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Fiscal and administrative aspects of the Laurion's mining leases during the 4th century BC

ABSTRACT: *This study is devoted to the main fiscal and administrative aspects of the mining leases in Laurion. It begins by considering the operating system of the Athenian mines, including discussions about their legal status, drawing mainly on the text of the Aristotelian Constitution of Athens. The next step is to give an order of magnitude of the state incomes from the mines, turning to the question of the distribution of the metal extracted from the mines between lessees and the city. This means investigating the prices of the leases and estimating the yearly output of the mines by developing a model based on the mining's sector profitability. At this point, the key issue is to determine what lessees did with their metal so that they could be able to pay the costs associated with mining activities. It is advocated in this paper that a lot – if not nearly all – of the silver produced in Laurion was actually converted into coins, the renowned Athenian "owls". Several important consequences for the Athenian monetary history follow from this conclusion, regarding the role of state authorities in the monetary process, the parameters determining the rhythm and scale of the monetary production, as well as the dissemination of the Athenian coinage.*

KEYWORDS: ATHENS, SILVER, COINAGE, FLEET, FINANCES

Introduction

The main aim of this study is to provide appropriate and supported answers to several crucial questions related to the fiscal and administrative aspects of the mining leases of Laurion during the 4th century BC: What happened to the silver after the smelting process? Could the lessees freely dispose of the metal? How did Athens earn revenues from the mines? How significant were they? Were they sufficient to maintain the war fleet?

Operating procedures of the Laurion mines

To answer those questions properly, a main parameter must be taken into account: since at least the seminal work of R.J. Hopper (1953, pp.200–209; see also Harrison, 1968, p.316; Healy, 1978, pp.103–105; Domergue, 2008, pp.181–182), it is admitted that silver veins were publicly owned in Athens. However, the nature of this right remains very difficult to establish. Since É. Ardaillon (1897, pp.173–174), the existence of a kind of "*Bergregal"* is assumed; by virtue of this right, the city would have reserved the property of the mineral resources of the underground, while private individuals could own the surface as any ordinary private property.

This assumption is entirely consistent with the indications of the mining leases erected during the 4th century BC by the *Polētai*, the magistrates who carried out public contracts in Athens.[1] Those documents are written on *stelai* registering leases year by year, including the names of the lessee, of the registrant, and of the mine with its location, as well as its category and price. Several aspects of those *stelai* still pose problems of interpretation, notably the meaning of mine categories (ἐργάσιμα, ἀνασάξιμα, παλαιὰ ἀνασάξιμα)[2] and the nature of payments made by lessees. Were these one-off payments (Crosby, 1950), annual fees, or prytany charges (Hopper, 1953)?[3] May this as it be, it should be noted here that in most instances, the lessee was obviously not the owner of the land on which his mining concession was located.[4]

However, as É. Ardaillon (1897, pp.175–176) himself granted, such a *Bergregal* would have been almost unique for the Greek world; even Roman laws did not distinguish between soil and underground products (Hopper, 1953, p.205–209; Harrison, 1968, p.234; Osborne, 1985, p.116; Faraguna, 2006, p.143, n.8). Furthermore, this *Bergregal* did not seem to have applied to stone quarries: quarries in

Athens were the property of demes, or of gods, and were rented like lands or houses, but not leased (Flament, 2013; 2015). It suffices to say that I am not very convinced that such a *Bergregal* ever existed in Athens during Classical Antiquity, but to take up this question would require extensive discussion and thus go far beyond the scope of this study. Furthermore, the outcome would not change the fact that, in one way or the other, Athens claimed ownership of the silver deposits or of the underground in which they are located.

As the exclusive owner, the city had two options to exploit the silver deposits: direct-labour operations or leasing out to private individuals. Each system actually has both advantages and disadvantages. In case of direct-labour operations, the main advantage consists in keeping nearly all the metal produced, but the city has, in return, to fully support the costs and the organization of all the operating systems. Conversely, by choosing leasing, most – if not all – of the operating costs are then incumbent on lessees but the city has *de facto* to abandon a large part of the metal produced to the same lessees.

Considering the organisation of the Athenian finances during the Classical period (Flament, 2007a), it is all but surprising that Athens opted for leasing: this is actually the way in which the various means supposed to provide revenue to the city were managed, notably taxes affecting many goods and activities,[5] of which Aristophanes drew up a non-exhaustive list (Vesp., vv.656–660). Each year, the *Polētai* sold at public auction the "right" to collect those taxes (Arist., *Ath. pol.* xlvii,2; Langdon, 1994; Migeotte, 2001). The winner of the auction was then required to pay the price he announced, not the amount obtained from the collection of the tax. His profit being precisely the difference between the sum announced and the amount he actually collected. Apart from the fact that such a procedure exempted the city from organizing itself the collection of those taxes, leasing had two other major advantages: firstly, to know in advance the income of each revenue – the sum being fixed at the public auction –; secondly, to collect all the revenues on a fixed date, usually at the end of the 9th prytany (Arist., *Ath. pol.* xlvii,4), that is to say just before the beginning of the next civil year.

