to Elaea that should provide a firm basis for reconstructing the system of denominations.

Elaea's quarter-obol: the first silver coin with a value mark in Aeolis

The silver coin in question combines the head of Athena with an Attic helmet facing left on the obverse and a T in an incuse square on the reverse. Since the studies of F. IMHOOF-BLUMER in the late 19th century at the latest, the T has been interpreted as the initial of the issuing city²³ and the coin, thus, identified as a quarter-obol of Tegea (Arcadia).²⁴ Now, it appears that the bust of Athena often shows close stylistic affinities with silver coins of Elaea bearing the city's ethnic on the reverse (fig. 2). This leaves no doubt that the engravers working for Elaea were involved in the production of the Athena/T coins, too. An explanation such as the transfer of dies from Elaea to Tegea, fails to convince, because it is hard to imagine that Tegea needed obverse dies from distant Elaea only to strike very small denominations. Moreover, it is also unlikely that die-cutters working for Elaea would have travelled to Tegea only to engrave dies of quarter-obols for the Arcadian city.²⁵ Fortunately, decisive evidence came recently from the publication of a Turkish collection attesting that the find spots of Athena/T silver coins concentrate in north-western Asia Minor,²⁶ while finds of the same

²³ F. IMHOOF-BLUMER (n. 18) 463, no. 23 (put to the «monnaies incertaines de Grèce d'Europe»); id., *Griechische Münzen*, 1890, 535, no. 18: «Die Zuthellung dieser sicher peloponnesischen Tetartemorien nach Tegea (...) kann (...) als unanfechtbar gelten. Hier steht T in erster Linie als Werthzeichen und nur zufällig ebenfalls für den Stadtnamen»; BABELON, *Traité*, 653, no. 976, pl. CCXXVII, no. 14: «L'obole, l'hémiobole, le téartémorion ont parfois la lettre T, qui ne peut être que l'initiale du nom de Tégée»; O. HOOVER, *Handbook of Coins of the Peloponnesos*, 2011, 269, no. 1054 (Tegea). The hemiobol showing a Corinthian helmet on the obverse and T on the reverse is another misattribution to Tegea (BABELON, *Traité*, 653, no. 975, pl. CCXXVII, no. 13; B. HEAD, *Historia Numorum*, 1911, 454; IMHOOF-BLUMER (op. cit., *Griechische Münzen*) 769, no. 799 [unbestimmt]). A. SOUTZO, RN 1869–1870, 177, no. 13 first assumed to read the T as a mark of value for trihemiobol. On the hoard evidence, O. RAVEL definitively attributed the helmet/T coins to Corinth (O. RAVEL, *Corinthian hoards [Corinth and Arta]*, 1932, 8f.; W. SCHWABACHER, *AArch* 12, 1941, 53f.). Nonetheless, the erroneous attribution to Tegea can still be found in recent works (e.g. HOOVER, op. cit., 268, no. 1051).

²⁴ This is not to be confused with the silver coin depicting the head of Athena Alea with laurel wreath to left on the obverse and T on the reverse; this coin type of about 1.05 g is rightly attributed to Tegea (HEAD [n. 23] 454; BABELON, *Traité*, 653, no. 974 [«obole éginétique»], pl. CCXXVII, nos. 11 f.).

²⁵ Note that there are no stylistic affinities between these quarter-obols and the other silver denominations issued at Tegea (n. 23 f.). In contrast, the engravers of the quarter-obols took part in the production of dies for other Elaeian denominations (fig. 2 and n. 28). This is another argument for the die-cutters involved in the production of the quarter-obols only worked at Elaea.

²⁶ O. TEKIN – A. EROL-ÖZDIZBAY, *SNG TURKEY* 9, *The Özkan Arıkan Türk Collection 3 Mysia*, 2020, nos. 1180–1193 («uncertain mint»). The authors let the identification of the Athena/T



Fig. 2: Stylistic affinities between quarter-obols falsely attributed to Tegea (left) and silver coins of Elaea (right). The pictures are not to scale; the list is not exhaustive.

coins are so far lacking on the Greek mainland. In consequence, the attribution of the Athena/T coins to Elaea instead of Tegea can be regarded as certain. Although Elaea and Tegea share (together with Pergamum) a common mythological past through the legend of Auge and Telephus,²⁷ the similarity of the reverse types struck at Elaea

coins open by suggesting an attribution to Teuthrania. By contrast, the excavations and surveys of the German Archaeological Institute at Pergamum and Elaea did not yield any silver coin of Elaea; since the first report on coin finds by K. REGLING, in: A. CONZE, *Stadt und Landschaft*, AvP I 2, 1913, 355–363, only one early silver coin of Pergamum was found in 2012 (http://ww2.smb.museum/mk_pergamon/index.php?lang=de&pagetype_id=3&object_id=53922). The collection of the Museum at Bergama includes silver coins of Elaea (O. TEKIN – A. EROL-ÖZDIZBAY, *Coins of Elaia in Aiolis in the Collection of Bergama Museum*, *Colloquium Anatolicum* 15, 2016, 253f.) and probably Athena/T coins among the unidentified silver coins.

