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Ancient Iranian Economies

Gerhard Thür – Michele Faraguna

Silver from Laureion: Mining, Smelting, and Minting*

In the first part of this article, Thür investigates how Athens encouraged private people to engage in prospecting silver ore and in leasing and exploiting the mines. The focus is on the legal framework, public and private, of 'producing' silver. Thür holds with Palme against Lambert that IG 2^3 433 concerns prospecting silver ore and not exploiting agricultural land. For leasing the mines by auction, some insights come from the recently published Hyperides speech *Against Timandros*.

In the second part, Faraguna focuses on the 'distribution' of the extracted silver. Since metallurgical analyses have shown that Athenian coinage was mostly struck from Attic silver, the question arises of what strategies the Athenian mint employed to acquire the metal necessary for its massive output. An examination of different possible explanations leads to the conclusion that Athens profited from the mines through a variety of taxes, including a significant share in the silver produced by the lessees.

I. Legal infrastructure of mining and smelting in fourth-century Athens: some notes on prospecting for ore and the procedure for leasing and controlling the mines

1. Prospecting

In the huge volume of literature on the mining lease records, based since 1991 on the collection of M. K. Langdon in the *Agora* volume 19, the topic of prospecting has been neglected. Indeed, only one Athenian inscription that might be relevant exists: dated to 337–325? BC, it was carefully re-edited in 2012 by S. Lambert as IG 2^3, 433 (IG 2^2, 411). The text, a contract between the polis and a non-Athenian, Sokles, has been known since 1839 and is still an extremely controversial issue. While until 1935 it was held to be a lease of public land, A. Wilhelm[1] and E. Schönbauer[2] considered it as leasing silver mines,[3] B. Palme (1987) as a prospecting agreement, and finally S. Lambert (2010) holds that the subject was a license for collecting wild honey, medicinal herbs or trapping some wild bird or animal in a large area owned by numerous private persons. In fact, the resource to be exploited is not mentioned in the text as far as it is preserved, and A. Wilhelm's restorations appear to be arbitrary.[4]

I would uphold B. Palme's view with some modifications. Certainly S. Lambert is right in stating that the surface of the Laureotike was well explored[5] and there was no need to prospect for new silver ores in the soil, and also that in Lykourgan times Athens was anxious to improve the city's revenues in an unorthodox way. Nevertheless, collecting natural products would not have required such high assets of capital and labour that it would necessitate the income being shared alternately year by year between the polis and Sokles for 25 years. Additionally, no public authority that might have been responsible for this new job is mentioned. In fact, in mining affairs Athens had a well operating administration. Thus, if Sokles had discovered mineable ore, exploitation of it by lessees was sufficiently regulated, and dividing the income over 25 years was the right means of sharing the risk. Considering new studies on mining and leasing, the system of galleries, old and new, ran over

* Part I is by Gerhard Thür, part II by Michele Faraguna.
1 Wilhelm 1935, 206–215.
2 Schönbauer 1935.
3 Doubtful Behrend 1970, 71–72: "Zweifelderwirtschaft?".
4 Especially εἰς [βάθος ὀρύξας] l. 8 and τὴ[ν ἀργυρῖτιν] l. 9.
5 Lambert 2010, 120; since prehistoric times, see Kakavogiannis 2005, 93.

a length of many miles and down to a depth of 119 m, and during the fourth century experience in mining techniques had advanced more and more.[6] I, therefore, believe that Sokles' task was preparing *sub*surface mining in operational and deserted galleries, by exploring new veins of silver or, possibly, of another metal in order to improve the polis' revenues (like the kind of subsurface exploration regulated in the Lusitanian *lex metallis dicta*[7]). 'Prospecting' metal in general – unorthodoxly not restricted to silver – might have been the reason why the text only speaks of *prosodos* instead of *arguritis*. To meet his goal, I think Sokles was allowed to enter any privately owned real estate containing shafts: [κ]ύρ[ιον πάντων τῶν ἐδαφ|ῶ]ν,[8] ὅθεν φησὶν τὴμ πρόσ[οδον ἔσεσθαι τῶι] | δήμωι (ll. 6–8).

To make one additional observation on prospecting: it is only from l. 25 onwards that the text speaks of ἐργασία and ἐργάζεσθαι, whereas the terms used at the beginning are κάρπωσις, καρποῦσθαι, καρπεία and συλλογή. The first refers to the contract, namely for work and labour, the second to the reward. Therefore, ἐργάζεσθαι does not mean that Sokles had to "work" during the 25 years when he was enjoying his reward. A reference to the "contract of work and labour" could already be found in the lacuna of l. 8, where I would suggest restoring: ἐπειδὰν δὲ εἰσ[ίων ἐργασίαν φαν]|ερὰν καταστήσηι τὴ[μ πρόσοδον …] ("when he starts working and establishes the revenue …"). The Greek contract of work and labour was made binding not by the consensus from the parties, but rather by setting about working.[9] The missing article (τήν) seems odd, but the same is probably the case in l. 5: δεδόχθαι δ[ήμωι τῶι Ἀθηναίων …[10]

2. The procedure of leasing the mines

Despite the huge number of *poletai* records containing the result of the leasing we have only very few examples of evidence for the procedure. Consistently with the *poletai* inscriptions, in the first sentence Ath. Pol. 47.2 uses the term πωλεῖν, to "sell" (to lease by auction), from which the name of *poletai* for the competent magistrates is derived. In mining issues they had to co-operate with two other financial magistrates in the presence of the Council, and, finally, the *poletai* ratified the persons to whom the Council had attributed the lease by a show of hands.[11] The following lines of Ath. Pol. deal with roughly classifying the mines – the terms are inconsistent with those used in the inscriptions – and how long the leases of the different types of mines lasted, the latter burdened with a palaeographic problem[12] and not mentioned in the inscriptions at all. This passage does not say anything about the leasing procedure, and therefore I need not enter this thorny field.

