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From owls to eagles. Metallic composition of Egyptian coinage (fifth–first centuries BC)

Thomas Faucher and Julien Olivier

Introduction

The aim of this paper is to offer a broad view on a discrete region: Egypt. A broad view, because the results presented here cover a long span of time, from the appearance of coinage in Egypt in the fifth century BC until the end of the Ptolemaic period towards the end of the first century BC; and because the results assembled here embrace different coined metals: gold, silver and bronze.

As previous analysis has shown, while silver coins circulating in Egypt at the beginning of the Ptolemaic period were of the purest quality, after different monetary reforms the coins from the very end of the period were finally of an alloy with a majority of copper and only a minority of silver.¹ A similar observation can be made about the bronze coins and, if we usually do not use the term ‘debasement’ for copper alloy coinages, it is nonetheless important for us to present characteristics for each metal, because monetary reforms often encompass all the denominations, and each metal. Therefore, what phases can be defined for this period, and what are the reasons for the different reforms – in other words, how and why did debasement occur?

The first part of the paper will be dedicated to the description of the method used for analysing the metallic composition of the coins. In the second part it is necessary to offer a short presentation of the coinage of the region. While the coinage of Egypt has been studied extensively in the past, the last decade has witnessed decisive improvements in the way coins are classified. It also presents an opportunity to put forward the characteristics that make the Egyptian coinage so special in the Greek world. The last part will focus on the results obtained for all coinages, trying to understand the bigger picture of debasement in Egypt before and during the Ptolemaic period.

Method

It is essential to introduce the method, because the results of the analyses form the bulk of the information we have for these debasements processes. We are also aware that each method offers its own limitations; and that it has to be born in mind that, while one method may be adopted for each type of coinage, certain additional limitations, due to the access to certain type of machines, or the lack of a large sample, make the results more trustworthy for certain samples than for others.

Gold and silver coins were analysed using the LA-ICP-MS method, and bronze by Fast Neutron Activation Analysis (FNAA), as were certain much debased silver coins.² These analyses were part of larger programmes of study. The study of gold coins was part of the Masters degree of Julien Olivier,³ and the analyses of fourth- to second-century Ptolemaic silver coins were performed by Julien Olivier for his PhD.⁴ Analyses of silver owls, Alexander tetradrachms and late Ptolemaic coins from Egypt were conducted by Thomas Faucher, and analyses of Ptolemaic bronze coins were undertaken for the PhD of Thomas Faucher.⁵

The LA-ICP-MS method consists of a micro-ablation of 80 µm performed on the coin, allowing penetration through the surface to a depth about 200 and 300 microns. This micro-ablation, invisible to the naked eye, has the advantage of being able to be used on museum material on a large scale. In this paper, we will present a total of 317 coins analysed; among them, 313 are kept in the Bibliothèque nationale de France. For the rest of the method of analysis, it does not differ much from the one used by Matthew Ponting (see chapter 1) and, therefore, we will not go into details here.

Bronze coins were analysed by Fast Neutron Activation, a method that is non-destructive, global and multi-elementary. The content of 11 elements is measured. One limitation of

the method is access to the cyclotron, its cost and the time it takes to analyse coins (in general for us around six coins, up to a maximum of 12, per week). This method is also used for coins consisting of debased silver-copper alloys. In our case, this method is used for silver-copper alloys when we reach the limits of reliability using the LA-ICP-MS method, either because the content of the alloy is not homogeneous enough for a small sample to be representative of the whole coin, or when we have an indication or a suspicion that the first few hundreds microns beneath the coin's surface will differ significantly from the original content of the coin.

Considering Ptolemaic coins, the period where we faced problems is the latest period of the dynasty where silver coins are of bad quality, usually averaging 35% of silver and the rest of copper, but in some cases with significantly more silver, up to 87%.⁶ Fortunately, we had the occasion to test both methods on the same coins, and also had the opportunity to cut four coins of Cleopatra VII (51–30 BC) into pieces. This was part of a larger study on the coins of this period investigating the observed discrepancy between heavy and light coins that were found in hoards. The cross sections show, for three of the four coins, an extremely heterogeneous composition formed by a core of metal surrounded by a layer of corroded alloy largely enriched in silver (see Fig. 6.5).

These sectioned coins illustrate the limits of all the methods used. Regardless of the method we employ, laser ablation, drilling sample or neutron activation, the results will not give you the original content of the coin. More analyses on these coins are needed to understand how the enrichment took place and how the minting techniques influenced this process. For the moment, it is prudent to be as cautious as possible when using the results on these types of debased silver coins.

The coinage of Egypt

Gold and silver

As mentioned above, coins appeared in Egypt as early as the fifth century BC. There is still a debate on their use and how Egyptians considered their new medium of payment at its first apparition. The presence of numerous hoards of silver debris mixed with early Greek coins in the country made archaeologists and numismatists think that these foreign coins were not used as such but simply as a store of value.⁷ Studies of ostraca in recent years changed our perspective on these first coins, and gave an indication that the 'Ionian coins' quoted in the texts were effectively used as coins as early as the end of the fifth century BC, having a correspondence with the *deben*, the long-established Egyptian standard of weight and value.⁸

It is nevertheless only in the fifth century BC, and to a greater extent in the second half of the fourth century, that Greek coins were imported in large quantities and used within Egypt. They took the form mainly of Athenian 'owls': the characteristic coins with a head of Athena on

the obverse and an owl on the reverse.⁹ We know that these coins were used mostly to pay Greek mercenaries, at least at the beginning, and it is certainly the principal reason why the rulers of Egypt in this century, Artaxerxes III (358–338 BC), and, after him, the satraps Sabakes and Mazakes, struck imitations of owls. We also have a unique obol struck by the city of Naukratis, in the delta (now in the American Numismatic Society (ANS): 1944·100·75458). Besides this production of silver, Egyptian rulers also struck gold, but in smaller quantities. Two issues are known: the first by only a single specimen, imitating an owl on the reverse, maybe struck by the pharaoh Tachos (361–358 BC) (British Museum 1925,0808.1). The second, and more significantly, is the *nwb nfr* coinage, struck with the hieroglyph for 'good gold' on the reverse.¹⁰ This issue was of little economic impact as only three obverse and three reverse dies have been recorded so far. It is interesting to note that these coins were circulating along with other Greek gold coins, like those of Philip, and Achaemenid darics.¹¹

When Alexander took Egypt in November 332 BC, both gold stateres and tetradrachms were struck in the country on the Attic standard (8.60 g and 17.20 g respectively), probably from the time of the satrap Cleomenes (331–323 BC).¹² Even if it is difficult for us to be sure which of these 'Alexander' coins belong to the Egyptian mints, several emissions have been identified as Egyptian by scholars.¹³ The question of the mint, Memphis or Alexandria, is also disputed.¹⁴ While this local production was probably quite restricted when compared with the scale of production across Alexander's empire, the Egyptian issues circulated together with other Alexander coins from Babylonia, Phoenicia, Asia Minor and Macedonia, as attested by several large Egyptian coin deposits such as the Demanhur hoard.¹⁵

Probably from the early 310s, typological and then metrological changes (from c. 306 BC) gradually isolated the Egyptian monetary system from the rest of the Hellenistic world. Different stages were identified, shifting from the original Attic standard to the final Ptolemaic one, and with the creation of an original typology, passing from the Alexander types to new ones employed by Ptolemy.¹⁶ The process led in 294 to the issue of tetradrachms weighing 14.3 g with portrait of Ptolemy I (king since 305 BC) on the obverse and the legend ΠΤΟΛΕΜΑΙΟΥ ΒΑΣΙΛΕΩΣ on the reverse together with an eagle on a thunderbolt.¹⁷ This model remained unchanged until the end of the dynasty, with tetradrachms of these types making up almost all the silver coinage minted by the kings of Egypt in Alexandria, and also at their provincial mints.¹⁸

The study of the gold coinage is also complex, as a result of many successive reforms, and given the importance of this metal in the Ptolemaic monetary system: progressing from the Attic stater to the *mnaietion* via the light stater, to the *trichryson*.¹⁹ No other Hellenistic kingdom struck as many gold coins as the Ptolemies, except for the massive

issues of Alexander and the *diadochoi* until about 300 BC. As in the case with silver, it was probably towards the end of the 310s that new types appeared. The standard changed three times between c. 306 BC and before 272 BC, with gold always overvalued in relation to silver. The system inaugurated in 272 BC continued until the last gold issues, probably around 140 BC.²⁰ After that, gold was no longer struck in Hellenistic Egypt.