²⁷ According to legend, Auge, a priestess of Athena, was driven from home by her father, king of Tegea, after he had discovered she was pregnant with Heracles's son Telephus. Auge was consigned to a chest and submerged in the sea, but thanks to Athena she was carried safely to the Aeolian coast (T. SCHEER, *Mythische Vorväter*, 1993, 85f.). The arrival of Auge has been depicted on the Telephus Frieze of Pergamum's Great Altar. By Roman times at the latest, the event was supposed to have taken place at Elaea, as depicted on a bronze coin struck under Marcus Aurelius (Kunsthistorisches Museum Wien GR-16851; illustrated in W.-D. HEILMEYER [ed.], *Der Pergamonaltar*, 1997, 114, no. 21). Auge was brought to Teuthras, king of Teuthrania, who married her, while her son Telephus was abandoned, but recovered by Heracles in the Parthenion Mountains. Along with a Greek army he went to Mysia in search of his mother and succeeded his step-father on the throne of Teuthrania. According to one tradition, King Telephus of Teuthrania later founded the city of Pergamum, where he buried his mother (Paus. VIII, 4, 9).



Trihemibol
1.24g



Hemibol
0.37g



Tetartemorion
0.21g

Fig. 3: First silver series of Elaea: denominations and mean weights (see table 1).

and Tegea seems to be no more than a coincidence, all the more so when the T on the reverse has different significations.

Actually, the Athena/T silver coin type is another example of a reverse letter that does not correspond to the initial of the minting city but to a mark of value, here T for tetartemorion (quarter-obol). On this basis, it allows identifying the further two silver denominations²⁸ with incuse square issued at Elaea. Starting with a mean weight of 0.21 g for the quarter-obol, the middle denomination of 0.37 g should correspond to a hemibol, the heaviest (1.24g) to a trihemibol, i.e. a quarter of a drachm (fig. 3; table 1). Despite the inconsistency of the weights stressed above, the weight relations between the quarter-obol and the trihemibol (1 to 6) or between the hemibol and trihemibol (1 to 3) show only minor differences of ca. 0.03 g that seem to confirm the proposed identifications. This implies a theoretical weight of 0.70–80 and 1.50–60 g for the obol and diobol respectively, both denominations not issued at Elaea.²⁹

The use of a value mark on the quarter-obol simply had a practical purpose. At Elaea, the obvious weight difference between the trihemibol (1.24g) and the lower denominations (0.37 or 0.21 g) made their differentiation easy. However, it would certainly have been more difficult to distinguish the hemibol (0.37g) from the quarter-obol (0.21 g) if they had shown the same type. In this sense, the T on the reverse erased any doubts occurring by minimal weight differences between half- and quarter-obols.³⁰

This foundation myth provided the basis for a close relationship between Tegea and Pergamum, culminating in a treaty of isopoliteia (IVP I 156) under Eumenes II (O. CURTY, *Les parentés légendaires entre cités grecques*, 1995, 86f., no. 41).

²⁸ It is worth noting that among the about 500 Elaeian silver coins recorded during the preparation of the corpus (see below), not a single obverse die link has been observed between two distinct denominations and only one reverse die link between a hemibol and a trihemibol. Although engravers generally made obverse dies for different silver denominations, in this case each denomination must have been struck with specific dies.

²⁹ Thus, the statement that «only mints emitting *Oboloi* are to be considered as mints with an emission of *Tetartemoria*» (N. CORFÙ, in: M. CACCAMO CALTABIANO [ed.], *XV International Numismatic Congress Taormina 2015, Proceedings*, 2017, 339) has to be rejected.

³⁰ At Elaea, the recorded weights range from 0.10 to 0.31 g for the quarter-obol and from 0.21 to 0.52 g for the hemibol. Hence, coins of both denominations may overlap and could not be identified only through their weight.

Persian fractions	Incuse square series				Elaea 2 nd series (fig. 4)	Chian fractions
	Elaea 1 st series (fig. 3)	Pergamum (fig. 6)	Teuthrania	Gambrium for Gorgion		
4 obols = ⅔ siglos			3.20 (3)	3.35 (2)	3.22 (4)	1 drachm
2 obols = ⅓ siglos	*1.50–60	1.55 (60)	1.59 (1)	1.58 (1)	1.56 (2)	½ drachm
1.5 obol = ¼ siglos	1.24 (179)				0.92 (30)	1.5 obol?
1 obol = ⅙ siglos	*0.70–80	0.65 (6)				
⅔ obol		0.49 (27)				1 obol
½ obol = ⅓ siglos	0.37 (196)					
¼ obol = ⅙ siglos	0.21 (70)					

Table 1: Silver coins of Elaea, Pergamum, Teuthrania and Gambrium as fractions of the Persian siglos or the Chian drachm. Mean weights (g); number of recorded coins (in brackets); theoretical weight of non-attested denominations (*).

Elaean silver coins as fractions of the siglos

The minting of silver quarter-obols is attested at further Aeolian (Cyme, Phocaea), Ionian (Colophon, Ephesus, Miletus, Samos, Teos) and Carian cities (Mylasa), where silver coins of ca. 0.20g were issued from the late 6th to the 5th century.³¹ As a general rule, the production of very small silver fractions of the obol was particularly widespread in western Asia Minor.³² A further specific group of small silver coins has been recorded there in recent decades consisting of coins of ca. 0.19g³³ which combine a Persian type (archer with bow and dagger) on the obverse with types occurring on civic hemiobols on the reverse. They were probably struck in the 5th/4th century at one

³¹ However, the set of denominations is a different one. The range of silver coins (1.6, 0.8, 0.4 or 0.2g) struck at Phocaea, Teos and Samos has been related to the Samian stater (13.1g) by M. MATZKE, JNG 50, 2000, 36, to the Milesian one by J. KAGAN, in: P. VAN ALFEN (ed.), *Agoranomia. Studies in Money and Exchange Presented to John H. Kroll*, 2006, 55. At Colophon, Archaic silver coins weighing 0.21g correspond to ⅓ of the siglos (H. KIM – J. KROLL, AJN 20, 2008, 55). Further examples at Cyme (SNG MÜNCHEN 441), Ephesus (SNG COPENHAGEN 211), Mylasa (SNG TÜRKÜY 1, 940–943) and Miletus (SNG TÜBINGEN 3000–3017).