The main question of procedure is: did the *poletai* farm out the mines by auction? According to the inscriptions, in most cases they did not. We find a lot of small lump sums such as 20 and often 150 drachms, which could not possibly have resulted from highest bids, in contrast to some figures of up

[6] Aperghis 1997–1998, 6; Kakavogiannis 2005, 100 with plate 2 and the map of Southern Attica.

[7] FIRA 1² no. 104 (AD 117–138) section 7, ll. 38–39: *Proc(urator) explorandi novi metalli causa ternagum a cuniculo agere | permittito, ita ut ternagus non plures latitudinis et altitudinis quam quaternos pedes habeat* (*ternagus*, Iberian, "exploratory shaft"; *cuniculus*, "mine") – contrary to the Sokles case seen earlier by Thür 2004, 182–183. Speaking of parent and 'spawn' mines Aperghis 1997–1998, 8–10 suggests a similar mining technique and administration (by the *poletai*) in Laureion.

[8] In the *poletai* records mines are usually located as: ἐν τοῖς ἐδάφεσιν… Granted that Sokles and his crew were also exploring within working mines operated by lessees, the penal clause on theft and preventing him from working added at the end (ll. 34–37) makes excellent sense.

[9] Thür 1984, 514.

[10] Thus *dubitanter* Lambert 2010, 124, omitted in IG 2³.

[11] Ath. Pol. 47.2: [μ]ισθοῦσι δὲ τὰ μισθώματα πάντα, καὶ τὰ μέταλλα πωλοῦσι καὶ τὰ τέλη μετὰ τοῦ ταμίου τῶν στρατιωτικῶν καὶ τῶν ἐπὶ τὸ θεωρικὸν ᾑρημένων ἐναντίον τῆς [βουλῆς], καὶ κυροῦσιν ὅτῳ ἂν ἡ βουλὴ χειροτονήσῃ, καὶ τὰ πραθέντα μέταλλα, τά τ' ἐργάσιμα τὰ εἰς τρία ἔτη πεπραμένα, καὶ τὰ συγκεχωρημένα τὰ εἰς [Γ? Ζ? Ι?] ἔ[τη] πεπραμένα. For the treasurer of the Stratiotic Fund see Faraguna in part II with notes 30–31.

[12] 3, 7 or 10 years: see Aperghis 1997–1998, 2 and 14–15 (10 years).

to 17,750 drachms,[13] which do indicate competitive bidding. The lump sums have been temptingly explained as 'registration fees.' Nevertheless, the inscriptions make no distinction in specifying low and high sums; they generally note: ὠνητής (lessee), name, sum. In this context the sum can only be the price (rent) and not an ἐπώνιον or some other transaction cost. Technically speaking, a lessee at the lowest rate was also a "buyer" and the state guaranteed his right to exploit the mine – at his own financial risk. To be vested in any right, in Greek law the purchaser had to pay the consideration.[14] It was payment, not registration, that established the license for exploiting minerals.

Did the Council vote on each of these trivial cases? I could imagine that it voted on undisputed matters en bloc. Only when two or more claimants had previously registered for one and the same mine was specific voting necessary. In this case, it was primarily the right person and not the amount of the rent that was at stake. Competitive bidding could, thus, have taken place. If the best bid automatically got the award, one may ask what sense co-operating with the Council made. Voting by a show of hands – after a few words addressed to the Council by the claimants in person – was a simple means of considering the claimants' personal qualifications in addition to the amount of rent they offered. In this way, the *poletai* shared their responsibility for safely exploiting Athenian soil resources with the Council. The leasing out of an orphan's estate worked in a very similar way to this procedure, as documented in the recently published Hyperides fragment *Against Timandros*.[15] Here a law court, instead of the Council, after listening to the claimants' speeches, votes to determine which person will administrate the estate "in child's best interest", notwithstanding the highest bid.[16] To conclude this point: Ath. Pol., in combination with the *poletai* inscriptions, demonstrates that *polein* was not an auction as we understand it, automatically giving the award to the highest bid.