Bronze

The classification of bronze coinage of the Ptolemies was recently updated in several publications.²¹ It seems worth presenting briefly the different steps that led to the bronze monetization of the country. First, it is noteworthy that no bronze coins were struck in Egypt before the Ptolemies, even though bronze coins circulated in Egypt – mainly coins from Asia Minor, in the form of the smallest denominations, the *chalkous*, and then bronze coins of Alexander: the *chalkous* and hemidrachmas.²² Ptolemaic bronze coinage has now been divided into ten different series, with their own distinct features, mostly showing a deity on the obverse and the eagle on the thunderbolt on the reverse. A number of characteristics set the denominations of each series: mainly size

(before weight), and an interplay between the image of the obverse and the reverse, small details changing on each denomination. The first and second series were of limited impact, even if some coins of the second series were issued in great numbers. The third series really launched the massive use of bronze coinage throughout the country, around 260 BC. This dissemination was mainly related to the payment of taxes, partly to be paid in cash. After series 3, 4 and 5, a large reform of the coinage at the very beginning of the second century BC introduced new reverse types and somewhat smaller denominations. After series 6 and 7, most likely right after the short-lived series 8, a new series was issued which lasted from 113 BC until Cleopatra, characterised by only two denominations and found in large numbers in excavations, if not in museums. Around 40 BC Cleopatra started the issue of coins bearing her own portrait and both her name and title.

Debasement: data and methodological problems

Gold

Traditionally dated from the reign of Nectanebo II (360–342 BC), the first significant issue of Egyptian gold

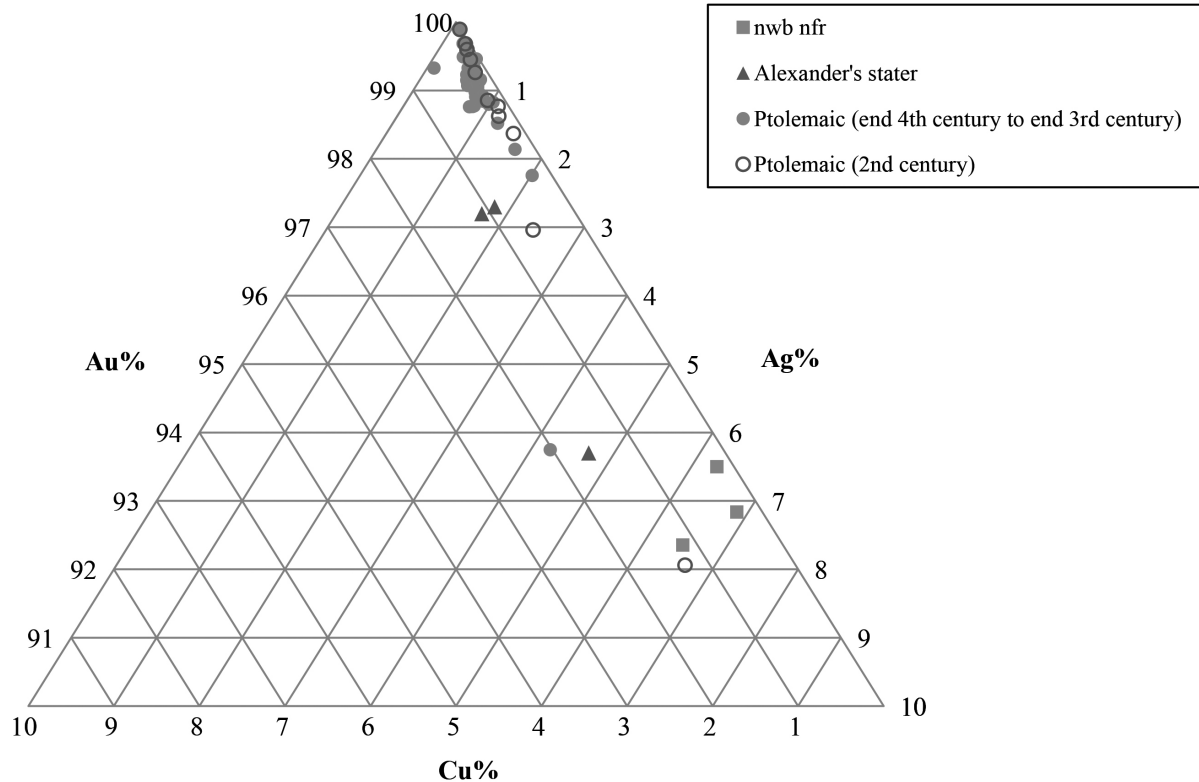


Figure 6.1: Gold-silver-copper content of gold coins struck in Egypt from mid-fourth century BC to c. 140 BC.

coinage,²³ the *nwb nfr* darics (Fig. 6.1), have a consistent but relatively low gold content (about 93%). This is far from the Greek standards represented in Egyptian hoards, including gold staters of Philip II (359–336 BC) (usually from 98.7% to 99.9%). This alloy is also not related to the gold darics – also found in Egypt – issued by the Achaemenid kings in Sardis, which usually contain 96–98% gold.²⁴

Gold staters with Alexander types and then with Ptolemaic types conform to Greek habits, with an alloy composed by at least 98.5% of gold. It was not be altered until the issues of Egyptian gold coinage definitively stopped, probably in the 140s BC. The coins containing a few percent extra silver and/or copper are probably isolated cases.²⁵

Silver

In the 1980s and 1990s R.A. Hazzard published a chart summarizing results of analyses carried out on Ptolemaic silver coins. This was the first attempt at a global study

of the evolution of the alloy for Ptolemaic coinage. The data, taken from publications from the 1930s to 1980s, were obtained by different methods, offering either global or surface analyses.²⁶ Analyses recently performed make it possible to establish a new graph, more extended chronologically (encompassing issues prior to Ptolemy I) both for gold and silver coinages (Fig. 6.2). For silver, it confirms the successive steps identified by Hazzard, but the chronology and details of these episodes need to be clarified.

The analyses of Egyptian owls compared with Athenian owls found in Egypt or elsewhere in the Near East clearly show that local coinage was less pure than Greek coins (the latter usually 98–99%). There is also a fairly large variability of alloy within the 15 coins of Artaxerxes III, Sabakes and Mazakes analyzed: three are 98–99.5%; seven contain around 95%; and five have less than 93%, down to 88.7% for the least pure. The study of the trace elements of the metal bullion clearly indicates that these Egyptian owls were struck using a different metal than the Athenian owls.