³² H. KIM – J. KROLL (n. 31) 66 emphasise that this production was a regional practice.

³³ Mean weight from 83 coins struck with 61 obverse dies (N. CORFÜ, SNR 94, 2015, 8, 10).

or more still not identified mint(s)³⁴ and circulated as quarter-obols. Therefore, the minting of quarter-obols at Elaea cannot be regarded as exceptional in western Asia Minor, although this denomination seems to have been much rarer in the Aeolis³⁵ than in Ionia.

More surprising, however, is the use of a value mark on the Athena/T coins, because it is the first occurrence of a value mark in Aeolian coinage, the nearest city striking silver series with marks of value being the Ionian city of Colophon in the late 6th to early 5th century.³⁶ Furthermore, the value mark shows that Elaea used the Greek reckoning of values (i. e. obol and drachm), even though this does not imply that the city struck silver coins on a mainland Greek weight standard.

As stated above, the Elaeian silver coins were thought to correspond to fractions of the Attic drachm. Nonetheless, this assumption cannot be confirmed by a closer examination of the weights which shows that the silver coins issued at Elaea (particularly the trihemiobol) weigh more than the means of the Attic fractions (table 2). By contrast, the three silver denominations of Elaea could correspond to underweight fractions of the siglos. Now, it is well known that cities issued underweight silver coins rather than full weight or overweight ones.³⁷ This widespread practice enabled the cities to finance their own coinage through exchange operations of full weight coins into local underweight silver fractions.³⁸ Exchanging, for instance, a full weight siglos for 12 Elaeian hemiobols resulted in a gain of about 1.00 g silver to the bankers, and finally

³⁴ A production at Colophon has been assumed by N. CORF   (n. 29) 341, 343 fig. 6; id. (n. 33) 28. The obverse type copies the siglos type IV (starting in the late 5th or early 4th century) and this is a reliable terminus post quem for the dating of the quarter-obols.

³⁵ E. g. only a few quarter-obols of Cyme (completely lacking from the SNG TURKEY) seem to have been recorded up to date (Leu Numismatik 1 [25/06/2017] 487).

³⁶ As in the case of the Athena/T coins, the ligated letters HM or TE on the reverse of Colophon's silver coins were initially interpreted as initials of the minting city (e. g. TE coins attributed to Teuthrania). A. VON SALLET was the first to show that these were marks of value for hemiobol and tetartemorion (*Zeitschrift f  r Numismatik* 5, 1878, 102; their attribution to Colophon is due to IMHOOF-BLUMER [n. 22] 279–283; id., *Zur griechischen und r  mischen M  nzkunde*, 1908, 70). J. G. MILNE, *Kolophon and its Coinage: A Study*, 1941, 31–35 placed the silver coin series with marks of value to the period of ca. 525 to ca. 490. The mean weights of the quarter- (0.23 g) and hemiobol (0.47 g; MILNE, op. cit., 35; further coins in C. M. KRAAY, *SNR* 42, 1962, 10; P. KINNS, *CH* 8, 1994, 90f., no. 599) are slightly higher than those observed at Elaea (table 1).

³⁷ Similar observations made by J. KAGAN, in: L. KYPRAIOU (ed.), *Coins in the Thessalian region: mints, circulation, iconography, history*, 2004, 80 on Larissa's early fractional coinage: keeping the silver small change underweight kept it at home and allowed profits of conversion.

³⁸ This is why loan agreements sometimes specified the repayment in coins on the Attic standard and of full weight (  λοσχερ  ς) (e. g. at Amorgos *IG XII* 7, 67–69 cited by O. PICARD, in: ΧΑΡΑΚΤΗΡ. Αφι  ρωμα στη Μάντω Οικονομίδου, 1996, 247–250). At Delphi, the   πουσ  ια accounts noted a loss of 12 to 15% between the full and underweight coins on the Aeginetic standard (C. DUNANT – J. POUILLOUX, *BCH* 76, 1952, 53; O. PICARD, in: D. KNOEPLER [ed.], *Comptes et inventaires dans la cit   grecque*, 1988, 99).

to the city which probably had a hand in the business of money exchange.³⁹ However, the conversion of Elaeian fractions to Attic obols or drachms would have been unfavourable for the money-changers (e.g. a loss of 0.61 g on exchange of an Attic drachm with four Elaeian trihemioobols). In view of the silver fractions struck at Elaea, the option of the Persian standard was obviously the most advantageous one for the city.

Attic weight standard (g)	¼ obol	½ obol	1 obol	1.5 obol	1 drachm
	0.18	0.36	0.72	1.08	4.35
Elaea (first series, fig. 3)	0.21	0.37	*0.70–0.80	1.24	*4.44–5.04
Persian weight standard (g)	0.23	0.46	0.92	1.38	5.50
	½ siglos	¼ siglos	⅙ siglos	⅓ siglos	1 siglos

Table 2: Comparison of Elaea's first silver series with the theoretical weight of Attic and Persian fractions. Theoretical weight of non-attested denominations (*).