The Sokles inscription also mentions the leasing procedure (ll. 20–22): "Sokles shall have the same means of gathering (the proceeds) as regards sale, valuation, and enforcement of money as there would be for the polis."[17] Since the foreigner, Sokles, could not have held the same authority as the *poletai*, one must understand this provision as meaning that, on the one hand, the leasing (*prasis*) of the new mines Sokles had explored took place in the same way as all the other ones specified in the Ath. Pol.; on the other hand, concerning enforcement (*praxis*) of money owed to him by the lessees, Sokles had the same privileges as the polis: entering the debtors in the records of the polis.[18] But what does the term *timesis* mean? In the given order, mentioned between *prasis* and *praxis*, a new mine was to be continuously assessed and classified. This, I believe, was the responsibility of the state authorities, the *poletai*. Then further leasing could go on. Hidden in ll. 15–16 I see a reference to the way in which this assessment could have taken place: "Each shall bring in the proceeds at their own expense."[19] Since the state leased out the mines, all the costs of mining and smelting were borne by the lessees, the polis and Sokles alternately receiving only the profit. For both of them the only expense would have been that of assessment. Mining and smelting was strictly controlled by the state. Xenophon's *Poroi* (4.49) mention public revenues "from the furnaces".[20] The most effective way of assessing – and thereby classifying – a mine is controlling the output of the furnace. Whether a percentage of the metal was also collected thereby and at what rate is not preserved. Anyway, I think that the *poletai* engaged high-

[13] The figures are: 1,550 (Langdon 1991, no. P5, ll. 47–51), 3,500 (P19, l. 4), 6,100 (P26, l. 94) and 17,750 (P19, ll. 26–30).

[14] For the 'cash sale principle' see Pringsheim 1950, 181–182.

[15] Tchernetska et al. 2007; Horváth 2008.

[16] Thür 2008a, 658; Thür 2008b, 132–133; Thür 2010, 14–15.

[17] IG 2^3, 433 ll. 20–24: ὁ αὐ]τὸς δὲ τρόπος ἔστω τ[ῆ]ς συ[λλογῆς περὶ τ]ῆς πράσεως καὶ τῆς τ[ι]μή[σεως καὶ τῆς πρ]άξεως τῶγ χρημάτων Σωκλ[εῖ καθάπερ ἂν] τῆι πόλει γίγνηται (translation Lambert 2010, 117).

[18] Dem. 37.24: ἐγγραφῆναι τὸ διπλαιοῦν τῷ δημοσίῳ.

[19] IG 2^3, 433 ll. 15–16: κομίζεσθαι [δὲ τὴν καρπεία|ν] τοῖς αὑτῶν τέλεσιν ἑκ[άτερον (translation Lambert).

[20] Xen. Vect. 4.49: καὶ ἀπὸ καμίνων καὶ ἀπὸ τῶν ἄλλων ἁπάντων πρόσοδοι ἂν πολλαὶ γίγνοιντο. This passage will be discussed thoroughly in part II, where Faraguna (at the end of this paper) argues that in the Sokles case it is not the amount of the refined silver (for starting to auction the mines), but rather that of the silver ore that was to be assessed (for taxation).

ly qualified metallurgical engineers in these places, and in the years in which he enjoyed the revenue Sokles had to pay for their employment. At any rate, *timesis* was essential for the procedure of leasing.

II. From bullion to owls: silver mining and coin production in classical Athens

In the first part of this paper Professor Thür presented a new reconstruction of some of the administrative mechanisms underlying the public leasing of the Laureion silver mines in the fourth century BC, focusing on the thorny question of how the epigraphic and literary evidence can be combined into a coherent whole. In what follows I would like to add another dimension to the problem, namely the relatively unexplored processes by which the Athenian mint acquired the silver it needed for conversion into large, if not enormous, volumes of owls, tetradrachms and also smaller denominations.

Recent investigations have confirmed that there was a direct correlation between Athenian monetary output and the intensity of mining activity at Laureion: metallurgical analysis of a random sample of standardized tetradrachms from the second half of the fifth century has shown that, even allowing for some few exceptions, well over 90% of the coins appear to have been struck from Attic silver.[21] Conversely, reconsideration of the Athenian coinage of the first half of the fourth century and the realization that, far from being quantitatively insignificant, it was "one of the most voluminous civic coinages of its time", have enabled scholars to conclude that the silver mining industry at Laureion had not come to a standstill after the end of the Peloponnesian War and the old mines, at least, were still being exploited.[22]

Based on the assumption of a tight interrelation between mining and minting, three points need to be emphasized. First, there is an almost total vacuum of information on the administrative procedures governing the mine leases for precisely the period when the mint's output reached its highest peak after c. 450 BC with the production of staggering amounts of standardized owls.[23] The only exception is represented by some loci in Aristophanes' comedies. In the *Knights* the sausage-seller boasts that he "will purchase mines" (362), showing that the lease system and the relative terminology we encounter in the *poletai* records were already in operation in the 420s. O. Picard has recently suggested that in actual fact they may well have gone back to the late sixth century when the third contact was discovered at Laureion.[24] In the *Frogs* (721–725) the chorus alludes to the old silver *nomisma,* which was the finest of all coins and was valid "everywhere among the Greeks and *the barbarians*", thus reflecting contemporary perceptions about its international status and its attractiveness beyond the limits of the Greek world.

Second, even considering the almost overwhelming consensus of the sources, literary and epigraphic, pointing to a lease system whereby private individuals (or partnerships) acquired the right to exploit a mining concession in exchange for rent – whether this was a one-off, annual or prytany payment is a question that can be left aside for now – there is some indication that the state profited from the mines by means of a wider set of taxes. The *poletai* inscription P26, ll. 474–477 mentions an otherwise unknown *telos*, the ἐν τοῖς ἔργοις πεντεδραχμία, a five-drachm tax, which must, in some way, be connected to the exploitation of the mines.[25] Xen. Vect. 4.49, referring to

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21 Flament 2007a; see also Kroll 2009, 196–198; Flament 2011, 47–49, esp. note 53. In Ar. Av. 1105–1109 the Athenian owls are significantly styled as *Laureiotikai*, "from Laureion".