Basically, the principles that have just been clarified for the management of the taxes are also valid for the leasing of the mining concessions in Laurion, as it can be deduced from this quotation of the Aristotelian *Constitution of Athens*:

> *"Ἐπειθ' οἱ πωληταὶ ἱ μέν εἰσι, κληροῦται δ' εἷς ἐκ τῆς φυλῆς. Μισθοῦσι 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 † [6] ἔτη πεπραμένα.*
>
> *Then there are the ten Vendors, elected by lot, one from each tribe. They farm out all public contracts and sell the mines and the taxes, with the co-operation of the Treasurer of Military Funds and those elected to superintend the Spectacle Fund, in the presence of the Council, and ratify the purchase for the person for whom the Council votes, and the mines sold, the* ergasima *that have been sold for three years and the* sunkechorèmena *sold for … years" (Arist., Ath. pol. xlvii,2, trs. H. Rackham, Loeb Classical Library).*

Several elements mentioned in this text are still debated, especially the meaning of the different categories of mines (ἐργάσιμα / συγκεχωρημένα), and the duration of the leases. Fortunately, the outcome of these various questions would have very limited impact on the topics discussed here. Most importantly it was precisely the vendors of the taxes, the *Polētai*, who were also responsible for the leasing of the mines, and the vocabulary used is, exactly as in the case of taxes, that of a sale: it is actually a "right" that the *Polētai* sold, the right to collect a tax, or to exploit a mine (Hopper, 1953, p.235; Domergue, 2008, pp.181 – 182).[7] There are, however, some specificities in the case of mining leases: firstly, unlike the farming of the taxes,[8] no document mentions the obligation for lessees to provide guarantors (Hopper, 1953, p.225; Faraguna, 2006, p.150); secondly, the concession period is obviously longer – at least three years, maybe even up to ten years (see n.6) – than in the case of taxes, which are theoretically sold for one year only.

In Athens, the mines of Laurion were then leased almost like all the other state revenues and, moreover, by the same *Polētai*. In the case of mining concessions, leasing also reduced for the city the risks associated with the hazards of exploitation, since lessees were, like tax farmers, forced to pay the sum fixed at the public auction, no matter what the actual output of the mine was. But this operating system had a huge impact on the field by dividing the Laurion's area into multiple mining concessions whose limits were minutely described in the abovementioned *Polētai* records. Such a concession system leads to multiple shafts for reaching the ore, because each concession had to possess its own.[9]

Order of magnitude of the state incomes from the Laurion mines

At this stage, it is time to ask the crucial question of the division between lessees and the city of the metal extracted from the mines. Several indications scattered throughout the literary tradition suggest that mining revenues made up a large part of Athens' ordinary revenues.[10] But unfortunately these sources do not provide any precise figures at all. However, we have several indications of amounts paid for acquiring a mining concession (see Shipton, 1998, p.58 for a table with the existing prices), but they are at

first sight contradictory. On the one hand, Attic forensic speeches mention substantial sums (9,000 drachmas in Dem. 37,22; 2,000 drachmas in Dem. 40,52)[11]; on the other hand, sums inscribed by the *Polētai* in their records are most often of a very inferior amount: 20 (39 times) and 150 drachmas (21 times). In our opinion, the best way to reconcile these two orders of magnitude is to interpret the sums indicated by the *Polētai* as rents due to each prytany, that is to say ten times a year. It should be noted that on the oldest stele of this *corpus* known so far (Langdon, 1991, P5; Hopper, 1953, p.238), the leases are precisely organized by prytanies and, furthermore, that rents of many other public leases were also paid each prytany.[12]

On these grounds, we are able to propose an order of magnitude of the revenues the city was supposed to derive from the leasing of the mines of Laurion, by following this reasoning. Relying on statistics based on the *Polētai* records, G.G. Aperghis (1997/8, p.18) estimated that about 500 mines were in operation simultaneously during the 340s BC.[13] On the other hand, the average price of a mining lease in those same *Polētai* records is a little bit more than 242 drachmas (Flament, 2007a, pp.72–80). If we consider that payments were due by lessees each prytany this would result in an annual income of about 200 talents, or 5.2 tons of silver.[14] This sum may seem considerable, but it fits perfectly in the order of magnitude of the revenues that the Thasians were supposed to draw from their own mining district during the Archaic period (according to Herodotus, 6, 46). At the scale of the Athenian finances, 200 talents represent roughly half of the city's entire ordinary incomes, which various testimonies allow us to fix to ca. 400 talents per year (Flament, 2007a, pp.31–64). Therefore, it is not at all surprising that many testimonies insist on the importance of the mining sector for the Athenian finances.

Collection of mining revenues and estimate of the annual output of the mines

Several fundamental questions remain however unanswered at this point: how did the city collect these mining rents? And, above all: to what proportion of the total production of silver in Laurion corresponded the revenues of Athens?

Regarding the first question, the speech entitled *Against Pantaenetus* from the Demosthenic *corpus* (*or*. xxxvii) proves to be of great interest (Flament, 2016). From the text it becomes clear that Pantaenetus, a mining lessee, had to bring himself his lease payment to the city. He complains indeed that Evergos, his opponent, seized the money his slave was bringing to be paid to the state for his mine, and caused him to be inscribed as public debtor (§22). There was therefore no automatic levy at the smelting furnace, or at the mint as postulated by some scholars (Aperghis, 1997/8, p.19; Bissa, 2009, pp.55–6; Faraguna, 2006, p.151). Nothing in this speech, however, makes it possible to determine if this payment to the state was made in coins or in raw silver.