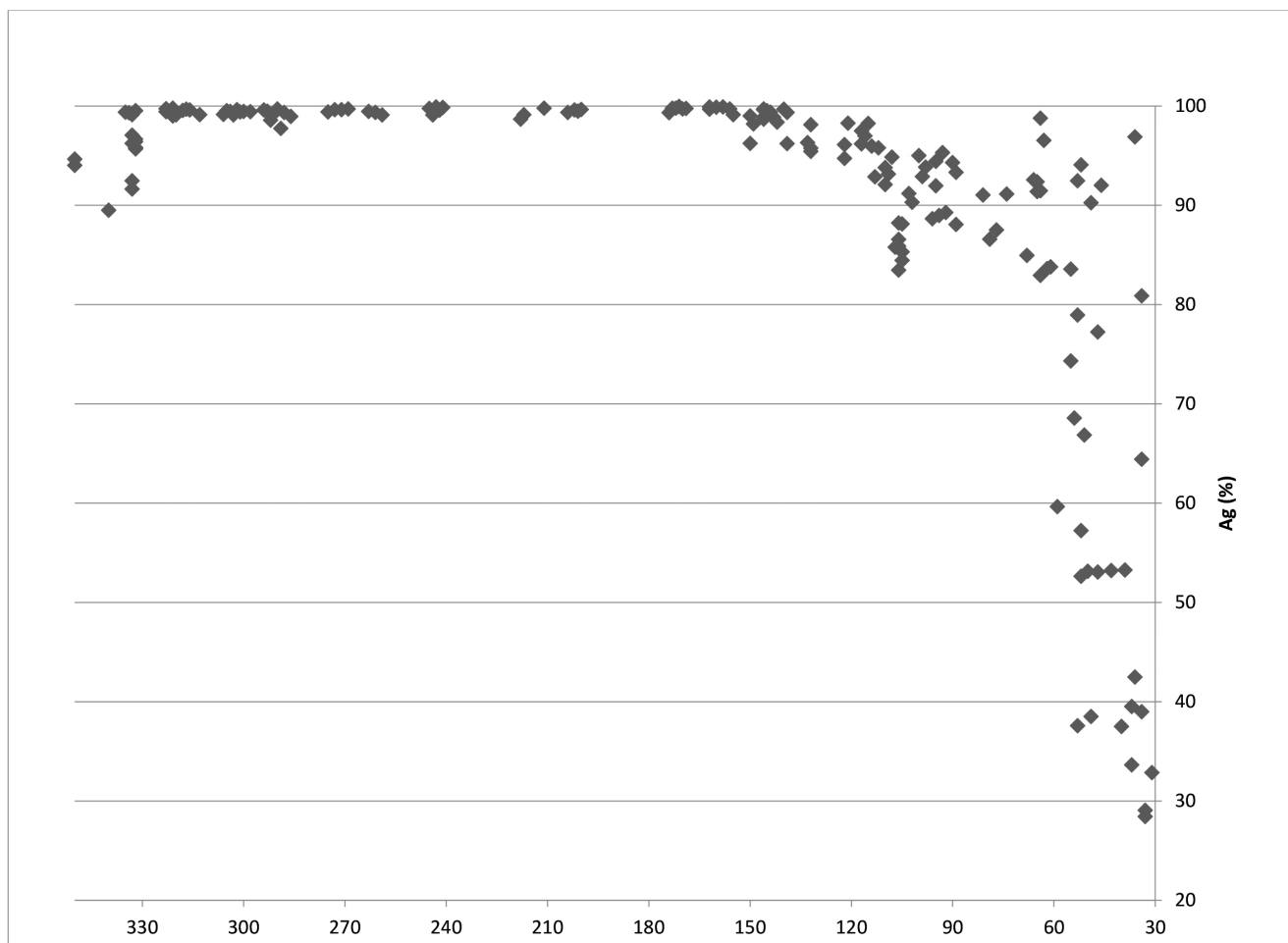


Figure 6.2: Silver content of the silver coinage struck in Egypt from the mid-fourth century BC to 31/30 BC.

The gold contents of the former are substantially higher and variable.²⁷

The situation changes drastically with the introduction of the Alexander coinage. The 13 tetradrachms analysed contain no less than 98.8 to 99.7% of silver. Interestingly, the trace elements of the silver bullion (gold and bismuth ratio) seems to indicate the use of several sources that may be identified as the same ones used for the Egyptian and Athenian owls. It is possible that these coins (probably together with other coinages or objects)²⁸ were melted down with purification of the alloy (cupellation). This hypothesis is strongly supported by the disappearance of the numerous owls from circulation as early as the 330s BC.

The closure of the Ptolemaic monetary system, achieved in 294 BC, does not change this situation of a high and stable silver content (with few exceptions, probably isolated incidents). Thanks to the new data provided in this chapter, it appears that the Ptolemaic silver coinage should be arranged into three phases (Table 6.1). Until 155/4, the alloy remains pure: all of the 49 coins analysed contain between 97.1% and 99.4% silver, with an average content of 98.8%. The year 155/4 coincides with a slight debasement which occurred at the same time as metrological modifications – the diameter was reduced and the weight much more controlled – and the addition of a date according the regnal era and the appearance of the letters ΠΑ on the reverse. This coincides with an evolution in the gold/bismuth trace elements, indicative of the metal stock used. The coincidence of this change with the sudden disappearance of the third century tetradrachms from circulation points towards the re-melting of the old coinage to supply the mint from this time. It seems unlikely that the addition of a small quantity of copper (around 1–2%) aimed at making a profit. We propose that the purpose was to balance the weight loss of the worn, recalled tetradrachms. From the 140s until the end of the 60s BC, the situation changes progressively with a double phenomenon of an increased copper/lead content together with a greater variability of the alloy: the standard deviation goes from c. 1 to almost 4. This phenomenon culminates in 107/6–105/4 BC with an unprecedented drop to 77–87% (Fig. 6.2). Finally, the last 30 years of the kingdom from 59/8 BC show an impressive intensification of this phenomenon. In this case, the calculation of an average has probably no meaning considering the high variability of the results obtained, and as the standard deviation of almost 19 suggests.

This latter change is probably the most significant debasement, but also the most difficult to analyse. It occurred after 59/8 BC, most likely in 55/4, after the Romans supported Ptolemy XII (80–51 BC) in his bid to reconquer his throne. The second part of his reign and the one of Cleopatra VII coincide with several perceptible changes in the production of silver coinage. Coins are shaped differently, the

Table 6.1: The three phases of silver coinage alloy struck in Alexandria during the Ptolemaic period

| | c. 323–155/4 | 150/49–61/0 | 59/8–31/0 |
|------------------------|--------------|-------------|-----------|
| Average silver content | 98.8 | 92.8 | – |
| Maximum silver content | 99.4 | 99.1 | 97 |
| Minimum silver content | 97.1 | 82.7 | 28 |
| Standard deviation | 0.97 | 3.99 | 18.76 |
| No. of analysis | 49 | 69 | 30 |

obverse portrait of Ptolemy I is stylistically overhauled and two new marks appeared on the reverse: a palm on the eagle's shoulder and an Isis headdress at its feet. The results obtained by various authors – those collected by Hazzard,²⁹ Ernst Göltzer³⁰ or more recently by Kevin Butcher and Matthew Ponting – show the importance of these changes in terms of debasement.³¹ Analyses of these coins raise several methodological problems. First, the variability of the published results must be questioned: the silver content ranges from about 30% for the lowest to 93.65% for the highest,³² with a large group between 40% and 60%. In 2014, Butcher and Ponting proposed to select the lower results to assume the traditional view 'that the tetradrachm of Cleopatra was about one-third fine'.³³ However we find the same large range of silver content among the 30 coins of Ptolemy XII and Cleopatra VII we analysed (28 tetradrachms, 2 drachms). Does this extreme variability of the results reflect a certain form of reality, or should we question the relevance of the analytical methods used?