22 Kroll 2011a (the quotation is from p. 17). Cf. also van Alfen 2011b.

23 Cf. Kroll 2009, 198: "These wide variables allow for a possible use of as many as 450 dies or as few as 55 dies per annum, which, at an assumed production life of 20,000 tetradrachms per die, would mean that Athens was annually minting between 6,053 talents (about nine million coins) and 733 talents (about one million). A realistic estimate should fall somewhere in between. As Meadows writes, 'This is a stunning amount of coinage, even at the lowest end of the estimate.'"

24 Picard 2001; see also Aperghis 2013; van Wees 2013, 101–104.

25 Shipton 1998. I find her attempt to interpret this five-drachm tax as the fixed fee paid by all lessees per prytany unpersuasive. 20 drachms, the most frequently recorded price in the *poletai* inscriptions, would thus equate to four

revenues ἀπὸ καμίνων, may allude to some fiscal charge (again a tax?) levied at the furnaces where the silver was produced after smelting.[26]

In addition, two entries in the lexicographic tradition appear to suggest that the state also made a profit by taking a share in the silver produced by the lessees. According to the Suda (s.v. ἀγράφου μετάλλου δίκη), mining operators who wanted to open a new "cutting", in other words a *kainotomia*, had to register it with a view to paying a 1/24th tax on (the product of) the new mine. The passage has generally been dismissed as reflecting later, perhaps Roman-Imperial practice, but in view of the fact that all entries concerning judicial institutions in the Suda (and Photius) were meant to illustrate questions posed by the Attic orators, this seems rather unlikely.[27] As stated in the lemma, exploiting a mine without registering was an offence subject to an ἀγράφου μετάλλου δίκη, for which, again, we have a parallel in fourth-century oratory (Hyp. Eux. 34).

The second entry concerns the technical term ἀπονομή. Its earliest occurrence is in Harpocration (s.v.; cf. also Suda, Phot. and Lex. Seg.). Here ἀπονομή is explained as a synonym of *apomoira* (ἀπόμοιρα) denoting the polis' share (μέρος) from the yield of the mines (μέρος τι τῶν περιγιγνομένων ἐκ τῶν μετάλλων λαμβανούσης τῆς πόλεως). As indicated in the entry, the term recurred "several times" (πολλάκις) in the speech *Against the children of Lycurgus* by Dinarchus, the Athenian politician and finance expert whose interest in the Laureion silver mines is also attested elsewhere (Hyp. Eux. 36; [Plut.] Mor. 843D). Although the importance of Harpocration's lemma has generally been underestimated, an Athenian fourth-century context is, in this case, beyond any doubt. Further evidence is finally provided by IG 2^2, 1443, ll. 12–88,[28] recording an inventory of 28 talents of unminted silver (ἀσήμου ἀργυρίου), 140 "cake" ingots (φθοῖδες) weighing 1,200 drachms each,[29] stored in the Parthenon by the treasurers of Athena in 344/343 BC after they had been set aside as reserve, presumably for military purposes, by the treasurer of the Stratiotic Fund, Nikeratos of Kydantidai (ll. 12–14: [ἀσή]μου ἀργυρίου τοῦ εἰς τὰ στρατιωτικὰ ἐξαιρεθέντ[ος] παρὰ ταμίου στρατιωτικῶν παρελάβομεν Νικηράτ[ου] Κυδαντίδου…).[30] We can only guess at the source of such a large quantity of silver bullion. It cannot, of course, be ruled out that it had been incorporated into the treasure of Athena as war booty or on some other account,[31] but, in view of the direct involvement of the treasurer of the Stratiotic Fund in the administration of the mine leases (Arist. Ath. Pol. 47.2), the simplest, and most plausible, explanation is that the bullion originated as a part of the portion of silver claimed by the polis.

Third, very little is known about the mint at Athens, including its precise whereabouts. The evidence on the *argyrokopeion* has recently been reviewed by C. Flament and P. G. van Alfen.[32] The mint worked under the supervision of a board of *epistatai* but all decisions about short-term and long-term policies on monetary output must have ultimately rested with the Council and Assembly. Concerning the interplay between mining and minting, the question of the location of the mint is not of secondary importance. J. McK. Camp and J. H. Kroll have identified a large square building in the south-eastern corner of the agora as the site where the minting of bronze coins took place.[33] The building was constructed in c. 410 BC and this leaves open the question of where silver coinage was produced both before and after the final years of the fifth century. Camp and

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months, a period of exploitation too short to make investment worthwhile (cf. Aperghis 2013, 11: "a deep mine would require a year or more of preparation before exploitation could commence"). Similarly, high prices such as 1,550, 6,100 or 17,750 drachms can hardly be explained on this basis.

26 Text quoted above, note 20. On silver production processes at Laureion cf. Rihll 2001.

27 On the entry see MacDowell 2006, 122–123, who has no qualms in referring it to fourth-century Athens.

28 Harris 1995, 123–127 (no. 67).

29 On the meaning of φθοῖς cf. Kroll 2001a, 9 with note 11.

30 As pointed out by Migeotte 2014, 431–433, 481–482, the total weight of the silver must have been larger (30 talents?) because there is a lacuna at the end of the list.