This question related to the form of payment actually opens up more broadly to the issue linked to the part of the silver produced that remained in lessees' hands. As previously pointed out, by choosing the leasing procedure, Athens automatically abandoned a part of the silver produced to lessees; in any other way a leasing system as described above could simply not work. But what was the proportion? The testimony of lexicographers reporting a levy of a 24th of the production by the state can resolutely be dismissed: this proportion seems far too small (see Lazzarini, 2001, p. 75), and may have been in force only after the Classical Period (Rhodes, 1985, p.554; Momigliano, 1932, p.255), maybe in Roman times only (Crosby, 1950, p. 203):

> *"Ἀγράφου μετάλλου δίκη: οἱ τὰ ἀργύρεια μέταλλα ἐργαζόμενοι ὅπου βούλοιντο καινοῦ ἔργου ἄρξασθαι, φανερὸν ἐποιοῦντο τοῖς ἐπ' ἐκείνοις τεταγμένοις ὑπὸ τοῦ δήμου καὶ ἀπεγράφοντο τοῦ τελεῖν ἕνεκα τῷ δήμῳ εἰκοστὴν τετάρτην τοῦ καινοῦ μετάλλου. Εἴ τις οὖν ἐδόκει λάθρα ἐργάζεσθαι μέταλλον, τὸν μὴ ἀπογραψάμενον ἐξῆν τῷ βουλομένῳ γράφεσθαι καὶ ἐλέγχειν."*
>
> *Suit for unregistered mine: those who work the silver mines, whenever they wanted to begin a new work, make it known to those put in charge of those by the demos and registered a tax of one twenty-fourth of the product of the new mine. If someone was suspected of operating illegally an unregistered mine, anyone who wished can bring a public suit against him (Suid. s.v. «Ἀγράφου μετάλλου δίκη»)".*[15]

Fundamentally, there is a more indispensable condition for the efficient functioning of the leasing system as it was organized in Athens: the mining sector had first and foremost to be regarded as profitable by the private individuals, i.e. that the profits generated had to be greater than the expenses incurred. Fortunately, many of these expenditures can reasonably be estimated for the mid-4th century BC, thus adding key data to a theoretical break-even point of the mining operations in Laurion during that period. Those figures are summarised in Tab. 1.

Given these results and the number of expenditures impossible to estimate, fixing the break-even point of the Laureotic mines during the intensive phase of exploitation of the second half of the 4th century at *ca*. 700 talents is probably still far below the actual value.[16] It is worth noting too that this break-even point is likely to vary widely according to the number of mines in operation, but also – and even especially – to the fluctuations of certain expenditures, as those devoted to feed the slave population, especially when grain prices rose over the last quarter of the 4th century (Descat, 2004, pp.267–280).

Nature of expenditures	Annual costs
Payments made by lessees to the State	ca. 200 talents
Rental and maintenance of the slaves: - rental of 15,000 slaves, at the rate of 1 obol each per day - food supply for 15,000 slaves, at the rate of 2 obols each per day - maintenance of the working force (fixing the life expectancy of a slave at 10 years, and the cost of one slave at 200 drachmas)	 ca. 150 talents ca. 300 talents ca. 50 talents
Rental of working installations - workshop for ore processing (ἐργαστήριον) - mill (κεγχρεών?) - furnace (κάμινος) - lifting machinery?	impossible to evaluate
Miscellaneous charges - equipment such as tools, lighting (oil for lamps), timber for the chambering of mines - fuel for furnaces - possibly: rent of the land on which the mining concession was located	impossible to evaluate
Total	at least 700 talents (ca. 18 tons of silver)

Tab. 1: Estimate of the mining expenditures in Laurion around the middle of the 4th century BC. This table is drawn by Flament (2019), where the reader will also find the details of the calculations on which those estimates are based.

More fundamentally, I argued in another study (Flament, 2007a, pp.79–80) that the interruption of the mining activities at the end of the 4th century was less caused by the depletion of the silver veins than by the increase of the break-even point of the mining sector, due in large parts to the enormous metallic stocks the conquests of Alexander the Great put back into circulation.[17]

But time has now come to ask another crucial question: how did the lessees defray those significant operating costs, and even made profits? Of course, Laurion being a polymetallic region (Rihll, 2001, pp.128–132), silver was not the only exploited resource in this area.[18] However, if one reads the *Poroi* of Xenophon, he is convinced that the key product of Laurion was silver; the main challenge is therefore to determine what the lessees do with this metal so that they could meet the various expenses listed above.

It is very unlikely that payments made to the city were made in bullion then converted into coins by state authorities themselves. This scenario would involve a special procedure for the payment of the mining rents (contrary to all other rents that would of course have been exclusively paid in coins) of which there is no mention in the description of the leasing procedure detailed in the Aristotelian *Constitution of Athens* quoted above. Furthermore, in such a scheme, only rents paid to the state would have been converted into coins, i.e. *ca*. 200 talents at the most. Given the level of coin production in Athens during the Classical period as well as the number of engravers employed in the mint evidenced by the diversity of "styles" recognizable on coins (Flament, 2007b, pp.61–120), this seems highly unlikely. More fundamentally, the other charges (notably for food supply) could not have been paid with bullion, but only with coins. Thus the question: how did they obtain those coins?