As emphasised for a long time in earlier works, the siglos was a regional silver coin probably struck at Sardis for paying the mercenaries stationed in Asia Minor. This can be clearly seen through the hoard evidence concentrated in Anatolia.⁴⁰ Nevertheless, the complete lack of sigloi among the single finds from Sardis⁴¹ and other Anatolian cities suggests that the Persian silver coin did not really circulate on the market places but was systematically exchanged against local silver coins. In any case, there is a strong supposition that the issues of fractional silver coinage in Elaea and more generally in western Asia Minor were linked to the massive presence of sigloi in Anatolia. On the contrary, Attic coins and particularly Athenian silver coins are still scarce in hoards or single finds of the 5th to early 4th century in Asia Minor, so that Athenian owls hardly played a role in the economy of the allied cities there.⁴²

³⁹ Pergamum is the best example of this. By the Roman period at the latest, the activity of exchange through the bankers brought in important revenues for the city (see the famous inscription OGIS 484 relating the response of Hadrian to the abuses of the money-changers; H. VON PROTTE, *MDAI(A)* 27, 1902, 82f.; R. BOGAERT, *Banques et banquiers dans les cités grecques*, 1968, 233; further comments by A. D. MACRO, *GRBS* 17, 1976, 169–179).

⁴⁰ D. SCHLUMBERGER, *L'argent grec dans l'Empire achéménide*, 1953, 15, 20; I. CARRADICE, in: id. (ed.), *Coinage and Administration in the Athenian and Persian Empires*, 1987, 89f.; MILDENBERG, *Münzwesen*, 57; LE RIDER, *Naissance*, 165f.

⁴¹ This cannot only be due to its high value or its early dating, because croeseids and fractions have been recorded among the single and group finds at Sardis (H. W. BELL, *Sardis X. Coins 1910–1914*, 1916, 22, nos. 223f.; T. V. BUTTREY et al., *Greek, Roman, and Islamic Coins from Sardis*, 1981, 33, no. 133; J. DEROSE EVANS, *Coins from the Excavations at Sardis*, 2018, 121f., nos. 2–5).

⁴² The assumption of a wide circulation of Athenian coins since ca. 450 in the ἀρχή and of their massive withdrawal through the payment of the tribute has been made to explain their scarcity among the finds (C. FLAMENT, *Une économie monétarisée: Athènes à l'époque classique*

Elaea's second silver series

A set of three silver coins corresponding in weight to further denominations issued up to then constitutes a homogeneous group. The obverse depicts the head of Athena with an Attic helmet facing left, the reverse a grain of barley⁴³ in an olive-wreath with the ethnic in the wreath or only the ethnic in the wreath (fig. 4). Especially the characteristic head of Athena leaves no doubt that all three silver types belong to the same series. Furthermore, the absence of the incuse square on the reverse and the probably parallel issue of three bronze denominations showing the same types (fig. 5)⁴⁴ are sufficient arguments for putting these silver and bronze coins after the silver series with incuse square (fig. 2, table 1). Despite their scarcity, the recorded coins attest the existence of a denomination of 3.22g and its half (1.56g), perfectly corresponding to a diobol and a tetrobol on the Persian standard. Concerning the third and smallest silver denomination (0.92g), the particular use of the short ethnic (EΛA instead of EΛAI) and the characteristic circular disposition of the three letters in a wreath might indicate that its value was a multiple of three.⁴⁵ If this interpretation is true, the coin might have circulated as a Persian trihemiobol (quarter-siglos), although the obvious weight difference with the trihemiobol of Elaea's first series (1.24g) cannot be explained at the present time. Alternatively, a shift to the Chian standard (based on a drachm of 3.4g), that was widely adopted in late 5th to 4th century Asia Minor,⁴⁶ cannot be en-

[440–338], 2007, 261, 265f.). However, this thesis seems to contradict the *raison d'être* of the Athenian Standards Decree in the second half of the 5th century.

⁴³ Similar representations of grains of barley in H. BAUMANN, *Pflanzenbilder auf griechischen Münzen*, 2000, 29; a unique silver coin depicting an ear of barley in an olive-wreath on the reverse (*Solidus Numismatik* 16 [16/07/2017] 90) probably belongs to this series. Because the ethnic unfortunately lay outside the blank, the attribution of this coin to Elaea (as a Chian hemidrachm of 1.55g?) on stylistic grounds will be discussed in the publication of the corpus.

⁴⁴ TEKIN – EROL-ÖZDIZBAY, *Elaia* (n. 26) 266–268, nos. 20–101. On the earliest bronze issues from Asia Minor (ca. 400) see the report about the hoard from Ionian Phygela (K. KONUK, in: F. DE CALLATAÏ [ed.], *Quantifying Monetary Supplies in Greco-Roman Times*, 2011, 151–153).

⁴⁵ The use of a short ethnic is not due to the small diameter of the coin (silver coins of similar module have a linear legend with the standard four-letters ethnic EΛAI [infra n. 47]). At Elaea, the circular disposition of EΛA occurs exclusively on this silver coin type and there is a strong suggestion that it combined the ethnic with a value mark. Other examples show that on silver coins, the value mark is sometimes given by the repetition of letters on the reverse: EEE for the trihemiobol at Tegea (P. LAMBROS, *Zeitschrift für Numismatik* 1875, 172) and Heraea (Arcadia; *SNG COPENHAGEN* 234), TTT for the tritemorion at Argos (D. BÉREND [n. 22] 12).

⁴⁶ A. MEADOWS, in: T. FAUCHER et al. (eds.), *Nomisma: la circulation monétaire dans le monde grec antique*, 2011, 287f. describes the rise of the Chian standard as a «revolution» affecting the monetary production and circulation in cities and kingdoms of western Asia Minor. It appears to have happened after Lysander's *symmarchy* and the production of the ΣΥΝ coinage on the Chian standard at Ephesus, Samos, Cnidus and Cyzicus in 405–404 (S. KARWIESE, *NC* 1980, 14). At Colophon, the shift from the Persian to Chian standard has been dated to the first half of the 4th century (MILNE [n. 36] 56).