31 Cf. e.g. van Alfen 2004–2005a, 20: "mines, taxes, or booty".

32 Flament 2010, 5–29; van Alfen 2011b, 135–139.

33 Camp – Kroll 2001.

Kroll cautiously suggested the possibility that silver coinage might have been struck somewhere in the Laureion district, possibly at Sounion, close to the sources of the silver and the installations where the ore was processed and smelted. Sections 10 and 14 of the Standards Decree (IG 1^3, 1453), providing for public display of the decree itself and other written documents "in front of the mint" (ἔμπροσθεν τοῦ ἀργυροκοπίο), however, somehow imply a potential audience for such records, and I wonder whether a location in the city would be more appropriate on this account. The question is, at any rate, worth posing because it forces us to focus on the administrative mechanisms ensuring that the silver extracted from the mines by *private* individuals made its way to the *public* mint.

In order to shed light on such mechanisms I propose to start with two 'theoretical' passages in Xenophon's *Poroi*, which, despite being set in different thematic sections of the treatise, can be combined to form a coherent argument. In chapter 4 Xenophon makes the point that, unlike other commodities, gold included, the value of silver (ἀργύριον) never decreases, even when this precious metal is available in large quantities, for "no one has acquired such a quantity that he no longer has the need for more" (4.7: ἀργύριον δὲ οὐδείς πω οὕτω πολὺ ἐκτήσατο ὥστε μηκέτι προσδεῖσθαι). This statement has been taken as evidence of Xenophon's naiveté and lack of understanding of economic phenomena.[34] A. Bresson, however, has correctly noted that the meaning of ἀργύριον is, to some extent, ambiguous, since the term can refer not only to silver, but also to coined money. As is manifestly indicated by 4.9 (καὶ εἰς ἐπιτήδεια καὶ εἰς ἐπικούρους νομίσματος δέονται), Xenophon was clearly thinking in terms of silver currency here because he distinguishes between the ordinary goods needed in the management of the household (τὰ ἔπιπλα), for which demand was necessarily limited, and τὸ περιττεῦον, any surplus that can be thesaurized and hoarded for future conspicuous consumption or, in difficult times, for grain imports or military purposes, so that the value of money remained stable.[35] In other words, Xenophon's argument focuses on the peculiar quality of money, which makes it different from other commodities.

The same concept recurs, though in a different form, at 3.2. Here Xenophon emphasizes the commercial advantages offered to merchants at Athens, where they could either load a great variety of goods on their ships as return cargo or they could export excellent merchandise, taking away silver (ἀργύριον ἐξάγοντες καλὴν ἐμπορίαν ἐξάγουσι), for "wherever they sell it, everywhere they make more than the capital they invested" (ὅπου γὰρ ἂν πωλῶσι αὐτό, πανταχοῦ πλέον τοῦ ἀρχαίου λαμβάνουσι). In an illuminating article, G. Le Rider has demonstrated admirably how Xenophon's statement can be made sense of in technical terms by distinguishing between the intrinsic, nominal and commercial value of coins.[36] Owing to their reputation for good quality and wide circulation, some international coinages, the Athenian owls being foremost among them, also retained an elevated commercial value outside the boundaries of the issuing polis, especially in regions where the supply of silver was scarce.[37]

More significantly, Xenophon's assertion has been proved reasonably accurate by the large numbers of hoards containing Athenian owls, or imitations thereof, discovered, in particular, in Egypt and the Near East. The evidence has recently been surveyed and tabulated in a number of articles by J. H. Kroll and P. G. van Alfen.[38] Athenian owls already appear in Levantine and Egyptian hoards in the archaic period and their numbers grow in a stunning fashion from the second half of the fifth century. During the fourth century, the proportion of owls in hoards in the Levant remains constant at c. 60%, while in Egypt it approximates 100%. The dominance of Athenian

[34] Gauthier 1976, 120 and 131–132. For a different assessment of Xenophon's economic thought see Jansen 2007; Figueira 2012.

[35] Bresson 2005, 52–54.

[36] Le Rider 1989, 159–167.

[37] Kroll 2011b, 28–33 argues that, starting from the last quarter of the sixth century, Athens produced her coinage in surplus quantities to supply the demand for silver.

[38] Kroll 2001a; van Alfen 2004–2005b; van Alfen 2011a; van Alfen 2012.

coinage is, moreover, reflected by the large numbers of imitation owls, which, despite already appearing in the fifth century, are "primarily a fourth-century phenomenon".[39]

The hoard evidence nonetheless indicates that tetradrachm owls were, for a long time, mostly used as bullion to be weighed on the balance scale and that "[i]t is only at the end of the fifth century that the first hints of a shift to using coins as coins begin to appear",[40] while mixed hoards assembling large silver ingots, dumps, Hacksilber, coins and fragmented coins, although largely attested for the earlier period, do not disappear in the fourth century.[41]