Silver was used in various fields related to craftsmanship, in Athens and elsewhere. Lessees may thus have sold some bullion to jewellers or other craftsmen,[19] but of course not all their silver stock: this solution would have implied enormous market opportunities, because almost 500 talents at least (i.e. the equivalent of the annual spending on slaves as estimated in Tab. 1) had to be sold off in this way every year. However, even flourishing craftsmanship certainly did not require as much silver as this.

Some scholars (recently Bissa, 2009, pp.60–61) suggested that silver bullion from Laurion could be sold abroad, notably to governments of other cities to strike their own coinage, since elemental analyses attest that many Aegean coinages were made of Laurion's silver (notably Aegina, Corinth, Samos and even Rome; see on this topic Flament, 2018b). I, however, argued in another study (*ibidem*) that most of the Laurion's silver was actually exported in the form of coins, then melted down and restruck by other cities. These considerations however highlight that in Athens the "owl" coinage offered the miners the main opportunity for the silver produced in Laurion, as already suggested by Aristophanes who called the coins of his city the "Laureotic owls".[20] Since more than a century this has also unquestionably been revealed by metal analyses (Flament, 2020). Fundamentally, if we want to explain the gigantic quantity of silver coins issued in Athens during the 5th and 4th centuries, it must be admitted that a considerable quantity of the Laurion's metal was in fact coined.

Because of these considerations, our main research question has therefore to be re-formulated as follows: how was the raw silver extracted from the Laurion's mines converted into "owl" coins? In my opinion, the only reasonable assumption is to admit that mine lessees had the opportunity to bring their silver bullion to the Athenian mint for converting it into coins. I am perfectly aware that according to the *communis opinio*, the principle of the so-called "free silver" or "frappe libre" would have been unknown in Greece during Antiquity[21]. There are however undeniable examples of this practice in written sources (Howgego, 1995, pp.33–34; Picard, 2000, p.83).

In other studies (Flament, 2018a; 2019), I tried to define the modalities of those operations in Athens by analysing epigraphic documents of the 5th and 4th centuries BC. The main conclusion is that private individuals would have been allowed in Athens to bring silver[22] to the state mint[23] for converting it into coins. The mint staff actually retained a given sum (3 or 5 drachmas) from every 100 drachmas (or mina) of coins produced. This levy was probably intended to cover the manufacturing[24] but also the essaying costs,[25] as well as the maintenance of the mint staff.[26] It seems quite logical indeed that the city controlled the quality of the silver[27] in the mint before striking the coins and not in the smelting places, most of the furnaces being actually privately owned.[28] Like the *dokimastes* mentioned in the Nicophon's decree of 375/4 (Rhodes and Osborne 2003, n.°25; Stroud, 1974; Alessandri, 1984; Martin, 1991; Feyel, 2003; Psoma, 2011), it were probably public slaves who carried out this control. The mint staff actually consisted largely of skilled slaves who were supervised by a board of Athenian magistrates called "*Epistatai* of the *argyrokopeion"*. Unfortunately, almost nothing is known about them.[29]

According to the scheme developed in this paper, the manufacturing of coins would thus be considered in Athens as a direct extension of the refining process of ore, minting thus being the ultimate stage of the silver mining. In those conditions, the break-even point here fixed at ca. 700 talents for the mining activities in Athens during the mid-4th century would thus also correspond to the minimal quantity of silver yearly produced in Laurion during that period. More than two thirds of the silver extracted in Laurion (i.e. 500 talents out of 700) remained in the hands of the lessees. Furthermore, in this scheme, those *ca*. 700 talents (the equivalent of 1,200,000 tetradrachms or 4,800,000 drachmas) also correspond to the minimal quantity of metal coined every year during the mid-4th century BC.

But this clarification of the links linking mining in Laurion to monetary production has far more important implications. It implies first that the intensity of the monetary production would have to be principally correlated to the intensity of the mining activity in Laurion. Still more fundamentally, the logical extension of this model is that the initiative to strike coins in Athens would not have come from state authorities, but from private individuals – essentially mine lessees – for the purpose of their financial activities. This is probably why Demosthenes says in his *Against Timocrates* (§ 213) that the laws (νόμοι) were the νόμισμα – that is to say the "norm" – of the City, while the coins were the νόμισμα of the individuals (ἰδιώται). Athenian authorities let thus coin production regulate itself on the basis of individual needs, guided by the precept that the more silver is coined, the more profit there is for the community, persuaded that silver never loses its value, as Xenophon naively stated in his *Poroi* (4,11). This situation perfectly accounts for the lack of information dealing with the monetary process in ancient sources. The few decisions directly related to coinage actually suggest that the Athenian state took a greater role in the coining process only when the normal situation was deteriorating: the "Coinage decree" (IG I^3 1453), as well as the emergency coinages at the end of the Peloponnesian War[30] and the above-mentioned Nicophon's decree of 375/4 BC all clearly sound like emergency measures rather than elements of a long-term monetary policy strategy. It is thus no coincidence that coinage is totally absent from the knowledges an Athenian politician is supposed to master according to Socrates in the *Memorabilia* of Xenophon (III, 6). If Glaucon wants to preside over Athens' destiny, he has to be aware of the revenues and expenses of the city, of the state of its armed forces, of the production from its mines, of the quantities of wheat produced in Attica, but there is no mention of any decision about coinage, which would naturally have been expected when Socrates was dealing with financial matters.