The metrological study of the tetradrachms reveals that, at the same time the debasement occurred, coins show a great variability in weights. While the Ptolemaic tetradrachms weighs theoretically about 14.25 g, it is common to find pieces weighing between 12 g to 14 g during the third or second centuries. The stylistic restoration of the tetradrachms following the return of Ptolemy XII in 55 BC rapidly leads to an increase of weight disparities. The first impression that emerges is that two distinct series by weight existed (but neither by diameter nor by types): a first remained at around 12–14 g, while a second dropped to 4 to 8 g: a perfectly abnormal gap for a silver coinage (Fig. 6.3).

Analyses by both LA-ICP-MS and FNA methods for four of them shows that the lighter coins have a high silver content, more than 90%, while most the heavy tetradrachms contain substantially less silver. The same trend found in our results appears in the Göltzer table, the higher silver content *tetradrachm* (93.65%) weighing 6.43 g while the lower one (36.50%) is a quite normal 12.34 g *tetradrachm*.

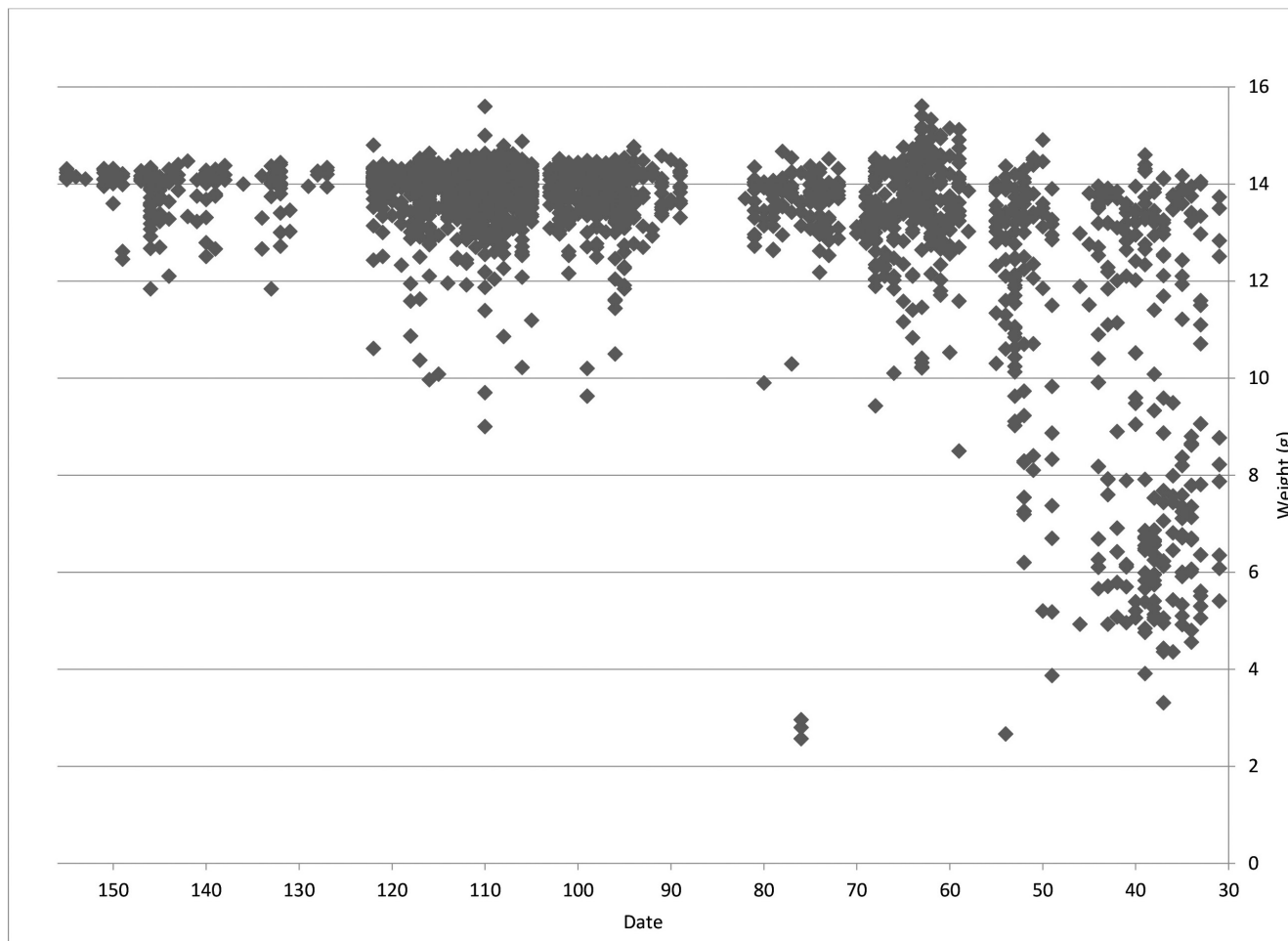


Figure 6.3: Weights of the tetradrachms struck in Alexandria from 155/4 to 31/30 BC (2784 coins).

The cross-sections of these light coins present an extremely porous alloy, the difference in weight being apparently due to the disappearance of copper and lead, leaving the silver almost alone (Fig. 6.4). How to explain this phenomenon?

Light coins are numerous in Egyptian hoards (as well as in the Egyptian museums), whereas they are rare in our western museum collections. If they are found in the latter at all, they have generally been kept either as ‘rejected’ coins (*i.e.* coins regarded as not beautiful and/or interesting enough to be in the main collection) or as forgeries (*e.g.* in Paris, BnF), but most probably they were usually discarded. In Egypt, the known hoards consist almost exclusively of light tetradrachms. Is this distinction the result of a selection, with users putting aside the heavy coins, leaving only the light ones in circulation; or were the light coins simply minted in greater quantities from the outset, with the heavy ones representing only a marginal group? In this respect, would our western museum collections be the result of an extremely careful selection? Further study should be carried out, but it seems certain that this weight phenomenon is the consequence of changes in practices within the

mint, probably linked to debasement. Thus, even beyond the analytical methods employed (global or not), it seems extremely difficult to determine the silver content of these series. The difficulty is even greater because it seems that the alloy of these coins is nevertheless variable. Two examples can be put forward.

The analyses of the two drachms with the portrait of Cleopatra VII dated from the year 47/6 BC (Svoronos 1904, no 1853), posed no problem. One gave 77% silver (Paris, BnF, Z.2884, 399, coll. Dattari) and the other 53% (Paris, BnF, D 3453).

Three tetradrachms of 34/3 BC (Svoronos 1904, no 1833) were analysed: **1.** 13.4 g – 39% (Paris, BnF, Fonds général 214); **2.** 11.8 g – 78.2% (FNAA) (Sample 1); **3.** 8.3 g – 65.8% (FNAA) (Sample 2). With a still acceptable weight, it is impossible that coin no 2 was originally composed of c. 30–40% silver. If we consider that copper and lead has leached out, we can estimate a minimum alloy around 64–65% silver for a coin originally weighing 14.30 g. In addition, coin no 3, if we do the same calculation, probably had an original silver content of 38–39%.