Laureion silver thus also had wide circulation in the Eastern Mediterranean as unmarked bullion in ingot form.[42] We must consequently assume that not all of the refined metal extracted from the mines was immediately converted into coins and that, leaving thesaurization aside, an unquantifiable, though perhaps not negligible proportion remained in private hands and entered a market of its own, being sold for minting by other poleis or exchanged for other commodities, thus flowing into the commercial networks. The fourth-century monetary decree from Olbia (SIG[3] 218; Dubois 1996, no. 14), for instance, set the rules for the circulation of coined (ἐπισήμου) silver and gold within the polis territory, the implication being that the decree did not concern ἄσημον gold and silver, in other words gold and silver bullion, which could circulate without restrictions.[43] To quote an earlier example, the early fifth-century Achaemenid customs register from Elephantine (TAD 3, no. C3.7) records duties paid in gold and silver by 42 Greek and Phoenician ships at a port on the Delta at a rate of roughly 10% on the imported and exported goods.[44] The register concerns ships originating from some limited regions of the Eastern Mediterranean over the span of less than two years. Yet, according to van Alfen, the total amount of the duties levied on the ships equalled 7,500 tetradrachms that "represent[s] a considerable transfer of precious metal from the Aegean region to Egypt".[45]

Within this Aegean context, where silver was in high demand as bullion as much as it was as coined money and where the interests of the polis and those of Laureion investors could, therefore, potentially collide, we have to go back to the question of the mechanisms enabling Athens to acquire the silver it needed to mint large volumes of tetradrachms. However speculative the argument may appear, three possible scenarios can be envisaged on the basis of the available evidence. The first scenario goes back to an article published by R. J. Hopper in 1953.[46] The prices we find in the *poletai* records, as suggested by P5, where the list of mine leases is organized by prytany (cf. e.g. l. 40: μέταλλα ἐπράθη ἐπὶ τῆς Ἱπποθωντίδος πρώτη), represented prytany payments and correspond quite closely to the amounts of the prices recorded in Demosthenes' speeches. On this calculation the income for the year 342/341 would amount to 160 talents, thus representing approximately 40% of the total annual revenue of 400 talents attested by Demosthenes' Fourth Philippic (10.37–38).[47] Hopper's estimate is certainly correct for the average prices of the inscriptions[48] in

[39] Van Alfen 2012, 15. For an overview of bronze coin dies used for producing imitations of Athenian tetradrachms in fourth-century Egypt see Meadows 2011.
[40] Van Alfen 2004–2005a, 26.
[41] Kroll 2001a; van Alfen 2004–2005a.
[42] As noted by Kroll 2001a, 10, while in some cases, like the Selinous hoard from Sicily, lead isotopic analyses of ingots have revealed that the silver is almost certainly from Laureion, "the most suggestive evidence for the origin of most ingots in Egyptian (and Levantine) bullion hoards is provided by the Greek coins that were found with them; for if most of the coined silver in Egypt came as it did from the mining districts of the northern and central Aegean basin, these should also be the sources that ... were supplying most of the unminted silver to Egypt as well".
[43] See the commentary by Muller 2010, 387–389 (no. 19).
[44] For a detailed study of the document cf. Briant – Descat 1998.
[45] Van Alfen 2012, 18 with note 32.
[46] Hopper 1953, 224–227; Flament 2007b, 72–77.
[47] On the figure of 400 talents see the commentary by Hajdú 2002, 304–305. Cf. also Flament 2007b, 45–47, 60–64; Migeotte 2014, 434–435.
[48] Flament 2007b, 77 calculates the average price of a mine as "un peu plus de 222 dr."

so far as the spectrum of the most frequently recurring sums ranges from 20 to 200 drachms, but cannot account for the highest recorded prices, such as 1,550 (P5, ll. 47–51), 3,500 (P19, l. 4), 6,100 (P26, l. 94) and 17,750 (P19, ll. 26–30), which, if multiplied by ten, would result in astronomical yearly rents (over 7 talents and 29 talents respectively for the last two leases). Hyperides (Eux. 35) indeed refers to a very productive mine, from which the income of the wealthy Athenians who had a stake in the enterprise made 300 talents in three years, but he was alluding to a penalty that was the equivalent of the total *return* on their investment and not to the price paid in order to be awarded the lease.[49]

Secondly, assuming that the state's revenues from the mines only consisted in the prices paid by the lessees, it remains to be explained how Athens obtained the pure metal for its coin production. It is generally believed that Athenian silver coins were valued at a percentage of 3 or 5% over their intrinsic value,[50] and, in particular, that the commercial 'market' mina used for the weighing of bulk silver bullion was 5% heavier than the monetary mina, so that minting allowed the issuing authority a slight profit to cover minting fees and, possibly, a value-added premium. We would therefore have to allow for the possibility that the state purchased large amounts of bullion from the producers at the market (or at a discount) price in exchange for owls.[51] This was, however, shown to be incorrect by J. H. Kroll, who observes that "[a]s is clear from Athenian inventories of precious-metal dedications in sanctuaries, the Athenian silver/coin weight system was used for weighing all items of gold and silver in whatever form, even bullion."[52] As J. H. Kroll concludes, "[a]ny profit extracted from the minting of silver coins would not therefore automatically result from the 5% differential between the two minas."[53]