Athens was however not totally deprived of "monetary policy": this was actually merged with its policy towards the mining sector. An increase in coin production necessarily supposed a rise in the volume of silver produced in Laurion. State authorities could promote this increase in mining activities by modifying the leasing procedure,[31] or by introducing financial incentives such as those to which alludes the litigant of the Demosthenic speech entitled *Against Phaenippos*.[32] In those conditions, coinage would not have been totally beyond the scope of the would-be politician in the *Memorabilia*: if there is no mention of coins as such, Socrates is indeed dealing with Laurion's mines, and thinks that Glaucon ought to find out why their production is then so low:

> *"Εἴς γε μήν, ἔφη, τἀργύρεια οἶδ' ὅτι οὐκ ἀφῖξαι, ὥστ' ἔχειν εἰπεῖν δι' ὅ τι νῦν ἐλάττω ἢ πρόσθεν προσέρχεται αὐτόθεν."*
>
> *"Οὐ γὰρ οὖν ἐλήλυθα, ἔφη."*
>
> *"Καὶ γὰρ νὴ Δί', ἔφη ὁ Σωκράτης, λέγεται βαρὺ τὸ χωρίον εἶναι, ὥστε, ὅταν περὶ τούτου δέῃ συμβουλεύειν, αὕτη σοι ἡ πρόφασις ἀκρέσει."*
>
> *SOCRATES: "Now for the silver mines. I am sure you have not visited them, and so cannot tell why the amount derived from them has fallen."*
>
> *GLAUCON: "No, indeed, I have not been there."*
>
> *SOCRATES: "To be sure: the district is considered unhealthy, and so when you have to offer advice on the problem, this excuse will serve" (Xen., Mem. 3,6,12, trs. Marchant, Loeb Classical Library).*

In the light of the scheme developed in this study, does Socrates not simply implies here that Glaucon has to find a solution to increase the coin production of his

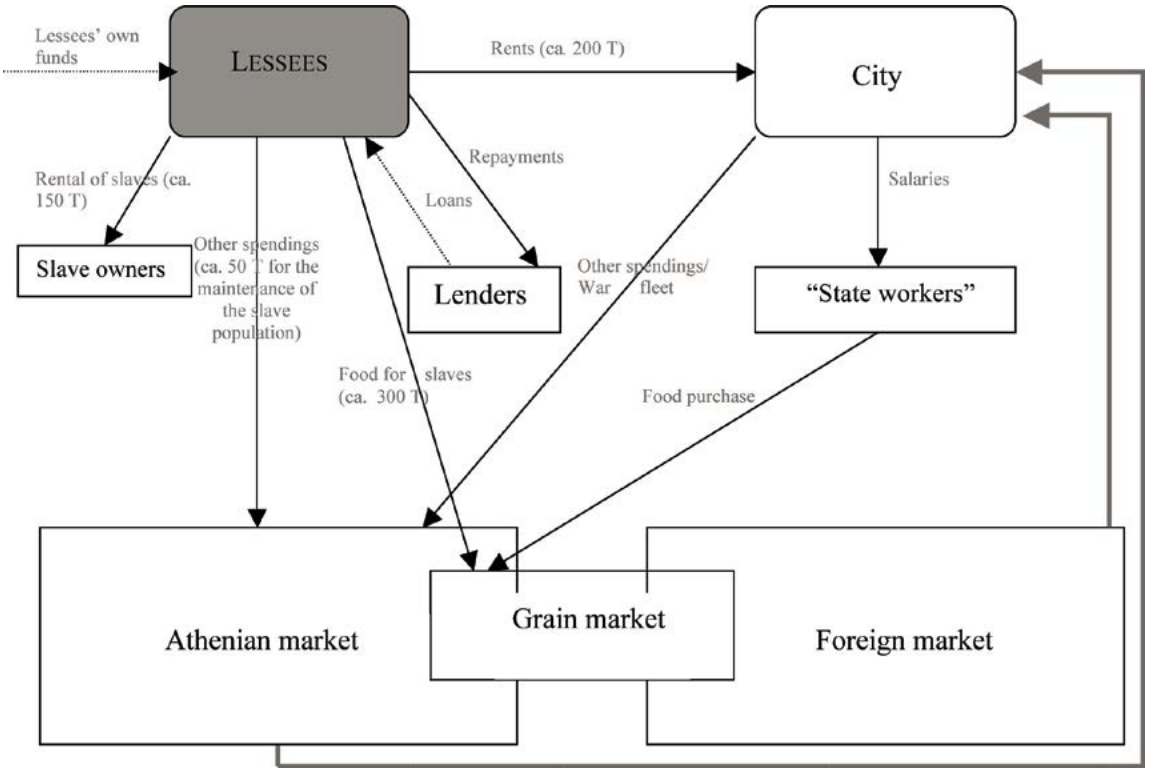

Fig. 1: Channels through which new Athenian coins were disseminated during the 4th century BC.

city, a very salutary measure at a time when the Athenians were running short of cash?

Channels through which new Athenian coins were disseminated during the 4th century BC

Finally, it was not state authorities but the lessees of the silver mines who put most of the newly minted coins into circulation, to a very large extent when paying for the above-detailed expenses related to mining exploitation. As the nature of those expenditures was previously clearly identified and quantified, it is therefore possible to reconstruct the channels through which these new coins were disseminated (see black arrows in Fig. 1).