Persian tetrobol
or Chian drachm
3.22g



Persian diobol
or Chian hemidrachm
1.56g



Chian trihemibol?
0.92g

Fig. 4: Elaea's second silver series.



6.25g



3.95g



1.26g

Fig. 5: Elaea's bronze series issued parallelely (?) to the second silver series.

tirely excluded for the second Elaeian silver series. In this hypothesis, Elaea would have struck a Chian drachm (3.22g), a hemidrachm (1.56g) and a somewhat overweight trihemibol (0.92g instead of a theoretical 0.85g),⁴⁷ but this last coin weakens the Chian option for the reasons propounded above.⁴⁸

To sum up, in the 5th to early 4th century (?), Elaea issued a first silver series with incuse square on the reverse and consisting of three denominations (quarter, half and trihemibol) most probably struck on the Persian standard (fig. 3, table 1). At a later stage (4th century?), the city produced a second silver series of a further three denominations without incuse square (fig. 4, table 1); these were struck in small quantities and can be arranged in the Persian (tetrobol, diobol and strong underweight trihemibol) or the Chian standard (drachm, hemidrachm and overweight trihemibol?). How much time passed between the end of Elaea's first silver series and the beginning of the second cannot be said. Nevertheless, the fact that coins of a similar weight were struck at Elaea, Pergamum, Teuthrania and Gambrium, as will be shown, suggests that contacts between the coastal and hinterland cities of the Caicus Valley had a decisive influence on the choice of the weight standard.

⁴⁷ Another silver denomination depicting Athena with a Corinthian helmet and the ethnic EAAI in an olive-wreath shows a completely different style (TEKIN – EROL-ÖZDIZBAY, *Elaiia* [n. 26] 265, nos. 13f.). Through its weight (ca. 1.06g) it might correspond to a diobol on the Chian standard and was accompanied by a bronze coin series showing the same types (*ibid.*, 269, nos. 106f.). Further research is needed to specify its dating.

⁴⁸ In the surroundings of Elaea, the unique silver coin recorded up to date for Grynium (3.14g; see n. 4) could be considered as a Persian tetrobol or a Chian drachm; it does not help in gaining certainty in the weight standard used in the region.

The silver series of Pergamum

Approximately in the 5th or the early 4th century, Pergamum issued three silver denominations depicting the laureate head of Apollo on the obverse and a bearded head with tiara or a bull's head (both in an incuse square) on the reverse (fig. 6). Their mean weights of 0.49, 0.65 and 1.55 g (table 1) leaves no doubt about a ratio of 1, 1.5 and 3 respectively. Earlier studies identified the coins as hemiobols, three-quarter obols and trihemiobols on the reduced Milesian standard. On this standard, the silver coins of 3.21–3.35 g struck at Teuthrania and Gambrium correspond to triobols, i.e. hemidrachms.⁴⁹

Alternatively, a Chian weight standard has been proposed for the silver issues of Pergamum, Teuthrania and Gambrium⁵⁰ including underweight obols (0.49 g), trihemiobols (0.65 g),⁵¹ hemidrachms (1.55 g) and drachms (3.30 g). In view of the widespread shift to the Chian standard observed in late 5th to 4th century Asia Minor, this may be a first indicator for the dating of the Pergamene series, which has to be confirmed through hoard evidence.

Interestingly, three denominations could have been considered as underweight fractions of the siglos, too: the Pergamene coin of 1.55 g as a Persian diobol,⁵² that of 0.65 g as a Persian obol and the coins of ca. 3.30 g issued at Teuthrania and Gambrium as Persian tetrobols. Coins on the Chian standard had the advantage of being easily convertible with sigloi and their fractions.⁵³ Hence, the observed equivalences cer-

⁴⁹ C. BOEHRINGER, in: *Pergamon. Ausstellung in Erinnerung an Erich Boehringer* (Ingelheim), 1972, s. p. M1–M3 without commentary on the standard; O. MØRKHOLM, in: A. HOUGHTON et al. (eds.), *Studies in Honor of Leo Mildenberg*, 1984, 182 suggested a trihemiobol on the Milesian standard for the heaviest Pergamene silver coin; H.-D. SCHULTZ, in: R. DREYFUS – E. SCHRAUDOLPH (eds.), *Pergamon. The Telephos Frieze from the Great Altar*, 1997, 12 considered the coin of 0.65 g as a Persian obol or a Milesian three-quarter obol. Cities using the Milesian standard struck e.g. hemidrachms of 3.5 g and trihemiobols of 1.75 g (H. A. CAHN [n. 22] 20). Rather vague is VON FRITZE's description of the system of denominations as «kleinasiatisch» (H. VON FRITZE, in: *Corolla Numismatica. Numismatic Essays in Honour of B. V. Head*, 1906, 47).

⁵⁰ M.-C. MARCELLESI, *Pergame de la fin du V^e au début du I^{er} siècle avant J.-C. Pratiques monétaires et histoire*, 2012, 30–31. However, the table p. 29 gives a very incomplete conspectus of the silver coinage in the Caicus Valley; in particular, it reports only one silver denomination for Elaea.

⁵¹ MARCELLESI excludes this coin from her study on the ground that it was known from a single example. It is now attested by six coins (Berlin 18231397; Staatliche Münzsammlung München; Asia Minor coins #9034; Gitbud & Naumann 23 [5/10/2014] 293; Numismatik Naumann 53 [7/05/2017] 168; Savoca !NNN904 [18/11/2017]) and must be taken into account in the reconstruction of the denominations.