The second scenario was proposed by C. Flament in his recent book on Athens' moneyed economy.[54] It is based on the notion that the driving force behind the massive output of coins by the Athenian mint was the needs of the mine investors. As argued by Flament, the annual yield of the Laureion mines at their peak period can be estimated in the range of 750–1,000 talents of silver.[55] He arrives at this result based on the fact that operations in the mine district entailed huge outlays of money on the part of the lessees to cover rents and taxes, the expenditure involved in leasing, feeding and maintaining the slave workforce as well as the costs of equipment and of the processing and refining of the ore, which Flament calculates to be at least 750 talents per year, so that we can safely assume that, in order for mining operations to be economically viable, the profits must have at least equalled the expenses. Other scholars have proposed lower estimates, between 450 and 600 talents[56] – and we must be aware that any attempt at quantification is to some extent impressionistic – but, leaving this question aside, the second part of Flament's argument is that investors in the silver industry desperately needed to convert their bullion into coins in order to cover such huge outlays and, in the case of the economic elite, on top of this, to perform the liturgies they were expected to undertake. The production of tetradrachm owls was thus driven by those private individuals who took their silver to the mint for coining at a modest cost, as witnessed by the Delphic *apousia* accounts of 336 BC, where the mint master Dexios obtained approximately 2% of the total silver coined as compensation for manufacturing the silver Amphictyonic coinage (CID 2, 75).

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[49] MacDowell 2003, 125–127.

[50] Mørkholm 1982, 290–292; Le Rider 2001, 257–260; Kroll 2011c, p. 237 note 23.

[51] Van Alfen 2011b, 145–146.

[52] Kroll 2011c, 237 note 23 followed by van Alfen 2011b, 142 with note 44. Cf. also Kroll 2001b, 89 note 9: "the silver mina was apparently used for weighing *all* gold and silver, whether in coin, bullion, or in worked *objets d'art.*"

[53] Kroll 2001b, 89 note 9.

[54] Flament 2007b, 241–250.

[55] Flament 2007b, 245–247: "ce n'est sans doute pas moins de 1000 T qui devaient être produits chaque année aux périodes les plus florissantes de l'industrie." In Flament 2011, 40–43 the author lowered his estimate to "au moins 750 T."

[56] Pébarthe 2008, 89–91.

Despite its *prima facie* attractiveness, this scenario is also not without its difficulties. Even if we allow for the possibility that, *pace* F. de Callataÿ,[57] 'free minting' was a well-known, and frequently resorted to, practice in antiquity,[58] the most serious objection concerns the role it attributes to private initiative in the production and supply of coinage at Athens. Granted that coinage was perceived as a common good, the production of which aimed at facilitating economic life, as is suggested by the sophistic treatise of the Anonymus Iamblichi (89 D. K., fr. 7.1–9),[59] and that it was in the general interest of the community to enforce all possible methods to guarantee an adequate supply of currency, Flament's hypothesis contradicts everything we know about the relationship between *nomos* and *nomisma* in classical Athens. On the contrary, the evidence we have in this respect, from the issue of Athens' fiduciary silver-plated bronze coinage in 406/405 (Ar. Ran. 718–733) to the decree that withdrew it from circulation (Ar. Eccl. 815–822),[60] the law of Nicophon on the *dokimastai* of silver coinage of 375/374 (RO 25),[61] or the massive reminting programme of the 'pi-style' tetradrachms in 353 BC, all point to state interventionism and tight political control.[62] On a more general level, we should not underestimate the simple fact that, from early times, the polis exerted a monopoly on the extraction of silver from the Laureion mines.[63] Moreover, a fragmentary decree from the late fifth century (IG 1^3, 90; 416? BC) contained a clause in which the Laureion mines were mentioned in connection with coinage (ll. 10–13), while an unpublished law proposed by an Epikrates in 354/353 dealt with "several measures concerning the festival of Hephaistos and Athena Hephaistia, coinage, the mint," with a view to producing revenue for the *dioikesis*, as well as "with the industrial processing of silver" referring to "silver ore" (ἀργυρῖτις), "furnaces" (κάμινοι), bullion and the refining of the precious metal.[64] While we must await the publication of this fragmentary legislation, it is still significant that the polis was in some way regulating activity in the Laureion district by means of a law.

As a result, the third and, in my opinion, most probable and intriguing scenario is that Athens obtained at least a large portion of the silver it needed for minting as a proportional quota of the silver extracted from the mines. As we have seen, the existence of such proportional quota cannot be doubted because it is independently attested by sources directly or indirectly going back to the fourth century. One may, of course, question what happened to the portion of silver retained by private mine investors. It cannot, obviously, be ruled out that, apart from being exported and/or exchanged on the market as a commodity, silver bullion could also be converted into coins at the Athenian mint at discount rates ('free minting'),[65] but the evidence seems to support the assumption that Athens obtained the bulk of the silver it needed for coinage by means of administrative methods, in other words through taxation.