- *Ca*. 300 talents were devoted to feed the slaves and were thus flowing to the grain trade.
- *Ca*. 150 talents were paid to the owners of the slaves rented by lessees.
- *Ca*. 50 talents fed the slave trade[33] for the maintenance of the slave population.
- An indeterminate amount was used to repay loans to lenders: indications from the Demosthenic *corpus*[34] suggest that it was not uncommon to borrow money for buying mining leases.[35]
- *Ca*. 200 talents were paid as rents to the city. As indicated above, this income corresponds to half of the annual incomes of Athens. These funds were mainly spent by the city on the maintenance of citizens serving as magistrates[36] or as juries (Flament, 2007a, p.45–57; Pritchard, 2015, p.52–82), on the improvement or renovation of urban infrastructures,[37] on the celebration of religious events,[38] as well as on the maintenance of the war fleet. If Athens intended to maintain a constant strength of 300 vessels, and the lifespan of a trireme was 20 years (O'Halloran, 2019, p.139; but 25 years according to Acton, 2014, p.197), an average of 15 new ships had thus to be built every year, which corresponds to an expense of 15 talents (1 talent being the building cost of a trireme: O'Halloran, 2019, p.140). The budget allocated to the war fleet would thus have corresponded to less than 4% of the total annual incomes of Athens, or less than 8% of its revenues from the mines.
- Finally, lessees also retained as profits an indeterminate amount of raw silver or coins. Mining industry had a reputation of being particularly lucrative in Athens: according to Hyperides (*Eux*. 35–6), a mine yielded to its lessees 300 talents in three years during the 330s. In another study (Flament, 2019), I regarded the celebrated Thorikos hoard (*IGCH* 134) as the cash reserve of a lessee directly taken from the mint because of the proportion of coins in mint condition, the number of die-links, and also the homogeneity of style for the majority of coins. But other expenses than those related to the mining industry also fell

on many lessees, because during the 4th century BC about one-fifth of them belonged to the liturgist-class.[39] It is therefore probable that a part of the newly minted coins was used for paying liturgies, and the sums involved could have been large: V. Gabrielsen (1994) thought that the *trierarchy* (the most expensive of the liturgies) costs *ca*. 60 talents per year, while disbursements related to religious celebrations would have been around 16–17 talents.[40]

- Determining the proportion of new coins carried in each of these channels is unfortunately out of the question because, whatever the channel taken, those new coins are likely to be mixed with old ones.
- The new coins represent only a part of the funds devoted to pay for the expenditure related to the mining exploitation, the other funds being constituted of sums lent by lenders or taken from the private fortune of the lessees, which of course could derive from many other activities (dotted arrows in Fig. 1).
- Passing through the hands of *apodektes* and *kolakretes*, new coins were mixed with old ones collected from the other state incomes, mainly from taxes paid by Athenians, as well as by foreigners who dwelled in the city and attended its *agorai* (grey arrows in Fig. 1). Anyway, if the total amount of the Athenian revenues was annually *ca*. 400 talents, mining revenues represented only a half. Given the special links uniting the war fleet and the Laurion's mines since the celebrated episode of the "naval law" of Themistocles in 483/2 (Flament, 2013b; 2014), it is possible that a part of the revenues from the mines (about 8%, see above) was directly devoted every year to the maintenance of the Athenian fleet.

Conclusions

To conclude, I propose to come back to the questions raised at the outset of this study.

The Laurion mines were leased by the city to private individuals at public auction for a certain period of time. The lessees paid rents, probably each prytany (so ten times a year), and the total amount of the revenues perceived by the city was *ca*. 200 talents (5.2 tons of silver) during the 350s, which corresponded to half of its yearly incomes. Among the many city´s expenditures, those devoted to the maintenance of the war fleet could easily be met, because they amounted to only a small percentage of the annual income (8%) from the mines.

According to the scheme developed in this study, a lot – if not nearly all – of the silver produced in the Laurion was actually converted into coins every year by the lessees themselves. The majority of those new coins were then probably used to defray the operating costs that were estimated here at *ca*. 700 talents (18 tons of silver) per year. This scheme also implies that the initiative to strike coins in Athens would not have come from state authorities, but essentially from mine lessees who also put most of the newly minted coins into circulation. It can be concluded therefore that in Athens, the intensity of the monetary production would have to be principally correlating with the intensity of the mining activity in Laurion. Under this scenario, the only way for state authorities to increase coin production was therefore to implement positive measures in favour of the Laurion's mining sector.

Notes

1 All these records are now published in Langdon (1991). See on this topic Crosby (1950; 1957), Hopper (1953; 1968), Vanhove (1996), Shipton (1998); Aperghis (1997–1998).

2 Opinions of scholars diverge widely (see Crosby, 1950; Hopper, 1953; Aperghis, 1997–1998; Vanhove, 1996; Flament, 2007a, pp.69–72; Bissa, 2009, p.51). See Domergue (2008, p.183) for a table summarising most of these proposals.

3 See also Shipton (1998) for an alternative explanation: payment indicated on the *stelai* corresponds to the total amount of a 5 drachms-tax to be paid every prytany (but Faraguna, 2006, pp.146–147 against this hypothesis).

4 But there were cases where a lessee was also the owner of the surface land (Healy, 1978, p.110). In other cases, several leases are located on the same property (Faraguna, 2006, p.156).