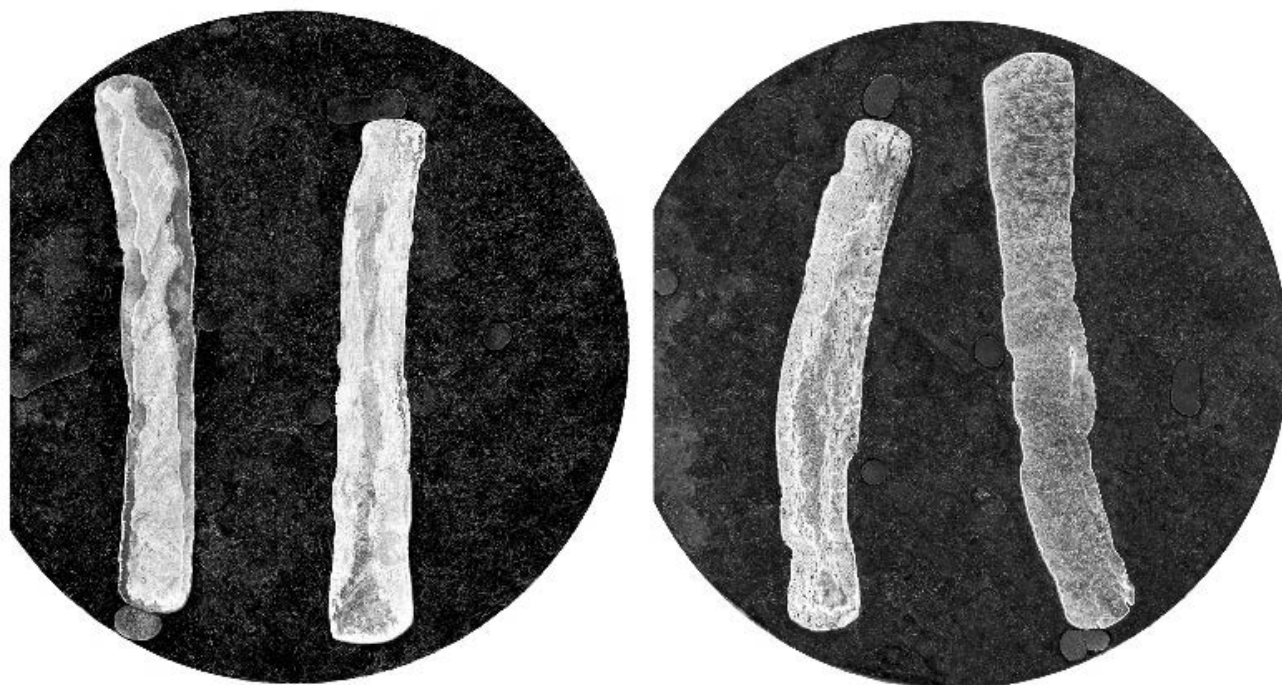


Figure 6.4: Sections of silver coins of Cleopatra (©Thomas Faucher).

It appears that in the middle of the 50s there occurred a massive debasement of the alloy alongside important changes in the methods of silver bullion preparation for coin production. As expected, at least some higher results (+90%) should definitely be discarded. However, the two samples of coins struck the same year put forward evidence that, if a significant portion of tetradrachms contains an average 30–40% silver content, some contemporaneous coins have higher contents, up to twice as much.

Bronze

For bronze Ptolemaic coins, analyses were initially undertaken in order to help our understanding of two processes. The first one was the succession of series. Before the set of analyses was launched, classification of second-century BC coins proved difficult. The work on coin hoards and textual evidence had their limits and it was clear that analyses would be an indispensable tool for the comprehension of the monetary issues. The second question was: how can metallic content help to understand the process of minting?

For the third century BC, despite a number of changes in gold, silver and bronze coinages, the metal content of all three remained stable. The only minor change was for bronze, in which a few changes occurred at the end of series 2 and the beginning of series 3, between 280 and 260 BC. It consisted mainly of a reduction in the tin content of the coins (Fig. 6.6). In this case, this small change is linked to the new processes employed in manufacturing the coins.

Initially the blanks were cut from cylindrical bars of bronze, but at some point in the second series, they began being cast in individual cavity moulds.³⁴ The appearance of large, or indeed very large coins, weighing as much as 100 g in the third series, obliged the workers of the mint to reduce the amount of tin to be able to pour the metal into the moulds easily.

At the very beginning of the second century BC there was a recall of bronze coins. At that point, coins of the former series were withdrawn or overstruck and those struck on new flans show an increased lead content (series 6 in Fig. 6.5). This coincides with a change of the iconography on the obverses of bronze coins, also accompanied by a major reform of the accounting system. Coins that were previously counted in *chalkoi*, obols and drachmas, were now counted in a decimal system, in units. This change is clearly apparent in the prices of commodities that suddenly rose at the beginning of the second century.³⁵

Concerning debasement, the big change occurred in the middle of the second century. At a date that we suppose to be around 150 BC, the new series 7 introduced bronze coins with a high lead content. Prior to this, a recall of old coins was clearly launched, leaving in circulation only a single denomination that served as the basis for the new series: a coin of 27 mm bearing the head of Isis on the obverse (Svoronos 1904, no 1234). The authorities decided that the new system would bear the same obverse types as the previous series (but with reduced-weight denominations) and distinguished simply by the addition of the monogram