⁵² As suggested for a long time by P. GARDNER, *A History of Ancient Coinage 700–300 BC*, 1918, 315, whereas he left the smaller fractions out; in the same way see F. BODENSTEDT, *GNS* 104, 1976, 73.

⁵³ KRAAY (n. 2) 249; KARWIESE (n. 46) 20f.

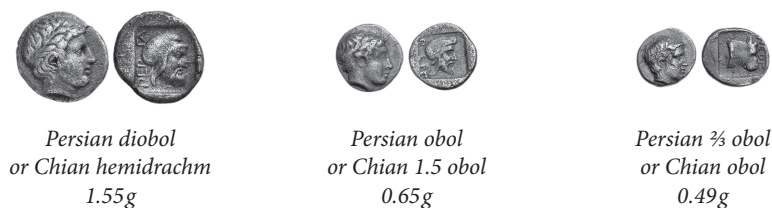


Fig. 6: Early silver series of Pergamum.

certainly made it easy to use Elaeian and Pergamene silver coins in parallel without exchange operations.

In short, as the first (Persian standard, fig. 3) and second (Persian or Chian standard, fig. 4) silver series issued at Elaea, the silver series with incuse square struck at Pergamum consisted of only three denominations (fig. 6), which can be accepted as Persian ($\frac{2}{3}$ obol, obol and diobol) or Chian fractions (1 and 1.5 obol, hemidrachm). Before elaborating on the existence of an early organisation of the silver coin production in the Caicus Valley, one should ask if the contrast observed between Elaea's very small fractional coinage and Pergamum's focus on middle denominations was solely linked to the cities' capacity to ensure a regular and sufficient silver supply. The following quantitative study will clarify this point.

Quantifying the early silver coin issues of Elaea and Pergamum

During the preparation of a corpus of Elaea's coinage, a sample of 495 silver coins⁵⁴ has been assembled, from which 81 obverse dies (d) were identified (d = 67 for the first and 14 for the second series). In comparison, only 93 silver coins struck with 25 obverse dies were recorded for the incuse square series of Pergamum (fig. 6). Solely from these numbers, the huge difference between the silver outputs of Elaea and Pergamum in the 5th/4th century appears more than obvious. However, every research into the volume of coins originally produced raises the question of the representativeness of the assemblage. Among different methods proposed to calculate the original number of dies (D) from die link statistics, the equation developed by G. CARTER seems to be the most suited, because it considers the «variable die lifetime» (i.e. a die produced a variable number of coins) and it is easy to use.⁵⁵ Concerning Elaea, CARTER's formula

⁵⁴ The material was collected over seven years from 2013 to March 2020. It is deeply regrettable that 82% (Pergamum) to 90% (Elaea) of the coins come from auctions and so few from archaeological excavations or public collections. Nevertheless, the preparation of a corpus as well as quantitative studies make it impossible to disregard this material of uncertain provenance. The final comment on the Elaeian corpus is to appear in a monograph on the studies of the DAI at Elaea under the direction of FELIX PIRSON.

⁵⁵ G. F. CARTER, *American Numismatic Society Museum Notes* 28, 1983, 202; for discussions of CARTER's method see W. W. ESTY, *NC* 1986, 203 f. and DE CALLATAÏ, *Quantifications*, 26–29; comparison of methods in G. F. CARTER, in: C. CARCASSONNE – T. HACKENS (eds.),

gives an estimated total of 89 original obverse dies ($D = 71$ for the first and 18 for the second series), so that the sample of 495 silver coins with $d = 81$ obverse dies identified can be regarded as highly representative of the original production. Another approach for testing the representativeness of the sample is to calculate its coverage (C), i.e. the fraction of the issue of die-varieties observed in the sample.⁵⁶ By such, we obtain a coverage of 97% ($\pm 2.2\%$ confidence interval) for the first and 88% ($\pm 7\%$) for the second series.⁵⁷ These results largely enhance the previous observations about the high representativeness of the sample of 495 coins.

A further step in estimating the silver coin production consists of calculating the number of coins struck with the original number of dies (D). This is certainly the most debated aspect of quantitative studies in numismatics, since, as outlined above, a die could have been used to strike a different number of coins.⁵⁸ The strongest evidence for Antiquity comes from the ἀπονομιαί accounts of the Amphictionic League at Delphi and the Amphictionic coinage itself. Combining the total value of minted silver (as recorded in the treasurers' accounts at Delphi) with the estimated original number of dies for Amphictionic staters, an output of up to 14,350 coins per die has been calculated.⁵⁹ Further evidence from medieval times shows a frequent average of 30,000 silver coins struck per die⁶⁰ but medieval silver coins are thin and have low reliefs compared to antique coins, so that the lifetime of a medieval die may have been longer than a Greek one. Since the definition of a constant value is not possible, it

Statistics and Numismatics, 1981, 209–212. In the case of a continuous and prolific coin production, the working life of coin dies stood in inverse relation to a mint's production rate (O. MØRK-HOLM, in: C. N. L. BROOKE et al. [eds.], *Studies in Numismatic Method presented to P. Grierson*, 1983, 16 citing the cases of the Athenian and Cypriot mints in the Hellenistic period).

⁵⁶ W. W. ESTY, NC 1984, 181f.; id. (n. 55) 186, 197, 208 stressed that, unlike estimates of the number of dies, the estimates of the coverage do not depend upon the presumed die-output distribution (i.e. the number of coins struck per die).

⁵⁷ That means that $d = 67$ (first series) and $d = 14$ (second series) produced an estimated 97% and 88% of the respective series with a 95% confidence interval of between 94,8% and 99,2% for the first estimate and a 68% confidence interval of between 81% and 95% for the second (the small size of the sample of the second series does not allow the calculation of a high confidence interval; ESTY [n. 56] 181).