5 A vivid picture of the leasing procedure may be found in Plut., *Alc.* 5.

6 The papyrus is here damaged, the number half-erased may be 10 or 3 (see Vanhove, 1996, p.243).

7 It should be noted that in both types of operations, the vocabulary of sale is used: the winner of the tax auction and the mining lessee are both labelled ὠνητής by the *Polētai*. From this point of view, there is a very clear difference with the public contracts also awarded by the same *Polētai*, where derivatives of the term μισθόω are usually employed. On this terminological issue, see Martini (1997, pp.40–43. 45, n. 33).

8 This was indeed commonplace in many public contracts, as in those compiled and commented by Hellmann (1999). State authorities could also turn against the guarantors for a fine imposed on the original contractor: see IG VII 3073, ll. 2–6; 29–41, with Pitt, 2014.

9 More than 2,000 shafts would have been reported in the Laureotic area (Forbes, 1950, p.182; Acton, 2014, p.18; Kakavogiannis, 2005, p.333 [including air-shafts]). More than one thousand (Conophagos, 1980, p.163; Domergue, 2008, p.102). But see the contribution of M. Vaxevanopoulos in this volume p.49: there would have been at least 284.

10 The above-mentioned Aristot., *vesp.* vv.656–660; Thuk. VI, 91; Hyp. *Eux*. iii, 36; see Samons II, 2000, pp.17–18.

11 Sums of the same order of magnitude appear also in mining leases, but are very rare: 1 talent and 100 dr.; 2 talents and 5,550 dr. (Crosby, 1957, p.13, S5, l. 15).

12 See, amongst others, D. lix, 27. Aeschin. iii, 25 reports that a receiver had to inform the *demos* of the city's incomes at the beginning of each prytany.

13 Aperghis explains that during the 340s, there have been as many as 140 mines leased annually. With a 10-year period for an *anasaximon* and a 3-year period for an *ergasimon*, he considers that there may have been at least 500 mines in operation simultaneously. In this volume (p.49), Vaxevanopoulos reports the discovery of 284 shafts. I consider this figure as a strict minimum. There are 62 concessions preserved in *Agora XIX, P26 (342/1);* this stele would thus have probably originally recorded at least one hundred leases. If the shortest duration of the lease was three years (cf. Arist. Ath. XVLII, 2), and unless Agora XIX, P26 is an exceptional document, this figure must therefore be multiplied by three, so 300 mines being potentially active simultaneously. But this duration of 3 years was for ergasima only, which represent one fifth of the leases recorded by the Poletai (Aperghis 1997–8, pp.4–5); the duration of the other leases

(anasaxima, palaia anasaxima) was longer (7, 10 years?). Therefore, the number of mines in operation simultaneously should *a fortiori* have been higher than 300.

14 Bissa (2009, p.53) following a different reasoning, advances the more important figure of 300 talents.

15 See also *Lexica Segueriana* s.v. « φάσις »· μήνυσις πρὸς τοὺς ἄρχοντας κατὰ τῶν ὑπορυττόντων τὸ μέταλλον, ἢ κατὰ τῶν ἀδικούντων χωρίον ἢ οἰκίαν ἤ τι τῶν δημοσίων, ἢ κατὰ τῶν ἐπιτρόπων τῶν μὴ μεμισθωκότων τὰς οἰκίας τῶν ἐρφανῶν. As well as Hyp. *Eux*. iii, 34: Καὶ πρῶτον μέν, Τ(ε)ίσιδος τοῦ Ἀγρυλῆθεν ἀπογράψαντος τὴν Εὐθυκράτους οὐσίαν ὥς δημοσίαν οὖσαν, ἢ πλεόνων ἢ ἑξήκοντα ταλάντων ἦν, καὶ μετ' ἐκείνην πάλιν ὑπισχνουμένου τὴν Φιλίππου καὶ Ναυσικλέους ἀπογράψειν, καὶ λέγοντος ὡς ἐξ ἀναπογράφων μετάλλων πεπλουτήκασι. "Let me give an instance. When Tisis of Agryle brought in an inventory of the estate of Euthycrates, amounting to more than sixty talents, on the grounds of its being public property, and again later promised to bring in an inventory of the estate of Philip and Nausicles saying that they had made their money from unregistered mines" (trs. J.O. Burtt, Loeb Classical Library).

16 But is of the same order of magnitude as the estimate made by C.E. Conophagos (1980, pp.136 – 140) which was based on the 1.5 million tons of ancient slags that were still visible in Laurion during the 20th century.

17 The equivalent of *ca*.180,000 talents of gold and silver, according to Callataÿ (1989).

18 Vitruvius (De arch. 7.7.1) records that ochre (iron hydroxide) was extracted, as well as zinc, realgar, orpiment, chalcopyrite, and cyanus (Thphr. Lap. 51). Copper ores were also mined in the Bronze Age (Gale and Stos-Gale, 1989), however there is no evidence for its working during the classical period (but Rihll, 2001, p.132). See also the contribution of E. Photos-Jones in this volume about lead. Lead was exported abroad (Jones-Eiseman and Sismondo-Ridgway, 1987, pp.53 – 60 [Laurion lead ingots in the Porticello shipwreck]) and employed in construction and shipbuilding. But lead was a very cheap commodity in Athens: we learn from Arist. Oec. II, 37, that a talent of lead costs only 2 silver drachmas.