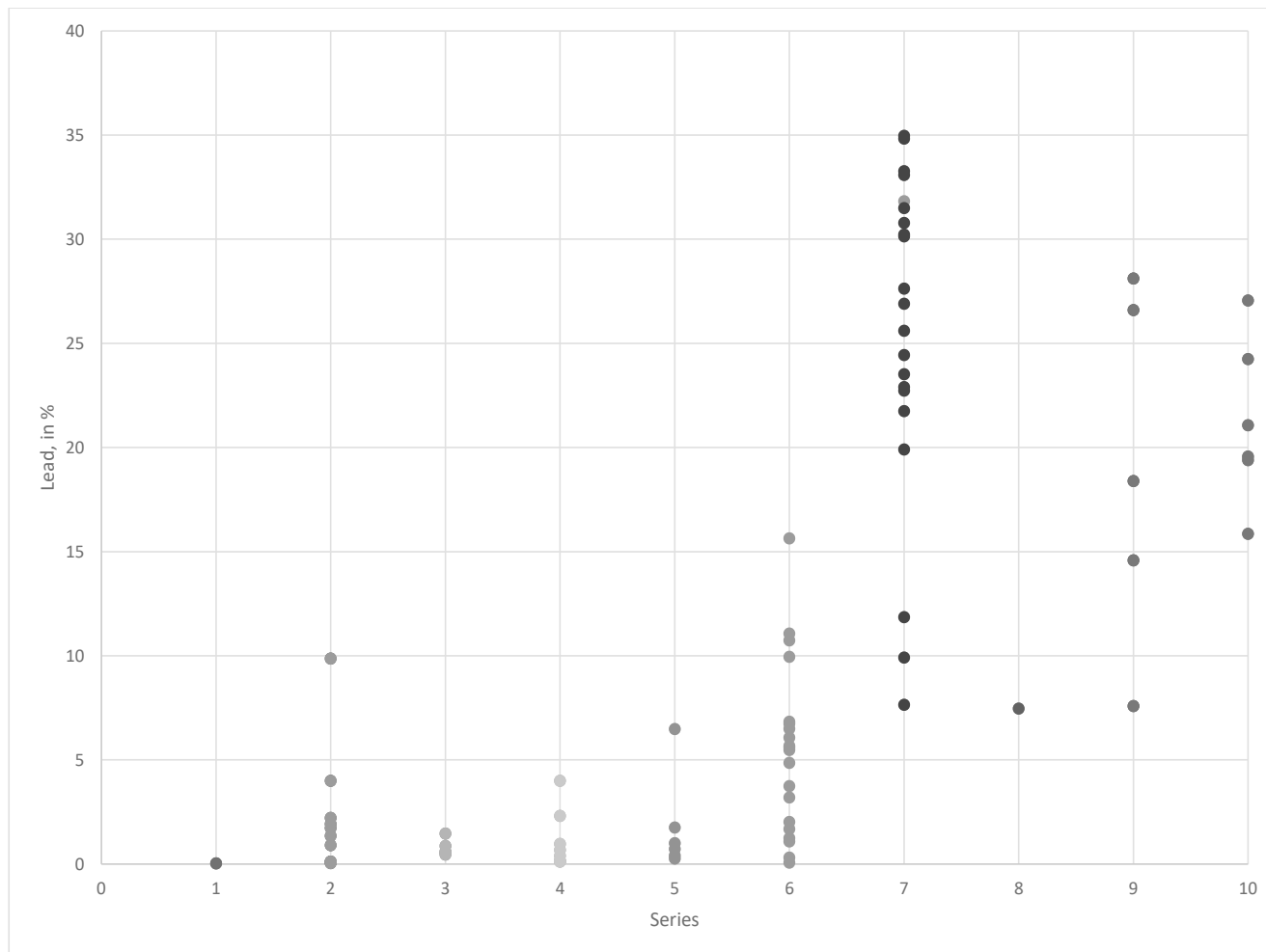


Figure 6.5: Lead content in Ptolemaic bronze coins, by series.

PIA on the reverse of the coins. We do not know what this debasement with lead signifies. It is hard to see this change as a way for the rulers to make savings. Compared to the savings to be made from the debasement of the silver coinage in this period, replacing a few tons of copper with lead does not represent much. A technical explanation may prevail here as well. The addition of lead would have allowed a lower melting point for the alloy, therefore, leading to a faster and a cheaper melting process. More lead also means a softer alloy, easier to strike, leading to a longer life for dies. It is interesting to see that the level of lead never rises above 35%. This is a limit found in other coinages. Experiments with coin minting have shown that it is almost impossible to strike a coin with a percentage of lead higher than this. The lead, which is not miscible in the copper-tin alloy, forms nodules and then layers inside the coin that makes the blank unsuitable for striking when the content is too high.³⁶

The evolution of the content of major elements in the bronze Ptolemaic coinage of Alexandria is clearly related to

the introduction of new series and types. The graph offers the evolution of the content of lead in the ten series presented earlier (Fig. 6.5).

There are no major evolutions in the lead content in the third century BC, with almost all the coins showing a content of less than 5%, and generally a lot less. At the turn of the series 6, at the beginning of the second century, lead was introduced in larger quantities in the alloy. Later, a higher level of the lead content occurred at the very beginning for the series 7, around the middle of the second century BC, with virtually no coins having less than 10% lead in their alloy. For more than a century, the same scheme is repeated during the following series 8, 9 and 10, down to the end of the Ptolemaic coinage.

Considering tin, the debasement shows different steps and characteristics (Fig. 6.6). The wide variation of the tin content in series 2 is quite remarkable but can be explained by technological requirements.

Series 3 to 9 show a gradual decline in the tin content of the coins. At the end of the dynasty, Cleopatra VII decided

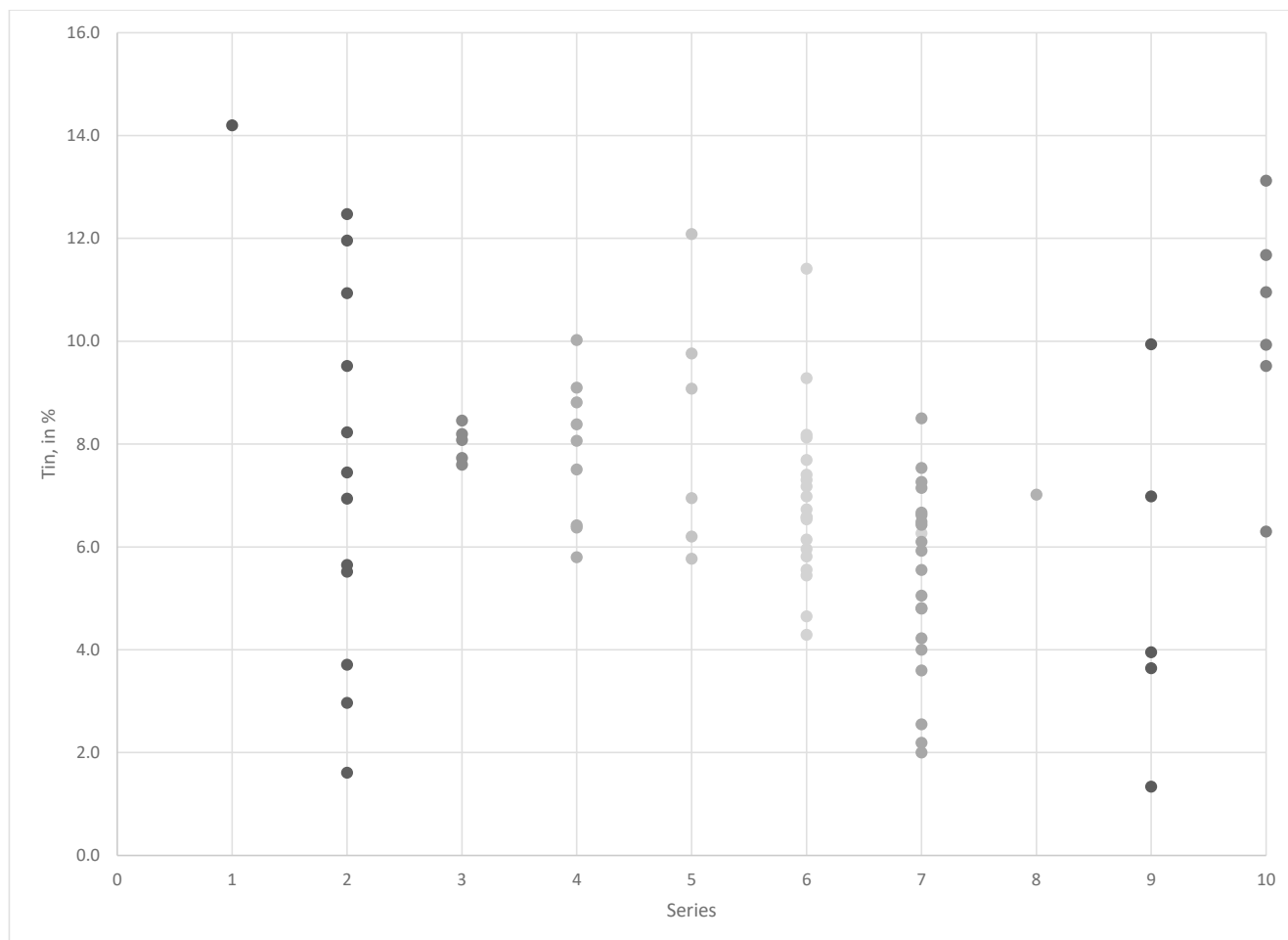


Figure 6.6: Tin content in Ptolemaic bronze coins, by series.

to increase the tin in her coins once again. This decision is quite surprising, considering the amount of lead still present in them. If she had wanted to restore confidence in a medium of payment that had become largely distrusted during the first half of the first century BC, it would have been necessary to produce an alloy free of lead. This would have given back the golden colour to the coins, as they had appeared in the third century BC; but perhaps by then no one remembered how the older coins had looked. It is quite obvious that, even if she put fresh copper in the coins, as analyses of the trace elements has shown, at least part of the alloy was made from old metal coming from the old coins from the former series, series 9, which had a high lead content.