⁵⁸ Harsh criticism of the extrapolation on the basis of a fix number of coins per die came from T. V. BUTTREY, NC 1993, 342–344 and NC 1994, 342f. BUTTREY argued that the production capacity of a die has always varied widely from die to die and from issue to issue; moreover, damage to some dies limits their use in the coin production. Nevertheless, this should not hamper the efforts to refine the works with statistics (DE CALLATAÏ, *Quantifications*, 54).

⁵⁹ Assuming a minted volume of 125 to 175 talents, P. KINNS, NC 1983, 18f. obtained an output ranging from 23,333 up to 47,250 coins per die. By improving the reading of the ἀπονομιαί accounts, P. MARCHETTI, RBN 1999, 109 reduced the minted volume to 61.5 talents, so that the average productivity of a die should have been much lower (ca. 15,000 coins). Whatever, an estimation under 40,000 coins per die is often preferred (DE CALLATAÏ, *Quantifications*, 73, 75f. [20,000 silver coins per die], 47, 86 [30,000]; id. [n. 44] 13 [10,000 to 40,000]).

⁶⁰ DE CALLATAÏ, *Quantifications*, 45–47.

seems preferable to provide an estimation covering a low (10,000) and a high (30,000) number of coins struck per die.

Regarding the results presented in table 3,⁶¹ the first silver series of Elaea would have brought between 710,000 and 2,130,000 coins into circulation, implying the use of 478 to 1,434kg of silver. As expected, the volume of the second series was less: 180,000 to 540,000 coins equivalent to 201 to 603kg of silver. This drop in the amount of the coinage is certainly due to the parallel issue of bronze coins (fig. 5) substituting the smallest silver denominations of the first series (quarter and hemiobol).

ELAEA		d number of coins	D	estimated number of struck coins		estimated quantity of minted silver (kg)	
				10,000 coins/dies	30,000 coins/dies	10,000 coins/dies	30,000 coins/dies
1 st series (fig. 3)	Persian 1.5 obol	26 187 coins	27	270,000	810,000	335	1,005
	Persian ½ obol	30 209 coins	32	320,000	960,000	118	354
	Persian ¼ obol	11 63 coins	12	120,000	360,000	25	75
	Total	67 459 coins	71	710,000	2,130,000	478	1,434
2 nd series (fig. 4)	Persian 4 obols / Chian drachm	1 4 coins	–	>10,000	>30,000	>32	>96
	Persian diobol / Chian ½ drachm	2 2 coins	–	>20,000	>60,000	>31	>93
	Chian 1.5 obol?	11 30 coins	15	150,000	450,000	138	414
	Total	14 36 coins	>18	>180,000	>540,000	>201	>603

Table 3: Estimates of Elaea's silver coin production (*d* = number of identified obverse dies; *D* = estimate of the original number of obverse dies after CARTER's formula [n. 55]).

⁶¹ ESTY's formula ([n. 56] 182) to estimate the total coinage ($d \times \text{number of coins per die} / C$) yields similar results to those presented in table 3. The number of silver coins could be set between $67 \times 10,000/0,97 = 690,702$ and $67 \times 30,000/0,97 = 2,072,165$ coins for the Elaeian first series, $14 \times 10,000/0,88 = 159,091$ and $14 \times 30,000/0,88 = 477,273$ coins for the second.

It is worth comparing the estimates of the production with Elaea's tribute to the League. Given the fact that the ἀπαρχή represents 1/60 of the φόρος, the city would have been assessed at 10 talents, i.e. 261 kg of silver. Obviously, the yearly payment of this amount would be disproportionately high compared with the estimated volume of minted silver during the first and second series. Either Elaea only paid the ἀπαρχή and not the φόρος,⁶² or – what is more likely – Elaea's silver production was never related to the tribute payments but just filled the local need for small change, as suggested by the exclusive issue of tiny fractions.

PERGAMUM (fig. 6)	d number of coins	D	estimated number of struck coins		estimated quantity of minted silver (kg)	
			10,000 coins/dies	30,000 coins/dies	10,000 coins/dies	30,000 coins/dies
Persian diobol / Chian 1/2 drachm	16 60 coins	19	190,000	570,000	295	885
Persian obol / Chian 1.5 obol?	2 6 coins	3	30,000	90,000	20	60
Persian 2/3 obol / Chian obol	7 27 coins	8	80,000	240,000	39	117
Total	25 93 coins	30	300,000	900,000	354	1,062

Table 4: Estimates of Pergamum's early silver coin series (*d* = number of identified obverse dies; *D* = estimate of the original number of obverse dies after CARTER's formula [n. 55]).

Concerning the volume of silver coin production at Pergamum (table 4), CARTER's formula gives for a sample of 93 silver coins and 25 obverse identified dies (*d*) an estimate of 30 original dies (*D*). The estimate of the coverage (*C*) is 93%.⁶³ Thus, Pergamum introduced about 300,000 to 900,000 silver coins into circulation corresponding to 42% of the number of coins of Elaea's first series. The Pergamene denominations being mostly heavier than the Elaeian ones, the required volume of silver comprised about 72% of Elaea's first series. This is a rather modest quantity of minted silver, if one compares it with the estimated volume of silver issued by the first Attalids.⁶⁴

⁶² As seems to have been the case for Methone (Macedonia) which was exempted from tribute (IG I³ 61) and paid 300 drachms in 432/431 and 429/428 but only as ἀπαρχή (PAARMANN [n. 5] 76). On a possible correlation between the level of the assessment and the size of coin issues see L. NIXON – S. PRICE, in: O. MURRAY – S. PRICE (eds.), *The Greek City from Homer to Alexander*, 1990, 156f.