19 Notably to make phials mentioned in huge quantities in the sacred inventories (Harris, 1995, pp.58 – 61, 68 – 74, 99 – 100, 148, 152, 154 – 5, 169 – 78, 212 – 4).

20 Aristoph., *Av.* 1105 – 8 (trs. Melville-Jones, 1993, n. 58): "First of all, which every judge longs for most of all, Laureotic owls will never leave you, but will dwell within (your city), and will nest in your purses, and hatch out little (deposit of) small change".

21 See Callataÿ, 2005. Faraguna (2006, p.150, n. 37) acknowledges its existence, but considers that this practice remained exceptional during Antiquity.

22 Probably not only silver directly extracted from the mines. Many silver objects (like vessels, foreign coins, etc.) could also be converted into Athenian coins. A Demosthenic speech (xxii, 48 – 9) clearly suggests that during the 4th century the melting down of vessels or offerings always remained an option when public funds were lacking. See Aleshire (1992).

23 In any case, the mint was located in a place easily accessible to the public, because a clause of the so-called "Coinage Decree" (IG I³ 1453, section X) ordered that information that everyone should be able to consult have to be displayed in front of this building.

24 It is worth noting that the manufacturing costs of other metal products were calculated exactly in the same way, that is to say by deducing a given sum from every mina manufactured, as in a excerpt of a 4th century inscription dealing with the manufacture of dowels for the Telesterion in Eleusis (*IG* II² 1675,31).

25 This situation indisputably evokes another one, far much closer to us: the regulation of the law of 7 germinal 1803, by which the *premier consul* Bonaparte established the *franc germinal* as the currency of the French Republic. The article 11 of this law stipulates that individuals were allowed to bring precious metals to the mint and will only be required to pay for the manufacturing and essaying of the coins, costs that were precisely related to the weight of the metal coined. See Doyen (2013) for more parallels between this law and antic numismatics.

26 The members of the mint staff were not paid from the ordinary revenues of the city, but have their own funds, as it can be deduced from a clause of the Nicophon's decree. This decree specifies that the *apodektai* had to pay for the salary of the public tester (*dokimastes*) only during the year 375/4 BC; for the future, his salary will be paid from the funds of the mint staff; those funds were thus necessarily distinct from the city's ordinary incomes: « Τ[ὴν δὲ μ]/ισθοφορίαν εἶναι τῶι δοκιμαστῆι τῶι ἐν τῶι [ἐμπ]/ορίωι ἐπὶ μὲν Ἱπποδάμαντος ἄρχοντος ἀφ' οὗ [ἂν κα]/τασταθῆι, μεριζόντων οἱ <ἀ>ποδέκται ὅσομπερ ṭ[ῶι]/ ἐν ἄστει δοκιμαστῆι, ἐς δὲ τὸν λοιπὸγ χρόν[ον ἐνα]/ι αὐτῶι τὴμ μισθοφορίαν ὅθεμπερ τοῖς ἀργυ[ροκό]/ποις. » (Rhodes and Osborne, 2003, n.°25, ll. 49 – 55).

27 The majority of elemental analyses confirm the very high percentage of silver in Athenian coinage (more than 95% usually), which probably explains why the owls were considered as the first international currency in the ancient world, as Aristophanes proudly wrote in his *Frogs* (*Ran.* 718 – 25).

28 The 6 furnaces mentioned in the *Poletai* records (Crosby, 1950, p.195) are each identified by their owner's name. One of them was indeed pledged in a 4th *horos* related to a *prasis epi lusei* (IG II² 2750), proof, if any were needed, that they were actually privately owned.

29 They are mentioned in IG I³ 1453, sections X, XIV, and were the dedicants of SEG XXI, 667 a-b (*ca*. 360). In this last inscription, the Leontid tribe counts two representatives; this detail could mean that the *Epistatai* of the mint were not drawn by lot, but selected according to specific criteria or skills. Ferguson (1932, p.77 – 78) proposed that the *Epistatai* mentioned in the 5th century inscription IG I³ 379 (ll. 28, 40, 72) were also those of the Athenian mint.

30 On golden coinage, see Philochoros (FGrH 328 F141); about the emergency coinages in general, see Flament (2007b, pp.118 – 120).

31 Several scholars think that the engraving of the διαγραφαί of the *Polētai* from 367/6 BC reflects a change in the management of the mining concessions (Hopper, 1968, p.303; Osborne, 1985, p.116; Lazzarini, 2001, p.64).

32 See § 31 of this speech. In §§ 17 and 23, the speaker says that the capitals invested in the mines were not to be included in the citizen's declaration of property used as a basis for tax calculation.

33 On the Athenian slave market, see Harp. and Hesych. s.v. « Kuklos »; Poll. iii 78; vii, 1,1. A tax was levied on this trade: Xen., *Vect.* iv,25.

34 Dem., *Epitaphios* 52; xl, 52.

35 Shipton (2000, p.76) thinks that it should have been common practice, because all social classes were represented among the mining lessees.

36 They would have been no less than 20,000 during the 5th century BC according to Arist. Ath. xxiv,3.

37 Xen., *Ath. pol.* ii,10.

38 An expense that could amount to *ca*. 75 talents, according to Pritchard (2015).

39 Shipton, 2000, pp.31 – 37. According to Bissa (2008, p.266) this proportion could have been higher.

40 But the expenses could have been greater, maybe close to 25 talents (Pritchard, 2015).

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