Further alteration of the alloy may have been for technical purposes. During series 9, alongside a regular production of struck coins bearing the head of Zeus Ammon and two eagles on the reverse, a huge number of cast copies of the same types have been produced everywhere in Egypt, in the Delta, in the Fayum and

even in the south of Egypt, if we consider the single finds during excavations. In this case a high lead content has the same explanation as before. These coins were produced by using clay moulds, bearing the impressions of an official coin. A high lead content meant a low melting point and easy and cheap production. In this case, it is obvious that the government allowed this production of cast coins to flourish, either because it was unable to supply, or disinterested in the production of, a sufficient amount of coins.

Synthesis

This set of analyses is the largest ever undertaken for a region and for such a long period, providing invaluable data to understand the behaviour of coin composition in the long-term. The comparison of the coinages of different metals also allows us to begin to understand what was going on inside the main mint of the country and if larger dynamics can be explained, be they technical or monetary.

Before Alexander: a debased beginning

The use of coinage in Egypt definitely changed the customs of the inhabitants of the Country of the Two Crowns. Even if it is most likely that the first coins were aimed at mercenaries and, therefore, not at the local market, their use spread early in the country, as early as the end of the fifth century BC, according to the written evidence.

It is perhaps a *topos* to say that things have a tendency to get worse and worse over time, and it may be true for some aspects of the coinage; but the first currency to be produced in Egypt was not of the best quality. It is true that a large portion of the coins that circulated within the country were genuine Athenian owls with a high silver content, but as soon as the Egyptian authorities started to strike their own coins in the mid-fourth century BC, the quality dropped, showing both a great variability in the content but also a lower average fineness than the other coins in circulation. It occurred with silver and the striking of imitative owls, but it also happened for the gold, where the coinages struck by the latest pharaoh, Nectanebo II, far from being of pure gold, had an average of 93% purity – unlike the contemporaneous Greek coinages, which are usually close to 100% gold.

Might this lower fineness be linked with the political circumstances that coincided with the inauguration of Egyptian coin production from the mid-fourth century, more than 150 years after the first appearance of Greek coins in the Nile valley? Several authors assumed that the issue of a local silver coinage may be linked with military expenses.³⁷ The same war context is usually brought up for both the unique gold daric of Tachos³⁸ and the *nwb nefer* darics.³⁹ Might we then suppose that the context was that of an emergency, causing local coinages to be produced with uncontrolled alloys? Despite the appeal of an emergency explanation, both L. Mildenberg and P. van Alfen pointed out there is no clear evidence to support a specific military purpose for the silver coinages.⁴⁰ Our results show that Egypt was not preparing the ground for a pure coinage and that the coinages brought first by Alexander and those struck subsequently by Ptolemy I show a different conception of coinage to the early, less pure issues. This assertion is supported by the results obtained in other regions of the Achaemenid empire. A. Gondonneau analysed some silver *sigloi* struck in Sardis from the fifth to the fourth century BC. The silver content ranged from 94.8% to 99.4%, just like the Egyptian owls.⁴¹ More recently, J.-M. Pedrono obtained the same range with silver coins of Lycian dynasts (late sixth century to mid-fourth century BC), from c. 93% to 99%.⁴² The extremely pure first Hellenistic coinage in Egypt, both in gold and silver, show that the Graeco-Macedonian rulers conceived their coinage as a pure piece of metal. They recalled the debased coins that were circulating in the country and most likely refined and recycled them.

The undebased gold coinage

After the brief gold issues of the Achaemenid period, Egypt stands out during the period of Ptolemaic rule for the importance of its gold coinage. The various die studies conducted (which do not include the first series of staters and *trichrysa*, issued down to around 272 BC) give about 300 obverse dies.⁴³ From the beginnings of the Ptolemaic dynasty in the fourth century until about 140 BC, this gold coinage also underwent various reforms under the first two sovereigns, resulting in a change in the system of denominations, the introduction of new types and the overvaluation of gold against silver. None of these changes had an impact on the purity of the gold alloy. This is consistent with what we know about the gold coinage of other Hellenistic kingdoms following the conquests of Alexander: the gold Philips, the Alexanders⁴⁴ or gold coins produced by Lysimachus, the Antigonids⁴⁵ or the Seleucids.⁴⁶ While these latter coinages had ceased almost completely at the beginning of the second century, the Ptolemies continued to issue an abundant gold coinage – almost as voluminous as it had been in the third century. This Egyptian specificity finally ceased either at the end of the reign of Ptolemy VI (180–145 BC) or at the beginning of that of Ptolemy VIII (145–116 BC) in the 140s. While gold remained pure until that period, it is interesting to note that the cessation of the gold production coincides with the first phases of debasement observed for silver and bronze.

Silver and bronze: from a thoroughly pure coinage to a rough, debased one

The beginning of the Ptolemaic period exhibits the use of a tri-metallic system in which all the coins are of very good composition. Gold and silver are almost pure, and the bronze is made of an alloy of copper and a good quantity of tin (around 10%, giving a nice golden colour). For more than a century, until the end of the third century BC, the metal content of the bronze coins remained the same, of the highest quality. Even so, recalls of bronze coinages occurred, and these could have presented an opportunity for the authorities to modify the content of coins, but it appears that they did not do this.

If the introduction of lead in the beginning of the second century represents a change from previous minting behaviours, the definitive change occurred around the middle of the second century BC for both bronze and silver. At that period, the gold coinage ceased, the silver content became variable for the tetradrachms and large amounts of lead were added to the bronze coins. These changes can be seen as a way for the Crown to save metal and money, but it also has to be considered in the context of a general modification of the minting techniques. Silver coins now show different, flatter portraits, struck with dies engraved in shallower relief, probably to improve the productivity of the dies that had to strike much harder blanks.⁴⁷ The

bronze coinage saw the appearance of lower quality coins, accompanied by contemporary cast, non-official issues. In a way, the debasement, or the reduction of the metallic quality of the coins, must be considered more globally, where not only the quality of the alloy has to be studied but also the more technical aspects of the minting process.

The silver debasement of the 50s BC is both the most important and the most problematic episode. As previously, the degradation of silver content came with many other *stigma* like extreme variation of weights, but also with less attention paid to blank production. Many are irregular, edges are no longer filed, and coins themselves are badly struck.

We notice that both the silver debasements occurring in 155/4 and 55 BC, and for bronze around 150 BC, are accompanied by the quasi-disappearance of previous coins. If this kind of recall is a quite common phenomenon for bronze series, it is quite unusual for silver. The numerous ancient worn tetradrachms of Ptolemy I and II had been definitely removed from circulation in the mid-second century, as well as most of the ‘good’ tetradrachms of Ptolemy XII from 55 BC. In the same time, new control marks appeared on coins: ΠΑ and a date on silver issues from 155/4; ΠΑ on bronze coins from c. 150; Isis headdress and a palm on the silver tetradrachms from 55. We may assume these marks were added in order to distinguish the old recalled coins from the new debased issues.

A die study of the second century silver coinage shows that the first peak of the debasement coincides with the growth of the production from the end of the 120s to about 90 BC, during the wars of succession between Ptolemy IX (116–81 BC), Ptolemy X (107–88 BC) and Cleopatra III (116–101 BC). While no die study has ever been undertaken for the later period, it is very likely that Cleopatra VII’s tetradrachms were struck in huge quantities. They are numerous in hoards but also frequent as single finds. If a ‘silver’ coin is found in Egyptian excavations, it is nearly always a coin of Cleopatra VII. The financial problems of Ptolemy XII, the succession war involving Cleopatra, her brother, then Caesar, and then Cleopatra’s material support for Antony, are all sufficient to explain the dire need for new coins.