Provided this reconstruction is correct, the lease system would thus appear to have been based on two forms of payment: a one-off or yearly registration fee, which we find recorded in the *poletai* inscriptions, and a percentage of the silver extracted. What remains obscure and, owing to a lack of information, can only be a matter of speculation and inference, are the level of the percentage and the mechanisms according to which the state exerted control over the output of the mines and obtained its share, determining the size of its portion. As far as I know, the only extant ancient doc-

[57] De Callataÿ 2005.
[58] That 'free minting' was both a medieval and an ancient phenomenon was underlined by many participants in the discussion following my paper at the Colloquium. Cf. Kroll 2009, 203–205; van Alfen 2011b, 139–147.
[59] Musti – Mari 2003, 254–332; Faraguna 2012, 360–363.
[60] On the question of the date of this enactment, before 393 but possibly "when the war ended in 404 or when democratic government was restored a year later", cf. Kroll 2011a, 6–8.
[61] See most recently Psoma 2011; Kroll 2011a, 18–19 note 41, with diverging interpretations of the provision on "foreign currency" (ξενικὸν ἀργύριον) and of Athenian "monetary policy" in the first half of the fourth century.
[62] Cf. Pébarthe 2012, 248–256.
[63] Faraguna 2006 with the response of Thür 2006.
[64] Faraguna 2006, 151–152; Kroll 2011c, 238–239.
[65] Van Alfen 2011b, 143–146.

ument addressing similar administrative problems is the *lex metallis dicta* from Vipasca (FIRA 1² no. 104), concerning the organization of silver and copper extraction in the Roman imperial province of Lusitania in the first half of the second century AD, where the occupant, in order to obtain full ownership of the *puteus,* had to pay *ex more* half of the extracted ore (*venae*) to the *fiscus* (sect. 1, 2 and 5) and the division of the production occurred at the shaft, or in any case before smelting (sect. 9).[66] In the case of the Laureion mines, it is doubtful that the polis' share was as large as 50% but it must have been very significant,[67] because we could not otherwise justify the large volume of the mint's output.[68] L. Migeotte has plausibly suggested that the 28+ talents of silver bullion recorded in the inventory of the treasurers of Athena of 344/343 BC (IG 2², 1443, ll. 12–88) were, in actual fact, a tithe of the portion of the silver extracted from the mines going to the city in that year. If this is correct, the polis' share of the profits for 344/343 BC can be estimated in the range of 280–300 talents.[69] In addition, it has been noted that the affluent members of the Athenian economic elite investing in the mining industry were more active as owners of land and installations for the processing of the ore than as lessees working in the extraction sector. Such an investment pattern appears to indicate that leasing a mine entailed lower costs but also involved higher risks and limited profit. It can be surmised that, alongside the risk factor, what made investment in extraction less attractive was the large share of the production taken by the polis as tax. Conversely, investment in land and *ergasteria*, though requiring more capital, minimized risk and guaranteed adequate long-term returns.[70]

As for the modes used by Athens to collect its portion, it cannot be ruled out that this happened at the shafts where the ore was heaped after it was carried to the surface, but it seems more likely that the division was made at the furnaces which, as we have seen, were, according to Xenophon, a source of income (πρόσοδοι) for Athens (Vect. 4.49).

To conclude: returning to the enigmatic contract between the polis and Sokles (IG 2³, 433), we are left with the intractable problem of interpreting the provision concerning the rights which the polis and Sokles enjoyed in alternate years with regard to the exploitation via subcontracting and the "gathering" (συλλογή) of the profits from the mine leases (ll. 21–24: ὁ αὐ]τὸς δὲ τρόπος ἔστω τ[ῆ]ς συ[λλογῆς περὶ τ]ῆς πράσεως καὶ τῆς τ[ι]μή[σεως καὶ τῆς πρ]άξεως τῶγ χρημάτων Σωκλ[εῖ καθάπερ ἂν] τῆι πόλει γίγνηται). In the first part of this paper, Professor Thür cogently proposed a 'legal' explanation of the clause whereby Sokles was placed on equal terms to the polis in respect of the leasing procedure (*prasis*), the assessment with a view to classification (*timesis*) of the mines as well as enforcement (*praxis*) in the event that the lessees defaulted on their contracts.[71] Tying up the threads of my discussion, I wonder, however, whether an 'economic' interpretation may not be equally possible, so that it could be suggested that the clause alluded to the two different forms of revenue Athens obtained from the mine leases: first the registration fee when the mine was "sold" (Arist. Ath. Pol. 47.2; P5, l. 40) and then the silver ore, the amount of which needed to be "assessed," "estimated" before being "exacted" (cf. LSJ s.v.). However, owing to the fragmentary state of the inscription, this question must inevitably remain open.

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66 Lazzarini 2001, 131–147, 167–176; Hirt 2010, 262–269, discussing earlier literature. Cf. also Domergue 1983, esp. 114–141; Domergue 1990, 295–299.

67 I consider that it must have been much higher than 10%, as suggested by Aperghis 1997–1998, 17–19.

68 It is now the prevailing view in scholarship that during the course of the fifth century all silver currency needed for ordinary external commercial and public transactions increasingly came to be provided by Athenian coinage and that the Standards Decree was enacted in the 420s or 410s when the supply system started to collapse or when the 5% harbour tax (εἰκοστή) replaced the annual φόρος; cf. Figueira 1998, esp. 265–73; Kroll 2009; Flament 2011, 45–51. See also the contribution by Vincent Gabrielsen in this volume.

69 Migeotte 2014, 481–482.

70 Bissa 2008; cf. also Shipton 2000, 31–37.

71 On *praxis* as "enforcement of penalties" see Rubinstein 2010. I would like to note, however, that, assuming this was the meaning of the clause, the restored expression συλλογὴ περί (?) followed by τ]ῆς πράσεως καὶ τῆς τ[ι]μή[σεως καὶ τῆς πρ]άξεως τῶγ χρημάτων sounds somewhat awkward and pleonastic.

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