⁶³ See n. 56f. and the simplified formula in W. W. ESTY, NC 2006, 359 (1) used here.

⁶⁴ During the reign of Eumenes I (263–241), an estimate of *D* = 33 obverse dies for tetradrachms would have minted between 6 and 18 tons of silver (after the data compiled in F. DE CALLATAÏ, *Recueil quantitatif des  missions mon taires hell nistiques*, 1997, 189). Even then,

These estimates only aim at giving an order of magnitude for comparing the silver issues of Elaea and Pergamum. Nevertheless, the significant gap observed in the results is a sufficient argument to affirm that the focus on small fractional coinage observed above was not due to inadequate silver supply; actually, in the 5th/4th century Elaea minted about 30% more silver than Pergamum for its incuse square series.

Silver small change in the Caicus Valley

The comparative study of the early silver coinage of Elaea and Pergamum through a systematic analysis of denominations and weight standards has highlighted just how the silver issues seem to have been influenced by Ionian coinages and the importance of the Persian siglos in the circulation. By contrast, the alliance with Athens by the middle of the 5th century at the latest had no discernible impact on the minting of silver at Elaea. The coastal city started its coinage with an abundant silver series in the tradition of the Ionian civic issues (e.g. Colophon), characterised by the minting of small silver fractional coins and the use of a value mark. Elaea did not issue silver fractions of the Athenian drachm but more likely of the siglos, because this was certainly the principal silver denomination available in the Caicus Valley and in Ionia, while Attic drachms were largely absent in 5th century Asia Minor. At Pergamum, the minting of silver was limited to fractions adhering to the Chian or Persian standard, i.e. compatible with the fractional coinage of Elaea. These weight equivalences allowed the parallel circulation of Elaeian and Pergamene coins, while a reassessment of their nominal value (to a particular standard) avoided exchange operations at both cities (and ultimately the reminting of the coins). Hence, local factors and not the involvement of Athenian or Persian leadership emerge as the main points in the option of the weight standard and the organisation of the silver coinage.

Further evidence of the regional basis of the silver minting is yielded by the contrast observed between the issues from coastal cities and those from the hinterland. Indeed, not only Elaea but also Pitane and Autokane focussed on the production of very small silver fractions,⁶⁵ while Pergamum, Teuthrania and Gambrium minted heavier

the production of silver coins under the Attalids seems to have been very low in comparison with the Ptolemaic or Seleucid kingdoms (id., in: P. THONEMANN [ed.], *Attalid Asia Minor*, 2013, 239f.). The data available for the Archaic and Classical coinage of other cities concern heavier denominations or electrum coins, so that a comparison with the estimates presented for Elaea and Pergamum remains difficult (id., *Recueil quantitatif des émissions monétaires archaïques et classiques*, 2003, 179–183 for the stater fractions of Mytilene).

⁶⁵ A unique, only recently recorded silver coin of Pitane (bearded laureate head/pentagram in incuse square; Numismatik Naumann 88 [5/04/2020] 170) weighing 1.23g corresponds exactly to an Elaeian trihemiobol; Apollo/pentagram coins of Pitane (Numismatik Naumann 53 [7/05/2017] 173) with an average weight of 0.37g (19 recorded coins) correspond precisely to Elaeian hemiobols; the female head/goat coins of Pitane (Savoca 10th Blue Auction [29/09/2018] 451) with an average weight of 0.53g (4 recorded examples) might be considered as Persian

silver denominations. Owing to the scarcity of the silver issues from Pitane, Autokane, Teuthrania and Gambrium, there is no doubt that the creation of these two areas is solely due to the relationship between Elaea and Pergamum, the abundant coinages of which provided the basis for further silver issues and their circulation in the Caicus Valley. Intensive economic relations between Elaea and Pergamum are certainly to be expected long before the Attalids, and the complementary denominations and weight standards could be the best evidence for that, even if they may have been in use when Elaea and Pergamum were controlled by two opposing empires.

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Photo credits

- Fig. 1: DAI – Pergamograbung (B. LUDWIG, Datengrundlage: TanDEM-X Deutsches Zentrum f ur Luft- und Raumfahrt e.V.).
- Fig. 2: quarter-obols: Naumann 7 (1/09/2013) 138; Savoca @ NNN2967 (18/3/2017); K unker 257 (10/10/2014) 8328; CNG 283 (25/07/2012) 95; coins with Elaeian ethnic: Peus 413 (29/10/2014) 73; Savoca 8th Blue Auction (14/07/2018) 354; VAuctions 260 (3/03/2011) 22; Amphora V12670.
- Fig. 3: CNG 76 (12/09/07) 690; Amphora V12670; CNG 283 (25/07/2012) 95.
- Fig. 4: M unzkabinett der Staatlichen Museen zu Berlin 18241093 (L.-J. L UBKE); Pecunem 39 (3/01/2016) 300; RGZM O.43324 (V. ISERHARDT).
- Fig. 5: Nomos 12 (31/03/2019) 322; RGZM O.43302 (V. ISERHARDT); RGZM O.43282 (V. ISERHARDT).
- Fig. 6: M unzkabinett der Staatlichen Museen zu Berlin 18200049 (L.-J. L UBKE); 18231397 (D. SONNENWALD); 18231404 (D. SONNENWALD).

three-quarter obols. The only two recorded silver coins of Autokane (0.37 and 0.47g; see n. 4) may have circulated as Persian hemiobols. Needless to say, the chronology of these issues is not better known than that of Elaeian and Pergamene silver coins.