All these scattered elements point to two conclusions. First, a fairly organized process to recall ancient coins in order to replace them with a new debased coinage. Second, at least for silver, the issue of an alloyed coinage has to be linked with a strong increase in coin production.

In a broader context, we have to consider the different elements that made these debasements possible. Coinage is a matter of trust. Before Alexander, the large number of hoards of *hacksilber* that have been found shows that Egyptians used the first coins as bullion, mostly trusting the coins for their silver content. However, as early as the fourth century, texts demonstrate that coins were also used as coins and exchanged at their face values. At that

period, coins of very fine silver like Athenian owls were circulating alongside Egyptian imitations of owls with a less pure silver content. In general, silver and gold coins struck in Egypt in that period exhibit an alloy that is maybe closer to a jewellery alloy than to a pure ‘Greek standard’. It is likely that all these coins were accepted at the same value.

At the beginning of the Hellenistic period, pure gold and silver coins were minted alongside very fine quality bronze coins. This coincides with a major expansion in the use of the coinage in the country. The famous papyrus of Zenon (*P.Cair.Zen.* 1 59021), shows how people were concerned to have new, good quality coins. As in other Hellenistic kingdoms, especially in the Near East, the third-century coins were well-manufactured and the dies carefully engraved. When Ptolemy II developed the bronze coinage with the introduction at the series 3, around 261 BC, he not only set up a large range of denominations, up to six, but also issued coins of a very good quality, both in their content but also in their manufacture. Some of the coins of this series were trimmed very carefully and filed on the edges, the moneyers spending a large amount of time polishing the coin to give it a pleasing appearance. At that moment, every effort was made to spread confidence to population, encouraging them to use the coins.⁴⁸

The debasement that occurred in the second century happened in a different environment. By now the population of the country was largely adapted to coinage and accustomed to using coins. Silver coins remained the basic means of payment for soldiers, while bronze coins were used, at least on an annual basis, by most of the Egyptians to pay their taxes. The introduction of large quantities of lead to the bronze coinage in the mid-second century BC did not result in a major crisis. The change in the accounting system of bronze coinage, which is the sort of change one might associate with a crisis, had already taken place before that, earlier in the century at the introduction of series 6, an issue in which the amount of lead is limited. In the same respect, the introduction of new, heavily debased silver coins at the end of the 50s did not leave any traces in the texts that permit us to think that there was a significant monetary crisis at that time. In both of these periods, the Egyptian population was accustomed to coinage and its use was necessary in everyday life. Maintaining a high level of purity was, therefore, maybe not essential to generate trust. If we just consider the introduction of lead in bronze coins, it seems that the Egyptian practice followed a general trend in the bronze coinages around the Mediterranean.⁴⁹ With this in mind, we do not regard the debasement as a signifier of crisis. We may assume it is first an evidence for the increasing monetization of Egypt and the full acceptance of royal coinage as an instrument of exchange.

Notes

- 1 See below.
- 2 Thus, four coins were analyzed twice, by LA-ICP-MS then by FNAA; see below.
- 3 Olivier 2007.
- 4 Olivier 2012.
- 5 Faucher 2013.
- 6 Olivier 2012: 41–45.
- 7 Vargyas 2010.
- 8 Chauveau 2000.
- 9 If discoveries of such coins are rare these days, these owls were melted down in great numbers at the end of the nineteenth and beginning of the twentieth centuries; van Alfen 2002.
- 10 Nicolet-Pierre 2005; Faucher, Fischer-Bossert and Dhennin 2012.
- 11 *IGCH* 1654. For a recent clarification, see Duyrat 2005.
- 12 Mørkholm 1991: 48, 52; Price 1991: 496–499; Le Rider 2003: 255–258; Lorber 2005 (the last two authors do not exclude the possibility of an inauguration of this coinage only from 323 BC, under the rule of Ptolemy I as satrap).
- 13 From four issues of tetradrachms according to Zervos 1974, to 12 for Lorber 2018.
- 14 On that point, we refer the reader to the debate between O. Zervos and M.J. Price (arguing for a mint at Memphis) and G. Le Rider (who prefers the Alexandrian option): Zervos 1974: 263–275; Price 1991: 496; Le Rider 2003: 262–265.
- 15 Duyrat 2005. Concerning coin circulation in Egypt, a complete list of Hellenistic coins hoards from 318/7 BC was recently published in Faucher, Meadows and Lorber 2017: 9–14.
- 16 Lorber 2005.
- 17 Lorber 2012.
- 18 Hazzard 1995: 29–45; Le Rider and Callataÿ 2006: 51. Concerning the predominance of this type: Olivier 2020. For an overview of other types struck by the Ptolemies, see Hazzard 1995: 1–15.
- 19 Duyrat, Olivier 2010; Olivier, Lorber 2013. Concerning the problematic Berenice coinage and its standard: Sewell-Lasater 2020.
- 20 Olivier 2012: 601–603.
- 21 See mainly, Faucher and Lorber 2010; Picard and Faucher 2012; Faucher 2013 and Lorber 2018.
- 22 Marcellesi 2012.
- 23 The gold coin of Tachos, known only by one specimen (British Museum n° 1925,0808.1) has not been analyzed.
- 24 For the analyses of both Philips and darics: Guerra, Gondonneau 2000, pp. 30–31; Gondonneau, Nicolet-Pierre and Guerra 2002: 370–372.
- 25 The Ptolemaic gold coins struck in the provincial mint of Phoenicia or Cyprus have usually a slightly lower gold content: Duyrat and Olivier 2010: 76.
- 26 Hazzard, Brown 1984 (the authors give a short description of each method and analytical setup they used, p. 232); Hazzard 1993; 1995: 51–55.
- 27 Faucher, forthcoming.
- 28 The trace elements of the metallic stock used for the Egyptian owls fit perfectly with the one used during the Persian period in the Levant (Byblos, Arwad, and probably Tyre and Sidon) and then for the Alexanders struck there and in Babylon during the last quarter of the 4th century: Olivier *et al.* 2018.
- 29 See n. 26.
- 30 Göllitzer 2004: 32–40 (5 new results) and 44–46 (about Hazzard’s work).
- 31 Butcher and Ponting 2014: 613–614 (with two new results).
- 32 Göllitzer 2004: 32, no 4.
- 33 Butcher and Ponting 2014: 614.
- 34 Faucher 2013: 183–198.
- 35 Gorre and Lorber forthcoming; Picard and Burkhalter forthcoming.
- 36 This limit applied to struck coins only. The cast coins produced in large quantities during series 7 and 9 can have lead contents higher than 30%.
- 37 See the references given by van Alfen 2011: 72, n. 27.
- 38 *Ibid.*: 70–71.
- 39 Faucher, Fischer-Bossert and Dhennin: 163.
- 40 Mildenberg 1998: 282; van Alfen 2011: 72–73.
- 41 Gondonneau 2001 (10 results).
- 42 Pedrono 2015 (71 results).
- 43 Olivier 2012; Olivier and Lorber 2013; Sewell-Lasater 2020.
- 44 Gondonneau 2000; 2001; 2002 (116 results: 57 Philips and 59 Alexanders).
- 45 Pujol 2011; Duyrat and Blet-Lemarquand forthcoming (44 results: 36 Lysimachus and 8 Antigons).
- 46 Feuillassier 2007; Duyrat and Olivier 2010; Olivier and Lorber 2013 (24 results).
- 47 Olivier 2012: 882–886.
- 48 Faucher 2010.
- 49 Blet-Lemarquand 2013.

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